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A Juxtaposition of rational choice and socio-cultural approaches to explain changes in family size throughout the process of economic development using household survey data from Brazil

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A JUXTAPOSITION OF RATIONAL CHOICE AND SOCIO-CULTURAL APPROACHES TO EXPLAIN CHANGES IN FAMILY SIZE THROUGHOUT THE PROCESS OF ECONOMIC DEVELOPMENT USING HOUSEHOLD SURVEY DATA FROM BRAZIL

BY

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THESIS

Submitted in Partial Fulfillment of the
Requirements for the Degree of

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Dedication

To my sweet, powerful, and much beloved Helga…

Acknowledgement

I am indebted to my wife Kristin for her understanding and help throughout this final chapter of my graduate school experience. Completing this work would not have been possible without her support. In addition, I would like to formally express my gratitude to my thesis committee for their assistance throughout this process.

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ABSTRACT OF THESIS

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A Juxtaposition of Rational Choice and Socio-Cultural Approaches to Explain Changes in Family Size Throughout the Process of Economic Development Using Household Survey Data From Brazil

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B.S., Economics, Portland State University, 2002
M.A., Economics, University of New Mexico, 2010

ABSTRACT

This research juxtaposes empirical approaches to analyze the relationship between fertility and economic development. Using household survey data from Brazil in the mid 1990's, separate Ordinary Least Squares (OLS) models are run that comparatively evaluate the explanatory power of divergent methods used to explain fertility in developing countries. Rational choice approaches, in the spirit of Gary S. Becker, are presented alongside approaches that account for heterogeneous socio-cultural traits to see which method explains more about family size in Brazil. The paper finds evidence to support the relevance of both the rational choice and the socio-cultural approaches to fertility studies. The research ultimately presents evidence that socio-cultural models generate relatively more explanatory power in the fertility analysis of Brazil than methods adopting the strict axioms of rational choice models from the Becker-era.

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> "[A]sk yourself in the stillest hour of the night: must *I write?* Delve into yourself for a deep answer. And if this should be affirmative, if you may meet this earnest question with a strong and simple 'I *must*," then build your life according to this necessity; your life even into its most indifferent and slightest hour must be a sign of this urge and a testimony to it."
>
> -Rainer Marie Rilke, from *Letters to a Young Poet*.

Section One -- Introduction

Rilke's words can easily be extended to comprehend the underlying motives for a number of choices human beings make in the course of their lives. The poet's decision matrix could in some cases apply to how career decisions are formed. In other cases, the rubric could be used to understand why an impoverished mother would continue her pregnancy in spite of a bleak outlook for the future of her child. During the pages to follow, the heart of Rilke's altruistic framework will underlie an analysis of fertility behavior in the developing world, and how that behavior responds throughout the process of economic development.

Theoretical treatments of the relationship between economic development and fertility date back to Malthus (Becker, 396). Per the Malthusian theory, economic development and fertility rates were positively related, ebbing and flowing in stride with each other through history. However, during the 20th century a number of countries experienced a phenomenon known as *demographic transition*[1]. This transition

[1] The concept of demographic transition is tersely stated: "…many countries have experienced the inverted U-shaped demographic transition, i.e., [income] rises followed by declines in the population growth rate" (Sato and Yamamoto, 45). A graph of the inverted-U curve for developed and less developed countries is provided in the appendix to this report in section A-11.

characterized economies that had increased their level of economic development but ultimately experienced a contraction in their fertility rates. Quite apart from Malthusian theory, those economies showed an initial increase in fertility that corresponded to economic growth, but eventually ended up witnessing contracting fertility rates as the economic growth continued (Becker, 397). Consequently, the observed fertility patterns of the past century confronted researchers with an empirical reality that the Malthusian framework could no longer explain.

Empirically, measuring the relationship between fertility rates and economic development has involved a set of simple calculations when reliable data for the two are readily available. Fertility rates are found by dividing the number of live births in a certain period by the number of women of childbearing age in that same period (Barclay, 51). Economic development is found through an even simpler mechanism, it is typically approximated by changes in per capita income. Understanding the *how* and *why* the two are related has been a task of significantly greater difficulty.

In his Nobel Lecture, Gary S. Becker remarked that his pioneering work on the structure of the family was "the most difficult sustained intellectual effort I have undertaken" (Becker, 395). Despite the level of difficulty encountered during his research, Becker eventually developed a choice model of fertility that went on to dominate the economic research of fertility in the developing world. In a nutshell, the framework of the prevailing Becker-era models used to understand fertility responses to economic development assumes that fertility behavior is determined by an optimization decision of parents. This rational optimization decision is then further assumed to operate subject to income, time, and altruism constraints.

The primary point of departure in this analysis from the still-dominant Becker-era models is the conceptual starting point used to understand fertility behavior. After repeated attempts to construct a number of optimization models to hypothesize fertility decisions, it became clear that the starting point of the constrained optimization approach was too far ahead of the primary event that governs fertility behavior. In asking the question "why do people have children," an application of Occam's razor cuts through the complexity of varying explanations of fertility decisions to uncover an answer that is quite simple: "because people have sex.[2]" Starting from that basic, yet strangely overlooked coital event, simple induction produces the following heuristic model of fertility:

$$F(c) = (\alpha + \beta - \omega)C$$

Where *F(c)* = Fertility as a function of coital events
C = the fertilized coital events
α = the proportion of unplanned fertilized coital events
β = the proportion of planned fertilized coital events
ω = the proportion of aborted fertilized coital events

From the fertility model provided, the following assumptions about fertility behavior can made:

Axiom 1: $P(C \mid Y = 0) > 0$, where Y = income
Axiom 2: $\alpha \neq \omega$
Axiom 3: $E(\alpha) > 0$ and that $E(\omega) > 0$
Axiom 4: $E(\beta)$ = fertilized coital events resulting from a rational choice model

[2] Although technological advancements have facilitated births without coital origins, this paper excludes those fertility events from the analysis. It should be noted, if those advancements produce a substantial number of fertility events, the scope of a study such as this one would need to be drastically altered.

The preceding framework is simply a heuristic tool to remove a few pertinent concepts related to fertility behavior from abstraction[3]. But does it provide the relevant foundation for fertility analysis? The above framework can account for cases in developing countries where people continue to have children they cannot afford to support and are unwilling or unable to abort during pregnancy. Moreover, this framework concurrently accounts for starving yet still procreating agents within the same framework used to account for the fertility decisions of prosperous agents. Consequently, this framework could provide an enhanced model for understanding fertility decisions across all economic agents. In so doing, such an approach would provide a different analytic approach from the Malthusian framework.

In the preceding fertility model, the fertility rates are determined by planned, unplanned, and aborted pregnancies. However, assuming that abortions are free and nobody is averse to utilizing them for unplanned pregnancies, the unplanned and aborted pregnancies can be treated as exogenous if they are assumed to be equal by relaxing Axiom 2. Removing Axiom 2 would return the relationship between economic development and fertility as being strictly measured by changes in per capita income and back within the realm of the Malthusian paradigm.

For an income driven model of economic development's governance of fertility to hold, socio-cultural norms (i.e., religious beliefs, emulative community pressures on family size, etc.) must, ceteris paribus, be assumed exogenous to the determination of the planned pregnancy rate. In turn, the rate of planned pregnancy can be neatly modeled through a constrained optimization framework grounded in microeconomic theory. On

[3] While the above model provides context for the discussion to follow in this paper, it will not be formally treated or tested in the pages that follow. This model is simply provided for illustrative purposes to, as Irving Fisher once said of algebraic statements, provide a "safeguard against loose reasoning."

its face, the likelihood of this assumption being more realistic than the assumption in Axiom 2 is marginal[4].

Consider the case of two newlywed couples facing the decision of whether or not to have children. One atheistic couple begins by identifying their income, their time, and their willingness and desire to raise a child. If the marginal benefit, measured by their willingness to pay for the joys of parenthood, equals or exceeds the opportunity cost associated with raising a child, a child will be created through rational coitus. Suppose, the atheists solve the first and second order conditions for their fertility decision and decide to have an optimal single child. Next door to the atheists lives a Latter-Day Saints (LDS) couple. Neither LDS spouse particularly likes children, but both feel duty bound by their religious convictions to produce as many children as they can feed, shelter and clothe. Nine months later, the atheists and the LDS couple meet in the delivery section of the hospital and welcome the respective additions to their families. The atheist couple stops having children after their firstborn, and the LDS couple has four more children.

Assuming significant levels of sub-market variation in the demand for children (such as the hypothetical couples presented above) presents a strictly income based model of fertility with challenges. If the assumption is made that tastes and preferences related to the demand for children exist independent of income, and that such tastes and preferences exist in significant scale to generate fertility behavior in noteworthy fashion, assuming homogenous preferences for children becomes problematic unless the income

[4] While the above discussion implies that fertility is not likely explained through the exclusive application of rational choice, the above discussion should not be taken to imply that fertility operates completely independent from rational choice processes. As will be emphasized throughout the paper, rational choice is assumed in this work to influence fertility in line with Becker's framework. This paper simply seeks to compare how much of fertility is explained through rational choice in comparison to other explanatory methods available to researchers – thereby providing another analytic tool in the analysis of fertility's relationship with economic development to be used in compliment with those provided by Becker.

based fertility decision dominates the effect(s) of the heterogeneous tastes and preferences for children in the area being analyzed.

Nonetheless, the treatment of socio-cultural norms as exogenous factors in the fertility analysis of developing countries has come to define the nomenclature of the mainstream economics literature on the subject. Consequently, the heuristic model of fertility in the preceding pages, or more relevantly a framework that accounts for sub-market variation based on the cultural tastes and preferences of the fertility consumers, is rendered pointless by many mainstream assumptions.

If the assumptions are made that socio-cultural attributes, abortion rates, and rates of unplanned pregnancies are directly affected throughout the process of economic development, an expanded model becomes relevant to research analyzing the relationship between fertility rates and economic development. However, in so doing, such a model becomes enhanced by its tacit assumption that economic development encompasses more than just increases in per capita income. Economic development, if defined as more than increasing per capita income, can affect fertility rates through the concomitant permutations of contraceptive behavior, socio-cultural norms that affect tastes and preferences for children, and utilization of the abortion alternative.

Unfortunately, expanding the conceptual scope of economic development results in the loss of a degree of theoretical generality. If factors such as socio-cultural norms are incorporated into the development analysis, the resulting approach becomes inherently country-specific. This results from the potential inter-country heterogeneity of socio-cultural institutions and their respective degrees of rigidity and scope in the determination of fertility behavior. In effect, the varying forms of socio-cultural

institutions take the form of sub-markets where income remains a factor in the fertility analysis, but remains so in harmony with the socio-cultural parameters defined by the various socio-economic groups / sub-markets. In turn, explanatory gains in the study of fertility responsiveness to economic development would come at the cost of broad extrapolations that could be made from research using the country-specific approach.

Those limitations notwithstanding, this paper will attempt to realize a higher level of explanatory power in its analysis of fertility behavior in Brazil. These explanatory gains will be pursued by incorporating the traditional economic development proxies, such as income, and then comparing their explanatory power to additional socio-cultural facets embodied through economic development that can affect planned versus unplanned pregnancy rates, the institutional factors (in)conducive to changing fertility rates, and the tastes and preferences for children.

This paper will not dispute the ceteris paribus merits of the prevailing Becker-era models used to evaluate fertility patterns. Moreover, this paper will not attempt to test or disprove the hypotheses of the Becker-era fertility models. The focus of this paper will strictly be to evaluate the potential for gains in the explanatory power of fertility models that can be obtained by accounting for factors related to economic development outside of the variables used in the Becker-era models. In so doing, this paper will address a fundamental question of what explains more about fertility in developing countries: income, or the socio-cultural attributes of a demographic experiencing economic development.

In the section II, a review of the relevant literature pertaining to the relationship between fertility and economic development will be presented. Therein, the prevailing

theoretical paradigm in economic fertility research will be discussed. Additionally, coverage of heterodox and interdisciplinary conceptions of economic development will be provided to address potential explanatory gains that may be culled from broadening the notion of economic development to account for otherwise overlooked factors that may influence fertility behavior.

After the literature review, section III will include a presentation of methodology with descriptive and summary statistics to demonstrate the reasons behind selecting Brazil as the source country for this study. Further, this section will describe the data used for this analysis, the method by which it was procured, and then how and why observations from that data set were grouped into the variable categories to be analyzed within the various model designations. Subsequently, model specifications and the rationale for the models used will be provided.

In section IV, the analysis and results from this study will be provided and described in detail. The limitations, surprises, strengths and weaknesses of the analytic results will be tersely stated in this section. Lastly, section V will recap the design of the study. The expected and observed results will be presented, as well as the formal research conclusions and implications for future research from this work.

Section Two -- Literature Review

The following literature review has been segmented into three separate parts: A, B, and C. Part A will present the prevailing model used to explain fertility behavior in economic development analyses. Extensions to the prevailing model that have impacted fertility studies in developing countries will also be presented. Part A will close with Gary Becker's response to critics of his research that has come to dominate mainstream economic analysis of fertility in developing countries.

Part B of the literature review will address attempts that have been made to expand the conceptual scope of economic development. This section will provide the literary basis for using a more comprehensive definition of economic development that can account for heterogeneous fertility patterns by bridging the gap between rational choice models and qualitative approaches. Further, this section will substantiate the claim that the economic research of family size is capable of gaining increased explanatory power by including more measures for economic development than per capita income alone.

Part C will present studies that have attempted to incorporate various qualitative facets of economic development into developmental research, and particularly emphasize the impact of such approaches for developmental fertility research. The section will conclude with an application of the qualitative developmental approach to a fertility analysis in India, and the increased explanatory power gained therein.

Part A -- Mainstream Economic Treatment: How Fertility Rates Change through the Process of Economic Development, as Characterized by Changes in per Capita Income and Rational Choice.

The prevailing theoretical paradigm and overwhelming source of citation in the economic analysis of fertility was formalized by Nobel Laureate Gary S. Becker. In Becker and Robert Barro's 1988 paper *A Reformulation of the Economic Theory of Fertility*, the axiomatic framework is stated with the precept that the economic analysis of fertility "emphasizes the effects of parents' income and the cost of rearing children" (Becker and Barro, 1). Fertility behavior is presented through the filter of a utility function that parents attempt to maximize. The parents' utility function is assumed to operate subject to a budget constraint that accounts for the parents' wage, the time-cost expended on raising children, and bequeaths.

