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THE DETERMINANTS OF FAMILY FORMATION IN CHILE, 1960: An Econometric Study of Female Labor Force Participation, Marriage, and Fertility Decisions

Julie DaVanzo

A Report prepared for

AGENCY FOR INTERNATIONAL DEVELOPMENT

Rand
SANTA MONICA, CA. 90406

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PREFACE

The objective of this project for the AID Office of Population is to formulate, test, and integrate the components of a theory of fertility as part of a general view of the family decisionmaking process. In this study the economic and demographic framework of analysis that has guided earlier Rand population studies[1] into the determinants of fertility has been modified considerably and broadened: conceptually, to include a larger number of related areas of economic and demographic behavior, and statistically, to reflect the simultaneous interactions among related aspects of family behavior that complicate statistical inference. In this study of Chile it is possible for the first time to examine the differential income and substitution effects of wages received by men and women with regard to marriage patterns, fertility, and women's labor force participation rates. These effects are estimated for seven five-year age groups of women from cross-sectional regional data derived, in most part, from the 1960 Census of Chile.

It is tempting to infer from this and other Rand investigations into factors affecting fertility that public policy could hasten the reduction in desired and actual fertility by selective policies that accelerate change in the family's economic environment. But much improved information on and analysis of the behavior of families over time is still required to identify with confidence the specific policies needed to narrow the divergence between private and social interests in having children.

---

[1] T. Paul Schultz and Julie DaVanzo, Analysis of Demographic Change in East Pakistan: A Study of Retrospective Survey Data, R-564-AID, September 1970; A. J. Harman, Fertility and Economic Behavior of Families in the Philippines, RM-6385-AID, September 1970; Marc Nerlove and T. Paul Schultz, Love and Life Between the Censuses: A Model of Family Decision Making in Puerto Rico, 1950-1960, RM-6322-AID, September 1970; Y. Ben-Porath, Fertility in Israel, An Economist's Interpretation: Differentials and Trends, 1950-1970, RM-5981-FF, August 1970; T. Paul Schultz, Fertility Patterns and Their Determinants in the Arab Middle East (assisted by Julie DaVanzo), RM-5978-FF, May 1970; T. Paul Schultz, Population Growth and Internal Migration in Colombia, RM-5765-RC/AID, July 1969; T. Paul Schultz, A Family Planning Hypothesis: Some Empirical Evidence from Puerto Rico, RM-5405-RC-AID, December 1967.

SUMMARY

This report presents a model that details the interrelationships among female labor force participation, marital status, and fertility decisions in Chile and how these are affected by economic factors and other aspects of the environment within which these decisions are made. The model proposed here is similar (but not identical) to the one Nerlove and Schultz use for Puerto Rico, in that it is simultaneous and includes equations explaining female labor force participation, the prevalences of legal and consensual marriage, and fertility. Unique features of the model are: (1) age-specific data are used to estimate the model; (2) male and female wages, rather than proxies, are included as variables; (3) termination of (legal) marriage is considered as a marital status option; and (4) the female wage, child schooling, and child economic activity variables are considered to be endogenous to the model and equations explaining them are estimated to close the model. For each of the nine age cohorts of women considered, an 8-equation simultaneous model is estimated using two-stage least squares, a technique appropriate for estimating simultaneous and jointly determined equations (because it produces "consistent" [unbiased in the probability limit] estimators). Parameter estimates yielded by ordinary least squares (which are not "consistent") are also presented for comparison.

The data used to test the model -- information on urban and rural areas of each of the 25 Chilean provinces in 1960 -- are primarily from the 1960 Chilean Census of Population; these are supplemented by vital statistics and wage data from other sources. Since the data are stratified by age, each observation refers to a fairly homogeneous group of women. The hypotheses advanced here refer to the individual woman and her family; therefore, the characteristics of each regional age group of women are assumed to be representative of the "propensities" of individual women in that cohort.

The female labor force participation section of the model is based on the established economic literature on female labor supply, for

example, Mincer (1962) and Cain (1966). The equation that is estimated combines supply and demand elements because it is not possible to identify them separately. The basic premise is that the propensity for a woman to participate in the labor force is positively related to the wage she can earn and negatively related to the opportunity costs of labor market work (forgone non-market production) and to the adequacy of other family income. Education is hypothesized to have a direct effect on the utility a woman receives from market work compared with non-market work, in addition to its indirect influence on labor force participation through the wage. Sex-specific wage data permit one to estimate the influence of education on women's labor force participation and decompose it into the indirect effect on wages and the direct effect on the woman's predisposition toward market work. Because the data used to estimate the model refer to aggregates rather than individuals, the female wage is considered to be endogenous to the model and is estimated as a function of the labor force participation rate and educational attainment of women.

This report separates into an income and a substitution effect the influence of children on female labor force participation. The income effect arises because, for a given level of family income, the more children there are in a family, the lower is income per capita and therefore the less "adequate" the given level of family income. This income effect alone implies a positive relationship between the number of children a woman has and her propensity to participate in the labor force. This positive income effect is usually outweighed by a (more commonly noted) negative substitution effect of children on female labor force participation, although some data are presented that illustrate cases in which the positive income effect predominates. The substitution effect is negative if an additional child causes a woman to take time away from market work to devote to child care. However, it is hypothesized that under certain conditions even the substitution effect will have a positive influence on female labor force participation.

Equations explaining the prevalences of three different marital states -- legal marriage, consensual marriage, and voluntary termination of marriage (separation, annulment, and divorce) -- are

estimated. It is found that women are more likely to marry legally and less likely to terminate their marriages when women's wages are low and men's are high. Attractive economic opportunities for women have a much greater inhibiting effect on legal marriage than on consensual marriage and in fact appear to encourage consensual marriage in the 20-39 year-old age group of women. Consensual marriage does not appear to be a low income phenomenon as it is sometimes thought to be but is nearly independent of the level of male income. The form of marriage chosen is sensitive to the employment status of men; high male unemployment rates induce a shift out of legal into consensual unions.

For most of the age cohorts, over 90 percent of the variation in the percent of women whose marriages have been voluntarily terminated can be explained. In addition to its indirect positive influence through the female wage, female educational attainment exerts a very strong positive direct effect on the termination of marriage

The fertility section of the model is based primarily on the work of Paul Schultz (for example, 1969a). The main premise is that parents desire a certain number of surviving children and are influenced by economic factors in deciding on this "target." The higher the cost of a child, the fewer children parents will desire. Some of the costs of children, for example, schooling expenses, cannot be considered to be exogenous to the model for they are subject to choice. A family can choose to have a few highly educated (high cost) children or a larger number of less costly children. Because of this, the child schooling variable and its counterpart, a measure of child economic activity, are considered to be endogenous to the model, and equations explaining them are estimated.

Since child care is very time intensive, the opportunity value of time spent with a child represents a very significant part of the cost of a child. The value of time spent with a child is measured here by the value of that time in the labor market -- that is, the market wage. However, the negative substitution effect of the wage on the number of children parents desire will be countered by a positive income effect,

for an increase in wage income enables parents to "consume" larger quantities of all normal goods, including children. Since the wife is usually in charge of child care, the negative substitution effect of her wage is hypothesized to outweigh the positive income effect, but the opposite is expected to be true for her husband's wage. The data usually support both of these hypotheses.

Parents are expected to compensate for expected and actual deaths among their offspring in planning the number of births they believe necessary to enable them to have a surviving family of desired size. The statistically significant positive relationship between the number of children ever born per woman and the infant mortality rate in an area lends support to this hypothesis.

The last section of this study deals with the policy implications of this research and includes suggestions for further research. Increased provision of educational services for women will help to slow population growth by inducing women to postpone or reject marriage and to desire fewer children. Because female education exerts a considerable influence, usually indirectly through the female wage, on the types of behavior studied here, a primary goal of further research should be to investigate what factors affect the amount of education a person receives. The child schooling equations presented here are an attempt at this, but they do not consider the influence of policy instruments on the supply of educational services or of the expected returns from education on the demand side. Once these factors are built into the child schooling equations, which can then, with the appropriate lag, be linked to the adult education measures that appear in the model presented here, simulation can be used to investigate the long-run effect of alternative education policies.

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I. INTRODUCTION

The determinants of and interrelationships among female labor force participation, marriage, and fertility decisions in Chile are analyzed in this report to test and possibly improve existing theories of family decisionmaking and to better understand the nature of family economic and demographic behavior in Chile. The female wage, child schooling, and child economic activity variables are also considered to be endogenous to the model, and equations explaining them are estimated to close the model. The goal of further work along these lines is to improve our ability to predict and possibly influence population growth and composition. Such information should be valuable to the economic planner.

Section II discusses the diversity of Chilean demographic patterns and trends. Section III reviews some of the literature concerning female labor force participation, marriage, and fertility and presents the hypotheses that are tested empirically. Some Chilean evidence supporting these hypotheses is discussed; several comparisons are made with United States and Puerto Rican data in Appendix A. Section IV estimates and discusses an 8-equation model testing the hypotheses set forth in Section III. Section V deals with the policy relevance of this research and suggests directions for further research.

II. DEMOGRAPHIC TRENDS IN CHILE

With an annual natural rate of population increase of 2.9 percent for the period 1963-1967, Latin America is currently growing more rapidly than any other major region of the world ever has. In this same period world population as a whole grew at a rate of 1.9 percent per year.[1] The population of Chile has been growing more slowly than that of the rest of Latin America, increasing at an annual rate of 2.2 percent in this same period. In the last couple of years the Chilean rate of population growth has fallen below 2.0 percent (see Fig. 1)

TRENDS IN VITAL RATES

International migration has been so small as to have a negligible effect on Chilean population growth in this century. Therefore, only the trends in birth rates and death rates are needed to analyze past rates of population growth and to predict future ones. The trends in Chilean vital rates in the period 1920-1969 are shown in Fig. 1. Chile is currently in the later stages of demographic transition. Death rates have been falling since the turn of the century. The crude birth rate, which had remained fairly constant at a level around 35 per thousand population since the late 1930s began to fall in the decade of the 1960s and was 27.3 in 1969.[2]

---

[1] These figures are United Nations estimates presented in U.S. Department of Commerce (1969), p. 1.

[2] For Fig. 1 data through 1966 (except for the 1966 crude marriage rate) are from the Chilean Demographic Yearbooks (Demografía). Figures for crude birth rates, crude death rates, infant mortality rates, and neo-natal mortality rates for the years 1960 through 1968 or 1969 were also available (in published and unpublished form) from the Servicio Nacional de Salud. These two series were not coincident for the mutual 1960-1966 period. To form a consistent series for each vital rate, the Servicio rates for the later years (1967, 1968, and 1969) have been adjusted by multiplying them by an adjustment factor defined as the average of the ratios of the Demografía to Servicio figures for 1960-1966 for the vital rate under consideration. (The adjustment factors were .9681, 1.0018, 1.0325, and 1.0184 for the crude birth rate, the crude death rate, the infant mortality rate, and the neo-natal mortality rate respectively.) The crude marriage rates for 1966 and 1967 are from the 1969 United Nations Demographic Yearbook. Data on the 1968 crude marriage rate and the 1969 infant mortality, neo-natal mortality, and crude marriage rates were not available; these rates are not plotted in Fig. 1.

