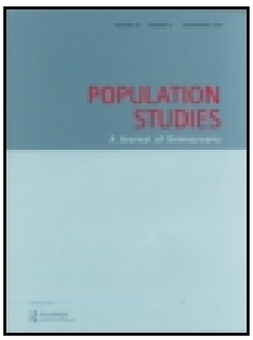

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Socio-economic status, permanent income, and fertility: A latent-variable approach

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This paper examines how permanent income and other components of socio-economic status (SES) are related to fertility in less developed countries. Because permanent income cannot be measured directly, we employ a latent-variable method. We compare our results with those of the more common proxy-variable method and investigate the consequences of not accounting for measurement error. Using 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. Controlling for measurement error in the proxies for permanent income can also 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. The results have implications beyond this specific dependent variable, providing evidence on the sensitivity of microanalyses to the treatment of long-term economic status.

Keywords: permanent income; income; wealth; socio-economic status; fertility; measurement error; proxies; latent variable; less developed countries

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Introduction

Socio-economic factors are featured in most studies of the determinants of childbearing. This is true whether they are posited to bear direct causal influences as in models of demographic transition (Notestein 1945; Hirschman 1994) or whether socio-economic factors are introduced to control for confounding influences (Cleland and Rodriguez 1988). Despite a diverse literature on the determinants and correlates of fertility decline, the notion that socio-economic status (SES) must be taken into account is a consistent theme (Bollen et al. 2001). While SES is a complex and often loosely defined multidimensional concept, one component of it that is related to fertility and is widely discussed is income. In this paper, we examine the concept of 'permanent income' and test the relationship of this variable, which we distinguish from other dimensions of SES, to fertility in Ghana and Peru. The concept of permanent income was proposed by Friedman (1957) and is one of the more important developments in empirical social sciences.

In any country, accurate measurement of income is a challenge. This is particularly true for less developed countries (LDCs), where markets are undeveloped and barter can be more common than monetary exchanges. For these reasons, income is relatively little studied. Typically, other dimensions of SES, such as maternal education, are studied instead (Jejeebhoy 1995; Desai and Alva 1998). An issue that is rarely addressed is whether the omission of income is justified, either because of its minor impact on the variable of interest or because it is difficult to measure. Even when income is included, its effect is often not distinguished from that of other components of SES, which makes it difficult to determine the distinct impact of income on fertility.

While income and other components of SES affect most life chances, their effects on fertility in LDCs are interesting for several reasons. First, high fertility levels in LDCs are expected to contribute nearly 2 billion people to the world population by 2125 (Bongaarts 1998). Second, births are major life events for households that also affect many other outcomes such as maternal and child health

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(Klebanoff 1988; Lobao and Brown 1998; Khlat and Ronsmans 2000). Third, the negative fertility–income gradient observed both within and between countries has been a continuing source of academic and policy disputes. These have ranged from the arguments of Malthus against the Poor Laws in Victorian England to debates about global population policy in the forums of the decennial population conferences (McIntosh and Finkle 1995).

One purpose of the study presented here was to formulate a model that would relate the components of SES, including permanent income, to fertility in LDCs. In doing so, we recognized the impossibility of perfectly measuring a variable based on an abstract concept like permanent income. Our strategy was to treat it 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 expenditure, which is likely to contain a good deal of measurement error. A second purpose of our study was to compare the results from our latent-variable approach with those of the more typical proxy-variable method. Our models also allow us to compare several proxy variables for permanent income and to assess their correlations with the latent construct.

The analyses are based on data from Ghana and Peru, both collected during the mid-to-late 1980s. The analysis of data from two countries from different regions of the less developed world and at 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, the analyses provide insight into the use of permanent income in examining other outcomes. Our results show that neglecting measurement error can have serious consequences.

SES, permanent income, and fertility

The concern with how to reduce fertility in high-fertility settings has generated much research on fertility change in poor countries (Lee and Bulatao 1983; Axinn and Barber 2001). However, this research has not led to a consensus about the determinants of fertility change (Hirschman 1994; Mason 1997). One of the weakest links in our understanding involves the role of socio-economic 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 socio-economic factors, which shift over the course of development and help determine fertility change. Yet, there is little convergence in the understanding of how these social and economic factors actually matter.

Pollak and Watkins' (1993) classification of theoretical perspectives on fertility change according to the roles of the individual's opportunities, preferences, and norms is a useful starting point from which to classify how socio-economic factors are incorporated in theoretical models of fertility change. The traditional economic perspective generally associated with the demographic-transition paradigm views socio-economic factors according to how they affect individual opportunities (Willis 1973; Becker 1981). It assumes fixed individual preferences and fertility decisions constrained by available resources. Socio-economic change leads to changing costs and benefits of children and hence forces parents to revise their childbearing strategies. Another view suggests that socio-economic factors influence fertility by changing individual preferences (Easterlin 1969; Namboodiri 1972). As Easterlin (1969), for example, has argued: socio-economic factors may affect fertility preferences through their effect on household consumption decisions, leading households to choose fewer children and more of other goods. Finally, many researchers assign a central role to the diffusion of fertility norms (Cleland and Wilson 1987; Axinn and Yabiku 2001; Thornton 2001). In this case, socio-economic factors are likely to operate by accelerating the diffusion of new ideas.