Becker and Barro assume that the utility of parents in time period T_o depends on their own consumption and the utility they derive from each child born in period T_o. For simplicity, the authors assume two stages of life, childhood and adulthood; children born in period T_o become adults in period T_1. By extension, a further assumption is made that incorporates the utility of grandchildren to parents in T_o, since it is assumed that these grandchildren factor into the utility of the children that are born to the parents in T_o (2). The result of this multi-generation linkage is a *dynastic utility function* that is maximized by the dynastic head of the family in period T_o, incorporating the utility of children and grandchildren that will reach adulthood in periods T_1 and T_2, respectively.

Formally, the *dynastic utility function* is stated as:

$$U_o = \sum_{i=0}^{\infty} A_i N_i \upsilon(c_i, n_i)$$

Where: A_i = the implied degree of altruism of the dynastic head towards each descendent in the i^{th} generation. $A \equiv \alpha(n_o), where \alpha'(n_o) > 0, and \alpha''(n_o) < 0$

N_i = the number of children

c_i = the consumption per adult in generation i.

Parents in period T_o then maximize this *dynastic utility function* subject to the following budget constraint:

$$w_i + (1 + r_i)k_i = c_i + n_i(\beta_i + k_{i+1})$$

Where: w_i = the wage of person i

k_{i+1} = a non-depreciable bequeath (assumed to be positive or negative)

β_i = the cost of raising children independent of the quality of the children raised

Consequently, the rate at which children are born into the world is determined through a system of constrained optimization. A crucial factor in the dynastic fertility model is the proposition that fertility is negatively affected by the wage rate, w_i, through the opportunity cost mechanism. As the wage rate increases, the opportunity cost of raising children increases, vis-à-vis time spent raising them. Parents in this dynastic framework thus adjust their time allocation away from raising children in favor of work as per capita income rises. Given sustained increases of per capita income, the dynastic optimization model of fertility thus predicts that familial size will contract.

A later paper by Becker *et al* (1990) extends the dynastic framework to growth theory, vis-à-vis the Endogenous Fertility Growth Model (EFGM), and formalizes a quality-quantity tradeoff relationship between fertility rates and discounted incomes of future generations. In *Human Capital, Fertility, and Economic Growth*, Becker *et al* posit a substitution effect away from more children to less as the returns to human capital increase. Becker *et al* transform the $\alpha(n_o)$ term in the *dynastic utility function* into a discount term for future earnings for the children and grandchildren. Thus, the dynastic head, through the altruism term, discounts the potential income of his children and grandchildren by $[\alpha(n_o)]^{-t} > R_h$, where R_h = the rate of return to investments in human capital.

Becker *et al* make the strong assumption that the rate of return to human capital investments increases as the stock of human capital increases. They then extend from the *dynastic utility function's* assumption that $\alpha'(n_o) > 0, and \alpha''(n_o) < 0$ to posit that parents realize a higher utility from the discounted earnings of child i than they do from the discounted earnings of child i_{+1}. By consequence, given sufficient increases in the human capital stock, the rate of return to human capital investments eventually exceeds the rate of return to children that will engage in professions that are not human capital intensive (i.e., agriculture or factory work)[5].

The extensions from the *dynastic utility function* treat fertility as endogenous to the economic growth model and posit two steady states of population growth. Becker *et al's* model purports that shifts from the developing (high) steady state of fertility to the

[5] By implication, this postulate provides an analytic framework to explain why higher fertility rates are commonly reported in rural areas (with more agricultural production) than in urban areas (with more human capital intensive production) (Sato and Yamamoto, 45).

developed (low) steady state of fertility characterizes economic conditions where sufficient increases in the human capital stock have manifested. As the rates of return to human capital exceed the rates of return to physical capital, parents in the dynastic framework substitute away from larger families to smaller ones that can benefit from a higher rate of return with increased human capital investments. In sum, the discounted values of future generation's income are used to determine how many in number the future generation will be. If smaller family sizes will yield a higher rate of return through human capital investment, smaller families will be produced, and; if larger family sizes yield a higher rate of return through physical capital, larger families will be produced.

Avner Ahituv formally incorporates the dynastic framework of Becker in research using panel data that finds population growth reducing GDP per capita growth at an increasing rate (51-71). Ahituv's empirical work ultimately supports the proposition that fertility choices are negatively related to the level of human capital and that rises in human capital associated with economic development come at the expense of higher fertility rates.

Higher levels of human capital investment are commonly posited to take place in response to increases in the adult-child wage gap (Lopex-Calva and Miyamoto, Ahituv). In cases where the adult-child wage gap grows (i.e. through increases in technology), the hypothesized outcome is an inducement for parents to invest their children's time in schooling and other activities that bolster their level of human capital. This can take place in response to an expectation that children will reciprocate their parent's investment in their human capital when the parents are elderly and in need of care (Lopez-Calva and Miyamoto). Alternatively, the contraction in fertility associated with increasing adult-

child wage gaps can be posited to result through the dynastic model's altruism term that does not require an assumption of reciprocity. Either motivational source of lower fertility rates in response to increased adult-child wage gaps can be used to explain movement from development-trap levels of fertility to those more characteristic of developed and stable economies (Lopez-Calva and Miyamoto, Ahituv).

In his 1989 paper, *On the Economics of the Family: Reply to a Skeptic*, Becker confronts the controversy of whether or not the "assumptions from microeconomic theory add much to analyses of linkages between parents and children that do not rely, or rely only a little, on economic theory" (Becker, 515). The response offered to the criticism of his dynastic model acknowledges that the microeconomic modeling approach is not an exhaustive explanation to fertility decisions (515). Quite contrary to the criticism, Becker explicitly notes his appreciation for the value that non-maximization approaches to fertility research provide. In concluding, Becker's response simply states that the dynastic model elucidates "novel implications…into the connection between parents' and children's earnings, assets, and other variables" that were not formally expressed or analyzed before its application (518).

The economic research of fertility's interplay with development remains steadfastly grounded in the framework of Becker. Permeating almost all of the mainstream extensions of Becker's work is his initial claim that the economic analysis of fertility "emphasizes the effects of parents' income and the cost of rearing children" (Becker and Barro, 1). However, income levels and time allocations for child rearing do not by themselves complete the list of factors that influence fertility. The evolution of fertility responses to economic development, and all of the variegated tastes and

preferences for children encompassed in a broad population base, are not completely explained through these variables alone.

If the proposition is accepted that economic development alters or is bound by additional fertility-affecting factors beyond changes in income and time-costs, then the next step in researching the interplay of fertility and economic development is to identify what they are.

Part B -- Decomposing Development: Is Development Simply a Positive Change in per Capita Income, or is a Positive Change in per Capita Income Part of a Broader Development Process?

Do changes in per capita income entirely define economic development, and thereby govern the fertility decisions of prospective parents through rational choice? If the wage rate and returns to capital investments govern fertility, a high state of economic development could theoretically undercut the value of raising children through Becker's framework. In the Marxist literature, this end-product would occur by design through the appropriation of surplus driving economic development. Under a Marxist paradigm, "if the laborer consumes his disposable time for himself, he robs the capitalist" (Marx, 224). Consequently, the capitalist, and by implication the economy, would be happiest when workers' disposable time was restricted to sleeping, eating meals and bathing. Ironically, in economic development, both Marx and Becker's postulates would anticipate higher stages of economic development to manifest the same consequence for a worker's available time to spend with their family.

Attempting to bridge the divide between qualitative and quantitative methods, David Fielding (393-414) formulates an holistic model of structural development to

synthesize the contributions of competing disciplines using five factors including, *but not limited to*, income. Fielding's model expresses the production function as:

$$y = \alpha + \alpha_1 e + \alpha_2 h + \alpha_3 k + \alpha_4 n$$
$$where: 1 > \alpha_1, \alpha_2, \alpha_3, \alpha_4 > 0$$

y = log per capita income
e = a measure of the average education level
h = a measure of the average level of health
k = log per capita physical capital stock

Fielding's complete structural model of development is posited to include five key endogenous variables: per capita income, education, health, fertility, and democracy. Fielding's work contains the significant implication of providing a model that allows for multi-directional causality, given the interplay of these variables to the development process. Importantly, Fielding's approach does not treat income and socio-cultural factors as dispositive points of focus for development research.

Orthodox development studies in economics do tend to fall within the restrictive framework that Fielding's paper hopes to ameliorate with its structural model. However, a persistent subset of economists has long appreciated the holistic model / approach articulated in Fielding's paper. Institutional economist Richard Brinkman argues the need for, and benefit from, an holistic approach to economic development research that moves beyond the exclusive emphasis on income measures in his paper *Economic Growth versus Economic Development: Toward a Conceptual Clarification*.

Brinkman begins with the premise that "institutional and heterodox economists have long since drawn a conceptual distinction between economic growth and economic development" (Brinkman, 1171). He emphasizes the importance of distinguishing economic growth from economic development to account for the "dynamics of

institutional adjustment" (1179) that are characteristic of economic development. Growth is defined as an increase of production within a given paradigm, subject to the diminishing returns of continued expansion within that paradigm. Conversely, Brinkman argues that the distinguishing feature of economic development is the process of structural transformation it characterizes –an upward shift of the paradigm itself.

The definition of economic development used in Brinkman's paper is cited from Nobel Laureate Gunnar Myrdal as "the movement upward of the entire social system" (1179). Brinkman then expands the scope of Myrdal's *social system* to include the complex whole of culture, encompassing its social, material and technological components. This distinction is a critical postulate of the Institutional Economist Thorstein Veblen that underlies much of Brinkman's work that the "[h]abits of thought with respect to the expression of life in any given direction unavoidably affect the habitual view of what is good and right in life in other directions…" (Veblen, 116). Crucial to the framework of Brinkman, and other heterodox economists, is the underlying precept that economic development characterizes an *organic and evolutionary* process that is affected primarily by qualitative variables.

Incorporating qualitative dynamics into studies of economic development is on the surface very appealing, and is largely accepted as beneficial when incorporated into development research. Unfortunately, the heterodox approach to the research of economic development encounters a host of conflagrating issues when researchers attempt to formally incorporate qualitative and socio-cultural items. Nobel Laureate Amartya Sen regarded "development … in terms of an expansion in 'capabilities' or 'positive freedoms'" (Qizilbash, 463). However, formally treating such items as

expansive capabilities and positive freedoms is not without challenge when engaging in the level of rigorous research that now defines the research conventions expected of professional economists.

Part C -- Working within Limits: Approaches Directed Towards Incorporating the Qualitative Socio-Cultural Factors of Development that can Affect the Analysis of Fertility.

Maxine Molyneux addresses a recent conceptual advance within development research in her paper *Gender and the Silences of Social Capital: Lessons from Latin America*. Molyneux begins by noting the recent trend in Latin American development policies to target improvements in the level of social capital. Social capital is framed as a concept that focuses on the importance of social networks and forms of associational activity (Molyneux, 171). Molyneux states that social capital as a primary policy target in Latin America represents a shift from an historically lopsided prioritization on macro-level development policies (i.e. trade, exchange rates, etc.) to ones directed at affecting persons at the micro level (i.e. bottom-up, community level approaches) (171). In a different paper, Lionel Beaulieu *et al* use a hierarchical linear model that finds evidence of social capital positively corresponding to student achievement. Beaulieu *et al* find community to be an essential attribute in the development of child education (Beaulieu *et* al, 127).

In an empirical paper researching time allocation in Burkina Faso, Michael Kevane and Bruce Wydick (119-29) focus on the capacity of societal norms to determine labor participation. Using an Ordinary Least Squares model, consistently heterogeneous labor responses are observed across the ethnicities facing similar changes in economic

variables such as income, number of children, and spousal time spent in fieldwork. Consequently, the claim for the relevance of socio-cultural factors in development studies finds an element of validation in Kevan and Wydick's paper.

Differentiating qualitative factors that impact occupational rigidity within the developing economy of India, James Scoville begins by stating the following three assumptions of the caste system: occupations are hereditary, compulsory, and endogamous (Scoville, 379). The preceding assumptions result in manifest inequality "of human capital formation, opportunity structures, and wage determinations" (379) that Scoville argues rebukes the proposition that the caste station is a choice determined through a utility function. Scoville finds the caste system robustly sustains itself through economic changes, particularly at the stratified levels, through (under)-utilization rates and upward adjustments in marital age. Scoville's empirical results find that caste most strongly affects marital age, labor utilization rates, and fertility. Thus, Scoville ultimately concludes that the rigidity of the caste system (with regard to its stubborn refusal to make the necessary labor adjustments predicted by the classical model) has empirically demonstrated strength.

Mary L. Brookins and Oscar T. Brookins incorporate the qualitative factors addressed in the preceding literature in their empirical research: *An Exploratory Analysis of Fertility Differentials in India*. Therein, the authors present a multi-stage analysis of the relationship between fertility and economic development. First, the authors run a standard ordinary least squares (OLS) regression to estimate the responsiveness of fertility to strictly economic indicators of development. Second, the authors use their

OLS analysis to include non-economic development variables. Models employed in their paper are run using household census data from 1991 collected in India.

The authors find in their first model that economic indicators of development explain roughly 70% of the interstate fertility rates in India. However, altering the model to evaluate non-economic developmental indicators boosts the explanatory power of their second model to roughly 84%. Variables in the analysis are grouped into the following four categories: Cultural and social development indicators, economic development indicators, female autonomy indicators, and family planning and family-size preference data. Brookins and Brookins run their OLS models separately for each of the data groups and report the explanatory power of each model in isolation from the other categories (66). Their results are statistically significant and are reported with no spatial or auto-correlation.

Incorporating non-standard economic development indicators into the analysis greatly increases the explanatory power of their models measuring the responsiveness of fertility to economic development. Of the variable groupings, the authors report the following hierarchy of explanatory power in each of their separate models (listed from highest to lowest): female autonomy, family planning variables, cultural and social variables, and finally economic variables (Brookins and Brookins, 66). Additionally, the authors make note of their approaches' relative strength to explain the country of analysis' developmental state over cross-country regression analyses. This argument is made under the assumption that cross-country regressions would negate the explanatory gains from the country-specific variable grouping applied in their work. Implicitly, the findings in this paper provide evidence of unique and distinguishable tastes and

preferences within India that the authors feel prevent its finding from being extrapolated across countries.

The Brookins and Brookins paper provides encouraging empirical results for economic development research that focuses on fertility while accounting for socio-cultural factors that can influence the propensity of households to produce children. Specifically, the authors establish the empirical relevance of researching the interplay between fertility and economic development from an holistic conceptualization of economic development itself. While fertility rates are simply calculated, the Brookins and Brookins paper lends credence to the heterodox argument that economic development research benefits from a more thorough conceptual clarity. In so doing, their research was empowered to explain a broader effectual scope of development's relationship to Indian fertility than would have been the case if development had simply been measured by changes in income and treated all other socio-cultural factors as homogenous.

