Socioeconomic Status, Permanent Income, and Fertility: A Latent Variable Approach

Kenneth A. Bollen, Jennifer L. Glanville, Guy Stecklov

October 2006

WP-06-90

MEASURE Evaluation

Carolina Population Center
University of North Carolina
at Chapel Hill
206 W. Franklin Street
Chapel Hill, NC 27516
Phone: 919-966-7482
Fax: 919-966-2391
measure@unc.edu
www.cpc.unc.edu/measure

Collaborating Partners:

ORC Macro
11785 Beltsville Drive, Suite 300
Calverton, MD 20705-3119
Phone: 301-572-0200
Fax: 301-572-0999
MEASURE.Evaluation@orcmacro.com

John Snow, Inc.
1616 N. Ft. Myer Drive, 11th Floor
Arlington, VA 22209
Phone: 703-528-7474
Fax: 703-528-7480
measure_project@jsi.com

Tulane University
1440 Canal Street, Suite 2200
New Orleans, LA 70112
Phone: 504-584-3655
Fax: 504-584-3653
measure2@tulane.edu

Constella Futures
4309 Emperor Blvd.,
Suite 350, Winchester Place
Durham, NC 27703
Phone: 919- 941-9295
Fax: 919- 941-9154

Funding Agency: U.S. Agency for International Development
Washington, DC 20523-3600
Phone: 202-712-4959

USAID
FROM THE AMERICAN PEOPLE

SOCIOECONOMIC STATUS, PERMANENT INCOME, AND FERTILITY: A LATENT VARIABLE APPROACH*

Kenneth A. Bollen
Department of Sociology
University of North Carolina at Chapel Hill

Jennifer L. Glanville
Department of Sociology
University of Iowa

Guy Stecklov
Department of Sociology and Anthropology
Hebrew University

Running Head: Socioeconomic Status, Permanent Income, and Fertility

* All authors contributed equally. This study was funded by a grant from the MEASURE Evaluation Project (USAID Grant Number HRN-A-00-97-0018-00). We thank Mark Montgomery for his participation in this project and Jim Knowles and Mary Noonan for their comments on earlier versions of this paper. Versions of this paper were presented at Princeton University and the University of Chicago and we are grateful for the comments and suggestions received while there. Direct correspondence to Jennifer Glanville, Department of Sociology, W140 Seashore Hall, University of Iowa, Iowa City, IA 52242; E-mail: jennifer-glanville@uiowa.edu, telephone: (319)335-2489; fax: (319)335-2509.

.

SOCIOECONOMIC STATUS, PERMANENT INCOME, AND FERTILITY: A LATENT VARIABLE APPROACH

ABSTRACT

Regardless of the specific, underlying theoretical model, it is safe to say that most studies of the determinants of childbearing focus on or control for the role of socioeconomic factors. In this paper we examine how permanent income, one of several components of SES, relates to fertility in developing countries and also pay attention to the role of other socioeconomic factors. Given that we cannot directly measure permanent income, we employ a latent variable approach to studying its impact on fertility. We compare our results to the more common practice of using a proxy variable to measure permanent income and thereby investigate the consequences of not accounting for the measurement error that is inherent in proxies. Using micro survey data from Ghana and Peru, we find that permanent income has a large, negative influence on fertility and that research must take the latent nature of permanent income into account to uncover its influence. Our results also show that controlling for measurement error in the proxies of permanent income, can lead to substantial changes in the estimated effects of control variables. Finally, we examine which of the common proxies for permanent income most closely capture the concept. Though our focus is on childbearing, our results have implications beyond this specific dependent variable, providing evidence on the sensitivity of microanalyses to the treatment of long-term economic status.

SOCIOECONOMIC STATUS, PERMANENT INCOME, AND FERTILITY: A LATENT VARIABLE APPROACH

INTRODUCTION

Socioeconomic factors are featured in most empirical studies of the determinants of childbearing. This is true regardless of whether the socioeconomic factors are posited to bear direct, causal influences as in the traditional models of demographic transition (Notestein 1945; Hirschman 1994) or whether they are simply introduced to control for confounding influences (Cleland and Rodriguez 1988). Despite an extremely diverse body of literature aimed at explaining fertility decline, ranging across many social science disciplines, the notion that SES must be considered appears to be a consistent theme (Bollen et al. 2001). While SES is itself a complex and often loosely defined multidimensional concept, one component that is often related to fertility and which has been widely discussed is income. One of the more important developments in empirical social sciences relates to Friedman's conceptualization of permanent income (Friedman 1957). In this paper, we examine Friedman's concept of permanent income, which we distinguish from other dimensions of SES, and test its relationship to fertility in two developing countries, Ghana and Peru.

In any country accurate measurement of permanent or transitory income is a challenge. This is particularly true in developing countries where markets are undeveloped and barter can be more common than monetary exchanges. As a result, income is relatively little studied as a determinant of life chances, such as fertility, in developing countries. Instead, other aspects of socioeconomic status, such as maternal education, are more typically examined (Desai and Alva 1998; Jejeebhoy 1995). Whether the omission of income is substantively justified because of its minor impact or due to the difficulty of measurement is rarely addressed. When researchers include a measure of income in studies of developing countries, it often is not considered as distinct from other components of socioeconomic status. This makes it particularly difficult to

determine whether income has an impact on fertility that is separate from other socioeconomic variables.

While income and SES affect most life chances, their effects on fertility in LDCs are particularly interesting for several reasons. First, high fertility levels in developing countries are expected to contribute nearly two billion people to the world population by 2125 (Bongaarts 1998). Second, fertility is a major life event for households that in turn affects many other outcomes such as maternal and child health (Khlat and Ronsmans 2000; Klebanoff 1988; Lobao and Brown 1998). Third, fertility is the subject of a rich theoretical and empirical literature from sociology and related disciplines (e.g. Caldwell 1982; Crenshaw, Christenson, and Oakey 2001; Davis and Blake 1956). Finally, the negative fertility-income gradient observed both within and between countries has been a continuing source of academic and policy dispute. Such disputes range from Malthus and his arguments against the Poor Laws in Victorian England to national governments and nongovernmental organizations debating global population policy in the forums of the decennial population conferences (McIntosh and Finkle 1995).

We have several objectives in this paper. First, we briefly discuss the relationship between socioeconomic status, permanent income, and fertility. We highlight the distinction between transitory and stable components in SES, with a particular emphasis on income. A second purpose is to formulate a model that relates the components of SES, including permanent income, to fertility in developing countries. In doing so, we recognize the impossibility of perfectly measuring an abstract concept such as permanent income and instead treat permanent income as a latent variable, thereby controlling for the confounding effects of measurement error. The more typical approach to measuring permanent income is to employ a proxy, such as household expenditures, which is likely to contain a good deal of measurement error. A third purpose is to compare the results from our latent variable approach to those of the more typical

proxy variable analysis. Our models also allow us to compare several proxy variables for permanent income and to assess which are most closely correlated with the latent construct. Finally, we aim to make our results more useful by testing for the generalizability of our findings across a variety of alternative specifications where births are in the short-term or lifetime; where women of different parities are analyzed together or in separate parity groups, and across a variety of alternative proxies of permanent income or economic status.

The analyses are based on data from Ghana and Peru, both collected during the mid to late-1980s. Analyzing data from two countries from different regions of the developing world that are at somewhat different levels of industrialization sheds some light on the generalizability of our findings. While our focus is on the relationship between permanent income, SES, and fertility in developing countries, we believe this analysis provides insight into the use of permanent income in examining other outcomes of interest to sociologists and other researchers. Our results show that neglecting measurement error can have serious consequences.

SOCIOECONOMIC STATUS, PERMANENT INCOME, AND FERTILITY

Practical concern with how to reduce fertility in high-fertility settings has generated much research directed towards understanding fertility change in poor countries (Axinn and Barber 2001; Lee and Bulatao 1983). However, this research has not created consensus on the determinants of fertility change (Hirschman 1994; Mason 1997). One of the weakest links in our understanding involves the role of socioeconomic variables, which are intrinsically associated with development and modernization. Education, income, occupation, and other social and economic variables are all part of the general nexus of socioeconomic factors, which are believed to shift over the course of development and to determine or facilitate fertility change. Yet, there is remarkably little convergence in understanding how these social and economic factors actually matter. We highlight here several concepts and models that are common in the literature. Our

emphasis is not on testing which of these is valid. Rather, we provide these arguments to elucidate the conceptual meanings of socioeconomic status and permanent income and to illuminate the different possible mechanisms through which these variables could affect fertility.

Pollak and Watkins' (1993) classification of theoretical perspectives on fertility change in terms of the roles they attribute to individual opportunities, preferences, and norms is a useful starting point from which to classify the manner in which socioeconomic factors are incorporated in theoretical models of fertility change. The traditional economic view, which is also popular among demographers and is generally associated with the demographic transition paradigm, views social and economic factors in terms of how they affect the opportunities that are available to individuals (Becker 1981; Willis 1973). This approach assumes that individual preferences are fixed, and individual fertility decisions are constrained by the value of available resources. Socioeconomic change leads to changing costs and benefits of children and hence forces parents to revise their childbearing strategies. In contrast, another view suggests that socioeconomic factors influence fertility by changing individual preferences (Easterlin 1969; Namboodiri 1972). As Easterlin (1969) has argued, for example, socioeconomic factors may affect fertility preferences through their effect on household consumption decisions, leading households to choose fewer kids and more of other types of goods. Finally, many researchers posit a central role for the diffusion of norms on fertility (Axinn and Yabiku 2001; Cleland and Wilson 1987; Thornton 2001). In this case, socioeconomic factors are likely to operate by accelerating the diffusion of new ideas either through the spread of mass education or through other forms of social interaction.

Regardless of which one or which combination of the above specific mechanisms underlie fertility change, socioeconomic variables feature prominently in both theoretical discussions and empirical evaluations. The strong inverse relationship between socioeconomic

status and fertility both across and within countries at least partially explains the persistent interest in these factors (Crenshaw, Christenson and Oakey 2000; Hirschman 1994). Virtually all research on fertility includes socioeconomic variables, either because of their substantive importance or as important control variables (Bollen, Glanville, and Stecklov, 2001). However, this consensus regarding the importance of including socioeconomic factors is not matched by a consensus on how such variables should be measured and how to incorporate such variables into models of fertility analyses.