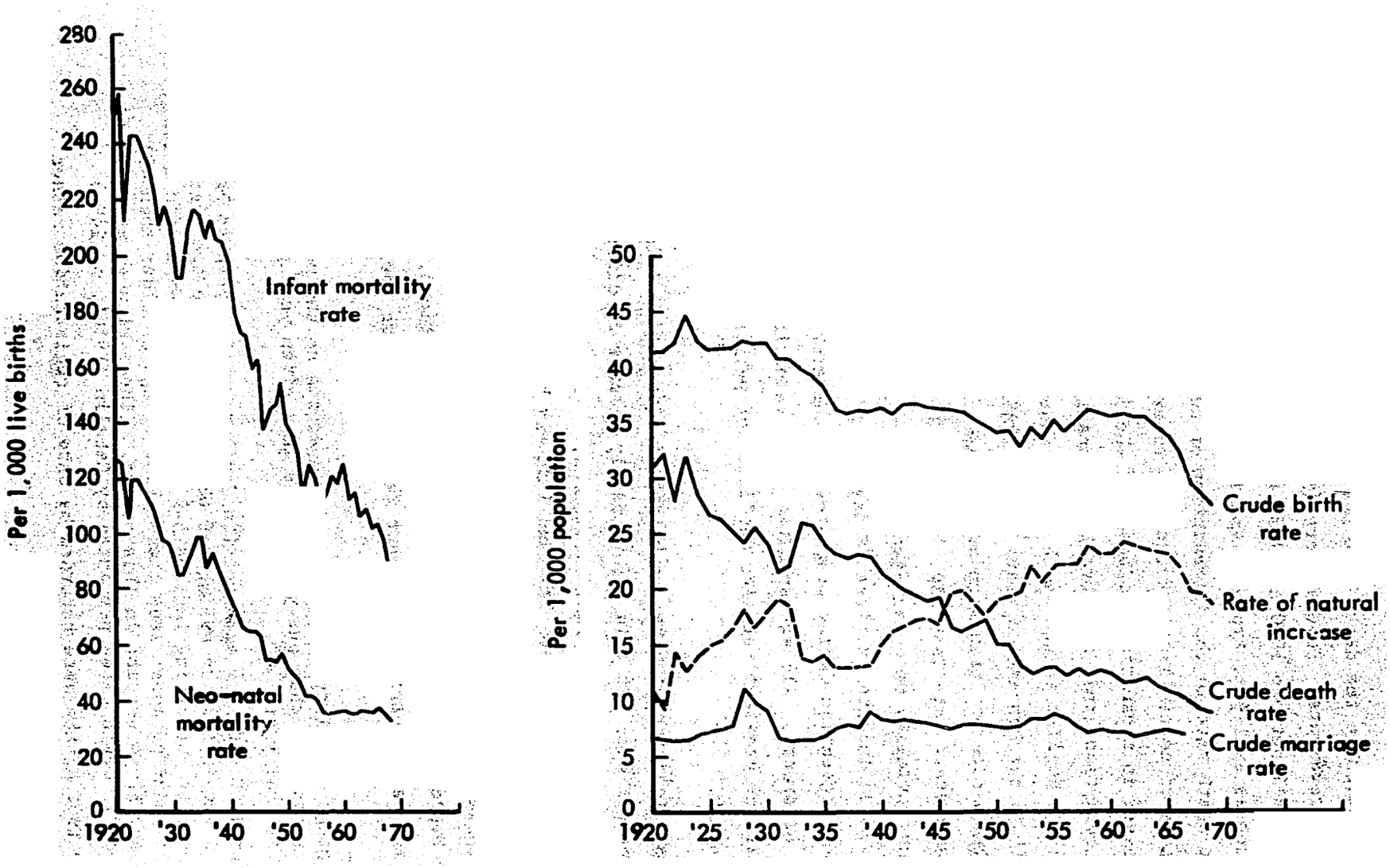


Fig. 1 — Chilean vital rates, 1920 - 1969

Sources: Republica de Chile, Demografia, Año 1953 and Año 1966, Dirección de Estadística y Censos, Santiago, 1955 and 1968.

United Nations Department of Economic and Social Affairs, United Nations Demographic Yearbook, 1969, United Nations, New York, 1970.

Republica de Chile, Defunciones y Causas de Muerte, Anuario 1968, Servicio Nacional de Salud, Santiago (date of publication not given).

Unpublished data from the Sub-Departamento de Estadística, Servicio Nacional de Salud, Santiago.

The reduction in the death rate has been attributed to health and sanitation improvements. Some authors (for example, Cabello, 1956) have ascribed the fall between 1920 and 1931 to the control of infectious diseases such as smallpox, typhoid, and influenza, and the 1939-1953 drop in the death rate to the introduction of new antibiotic drugs and better methods of controlling and treating tuberculosis. However, incomes increased in these time periods, and the improvements in nutrition and living conditions that undoubtedly accompanied them, probably contributed to the decline in the death rate. (Notice that the death rate did not fall in the Depression years of the 1930s.) The infant mortality rate (the death rate of infants under one year of age) has fallen along with the crude death rate (see Fig. 1).[1] Until recently the decrease in the infant mortality rate had been primarily in its neo-natal component (deaths of infants in first 28 days after birth), which reflected better medical attention during pregnancy, at the time of birth, and immediately afterward. All age-specific death rates have fallen in this century, with the greatest relative declines for persons between the ages of 1 and 49.[2]

Official statistics indicate substantial fluctuation in birth rates in some periods, but this may be partly because of differences in the method of collecting vital statistics.[3] The rather dramatic drop in the birth rate between 1930 and 1936 may have been an adjustment to the fall in the death rate in the previous decade (see Section III on the influence of mortality on fertility behavior) or perhaps a response to Depression changes in socio-economic conditions. Birth rates fell in most countries throughout the world during these years.

---

[1]The infant mortality rate is usually measured as the number of deaths of infants less than one year of age in a given year per 1,000 live births in that year.

[2]Between 1920 and 1952 age-specific death rates for persons between the ages of 1 and 49 fell an average of 68.5 percent, with the greatest drop (79.8 percent) occurring for the 5-9 age group. Age-specific death rates for all other persons (less than 1 year of age or older than 49) fell an average of 44 percent in this period. (These figures are derived from age-specific death rates presented by Cabello (1956), p. 249.)

[3]Before 1952 births were recorded by date of registration rather than by the year of occurrence.

As mentioned above, the birth rate began to fall again in the 1960s; this decrease is sometimes attributed to increasing interest in family planning (U.S. Department of Commerce, 1969). If present, this greater concern with controlling family size indicates either that the number of living children parents desire is decreasing or that the costs they associate with exceeding their desired family-size goal have increased or those associated with falling short of the goal have decreased. The factors influencing desired family size will be discussed in Section III.

The percent of registered illegitimate births has decreased markedly in this century. In 1960 15.9 percent of all births were illegitimate as compared with 39.1 percent in 1917. This reduction in illegitimacy has been mainly due to increases in the portion of the population that is legally married. The crude marriage rate (marriages per 1,000 population) increased during the 1920s, but then dropped during the Depression years 1931-1934 (see Fig. 1).[1] The marriage rate began to rise again when economic conditions improved, as did the marriage rates of most countries during this post-Depression period (Carter and Glick, 1970, pp. 16-17).[2]

---

[1]The sudden rise in the marriage rate in the years 1928-1930 has been attributed to a "civil registration campaign which advocated the legal constitution of the family" (Cabello, 1956, p. 243).

[2]We observe this positive income effect on the "demand for (legal) marriage" because marriage is a "good" whose costs are more easily afforded and whose benefits, legal recognition of wife and children, are likely to be of greater importance the higher the level of income.

Some authors (for example, Cabello, 1956) have attributed the rise in the marriage rate at the end of the 1930s to the introduction of family allowances in 1937. These allowances provided wage benefits for the wives and children of certain workers if the married couple and their children were entered in the Civil Register. Marriage rates jumped again in 1953 (and the years immediately following) when family allowances were extended to all workers. These family allowances are by no means negligible; in 1959 the monthly family allowance was 9,449 pesos per dependent, and the monthly "living wage" was between 32,150 and 65,890 pesos (Bohan and Pomeranz, 1960, pp. 24-26).

CROSS-SECTIONAL VARIATION IN VITAL RATES AND RELATED VARIABLES

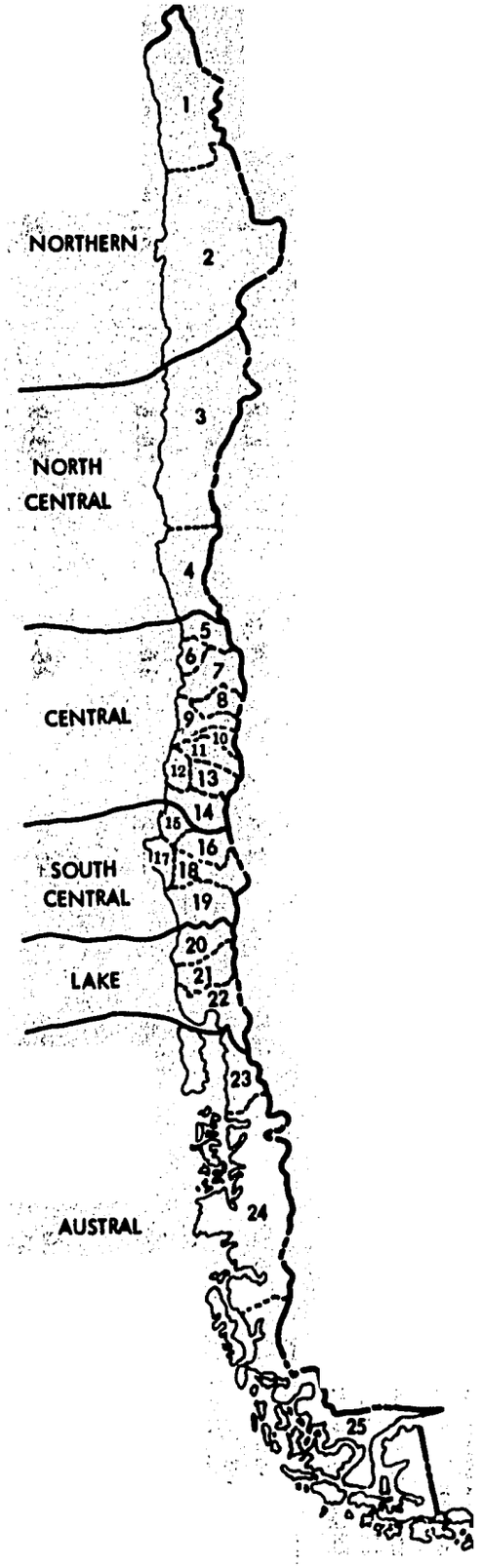
Chile occupies the southern half of the west coast of South America. Because of its unusual ribbon-like shape, a length of 2600 miles and average width of only 110 miles, the country experiences a wide range of climates and natural resource endowments that influence the economic lives of the Chilean people.[1] The most common geographic classification of Chile divides the country into six regions: (1) Northern Chile (Tarapacá and Antofagasta Provinces); (2) North Central Chile (Atacama and Coquimbo); (3) Central Chile (Aconagua, Valparaiso, Santiago, O'Higgins, Colchaqua, Curicó, Talca, Maule, Linares, and Ñuble); (4) South Central Chile (Concepción, Arauco, Bío-Bío, Malleco, and Cautin); (5) the Lake Region (Valdivia, Osorno, and Llanquihue); and (6) the Austral or Canal Region (Chiloé, Aisen, and Magallanes). A map of Chile showing the location of these provinces and regions is presented in Fig. 2. Table 1 gives the values of vital rates and related demographic and economic variables for these regions.

Northern Chile is desert and is almost entirely dependent on mining (nitrate, copper, sulfur, and iodine) for its livelihood. Southward, temperatures become cooler and average precipitation increases, except in southeastern Magallanes on the eastern side of the Andean cordillera, where rainfall is considerably less than on the archipelago. Agriculture becomes increasingly more important from north to south, taking the form of cattle and sheep raising in the southernmost areas.

The population is concentrated in the middle of the country, mainly in the industrial region of Central Chile which is the most rapidly growing area in the Republic because of very fertile soils and the attractions of urban life, greater educational opportunities, and a comfortable climate. Migration to the Central region has been

---

[1] The extreme nature of the climatic differences is illustrated by the fact that Chile contains the driest region in the world, the Atacama Desert, where rain has never fallen, as well as the place which holds the world's record for the most rainy days (348) in a year, Bahia Felix in 1916. (McWhirter and McWhirter, 1968, p. 94.)