Section Three -- Methodology: Data Description and Model Specification

The data to be used in this study focuses on Brazilian demography. Specifically, Brazil was chosen for analysis primarily for the diversity represented within its demography. Brazil is comprised of numerously differentiable social, cultural and economic segments. Further, this heterogeneous demography has experienced significant changes with regards to social and health policies, economic prosperity, and political stability over the course of the last century.

The totality of Brazil's enormous landscape covers a number of urban and rural regions. Economic activity and forms of social organization (i.e., communal, political, etc.) can differ significantly depending on regional location. Additionally, Brazil's population is composed from a rich diversity of ethnicities. Given the substantial intra-country variance across Brazil's demographic attributes, its value as the country of focus for this study is great.

Description of Survey

Data used for this study were procured through the Living Standards Measurement Study Survey (LSMSS). This representative survey was conducted through an agreement between the World Bank and the Brazilian Institute of Geographics and Statistics. Survey respondents were legally obligated to comply with this data collection. The objectives of the LSMSS were to "…specify the determinants of the social well-being of different social groups and … identify the effects of government policies on household living conditions" (Interviewer Manual, 13).

The LSMSS was completed over a 12-month period ranging from March of 1996 through to March of 1997. Through segmentation, 10 distinct regions were identified: six metropolitan areas, urban northeast, rural northeast, urban southeast, and rural southeast. Brazil's geographic landscape was then further segmented into 554 separate sectors for the analysis. These sectors were sampled proportionally throughout the 12 month survey period within their respective region. Each sector appeared only once within the 12 month sampling period.

Surveys were conducted in person and were administered in two stages. The purpose of the two-stage administration was to give respondents sufficient time to prepare their records and answers for the second phase questions. Increased survey control and response accuracy were purported to result from this two-staged approach, given the level of complexity and detail surrounding the second stage questions. Formally, the first stage of questioning solicited answers to the following topical groups: characteristics of dwelling, characteristics of household members, migration, education, health, economic activity, and fertility. The second stage of the survey solicited answers to the remaining topical groups: income (excluding labor), investments and credit, spending and inventory of possessions, spending and food consumption, self-employed / employer, farm activities, evaluation of living conditions, and anthropometry.

Summary of Data Observations from Survey

The data sample collected in the LSMSS reflects the geographic and socio-cultural diversity of Brazil. Almost five thousand households were sampled through the LSMSS and data were collected for over nineteen thousand persons residing in those

households. The data points identified in tables 3.1, 3.2, and 3.4 (see below) were collected from all persons contacted for the LSMSS. The survey section regarding income and work history (summary statistics provided in table 3.3 below) was only directed towards, and recorded for, persons five years of age and older. Data regarding fertility (see table 3.5) was only collected from survey respondents who were female and between the ages of 12 and 49 years. The survey sampling and restrictions for persons eligible to respond to various questions are consistent with the conventions of demographic data collection (Barclay).

General Demographic Tables

Table 3.1

Households	Persons	Persons per Household	Children per Household
4940	**19,409**	**3.928**	**1.849**

Table 3.2

Male	Female	Mean Age	Std Dev: Age
9410	**9,999**	**27.9**	**1.849**

Table 3.3

Worked in Last Year	Worked in Last Seven Days	Volunteered in Last Month	Mean Gross Salary in Most Recent Payment
8,836	**7,962**	**474**	**R$ 440.00**[6]

Table 3.4

Birthplace = Urban (all)	Birthplace = Rural (all)	Birthplace = Urban (children only)	Birthplace = Rural (children only)
12,111	**7,298**	**6,613**	**2,523**
Rural Birthplace as Percentage of Total (all) =>	**37.60%**	Rural Birthplace as Percentage of Total (children only) =>	**27.62%**

[6] As of the date of this paper, the exchange rate is $1 USD per $R 1.7725. Inflation over the 13 year period since the LSMSS was conducted has been higher in Brazil than in the United States. If inflation in both countries held parity, at 3% annually, the present value of this amount in USD would equal $299.61.

Fertility Age Chart

Table 3.5

Range	12 > Age > 0	49 ≥ Age ≥ 12	Age > 49	Total
Men	**2,361**	**5,686**	**1,363**	**9,410**
Women	**2,291**	**5,996***	**1,712**	**9,999**
Total	**4,652**	**11,682**	**3,075**	**19,409**

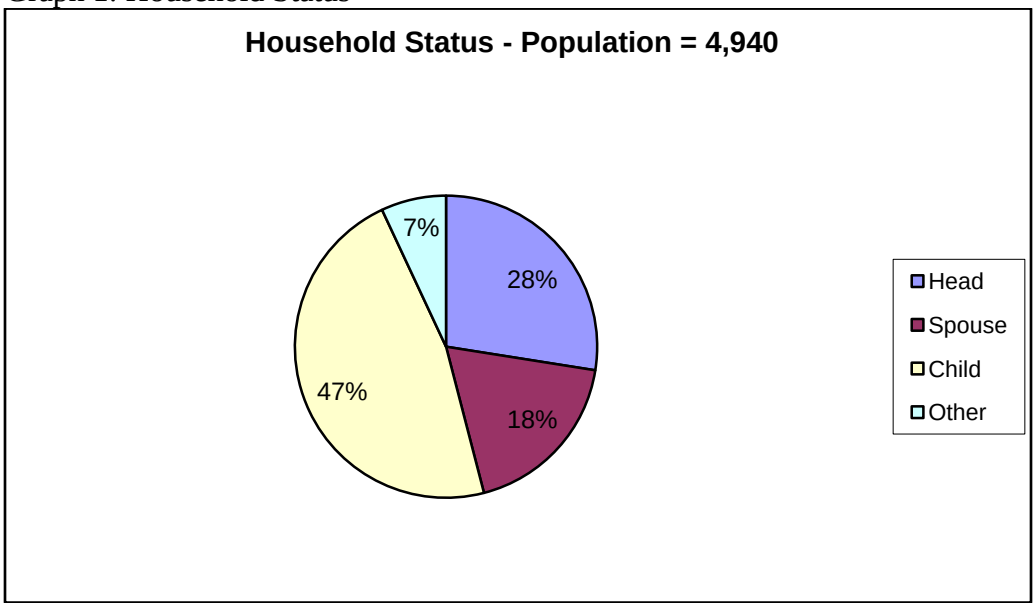
* The mean age for a mother during the birth of her first live child in this cohort = 21.66. The standard deviation from this mean age = 4.69

The preceding tables produce a few noteworthy observations. The gender balance is skewed slightly in favor of women and the average number of children per household is below the replacement rate. If these data are reflective of the country surveyed, this would imply that without an offsetting level of migration into Brazil, the population of Brazil is contracting. This implication provides evidence that the inverted-U curve so commonly referenced in fertility studies characterizes Brazilian fertility to some degree.

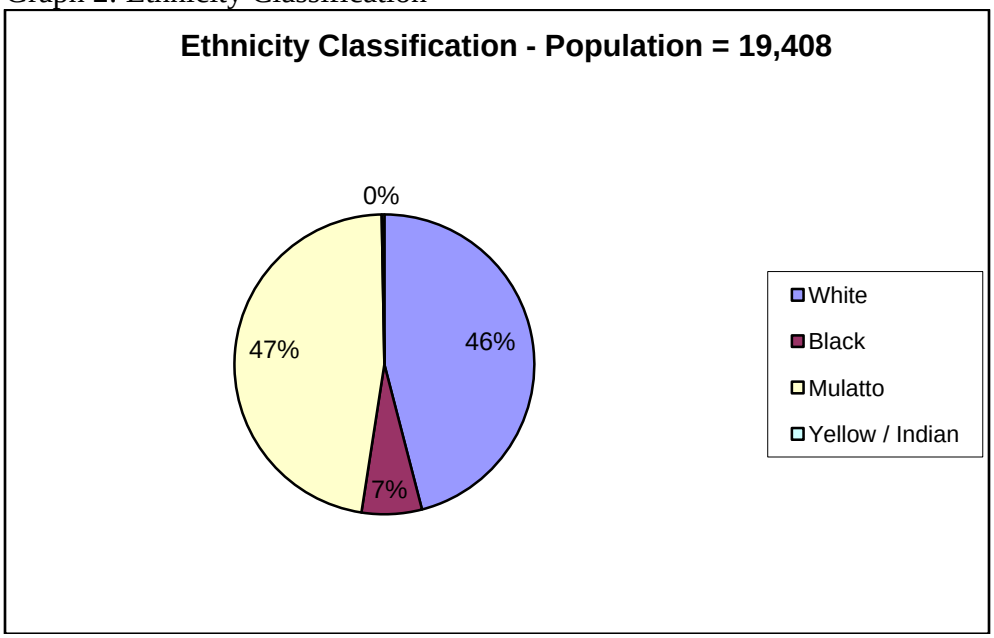
When live births are averaged, from women currently of childbearing age who have been pregnant at least once in their life, the mean number of live children born is 1.58, with a standard deviation of 2.09. This statistic provides further evidence that Brazilian fertility rates, on a macro level, are declining as the older generation's fertility data represented by the total number of children in the survey gives way to the younger generations reflected in the age-restricted fertility section. A second generational observation is significant to the demographic transition characterizing Brazil: Births in rural locations, as a proportion of total births, are declining (see table 3.4). When the birthplace (urban or rural) of all respondents -regardless of age- is compared to the birthplace of persons in the survey identified only as children, the data indicates that the percentage of total births occurring in rural locations falls by almost 10%. This statistic provides strong evidence of increased urbanization over the spans of life embodied by the survey respondents.

The social fabric enveloping the Brazilian landscape provides a fertile ground of differentiation possibilities. A series of illustrative graphs are provided below detailing the composition of households in the survey (see graph 1), the ethnic diversity embodied by survey respondents (see graph 2), the marital status of persons in the survey (see graph 3), and the diverse natures of marital relationships uncovered in the survey (see graph 4).

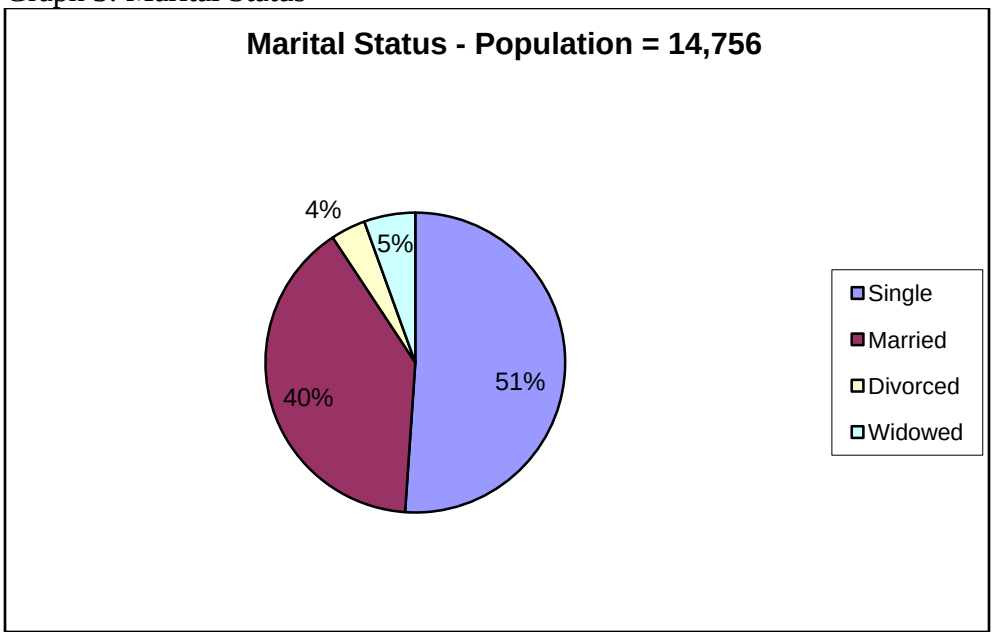
Graph 1: Household Status



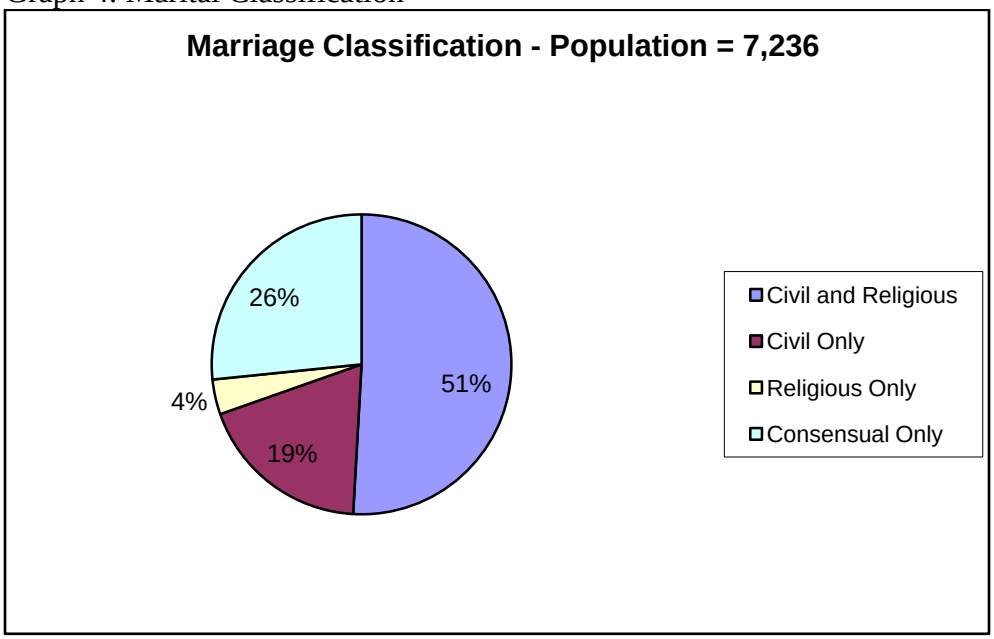
Graph 2: Ethnicity Classification



Graph 3: Marital Status



Graph 4: Marital Classification



The potential for meaningful analysis measuring the degree of variation in fertility rates accounted for by the respective facets of Brazilian diversity is substantial. A discussion of the data points used for the analysis in this paper will follow next.