Furthermore, fertility research pays little attention to discussions of the role of socioeconomic factors in stratification research, where there is a long tradition of research on the dimensions of SES. At a broad level, we can classify treatments into two categories. The first views class or SES as a unitary concept. From this perspective, there is a fundamental dimension that underlies class (or SES) and it is this dimension that is the primary driving force. Marx's work on class is a prime example of an early representation of this unitary concept. Socioeconomic status is also sometimes viewed as a one-dimensional concept in which education, occupation, income, and wealth influence or reflect status. For example, researchers sometimes employ an index that combines two or more aspects of SES as in the Hollingshead index, which combines education and occupation (Hollingshead and Redlich 1958). The second viewpoint disputes the unidimensionality of class and instead highlights the separate dimensions of stratification. For example, Weber (1946) and more contemporary empirical researchers (e.g., Blau and Duncan 1967; Featherman and Hauser 1977; Hauser & Warren 1997) have treated variables such as education, occupational prestige, and income as separate aspects of SES that can have distinct consequences.

A unitary concept that sociologists less widely discuss, but that economists consider particularly important, is permanent income. Permanent income relates closely to wealth, a

concept that is gaining increasing importance in stratification research (Sørensen 2000; Spilerman 2000; 2004). According to Friedman,

> (T)he permanent component [of income] is to be interpreted as reflecting the effect of those factors that the unit regards as determining its capital value or wealth: the nonhuman wealth it owns; the personal attributes of the earners in the unit, such as their training, ability, personality; the attributes of the economic activity of the earners, such as the occupation followed, the location of the economic activity, and so on (1957: 21).

Clearly, the concepts of SES and permanent income have much in common (Henretta and Campbell 1978; Rainwater 1974; Sørenson 2000; Williams and Collins 1995). Friedman's conception of permanent income indicates how other components of SES are related to permanent income.

One important dimension is in how the concept of permanent income distinguishes between long-term and transitory economic status. This distinction is particularly important for the income component of SES because education and occupation are less transitory in nature. That is, education remains relatively stable in adulthood, and although people experience job changes, there is considerable stability in the agricultural sector, which is the most important sector in many developing countries. In contrast, the volatility of income in poor countries and the measures taken by households to reduce their vulnerability to income fluctuations has been widely discussed (Deaton 1992; Townsend 1995). The definition of permanent income clearly distinguishes between those economic factors affecting behavior that are transitory from those like assets and education which should be relatively constant over the life course. The stable aspect of income is likely to be more influential for a variety of outcomes. Indeed, permanent income has entered the sociological and demographic literature as a powerful predictor of a variety of behaviors and outcomes such as premarital childbearing (Wu 1996) and child health

(Williams and Collins 1995). It is the more stable aspect of economic status, rather than economic status in any given year, which more strongly predicts children's mental health (McLeod and Shanahan 1993), cognitive development (Duncan, Brooks-Gunn, and Klebanov 1994), and behavioral problems (Takeuchi, Williams, and Adair 1991). In the context of fertility, researchers have also argued that the more stable aspects of income are more important than transitory income (Easterlin 1969; Mueller and Short 1983).[1]

We can consider three distinct approaches to the relationship between SES and fertility. All three approaches focus on the reduced-form relationship. That is, they consider the total effect of SES on fertility and ignore the separate biological and demographic pathways, or intermediate variables (e.g., contraceptive use), through which the effect of SES is transmitted (Davis and Blake 1956). One approach is that social and economic factors act on fertility or other outcomes as a single, general factor. For instance, occupation, income, and education might be important because they all are part of a more general socioeconomic status variable, which in turn impacts fertility. Another approach is that each of the individual components of SES affects the outcome. In this case, occupation, income, and education might each have effects as separate components rather than as aspects of some broader concept. There is a third possibility whereby these socioeconomic variables are part of a general concept that has an impact, but these variables also have some specific effect on fertility that is not mediated by the general construct.

In the stratification literature on the United States, the component view of stratification dominates. That is, researchers usually treat education, occupation, and income, for example, as distinct components of stratification that have distinct impacts on various outcomes. In the fertility literature on LDCs, it is typical to include a measure of SES in empirical analyses, but

[1] This is not to say that current status plays no role in fertility decisions. However, we are focusing on longer-term status, which should have a more important influence. Furthermore, we examine both fertility behavior in the short-term (births in the past 3 years) as well as children ever born to identify potential differences in the ability of longer-term income measures to predict fertility.

there is little explicit discussion of the meaning of SES or class, or of the best way to measure them (Bollen et al. 2001). Instead, maternal education or some other indicators of SES are included to control for socioeconomic effects, leaving ambiguous whether the measure(s) function as specific components or as indicators of several components of SES. It seems safe to conclude that most stratification theory emphasizes a component perspective and that, although ambiguous, the fertility literature is mostly consistent with this component view of SES and class.

While decades of sociological and social science research have pointed toward a component rather than unidimensional approach, increasing attention is being paid to wealth and the more stable dimensions of income, such as permanent income. Permanent income is much more of a construct than component idea. In fact, referring back to Friedman's definition, it encompasses nearly all of the components that are typical in social and economic status research, which suggests the value of attempting to integrate and test the validity of such a concept in the context of fertility determinants. While we acknowledge the plausibility of viewing the components of SES as having distinct effects on fertility, the fertility literature on LDCs has not systematically explored the possibility that a unitary concept, like permanent income, might capture the effects of several more specific components. Accordingly, our analyses examine the impact of permanent income on fertility and also assess whether other components of SES such as education and occupation have their effects completely mediated through permanent income or whether part of their influence is unmediated by this construct.

Another important contribution of our analyses is that we treat permanent income as a latent variable because it cannot be perfectly measured by any of its indicators. Despite a clear conceptual definition of permanent income, operationalization is less straightforward because it is not directly observable. In other words, no measure perfectly captures the concept. Instead,

permanent income is a latent variable. Empirical work most frequently operationalizes permanent income by using one or more proxy variables. Therefore, when the concept of permanent income is used to study fertility or other outcomes, researchers fail to take account of the latent nature of the concept. Consequently, researchers tend to ignore the contaminating effects of measurement error. It is well known that these biases not only undermine our attempts to understand the impact of the latent variable, but they may lead to inaccurate estimates of the effects of other explanatory variables as well (Bollen 1989).

Because of the substantial amount of extant research on fertility in LDCs, it is particularly important to evaluate how common uses of social and economic status factors in models of reproductive behavior may depend on the conceptual and operational specifications of SES and permanent income.[2] Our goal is not to develop a new theory of the relationship between economic status and fertility but rather to develop a better model of the relationship of SES and permanent income to fertility with a more realistic approach that recognizes the less than perfect measurement of these explanatory variables. The next section reviews common proxy measures of permanent income in the study of developing countries.

PROXY VARIABLE MEASURES OF PERMANENT INCOME

Although occupation, education, and income are often viewed as separate components of SES, occupation and education are clearly important determinants of permanent income and as such are sometimes used as proxies for permanent income. For example, Houthakker (1957) and Mayer (1963) treat occupation as a proxy for permanent income in their evaluations of Friedman's hypothesis about the relationship between income and consumption. Hauser and Warren (1997) argue that occupation provides a useful proxy for permanent income because

[2] It is worth noting that in contrast to the abundant theoretical modeling of the relationship between economic status and fertility, and despite some notable exceptions (e.g., Mueller and Short 1983), little has been written on the relationship between permanent income and fertility.

occupational status is more highly correlated over time than is income. Education is another important aspect of permanent income. Maternal education is the socioeconomic variable most commonly included in empirical studies of fertility and child health (Bollen et al. 2001). Some researchers treat education as a proxy or determinant of permanent income. Others regard maternal education as having a distinct effect on fertility through its impact on attitudes, knowledge, or behaviors (Axinn and Barber 2001; Caldwell 1982). A few studies have attempted to disentangle the effect of women's education from its association with household economic status with mixed results (Cleland and Rodriguez 1988; Martin and Juarez 1995; Rodriguez and Cleland 1981). Husband's education is not included in models of fertility as often as female education, but when it is employed, it is often assumed to reflect the household's SES (e.g., Raftery, Lewis, and Aghajanian 1995) and not necessarily more specific attitudes and knowledge (Bollen et al. 2001).

Measures of income from cross-sectional data are generally not viewed as adequate proxies for permanent income because of the volatility of income (Deaton 1992). Averaging earnings over several years is one way of dealing with income's variability over time (Behrman and Deolalikar 1990). However, income data in developing countries are often unreliable and rarely collected (Hentschel and Lanjouw 1996). In addition, given the predominance of non-market activities in most developing country economies, it is often difficult to estimate the monetary value of many labor market activities. Thus, direct measures of income are rare, and most research relies on information about consumption or ownership of consumer durable goods as proxy measures. Both of these types of proxies aim to tap into the more long term or permanent aspect of income.

In fact, many researchers prefer expenditures to income as a measure of long-run economic status (Deaton 1992). Following Friedman, the underlying assumption of using this

measure is that long-term considerations, rather than current income, drive consumption decisions. Households borrow or save to smooth consumption across years to maintain a relatively consistent standard of living. Thus, household expenditures can serve as a proxy for permanent income (Deaton 1992). However, this option is not without its limitations. Expenditure data are rarely collected in household surveys. Moreover, even when collected, researchers have questioned their reliability (Bouis 1994; Scott and Amenuvegbe 1990).

Because of the scarcity of data on income and expenditures, many researchers use information on ownership of consumer durable goods and/or housing quality as proxies for permanent income. Information on these household characteristics is far easier to collect and more widely available than income and expenditure data. For example, the Demographic and Health Surveys (DHS) and the earlier round of World Fertility Surveys (WFS) have collected this information in over 50 countries.

There are several approaches to employing asset and housing quality measures as proxies for permanent income. Montgomery et al. (2000) include a series of consumer durable goods as separate indicators to analyze fertility and child health in several developing countries. A far more common approach is to employ an index of equally weighted items. For example, studies using DHS data often use a sum of the items available in the DHS (radio, television, refrigerator, bicycle, motorcycle, and car) as an indicator of household status. Other recent research has employed weighted sums of assets. One way of weighting is to sum the estimated monetary value of each asset (Dargent-Molina et al. 1994). Filmer and Pritchett (1999; 2001) present an alternative approach where the asset weights are estimated using principal components analysis. The principal component approach provides a convenient weighting method; however, the weights have an empirical rather than theoretical foundation.

Three recent studies have evaluated the performance of one or more of these asset-based approaches. Montgomery et al's (2000) findings suggest that consumer durable goods entered as separate variables are weak proxies for expenditures but when tested as a group might reveal effects. Filmer and Pritchett's (2001) analysis shows that the principal components score approach to weighting assets outperforms expenditure data. For example, they show that the principal components score better predicts school enrollments in India than a measure based on household expenditures. In addition, Filmer and Pritchett suggest that the principal components score has less measurement error than consumption per capita. In a comparison of several different proxy approaches, Bollen et al. (2002) find that an unweighted sum of the number of items owned and the principal components score more strongly predict fertility than expenditures and alternative ways of weighting assets in an index. Although these other papers acknowledge the measurement error in their proxies for income, researchers rarely treat permanent income as a latent variable in their models.[3]

Our approach differs in that we introduce permanent income into our model and evaluate how measurement error influences results. Furthermore, in evaluating the performance of proxies constructed from indexes of ownership of consumer durable goods, we compare several ways of weighting the individual items. Specifically, we compare the unweighted sum of the number of items owned and the principal components score to alternative weightings based on the monetary value of the goods.