PROVINCES

1. Tarapaca
2. Antofagasta
3. Atacama
4. Coquimbo
5. Aconcagua
6. Valparaiso
7. Santiago
8. O'Higgins
9. Colchagua
10. Curico
11. Talca
12. Maule
13. Linares
14. Nuble
15. Concepcion
16. Bio-Bio
17. Arauco
18. Malleco
19. Cautin
20. Valdivia
21. Osorno
22. Llanquihue
23. Chiloe
24. Aysen
25. Magallanes

0 200 400
Scale (mi)

Fig.2 — Map of Chile

Table 1

CROSS-SECTIONAL VARIATION IN DEMOGRAPHIC AND ECONOMIC VARIABLE

	Northern Region[a]	North Central Region[b]	Central Region[c]	South Central Region[d]	Lake Region[e]	Austral Region[f]	Whole Country
Crude birth rate	34.7	40.1	34.9	35.5	35.9	31.1	35.2
Crude death rate	11.8	12.5	11.9	15.4	15.9	11.9	12.8
Infant mortality rate (1958)	120.5	138.9	112.2	146.0	155.6	137.1	123.4
Percent of births illegitimate	22.1	30.4	14.9	13.9	13.4	17.7	15.9
Children ever born per women 12 or older	2.21	2.46	2.03	2.29	2.42	2.14	2.14
Percent of women 12+ currently legally married	46.8	39.5	44.5	43.0	44.0	45.7	44.1
Percent of women 12+ consensually married	5.5	5.0	2.4	3.7	4.0	2.1	3.0
Labor force participation rate of women 12+	16.5	16.0	23.5	16.4	16.6	21.0	20.9
Percent of women 25+ who finished primary school	60.0	19.8	45.2	28.2	23.9	22.4	39.9
Percent of women 25+ who attended vocational school or completed secondary school	9.5	5.4	8.5	4.5	3.5	3.3	7.2

Table 1 (continued)

	Northern Region[a]	North Central Region[b]	Central Region[c]	South Central Region[d]	Lake Region[e]	Austral Region[f]	Whole Country
Female employment opportunities index[g]	82.2	76.4	116.6	91.1	86.9	83.2	100.0
Percent of children 10 yrs. old attending school	92.9	87.3	90.1	83.7	84.7	91.1	88.6
Percent of children 12-14 economically active	4.5	7.5	7.1	7.7	9.0	6.9	7.2
Percent of population employed in agriculture	3.0	13.0	9.8	17.0	21.5	21.5	11.8
Percent of popula- that is urban	94.1	62.7	80.2	61.0	49.4	50.0	73.4
Percent of area	24.1	16.2	12.5	7.3	6.5	33.4	100.
Percent of population (1958)	4.8	5.8	58.6	19.3	8.4	3.1	100.
Population density per square mile (1958)	5.2	9.2	120.5	68.0	33.0	2.4	25.8

[a]Tarapaca and Antofagasta

[b]Atacama and Coquimbo.

[c]Aconagua, Valparaiso, Santiago, O'Higgins, Colchaqua, Curicó, Talca, Maule, Linares, and Ñuble.

[d]Concepción, Arauco, Bío-Bío, Malleco, and Cautin.

[e]Valdivia, Osorno, and Llanquihue.

[f]Chiloé, Aisen, and Magallanes.

[g]See Table 3 for definition.

Source: Derived from Census data and data in U.S. Department of Commerce (1960), Chapter IV.

mainly from the South Central rural areas. Migration from the North has fluctuated with the fortunes of the mining industry.

Birth rates and fertility rates are lower in areas subject to considerable foreign influence, for example, Santiago, Valparaiso, and Magallanes provinces, and in areas where women are likely to work in the labor force. The data in Table 1 illustrate some of the relationships between demographic and economic variables but are presented mainly to point out differences among the major regions of Chile. The precise nature and direction of these relationships will be analyzed in the remaining sections of this report.

Death rates are higher in the areas below Santiago than in the rest of the country because of humidity, high temperatures, and congested living conditions, which are conducive to the spread of disease. Mortality rates are also high in the South Central and Lake regions because low winter temperatures and heavy precipitation contribute to the incidence of tuberculosis (Butland, 1953).

III. THE DETERMINANTS OF AND RELATIONSHIPS AMONG FEMALE LABOR FORCE PARTICIPATION, MARITAL STATUS, AND FERTILITY DECISIONS IN CHILE

INTRODUCTION

In this section I discuss the determinants of and relationships among female labor force participation, marital status, and fertility decisions, and how these affect and are affected by a woman's wage rate, her education, the size and earnings of her family, and other features of the environment in which these decisions are made [1].

The wage a woman can earn in the labor force represents the value of her time in labor force activities and therefore the opportunity cost of time spent in other ways (for example, housework or child care). In addition to this substitution effect her wage will have an income effect as well, for it influences her command over market goods and her ability to be self-sufficient.

A woman's education will affect the wage she can earn in the labor market. It may also influence her attitudes concerning labor market work, different forms of marriage, or birth control practice. Continued schooling can be an alternative to labor force participati..., marriage, or childbearing for a woman.

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[1] The model proposed here is not a formal theoretical economic model. That is, I do not specify an objective function, maximize it subject to constraints, and then use the first order conditions to derive estimable equations. The basic economic model underlying all of the hypotheses proposed below is that an individual or family maximizes its utility subject to a budget constraint (determined by the prices of goods and of time and by non-employment income). Hypotheses about the relationships among the demographic and economic phenomena considered here usually (implicitly) assume tastes (preferences) are being held constant. But tastes vary, and unfortunately they are not held constant in the empirical model below because it is very difficult to do so (we cannot really measure or observe "tastes"). The omission of tastes as a variable in the empirical model will bias some of the estimated parameters if tastes (for example, for children relative to other goods or for labor market work relative to home activities) vary across the samples considered here and are systematically related to the dependent or independent variables. In some equations, an explanatory variables, for example, educational attainment, is included as a proxy for tastes.

A woman is productive in the home as well as in the labor market. Her productivity at home is likely to be positively related to the size of her family. A woman who has many children will have a higher value of time spent at home than a childless woman. The value of time spent at home represents the opportunity cost of participating in the labor force. A woman will tend to allocate her time between market and non-market uses so that at the margin the value of time spent in the market (which is the opportunity cost of time spent at home) equals the value of time in non-market production at home.[1] If family members vary in their relative productivities in market and non-market activities, they will tend to specialize along the lines of comparative advantage (and then trade). For example, if the husband is relatively more productive in the market than at home compared with his wife, he will specialize in market production and she in non-market production.[2]

The adequacy of the earnings of other family members, which will depend on the magnitude of those earnings and the number of family members among whom they must be divided, will influence the likelihood that a woman will work. The less adequate the income of a woman's husband, the more likely it is that she or her children will work to supplement family income. Other things being the same, an unmarried woman will be more likely to work than a married woman because of lack of other means of support.

Increases in income will enable a person or family to consume larger quantities of normal goods, provided that the increases in

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[1]There may be some inequalities if the equilibrium is a corner solution. For example, even if a woman spends all her time in non-market production, the value of her marginal product could still be greater there than the wage she could earn in the market; if this is the case, she will not participate in the labor force.

[2]This does not mean that they will devote all their time to the activities in which they "specialize" but merely that they will devote more time to these activities than they would if they were acting in isolation, that is, in the absence of trade. Therefore, even if a woman "specializes" in non-market production she may still devote some time to the labor market, but less over her lifetime than she would in isolation.

income do not increase the prices of these goods.[1] For example, if legal marriage is a normal good we expect more people to marry when income is high. If children are a normal good, we expect increases in the types of income that do not have much effect on the cost or "price" of a child (property income or husband's income) to increase the number of children parents desire.

In this section I will look at how a woman chooses to allocate her time between market and non-market uses over her lifetime and how these decisions affect and are affected by the nature and size of her family and the behavior of its members. I will be mainly concerned with female labor force participation, marital status, and fertility decisions. Labor force participation represents market use of time. A woman's marital status will determine the type of family (if any) within which she decides how to allocate her time and will also affect the total amount of non-market work done by the family. Five different states are distinguished here: legal marriage, consensual marriage, termination of marriage (separation, annulment, or divorce), widowhood, and remaining single. Fertility decisions will also affect the amount of non-market work done and will influence the size of the household in which family decisions are made.

FEMALE LABOR FORCE PARTICIPATION AND WAGES

At any moment of time, the observed female labor force participation rate (the percent of women who are working or actively seeking work) is the result of the interaction of supply and demand relations. I will deal primarily with supply factors since my main interest is how other aspects of female behavior (especially marriage, fertility, and educational attainment) are related to and determined by a woman's propensity to work in the labor force.

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[1] The "full price" of commodities consumed by a household is made up of a goods component and a time component (Becker, 1965). Increases in types of income that also increase the value of time (for example, wages) will increase the full prices of commodities, especially those with a large time component.

A woman is most likely to be a member of the labor force if the opportunities for work (in terms of both availability of work and remuneration for it) are good, if the opportunity costs of working are low, and if it is necessary for her to supplement family income. A woman is more likely to be a member of the labor force the higher the wage she can earn; that is, the supply of female labor services is upward sloping. A high level of educational attainment will increase the wage she can earn since she will be capable of holding a more skilled job.[1] In addition to increasing her wage, a higher level of educational attainment may exert independent influences, such as increasing the woman's desire to work (the utility she receives from labor force relative to home activities) or her appreciation of the value of personal care for her children.

A woman is less likely to be a member of the labor force the greater the opportunity costs of her participating. Her opportunity costs of work in the labor force will be forgone household production. The costs will be high when she has many responsibilities at home, such as housework and caring for children. A married woman is more likely to have such responsibilities than a single woman, although in Chile the number of single women who have children is not negligible (see Fig. A-4).

The necessity for a woman to work to supplement family income is an inverse function of the per capita income of other family members. Mincer (1962), Cain (1966), and Sweet (1970) all find a negative relationship for the United States between the labor force participation rates of married women and their husband's wage, when wife's wage is held constant.

For a given level of family income the presence of children increases family consumption requirements and lowers income per

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[1] Thus, the wage she can earn is, to some extent, a matter of (past) choice. For this reason, and also because aggregate data are used to estimate the model (female labor force participation rates may affect the wages of women), the female wage is considered to be endogenous to the model. As a dependent variable it is estimated as a function of the female labor force participation rate, female educational attainment, and an urban dummy (see below, p. 57).

family member; thus, the need for the woman to work to supplement family income is increased.[1] However, at the same time, this additional responsibility at home (caring for children) raises her opportunity cost of participating in the labor force. Therefore, the net effect of children on female labor force participation is ambiguous.

The first effect of children, the income effect, will be more important the greater the increase in family consumption requirements relative to the total income of other family members. For a given level of other family income the total magnitude of this income effect will be positively related to the number of family members and probably to their ages, since older children are likely to consume more than younger ones. Marginal consumption requirements probably decrease with the number of children since many of the items the older children use can be passed down to younger children. Many persons have observed these economies of scale to family size. For a given number of children the overall importance of this income effect will be negatively related to the adequacy of other family income, and it should therefore have a greater influence for women who are not currently married.

The magnitude of the second effect of children, substitution away from labor force activities because of an increase in the opportunity

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[1] I do not mean to imply that families are worse off, in a welfare sense, with more children than with less. If children are "wanted," the parents' real income (welfare) will increase when they have an additional child, but more of their money income will be devoted to children and less to other goods. If we could hold constant for the money income of other family members and tastes for children relative to other goods, the "necessity" for a woman to work to supplement family income will be positively related to the number of members in her family. This relationship will be weakened to the extent that number of children and tastes for children relative to other goods are positively related. We will see below that the only cases in which the income effect of children on female labor force participation dominates the substitution effect are for women who are not currently married. There are two possible explanations for this: (1) the "other family income" of these women is likely to be considerably lower than that of women who are currently married, and (2) there is a greater probability that their children are not "wanted" (either they were not originally or are not now in view of the woman's current marital status).

costs of labor market work (due to greater responsibilities at home) is probably also positively related to the number of children a woman has, but it will be a negative function of their ages. Very young children require nearly constant supervision and care; children over twelve years of age need very little. Sweet (1970) observes a positive relationship for the United States between the percentage of married women who are employed and the age of their youngest child.[1] When we hold constant the age of the youngest child, the marginal time cost of caring for children will be a decreasing function of the number of children (ranked by age, youngest child first) and could become negative if older children are able to help care for younger ones.[2] Thus the total amount of time a woman must spend with her children, and therefore the importance of the substitution effect, will at first be positively related to the number of children she has but may begin to decrease beyond a certain number of children. However, if we are unable to control for the age of the youngest child we are likely always to observe a positive relationship for women of the same age between the magnitude of this substitution effect and the number of children, because women with a greater number of children are more likely to have younger children.