Variable Groups and Descriptive Statistics

Two primary observations were chosen for use as the dependent variables in this paper's fertility analysis: number of pregnancies and number of live births. Both data points were available for women in the survey between the childbearing ages of 12 and 49. These dependent variables were chosen for their primary relevance to the two fundamental events that characterize fertility behavior: fertilized coital events and birth. The independent variables used to explain the variation of these two dependent variables were segmented into three distinct categories to differentiate their respective influence on fertility behavior. Independent variables were grouped into the following three categories: Economic, Strength of Social Institutions, and Culture. These variable

groupings were selected to isolate the relative effects of the conventional and unconventional facets of economic development discussed in the literature review section. An explanation of each of these three independent variable groups will be presented next.

Table 3.6 - Economic Variables

Variables	Description
PYCHKAMOUNT	Gross salary of most recent payment
ALIMONYINCM	Income from alimony: 1 = Yes, 2 = No
TRANSPTASSIST	Receipt of transportation assistance from employer: 1 = Yes, 2 = No
HOUSNGASSIST	Receipt of housing assistance from employer: 1 = Yes, 2 = No
RCVREMITT	Receipt of donations, allowances, or gifts from others living outside: 1 = Yes, 2 = No
PRFRMHHCHRS	Performance of household chores in the past seven days: 1 = Yes, 2 = No
NMBOFPYCHKS	Number of paychecks received in past year

Variables were chosen to approximate the effects on fertility from direct earnings received as payments from primary employers, former spouses and remittances, and economic activity indirectly accounted for by the number of checks received for work the survey respondents received over the course of the most recent year. Non-wage benefits were selected to incorporate additional factors in the economic activity of survey respondents that could affect fertility responsiveness through the opportunity cost mechanism postulated in Becker's framework (Becker and Barro, 1). These non-wage benefits were limited to transportation and housing. Expanding the non-wage benefits beyond those two variables yielded little gains in explanatory power and reduced the total number of observations available for analysis.

Initially, there were four additional variables grouped in a separate model to account for labor market characteristics that might influence fertility responsiveness. The four labor market variables were union membership status, contribution status in a pension fund, whether or not the respondent had ever worked, whether or not the respondent had worked in the past 12 months. However, after a preliminary statistical analysis, variables within the labor market characteristic group proved to be uniform in their statistical insignificance. Consequently, the labor market characteristic group was dropped from the results section of this study.

Additional variables were included in the economic model used in the Brookins and Brookins paper to measure the "economic" affect on fertility rates. These additional variables used in the Brookins and Brookins paper included items such as characteristics of the dwelling (e.g. amenities, plumbing access, etc.). The expansive treatment of economic variables under the Brookins and Brookins approach was not adopted in this paper. The fertility model postulated by Becker and Barro placed particular emphasis on parental earnings potential, the potential earnings of the child, and relative rates of return to levels of human capital investment (see Lopez-Calva and Miyamoto).

Subsequent tests of Becker and Barro's framework have traditionally focused on the variables closely related to those indicated in the preceding page to test the robustness of his theory with empirical data. Incorporating variables apart from the (in)direct wage mechanism would theoretically expand the power of an explanatory model. Unfortunately, the ensuing departure from Becker's framework would end up encompassing broad characteristics, such as that of the dwelling place, that may be more

a function of institutional and environmental factors, or individual tastes and preferences, than of the earnings potential driving Becker's model.

Since the primary objective of the analysis in this research is to compare the relative explanatory power of a wage driven fertility analysis to the relative explanatory power of additional models measuring the strength of social institutions, and cultural variables, the economic model in this analysis has been restricted to the wage-based incentives purported by Becker and Barro to so prevalently factor into the fertility decisions of households.

Table 3.7 - Strength of Social Institutions

Variables	Description
VOLUNT	Community assistance and unpaid volunteer work within past 30 days: 1 = Yes, 2 = No
BIRTHPLACE	Place of birth: 1 = Urban, 2 = Rural
CHRONICHLTH	Presence of chronic health problems: 1 = Yes, 2 = No
TERMNTDPREG	Interrupted pregnancy within seven months of conception: 1 = Yes, 2 = No
CONTRCPTUSE	Utilization of contraception: 1 = Yes, 2 = No
FRSTJOBAGE	Age when first job was obtained

These variables were chosen to account for the role that strong social institutions play in the fertility behavior of households. In a qualitative realm of social institutional strength: community involvement becomes prevalent, the persons dwell in urban areas, persistent health problems are minimal, children remain in school or training to develop human capital instead of working before their skills are fully developed, contraception would be used to manage fertility in line with a rational choice model, and interrupted pregnancies (from miscarriage and abortions) would be minimal. These variables selected for the Strength of Social Institutions model attempt to account for the *capabilities* and *positive*

freedoms that Amartya Sen noted as being instrumental measurements of economic development (Qizilbash, 436).

Table 3.8 - Cultural Variables

Variable	Description
ETHNWHITE*	Ethnicity is white: 0 = No, 1 = Yes
ETHNBLACK	Ethnicity is black: 0 = No, 1 = Yes
ETHNMULATT	Ethnicity is mulatto: 0 = No, 1 = Yes
ETHNYELLOW	Ethnicity is yellow or Indian: 0 = No, 1 = Yes
FATHRLITYES*	Literacy of father: 0 = No, 1 = Yes
FATHRLITNO	Father is illiterate: 0 = No, 1 = Yes
FATHRLITUNKNOWN	Literacy of Father is unknown: 0 = No, 1 = Yes
MOTHRLITYES*	Literacy of mother: 0 = No, 1 = Yes
MOTHRLITNO	Mother is illiterate: 0 = No, 1 = Yes
MOTHRLITUNKNOWN	Literacy of Mother is unknown: 0 = No, 1 = Yes
SINGLE*	Marital status is single: 0 = No, 1 = Yes
DIVORCED	Marital status is divorced: 0 = No, 1 = Yes
MARRIED	Marital status is married: 0 = No, 1 = Yes
WIDOWED	Marital status is widowed: 0 = No, 1 = Yes
CIVILMRG	Nature of marriage is civil only: 0 = No, 1 = Yes
RELIGMRG	Nature of marriage is religious only: 0 = No, 1 = Yes
CONSENSUALMRG	Nature of marriage is consensual only: 0 = No, 1 = Yes
CIVANDRELIMRG*	Nature of marriage is **both** civil and religious: 0 = No, 1 = Yes
HEADOFHH	Household status is head: 0 = No, 1 = Yes
HHSPOUSE	Household status is spouse: 0 = No, 1 = Yes
HHCHILD*	Household status is child: 0 = No, 1 = Yes
HHSTATOTHR	Household status is "other:" 0 = No, 1 = Yes
AGE	Age of survey respondent
AGE2	Squared age of survey respondent
TERMPREGNBR	Number of pregnancies that were interrupted within seven months of conception

These variables were chosen to measure the influence of cultural attributes on fertility behavior. Each of the specified variables in table 3.8 represent respondent attributes that are inherently dependent upon inherited social traits and attributes (see Veblen). Six parity classifications (dummy variables) were set for subcategories of the following data

groups: ethnicity, father literacy, mother literacy, marital status, the nature of respondent's marriage, and household status. While stated for completeness in the above table, those dummy variables noted with an asterisk were used as the reference category for the tests (Dougherty, 267-69)[7]. The variables in the Cultural Model were set to account for the cultural heterogeneity, vis-à-vis the respective tastes and preferences of survey respondents.

On the following page in Table 3.9, descriptive statistics are provided for all observations recorded in the LSMSS sample. These statistics represent the entire LSMSS sample and are based on the number of total responses for each of the respective questions. Following the descriptive statistics for the sample noted in Table 3.9, a descriptive statistics table will follow for the observations used in each of the six regression equations (see table 3.10 through table 3.12). These model specific tables only represent the descriptive statistics for observations used in each of the respective models.

[7] The noted reference categories each represent the largest proportion of values identified in Table 3.9 within each of the respective parity conditions.

Table 3.9 - Descriptive Statistics from Survey

Variable	Obs	Mean	Std. Dev.	Min	Max
PREGNANCIES	5996	1.794196	2.357818	0	17
LIVE BIRTHS	5856	1.584069	2.099896	0	17
Economic	xxxx	xxxxxxxx	xxxxxxxx	x	x
PYCHKAMOUNT	5065	440.2117	877.0088	0	15000
ALIMONYINCM	15607	1.990069	0.099164	1	2
TRANSPTASSIST	5071	1.661014	0.473412	1	2
HOUSNGASSIST	5071	1.912838	0.282101	1	2
RCVREMITT	15607	1.929198	0.256501	1	2
PRFRMHHCHRS	17492	1.440316	0.496439	1	2
NMBOFPYCHKS	5065	33.07266	35.1599	0	98
Social Institutions	xxxx	xxxxxxxx	xxxxxxxx	x	x
VOLUNTR	17492	1.972902	0.162374	1	2
BIRTHPLACE	19409	1.376011	0.484395	1	2
CHRONICHLTH	19409	1.844711	0.362189	1	2
TERMNTDPREG	3388	1.757969	0.428376	1	2
CONTRACEPTUSE	5791	1.698670	0.458875	1	2
FRSTJOBAGE	12047	13.61617	5.242747	2	55
Cultural	xxxx	xxxxxxxx	xxxxxxxx	x	x
ETHNWHITE	19408	0.459604	0.498378	0	1
ETHNBLACK	19408	0.06487	0.246303	0	1
ETHNMULATT	19408	0.472692	0.499267	0	1
ETHNYELLOW	19408	0.002834	0.05316	0	1
FATHRLITYES	19409	0.661960	0.473054	0	1
FATHRLITNO	19409	0.303776	0.459899	0	1
FATHRLITUNKNOWN	19409	0.034262	0.181907	0	1
MOTHRLITYES	19409	0.634241	0.481654	0	1
MOTHRLITNO	19409	0.348498	0.476507	0	1
MOTHRLITUNKONWN	19409	0.172600	0.130242	0	1
SINGLE	14756	0.510911	0.499898	0	1
DIVORCED	14756	0.03768	0.190427	0	1
MARRIED	14756	0.396178	0.489119	0	1
WIDOWED	14756	0.055232	0.22844	0	1
CIVILMRG	7236	0.18712	0.390035	0	1
RELIGMRG	7236	0.037728	0.190551	0	1
CONSENSUALMRG	7236	0.266169	0.441984	0	1
CIVANDRELMRG	7236	0.508983	0.499954	0	1
HEADOFHH	19409	0.274976	0.446513	0	1
HHSPOUSE	19409	0.184605	0.387987	0	1
HHCHILD	19409	0.470813	0.49916	0	1
HHOTHER	19409	0.073316	0.395727	0	1
AGE	19409	27.90865	19.91239	0	96
AGE2	19409	1175.375	1460.494	0	9216
TERMPREGMBR	19409	0.065743	0.379294	0	11

Table 3.10 – Descriptive Statistics from Economic Models

Dependent Variable = Number of Pregnancies

Variable	Obs	Mean	Std. Dev.	Min	Max
PREGNANCIES	1810	1.635359	2.136231	0	15
PYCHKAMOUNT	1810	353.3983	725.7564	0	14000
ALIMONYINCM	1810	1.978453	.1452389	1	2
TRANSPTASSIST	1810	1.61989	0.485548	1	2
HOUSNGASSIST	1810	1.949724	.2185748	1	2
RCVREMITT	1810	1.932044	.2517396	1	2
PRFRMHHCHORES	1810	1.193923	.3954783	1	2
NMBOFPYCHKS	1810	34.61381	36.6756	0	98

Dependent Variable = Number of Live Births

Variable	Obs	Mean	Std. Dev.	Min	Max
LIVE BIRTHS	1766	1.419592	1.854492	0	13
PYCHKAMOUNT	1766	354.6228	732.7182	0	14000
ALIMONYINCM	1766	1.978482	.145143	1	2
TRANSPTASSIST	1766	1.625142	.484223	1	2
HOUSNGASSIST	1766	1.95017	.2176555	1	2
RCVREMITT	1766	1.930917	.2536665	1	2
PRFRMHHCHORES	1766	1.193658	.3952759	1	2
NMBOFPYCHKS	1766	34.62911	36.70089	0	98

Table 3.11 – Descriptive Statistics from Strength of Social Institutions Models

Dependent Variable = Number of Pregnancies

Variable	Obs	Mean	Std. Dev.	Min	Max
PREGNANCIES	2815	3.253286	2.391379	1	17
VOLUNTR	2815	1.963766	.1869062	1	2
BIRTHPLACE	2815	1.424512	.493565	1	2
CHRONICHLTH	2815	1.827709	.3777005	1	2
TERMNTDPREG	2815	1.746714	.4349706	1	2
CONTRACEPTUSE	2815	1.511901	.4999472	1	2
FRSTJOBAGE	2815	14.8302	5.752748	4	49

Dependent Variable = Number of Live Births

Variable	Obs	Mean	Std. Dev.	Min	Max
LIVE BIRTHS	2767	2.895916	2.117655	1	17
VOLUNTR	2767	1.96386	.1866727	1	2
BIRTHPLACE	2767	1.427539	.4948109	1	2
CHRONICHLTH	2767	1.828695	.3768431	1	2
TERMNTDPREG	2767	1.75786	.4284557	1	2
CONTRACEPTUSE	2767	1.509939	.4999916	1	2
FRSTJOBAGE	2767	14.83339	5.76975	4	49

Table 3.12 – Descriptive Statistics from Culture Models

Dependent Variable = Number of Pregnancies

Variable	Obs	Mean	Std. Dev.	Min	Max
PREGNANCIES	2788	3.0434	2.389859	0	17
ETHNWHITE	2788	0.496413	0.500076	0	1
ETHNBLACK	2788	0.581062	0.233986	0	1
ETHNMULATT	2788	0.443687	0.496907	0	1
ETHNYELLOW	2788	0.001793	0.042318	0	1
FATHRLITYES	2788	0.612266	0.487320	0	1
FATHRLITNO	2788	0.352582	0.477859	0	1
FATHRLITUNKNOWN	2788	0.035150	0.184193	0	1
MOTHRLITYES	2788	0.552367	0.497339	0	1
MOTHRLITNO	2788	0.428622	0.494967	0	1
MOTHRLITUNKONWN	2788	0.01901	0.136584	0	1
SINGLE	2788	0.229913	0.420852	0	1
DIVORCED	2788	0.022955	0.149788	0	1
MARRIED	2788	0.736370	0.440679	0	1
WIDOWED	2788	0.010760	0.103191	0	1
CIVILMRG	2788	0.199067	0.399370	0	1
RELIGMRG	2788	0.028694	0.166976	0	1
CONSENSUALMRG	2788	0.305595	0.460741	0	1
CIVANDRELMRG	2788	0.466642	0.498975	0	1
HEADOFHH	2788	0.007532	0.086476	0	1
HHSPOUSE	2788	0.978479	0.145138	0	1
HHCHILD	2788	0.004662	0.068137	0	1
HHOTHER	2788	0.009325	0.096135	0	1
AGE	2788	33.52726	8.569037	14	49
AGE2	2788	1197.479	575.1454	196	2401
TERMPREGMBR	2788	0.336441	0.797920	0	11