Regardless of which combination of the above specific mechanisms underlies fertility change, socio-economic variables feature prominently. In fact, virtually all research on fertility includes socio-economic variables (Bollen et al. 2001). However, this consensus about the importance of socio-economic factors is not matched by practical consensus about its conceptualization or measurement.

In contrast to the general neglect of conceptualization and measurement issues related to socio-economic factors in the fertility literature, the literature on social stratification has 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 this unitary concept. SES is also sometimes viewed as a one-dimensional concept in which education,

occupation, income, and wealth influence or reflect status. The second viewpoint disputes the unidimensionality of SES and instead highlights its separate dimensions. For example, Weber (1946) and more contemporary empirical researchers (e.g., Blau and Duncan 1967; Featherman and Hauser 1977) have treated variables such as education, occupational prestige, and income as separate dimensions of SES that can have distinct consequences.

A unitary concept that sociologists less widely discuss, but that economists consider particularly important, is that of permanent income. Permanent income is closely related to wealth, a concept that is gaining increasing importance in research on stratification (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, p. 21). Clearly, the concepts of SES and permanent income have much in common (Rainwater 1974; Henretta and Campbell 1978; Williams and Collins 1995; Sørenson 2000). Friedman's conception of permanent income indicates how other components of SES are related to permanent income.

One important aspect of permanent income is the distinction between long-term and transitory economic status. The volatility of income in poor countries and the measures taken by households to reduce their vulnerability to income fluctuations have been widely discussed (Deaton 1992; Townsend 1995). It is the more stable aspect of economic status, rather than economic status in any given year, that more strongly predicts children's mental health (McLeod and Shanahan 1993), cognitive development (Duncan et al. 1994), and behavioural problems (Takeuchi et al. 1991). In the context of fertility, researchers have also emphasized the more stable aspects of income rather than the transitory component (Easterlin 1969; Mueller and Short 1983).

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 intermediate variables (e.g., contraceptive use), through which the effect of SES is transmitted (Davis and Blake 1956). One approach is to suppose that the socio-economic factors act on fertility as a single, general factor. For instance, occupation, income, and education might appear to have important effects because they all are indicators of a more general SES variable and it is the latter, not the former, that affects fertility. Another approach is to suppose that each of the individual components of SES affects fertility separately. The third possibility is to suppose that these socio-economic variables are components of a general variable that has an impact, but that each of these component variables also has a specific effect that is not mediated by the general variable.

In the literature on stratification in the USA, the component view of stratification dominates: researchers treat education, occupation, and income as distinct components of stratification with distinct impacts. In the fertility literature on LDCs, it is typical to include a measure of SES in empirical analyses, but 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 socio-economic effects, leaving as ambiguous whether such measures function as specific components or as indicators of several components of SES. In short, most stratification theory emphasizes a component perspective, whereas, although ambiguous, most fertility literature is at least consistent with this component view of SES and class.

While decades of sociological and social science research have pointed toward a component rather than a 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 general factor or unidimensional variable than a component. In fact, referring back to Friedman's definition, it encompasses nearly all of the components typically used in research on social and economic status. 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, and this possibility seemed well worth investigating. Accordingly, we set out to examine the impact of permanent income on fertility and also to assess whether other components of SES have their effects completely mediated through permanent income. The major components of SES—education, occupation, and income—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.

Despite a clear conceptual definition of permanent income, operationalization is not straightforward because the variable is not directly observable, and cannot be perfectly measured by its indicators. An important contribution of our analyses is that we treat it as a latent variable. Because most empirical work operationalizes permanent income with proxy variables, 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 may also lead to inaccurate estimates of the effects of other explanatory variables (Bollen 1989). Ultimately, our goal is not to develop a new theory of the relationship between economic status and fertility but to develop a more realistic model of the relationship of SES and permanent income to fertility, a model that recognizes the less-than-perfect measurement of these explanatory variables.

Proxies for permanent income

Although many view them as separate components of SES, occupation and education are clearly important determinants of permanent income and sometimes serve as proxies for it. For example, Houthakker (1957) and Mayer (1963) treat occupation as a proxy for permanent income when evaluating the relationship between income and consumption. Hauser and Warren (1997) argue that occupation proxies permanent income because occupational status is more stable over time than is income. Education is also sometimes treated as a proxy for permanent income. Others regard women's education as having a distinct effect on fertility through its impact on attitudes, knowledge, or behaviours (Caldwell 1982; Axinn and Barber 2001). A few studies have attempted to disentangle the effect of women's education from its association with household economic status with mixed results (Rodriguez and Cleland 1981; Cleland and Rodriguez 1988; Martin and Juarez 1995). Husband's education is not included in models of fertility as often as women's education, but when it is employed, it is often assumed to reflect the household's SES (e.g., Raftery et al. 1995) rather than 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), though averaging earnings over several years is one way of dealing with income's variability over time (Behrman and Deolalikar 1990; Solon 1992). However, income data in LDCs are often unreliable and rarely collected (Hentschel and Lanjouw 1996). In addition, given the predominance of non-market activities in most LDC economies, it is often difficult to estimate the monetary value of labour activities.