Summary and assessment

In sum, empirical approaches to estimating the impact of permanent income on fertility suffer two serious problems. One is that of omitted variables. Components of SES such as

[3] Filmer and Pritchett (2001) use instrumental variables in part of their analyses to control for measurement error. In an unpublished paper, Naga and Burgess (1997) apply a latent variable framework to examine permanent income for households in China.

education and occupation are rarely included in the same model, leaving open the possibility that effects attributed to the included variable are really due to the omitted components. Yet these are distinct aspects of SES with possibly distinct impacts on outcomes such as fertility. In addition, the impact of these components of SES on permanent income is not considered nor are the direct and indirect effects of the components of SES, including permanent income, on fertility treated.

The second serious limitation is the potential impact of measurement error in proxies for permanent income. Like omitted variables, this error can lead to mistakes in inferences about influences. Given its greater over time fluctuation than education and occupation, it is particularly important that we distinguish transitory from permanent income. Though not always explicit, researchers seem to treat permanent income as more important than transitory income in predicting fertility behavior, at least in predicting long-term childbearing outcomes. Permanent income's latent nature presents special challenges to including it in empirical research. Scholars have responded to this challenge by using proxies of permanent income such as consumption or expenditure data and by using weighted and unweighted sums of asset data. Almost without exceptions, their models have not acknowledged that permanent income is a variable for which we have only indirect measures. Ultimately, our study aims to address this neglect and to provide insight into how permanent income can be best operationalized in empirical research on developing countries.

DATA

Our analyses are based on data from two countries on different continents at different stages of development: Ghana and Peru. Ghana, which achieved independence from Britain in 1957, is one of the few Anglophone countries in the West African region. It is also one of the few in recent years to witness a peaceful democratic change of power. The Ghanaian economy, which is categorized by the World Bank as a lower income country with a per capita gross

national income of only $340, has been undergoing a gradual transition to a market economy (Ho-Won 1996). Still, over 35 percent of Ghana's gross domestic product is associated with agriculture. Furthermore, a substantial number of rural households are self-reliant and not integrated into the market economy. Fertility in Ghana is still quite high, with today's total fertility rate (TFR) estimated at fewer than 4 children per women, but it has declined considerably from earlier levels of around 6.5 in 1980. The survey data for our analysis come from the Ghana Living Standards Survey (GLSS) collected in 1988 by the Ghana Statistical Service in conjunction with the World Bank. During that earlier period, Ghana's per capita GDP was slightly higher at $350. In addition, school enrollment levels for girls in primary school are now up to 74 per cent, rising from levels estimated at 68 per cent in 1990.

The second country in our study, Peru, has a per capita gross national income of $2,080 and is included in the World Bank's category of middle-income countries. Peru's economy, even during the time of the survey (1985), is much more oriented towards industry, with less than 8 per cent of the gross domestic product derived from agriculture. Fertility in Peru is also substantially lower than in Ghana. The TFR today is estimated at about 2.8 and it is estimated to have been about 4.5 in the late 1980s. Education levels are also much higher, with essentially universal schooling of boys and girls at the primary level. Our analysis is based on the 1985 Peru Living Standards Survey (PLSS) collected by the Statistical Institute of Peru in conjunction with the World Bank.

Both the Ghana and Peru datasets are part of the World Bank's Living Standards Measurement Study (LSMS). LSMS surveys are ideal for our study because they contain detailed socioeconomic data on households and individuals, including information about household expenditures and ownership of consumer durable goods, and some of them incorporate a fertility module. We chose these particular LSMS datasets because they represent

countries in different regions and at different stages of development, and they both included a fertility module.

A total of 3,192 households were interviewed in the GLSS; 5,107 households were interviewed in the PLSS. Both surveys employed stratified random sampling to obtain representative samples. (For further details see World Bank [1993a; 1993b]) Both surveys randomly selected a woman between the ages of fifteen and fifty from each household where a woman in this age group was present. The GLSS collected fertility data on a total of 2,270 women and the PLSS collected fertility data on a total of 4,119 women.[4] We omitted women who were not married or cohabiting with a man (598 women in Ghana and 1,478 women in Peru) since the vast amount of fertility occurs within marriage in both countries.[5] Our interest in the influence of the household's SES necessitates the inclusion of the educational and occupational status of the head of household, important components of SES and determinants of permanent income. For most households in both samples this head is male. Because we also include the female respondent's educational attainment in our models, for cases where our female respondent was identified as the head of the household, we used her spouse's characteristics as the head's characteristics. The necessity of including the male head's characteristics in the model results in some missing cases because some of respondents' husbands were absent from the household (352 in Ghana and 90 in Peru). Thus, our results are

[4] For Ghana, of the 3,192 households in the sample, 847 had no women between the ages of fifteen and fifty. Seventy-five women were missing from the fertility module. For Peru, of the 5,107 households in the sample, 907 had no women between the ages of fifteen and fifty. Eighty-three women were missing from the fertility module.
[5] Other research on fertility and contraception also restricts the sample to currently or ever married women (e.g., Axinn and Barber 2001; Barber et al. 2002; Dharmalingam and Morgan 2004; Entwisle and Mason 1985; Lindstrom and Berhanu 1999). Given the later average age of entry into union in Peru more cases are dropped than in Ghana since the sample includes women starting at the age of 15.

only generalizable to these populations of Ghanaian and Peruvian women. Our final samples include 1,282 women in Ghana and 2,423 women in Peru.[6]

Variable definitions

Our main analyses examine the influence of permanent income on whether the respondent had given birth within the last three years. Because an important SES component, female education, could be endogenous to fertility, examining births within a relatively short time period allows us to better evaluate the influence of SES and permanent income. However, it is also important to understand how SES and permanent income relate to longer-term, cumulative fertility outcomes. Therefore, additional analyses that we discuss later use children ever born as the outcome variable. Another issue is whether SES and permanent income has similar effects across parity of child. Trying to control for parity by entering prior fertility into the model creates endogeneity problems for the prior fertility variable. An alternative is to repeat the analysis of "birth in last 3 years" for women at different parity levels to determine whether permanent income maintains its effect. We do so later in a section that reports auxiliary analyses.

The detailed nature of the LSMS surveys allows us to measure many different aspects of permanent income. Table 1 organizes the permanent income variables into two types. The first are variables that are determinants of permanent income and the second are those that are affected by permanent income.

We begin with a description of the various determinants of permanent income, which are listed in the first column of Table 1. Several of these variables are components of socioeconomic status. For instance, both female and male head's **educational status** are included as a series of dichotomous variables indicating the highest level of education achieved.

[6] For Ghana, an additional 38 cases were missing on individual variables. For Peru, 126 had missing values on individual variables.

These include primary, middle, and secondary or greater, with none as the reference category.[7] Second, the head of the household's **occupational status** is measured using Treiman's (1977) international occupational prestige score. Because the occupational prestige score may miss the distinctive aspects of being a farmer in poor rural settings, we also include a dummy variable for being a farmer.

[INSERT TABLE 1 ABOUT HERE]

The second column of Table 1 lists variables that "reflect" or are "effect" indicators of permanent income. One of these is the **log of household expenditures** per adult. Stocks of assets owned by the household must be converted into a measure of the flow of services the assets provide to the household. The estimate of the flow of services is then used to adjust the estimate of household expenditures. We also adjust this measure for regional variations in price and inflation during the time of data collection.[8] In Ghana the units are expressed in cedis, and in Peru they are expressed in intis. In 1988 the exchange rate was 188 cedis for one U.S. dollar, and in 1985 the exchange rate was 10.98 intis for one U.S. dollar.

Information about the ownership of a long list of **consumer durable goods**, such as a cassette player or a stove, was collected in both surveys.[9] This information allows us to assess a number of different effect indicators of permanent income. Our analyses compare four different approaches to combining these assets, which we describe below.

---

[7] We do not use a category for secondary or higher schooling for females in Ghana because less than 3 percent of the sample had this much education.

[8] For the GLSS we obtained the regional and monthly inflation adjustments from the basic information document provided by the World Bank (1993a). For the PLSS we obtained the regional price deflators from Glewwe (1987) and the monthly adjustments from Webb and Baca de Valdez (1991).

[9] For the GLSS the full list is: sewing machine, stove, refrigerator or freezer, air conditioner, fan, radio, cassette player, phonograph, stereo equipment, video equipment, washing machine, black and white television, color television, bicycle, motorbike, car, and camera. For the PLSS the full list is: radio; refrigerator; sewing machine; car; bicycle; floor polisher; telephone; black and white television; color television; washing machine; knitting machine; motorcycle; record player or other sound equipment, blender, mixer or fan; and gas stove.

1. *Simple sum*. This measure is the sum of the number of goods owned by the household, which is the most common approach to constructing an index of consumer durable goods.
2. *Current value sum*. The second measure is the sum of the respondents' estimates of the current values of the goods owned by their households.
3. *Median value sum*. We expect that the answers to the reported value of goods may be highly variable, particularly in settings where no market exists for the goods. Therefore, our third approach estimates the values of all goods owned by the household as the median value reported for all households that owned that particular item. We construct this measure by summing the median values of the items owned by the households.
4. *Principal components score*. Following Filmer and Pritchett (1999; 2001) a final approach we use is the first principal components score for the items owned by the household. Principal components involves estimating a linear combination of the separate components such that the maximum of the common variance is explained and using the estimated "coefficients" as weights. The use of principal components allows each item to have a different weight, but the weight is based on the results of the principal component analysis rather than any information on the actual reported value of each of the assets. The first component captured about 24 and 32 percent of the variation in the consumer durable goods items for Ghana and Peru respectively.[10]

[10] The weights in Ghana are as follows: sewing machine .183, gas stove .280, refrigerator or freezer .370, air conditioner .067, fan .317, radio .089, radio/cassette player .241, phonograph .159, stereo equipment .316, video equipment .322, washing machine .089, black and white television .307, color television .286, bicycle .008, motorbike .044, car .283, camera .292. The weights in Peru are as follows: radio .062, refrigerator .352, sewing machine .216, car .264, bicycle .176, floor polisher .315, telephone .279, black and white television .210, color television .323, washing machine .318, knitting machine .109, motorcycle .065, record player or sound equipment .261, blender mixer or fan .339, gas stove .315.