In sum, when the number of children in a family is held constant, the importance of the substitution effect of children on the likelihood

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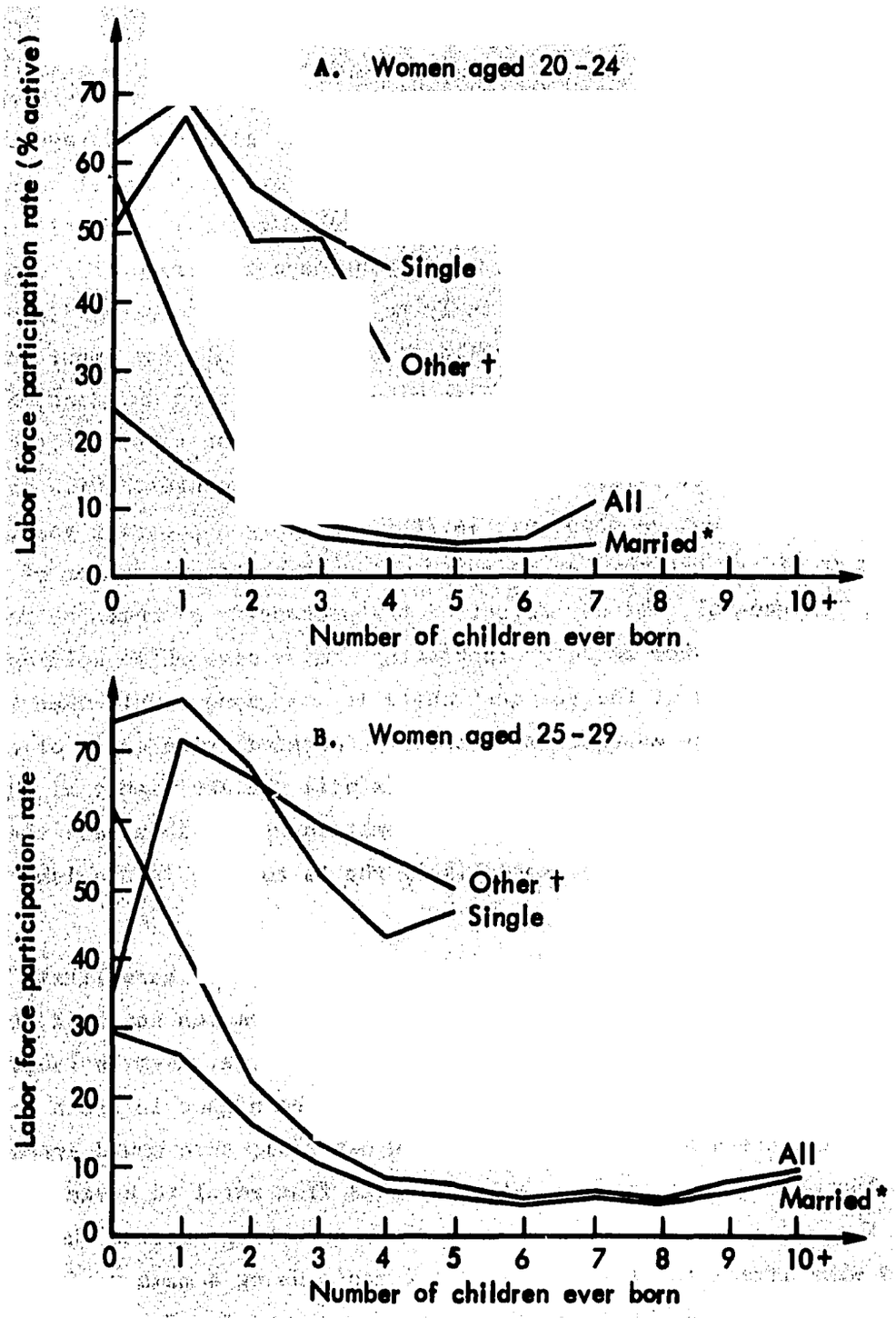
[1] Sweet observes this positive relationship regardless of whether he holds constant the number of children. When the number of children is not held constant, the greatest jump in the labor force participation rates of mothers by the age of their youngest child occurs between the child ages of zero and one. There is then a linear increase of approximately two percentage points per child year of age until age twelve, beyond which there is practically no effect of increasing the age of the youngest child (Sweet, 1970, p. 197).

[2] In other words, there are economies of scale associated with the time inputs to child care as well as with the goods inputs. Alternative child care arrangements, for example, grandmothers or paid baby sitters, will also reduce the mother's child care responsibilities (in the case of paid baby sitters by substituting pecuniary costs for time costs). Sweet (1970) finds the presence of "other related adults" in a household to increase the probability that the mother is working. There will be an income effect here also if the family must support the "other related adult."

that the mother will work in the labor force will be negatively related to the age of her youngest child (and probably also the average age of her children); the total influence of the income effect will be positively related to the average age of her children (who are still at home). These two effects are reinforcing, and therefore, for a given family size, a woman is more likely to work the older her children. When the age of the youngest child is held constant, the importance of the income effect will increase with the number of children, but the relationship between the total magnitude of the substitution effect and the number of children, when the age of the youngest child is held constant, may not be monotonic -- it is probably a positive relationship at first, but may become inverse beyond a certain number of children. In general, the net effect on the propensity of women to participate in the labor force of increasing family size while holding constant the age of the youngest child is ambiguous. Only when a woman has a large enough family that the marginal time costs of caring for older children have become negative will the net result of the income and substitution effects be unambiguous: In this case the more children a woman has, the more likely she is to work in the labor force.

For a given supply of labor services a woman is more likely to be working if there are many jobs available that females can hold, that is, when demand for female labor services is large. Female labor force participation rates and wages tend to be higher in urban areas because there are more jobs that women can fill; this would appear to be the main reason why many women migrate from rural to urban areas in Chile. Regional attitudes toward women working outside the home may also affect the likelihood of a woman's being a member of the labor force since these may influence the demand for female labor services and perhaps the woman's "taste" for labor market work relative to home activities.

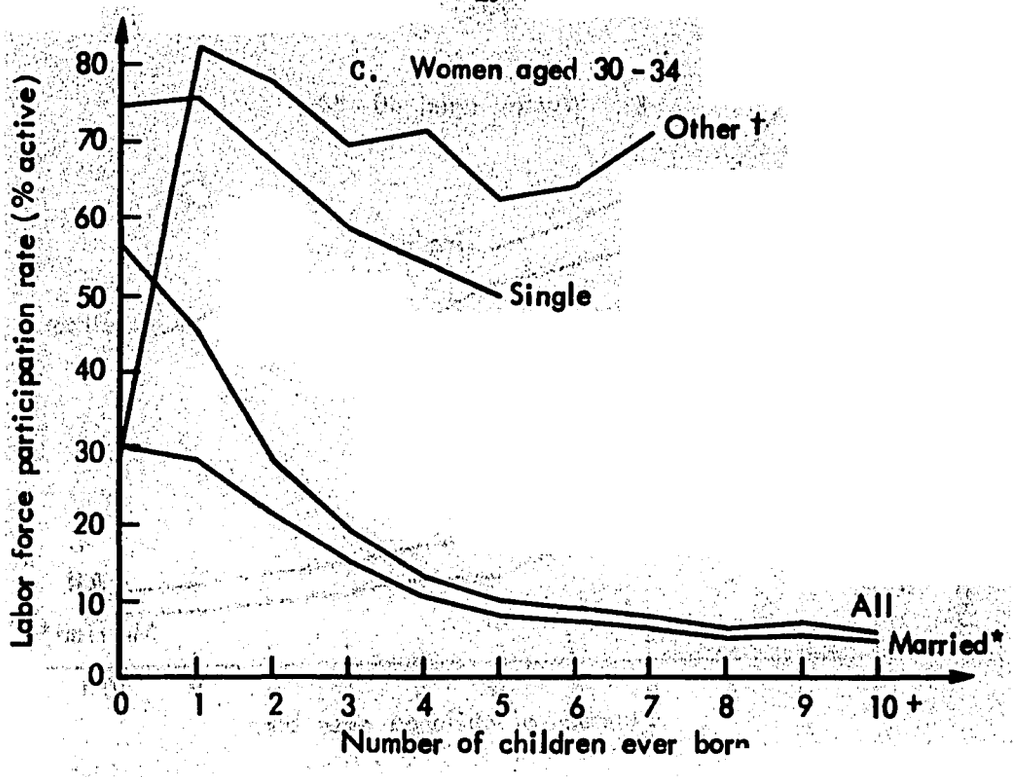
Figs. 3 A-H illustrate how number of children ever born is associated with the labor force participation rates of women of various

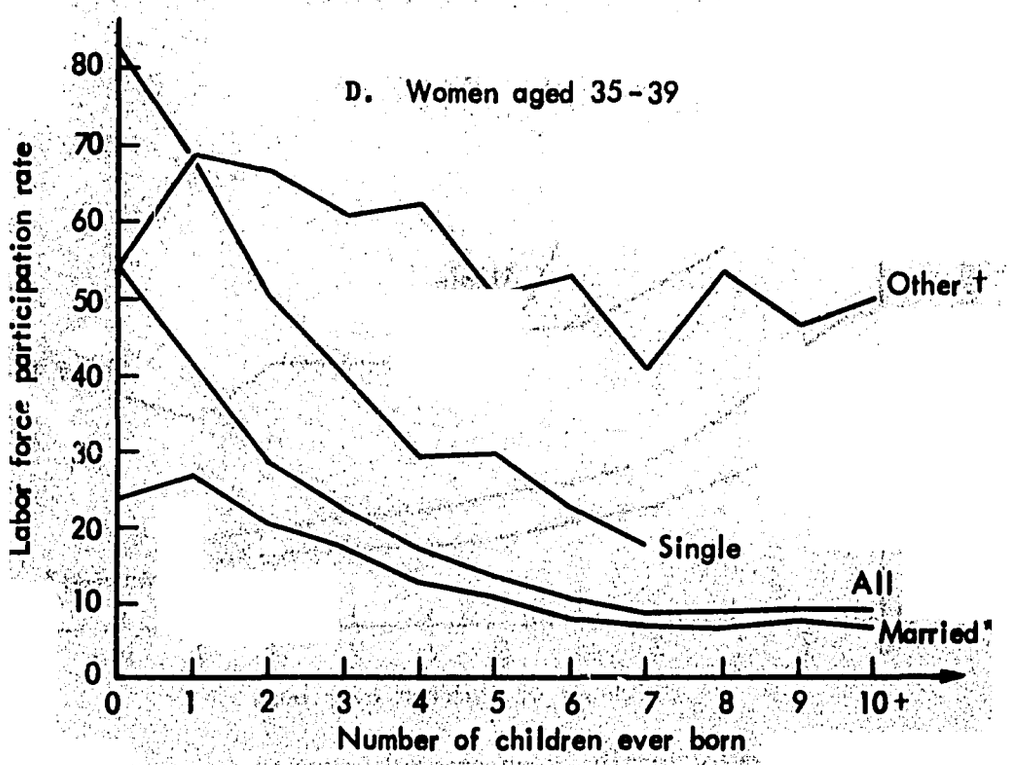


*Currently legally or consensually married
† Widowed, separated, divorced, or marriage annulled

Note: Rates not plotted if sample size less than 50

Fig. 3A & 3B—Age-specific female labor force participation rates by marital status and number of children ever born for Santiago Province, 1960