Dependent Variable = Number of Live Births

Variable	Obs	Mean	Std. Dev.	Min	Max
LIVE BIRTHS	2703	2.732149	2.133765	0	17
ETHNWHITE	2703	0.497965	0.500088	0	1
ETHNBLACK	2703	0.058823	0.235337	0	1
ETHNMULATT	2703	0.441731	0.496685	0	1
ETHNYELLOW	2703	0.001479	0.038447	0	1
FATHRLITYES	2703	0.610062	0.487826	0	1
FATHRLITNO	2703	0.354791	0.478538	0	1
FATHRLITUNKNOWN	2703	0.035146	0.184183	0	1
MOTHRLITYES	2703	0.548279	0.497755	0	1
MOTHRLITNO	2703	0.432852	0.495562	0	1
MOTHRLITUNKONWN	2703	0.018867	0.136083	0	1
SINGLE	2703	0.225305	0.417860	0	1
DIVORCED	2703	0.023307	0.150906	0	1
MARRIED	2703	0.740658	0.438354	0	1
WIDOWED	2703	0.010728	0.103041	0	1
CIVILMRG	2703	0.196448	0.397385	0	1
RELIGMRG	2703	0.029226	0.168472	0	1
CONSENSUALMRG	2703	0.302256	0.459320	0	1
CIVANDRELMRG	2703	0.472068	0.499311	0	1
HEADOFHH	2703	0.006659	0.081347	0	1
HHSPOUSE	2703	0.981502	0.134768	0	1
HHCHILD	2703	0.003699	0.060722	0	1
HHOTHER	2703	0.008139	0.089865	0	1
AGE	2703	33.83315	8.440056	14	49
AGE2	2703	1215.89	570.6475	196	2401
TERMPREGMBR	2703	0.328893	0.796135	0	11

Model Specification

An Ordinary Least Squares (OLS) model was chosen for the analysis. Selection of the OLS model was based on two primary factors: one; the type of data used in the analysis, and two; the observed use of this particular model in peer-reviewed fertility analyses researched for this project which utilized household survey data. The choice and application of the OLS model was based in large part on the approach used in the

Brookins and Brookins paper to address the relative explanatory power of models focusing on different thematic factors. An inspection of the correlation coefficient matrix (see appendix table A-7) revealed no significant signs of multi-collinearity for the independent variables.

In post-estimation testing, no evidence of endogeneity was found in any of the models or independent variables (see appendix tables A-1 through A-6). As noted in Baum

> "a variable is endogenous if it is correlated with the disturbance. In the model: $Y = \beta_o X_o + \beta_1 X_1 + \cdots \beta_k X_k + \mu$, X_j is endogenous if $Cov[X_j, \mu] \neq 0$. X_j is exogenous if $Cov[X_j, \mu] = 0$. The OLS estimator will be consistent only if $Cov[X_j, \mu] = 0$, j=1, 2,…,k… it is [this] definition of endogeneity that matters in empirical work." (185)

To test for the presence of endogeneity, a column of residuals was saved for each of the regression equations in post-estimation. The models were then rerun against the residual columns to see if any of the independent variables were correlated to the residuals. Neither the respective models (R^2) nor the respective variables (t values) were found to be related to the residuals. Additionally, a covariance matrix is reported in the appendix (see tables A-8 through A-10) for each of the residuals from the models and their respective independent variables used. The covariance matrices provide no evidence that the zero mean assumption has been violated. Consequently, no further control for endogeneity was pursued in this paper.

If endogeneity had been found through a violation of the zero mean assumption, a Hausman test would have been necessary to "test of the consequence of using different

estimation methods on the same equation" (Baum, 212) by utilizing Instrument Variables[8]. It should be noted that in some cases, an application of the Hausman test is still warranted in spite of evidence that no endogeneity is present. For example, in cases where a model contains endogeneity by construction (such as is commonly the case in systems of simultaneous equations), a Hausman test would be appropriate even if covariance results indicated that the zero mean assumption had not been violated. Having found satisfactory evidence in this work through post estimation testing that endogeneity was absent, no further control for endogeneity was adopted in this paper[9].

Separate OLS regression equations were run twice for each variable grouping. The first was run using the number of pregnancies as the dependent variable, Y_p. The second OLS regression equation was run using the number of live births as the dependent variable, Y_b. Observations available for this analysis were restricted to those female persons, aged 12 to 49 years, who responded to the survey question "have you ever been pregnant, yes or no." As mentioned previously, restricting the fertility analysis to the female sample of childbearing age is a common fertility analysis convention (see Barclay) and was a limitation imposed by the data reporting method used in the LSMSS. Formally, the OLS regression equations and hypotheses for the tests are stated as follows:

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[8] The reason for this is that, if endogeneity is present in any independent variable contained in an econometric model, the results for that entire model can be biased and inconsistent based on the presence of a single endogenous independent variable. The Hausman test will indicate if the estimates from the instrumental variable model are better than the estimates obtained from the OLS model. To attempt to find improved estimates through the Hausman test, instrument variables are chosen that are highly correlated to the endogenous independent variables but unrelated to the disturbance term from the model (Baum, 212).

[9] Enterprising readers of this work may yet suspect the presence of endogeneity, in spite of the post-estimation testing results. In cases where future work (e.g. through enhanced modeling) draws an endogenous line between independent and dependent variables used in this work, an instrumental variable model would become appropriate to correct for the hypothesized endogeneity if a theoretical basis was hypothesized for an endogenous relationship between the independent and dependent variables used in this paper .

Equation 1. – Economic Relationship to Number of Pregnancies

$$Y_p^e = \beta_0 + \beta_1 PYCHKAMOUNT_i + \beta_2 ALIMONYINCM_i + \beta_3 TRANSPTASSIST_i + \beta_4 HOUSNGASSIST_i + \beta_5 RCVREMITT_i + \beta_6 PRFRMHHCHRS_i + \beta_7 NMBOFPYCHKS_i + \varepsilon$$

Equation 2. – Economic Relationship to Number of Live Births

$$Y_b^e = \beta_0 + \beta_1 PYCHKAMOUNT_i + \beta_2 ALIMONYINCM_i + \beta_3 TRANSPTASSIST_i + \beta_4 HOUSNGASSIST_i + \beta_5 RCVREMITT_i + \beta_6 PRFRMHHCHRS_i + \beta_7 NMBOFPYCHKS_i + \varepsilon$$

Equation 3. – Strength of Social Institutions Relationship to Number of Pregnancies

$$Y_p^s = \beta_0 + \beta_1 VOLUNTR_i + \beta_2 BIRTHPLACE_i + \beta_3 CHRONICHLTH_i + \beta_4 TERMNTDPRG_i + \beta_5 CONTRACEPTUSE_i + \beta_6 FRSTJOBAGE_i + \varepsilon$$

Equation 4. – Strength of Social Institutions Relationship to Number of Live Births

$$Y_b^s = \beta_0 + \beta_1 VOLUNTR_i + \beta_2 BIRTHPLACE_i + \beta_3 CHRONICHLTH_i + \beta_4 TERMNTDPRG_i + \beta_5 CONTRACEPTUSE_i + \beta_6 FRSTJOBAGE_i + \varepsilon$$

Equation 5. – Strength of Cultural Relationship to Number of Pregnancies

$$Y_p^c = \beta_0 + \beta_1 ETHNYELLOW_i + \beta_2 ETHNBLACK_i + \beta_3 ETHNMULATT_i + \beta_4 FATHRLITNQ_i + \beta_5 FATHRLITUNKNOWN + \beta_6 MOTHRLITNQ_i + \beta_7 MOTHRLITUNKNOWN + \beta_7 WIDOWED_i + \beta_8 DIVORCED_i + \beta_9 MARRIED_i + \beta_{10} CIVILMRG_i + \beta_{11} RELIGMRG_i + \beta_{12} CONSENSUALMRG_i + \beta_{13} HEADOFHH_i + \beta_{14} HHSPOUSE_i + \beta_{15} HHOTHER_i + \beta_{16} AGE_i + \beta_{17} AGE2_i + \beta_{18} TERMPREGNBR_i + \varepsilon$$

Equation 6. – Strength of Cultural Relationship to Number of Live Births

$$Y_b^c = \beta_0 + \beta_1 ETHNYELLOW_i + \beta_2 ETHNBLACK_i + \beta_3 ETHNMULATT_i + \beta_4 FATHRLITNQ_i + \beta_5 FATHRLITUNKNOWN + \beta_6 MOTHRLITNQ_i + \beta_7 MOTHRLITUNKNOWN + \beta_7 WIDOWED_i + \beta_8 DIVORCED_i + \beta_9 MARRIED_i + \beta_{10} CIVILMRG_i + \beta_{11} RELIGMRG_i + \beta_{12} CONSENSUALMRG_i + \beta_{13} HEADOFHH_i + \beta_{14} HHSPOUSE_i + \beta_{15} HHOTHER_i + \beta_{16} AGE_i + \beta_{17} AGE2_i + \beta_{18} TERMPREGNBR_i + \varepsilon$$

Hypothesis 1: R^2 Equation 5 > R^2 Equation 3 > R^2 Equation 1

Hypothesis 2: R^2 Equation 6 > R^2 Equation 4 > R^2 Equation 2

Section Four -- Analysis and Results

In step with the reporting method used in the Brookins and Brookins paper, the analytic results will be reported in the following order: the Economic model, the Strength of Social Institutions model, and finally the Culture model. In keeping with the Brookins and Brookins reporting style, all three models were run separately (once for each dependent variable). The objective of the models was to compare their relative explanatory power to test hypotheses 1 and 2. The objective of the models was not to develop and test an integrated model of fertility.

Generally, the majority of the variables chosen for the respective models were found statistically significant at the 95% and 99% levels. There were no significant signs of multi-collinearity among the statistically significant independent variables within the respective models when the correlation coefficient matrix was reviewed (see the correlation coefficient matrix in appendix A-7) and no signs of endogeneity were found (see appendix tables A-1 through A-6). However, the relative explanatory power of the models did vary substantially. Of the three models, the Economic model yielded a surprisingly low explanatory power of the fertility variance, as measured by R^2. The Strength of Social Institutions model provided slightly higher explanatory power of the fertility variance, as measured by R^2. Out of the three models, the Culture model returned the highest degree of explanatory power for the fertility variance, as measured by R^2. After running the models for equations 1 through 6, hypotheses 1 and 2 were not rejected.

Table 4.1 – Summary of Regression Results

Dependent Variable	Economic Model	Strength of Social Institutions Model	Cultural Model
# of Pregnancies	R^2: 0.0634 Obs: 1,810	x	X
# of Live Births	R^2: 0.0620 Obs: 1,766	x	X
# of Pregnancies	X	R^2: 0.1961 Obs: 2,815	X
# of Live Births	X	R^2: 0.1134 Obs: 2,767	X
# of Pregnancies	X	X	R^2: 0.3665 Obs: 2,788
# of Live Births	X	X	R^2: 0.2582 Obs: 2,703

In all three of the models, the explanatory power was higher for explaining the variance in the number of pregnancies than it was in explaining the variance in the number of live births. Also, the same order of explanatory power was observed for each of the three models regardless of the dependent variable used. The results for each of the three models, and the two separate regressions run for each, will now be reported. The model name will be stated first. Following, the specific regression equation will be stated for each corresponding dependent variable. After the statement of the regression equation, the formal results will be reported. The statistical level of significance will be denoted by:

99% = ***

95% = **

90% = *

Insignificant = no asterisk

Model 1: Economic Variables

$$Y_p^e = \beta_0 + \beta_1 PYCHKAMOUNT_i + \beta_2 ALIMONYINC_i + \beta_3 TRANSPTASSIST_i + \beta_4 HOUSNGASSIST_i + \beta_5 RCVREMITT_i + \beta_6 PRFRMHHCHRS_i + \beta_7 NMBOFPYCHKS_i + \varepsilon$$

Observations: 1,810	R-squared: 0.0634	Adjusted R-squared: 0.598
Variable	**Coefficient**	**Standard Error**	**P > |t|**
PYCHKAMOUNT	-0.0001274*	.0000686	0.064
ALIMONYINC	-0.8031566**	.3358246	0.017
TRANSPTASSIST	0.1549908	.1011984	0.126
HOUSNGASSIST	0.9187147***	.2257299	0.000
RCVREMITT	-0.6879505***	.1945697	0.000
PRFRMHHCHRS	-1.0741730***	.1237099	0.000
NMBOFPYCHKS	-0.0000497	.0013514	0.971
CONSTANT	3.8404350***	.9263912	0.000

$$Y_B^e = \beta_0 + \beta_1 PYCHKAMOUNT_i + \beta_2 ALIMONYINC_i + \beta_3 TRANSPTASSIST_i + \beta_4 HOUSNGASSIST_i + \beta_5 RCVREMITT_i + \beta_6 PRFRMHHCHRS_i + \beta_7 NMBOFPYCHKS_i + \varepsilon$$

Observations: 1,766	R-squared: 0.0620	Adjusted R-squared: 0.0583
Variable	**Coefficient**	**Standard Error**	**P > |t|**
PYCHKAMOUNT	-0.0000798	.0000598	0.182
ALIMONYINC	-0.7554759**	.2955425	0.011
TRANSPTASSIST	0.1539392*	.0892623	0.085
HOUSNGASSIST	0.7913244***	.1994802	0.000
RCVREMITT	-0.4067585**	.1698342	0.017
PRFRMHHCHRS	-0.9614882***	.1088809	0.000
NMBOFPYCHKS	-0.0003975	.0011880	0.738
CONSTANT	3.0960770***	.8151852	0.000

Five of the seven independent variables for the economic model were statistically significant in the regressions. Direct monetary wages were only weakly significant in the first model using the number of pregnancies as the dependent variable. In the model using the number of live births as the dependent variable, the receipt of transportation assistance (insignificant in the pregnancy model) became weakly significant. All signs remained consistent in the models when the dependent variables were changed.