We construct measures corresponding to these four approaches based on the consumer durable good items available in the LSMS datasets. We also construct measures that include only the consumer durable goods that are available in the DHS: radio, television, refrigerator, bicycle, motorcycle, and car. By comparing the performance of the measures based on the full set of items to the measures based on the DHS items, we can evaluate whether collecting information about a longer list of durable goods creates a more accurate proxy for permanent income. Because they are highly skewed and have outliers, we log all of the asset measures.[11]

Our final effect indicator of permanent income is an index of **housing quality**. The index includes the presence of a flushing toilet, piped water, electricity, non-dirt floor, and number of rooms in the dwelling. To maintain consistency with the scaling for the other items we code the number of rooms in the dwelling as a dummy variable. In the GLSS the variable distinguishes between one room and more than one room. About forty percent of the sample had only one room. In the PLSS we code this variable as two or fewer rooms and more than two rooms. About 50 percent of the sample had two or fewer rooms.

The control variables include religion, ethnicity, region, urban/rural, and age. Some of these variables, such as place of residence, Friedman (1957) identifies as determinants of permanent income. In addition, many of variables are likely to influence both permanent income and fertility and are therefore included as controls. For example, ethnicity and religion are likely to capture important differences in cultural values that may affect permanent income standing or fertility. Each of the control variables as well as its reference category is listed below in Table 2. Table A1 in the appendix provides descriptive statistics for these variables.

[INSERT TABLE 2 ABOUT HERE]

LATENT VARIABLE MODELS

[11] For each we added '1' before logging except for the principal components score where we added a constant value so that no values were '0' or negative.

As we described in the previous section, it is important to distinguish between *causal indicators*, which affect the latent variable, and *effect indicators*, which are determined by the latent variable (see Bollen and Lennox 1991). Education and occupational status are important components of socioeconomic status and causal indicators of permanent income. In Friedman's conceptualization, education is an attribute that influences one's capacity to generate income, so it makes more sense that education determine permanent income rather than vice versa. Occupational status is also an attribute that influences earnings potential. Similarly, both residence and ethnicity might be considered causal factors. Persons who live in more developed places should have a higher income than those who live in less developed areas. Finally, ethnic stratification has implications for economic chances, and foreigners generally have lower economic status in Ghana and higher status in Peru. In contrast, the other indicators of permanent income, expenditures, ownership of consumer durable goods, and housing quality are likely to be effect indicators of permanent income.[12]

The equations for this model have the form of:

$$y_j = \alpha_{yj} + \lambda_j \eta + \varepsilon_j$$
$$\eta = \alpha_\eta + \Gamma_1 \mathbf{x}_1 + \zeta_1$$
$$F^* = \alpha_F + \beta \eta + \Gamma_2 \mathbf{x}_2 + \zeta_2$$

where y_j represents the effect indicators of permanent income ( ) with j=1, 2,…, J , the number of indicators, $_{yj}$ is the intercept for the jth indicator equation, $_j$ is the coefficient of the impact of the latent permanent income variable ( ) on the jth indicator, $_j$ is a random measurement error with E($_j$)=0 and COV($_j$,)=0. The second equation has the permanent income ( ) as the

[12] These effect indicators are chosen in accordance with Friedman's (1957) definition of permanent income, and they help to establish that the latent variable in the model corresponds to permanent income rather than other more general concepts such as SES. As stated in the text, we view permanent income as a component of the more general concept of SES. They are not interchangeable concepts.

latent dependent variable, is the intercept, $_1$ is the row vector of coefficients for the exogenous variables included in $\mathbf{x_1}$, and $_1$ is the equation disturbance with E($_1$)=0, COV($_1$, $\mathbf{x_1}$)=0, and COV($_1$, $_j$)=0. The propensity for a birth in the last three years (F*) is the final equation where $_F$ is the intercept term, is the regression coefficient for permanent income's effect on F, $_2$ is the coefficient matrix for the exogenous variables ($\mathbf{x_2}$) in the equation, and $_2$ is the equation disturbance with E($_2$)=0, and COV($_2$, $\mathbf{x_2}$)= COV($_2$, $\mathbf{x_1}$)=0. There is some overlap in the variables in $\mathbf{x_1}$ and $\mathbf{x_2}$. We also assume that COV($_1$, $\mathbf{x_2}$)=0, COV($_2$, $_1$)=0, and COV($_2$, $_j$)=0, except for the covariance between the error terms of fertility and expenditures. These disturbances are permitted to correlate since it is possible that additional children in the household will be associated with higher expenditures. The correlation permits us to control for this possibility without confounding our estimate of permanent income's impact on fertility.[13] We also allow the errors of the expenditure variable and the consumer durable goods variable to correlate because the rental value of the durable goods is used in the construction of the expenditure variable. Finally, we allow the errors between the consumer durable goods variable and housing quality to correlate because many of the durable goods depend on the presence of electricity that is a part of the housing quality index. Figure 1 shows the path diagram for this model.[14] We also allow for urban and suburban residence to have direct effects on housing quality and consumer durable goods since electricity is dependent upon community

[13] Omitting this error covariance from the model makes little difference for the estimated effect of permanent income. We include it to demonstrate that this potential effect does not change our assessment of permanent income's effect on fertility.

[14] In path diagrams latent (unobserved) variables are represented with ovals and observed variables are represented with boxes. Straight one-headed arrows designate direct causal relationships. Usually, the exogenous variables in a model are intercorrelated, which we indicate by the straight bar with arrows coming down to each of the exogenous variables.

infrastructure (i.e., place of residence has direct paths to "durable goods" and "housing quality" though the paths are not shown in figure).[15]

[INSERT FIGURE 1 ABOUT HERE]

There are several questions that this type of modeling allows us to address. First, we assess whether it makes sense to treat permanent income as a latent variable. Our model has this latent variable mediating the effect of some variables and explaining the association of other variables. If the latent variable is not needed, then the fit of this model to the data will be poor in that the paths from permanent income will be statistically insignificant and the R-squares of durable goods, housing quality, and expenditures per adult will be low.

Second, this approach enables us to distinguish between direct and indirect effects in terms of the components of SES. For example, we can test whether the effect of female education, a component of SES, is completely mediated through permanent income or whether it also has a direct effect on fertility, a question that has motivated considerable research (e.g., Cleland and Rodriguez 1988; Martin and Juarez 1995; Rodriguez and Cleland 1981). Cleland and Rodriguez (1988) and Rodriguez and Cleland (1981) were not able to include income or permanent income in their analyses. Martin and Juarez (1995) included a measure using consumer durable goods, but did not account for the measurement error in this proxy.

Third, we determine which of the permanent income indicators are most closely associated with permanent income. We do this by comparing the squared correlation of the indicator variables with permanent income. A greater correlation suggests a closer relation between the indicator and permanent income. This result is important because it provides information on which measure is preferable to collect in surveys in order to help reduce the

[15] Strictly speaking the relation of the variables in the diagram to the "Birth in Last 3 Years" is nonlinear since the latter variable is dichotomous. To fully represent this in a path diagram we could add an underlying continuous indicator variable with a nonlinear relation to the dichotomous birth in last 3 years indicator. However, to simplify the diagram, we leave this relation implicit.

length of survey questionnaires while maximizing the accuracy of income measures. Because we want to evaluate several different ways of constructing measures based on the consumer durable goods items, we estimate separate models for each of the approaches.

Finally, as already mentioned above there are good substantive reasons to expect some of the errors in these equations to correlate (e.g., errors for fertility and expenditures) and for some measures of permanent income to be "contaminated" by exogenous variables (e.g., urban affects housing quality). These types of problems are typically either ignored or assumed away. Our model permits us to include and to test for their presence.

The models are estimated using Mplus 3.12. Because one of the endogenous variables in the analysis, having given birth in the last three years, is dichotomous, we use the robust weighted least squares estimator (labeled weighted least squares with a mean and variance adjusted test statistic [WLSMV] in Mplus). WLSMV produces consistent parameter estimates, unbiased standard errors, and a correct chi-square test statistic when there are categorical endogenous variables (Muthén and Satorra 1995).

RESULTS

The discussion of the results is organized as follows. First, we describe the results of the latent variable models for both countries. Second, we assess which of the permanent income indicators most closely measure permanent income. Third, we compare how the results differ when measurement error is taken into account versus when a proxy for economic status is used.[16]

Latent Variable Models

The first panel of results in Table 3 pertains to the latent variable model for Ghana, and the first panel of Table 4 summarizes the results of the latent variable model for Peru. In the

[16] For descriptive statistics see Table A1 in the appendix.

latent variable models displayed in Tables 3 and 4, ln expenditures per adult, the housing quality index, and ln principal components score are the three effect indicators of permanent income.[17] Overidentified latent variable models such as ours have measures of overall fit that provide information on testing the overidentifying restrictions (Bollen 1989, Ch.7). Our model is overidentified in that we estimate fewer parameters than there are variances, covariances, and means of the observed variables.[18] The fits of the models are acceptable. For both countries the Chi-square is statistically significant, but with so many cases there is enough power to detect even minor deviations from the true model (Bollen 1989: 268). For both countries, the Root Mean Squared Error of Approximation (RMSEA) shows an acceptable fit (Browne and Cudeck, 1993).[19] Given this acceptable fit, we now discuss the coefficient estimates.

[INSERT TABLE 3 ABOUT HERE]

We first consider the predictors of permanent income. Not surprisingly, female and male education, two components of socioeconomic status, are strong predictors of permanent income in both Ghana and Peru. In addition, higher occupational prestige, another component of socioeconomic status, generates higher permanent income and being a farmer is associated with lower income. Place of residence is also an important predictor of permanent income. Urban households have higher income than rural households in both countries. In Ghana, residence in the Greater Acra region is associated with higher income than residence in any of the other

[17] For models that use a different durable goods effect indicator we summarize the factor loadings, standard errors, standardized factor loadings, and squared correlations with the latent, permanent income variable in Table 5.

[18] Overidentification implies that at least some parameters in the system are solvable from at least two different equations that have as solutions unique functions of the moments of the observed variables. If the model is correct, these unique functions should equal the same quantity in the population. When they are not equal, this is evidence that the model is incorrect. Thus, the chi square test examines whether the overidentifying restrictions of the model are consistent with the data.

[19] Baseline fit indices such as the IFI or CFI are sometimes reported along with the RMSEA. In this model with exogenous covariates and a categorical outcome, calculating these indices is problematic. The difficulty is that the usual baseline model that forces a zero covariance among all observed variables is not available and without this baseline model, we cannot calculate the usual baseline fit indices. An alternative is to use a baseline model that permits all exogenous covariates to covary. However, the interpretation of the magnitude of the baseline fit indices becomes ambiguous with this new type of baseline.

regions. In Peru, residence in most regions outside of Lima is a negative predictor of permanent income.