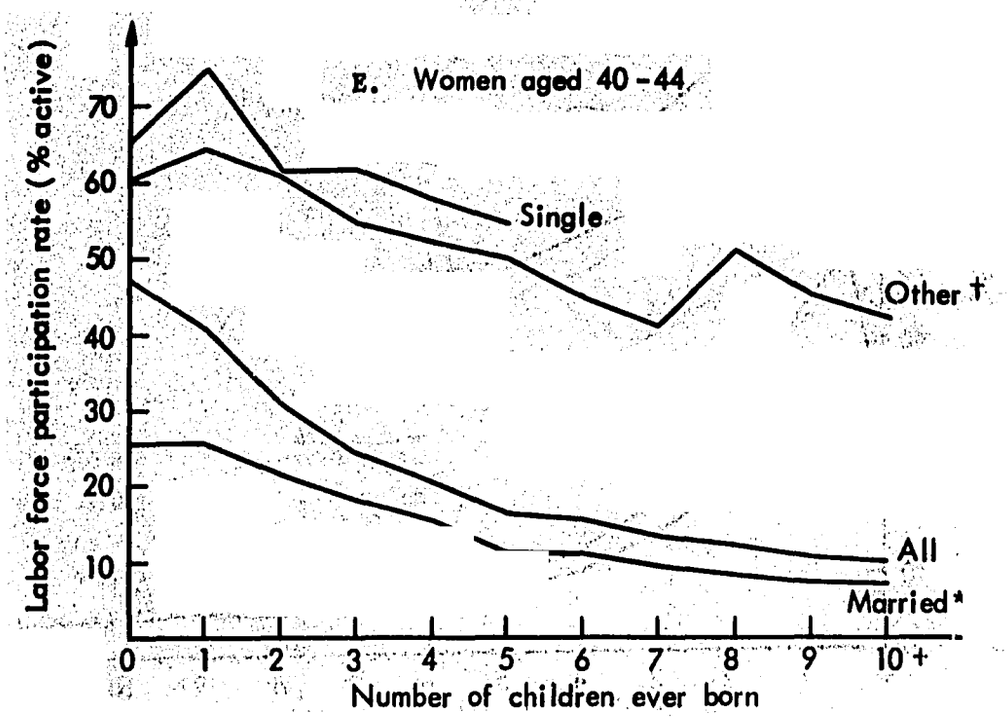


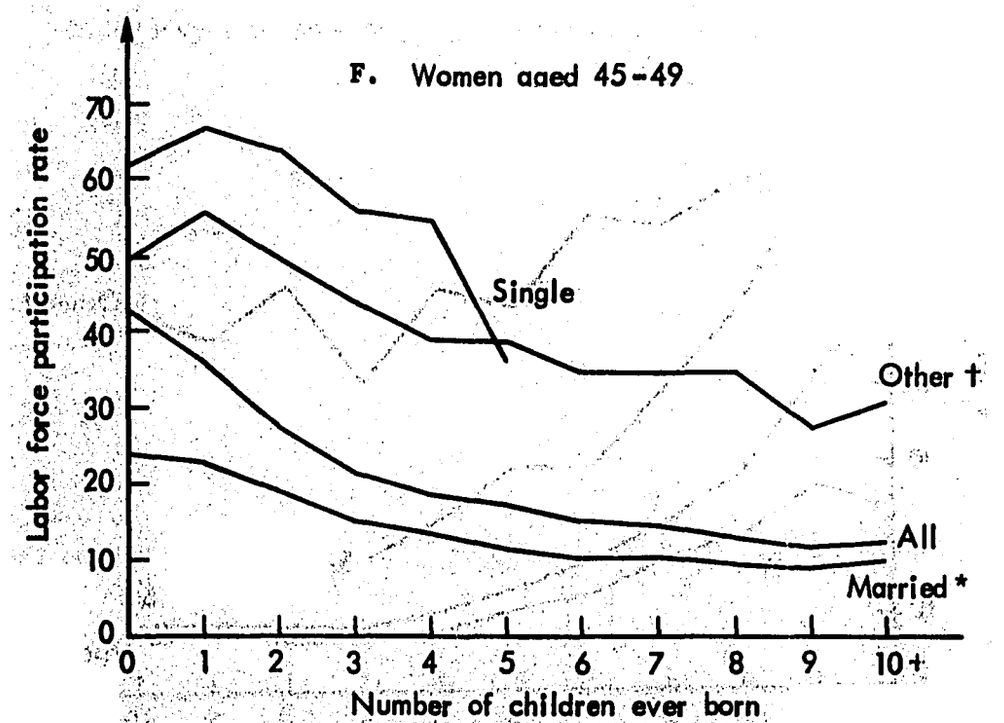


* Currently legally or consensually married
† Widowed, separated, divorced, or marriage annulled

Note: Rates not plotted if sample size less than 50

Fig. 3C & 3D —Age-specific female labor force participation rates by marital status and number of children ever born for Santiago Province, 1960





*Currently legally or consensually married
† Widowed, separated, divorced, or marriage annulled

Note: Rates not plotted if sample size less than 50

Fig. 3E & 3F—Age-specific female labor force participation rates by marital status and number of children ever born for Santiago Province, 1960

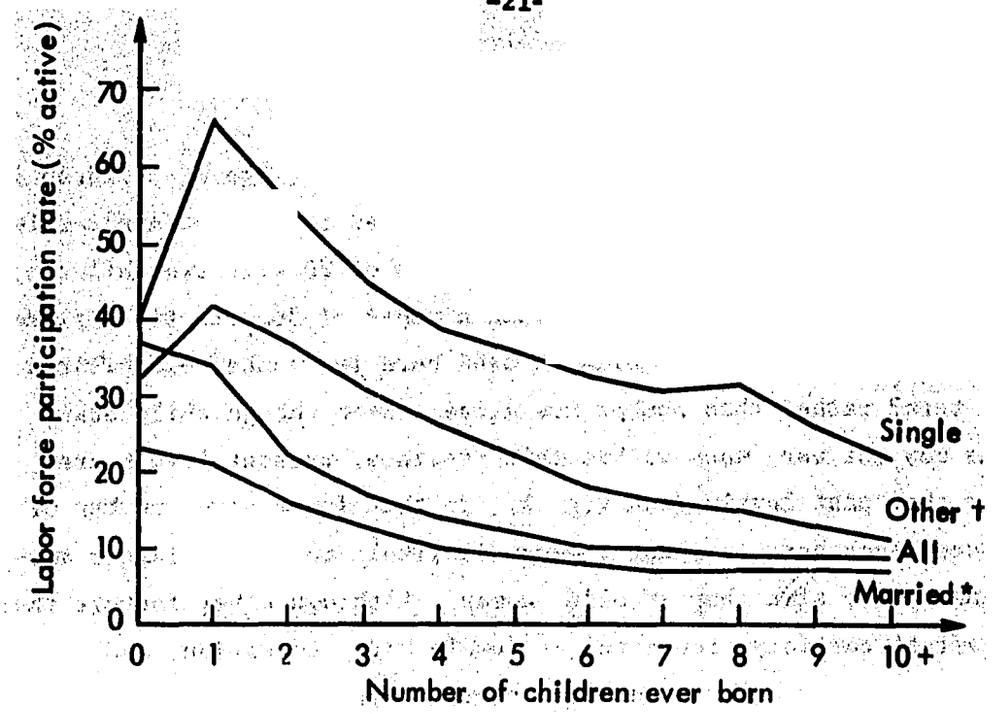
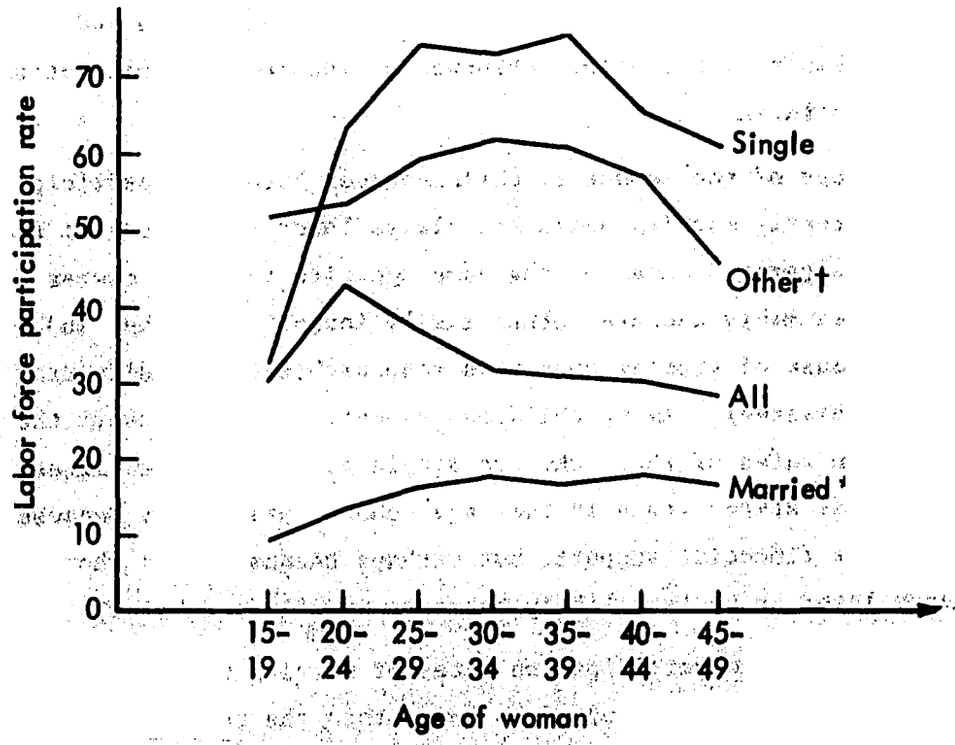


Fig. 3G—Labor force participation rates by marital status and number of children ever born for Santiago Province for women aged 12 or over, 1960



Currently legally or consensually married
† Widowed, separated, divorced, or marriage annulled

Fig. 3H—Summary of age-specific female labor force participation rates by marital status for Santiago Province, 1960

Source: Derived from 1960 census of Chile, Volume 7 (Santiago Province), Table 9.

ages and marital statuses in Santiago Province.[1] Age of children is not held constant here, but it can be assumed to be positively related to the age of the mother, that is, a woman of 20 with two children is likely to have younger children than a woman of 30 with two children. Moreover, the measure of children used here is "number of children ever born" rather than number now alive. Even though child death rates may not vary much within this province, present levels are lower than past levels (see Fig. 1), so that for a given number of children ever born, a younger woman is likely to have a larger surviving family size than an older woman. Although other factors that may affect participation rates -- female wage, education, and other family income -- are not held constant, it is unusual to have published census data in a developing country tabulated by four significant characteristics of the woman simultaneously -- labor force status, age, marital status, and children ever born. The patterns of these rates confirm the hypotheses presented above and give some indication of the net result of the joint influence of income and substitution effects of children.

Regardless of the number of children ever born, the participation rates of currently married women are always lower than those of single, widowed, or separated women of the same age with the same number of children, presumably because "other family income" is higher and possibly because of greater household responsibilities (aside from caring for children). Among childless women in any age cohort the participation rates of those who are single are always the highest of any marital status group in that age cohort, presumably because of lack of other financial support, but perhaps because women who work may marry later or be less likely to marry at all (see below).

The labor force participation rates of married women who have given birth to one child tend to be lower than the rates for childless

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[1]Additional graphs and tables illustrating the relationships between female labor force participation and some of the economic and demographic variables discussed above are presented in Appendix A. In some cases these are compared with similar data from the United States or Puerto Rico.

married women of the same age, except for a slight increase for women 35-39 and practically no change for women 40-44. The absolute and relative magnitudes of the drop tend to decrease with the age of the women, indicating some combination of a weakening of the substitution effect as the child becomes older and a strengthening of the income effect as the child's consumption requirements increase.[1]

Single and "other" (widowed, separated, marriage annulled, or divorced) women with one child are in almost all cases more likely to participate in the labor force than childless women of the same age and marital status. In the extreme case of separated or widowed women aged 30-34, women with one child are nearly three times more likely to be in the labor force as women of the same age and marital status with no children. This is evidence for the predominance of the income effect of children for these women. The participation rates of single and "other" women with one child increase with age before age 35, again supporting the hypothesis of a decreasing substitution effect and increasing income effect as the child grows older.

With more than one child both the child-care responsibilities and the consumption-requirements pressures are strengthened. For each age and marital status group, each additional child after the first appears to increase child-care responsibilities (substitution effect) relatively more than consumption requirements (income effect), since labor force participation rates generally decrease as the number of children increases (although the single and "other" curves are not nearly as smooth as those for married women). This is probably because the more children a woman has, the more likely she is to have younger children who require more careful supervision. The labor force participation rates for all age and marital status cohorts reach their peak at either zero or one and decline thereafter at a decreasing rate. The decreasing slope of each curve is probably due to economies of

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[1] Also, the older women are less likely to have a surviving child and are therefore more likely to behave like childless women.

scale associated with the time input to child care. For each marital status group, the rate of decrease in the labor force participation rate when number of children is increased becomes smaller (the curves become flatter) when age is increased. This is consistent with the hypothesized decreasing influence (in absolute value) of children on participation as the children grow older (because of a diminishing substitution effect and possibly an increasing income effect).

MARITAL STATUS

Legal and Consensual Marriage

Marriage can take two forms in Chile -- legal or consensual (sometimes called common-law marriage). Therefore, we must determine not only why a woman chooses to enter a marital relationship, but also why she (and her husband) opt for one form rather than the other.