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. However, expenditure data are expensive to collect and of questionable reliability (Scott and Amenuvegbe 1990; Bouis 1994).

Information on ownership of household durables and housing characteristics is far easier to collect and more widely available than either income or expenditure data. For example, the Demographic and Health Surveys (DHS) have collected this information in over 70 countries. There are several ways of employing measures of assets and housing quality as proxies for permanent income. One approach is to include a series of consumer durable goods as separate indicators (Montgomery et al. 2000). A far more common approach is to employ an index of equally weighted items by summing the number of assets owned by the household. Other recent research has employed weighted sums of assets. One way of weighting is to estimate the monetary value of each asset (Dargent-Molina et al. 1994). Pollitt et al. (1993) and Filmer and Pritchett (1999, 2001) present an alternative method in which principal components analysis provides the weights.

Three recent studies have evaluated the performance 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 method outperforms expenditure data: the former better predicts school enrolments 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 head. In a comparison of several different proxy methods, Bollen et al. (2002) find that an unweighted sum of the number of items owned and the principal components score predict fertility more strongly than expenditures and alternative ways of weighting assets.

The approach here differs in that we measure permanent income as a latent variable and evaluate how measurement error influences the results. Measurement error can lead to mistakes in inferences about influences. With few exceptions (Naga and Burgess 1997; Filmer and Pritchett 2001), previous research has 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 best to operationalize permanent income in LDCs.

Data

Our analyses are based on data from two countries on different continents at different stages of development: Ghana and Peru. Ghana, categorized by the World Bank as a lower-income country, has been undergoing a gradual transition to a market economy (Ho-Won 1996). Fertility in Ghana is still quite high, with today's total fertility estimated at fewer than four children per woman, but it has declined considerably from earlier levels of around 6.5 in 1980. The data come from the Ghana Living Standards Survey (GLSS) conducted in 1988 by the Ghana Statistical Service in conjunction with the World Bank. During that earlier period, Ghana's GDP per head was about US$350. In addition, school enrolment levels for girls in primary school are now up to 74 per cent, rising from an estimated level of 68 per cent in 1990.

The second country, Peru, has an income per head of US$2,080 and is a middle-income country according to the World Bank. The country's total fertility today is estimated to be about 2.8 and to have been about 4.5 in the late 1980s. Education levels are also much higher now, with essentially universal schooling for boys and girls at the primary level. Our analysis is based on the 1985 Peru Living Standards Survey (PLSS) conducted by the Statistical Institute of Peru in conjunction with the World Bank.

Both data-sets are part of the World Bank's Living Standards Measurement Study (LSMS). The surveys employed multistage random sampling to obtain representative self-weighting samples of 3,192 households in the GLSS and 5,107 households in the PLSS. (For further details see World Bank 1993a, b.) Where present, a woman between the ages of 15 and 50 from each household was randomly selected to be a respondent to the fertility module of the surveys, resulting in fertility data on 2,270 and 4,119 women in the GLSS and the PLSS, respectively. Since almost all fertility occurs within marriage in both countries, we omitted women not married or cohabiting with a man (598 in Ghana and 1,478 in Peru)—a common strategy in demographic analyses (e.g., Entwisle and Mason 1985; Axinn and Barber 2001; Dharmalingam and Morgan 2004). Thus, our results are only generalizable to the currently married or cohabiting populations of Ghanaian and Peruvian women. In each sample about 9 per cent of women were widowed, separated, or divorced. For cases where the respondent was identified as the head of the household, we used her spouse's characteristics as the head's characteristics. (See Bollen et al. 2006 for more details on sample selection.)

Definitions of variables

Our main analyses examine the influence of permanent income on whether the respondent had given birth within the previous 3 years. Because an important SES component, woman's 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, in a later auxiliary analyses section, we also examine children ever born.

Table 1 organizes the permanent income variables into two types, variables that are determinants of permanent income ('causal indicators') and variables that are affected by permanent income ('effect indicators'). We begin with a description of the causal indicators in the first column. The educational statuses of the woman and of the male head are dummy variables indicating completion of primary, middle, and secondary or greater, with no education as the reference category. Treiman's (1977) international occupational prestige score measures the

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
Woman's educational attainment	Housing quality
Male head's occupational status:	Ownership of consumer durable goods
Treiman's occupational prestige	
Farmer	

household head's occupational status, supplemented with a dummy variable for being a farmer.

The second column of Table 1 lists the effect indicators of permanent income. The first is the log of household expenditures per adult. Stocks of assets owned by the household are converted into flows of services and 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 (see Bollen et al. 2006 for further details).

Ownership information on consumer durable goods, such as a radio or stove, was collected in both surveys. Our analyses compare four approaches to combining these assets.

i. *Simple sum*: The number of goods owned by the household, which is the most common approach to constructing an index of consumer durable goods.
ii. *Current-value sum*: The sum of the respondent's own estimates of the current values of the goods owned by the household.
iii. *Median-value sum*: The values of all household goods owned using median values reported from all households that owned that particular item. The use of median values may reduce error, particularly in settings where no market exists for the goods.
iv. *Principal components score*: The first principal components score for the items owned by the household. The use of principal components entails 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 (Filmer and Pritchett 1999, 2001). Therefore, each item has a different weight, but the weight is based on the results of the principal component analysis rather than information on the value of the assets. The first component captured about 24 and 32 per cent of the variation in the consumer durable goods items for Ghana and Peru, respectively. The rank order correlations between the principal component and median-value weights for the items are 0.24 and 0.09 for Ghana and Peru, respectively.