[INSERT TABLE 4 ABOUT HERE]

We now turn to the effects on fertility. These results allow us to see the effect of the *latent* permanent income variable, rather than its proxies. In Ghana the estimated influence of permanent income on the likelihood that the woman had given birth in the last three years is –1.016. To put the magnitude of this predicted influence into some context, we report the predicted probabilities of a birth for a woman between the ages of 25 and 29 with mean or modal characteristics on the other explanatory variables at various levels of permanent income. At the mean level of permanent income the predicted probability of a birth is 0.79, at one standard deviation below it is 0.92, and at one standard deviation above it is 0.60. For Peru, we also find a large, negative and statistically significant coefficient (-1.189). The predicted probability of a birth for a woman between the ages of 25 and 29 who has mean or modal values on all other explanatory variables is 0.49; her predicted probabilities with permanent income at one standard deviation below and above the mean are 0.82 and 0.17, respectively. These findings suggest that permanent income has a strong negative influence on children ever born in both settings.

We also wanted to evaluate whether the other components of SES have a direct effect on fertility once their relationships with permanent income were introduced. In Tables 3 and 4 the male and female education coefficients reported in the fertility panel are the estimated direct effects on birth in the last three years (the part of the education effect that is not mediated by permanent income). To assess whether it is necessary to include direct paths from male and female educational attainment to fertility, we compared the model reported with a model in which these paths are omitted using a likelihood ratio test. For Ghana, excluding these paths does not diminish the model fit, which is consistent with male and female education having no

direct effects on births once permanent income is controlled. Thus in Ghana, all of the influence of male and female education is mediated by permanent income. For Peru, omitting the direct effects of educational attainment significantly worsens the model fit. In examining the direct effects we observe that male education higher than 'none' is associated with a higher probability of a birth, net of permanent income. Also, we note that the indirect effect of male education on fertility through permanent income is statistically significant and negative.

The finding that male education, net of permanent income, affects fertility provides support for research indicating that in developing countries, men tend to want more children than women (Bankole and Singh 1998). Higher male education (controlling for female education level and for household permanent income) may indicate their greater relative power within the household and hence their ability to impose more favorable (higher) childbearing patterns. In contrast, higher female education (controlling for male education and household permanent income) may indicate more autonomy for women to control their fertility (Balk 1994).

In additional analyses, we tested whether another component of SES, occupational status, influences fertility once permanent income is controlled (not shown). Neither occupational prestige nor farmer significantly influenced fertility, and adding these paths to the model did not improve the model fit. Thus, the data suggest that the effects of occupational status on the probability of a birth in the last three years do not go beyond their indirect effects that operate through permanent income.

The next set of coefficients reported in Tables 3 and 4 pertain to the effect indicators of permanent income. Permanent income is scaled to expenditures per adult so we do not interpret this coefficient. In both Ghana and Peru, the principal components score and housing quality index are positively influenced by permanent income. As expected, urban residence positively

influences both indicators, net of its influence on permanent income. We next turn to a comparison of all of the effect indicators of permanent income.

Comparing the Effect Indicators of Permanent Income

Another desirable aspect of our latent variable model is that we can estimate the proportion of variance in the proxy variables that is due to error. Table 5 reports the coefficient estimates ("factor loadings"), asymptotic standard errors, standardized coefficients, and the squared correlations of the proxy variables with the permanent income latent variable. The higher the squared correlation, the stronger is the association between permanent income and the proxy variable. This information helps in choosing measures in future studies. It also tells us the degree of error in our measures and the potential impact of treating these variables as if they were error free. Note that the expenditures and housing quality variables were effect indicators in all of the models, whereas each of the asset variables were taken one at a time in separate models as the third indicator of permanent income.

[TABLE 5 ABOUT HERE]

In both countries all the effect indicators of permanent income have highly significant factor loadings, except for the DHS median value sum in Ghana, which has only a marginally significant factor loading. Some of the indicators have substantially higher squared correlations with the latent permanent income variable than the others. The four proxy variables with the highest squared correlations with permanent income in Ghana are the full principal components (0.51), the simple sum of durable goods (0.33), the housing quality index (0.30), and the reduced DHS asset set principal components (0.30). Interestingly, the same top four indicators hold in Peru, though in a slightly different order, and their squared correlations are generally higher (0.68 to 0.51) than in Ghana. Though we cannot know for sure that these same variables will

perform similarly in other countries, it is impressive to see the proxies operating similarly across two very different contexts.

The most information and calculation intensive measures are the expenditure, current value, and median value variables. These same indicators have lower squared correlations with permanent income than do the far easier to construct simple sum and principal components measures. The lowest squared correlations with permanent income occur for current value and median value measures in Ghana, where the measures based on the full set of durable goods have almost 90 percent of their variance unassociated with permanent income, and the measures based on the DHS subset have over 90 percent of their variances unassociated with permanent income.[20] Even the best measure, the principal component variable in Peru, has about 32 percent of its variance unrelated to permanent income. Thus, even the best of the proxies fall considerably short of measuring permanent income with negligible error.

Comparing the Latent Variable and Proxy Approaches

Thus far, our results have suggested that when permanent income is measured as a latent variable, it has a strong negative influence on fertility and that various measures that are often employed as proxies for income contain a considerable amount of measurement error. Given these findings, it is important to ask whether the substantive conclusions drawn from our fertility model would be different if we followed the far more commonplace approach of measuring income with a proxy variable. In this section we describe the differences between our latent variable models and probit models that use a proxy as the measure of permanent income. We note differences in the estimated influences of both permanent income and of the other explanatory variables in the model.

[20] In fact, the current value and median value measures are so weakly related to permanent income in the Ghanaian data that when they are employed as the consumer durable good item, the predicted influence of permanent income on birth in the last three years is not statistically significant.

The second panel of results in Tables 3 and 4 pertain to the proxy approach. In the latent variable model the permanent income variable has its metric set to be similar to that of the ln expenditures per adult variable, so we compare the results of this model to the proxy variable model where ln expenditures per adult is the proxy variable.

For Ghana, the major difference between the two models is that in the latent variable model, the effect of permanent income on fertility is large, negative, and highly statistically significant, whereas in the proxy model the predicted influence of income is not statistically significant and has the opposite sign. This illustrates a fundamental shift in the conclusion about whether permanent income negatively influences fertility. When we treat ln expenditures as a proxy for permanent income, we conclude that there is no effect. Yet when we take account of the measurement error in ln expenditures as an indicator of permanent income, we find a substantial negative estimate for permanent income. We also estimated a probit model with the full set principal components score, the proxy our latent variable models indicate most closely captures permanent income. With the principal components score used as the proxy, we find that the estimated influence of permanent income on fertility is negative and statistically significant (results not shown). To set a common metric and thereby allow a comparison between the estimated influence of permanent income in this proxy model and that in the latent variable model, we re-estimated the latent variable model using the principal components score as the scaling indicator. In this comparison, the estimated influence of permanent income in the latent variable model is over twice as large as it was in the proxy model.

For Peru we also find that permanent income's coefficient estimate is quite different when we control for measurement error than when ln expenditures per adult is employed as a proxy variable. The predicted influence of permanent income is more than ten times as large in the latent variable model (-1.189 versus –0.078). Even if we use the principal components

measure as the proxy instead, the predicted influence of permanent is more than 50 percent as large when we account for measurement error (not shown).

For Peru, the differences extend beyond the assessment of the influence of permanent income. Most strikingly, the proxy model predicts that women who have secondary or higher education are less likely to have had a child than their less educated counterparts. However, the latent variable model indicates that there is no such *direct* influence of female education. This is not due to the fact that in our latent variable model we separate the direct and indirect effects of the variables that influence both permanent income and fertility (e.g., maternal education). In the proxy approach the coefficients of these variables should be viewed as direct effects because their correlations with (and therefore potential indirect effects on) the proxy for permanent income are taken into account. A pattern that we did not predict was the positive direct effect of male education on fertility when controlling for permanent income. Though not statistically significant in Ghana, the same pattern of effects is present there. The coefficient for urban residence is also substantially smaller in magnitude in the latent variable model. We also note that the predicted influences of several of the regional variables differ across the two approaches. While the coefficients of some variables in the model change a good deal, others are more stable. In particular, the age variable effects are very similar across the two models.

Overall, we find that substantial differences in our results occur when we account for the measurement error in the measures of permanent income. First, we find a very different impact of permanent income on fertility. This is true regardless of which indicator of permanent income is utilized in the proxy variable approach. Even when the best proxy for permanent income, the principal components score, is used as the proxy, the estimated influence of permanent income is substantially larger in the latent variable approach. Second, in one of the countries we find that the error in the proxy variables leads to inaccurate estimates of several of the control variables

even when these controls are free of measurement error. Given the dominance of the proxy variable approach to measuring permanent income in fertility models, this is an important result that suggests that researchers should not ignore measurement error in their proxy variables. Nevertheless, when proxy variable models are adopted, our results suggest that the principal components approach is the preferred approach of estimating the appropriate weights for each of the included items.

Auxiliary Analyses

We conducted supplemental analyses to examine the robustness of our results under different specifications. First, we examined a different fertility variable, children ever born, because we wanted to evaluate whether our substantive findings would apply to this commonly used dependent variable. The use of children ever born, in particular, is interesting because this variable captures lifetime parity to the point of the survey. It provides evidence on whether permanent income's effects, as well as those of the other controls, change when we look at life course parity as opposed to just children born in the immediate past. Although there is no direct way of comparing the magnitudes of the permanent income coefficient across the models predicting births in the last three years and children ever born, we did find that the influence of permanent income in the children ever born models was large, negative, and statistically significant. Moreover, a comparison between the latent variable models and proxy models using children ever born as the outcome also indicated that the predicted influence of permanent income is substantially larger when measurement error is taken into account.

We also examined multiple group models to explore whether the effect of permanent income is parity specific. We formed three parity groups (0 to 2, 3 to 5, and 6 or more) and repeated our analyses for each group. In Peru, permanent income has a negative effect on the probability of a birth in the last three years for all parity groups. Although the coefficients in the

medium and high parity groups are larger, they do not differ statistically from the coefficient in the low parity group. In Ghana, permanent income only has a statistically significant effect is in the high parity group, and the coefficient in this group is statistically significantly different from the other two groups. These results suggest that permanent income may be more likely to discourage further fertility at higher levels of parity, particularly in high fertility contexts.