While statistically significant in cases, the results for the economic model yielded little explanatory power. Persons not engaging in household "chores" were observed

with a negative relationship to fertility. As persons distanced themselves from household chores, the sign indicates that they would be less likely to produce children or become pregnant. Persons not receiving *fringe* benefits such as transportation and housing assistance were less likely to have pregnancies and children. While this finding does not support the proposition that increased wages (including non-wage benefits) reduces fertility, it follows intuitively that only persons currently working would answer this questions and that those persons working are less likely to become parents if they are expected to be "stay-at-home" parents.

The income from alimony was negatively related to pregnancy and birth and was statistically significant in both models, this relationship was consistent with the expectations under Becker framework. Also consistent with expectations under Becker's framework, the gross payment amounts were negatively related to pregnancies at a statistically significant level. The frequency of checks received for work during the past year was surprisingly insignificant in both models. Perhaps the most surprising and interesting result came from the remittance variable. Persons not receiving remittance and / or gift payments showed a negative relationship to pregnancy and live child births. Given Becker's postulates, this result does not counter his theory. Since receiving remittance and gift payments would not result in less time available for children (because work wasn't required to acquire these payments), there would be no opportunity costs of raising children associated with the remittance and / or gift payments received. The variable's consistency with Becker's framework was revealing: It highlights the importance of the subtle assumption stated in Becker's model that the income driving the

fertility in his model is in large part the income a person exchanges their working time for.

The surprise from the results of both regressions for the Economic model came through the low value of R^2. As previously mentioned in the methodology section, a number of attempts were made to increase the explanatory power of the model, as reported by R^2, through incorporation of other economic variables such as labor market attributes. Incorporating labor market variables, and even pensions from private sector institutions, yielded no added explanatory power to the models. Further, the variables used in those corrective attempts proved to be statistically insignificant in all cases.

Model 2: Strength of Social Institutions and Migration Variables

$$Y_p^s = \beta_0 + \beta_1 VOLUNTR_i + \beta_2 BIRTHPLACE_i + \beta_3 CHRONICHLTH_i + \beta_4 TERMNTDPREG_i + \beta_5 CONTRACEPTUSE_i + \beta_6 FRSTJOBAGE_i + \varepsilon$$

Observations: 2,815	R-squared: 0.1961	Adjusted R-squared: 0.1943
Variable	**Coefficient**	**Standard Error**	**P > |t|**
VOLUNTR	0.260067	.2171396	0.231
BIRTHPLACE	1.046854***	.0840646	0.000
CHRONICHLTH	-0.4964697***	.1081053	0.000
TERMNTDPREG	-1.72309***	.0932842	0.000
CONTRACEPTUSE	0.6649303***	.0811866	0.000
FRSTJOBAGE	-0.0297026***	.0072221	0.000
CONSTANT	4.603654***	.532683	0.000

$$Y_B^s = \beta_0 + \beta_1 VOLUNTR_i + \beta_2 BIRTHPLACE_i + \beta_3 CHRONICHLTH_i + \beta_4 TERMNTDPREG_i + \beta_5 CONTRACEPTUSE_i + \beta_6 FRSTJOBAGE_i + \varepsilon$$

Observations: 2,767	R-squared: 0.1134	Adjusted R-squared: 0.1115
Variable	**Coefficient**	**Standard Error**	**P > |t|**
VOLUNTR	0.289332	.2039042	0.156
BIRTHPLACE	0.9912159***	.0788295	0.000
CHRONICHLTH	-0.4303566***	.1016197	0.000
TERMNTDPREG	-0.4846572***	.0888466	0.000
CONTRACEPTUSE	0.6387218***	.0761302	0.000
FRSTJOBAGE	-0.0264875***	.0067558	0.000
CONSTANT	1.9801290***	.5015924	0.000

Results for the Strength of Social Institutions (SSI) model returned higher explanatory power than the Economic model. The same five out of six variables returned statistically significant results in both SSI models. However, it is worth noting that the explanatory power of this model decreased when the regressions switched from the number of pregnancies dependent variable to the number of births dependent variable.

Only one variable was insignificant in both models: community involvement. The results for this variable were opposite from my expectations and those anticipated after the review of Beaulieu *et al*'s work. My hypothesis for this variable was that stronger community involvement would be associated with lower fertility, since fertility was tacitly assumed in this paper to be negatively related to higher stages of economic development. However, given the relatively small proportion of volunteer activity in the survey responses, the capacity for this variable to increase the explanatory power of the model was inherently limited.

The statistically significant variables all followed the intuitive, and expected, direction based on the review of development literature and fertility studies. Persons born in rural locations were more likely than their urban counterparts to become pregnant and have children. Persons without histories of chronic health problems demonstrated a negative relationship with pregnancies and live births. Persons with no history of interrupted pregnancies had a negative relationship with pregnancy and birth. Persons not using contraception showed evidence of a positive relationship with their number of pregnancies and births. And finally, persons who began working their first job later in

life were observed to have a negative relationship with the number of pregnancies and births.

The five statistically significant variables in the preceding paragraph all embody facets of the social institutions in the country. These variables addressed the fertility impacts from, and levels of relative identity to, urban and rural communities, healthcare strength, the prevalence of available contraceptives, and the characteristic implications of the labor markets when opened to children. The results from these models comported with those of Brookins and Brookins (in terms of their order in the explanatory power of models used) and demonstrated, and validated, the continued potential for further development models incorporating the relative strength of social institutions in fertility research.

Model 3: Culture Variables

$$Y_p^c = \beta_0 + \beta_1 ETHNYELLOW_i + \beta_2 ETHNBLACK_i + \beta_3 ETHNMULATT_i + \beta_4 FATHRLITNO_i + \beta_5 FATHRLITUNKNOWN + \beta_6 MOTHRLITNO_i + \beta_7 MOTHRLITUNKNOWN + \beta_7 WIDOWED_i + \beta_8 DIVORCED_i + \beta_9 MARRIED_i + \beta_{10} CIVILMRG_i + \beta_{11} RELIGMRG_i + \beta_{12} CONSENSUALMRG_i + \beta_{13} HEADOFHH_i + \beta_{14} HHSPOUSE_i + \beta_{15} HHOTHER_i + \beta_{16} AGE_i + \beta_{17} AGE2_i + \beta_{18} TERMPREGNBR_i + \varepsilon$$

Observations: 2,788	R-squared: 0.3665	Adjusted R-squared: 0.3621
Variable	**Coefficient**	**Standard Error**	**P > |t|**
ETHNYELLOW	-1.158534	.8594242	0.178
ETHNBLACK	0.2589169	.1619137	0.110
ETHNMULATT	0.5179257***	.0777309	0.000
FATHRLITNO	0.4449425***	.0877056	0.000
FATHRLITUNKOWN	0.3675486*	.2081535	0.078
MOTHRLITNO	0.6481489***	.0849241	0.000
MOTHRLITUNKNOWN	0.6717587**	.2794388	0.016
WIDOWED	0.2243518	.3615142	0.535
DIVORCED	0.2057719	.2544821	0.419
MARRIED	0.1816713	.193531	0.348
CIVILMRG	0.1275211	.0978081	0.192
RELIGMRG	0.5107643**	.2222235	0.022
CONSENSUALMRG	0.2496848	.1859454	0.179
HEADOFHH	0.6381126	.6793996	0.348
HHSPOUSE	1.056742**	.5351426	0.048
HHOTHER	0.4847625	.6523226	0.457

AGE	0.1463579***	.0326989	0.000
AGE2	-0.0006545	.0004847	0.177
TERMPREGNBR	1.033225***	.0463146	0.000
CONSTANT	-3.880565***	1.13695	0.000

$$Y_b^c = \beta_0 + \beta_1 ETHNYELLOW_i + \beta_2 ETHNBLACK_i + \beta_3 ETHNMULATT_i + \beta_4 FATHRLITNO_i + \beta_5 FATHRLITUNKNOWN + \beta_6 MOTHRLITNO_i + \beta_7 MOTHRLITUNKNOWN + \beta_7 WIDOWED_i + \beta_8 DIVORCED_i + \beta_9 MARRIED_i + \beta_{10} CIVILMRG_i + \beta_{11} RELIGMRG_i + \beta_{12} CONSENSUALMRG_i + \beta_{13} HEADOFHH_i + \beta_{14} HHSPOUSE_i + \beta_{15} HHOTHER_i + \beta_{16} AGE_i + \beta_{17} AGE2_i + \beta_{18} TERMPREGNBR_i + \varepsilon$$

Observations: 2,703	**R-squared: 0.2582**	**Adjusted R-squared: 0.2530**
Variable	**Coefficient**	**Standard Error**	**P > |t|**
ETHNYELLOW	-1.454088	.9238354	0.116
ETHNBLACK	0.1515038	.1579563	0.338
ETHNMULATT	0.463962***	.0762628	0.000
FATHRLITNO	0.4073907***	.086093	0.000
FATHRLITUNKNOWN	0.3522736*	.2051439	0.086
MOTHRLITNO	0.6753978***	.0833046	0.000
MOTHRLITUNKNOWN	0.675029**	.2758243	0.014
WIDOWED	-0.0125504	.355725	0.972
DIVORCED	0.1839548	.2483945	0.459
MARRIED	0.1606405	.1883119	0.394
CIVILMRG	0.1275207	.0962061	0.185
RELIGMRG	0.4295786**	.2161192	0.047
CONSENSUALMRG	0.2375851	.1807234	0.189
HEADOFHH	0.3129424	.7331186	0.670
HHSPOUSE	0.525036	.5898809	0.374
HHOTHER	-0.1685606	.7092659	0.812
AGE	0.1732627***	.033163	0.000
AGE2	-0.0010747**	.0004882	0.028
TERMPREGNBR	0.2236382***	.0457544	0.000
CONSTANT	-4.954263***	1.196339	0.000

The Culture model returned the highest explanatory power, as measured by R^2, of the three models run. In both regressions, the Culture model consistently returned the same eight statistically significant independent variables. In the model for the number of births, a three additional variables became statistically significant.

There were six dummy variable categories in the cultural model: ethnicity, literacy of the father, literacy of the mother, marital status, nature of marriage, and the household status of the survey respondent. In the dummy categories, the following

parities were dropped and used as reference categories: Ethnicity = White, Father Literacy = Yes, Mother Literacy = Yes, Marital Status = Single, Nature of Marriage = Civil and Religious, and Household Status = Child. Although selecting different reference categories would change the sign and interpretation of the respective dummy coefficients, the explanatory power of the model would remain unchanged regardless of the reference category used.

Statistically significant results were observed for both Mulatto ethnic group in the birth model. Relative to the frequency of pregnancies and births in the White ethnic group, both Mulattos were observed with positive fertility signs. The nature of marriage was significant for persons identified in marriages only sanctioned by religion. In those cases, survey respondents in religious only marriages were observed to have a positive relationship with pregnancy and child numbers relative to the reference group where the marital identity was sanctioned by both religious and civil procedures.

Consistent with a number of fertility studies, the literacy of the mother and father showed a statistically significant relationship to the numbers of pregnancies and births. Survey respondents with illiterate fathers and mothers demonstrated positive relationships to the number of pregnancies and births in comparison to the pregnancy and birth rates for persons whose mothers and fathers were literate. Additionally, survey respondents who did not know the literacy of their fathers or mothers were observed to have a positive relationship to the number of pregnancies and births in comparison to survey respondents that knew their fathers or mothers were literate. As expected, a positive relationship between the age of respondents was observed with respect to their number of experienced pregnancies and births; as the survey respondents aged, the

survey respondents were observed with less births at a statistically significant level. These age results were consistent with a number of studies on fertility.

The number of interrupted pregnancies was highly significant in its relationship to pregnancy and birth rates. As the number of interrupted pregnancies within seven months of conception increased, survey respondents showed a positive relationship with increasing rates of pregnancy and childbirth. This result has a number of possible interpretations. Using conjecture, this result could imply an "if at first you don't succeed, try, try again…" relationship. Conversely, this result could imply a strong reliance on the abortion alternative. Moreover, this result could simply imply that prenatal care is lacking and that persons sometimes go through multiple attempts before successfully having a live childbirth. The significance of this variable supports a compelling case for decomposition of this variable to understand its implications more thoroughly. The number of interrupted pregnancies added explanatory power to the model, and is by consequence relevant; however, its explanatory power in this case is more appropriately used to justify the need for further refinement of this data category.

Section Five -- Summary and Conclusion

This paper began by tacitly framing a simple question: What explains more about why people have children in developing countries: rational choice modeling or socio-cultural attributes that form heterogeneous tastes and preferences for family size?

To answer this simple yet relevant research question, rational choice approaches were juxtaposed with those adopting heterogeneous socio-cultural attributes as their core precepts. In the literature review, both approaches were presented as having empirical support to bolster their respective claims for relevance. In evaluating which approach explained more about fertility in developing countries, the juxtaposing style of the Brookins and Brookins framework was loosely adopted for this work.

Similar to the Brookins and Brookins work, this research utilized household survey data from a single year to explain the variation in fertility of a developing country. The data source for this study was the representative LSMSS conducted in Brazil from 1996-1997 which contains observations from almost five thousand households. Separate OLS regressions were run to explain fertility behavior using elements of rational choice approaches, and those grounded in the use of socio-cultural attributes.

In the formal analysis of this paper, three separate models were used to account for the impact of Economic variables, proxies related to the Strength of Social Institutions, and Culture variables. Using the rational choice approach of Becker and the socio-cultural approaches of others, these three models were developed and evaluated for their intuitive and literature-based relevance to explain fertility behavior. Each model was first run using the number of pregnancies as the dependent variable, and then subsequently re-run using the number of births as the dependent variable. Using these

two dependent variables allowed for the analysis to address the effects of the independent variables on the two primary events in the story of fertility: conception and birth.

The expected results of this work were that socio-cultural attributes would matter more in the explanation of fertility than the exclusive use of rational choice models driven by income through the opportunity cost mechanism. Consistent with the conclusions reported in the Brookins and Brookins paper, expectations matched outcomes in this research insofar as the cultural model dominated the explanatory power from the strength of social institutions and, in turn, the economic models. Additionally, the results of this analysis corroborated steadfastly reliable fertility indicators such as parental education, urban versus rural identity, and the *normally* expected relationships between income and fertility postulated by Becker's model.

While ordinal consistency was maintained, the results in the explanatory power of the models used in this study were substantially lower than the explanatory power of *kindred spirit* models applied in the Brookins and Brookins paper. In part, these differences in explanatory degree are largely attributable to the differences and limitations from the respective data sets used. Moreover, the differences in relative explanatory power are likely further exacerbated by the respective data points and taxonomy used for the specified models. In particular, the comparative explanatory power of the economic models is largely explained by the level of generality embodied by the Brookins and Brookins work in comparison to the level of specificity used in this paper.