A woman tends to marry for companionship, to have a family, and for financial security, although sex in a socially sanctioned setting, status, and escape from restrictive parents are other possible reasons. Legal marriage is the more acceptable and more stable form of marital relationship in Chile. This is illustrated by the fact that consensual unions are sometimes referred to as "irregular" unions (Cabello, 1956). The benefits of entering a legal relationship, rather than a consensual one, are greater because (1) the relationship is socially acceptable, (2) only a legally married male can receive family allowances for his wife and children, and (3) the wife and children are assured of inheriting the man's property. However, the costs of forming a legal union are also higher. The customary, but not obligatory, church marriage ceremony and accompanying reception can be expensive (Goode, 1960). Since legal marriages tend to be longer lasting relationships than consensual unions, the future costs also are higher because a longer-term financial commitment is being made. Consensual unions, which are (reported to be) relatively more prevalent among the young (see Table 2), are often "trial marriages," legalized at a later date.

Table 2

LEGALLY AND CONSENSUALLY MARRIED WOMEN
IN CHILE BY AGE OF WOMEN, 1960

Age of Women	Percent of Women Currently Consensually Married	Percent of Women Currently Legally Married	Consensual Marriage as Percent of all Marriage
12-14	0.02	0.16	11.0
15-19	0.79	8.6	8.4
20-24	2.8	38.9	6.7
25-29	4.0	60.9	6.2
30-34	4.7	69.6	6.3
35-39	5.2	70.6	6.9
40-44	5.0	69.3	6.7
45-49	4.6	66.2	6.5
12+	3.0	44.1	6.8

Source: Dirección de Estadística y Censos, Población del Pais: Characteristicas Basicas de la Poblaci- (Censo 1960), Table 10.

A woman is more likely to marry legally the greater her need for the financial security provided by a legal marital relationship. If the alternatives to marriage, labor force participation or schooling, are attractive, she may choose to delay marriage or not to marry at all. The negative relationship between marriage and labor market opportunities will be weakened if market work and marriage are compatible.

Consensual marriage may be more compatible with labor force activities than legal marriage. Sociologist William Goode (1968) believes that consensual marriage tends to be a more matriarchal type of relationship than legal marriage and that it is more common where the social and economic positions of women, relative to that of men, are more favorable.[1]

A man is more likely to marry legally if he can afford the expense of the marriage ceremony and can bear the financial responsibility of supporting a wife and possibly children, that is, if his income is high and the prospect for his continued employment is good. The importance a man puts on the legal recognition of his wife and children is also likely to be related to his income. For both of these reasons we should observe a positive income effect of male earnings on the demand for legal marriage by both men and women. There will be a much smaller income effect associated with the "demand for consensual marriage," and if consensual marriage is an "inferior" good, this income effect will be negative.

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[1]Data from Santiago Province give some weak support to this hypothesis: in 1960 of the persons consensually married who classified themselves as "head of household" 6.21 percent were women, but only 3.77 percent of the currently legally married heads of households were women. However, consensual unions are in general less stable than legal unions and the husband is more frequently absent from the household; this also may account for this difference in the percentages of heads of households who are women. Because the husband is more frequently absent in a consensual marriage than in a legal one, other things being equal, the wife in a consensual union will be more likely to work because the <u>average</u> "other family income" she receives is lower.

Whether or not consensual marriage is thought to be less desirable than legal marriage may depend on the social attitudes toward the two forms of marriage. Sociologists devote much of their literature on consensual marriage to this topic (Blake, 1961). Goode (1961, p. 918) says that consensual marriage tends to be a "lower class phenomenon most prevalent in communities not socially integrated into the main social system." He connects it with a "low [level of] norm commitment to various instrumental norms such as literacy."[1] However, such sociological theories are difficult to test empirically. It seem reasonable, a priori, that educated persons are more likely to be informed of and to be influenced by the legal and social advantages of legal compared with consensual marriage, although for the male some of the features of legal marriages, such as the wife's legal claim on his income, may be viewed as disadvantages and could discourage legal marriage. In the younger age groups this positive influence of education for women and possibly for men on their tendency to choose legal over consensual marriage will be offset by the negative influence of continued schooling, which is likely to be an alternative to legal marriage and possibly to consensual marriage also.[2] The net effect of education on marriage behavior is uncertain a priori.

All these things being the same, a woman is more likely to marry when men are more readily available, that is, when the ratio of marriageable men to marriage-interested women is high. Since sex-specific migration causes considerable variation in the regional ratios of men to women in Chile, this is a relevant consideration here.[3]

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[1]In the sociological literature the social attitudes conducive to consensual marriage are very similar to those associated with illegitimacy. This is partly because children born to consensually married parents are classified as illegitimate. Because of this definitional relationship the illegitimacy rate is not a suitable proxy for the social attitudes toward consensual marriage. In the empirical estimation of this model, the percent of single women who have children, a measure of illegitimacy among single women, will be used instead.

[2]Nerlove and Schultz (1970) found adolescent schooling (of males and females together) to discourage legal marriage but to encourage consensual marriage in Puerto Rico.

[3]Sex differentials in death rates will also cause some variation in the sex ratio.

Widowhood and Separation

Women who were once but are not currently married are of interest in this study because we expect these women to behave differently from either currently married women or single women (recall Figs. 3 A-H). Since widowhood is a condition beyond the control of a woman (although the decision to be no longer classified as a widow by remarrying is not), it will be treated as exogenous to this model.[1] It would be endogenous to a much larger socio-demographic model that included death rates as variables. The percent of women who have ever been widowed (which is not the same as the percent of women currently classified as "widows") is determined by the death rate of married men.

Separation, annulment, or divorce,[2] on the other hand, are the result of conscious choice on the part of at least one spouse to terminate the marriage. For a given level of marital discord, the woman is more likely to discontinue the relationship the less dependent she is on her husband for financial support. Therefore, other things being equal, separation rates should be higher among women who enjoy better labor market opportunities.[3] There will be a positive substitution effect of her earning power in addition to this positive income effect if she feels that marriage and labor market activities are not compatible. This hypothesis is supported by 1960 data for the United

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[1]The percent of women who are widows is not included as a variable in any of the empirical results presented in this report.

[2]Divorce does not exist in Chile, but there is judicial separation, which does not dissolve the marriage bond. I have not been able to find any information on the types of financial arrangements, if any, usually made between the husband and wife when there is a judicial separation. This is important to know when talking about "other income" of separated women. I would guess that women in Chile who were divorced in countries that permit divorce are classified as either separated or "unknown" in the Chilean census.

[3]Although good labor market opportunities may cause some marital breakups, they may also attract the in-migration of women without husbands. Such selective migration would reinforce the positive relationship expected between the percent of women who are separated and female wages.

States showing a positive relationship between the prevalence of divorce among women and their annual incomes (Carter and Glick, 1970, p. 264).[1]

A woman is more likely to be dissatisfied with her husband if he is unable to support her in the manner she would like. The husband may be more likely to leave his wife, either permanently or temporarily, if he cannot "afford" to support her; he may migrate to another region with hopes of increasing his earnings. For these reasons separation rates should be negatively related to the level of male income.[2] In the United States the prevalence of separation and of divorce among men was negatively related to their incomes in 1960 (Carter and Glick 1970, p. 264).[3]

Spouses are probably less likely to separate when they have children (although it is true that children will lower income per family member), and therefore separation rates are probably higher among childless couples than among couples with children.[4]

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[1]The percent of women who are separated increased with their annual income for incomes below $3,000 per year in 1960 but was negatively related to annual income for higher levels of income. The higher income groups can afford divorce.

[2]Note that the same factors that reduce the propensity of a woman to marry legally -- attractive economic opportunities for women and poor ones for males -- also increase the likelihood that, if the woman marries, her marriage will not last.

[3]Divorced women in the United States are on average more highly educated than divorced men, the former having completed 1.5 more years of school than the latter (Carter and Glick, 1970, p. 255). Among American men the percent divorced tends to diminish as the level of educational attainment increases, but for women there is a positive relationship between the percent divorced and amount of education received (Carter and Glick, 1970, p. 256). To the extent that wages are correlated with educational attainment, this evidence supports the above hypotheses that the incidence of marital dissolution is positively related to female economic opportunities and negatively related to male earnings. It is likely that educational attainment is exerting some independent influences as well. For example, educated women are more likely to know their rights and to have a greater sense of self-assurance.

[4]For this reason the number of children ever born per separated woman is probably lower than the number of children ever born per

It is worth noting that marital status as reported in the Chilean census is the classification of the woman interviewed; no attempt is made to verify her classification by consulting official records. Therefore what is actually measured is the percent of women who classify themselves as, say, separated or as consensually married. If a woman feels that it is not socially acceptable to be separated or consensually married, she may classify herself in response to the census taker's question as being legally married or perhaps even single. Biases in the data will arise if, for example, uneducated women are likely to misreport their marital status.

The variables used to measure the various marital statuses in the empirical model are age-specific stocks -- the percent of women of a given age who report themselves as having a particular marital status. Although marital-status stocks are not as responsive to economic variables as are the corresponding rates (flows), they do give an indication of the magnitudes of past rates and differences in timing of marital status decisions.

FERTILITY

The measure of fertility used in the estimation of the model, children ever born per 1,000 women, is also a stock determined by past rates, but in this case the stock itself has more meaning because families presumably aim for a desired number of surviving children and attempt to regulate the rate at which they add to this stock in accordance with their goal.

Since children are in part an economic good, the number of surviving children desired by parents is determined by the costs and benefits of having and raising children -- that is, the perceived price of a child.[1] Net costs of child rearing will be smaller and

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widowed or currently married woman who has been married for the same length of time. In the United States, 40 percent of all couples getting divorced in 1962 had no children (Carter and Glick, 1970, p. 253).

[1] Recent economic theories of fertility (Willis, 1969; DeTray, 1970) have pointed out that the most commonly used measure of children

perhaps negative if the child is able to supplement family income or production. If the child is attending school rather than working, the cost of the child will be higher, even if schooling is provided by the state, for there are opportunity costs (forgone earnings and household production) as well as direct costs (school supplies, clothes) of sending a child to school. Expected costs of schooling will be positively related to the expected duration of the schooling.

The opportunity cost of parents' time is also a very significant cost of children, since children are time-intensive commitments. Because the mother is usually in charge of child care, the opportunity cost of her time is usually the more important. If a woman can participate in the labor force and earn a good wage, her opportunity cost of staying home with children is high. If she does have children she may space the births fairly close together so as to minimize her time out of the labor force. Desired family size and desired birth intervals will be negatively related to the value of the woman's time, other things being equal.

The number of children parents desire is determined not only by the cost or "quality" of a child but also by the family's income, which is composed of property income and the husband's, wife's, and

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(the measure that will be used in the empirical test of this model), a physical number of child bodies, may not be the proper measure of the true quantity of children parents have. They hypothesize that parents desire and produce a given "full" stock of children (from which they derive a flow of "child services") which is a function of both the number of children and the quality (education, health, etc.) of these children. If children are a normal or superior good, parents will desire a larger full stock of children when they believe the price of children has fallen, or when they experience an increase in income. However, whether this increase takes the form of an increase in quantity or an increase in quality, or both, depends on the magnitudes of the price and income elasticities of demand for the full stock of children, the elasticity of substitution between quantity and quality, and the relative weights of quantity and quality in the production of the full stock of children (DeTray, 1970). In the empirical estimation of this model no attempt will be made to adjust the dependent variable for quality of children, but "quality" measures, such as child schooling, will be included in the equation explaining fertility to account for the tradeoff between quantity (child bodies) and "quality."

ossibly children's earnings.[1] Since children are probably considered o be a normal "good," the number of children parents desire at a pecified "price" will be positively related to their income. But ince there are price aspects of the wage-earnings components of amily income, it is impossible to predict a priori the direction sign) of the effect on the number of children desired of a change n the husband's or wife's earnings; only a change in non-employment ncome will give rise to a "pure" income effect. The substitution ffect of a woman's earnings, the opportunity cost of child care dis- ussed above, is usually (and I think correctly) assumed to predom- nate over the income effect of her earnings. The male wage represents he value of the time the father spends with his children, but since he mother is usually in charge of child care, the substitution effect f his wage should be much weaker than that associated with her earn- ing power, and is assumed to be dominated by the income effect. In the empirical estimation of this model the female and male wage appear in the equation explaining fertility levels. The former is expected to have a negative coefficient, indicating a predominance of the sub- stitution effect for women, and the latter a positive coefficient showing a preponderance of the income effect for men. Unfortunately, data on unearned income, which would enable us to measure a "pure" income effect, are not available.