In addition to constructing measures corresponding to these four approaches using the full set of consumer durable goods available, we also constructed measures that include only the goods recorded in DHS surveys: radio, television, refrigerator, bicycle, motorcycle, and car. By comparing the performance of the measures based on the full set of items with that of 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, logs of the asset measures are used.

The final effect indicator of permanent income is an index of housing quality, which includes the presence of a flushing toilet, piped water, electricity, non-dirt floor, and number of rooms in the dwelling. Number of rooms in the dwelling is coded as a dummy variable that distinguishes one room and more than one room in the GLSS and two or fewer rooms and more than two rooms in the PLSS.

The control variables include religion, ethnicity, region, urban/rural, and age. Some of these variables, such as place of residence, influence permanent income (Friedman 1957). In addition, many of the variables are likely to influence both permanent

Table 2 Description of control variables used to predict the effect of permanent income on fertility in Ghana (1988–89) and Peru (1985)

	Ghana	Peru
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, Muslim, 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)	Ecological zones: northern coast, southern coast, Lima (reference), northern mountain, central mountain, southern mountain, and jungle
	Urban, semi-urban, and rural (reference)	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

income and fertility and are therefore included as controls in both equations. For example, ethnicity and religion are likely to capture important differences in cultural values that may affect permanent income or fertility. Each of the control variables as well as their reference category is listed in Table 2. Table A1 in the Appendix provides descriptive statistics.

Latent-variable models

As mentioned in the previous section, we distinguish between *causal indicators*, which affect the latent variable, and *effect indicators*, which are determined by the latent variable (Bollen and Lennox 1991). The SES components of education and occupational status are causal indicators of permanent income. In Friedman's conceptualization, both variables influence one's capacity to generate income and hence determine permanent income rather than vice versa. Similarly, residence and ethnicity are probable determinants. Persons who live in more developed places should have a higher income than those who live in less developed areas. Foreign ethnicity leads to lower economic status in Ghana and higher status in Peru. In contrast, expenditures, ownership of consumer durable goods, and housing-quality function as effect indicators of permanent income in accordance with Friedman's (1957) definition of permanent income.

The equations for this model have the form of:

$$y_j = \alpha_{y_j} + \lambda_j \eta + \varepsilon_j$$

$$\eta = \alpha_\eta + \mathbf{\Gamma}_1 \mathbf{x}_1 + \zeta_1$$

$$F^* = \alpha_F + \beta\eta + \mathbf{\Gamma}_2 \mathbf{x}_2 + \zeta_2$$

where y_j represents the effect indicators of permanent income (η) with $j = 1, 2, \ldots, J$, the number of indicators, α_{y_j} is the intercept for the jth indicator equation, λ_j is the coefficient of the impact of the latent permanent income variable (η) on the jth indicator, ε_j is a random measurement error with $E(\varepsilon_j) = 0$ and $COV(\varepsilon_j, \eta) = 0$. The model for the effect indicators does not depend on having all possible assets, but its performance is improved to the degree that the asset measures correlate with the latent permanent income variable. Later in the results section, we report these correlations for the different asset measures. The second equation has permanent income (η) as the latent dependent variable, α_η is the intercept, $\mathbf{\Gamma}_1$ is the row vector of coefficients for the exogenous variables included in $\mathbf{x}_1$, and ζ_1 is the equation disturbance with $E(\zeta_1) = 0$, $COV(\zeta_1, \mathbf{x}_1) = 0$, and $COV(\zeta_1, \varepsilon_j) = 0$. The propensity for a birth in the last 3 years (F^*) is the final equation where α_F is the intercept term, β is the regression coefficient for permanent income's effect on F, $\mathbf{\Gamma}_2$ is the coefficient matrix for the exogenous variables ($\mathbf{x}_2$) in the equation, ζ_2 is the equation disturbance with $E(\zeta_2) = 0$, and $COV(\zeta_2, \mathbf{x}_2) = COV(\zeta_2, \mathbf{x}_1) = 0$. There is some overlap in the variables in $\mathbf{x}_1$ and $\mathbf{x}_2$. We also assume that $COV(\zeta_1, \mathbf{x}_2) = 0$, $COV(\zeta_2, \zeta_1) = 0$, and $COV(\zeta_2, \varepsilon_j) = 0$. The error terms for fertility and expenditures are permitted to correlate. These disturbances are permitted to correlate since it is possible that additional children in the household will be associated with higher expenditures. We also let the errors of the expenditure variable and the consumer durable goods variable 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 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. Not shown are direct paths from place of residence to 'durable goods' and 'housing quality', which are included since electricity is dependent on community infrastructure.

There are several issues that this model allows us to address. First, does it make 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 others. If the latent variable is not needed, 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 of SES components. For example, we can test whether the effect of woman's 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 much research (e.g., Rodriguez and Cleland 1981; Cleland and Rodriguez 1988; Martin and Juarez 1995). Rodriguez and Cleland (1981) and Cleland and Rodriguez (1988) 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.