In this paper, economic variables were selected for their likelihood to approximate the driving force of Becker's optimization model: the parents' opportunity costs of

raising children. In the Brookins and Brookins paper, attributes such as household dwelling characteristics were used to approximate economic influence. While those variables surely represent a degree of economic or institutional achievement, those variables are unrelated to the elements driving the opportunity cost mechanism in Becker's work, and of those following in his footsteps.

The premise and relevance of Becker's work and rational choice approaches to explain fertility behavior were not disputed in this paper. However, the limitations of an exclusive application of Becker's framework were evidenced by the results of this study. In conclusion, this paper found evidence that socio-cultural factors matter in fertility decisions, and also provided evidence to support Becker's claim that *the microeconomic modeling approach is not an exhaustive explanation to fertility decisions* (Becker, 515).

Implications for Future Research

As presented in the literature review, a significant premium can sometimes be placed on the relationship between fertility and strictly economic variables. In particular, the development models emphasizing the rates of return to human capital investment as the driving force behind changes in fertility patterns appear to warrant further scrutiny. While this paper does not dispute the observation and postulate that higher rates of return to human capital investment are empirically accompanied by lower levels of fertility (Becker and Barro, 1988; Ahituv, 2001; Hazan and Berdugo, 2002), the results of this paper corroborate the Brookins and Brookins results and provide further evidence that the causal linkage between those two respective rates could benefit from further examination in empirical research.

References

A Reformulation of the Economic Theory of Fertility: The Quarterly Journal of Economics; By Gary S. Becker and Robert J. Barro; February 1988, Vol. CIII, Issue 1, pp.1-25

An Exploratory Analysis of Fertility Differentials in India: By Mary Laura Brookins and Oscar T. Brookins; Journal of Development Studies; December 2002, Vol. 39, No. 2, pp.54-72

Authoritarian Brazil: Origins, Policies, and Future: By Alfred Stepan; 1973; Yale New Haven Press.

Be Fruitful or Multiply: On the Interplay Between Fertility and Economic Development: By Avner Ahituv; The Journal of Population Economics; Spring 2001; 14; pp.51-71

Capital: Vol. 1 A Critical Analysis of Capitalist Production: By Karl Marx; 1984; International Publishers

Child Labour, Fertility, and Economic Growth: By Moshe Hazan and Binyamin Berdugo; The Economic Journal; October 2002, 112, pp.810-28

Development, Common Foes and Shared Values: By Mozaffar Qizilbash; Review of Political Economy, October 2002, V. 14, Iss. 4, pp.463-80

Discarding Facts: The economics of Caste: By James G. Scoville; Review of Development Economics, August 2003, V. 7, Iss. 3, pp.378-91

Economic Growth versus Economic Development: Toward a Conceptual Clarification: By Richard Brinkman; Journal of Economic Issues; December 1995, V. 29, Iss. 4, pp.1171-88

Filial Obligations and Child Labor: By Luis Felipe Lopez-Calva and Koji Miyamoto; Review of Development Economics, August 2004, V. 8, Iss. 3, pp.489-504

For Whom Does the School Bell Toll? Multi-contextual Presence of Social Capital and Student Educational Achievement: By Lionel J. Beaulieu; Journal of Socio-Economics, 2001, V. 30, Iss. 2, pp.121-7

Gender and the Silences of Social Capital: Lessons from Latin America: By Maxine Molyneux; Development and Change, April 2002, V. 33, Iss. 2, pp.167-88

Introduction to Econometrics: By Christopher Dougherty; 1992; Oxford University Press.

An Introduction to Modern Econometrics Using Stata: By Christopher F. Baum; 2006; Stata Press.

Letters to a Young Poet: By Rainer Marie Rilke; 1962; W. W. Norton & Company, Inc.

Living Standards Measurement Study Survey: Data Set: 1996-1997 household survey data; World Bank http://www.worldbank.org/lsms/guide/select.html

Living Standards Measurement Study Survey: Interviewer Manual: 1996-1997; World Bank. http://www.worldbank.org/html/prdph/lsms/country/brazil/docs/intmane.pdf

Living Standards Measurement Study Survey: Data Dictionary: 1996-1997; World Bank http://www.worldbank.org/html/prdph/lsms/country/brazil/docs/datadict.pdf

Living Standards Measurement Study Survey: Household Questionnaire: 1996-1997; World Bank http://www.worldbank.org/lsms/country/brazil/br96docs.html

Health and Wealth: A Structural Model of Social and Economic Development: By David Fielding; Review of Development Economics, October 2002, V. 6, Iss. 3, pp.393-414

Human Capital, Fertility, and Economic Growth: By Becker, Gary S.; Murphy, Kevin M.; and Robert Tamura; Journal of Political Economy; 1990, Vol. 98, No. 3, pp.212-37

Nobel Lecture: The Economic Way of Looking at Behavior: By Gary S. Becker; Journal of Political Economy, June 1993, Vol. 101, No. 3, pp.385-409

On the Economics of the Family: Reply to a Skeptic: By Gary S. Becker; American Economic Review, June 1989, V. 79, pp.514-18

Portuguese Dictionary: Harper Collins; 2000; New York, NY

Population Concentration, Urbanization, and Demographic Transition: By Yasuhiro Sato and Kazuhiro Yamamoto; Journal of Urban Economics, 2005, 58, pp.45-61

Social Norms and the Time Allocation of Women's Labor in Burkina Faso: By Michael Kevane and Bruce Wydick; Review of Development Economics, February 2001, V. 5, Iss. 1, pp.119-29

Techniques of Population Analysis: By George W. Barclay; 1963; John Wiley & Sons Inc.

The Theory of the Leisure Class: By Thorstein Veblen; 1994; Penguin Books.

Appendix

Endogoneity Tests

Table A-1

$$Y(residuals)_p^e = \beta_0 + \beta_1 PYCHKAMOUNT_i + \beta_2 ALIMONYINC_i + \beta_3 TRANSPTASSIST_i + \beta_4 HOUSNGASSIST_i + \beta_5 RCVREMITT_i + \beta_6 PRFRMHHCHRS_i + \beta_7 NMBOFPYCHKS_i + \varepsilon$$

Observations: 1,810	R-squared: 0.0000	Adjusted R-squared: -0.0039
Variable	**Coefficient**	**Standard Error**	**P > |t|**
PYCHKAMOUNT	1.92e-12	.0000686	1.000
ALIMONYINC	-7.96e-10	.3358246	1.000
TRANSPTASSIST	-3.47e-09	.1011984	1.000
HOUSNGASSIST	-1.65e-09	.2257299	1.000
RCVREMITT	6.04e-09	.1945697	1.000
PRFRMHHCHRS	-5.18e-09	.1237099	1.000
NMBOFPYCHKS	9.02e-11	.0013514	1.000
CONSTANT	2.50e-09	.9263912	1.000

Table A-2

$$Y(residuals)_B^e = \beta_0 + \beta_1 PYCHKAMOUNT_i + \beta_2 ALIMONYINC_i + \beta_3 TRANSPTASSIST_i + \beta_4 HOUSNGASSIST_i + \beta_5 RCVREMITT_i + \beta_6 PRFRMHHCHRS_i + \beta_7 NMBOFPYCHKS_i + \varepsilon$$

Observations: 1,766	R-squared: 0.0000	Adjusted R-squared: -0.0040
Variable	**Coefficient**	**Standard Error**	**P > |t|**
PYCHKAMOUNT	-7.33e-13	.0000597	1.000
ALIMONYINC	4.75e-10	.2955425	1.000
TRANSPTASSIST	-3.62e-09	.0892623	1.000
HOUSNGASSIST	-5.11e-09	.1994802	1.000
RCVREMITT	-7.15e-09	.1698342	1.000
PRFRMHHCHRS	3.06e-09	.1088809	1.000
NMBOFPYCHKS	-4.42e-11	.001188	1.000
CONSTANT	2.54e-08	.8151852	1.000

Table A-3

$$Y(residuals)_p^s = \beta_0 + \beta_1 VOLUNTR_i + \beta_2 BIRTHPLACE_i + \beta_3 CHRONICHLTH_i + \beta_4 TERMNTDPREG_i + \beta_5 CONTRACEPTUSE_i + \beta_6 FRSTJOBAGE_i + \varepsilon$$

Observations: 2,815	R-squared: 0.0000	Adjusted R-squared: -0.0021
Variable	**Coefficient**	**Standard Error**	**P > |t|**
VOLUNTR	-5.63e-09	.2171396	1.000
BIRTHPLACE	-5.56e-09	.0840646	1.000
CHRONICHLTH	8.68e-10	.1081053	1.000
TERMNTDPREG	-7.38e-09	.0932842	1.000
CONTRACEPTUSE	-9.68e-11	.0811866	1.000
FRSTJOBAGE	8.03e-11	.0072221	1.000

CONSTANT	5.49e-09	.532683	1.000

Table A-4

$$Y(residuals)_B^s = \beta_0 + \beta_1 VOLUNTR_i + \beta_2 BIRTHPLACE_i + \beta_3 CHRONICHLTH_i + \beta_4 TERMNTDPREG_i + \beta_5 CONTRACEPTUSE_i + \beta_6 FRSTJOBAGE_i + \varepsilon$$

Observations: 2,767	**R-squared: 0.0000**	**Adjusted R-squared: -0.0022**
Variable	**Coefficient**	**Standard Error**	**P > |t|**
VOLUNTR	-3.16e-09	.2039042	1.000
BIRTHPLACE	-2.05e-09	.0788295	1.000
CHRONICHLTH	-6.44e-10	.1016197	1.000
TERMNTDPREG	1.35e-09	.0888466	1.000
CONTRACEPTUSE	-2.87e-09	.0761302	1.000
FRSTJOBAGE	3.94e-10	.0067558	1.000
CONSTANT	6.26e-09	.5015924	1.000

Table A-5

$$Y(residuals)_p^c = \beta_0 + \beta_1 ETHNYELLOW_i + \beta_2 ETHNBLACK_i + \beta_3 ETHNMULATT_i + \beta_4 FATHRLITNO_i + \beta_5 FATHRLITUNKNOWN + \beta_6 MOTHRLITNO_i + \beta_7 MOTHRLITUNKNOWN + \beta_7 WIDOWED_i + \beta_8 DIVORCED_i + \beta_9 MARRIED_i + \beta_{10} CIVILMRG_i + \beta_{11} RELIGMRG_i + \beta_{12} CONSENSUALMRG_i + \beta_{13} HEADOFHH_i + \beta_{14} HHSPOUSE_i + \beta_{15} HHOTHER_i + \beta_{16} AGE_i + \beta_{17} AGE2_i + \beta_{18} TERMPREGNBR_i + \varepsilon$$

Observations: 2,788	**R-squared: 0.0000**	**Adjusted R-squared: -.0069**
Variable	**Coefficient**	**Standard Error**	**P > |t|**
ETHNYELLOW	1.18e-09	.8594242	1.000
ETHNBLACK	-1.71e-09	.1619137	1.000
ETHNMULATT	-9.06e-09	.0777309	1.000
FATHRLITNO	-1.05e-09	.0877056	1.000
FATHRLITUNKNOWN	-1.20e-09	.2085135	1.000
MOTHRLITNO	-4.28e-09	.0849241	1.000
MOTHRLITUNKNOWN	-2.25e-09	.2794388	1.000
WIDOWED	-5.66e-09	.3615142	1.000
DIVORCED	2.56e-09	.2544821	1.000
MARRIED	-3.53e-10	.193531	1.000
CIVILMRG	-1.75e-09	.0978081	1.000
RELIGMRG	4.16e-09	.2222235	1.000
CONSENSUALMRG	7.18e-10	.1859454	1.000
HEADOFHH	2.85e-08	.6793996	1.000
HHSPOUSE	2.72e-08	.5351426	1.000
HHOTHER	2.47e-08	.6523226	1.000
AGE	-3.20e-10	.0326989	1.000
AGE2	9.61e-13	.0004847	1.000
TERMPREGNBR	-1.60e-09	.0463146	1.000
CONSTANT	5.32e-09	1.13695	1.000

Table A-6

$$Y(residuals)_b^c = \beta_0 + \beta_1 ETHNYELLOW_i + \beta_2 ETHNBLACK_i + \beta_3 ETHNMULATT_i + \beta_4 FATHRLITNO_i + \beta_5 FATHRLITUNKNOWN + \beta_6 MOTHRLITNO_i + \beta_7 MOTHRLITUNKNOWN + \beta_7 WIDOWED_i + \beta_8 DIVORCED_i + \beta_9 MARRIED_i + \beta_{10} CIVILMRG_i + \beta_{11} RELIGMRG_i + \beta_{12} CONSENSUALMRG_i + \beta_{13} HEADOFHH_i + \beta_{14} HHSPOUSE_i + \beta_{15} HHOTHER_i + \beta_{16} AGE_i + \beta_{17} AGE2_i + \beta_{18} TERMPREGNBR_i + \varepsilon$$

Observations: 2,703	**R-squared: 0.0000**	**Adjusted R-squared: -.0071**
Variable	**Coefficient**	**Standard Error**	**P > |t|**
ETHNYELLOW	-8.62e-09	.9238354	1.000
ETHNBLACK	-6.81e-09	.1579563	1.000
ETHNMULATT	2.42e-11	.0762628	1.000
FATHRLITNO	-2.74e-09	.086093	1.000
FATHRLITUNKNOWN	-7.77e-10	.2051439	1.000
MOTHRLITNO	2.89e-09	.0833046	1.000
MOTHRLITUNKNOWN	1.37e-08	.2758243	1.000
WIDOWED	-1.80e-09	.355725	1.000
DIVORCED	-6.02e-09	.2483945	1.000
MARRIED	-5.32e-09	.1883119	1.000
CIVILMRG	2.85e-09	.0962061	1.000
RELIGMRG	-4.08e-09	.2161192	1.000
CONSENSUALMRG	-8.93e-09	.1807234	1.000
HEADOFHH	4.20e-09	.7331186	1.000
HHSPOUSE	1.30e-09	.5898809	1.000
HHOTHER	-2.74e-09	.7092659	1.000
AGE	-2.61e-10	.033163	1.000
AGE2	3.49e-12	.0004882	1.000
TERMPREGNBR	-3.40e-09	.0457544	1.000
CONSTANT	-3.18e-09	1.196339	1.000