CONCLUSIONS

The past few years have seen a resurgence of interest in the importance of long-term economic status in social science research. We concur that long-term economic status is important, but also call attention to the fact that permanent income is inherently difficult to measure, particularly in developing countries. Our analyses question the conventional approach of using proxy variable analyses to assess the impact of permanent income on fertility. Despite finding evidence that the principal components score and the simple sum proxies are better than others, our latent variable models demonstrate that these are hardly ideal. Even the best indicator of permanent income contains a good deal of measurement error. This measurement error biases both the coefficients of permanent income and the other coefficients. Indeed, we saw this happen in our analyses. The estimated impact of permanent income was much larger in the latent variable models for both countries, and for Peru the coefficients for some of the control variables were influenced by measurement error. Therefore incorporating a latent variable for income enhances the accuracy of the model results.

From the perspective of data collection we also have recommendations. Depending on one's purposes, it may not be useful to collect information on the value of durable goods and expenditures if their main purpose would be to be used as control variables for SES or income. We found that these indicators performed much worse than the simple sum and principal components scores. This could be for several reasons. First, respondents may be unable to

realistically estimate the value of their goods, and it may be particularly difficult to estimate the value of goods and services that are acquired through non-market channels. Consequently, these responses are likely to contain a large amount of error. Second, there can be a great deal of regional price variation and inflation as was the case for the countries in our study. Although adjustments for these variations can and should be made, they require important assumptions and extensive information on price deflators. For example, in Peru monthly price information is only available for the 13 major cities. Therefore, the researcher wishing to adjust the value of goods and expenditures must assume that the areas surrounding the cities for which the information on prices is available should be adjusted in the same way. Our results suggest that the current method of collecting expenditure data are not proving to be reliable estimates of permanent income and that simpler counts or principal components scores of consumer durables perform better as indicators.

We also wanted to evaluate whether collecting long lists of consumer durable goods results in a more accurate measure of income than the shorter DHS list. Our results were mixed. It made a large difference in Ghana but not in Peru. This may imply that in very undeveloped contexts where hardly any durable goods are owned and there is thus less variance across households, such as in Ghana, it may make more of a difference than in relatively more developed contexts, such as Peru. However, further research will have to determine whether this finding generalizes to other settings.

Overall, we find that permanent income is an important determinant of fertility and that how it is measured influences the substantive conclusions that researchers will draw. Therefore researchers interested in income alone or the effect of other variables should take great care in controlling for the measurement error in it. Our study provides some guidelines on how to

operationalize permanent income in studies of fertility and as well as other demographic and non-demographic outcomes in LDCs.

Finally, stratification research continues to question whether individual components of SES such as education, occupation, ethnicity, etc. act as a single general factor or as distinct components in determining outcomes. Much evidence points toward the component view. However, our paper paints a more complex picture. First, we distinguish between the usual components of SES and the permanent income component. Permanent income is shown to be a general characteristic with a substantial impact on fertility in both Ghana and Peru. In both countries, we find that the other specific components of SES, such as occupation and female education, have their effects on fertility largely mediated through permanent income. Thus there is support for the SES components channeling their impact through another component (i.e., permanent income) rather than each of these other SES components having predominately distinct, direct effect on fertility. This result runs counter to the more typical finding that all components of SES are likely to have distinct, *direct* effects on fertility and other outcomes. A plausible explanation for our finding is that we have controlled for measurement error whereas other studies typically do not. Using a latent variable model rather than a proxy variable approach reveals the intervening role played by permanent income. We speculate that the concept of permanent income will be useful in the study of other outcomes in other contexts.

REFERENCES

Axinn, William G. and Jennifer S. Barber. 2001. "Mass Education and Fertility Transition." *American Sociological Review* 66:481-505.

Axinn, William G. and Scott T. Yabiku. 2001. "Social Change, the Social Organization of Families, and Fertility Limitation." *American Journal of Sociology* 106:1219-1261.

Balk, Deborah. 1994. "Individual and Community Aspects of Women's Status and Fertility in Rural Bangladesh." *Population Studies* 48 (1): 21-45.

Bankole, Akinrinola and Susheela Singh. 1998. "Couples' Fertility and Contraceptive Decision-Making in Developing Countries: Hearing the Man's Voice." *International Family Planning Perspectives* 24(1): 15-24.

Barber, Jennifer S., Lisa D. Pearce, Indra Chaudhury, and Susan Gurung. 2002. "Voluntary Associations and Fertility Limitation." *Social Forces* 80:1369-1401.

Becker, Gary S. 1981. *A Treatise on the Family*. Cambridge: Harvard University Press.

Behrman, Jere R. and Anil B. Deolalikar. 1990. "The Intrahousehold Demand for Nutrients in Rural South India: Individual Estimates, Fixed Effects, and Permanent Income." *Journal of Human Resources* 25(4):665-696.

Blau, Peter M. and Otis Dudley Duncan. 1967. *The American Occupational Structure*. New York: Wiley.

Bollen, Kenneth A. 1989. *Structural Equations with Latent Variables*. New York: John Wiley & Sons.

Bollen, Kenneth A., Jennifer L. Glanville and Guy Stecklov. 2001. "Socioeconomic Status and Class in Studies of Fertility and Health in Developing Countries." *Annual Review of Sociology*.

Bollen, Kenneth A., Jennifer L. Glanville and Guy Stecklov. 2002. "Economic Status Proxies in Studies of Fertility in Developing Countries: Does the Measure Matter?" *Population Studies* 56(1): 81-96.

Bollen Kenneth A. and Richard Lennox. 1991. "Conventional Wisdom on Measurement - A Structural Equation Perspective." *Psychological Bulletin* 110: (2) 305-314.

Browne, Michael W. and Robert Cudeck. 1993. "Alternative Ways of Assessing Model Fit." In *Testing Structural Equation Models*, edited by Kenneth A. Bollen and J. Scott Long. Newbury Park, CA: Sage Publications.

Bongaarts, John. 1998. "Demographic Consequences of Declining Fertility." *Science* 282, 419-420.

Bouis, Howarth E. 1994. "The Effect of Income on Demand for Food in Poor Countries: Are Our Food Consumption Databases Giving Us Reliable Estimates?" *Journal of Development Economics* 44(1):199-226.

Caldwell, John C. 1982. *Theory of Fertility Decline*. New York: Academic Press.

Cleland, John and German Rodriguez. 1988. "The Effect of Parental Education on Marital Fertility in Developing Countries." *Population Studies* 42:419-442.

Cleland, John and Chris Wilson. 1987. "Demand Theories of the Fertility Transition: an Iconoclastic View. *Population Studies* 41: 5-30.

Crenshaw, Edward M., Matthew Christenson, and Doyle R. Oakey. 2000. "Demographic Transition in Ecological Focus" *American Sociological Review* 65 (3): 371-391.

Dargent-Molina, Patricia S., Sherman A. James, David S. Strogatz and David A. Savitz. 1994. "Association between Maternal Education and Infant Diarrhea in Different Household and Community Environments." *Social Science & Medicine* 38(2):343-350.

Davis, Kingsley and Judith Blake. 1956. "Social Structure and Fertility: An Analytic Framework." *Economic Development and Cultural Change* 4(3): 211-35.

Deaton, Angus. 1992. *Understanding Consumption*. New York: Oxford University Press.

Desai, Sonalde and Sylvia Alva. 1998. "Maternal education and child health: is there a strong causal relationship?" *Demography* **35**(1): 71:82.

Dharmalingam, A. and S. Philip Morgan. 2004. "Pervasive Muslim-Hindu Fertility Differences in India." Demography 41(3): 529-545.

Duncan, Greg J., Jeanne Brooks-Gunn, and Pamela K. Klebanov. 1994. "Economic Deprivation and Early Childhood Development." *Child Development* 65: 296-318.

Easterlin, Richard A. 1969. "Towards a Socioeconomic Theory of Fertility." In S. J. Behrman et al (eds) *Fertility and Family Planning: A World View*. Ann Arbor: University of Michigan Press.

Entwisle, Barbara and William M. Mason. 1985. "Multilevel Effects Of Socioeconomic-Development And Family-Planning Programs On Children Ever Born." *American Journal of Sociology* 91:616-649.

Featherman, David L. and Robert M. Hauser (eds.). 1977. *The Process of Stratification: Trends and Analysis* NY: Academic Press.

Filmer, Deon and Lant Pritchett. 1999. "The Effect of Household Wealth on Educational Attainment: Evidence from 35 Countries." *Population and Development Review* 25(1): 85-120.

Filmer, Deon and Lant Pritchett. 2001. "Estimating Wealth Effects without Income or Expenditure Data—or Tears: Educational Enrollment in India." *Demography* 38(1): 115-132.

Friedman Milton. 1957. *A Theory of the Consumption Function*. Princeton: Princeton University Press.

Hauser, Robert M. and John R. Warren. 1997. "Socioeconomic Indexes for Occupations: A Review, Update, and Critique." In *Sociological Methodology*, edited by Adrian E. Raftery, 177-298. Cambridge: Blackwell Publishers.

Henretta, John C. and Richard T. Campbell. 1978. "Net Worth as an Aspect of Status." *American Journal of Sociology* 83(5): 1204-1223.

Hentschel, Jesko and Peter Lanjouw. 1996. "Constructing an Indicator of Consumption for the Analysis of Poverty: Principles and Illustrations with Reference to Ecuador." Living Standards Measurement Study, Working Paper No. 124, World Bank, Washington, D.C.

Hirschman, Charles. 1994. "Why Fertility Changes." *Annual Review of Sociology* 20: 203-33.

Hollingshead August B. and Fredrick C. Redlich. 1958. *Social Class and Mental Illness*. New York: Wiley. Pp. 387-97.

Houthakker, Hendrik S. 1957. "The Permanent Income Hypothesis: A Review Article." *American Economic Review*. 47(2): 396-404.

Ho-Won, Jeong. 1996. "Ghana: Lurching Toward Economic Rationality." *World Affairs* 159(2): 64-71.

Jejeebhoy, Shireen J. 1995. *Women's Education, Autonomy, and Reproductive Behavior: Experience from Developing Countries.* Oxford: Clarendon Press.

Khlat, Myriam and Carine Ronsmans. 2000. "Deaths Attributable to Childbearing in Matlab, Bangladesh: Indirect Causes of Maternal Mortality Questioned." *American Journal of Epidemiology* 151(3): 300-306.

Klebanoff, Mark. 1988. "Short Interpregnancy Interval and the Risk of Low-Birth-Weight." *American Journal of Public* 78(6): 667-670.

Lee, Ronald D. and Rodolfo K. Bulatao: "The demand for children: A critical essay". In R.A. Bulatao and R.D. Lee (eds.) *Determinants of Fertility in Developing Countries*, Vol. 1, Academic Press, New York, 1983

Lindstrom, David P. and Betemariam Berhanu. 1999. "The Impact of War, Famine, and Economic Decline on Marital Fertility in Ethiopia." *Demography* 36:247-261.

Lobao, Linda M. and Lawrence A. Brown. 1998. "Development Context, Regional Differences among Young Women, and Fertility: The Ecuadorean Amazon." *Social Forces* 76 (3): 819-849.