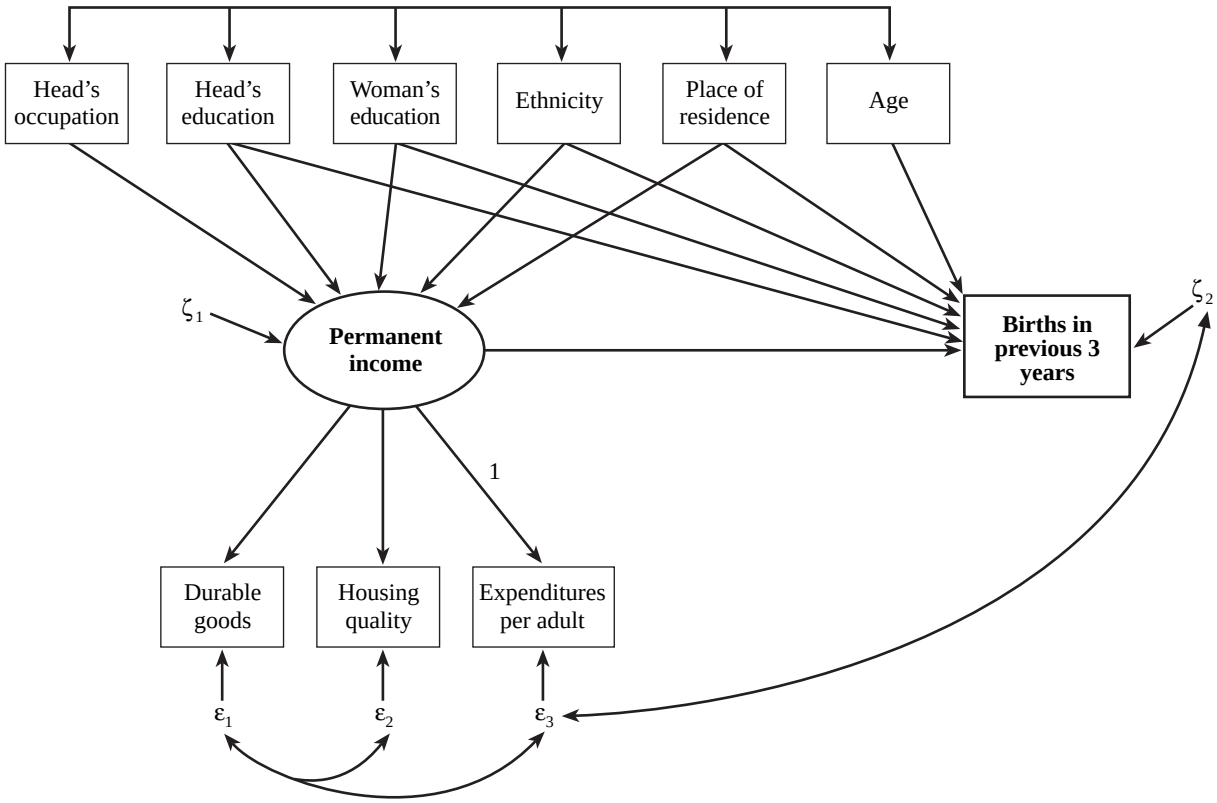

Figure 1 Path diagram of a latent-variable model of the effects of permanent income on births in previous 3 years
Note: In path diagrams latent (unobserved) variables are represented with ovals and observed variables are represented with boxes. Straight one-headed arrows designate direct causal relationships. 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. The coefficient of '1' for the influence of permanent income on expenditures per adult reflects the fact that expenditures is the scaling indicator for the permanent income latent variable. Strictly speaking, the relation of the variables in the diagram to 'Births in previous 3 years' is non-linear since the latter variable is dichotomous. To represent this fully we could add an underlying continuous-indicator variable with a non-linear relation to the dichotomous 'Births in previous 3 years' indicator. However, to simplify the diagram, we leave this relation implicit

Third, we can 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, with higher correlations meaning a closer relation. This information could inform data collection efforts to maximize the accuracy of income measures.

Finally, as noted above, there are 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., living in an urban area affects housing quality). In this manner, we allow for both non-random as well as random forms of error. These types of problems are typically either ignored or assumed away. We test for their presence.

Because one of the endogenous variables, birth in the last 3 years, is dichotomous, we use the weighted least squares with a mean and variance adjusted test statistic (WLSMV) available in the program Mplus 3.12. WLSMV produces consistent parameter estimates, asymptotically unbiased standard errors, and an asymptotic chi-square test statistic when there are categorical endogenous variables (Muthén and Satorra 1995). The analyses account for the complex sampling design by correcting the standard errors for clustering.

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 measures permanent income. Third, we investigate the difference in results between those obtained when measurement error is controlled and those obtained using a proxy for economic status.