Assuming that the parents have a completed family size goal in mind and have decided how they want to space the births, at any point in time the number of children to whom the woman has given birth will be a function not only of these preferences but also of her fecundity, her exposure to the risk of pregnancy, and her ability to control the number of births she has. The matter of fecundity will not be dis- cussed here.[2]

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[1] Since children are long-run commitments, permanent income is the most appropriate income measure.

[2] A woman's fecundity is related to her age. The model presented here is estimated for seven five-year age groups (15-19,..., 45-49) and two aggregate cohorts (12+ and 15-49).

A woman's exposure to the risk of pregnancy depends on the frequency and timing of sexual intercourse. Although there is no way to measure this with the data available, it seems reasonable to assume that a married woman is subject to a greater risk of pregnancy than a single one. Since the measure of fertility used in this estimation of this model is a stock (the number of children ever born per 1,000 women) that was formed in the past, we are interested in previous exposure to the risk of pregnancy, and therefore must consider all women who were ever married, whether or not they are currently married.[1] Because consensual unions are less stable than legal marriages and the husband is more often absent, a woman living in a consensual union is probably less frequently exposed to intercourse than a woman who is legally married. Aside from a smaller risk of pregnancy, a consensually married couple is also likely to have fewer children because their family size target is smaller. A consensually married couple may desire fewer children than a legally married couple, other things being equal, because the man cannot receive family allowances for his wife and children, and they are not protected by legal claims on his income or property.[2]

If a woman is able to control the number of births she has, she will probably want to compensate for expected and actual deaths among her offspring in determining the number of births she believes necessary to leave her with a <u>surviving</u> family of desired size. For example, if she wants three surviving children and expects half of her children to die, she will plan to give birth to six children. Thus, the number of births she plans is

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[1] Length of marriage should be a good indication of past exposure to the risk of pregnancy for an individual woman. However, since such information is not available, it is necessary to assume for the empirical test of these hypotheses that the percent of women who were ever married (the measure used here) is closely related to the average number of woman-years these women were married.

[2] Appendix Figs. A-4 and A-5 illustrate how number of children ever born varies with age, labor force status, and marital status. Unfortunately, the data used to construct these figures do not distinguish legal and consensual marriage, but lump them together into a single category.

$$B^* = \frac{S^*}{(1 - D)}$$

where B^* = desired number of births,

S^* = desired number of surviving children,

D = probability that a child will die.

The parents' evaluation of the chance of a child dying is a subjective probability positively related to the level of infant and child mortality rates in their area. Parents may tend to overcompensate or undercompensate for child deaths depending on the accuracy of their evaluation of D and the costs they associate with under- or overshooting their desired family size goal (S^*).

If a woman loses a child she has not expected to die, for example, after she has already reached her target family size, she may want to "replace" that child in order to maintain the desired family size. This replacement effect will be directly related to the number of the woman's children who have died, other things being equal.[1]

Since the data used to estimate this model refer to aggregates (urban and rural provincial regions) rather than individual households, it will not be possible to separate the uncertainty and replacement behavioral implications of infant and child mortality. In the empirical test of this model the infant mortality rate (lagged two years to allow for a decisionmaking and biological lag for replacement) will be used to represent both aspects of child mortality.[2] However, these

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[1] Because resources are expended on children who die, infant and child deaths increase the pecuniary cost (and also the psychic cost) of attaining a given surviving family size goal and thereby could reduce the number of surviving children parents desire. I believe that this negative influence of infant and child mortality on the number of births parents desire will be outweighed by the two positive effects (compensation in planning and replacement) mentioned above.

[2] In using the infant mortality rate as the measure of child mortality, we are ignoring deaths of children past their first birthday. However, this omission is not considered to be serious since most child deaths occur in the first year of life and also because it is likely that the regional pattern of levels of mortality for children past their first birthday is very similar to the pattern of infant mortality rates.

The 1958 infant mortality rate is used in the estimation of the fertility equation for all age groups. However, for older women it is

two factors operate at different times during a woman's fertile years: Uncertainty causes the parents to compensate for expected deaths in planning the number of births (B^*) they believe necessary to reach their target family size (S^*); the replacement factor comes into operation mainly after the parents have achieved this family size. Therefore, the total effect of compensating for child deaths should be greater for older women.

Most of the above hypotheses are based on the premise that a woman is able to control the number of times she gives birth and will do so in accordance with her target family size and corresponding desired number of births. For a given level of fecundity, ability to control the number of pregnancies and births depends on the sophistication of birth control methods used and how they are used.[1] The data used in the estimation of the model presented here are for 1960, before the establishment of the national family planning program in

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likely that the adjustments they made for expected deaths in planning the desired number of births were based on earlier levels of child mortality. The 1958 regional levels of infant mortality will be lower than those in earlier years (see Fig. 1). If 1958 regional levels of infant mortality are perfectly correlated with previous levels, the coefficient of the 1958 infant mortality rate will be biased upward for the older cohorts of women, but the statistical significance of the relationship will not be altered. However, if 1958 and earlier levels of infant mortality are not perfectly correlated, there will be a (counterbalancing) asymptotic downward bias (toward zero) in the estimated coefficients of the 1958 infant mortality rate due to errors in variables. If the infant mortality rate is the only variable in the fertility equation that contains measurement error, its t-statistic also will be biased toward zero (Cooper and Newhouse, 1971).

[1]Since Chile is a predominantly Catholic country, no method more advanced than the rhythm method is religiously acceptable. However, the Chilean Church is reputed to be the weakest in Latin America, and some of the more liberal clergy have openly advocated contraception. Until recently, induced abortion may have been the main form of birth control used (although statistics on contraceptive methods used are scarce). In the 1960s interest in family planning began to increase and culminated in 1966 in official recognition of family planning as part of a nationally sponsored health services program. The focus of this official program has been the giving of contraceptives to multiparous women of straitened economic circumstances who have just given birth, although much attention is still devoted to women resorting to induced abortion.

1966. Although no information is available on the birth control methods then in use, it seems reasonable to assume that more educated couples are more likely to be informed of and to use more effective forms of birth control.[1]

LABOR FORCE PARTICIPATION AND SCHOOLING OF CHILDREN

In the estimation of this model child labor force participation and schooling are considered to be endogenous for they are aspects of the "quality" or costs of children that are subject to choice. Since parents may feel that quantity and "quality" are substitutable, that is, they may desire fewer high-cost children than low-cost children, decisions concerning the number of children they want to have and the schooling or economic activity they foresee for these children will be jointly determined.

Child Economic Activity

Like their mothers (and other "secondary" workers) children are more likely to work when other family resources (per family member) are scarce, whether this scarcity is due to inadequate earnings by their parents or to a large number of family members among whom those earnings must be divided.[2]

A child's propensity to participate in the labor force will be positively influenced by the wage he or she can earn (or, in the case

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[1] Since parents' education is positively correlated with some of the factors that tend to increase the "price" of a child, for example, the female wage and child schooling, educated couples will also have a greater incentive to practice birth control, for the costs of not doing so are higher.

Miro and Mertens (1968) found a positive relationship between the percentage of currently married women who have ever used some form of birth control and the educational attainment of these women in two small Chilean cities (Cauquenes-Chanco in Maule Province and Mostazal in O'Higgins Province).

[2] If there are many children in the family, the mother is likely to send some of them to work rather than join the labor force herself, because her opportunity costs of labor force activity (household responsibilities, which include caring for children) are likely to be considerably higher than theirs.

of unpaid family workers, by their average product) and negatively related to the opportunity cost of labor force activities.[1] Since schooling is an alternative to full-time (market or non-market) work for a child, the value parents (and children) attach to education will represent the opportunity cost of work for the child.[2]

In the empirical test of these hypotheses the labor force participation rate of children 12-14 years old will be used as the measure of child economic activity. There are two unavoidable drawbacks of this measure: (1) in rural areas meaningful economic activity for children may begin as early as age five, but Census data on labor force participation begin with age 12; and (2) the recorded labor force participation rate is likely to understate the proportion of working children because unpaid family workers are often not counted as being in the labor force.[3]

Child Schooling

The amount of schooling parents desire for their children will be determined by the expected returns to the investment in schooling, the price of schooling, and the family's income. The quantity of

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[1]The wage children can earn was not available as a variable when this equation was estimated. Such a wage, which can be created with the same method used to construct the male and female wage measures used here (see Appendix B), should be included in future work on child economic activity. In the estimation of this equation the female wage is included as a proxy for the wage children can earn. Since children, like women, are often "secondary" workers, they may be fairly close substitutes for each other in some jobs.

[2]Other things being equal, educated parents are probably more likely to desire highly educated children. In economic terms, the "value of education" is the net present value of the investment in continued education. However, only some, if any, of the return to the child's education will be received by the parents.

[3]Of course, the same problem exists, and is more serious, for women since non-market activities, such as housework and caring for children, are not counted as labor force activities. However, we are able to approximate the magnitude of a woman's household responsibilities by considering her marital status and the number of children she has.

schooling children actually receive will of course be determined by the interaction of this demand for schooling with the community's supply of schooling facilities.

The "price" of schooling includes direct costs, such as tuition or expenditures on school supplies, as well as indirect costs, forgone market earnings or non-market production. For the estimation of the child schooling equation the female wage, which is used as a proxy for the wage children can earn, will be used to represent the opportunity costs of sending a child to school.[1] Direct costs are not included in the estimation because no data were found, but these costs probably do not exhibit much regional variation.

Since schooling is a normal (and probably a superior) good, the amount of schooling a child receives should be positively related to family income per capita, other things being equal. To test this hypothesis, the number of children ever born and the male wage will be included in the child schooling equation; I expect the percent of children attending school to be negatively related to the former and positively related to the latter.

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[1]Paul Schultz has pointed out to me that women with good labor market opportunities may be less able to oversee the schooling of their children. This would further strengthen the negative relationship that is anticipated between child school attendance and the female wage. However, the relationship between the female wage and child school attendance is probably much more complex. The value of school as a baby sitter is probably positively related to the wage a woman can earn in the labor market and to the costs of alternative child-care arrangements. Other things the same, this would lead to a positive relationship between child school attendance and the female wage. However, if more mothers work where more children are attending school, this increase in labor force participation could reduce the wages available to women, causing a negative relationship between child school attendance and the female wage rate. Correlation between the female wage and the mother's preferences for education or between female wage levels and the investment potential of schooling could also affect the relationship between child school attendance and female wage rates. I am indebted to Glen Cain for pointing out the many different ways in which the market wage of women and the percent of children attending school may be related and influence one another.

The percent of children who attend school or the amount of schooling children receive is determined by the interaction of parents' and children's demand for schooling and the community's supply of schooling. Well-enforced compulsory schooling laws are likely to increase the observed (equilibrium) quantity, for they increase the expected costs of not attending school. The factors discussed above primarily affect the demand side, although they may have some impact on the public sector's decisions concerning how best to allocate resources for education. The supply schedule is much more difficult to specify, and necessary data and information were not available to include in the model factors that affect the supply of schooling.[1] In the estimation of the child schooling equation, population density or the urban dummy will be included in a crude attempt to adjust for supply shifts. It is believed that areas that are more heavily populated or more developed economically will be more likely to have schooling facilities, partly because it is less costly for them to provide these services.[2]

For the estimation of this model the percent of 10-year old children who attend school is the measure of child schooling used. Although it would be more desirable to have a measure that gives us an indication of the total amount of schooling a child receives, for example, the total number of years he attends school, such a measure could not be used because the Census data on school attendance for levels of schooling higher than primary (grades 1-6) were not available in a form that could be used in the model.[3]

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[1] See DeTray (1971) for an attempt at estimating schooling supply schedules.

[2] DeTray (1971) believes that "more densely populated areas, especially urban areas, have economies of scale in the production of schooling" (p. 14). His regression results for Puerto Rico confirm this hypothesis: both the percent of the population that is urban and the population density of rural areas have positive and usually significant coefficients in equations explaining the percent of children enrolled in school.