Martin, Teresa Castro and Fatima Juarez. 1995. "The Impact of Women's Education on Fertility in Latin America: Searching for Explanations." *International Family Planning Perspectives* 21: 52-57.

Mason, Karen. 1997. "Explaining Fertility Transitions." *Demography* 34: 443-454.

Mayer, Thomas. 1963. "The Permanent Income Theory and Occupational Groups." *Review of Economics and Statistics* 45(1):16-22.

McIntosh, Alison C. and Jason L. Finkle. "The Cairo Conference on Population and Development: A New Paradigm?" *Population and Development Review* 21(2): 223-260.

McLeod, Jane D. and Michael J. Shanahan. 1993. "Poverty, Parenting and Children's Mental Health." *American Sociological Review* 58: 351-366.

Montgomery, Mark R., Michele Gragnolati, Kathleen A. Burke and Edmundo Paredes. 2000. "Measuring Living Standards with Proxy Variables." *Demography* 37: (2) 155-74.

Mueller, Eva and Kathleen Short. 1983. "Effects of Income and Wealth on the Demand for Children." published in RA Bulatao and RD Lee (eds.) *Determinants of Fertility in Developing Countries, Volume 1.* New York: Academic Press.

Muthén, Bengt O and A. Satorra. 1995. "Technical aspects of Muthén's Liscomp approach to estimation of latent variable relations with a comprehensive measurement model." *Psychometrika,* 60: 489-503.

Naga, Ramses H. Abul and Robin Burgess. 1997. "Prediction and Determination of Household Permanent Income." London School of Economics and Political Science. Discussion Paper No. DARP/32, London, England.

Namboodiri, N. Krishnan. 1972. "The Integrative Potential of a Fertility Model: An Analytical Test." *Population Studies* 26: 185-206.

Notestein, F. 1945. "Population – the long view," In *Food for the World,* ed. TW Schultz, pp. 36-57. Chicago: University of Chicago Press.

Pollack, Robert A. and Susan C. Watkins. 1993. "Cultural and Economic Approaches to Fertility: Proper Marriage or Mesalliance?" *Population and Development Review* 19(3): 467-496.

Raftery Adrian E., Steven M. Lewis, Akbar Aghajanian. 1995. "Demand or Ideation? Evidence from the Iranian Marital Fertility Decline." *Demography* 32(2): 159-82.

Rainwater, Lee. 1974. *What Money Buys: Inequality and the Social Meanings of Income*. New York: Basic Books.

Rodriguez, German, and John Cleland. 1981. "The Effects of Socioeconomic Characteristics on Fertility in 20 Countries." *International Family Planning Perspectives* 7: 93-101.

Scott, Chris and Ben Amenuvegbe. 1990. "Effect of Recall Duration on Reporting Household Expenditures: An Experimental Study in Ghana." Social Dimensions of Adjustment in Africa Working Paper 6, The World Bank.

Sørensen, Aage B. 2000. "Symposium on Class Analysis: Toward a Sounder Basis for Class Analysis." *American Journal of Sociology* 105: 1523-1558.

Spilerman, Seymour. 2000. "Wealth and Stratification Processes." *Annual Review of Sociology* 26: 497-524.

Spilerman, Seymour. 2004. "The Influence of Parental Wealth on Early Living Standards in Israel." *American Journal of Sociology*.

Takeuchi, David T., David R. Williams, and Russell K. Adair. 1991. "Economic Stress in the Family and Children's Emotional and Behavioral Problems." *Journal of Marriage and Family* 53: 1031-1041.

Thornton, Arland. 2001. "The Developmental Paradigm, Reading History Sideways, and Family Change." *Demography* 38: 449-466.

Townsend, Robert M. 2005. "Consumption Insurance: An Evaluation of Risk-Bearing Systems in Low-Income Economies." *Journal of Economic Perspectives* 9: 83-102.

Treiman, Donald J. 1977. *Occupational Prestige in Comparative Perspective*. New York: Academic Press.

Webb, Richard. and Graciela Fernández Baca de Valdez. 1991. *Peru en Numeros*. Cuanto S.A: Lima, Peru.

Weber, Max. 1946. *Class, Status, and Party*. In From Max Weber: Essays in Sociology, trans. HH Gerth, CW Mills, pp. 180-95. New York: Oxford University Press.

Williams, David R. and Chiquita Collins. 1995. "US Socioeconomic and Racial-Differences in Health - Patterns And Explanations." *Annual Review of Sociology* 21: 349-386.

Willis, Robert J. 1973. "New economic approaches to fertility." *Journal of Political Economy* 81(2): S14-S64.

World Bank, (Poverty and Human Resources Division). 1993a. "Ghana Living Standards Survey (GLSS), 1987-88 and 1988-89: Basic Information." Unpublished document. Washington, DC.

World Bank, (Poverty and Human Resources Division). 1993b. "Peru Living Standards Survey (PLSS), 1985-86: Basic Information." Unpublished document. Washington, DC.

Wu, Lawrence L. 1996. "Effects of Family Instability, Income, and Income Instability on the Risk of Premarital Birth." *American Sociological Review* 61: 386-40.

Table 1. Classification of the Measures of Permanent Income

Determinants of Permanent Income (Causal Indicators)	Effects of Permanent Income (Effect Indicators)
Male head's educational attainment	Log of household expenditures per adult
Female's educational attainment	Ownership of consumer durable goods (several different approaches to constructing index)
Male head's occupational status: Treiman's occupational prestige Farmer	Housing quality

Table 2. Description of Control Variables

	GLSS	PLSS
Foreign	Equals 1 if head of household was born out of the country	Equals 1 if head of household was born out of the country
Religion	Catholic, other Christian, Moslem, other religion, and traditional religion (reference)	
Ethnicity	Ewe, Gaadang, Akan, and other ethnicity (reference)	Equals 1 if interview was conducted in an indigenous language
Place of residence	Ecological zones: coast, greater Accra, forest, and savannah (reference) Urban, semi-urban, and rural (reference)	Ecological zones: northern coast, southern coast, Lima (reference), northern mountain, central mountain, southern mountain, and jungle Urban and rural (reference)
Woman's age	15-19 (reference), 20-24, 25-29, 30-34, 35-39, and 40-50	15-24 (reference), 25-29, 30-34, 35-39, and 40-50

Table 3. Parameter Estimates for the Latent Variable Model and the Proxy Variable Model Predicting a Birth in the Last Three Years, Ghana

		Latent Variable Model[a]		Proxy Model	
Predicted variable	**Explanatory variable**	**Coef.**	**SE**	**Coef.**	**SE**
Permanent Income					
	Education				
	Female primary	0.008	0.024		
	Female greater than primary	0.103 ***	0.026		
	Female none (reference)				
	Male primary	0.008	0.033		
	Male middle	0.063 *	0.031		
	Male secondary or greater	0.234 ***	0.049		
	Male none (reference)				
	Occupation				
	Occupational prestige/10	0.049 ***	0.012		
	Farmer	-0.137 ***	0.026		
	Residence				
	Urban	0.088	0.054		
	Semi-urban	-0.051	0.042		
	Rural (reference)				
	Coast	0.072	0.043		
	Greater Accra	0.291 ***	0.065		
	Forest	0.035	0.040		
	Savannah (reference)				
	Ethnicity				
	Ewe	-0.039	0.034		
	Gaadang	-0.008	0.040		
	Akan	0.028	0.027		
	Other (reference)				
	Foreign	-0.085 *	0.042		
R-square		0.668			
Birth Last 3 Years					
	Socioeconomic status				
	Permanent income (latent)	-1.016 *	0.439		
	Income proxy (expenditures)			0.086	0.071
	Female primary	0.031	0.104	0.020	0.103
	Female greater than primary	0.104	0.101	-0.011	0.091
	Female none (reference)				
	Male primary	0.029	0.146	0.010	0.136
	Male middle	0.140	0.136	0.060	0.121
	Male secondary or greater	0.169	0.221	-0.104	0.156
	Male none (reference)				
	Place of residence				
	Urban	-0.012	0.136	-0.141	0.103
	Semi-urban	-0.138	0.132	-0.096	0.120
	Rural (reference)				

Table 3, continued					
	Coast	0.102	0.170	0.006	0.148
	Greater Accra	0.334	0.238	-0.008	0.183
	Forest	0.109	0.136	0.059	0.119
	Savannah (reference)				
	Age				
	15 to 19 (reference)				
	20 to 24	0.591 **	0.184	0.575 **	0.180
	25 to 29	0.445 **	0.159	0.420 **	0.155
	30 to 34	0.278	0.169	0.246	0.168
	35 to 39	0.036	0.190	0.018	0.184
	40 to 50	-0.698 ***	0.192	-0.709 *	0.186
	Ethnicity				
	Ewe	-0.147	0.155	-0.098	0.138
	Gaadang	0.061	0.221	0.073	0.202
	Akan	0.084	0.138	0.053	0.125
	Other (reference)				
	Foreign	0.326	0.168	0.403 **	0.153
	Religion				
	Catholic	0.088	0.136	0.081	0.132
	Other Christian	0.042	0.134	0.034	0.136
	Moslem	0.048	0.138	0.038	0.14
	Other religion	0.560 **	0.201	0.568 **	0.206
	Traditional (reference)				
R-square[b]		0.198			
Indicators of Permanent Income					
Expenditures per adult					
	Permanent income	1.000			
Durables--pc score					
	Permanent income	1.339 ***	0.171		
	Urban	0.234 **	0.073		
	Semi-urban	0.116	0.060		
Housing quality					
	Permanent income	1.671 ***	0.366		
	Urban	1.089 ***	0.162		
	Semi-urban	0.435 *	0.179		
Covariances					
	Expenditures, birth	0.048 **	0.018		
	Expenditures, principal comp.	0.018	0.013		
	Hsg. quality, principal comp.	0.080 ***	0.021		

N = 1,282

*p<.05, **p<.01, ***p<.001 (two-tailed tests).

[a]Chi-square=103.514, DF=21, RMSEA=.055

[b]We do not report an r-square for the proxy model because the r-squares in the probit and latent variable models are not comparable.