Latent-variable models

The first panel of results in Tables 3 and 4 refers to the latent-variable model for Ghana and Peru, respectively. In the models displayed in Tables 3 and 4, expenditures per adult, the housing-quality index, and principal components score are the three effect indicators of permanent income. Because the models are not covered by the standard rules of model identification, we relied on empirical tests and these supported the over-identification of our models. Over-identified latent-variable models have measures of overall fit that provide information on testing the over-identifying restrictions (Bollen 1989, Ch. 7). Our model is over-identified in that we estimate fewer parameters than there are variances, covariances, and means of the observed variables. 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, p. 268). For both countries, the Root Mean Squared Error of Approximation (RMSEA) shows an acceptable fit (Browne and Cudeck 1993). Baseline fit indices with the 'independent' baselines were not available, and therefore the Comparative Fit Index (CFI) and Incremental Fit Index (IFI) were not available. However, the favourable RMSEAs suggest a good fit. Given this acceptable fit, we discuss the coefficient estimates.

The coefficients in the model are essentially regression coefficients. The main difference from multiple regression is that in structural equation models (SEM), some variables are latent so that coefficients give estimated effects to and from various combinations of latent and observed variables, whereas in multiple regression the coefficients give the effect of exogenous observed variables on the dependent observed variable. SEM is less restrictive and more complex than multiple regression in that there are multiple indicators of the latent variables, multiple equations, and we can include random and non-random measurement error.

We first consider the predictors of permanent income. Not surprisingly, respondent's and spouse's education—components of SES—are strong predictors of permanent income in both countries. In addition, higher occupational prestige, another component of SES, 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, and there are regional differences in both countries as well.

We now turn to the effects on fertility. These results show the effect of the *latent* permanent income variable, rather than that of its proxies. In Ghana the estimated influence of permanent income on the likelihood that the woman had given birth 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 level of permanent income predicted by the sample mean and modal values of the exogenous variables, the predicted probability of a birth is 0.77. At one standard deviation below it is 0.84 and at one standard deviation above it is 0.67. For Peru, we also find a large, negative, and statistically significant coefficient (−1.189). The predicted probability of a birth for a woman at the level of permanent income predicted by mean or modal values on all explanatory variables in the permanent income equation is 0.32; her predicted probabilities with permanent income at one standard deviation below and above the mean of permanent income are 0.46 and 0.15, respectively. These findings suggest that permanent income has a strong negative influence on fertility in both settings.

We also wanted to evaluate whether other components of SES have a direct effect on fertility once their relationships with permanent income were introduced. In Tables 3 and 4 the education coefficients reported in the fertility panel are the estimated direct effects (not mediated by permanent income) on birth in the previous 3 years. To assess whether it was necessary to include direct paths from educational attainment to fertility, we compared the model reported with a model in which these paths were omitted using a nested chi-square test. For Ghana, excluding these paths does not diminish the model fit, which is a result consistent with education having no direct effects on births once permanent income is controlled. Thus in Ghana, all of the influence of respondent's and spouse's 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 head's education higher than 'none' is associated with a higher probability of a birth, net of permanent income. However, note that the indirect effect of male head's education on fertility through permanent income is statistically significant and

Table 3 Parameter estimates for latent-variable and proxy-variable models used to predict a birth in the previous 3 years, Ghana 1988–89. $N = 1{,}282$

		Latent-variable model		Proxy-variable model	
Predicted variable	Explanatory variable	Coef.	SE	Coef.	SE
Permanent income					
	Education				
	Woman's primary	0.008	0.024		
	Woman's greater than primary	0.103***	0.026		
	Woman's none (reference)				
	Head's primary	0.008	0.033		
	Head's middle	0.063*	0.031		
	Head's secondary or greater	0.234***	0.049		
	Head's 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 in previous 3 years					
	Socio-economic status				
	Permanent income (latent)	−1.016*	0.439		
	Income proxy (expenditures)			0.086	0.071
	Education				
	Woman's primary	0.031	0.104	0.020	0.103
	Woman's greater than primary	0.104	0.101	−0.011	0.091
	Woman's none (reference)				
	Head's primary	0.029	0.146	0.010	0.136
	Head's middle	0.140	0.136	0.060	0.121
	Head's secondary or greater	0.169	0.221	−0.104	0.156
	Head's 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)				
	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				
	15–19 (reference)				
	20–24	0.591**	0.184	0.575**	0.180
	25–29	0.445**	0.159	0.420**	0.155
	30–34	0.278	0.169	0.246	0.168
	35–39	0.036	0.190	0.018	0.184
	40–50	−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

Table 3 (*Continued*)

Predicted variable	Explanatory variable	Latent-variable model		Proxy-variable model	
		Coef.	SE	Coef.	SE
	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
	Muslim	0.048	0.138	0.038	0.14
	Other religion	0.560**	0.201	0.568**	0.206
	Traditional (reference)				
R-square		0.198			
Indicators of permanent income					
Expenditures per adult					
	Permanent income	1.000			
Durables—principal components 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 components	0.018	0.013		
	Housing quality, principal components score	0.080***	0.021		

Note: *p <0.05, **p <0.01, ***p <0.001 (two-tailed tests). Chi-square for the latent-variable model = 103.514, with df = 21, RMSEA = 0.055. *R*-square for the proxy model is not reported because the *R*-squares in the probit and latent-variable models are not comparable.
Source: 1988–89 Ghana Living Standards Survey (GLSS).

negative. The finding that male head's education, net of permanent income, affects fertility provides support for research indicating that in LDCs, men tend to want more children than women (Bankole and Singh 1998). Higher male head's education (controlling for woman's education level and for household permanent income) may indicate their greater relative power within the household and hence their ability to impose higher childbearing patterns.