Table A-7 Correlation Coefficient Matrix

Correlation:	PYCHKAMOUNT	ALIMONYINC	TRANSPTASSIST	HOUSINGASSIST	RCVREMIT	PRFRMHHCHRS	NMOFPYCHKS	VOLUNTR
PYCHKAMOUNT	1							
ALIMONYINC	0.0231	1						
TRANSPTASSIST	0.0229	-0.0488	1					
HOUSINGASSIST	0.0386	-0.0128	-0.0912	1				
RCVREMIT	-0.1154	0.0473	-0.0297	0.0358	1			
PRFRMHHCHRS	0.1410	-0.0355	-0.0112	0.0311	-0.0041	1		
NMOFPYCHKS	-0.1586	0.0087	0.0279	0.0257	0.0196	-0.1107	1	
VOLUNTR	-0.1810	-0.0221	-0.0408	-0.0251	0.0283	-0.0127	0.0601	1
BIRTHPLACE	-0.1891	0.0854	0.0846	-0.1227	0.0883	-0.1123	0.0761	0.0524
CHRONICHLTH	0.0896	0.1297	-0.0447	0.0653	0.0361	0.0301	-0.0472	0.0746
TERMNTDPREG	0.0497	0.0112	0.0395	-0.0053	0.1184	0.0215	-0.0709	0.0512
CONTRACEPTUSE	-0.0010	0.0059	0.0865	0.0298	0.1003	0.0426	0.0646	-0.0826
FRSTJOBAGE	0.1012	0.0519	0.0346	-0.0184	0.0310	0.0206	-0.0626	-0.0615
ETHNYELLOW	0.0239	0.0042	-0.0529	0.0048	0.0090	-0.0103	-0.0196	0.0083
ETHNBLACK	-0.0208	-0.0390	-0.0985	0.0298	0.0232	-0.0352	0.0002	0.0513
ETHNMULATT	-0.1455	0.0961	-0.0630	0.0282	0.0074	0.0459	0.1336	0.0433
FATHRLITNO	-0.1567	0.0373	0.0609	-0.0075	0.0185	-0.0413	0.0919	0.0508
FATHRLITUNKNOWN	-0.0300	0.0177	-0.0167	-0.0624	-0.0086	-0.0430	-0.0092	0.0347
MOTHRLITNO	-0.2025	-0.0424	0.0286	-0.0165	0.0977	-0.0918	0.0810	0.0796
MOTHRLITUNKNOWN	-0.0223	0.0142	-0.0253	-0.0860	0.0300	0.0159	0.0422	-0.0331
WIDOWED	-0.0151	-0.1611	-0.0441	0.0108	0.0201	-0.0231	-0.0439	0.0186
DIVORCED	-0.0087	-0.1335	0.0015	0.0246	-0.0689	0.0488	-0.0173	0.0015
MARRIED	0.0844	0.0914	0.1090	-0.0310	0.0271	0.0074	-0.0577	-0.0706
CIVILMRG	0.0191	0.0127	-0.0146	-0.0442	-0.0058	0.0269	0.0190	0.0191
RELIGMRG	-0.0444	0.0155	0.0402	0.0176	-0.0198	-0.0375	0.0138	0.0303
CONSENUALMRG	-0.0641	-0.1369	-0.1062	0.0452	-0.0271	0.0017	0.0614	0.0759
HEADOFHH	-0.0090	0.0113	-0.0143	0.0128	-0.1184	-0.0274	-0.0525	0.0221
HHSPOUSE	0.0130	-0.0155	0.0063	-0.0176	0.0723	0.0375	0.0430	-0.0303
HHOTHER	-0.0188	0.0085	-0.0227	0.0097	0.0180	-0.0206	0.0119	0.0167
AGE	0.1221	-0.0226	-0.003	0.0042	0.0101	0.0634	-0.1445	-0.1040
AGE2	0.1146	-0.0164	-0.0038	0.0014	0.0160	0.0595	-0.1363	-0.1013
TERMPREGNBR	-0.0622	0.0128	-0.0378	0.0234	-0.1486	-0.0398	0.0980	-0.0354

Correlation:	BIRTHPLACE	CHRONICHLTH	TERMNTDPREG	CONTRACEPTUSE	FRSTJOBAGE	ETHNYELLOW	ETHNBLACK	ETHNMULATT
BIRTHPLACE	1							
CHRONICHLTH	-0.0903	1						
TERMNTDPREG	-0.0516	0.1311	1					
CONTRACEPTUSE	-0.0211	-0.1000	-0.0533	1				
FRSTJOBAGE	-0.2110	0.0350	-0.0405	0.1080	1			
ETHNYELLOW	-0.0321	0.0164	0.0225	-0.0366	0.0141	1		
ETHNBLACK	-0.0158	0.0033	-0.0213	-0.0196	-0.0745	-0.0099	1	
ETHNMULATT	0.1074	-0.0322	-0.1506	-0.0491	-0.0301	-0.0361	-0.2231	1
FATHRLITNO	0.3411	-0.0750	0.0162	0.0339	-0.1346	-0.0265	0.0899	0.0912
FATHRLITUNKNOWN	0.0066	-0.0437	-0.0667	0.0048	-0.0890	-0.0067	0.0432	0.0859
MOTHRLITNO	0.3437	-0.0843	0.0006	0.0455	-0.1525	-0.0312	0.1611	0.1151
MOTHRLITUNKNOWN	0.0170	-0.0146	0.0184	0.0484	-0.0602	-0.0053	-0.0330	0.0257
WIDOWED	0.0381	-0.0144	0.0086	-0.0101	0.0375	-0.0036	0.0550	0.0271
DIVORCED	-0.0636	-0.1026	-0.0568	0.0425	0.0252	-0.0081	0.0548	-0.0040
MARRIED	0.0108	-0.0609	0.0475	0.0158	0.0715	0.0210	-0.1363	-0.0687
CIVILMRG	-0.0057	0.0009	-0.0698	0.0712	0.0708	-0.0193	-0.0495	0.1102
RELIGMRG	0.0665	-0.0681	-0.0751	0.0465	0.0348	-0.0058	-0.0359	0.0934
CONSENUALMRG	-0.0048	0.0418	-0.0404	-0.0344	-0.1058	-0.0249	0.1063	0.0879
HEADOFHH	0.0701	0.0002	0.0243	0.0855	0.0176	-0.0042	-0.0262	0.0260
HHSPOUSE	0.0023	-0.0276	-0.0558	-0.0465	0.0165	0.0058	0.0359	0.0191
HHCHILD	-0.0644	0.0328	0.0451	-0.0734	-0.0570	-0.0032	-0.0198	-0.0322
AGE	-0.0347	-0.2207	-0.0841	0.2511	0.1215	-0.0229	-0.0176	-0.0452
AGE2	-0.0293	-0.2240	-0.0772	0.2544	0.1261	-0.0261	-0.0176	-0.0430
TERMPREGNBR	-0.0005	-0.1353	-0.7985	0.0636	0.0750	-0.0180	0.0389	0.1211

Correlation:	FATHRLITNO	FATHRLITUNKNOWN	MOTHRLITNO	MOTHRLITUNKNOWN	WIDOWED	DIVORCED	MARRIED	CIVILMRG
FATHRLITNO	1							
FATHRLITUNKNOWN	-0.1105	1						
MOTHRLITNO	0.4488	0.0724	1					
MOTHRLITUNKNOWN	-0.0093	0.2021	-0.1042	1				
WIDOWED	-0.0204	-0.0150	0.0411	-0.0120	1			
DIVORCED	-0.0109	0.0664	-0.0076	0.0349	-0.0183	1		
MARRIED	-0.0300	-0.0313	-0.0925	-0.0476	-0.1704	-0.3872	1	
CIVILMRG	0.0155	0.0695	0.0253	-0.0337	-0.0434	-0.0986	0.2547	1
RELIGMRG	0.0253	0.0446	-0.0211	-0.0194	-0.0130	-0.0297	0.0766	-0.0704
CONSENUALMRG	0.0671	0.0275	0.1236	0.0252	0.1441	0.3275	-0.8458	-0.3012
HEADOFHH	0.0286	-0.0177	0.0111	-0.0142	0.3318	-0.0217	-0.0914	-0.0127
HHSPOUSE	-0.0010	0.0243	0.0442	0.0194	-0.2386	-0.0276	0.0592	0.0419
HHOTHER	-0.0095	-0.0134	-0.0625	-0.0107	-0.0072	-0.0163	0.0422	-0.0388
AGE	-0.0392	0.0085	-0.0119	-0.0353	0.0708	0.0915	0.1398	-0.0021
AGE2	-0.0361	0.0046	-0.0081	-0.0261	0.0704	0.0903	0.1357	-0.0033
TERMPREGNBR	0.0094	0.0945	0.0280	-0.0182	0.0422	0.0678	-0.0305	0.0258

Correlation:	RELIGMRG	CONSENUALMRG	HEADOFHH	HHSPOUSE	HHOTHER	AGE	AGE2	TERMPREGNBR
RELIGMRG	1							
CONSENUALMRG	-0.0905	1						
HEADOFHH	0.0911	0.0692	1					
HHSPOUSE	-0.0574	-0.0342	-0.7302	1				
HHOTHER	-0.0117	-0.0499	-0.0085	-0.5507	1			
AGE	0.0339	-0.1642	0.0505	-0.0544	-0.0013	1		
AGE2	0.0368	-0.1629	0.0529	-0.0541	-0.0056	0.9933	1	
TERMPREGNBR	0.0634	0.0230	0.0221	0.0139	-0.0360	0.1010	0.0960	1

Appendix A-8 – Endogeneity Tests – Covariance Matrix Output for Economic Models

Covariance	RESIDUALS PREG	RESIDUALS BIRTH
PYCHKAMOUNT	-6.50E-06	-6.90E-06
ALIMONYINC	3.70E-10	6.70E-11
TRANSPTASSIST	-1.30E-09	-4.10E-09
HOUSINGASSIST	-1.10E-09	-1.10E-09
RCVREMIT	9.80E-10	3.20E-09
PRFRMHHCHRS	-7.30E-10	-2.60E-09
NMOFPYCHKS	3.60E-07	5.50E-07

Appendix A-9 – Endogeneity Tests – Covariance Matrix Output for Strength of Social Institutions Models

Covariance:	RESIDUALS PREG	RESIDUALS BIRTH
VOLUNTR	-1.40E-10	7.80E-10
BIRTHPLACE	-2.90E-09	-3.00E-10
CHRONICHLTH	2.10E-09	6.20E-09
TERMNTDPREG	1.20E-09	-4.00E-09
CONTRACEPTUSE	9.20E-09	-1.20E-08
FRSTJOBAGE	-3.10E-08	-2.60E-08

Appendix A-10 – Endogeneity Tests – Covariance Matrix Output for Culture Models

Covariance:	RESIDUALS PREG	RESIDUALS BIRTH
ETHNYELLOW	4.40E-12	-1.00E-11
ETHNBLACK	-1.30E-10	-4.20E-10
ETHNMULATT	-3.30E-10	4.90E-11
FATHRLITNO	-7.40E-10	-5.00E-10
FATHRLITUNKNOWN	-6.50E-11	8.90E-11
MOTHRLITNO	-1.30E-09	7.60E-11
MOTHRLITUNKNOWN	-2.10E-11	2.20E-10
WIDOWED	-9.70E-11	-7.00E-11
DIVORCED	5.20E-11	-2.30E-10
MARRIED	-2.90E-10	8.90E-10
CIVILMRG	-3.60E-10	7.40E-10
RELIGMRG	7.40E-11	-1.00E-10
CONSENUALMRG	3.30E-10	-1.20E-09
HEADOFHH	1.70E-12	-6.50E-12
HHSPOUSE	1.20E-10	5.60E-11
HHOTHER	3.40E-12	-2.20E-11
AGE	-2.10E-08	-2.30E-10
AGE2	-1.40E-06	2.00E-09
TERMPREGNBR	-1.50E-09	-2.30E-09

Appendix A-11 – Demographic Transition Graphs

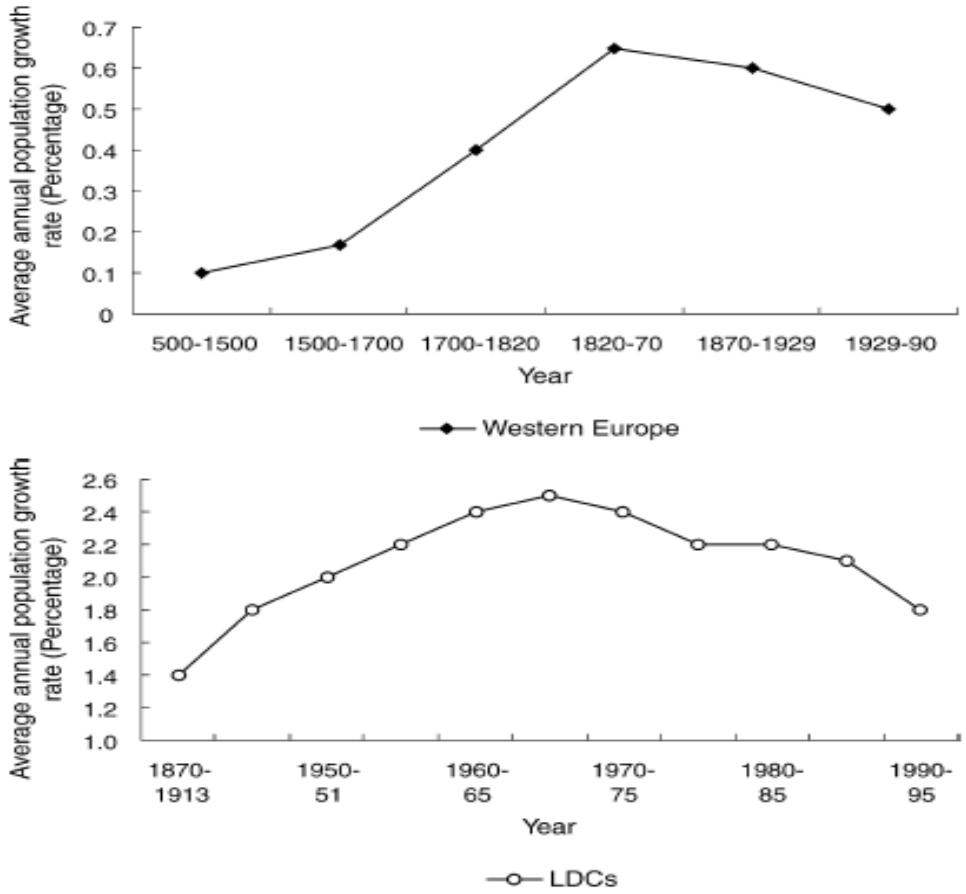

Fig. 1. Population growth rate. *Notes*: Data regarding Western Europe are from Maddison [16]. Data regarding LDCs are from United Nations [21].