Table 4. Parameter Estimates for the Latent Variable Model and the Proxy Variable Model Predicting a Birth in the Last Three Years, Peru

		Latent Variable Model[a]		Proxy Model	
Predicted variable		**Coef.**	**SE**	**Coef.**	**SE**
Permanent Income					
	Education				
	Female primary	0.133 ***	0.028		
	Female secondary	0.339 ***	0.040		
	Female more than 2nd.	0.517 ***	0.056		
	Female none (reference)				
	Male primary	0.117 **	0.040		
	Male secondary	0.209 ***	0.046		
	Male more than 2nd.	0.358 ***	0.056		
	Male none (reference)				
	Occupation				
	Occupational prestige/10	0.057 ***	0.009		
	Farmer	-0.150 ***	0.032		
	Place of residence				
	Urban	0.114 *	0.054		
	Rural (reference)				
	Northern coast	-0.214 ***	0.034		
	Southern coast	-0.044	0.043		
	Northern mountain	-0.247 ***	0.052		
	Central mountain	-0.196 ***	0.044		
	Southern mountain	-0.193 ***	0.045		
	Jungle	-0.235 **	0.078		
	Lima (reference)				
	Ethnicity				
	Indigenous language	-0.126 *	0.054		
	Foreign	0.197 **	0.076		
R-square		0.806			
Birth Last 3 Years					
	Socioeconomic status				
	Permanent income (latent)	-1.189 ***	0.260		
	Income proxy (expenditures)			-0.078	0.050
	Female primary	-0.038	0.097	-0.216 *	0.093
	Female secondary	0.079	0.153	-0.352 **	0.122
	Female more than 2nd.	0.163	0.217	-0.487 **	0.155
	Female none (reference)				
	Male primary	0.279 *	0.124	0.145	0.113
	Male secondary	0.334 *	0.157	0.057	0.132
	Male more than 2nd.	0.598 **	0.209	0.052	0.156
	Male none (reference)				

Table 4, continued

	Place of residence				
	Urban	-0.141	0.116	-0.361 *	0.082
	Rural (reference)				
	Northern coast	-0.159	0.098	0.076	0.084
	Southern coast	-0.030	0.123	0.020	0.111
	Northern mountain	-0.301 *	0.152	-0.013	0.142
	Central mountain	0.024	0.117	0.257 *	0.101
	Southern mountain	-0.021	0.125	0.208 *	0.104
	Jungle	-0.228	0.176	0.019	0.141
	Lima (reference)				
	Age				
	15 to 24 (reference)				
	25 to 29	-0.117	0.095	-0.113	0.095
	30 to 34	-0.491 ***	0.090	-0.497 *	0.092
	35 to 39	-0.806 ***	0.098	-0.815 *	0.101
	40 to 50	-1.695 ***	0.102	-1.711 *	0.104
	Ethnicity				
	Indigenous language	-0.267	0.146	-0.151	0.115
	Foreign	0.307	0.559	0.083	0.408
R-square[b]		0.363			
Indicators of Perm. Income					
Expenditures per adult					
	Permanent income	1.000			
Durables--pc score					
	Permanent income	1.182 ***	0.098		
	Urban	0.037	0.071		
Housing quality					
	Permanent income	1.861 ***	0.201		
	Urban	0.710 ***	0.140		
Covariances					
	Expenditures, birth	0.024	0.017		
	Expenditures, principal comp.	0.050 ***	0.010		
	Hsg. quality, principal comp.	0.054 **	0.018		

N=2,423

*p<.05, **p<.01, ***p<.001 (two-tailed tests).

[a]Chi-square=325.185, DF=21, RMSEA=.077

[b]We do not report an r-square for the proxy model because the r-squares in the probit and latent variable models are not comparable.

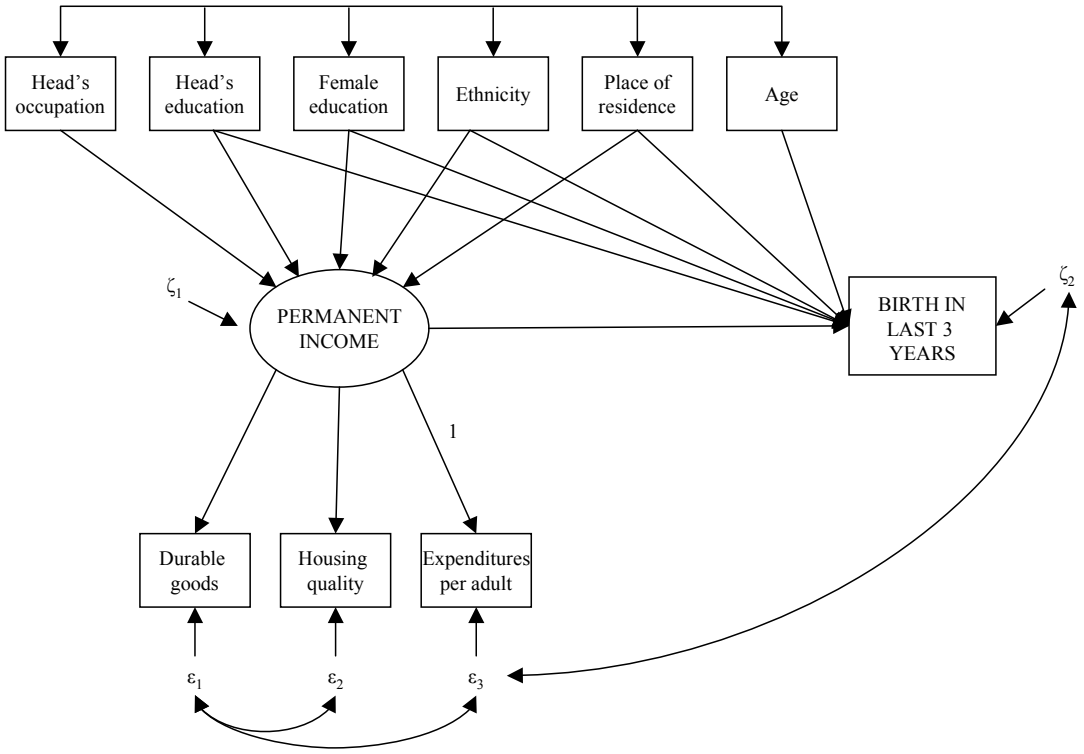
Table 5. Factor Loadings and Squared Correlations of Effect Indicators with Permanent Income

	Unstandardized Coefficient	S.E.	Standardized Coefficient	Squared Correlation with Income
Ghana				
Expenditures[a]	1.000		0.505	0.255
Housing quality[a]	1.671 ***	0.366	0.366	0.303
Simple sum	1.311 ***	0.192	0.523	0.326
Current value	5.864 ***	1.274	0.313	0.129
Median value	5.050 ***	1.294	0.272	0.102
Principal components	1.339 ***	0.171	0.631	0.511
DHS--simple sum	1.763 ***	0.460	0.574	0.265
DHS--current value	4.676 ***	1.284	0.232	0.063
DHS--median value	2.311	1.210	0.121	0.016
DHS--principal components	0.859 ***	0.131	0.476	0.296
Peru				
Expenditures[a]	1.000		0.610	0.372
Housing quality[a]	1.861 ***	0.201	0.585	0.558
Simple sum	1.869 ***	0.154	0.695	0.511
Current value	3.994 ***	0.411	0.591	0.355
Median value	4.284 ***	0.414	0.670	0.442
Principal components	1.182 ***	0.098	0.808	0.684
DHS--simple sum	0.706 ***	0.061	0.662	0.477
DHS--current value	3.666 ***	0.364	0.544	0.325
DHS--median value	4.213 ***	0.378	0.647	0.462
DHS--principal components	0.911 ***	0.076	0.748	0.629

***p<.001

[a] Estimates are for the full set principal components model.

Figure 1. Path Diagram of Latent Variable Model



APPENDIX

Table A1. Descriptive Statistics

	Ghana			Peru	
Variable	Mean	St. D.		Mean	St. D.
Fertility			*Fertility*		
Birth in last 3 years	0.594	0.491	Birth in last 3 years	0.487	0.500
Children ever born	3.870	2.727	Children ever born	4.272	2.880
Economic Resources			*Economic Resources*		
Occupational prestige	39.603	8.082	Occupational prestige	38.374	10.578
Farmer	0.573	0.495	Farmer	0.389	0.488
Expenditures per adult	11.421	0.568	Expenditures per adult	6.388	0.774
Sum of asset indicators	0.710	0.614	Sum of asset indicators	1.254	0.718
Sum of current values	6.512	4.776	Sum of current values	6.417	3.314
Sum of median values	6.561	4.764	Sum of median values	6.679	2.977
Principal components	0.448	0.593	Principal components	0.861	0.647
DHS--sum of asset indicators	0.411	0.452	DHS--sum of asset indicators	0.889	0.514
DHS--sum of current values	4.598	4.804	DHS--sum of current values	5.942	3.520
DHS--sum of median values	4.405	4.749	DHS--sum of median values	6.198	3.216
DHS-principal components	0.315	0.495	DHS-principal components	0.759	0.556
Housing quality	1.732	1.048	Housing quality	2.373	1.493
Education			*Education*		
Female none (reference)	0.501	0.500	Female none (reference)	0.212	0.408
Female primary	0.180	0.384	Female primary	0.429	0.495
Female middle or greater	0.319	0.466	Female secondary	0.270	0.444
			Female greater than secondary	0.089	0.285
Male none (reference)	0.342	0.479	Male none (reference)	0.077	0.272
Male primary	0.125	0.331	Male primary	0.480	0.500
Male middle	0.425	0.495	Male secondary	0.294	0.456
Male secondary or greater	0.108	0.311	Male greater than secondary	0.149	0.357
Place of residence			*Place of residence*		
Urban	0.279	0.449	Urban	0.556	0.497
Semi-urban	0.169	0.375			
Rural (reference)	0.552	0.498	Rural (reference)	0.444	0.497
Coast	0.211	0.408	Northern coast	0.224	0.417
Grtacra	0.108	0.310	Southern coast	0.088	0.283
Forest	0.436	0.496	Northern mountain	0.100	0.300
Savannah (reference)	0.245	0.425	Central mountain	0.125	0.331
			Southern mountain	0.124	0.330

Table A1, continued

			Jungle	0.041	0.199
			Lima (reference)	0.297	0.457
Age			*Age*		
15 to 19 (reference)	0.065	0.246	15 to 19 (reference)	0.039	0.193
20 to 24	0.206	0.405	20 to 24	0.114	0.318
25 to 29	0.231	0.422	25 to 29	0.208	0.406
30 to 34	0.202	0.402	30 to 34	0.215	0.411
35 to 39	0.138	0.345	35 to 39	0.180	0.384
40 to 50	0.158	0.365	40 to 50	0.245	0.430
Religion					
Catholic	0.176	0.381			
Other Christian	0.391	0.488			
Moslem	0.137	0.344			
Other religion	0.048	0.215			
Traditional (reference)	0.248	0.431			
Ethnicity			*Ethnicity*		
Ewe	0.159	0.366	Indigenous language	0.059	0.236
Gaadang	0.067	0.250			
Akan	0.424	0.494			
Other (reference)	0.350	0.475			
Foreign	0.048	0.213	Foreign	0.004	0.064
N=1282			N=2423		