The next set of coefficients reported in Tables 3 and 4 refer 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 attributable 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. Note that the expenditures and housing-quality variables were effect indicators in all of the models, whereas each of the asset variables was taken one at a time in separate models as the third indicator of permanent income.

In both countries all the effect indicators of permanent income have highly significant factor

Table 4 Parameter estimates for the latent-variable and proxy-variable models used to predict a birth in the previous 3 years, Peru 1985. $N = 2{,}423$

	Latent-variable model		Proxy-variable model	
Predicted variable	Coef.	SE	Coef.	SE
Permanent income				
Education				
Woman's primary	0.133***	0.028		
Woman's secondary	0.339***	0.040		
Woman's more than 2nd	0.517***	0.056		
Woman's none (reference)				
Head's primary	0.117**	0.040		
Head's secondary	0.209***	0.046		
Head's more than 2nd	0.358***	0.056		
Head's 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 in previous 3 years				
Socio-economic status				
Permanent income (latent)	−1.189***	0.260		
Income proxy (expenditures)			−0.078	0.050
Education				
Woman's primary	−0.038	0.097	−0.216*	0.093
Woman's secondary	0.079	0.153	−0.352**	0.122
Woman's more than 2nd	0.163	0.217	−0.487**	0.155
Woman's none (reference)				
Head's primary	0.279*	0.124	0.145	0.113
Head's secondary	0.334*	0.157	0.057	0.132
Head's more than 2nd	0.598**	0.209	0.052	0.156
Head's none (reference)				
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				
15–24 (reference)				
25–29	−0.117	0.095	−0.113	0.095
30–34	−0.491***	0.090	−0.497***	0.092
35–39	−0.806***	0.098	−0.815***	0.101
40–50	−1.695***	0.102	−1.711***	0.104

Table 4 (*Continued*)

Predicted variable		Latent-variable model		Proxy-variable model	
		Coef.	SE	Coef.	SE
	Ethnicity				
	Indigenous language	−0.267	0.146	−0.151	0.115
	Foreign	0.307	0.559	0.083	0.408
R-square		0.363			
Indicators of permanent income					
Expenditures per adult					
	Permanent income	1.000			
Durables—principal components 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 components	0.050***	0.010		
	Housing quality, principal components score	0.054**	0.018		

Note: *p <0.05, **p <0.01, ***p <0.001 (two-tailed tests). Chi-square for the latent-variable model = 325.185, df = 21, RMSEA = 0.077. *R*-square for the proxy model is not reported because the *R*-squares in the probit and latent-variable models are not comparable.
Source: 1985 Peru Living Standards Survey (PLSS).

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 principal components score for the full set of assets (0.51), the simple sum of durable goods (0.33), the housing-quality index (0.30), and the principal components score for the reduced DHS asset set (0.30). Interestingly, the same top four indicators hold in Peru, though in a slightly different order, and their squared correlations are generally higher (0.68–0.51) 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 measures that require the most information and calculation 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 per cent of their variance unassociated with permanent income. Even the best measure, the principal components variable in Peru, has about 32 per cent of its variance unrelated to permanent income. Thus, even the best of the proxies fall considerably short of measuring permanent income with negligible error. Given these findings, it is important to ask whether the substantive conclusions drawn from our fertility model would be different if we had used the proxy-variable method that is typically used to measure income.

Comparing the latent-variable and proxy methods

The second panel of results in Tables 3 and 4 refer to probit models that employ the proxy method. Because in the latent-variable model the permanent income variable has its metric set to be similar to that of the expenditures-per-adult variable, we compare the results of this model with those of the proxy-variable model where expenditures per adult is the proxy variable.

Table 5 Factor loadings and squared correlations of effect indicators with permanent income in Ghana (1988–89) and Peru (1985)

	Coefficient	SE	Standardized coefficient	Squared correlation with income
Ghana				
Expenditures[1]	1.000		0.505	0.255
Housing quality[1]	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[1]	1.000		0.610	0.372
Housing quality[1]	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

[1]Estimates are for the principal components model using the full set of consumer durable goods available.
Note: ***$p < 0.001$.
Source: As for Tables 3 and 4.

For Ghana, the major difference between the two 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 is not statistically significant and has the opposite sign. This result points to a fundamental shift in the conclusions to be drawn about the use of proxy variables. We also estimated a probit model with the full-set principal components score, which is the proxy our latent-variable models indicate most closely captures permanent income. With the principal components 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, 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 too we find that when we control for measurement error, permanent income's coefficient estimate is quite different from what it is when 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 vs. -0.078). Even if we use the principal components measure as the proxy instead, the predicted influence of permanent income is more than 50 per cent larger when we account for measurement error (details not shown).

For Peru, the differences extend beyond the assessment of the influence of permanent income. Most strikingly, the proxy model has a direct negative effect on fertility for women who have secondary or higher education. However, the latent-variable model indicates that there is no such *direct* influence of woman's education. This is not due to the fact that the latent-variable model separates the direct and indirect effects of the variables that influence both permanent income and fertility (e.g., maternal education). In the proxy method 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 head's 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. 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 effects of age are very similar across the two models.

Auxiliary analyses

We conducted supplementary analyses to examine the robustness of our results. First, information in the GLSS made it possible also to use *number* of births in the previous 3 years as the outcome variable, rather than a dichotomous variable indicating a birth. The results of this alternative analysis are virtually identical to the main analyses. Second, 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 is especially interesting because this variable captures lifetime parity up to the date of the survey. Although there is no direct way of comparing the magnitudes of the permanent income coefficient across the models predicting births in the last 3 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 (0–2, 3–5, 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 previous 3 years for all parity groups. Although the coefficients for the medium-parity and high-parity groups are larger, they do not differ statistically from the coefficient for the low-parity group. In Ghana, permanent income has a statistically significant effect for the high-parity group only, and the coefficient for this group is significantly different from that in the other two groups. These results suggest that permanent income may be more likely to discourage further fertility at higher parities, particularly in high-fertility contexts.

Conclusions

The past few years have seen a resurgence of interest in long-term economic status. We share the view that permanent income is important, but also call attention to the inherent difficulty of measuring it, particularly in LDCs. Our analyses question the conventional method of assessing the impact of permanent income on fertility, which is to use proxy variables. Despite 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 of the control variables were influenced by measurement error.

Our findings also have implications for data collection. The results suggest that if the main purpose is to control for SES or income, then collecting data on the value of durable goods and expenditures is not an optimal strategy. These indicators performed much worse than the simple-sum and principal components scores. There could be several reasons for this. First, respondents may be unable to estimate the value of their goods realistically, and it may be particularly difficult to estimate the value of goods and services that are acquired through non-market channels. 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. Our results suggest that the current method of collecting expenditure data does not yield estimates of permanent income and that simpler counts or principal components scores of consumer durables perform better as indicators.

We also examined whether using long lists of consumer durable goods results is a more accurate measure of income than the shorter DHS list. We found that it made a large difference in Ghana but

not in Peru. This may imply that in very undeveloped areas, 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 areas, such as Peru. However, further research will have to determine whether this finding can be generalized 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 about its effects. One implication is that researchers interested in income alone or the effect of other variables should control for measurement error. Our study provides some guidelines on how to operationalize permanent income in studies of the determinants of fertility and other demographic and non-demographic outcomes in LDCs. While our analysis included two countries at different levels of development, further studies would be needed to show that our findings are valid across additional settings.

Stratification research continues to question whether individual components of SES such as education and occupation represent a single general factor in the way they act or act as distinct components in determining outcomes. Much evidence points toward the distinct-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 factor that has 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 woman's education, have their effects on fertility largely mediated through permanent income. This finding supports the view that SES components channel their impact through another component (i.e., permanent income), rather than the view that each of these other SES components has a predominately distinct, direct effect on fertility. It is a result that runs counter to the more typical view that all components of SES are likely to have *direct* effects on fertility and other outcomes. A plausible explanation for our finding is that we have controlled for measurement error whereas other studies do not. Using a latent-variable model rather than a proxy-variable method reveals the intervening role played by permanent income.

That we find a negative relationship between permanent income and childbearing is not surprising. Such a relationship is consistent with standard economic modelling of childbearing behaviour (Becker and Lewis 1973). But our findings also would appear to run counter to predictions about the role of ideational factors, because the components of SES no longer have an impact on fertility once permanent income is accounted for. While it may be that ideational factors are operating to change permanent income, the elimination of the direct effect of woman's education, a central focus of socio-demographic studies, remains particularly intriguing and worthy of further consideration. We speculate that the concept of permanent income will be useful in the study of other outcomes in other contexts.

Appendix

Table A1 Descriptive statistics for variables used in models to predict the effect of permanent income on fertility in Ghana (1988–89) and Peru (1985)

	Ghana			Peru	
Variable	Mean	SD	Variable	Mean	SD
Fertility			*Fertility*		
Birth in previous 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

Table A1 (*Continued*)

	Ghana			Peru	
Variable	Mean	SD	Variable	Mean	SD
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*		
Woman's none (reference)	0.501	0.500	Woman's none (reference)	0.212	0.408
Woman's primary	0.180	0.384	Woman's primary	0.429	0.495
Woman's middle or greater	0.319	0.466	Woman's secondary	0.270	0.444
			Woman's greater than secondary	0.089	0.285
Head's none (reference)	0.342	0.479	Head's none (reference)	0.077	0.272
Head's primary	0.125	0.331	Head's primary	0.480	0.500
Head's middle	0.425	0.495	Head's secondary	0.294	0.456
Head's secondary or greater	0.108	0.311	Head's 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
Greater Accra	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
			Jungle	0.041	0.199
			Lima (reference)	0.297	0.457
Age			*Age*		
15–19 (reference)	0.065	0.246	15–19 (reference)	0.039	0.193
20–24	0.206	0.405	20–24	0.114	0.318
25–29	0.231	0.422	25–29	0.208	0.406
30–34	0.202	0.402	30–34	0.215	0.411
35–39	0.138	0.345	35–39	0.180	0.384
40–50	0.158	0.365	40–50	0.245	0.430
Religion					
Catholic	0.176	0.381			
Other Christian	0.391	0.488			
Muslim	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

Source: As for Tables 3 and 4.

Notes

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