[3] The data used to estimate this model refer to urban and rural areas of Chilean provinces. Only data on primary school attendance are given by the requisite urban-rural breakdown.

OTHER ASPECTS OF FEMALE ECONOMIC AND DEMOGRAPHIC BEHAVIOR

Although a woman's decision to migrate is interrelated with her labor market, marriage, and fertility choices, migration is not explicitly considered in this report. Female migration is implicitly included in the model to the extent that some of the factors to which migrants respond are in the model, and part of the measured response to those factors is by migrants. For example, a high wage may induce some in-migration of working women (or women with a "taste" for labor market work) and thus raise the female labor force participation rate.[1]

Female education is included in the model, but it is considered to be exogenous. Since schooling may be an alternative to early marriage or labor force participation, it should in the future be treated as endogenous and linked, with the appropriate lags, to child schooling.

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[1]Taste factors may motivate individuals or families to migrate to areas where their desired patterns of behavior can best be achieved. This may complicate the interpretation of some of the estimated parameters to the model. For example, high wages may attract (the in-migration of) women without husbands, rather than cause them to leave their husbands.

If further work is done on the economic and demographic behavior of women in Chile, I recommend including migration as endogenous to the model as Nerlove and Schultz (1970) and Harman (1970) have done in their studies of Puerto Rico and the Philippines, respectively. I refer the reader interested in Chilean migration to Herrick (1965).

IV. SPECIFICATION AND ESTIMATION OF THE MODE

DATA

The hypotheses developed in Section III generally pertain to the individual woman and her family's behavior. However, data are not available to test these hypotheses at the individual level. Aggregate data for urban and rural areas in each of the twenty-five Chilean provinces represent the sample of 50 observations used to estimate the model. Most of the data are for five-year age groups of women, and the model is estimated for seven of these cohorts (15-19, 20-24, ..., 45-49) and for two combined groups (12 or older and 15-49) of women to determine how the responses of the dependent variables to changes in the independent variables vary with the age of the women.[1] Characteristics of each regional age group are interpreted as "propensities" of individual women in that cohort; each group can be viewed as behaving like a "representative individual." In the estimation of the model regional observations for each age group are weighted to reflect the size of the cohort observed.[2]

Variables used in the estimation of the model are defined in Table 3; their means and standard deviations are presented in Table 4. The data are primarily from the 1960 Census of Chile;[3] these are supplemented by vital rates from the 1958 and 1960 Chilean Demographic Yearbooks[4] and wage data from the 1960 Social Security Yearbook of

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[1] Two different aggregate groups are used because the two measures of aggregate fertility that will be used are defined for different age groups. The aggregate children even born measure is for women 12 or older, whereas the child-woman ratios (measures of recent surviving fertility) are for women 15-49.

[2] Each observation is weighted by the square root of the number of women in that regional age group. This is equivalent to weighting the moment matrix by the numbers of females in the age group under consideration.

[3] Republica de Chile, XIII Censo de Población (29 de Noviembre de 1960), Series B, Nos. 1-25, Dirección de Estadística y Censos, Santiago (n.d.).

[4] Republica de Chile, Demografía Año 1958 and Demografía Año 196 Dirección de Estadística y Censos, Santiago, 1961 and 1963.

Table 3

DEFINITIONS OF VARIABLES[a]

*Female Labor Force (L.F.) Participation	Percent of women (of specified age group) who are economically active (members of the labor force).
*Female Marital Status	
*Currently Legally Married	Percent of women (of specified age group) who are currently legally married.
*Consensually Married	Percent of women who are currently consensually married.
*Separated	Percent of women who are separated, divorced, or whose marriage has been annulled. (Included in the numerator is the Census category "Unknown"; see footnote 2 on page 28.)
*Widowed	Percent of women who are widows.
*Fertility	Number of children ever born per 1,000 women of specified age group (15-19, 20-24, ..., 45-49, 12+). For 15-49 age group: Number of children 0-4 years old per 1,000 women 15-49 years old, or Number of children 5-9 years old per 1,000 women 15-49 years old.
*Female Education	
*Literacy	Percent of women who are classified as literate.

Table 3 (contd.)

*Primary Education	For women 15-19 and 20-24: Percent of women of specified age group who have completed primary school (grades 1-6 in 1960 Census). For women 25-29, 30-34, ..., 45-49, 12+, 15-49: Percent of women 25 or older who have completed primary school.[b]
*Secondary Education	For women 20-24: Percent of women 20-24 who have completed secondary school or who have attended vocational school. For women 25-29, 30-34, ..., 45-49, 12+, 15-49: Percent of women 25 or older who have completed secondary school or who have attended vocational school.[b]
*Average Schooling	Average number of years of school completed by women of specified age group (see Appendix B for an explanation of the derivation of this variable).[c]
Male Education	
Literacy	Percent of men 25 years old or older who are classified as literate.
Primary Education	Percent of men 25 or older who have completed primary school.
Secondary Education	Percent of men 25 or older who have completed secondary school or who have attended vocational school.
Average Schooling	Average number of years of school completed by men 25 or older (see Appendix B for an explanation of the derivation of this measure).

Wages (see Appendix B for an explanation of the derivation of these variables)

*Female Wage	Median daily wage of women in specified age group (in escudos).[d]
Male Wage	Median daily wage of males 12 years old or older (in escudos).[d]
*Sex Ratio	The number of men in age group J per 100 women in age group J, where J is defined for each of the cohorts studied in the model as:[e]

Age of female cohort in model	Age of groups used in sex ratio (J)
15-19	15-29
20-24	15-29
25-29	25-39
30-34	30-44
35-39	35-49
40-44	40-54
45-49	45-59
12+	12+
15-49	15-59

*Single Illegitimacy	The percent of single women who have children. (These data were not available by the urban and rural distinction, and therefore the value is the same for the urban and rural regions of a province.)
Urban	A dummy whose value is 1 for urban areas, 0 for rural areas.[f]
Male Unemployment	Percent of males 12 years old or older who are classified as unemployed ("cesantes" and "buscan trabajo por primera vez").

Table 3 (contd.)

Child Labor Force (L.F.) Participation	Percent of children 12-14 years old who are economically active.
Child School Attendance	Percent of ten-year-old children who attend school.
Vital Rates (See Appendix B for an explanation of the construction of these variables)	
Infant Mortality Rate	Number of infants who die before thei first birthday per 1,000 live births (1958).
Crude Death Rate	Number of deaths per 1,000 population (1960).
Illegitimacy	Percent of all births in 1960 that were illegitimate (parents not legally married).
Population Density	Number of persons per square kilometer (see Appendix B for an explanation of the construction of this variable).
Female Opportunities Index	An index of economic opportunities for women (base 100); for each region i

$$\frac{\sum_{j=1}^{J} w_j e_{ij}}{\sum_{j=1}^{J} w_j e_j} \times 100$$

where w_j = Percent who are women of those employed in the jth industry for Chile as a whole. (See Appendix B for values of w_j.)

Table 3 (contd.)

e_{ij} = Percent of labor force in region i employed in j^{th} industry.

e_j = Percent of total Chilean labor force employed in j^{th} industry.

J = 10, total number of industries. (See Appendix B for list.)

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[a]Many of these variables are age-specific and a value is available for each of the age groups investigated here: 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 12+, and 15-49. An asterisk (*) before the variable name indicates that the variable is age-specific.

[b]Note that this measure refers to all women 25 or older and is not age-specific for the particular five-year age cohorts being considered.

[c]Since this measure is a weighted average of the above education measures (see Appendix B), it is only accurately representative of the schooling experiences of the 15-19 and 20-24 age groups.

[d]In April 1959, when the escudo was established as the new monetary unit replacing the peso, it was approximately equal in value to $1.00 U.S.

[e]For each five-year cohort j-(j+4) considered here two different age groups J((j-5)-(j+9) and j-(j+14)) were tried for the sex ratios and the one that performed the best in the empirical analysis was chosen (the differences in performance were minimal).

[f]"For purposes of the Census, urban areas are those with urban characteristics (cities, villages, hamlets, mines, and other populated centers with those characteristics, such as air bases, mining camps, etc.), that is, concentrated areas with some paved streets or with some public utility services" (translated from Spanish in Republica de Chile, XIII Censo de Población (29 de Noviembre de 1960), Dirección de Estadística y Censos, Santiago, Vol. Resumen País, p. 22). Professor Bruce Herrick has pointed out to me that, unlike other definitions of "urban," this one places no lower limit on the size of the population of areas denoted as urban. He said his conversations with census officials have indicated that the lower limit is probably around 1,000 persons.

Table 4

MEANS AND STANDARD DEVIATIONS OF DATA

Age-specific Variables[a]	15-19	20-24	25-29	30-34	35-39	40-44	45-49	12+	15-49
Female labor force participation	23.5	32.5	27.9	23.7	22.5	22.2	21.3	20.9	25.3
	(8.29)	(13.2)	(11.4)	(10.0)	(9.84)	(9.41)	(8.49)	(8.20)	(10.1)
Female marital status									
Currently legally married	8.56	38.9	60.9	69.6	70.6	69.3	66.2	44.1	50.0
	(2.12)	(5.39)	(4.82)	(4.21)	(4.23)	(4.52)	(5.44)	(3.37)	(4.04)
Consensually married	.788	2.77	3.96	4.68	5.18	4.99	4.59	3.02	3.51
	(.630)	(1.90)	(2.26)	(2.10)	(2.26)	(2.08)	(1.91)	(1.44)	(1.72)
Separated	.155	.902	1.91	2.81	3.49	4.02	4.19	2.17	2.12
	(.072)	(.409)	(.839)	(1.32)	(1.75)	(2.05)	(2.06)	(1.05)	(1.05)
Widowed	.051	.309	.843	1.85	3.62	6.61	10.7	8.70	2.59
	(.028)	(.096)	(.178)	(.368)	(.658)	(1.08)	(1.98)	(1.15)	(0.39)
Fertility	121.9	869.5	1917.	2805.	3390.	3637.	3621.	2139.	619.1[b] (134.6) / 550.0[c] (142.8)
	(36.12)	(194.0)	(362.1)	(555.5)	(811.1)	(980.5)	(1048)	(419.2)	
Female education									
Literacy	91.2	88.6	87.6	85.9	82.3	81.4	79.8	82.2	86.2
	(7.47)	(9.32)	(10.5)	(11.8)	(14.0)	(14.5)	(14.9)	(12.3)	(11.0)
Primary	49.8	49.0	←	←	←	39.9	→	→	→
	(21.3)	(20.1)	←	←	←	(18.3)	→	→	→
Secondary	NA	11.7	←	←	←	7.22	→	→	→
		(6.2)	←	←	←	(3.97)	→	→	→
Average schooling	5.48	5.52	4.88	4.85	4.70	4.66	4.60	4.65	4.80
	(1.50)	(1.55)	(1.36)	(1.39)	(1.48)	(1.50)	(1.52)	(1.44)	(1.39)

Table 4 (continued)

Age-specific Variables[a]	15–19	20–24	25–29	30–34	35–39	40–44	45–49	12+	15–49
Female wage	.554 (.147)	.657 (.174)	.709 (.174)	.737 (.188)	.740 (.200)	.733 (.197)	.721 (.194)	.672 (.181)	.677 (.178)
Sex ratio	93.9 (20.9)	93.4 (20.7)	93.0 (19.9)	94.7 (19.4)	94.7 (19.8)	96.2 (21.3)	95.6 (23.1)	93.8 (19.4)	94.3 (20.4)
Single illegitimacy	3.24 (1.88)	12.3 (4.38)	19.6 (6.12)	24.6 (6.85)	28.5 (7.07)	28.5 (8.57)	27.6 (9.10)	10.1 (3.27)	11.8 (3.65)
Urban	.726 (.446)	.742 (.438)	.755 (.430)	.760 (.427)	.745 (.436)	.742 (.437)	.735 (.441)	.734 (.442)	.743 (.437)

Non-age-specific Variables[d]	Mean	ndard Deviation
Male wage	1.07	.385
Male education		
Literacy	84.5	12.8
Primary	45.3	20.1
Secondary	11.7	6.61
Average schooling	5.30	1.73
Male unemployment	7.87	2.98
Child L.F. participation	7.27	3.52
Child school attendance	88.6	8.60
Infant mortality rate	124.	25.5
Crude death rate	12.8	2.15
Illegitimacy	15.9	4.37
Population density	137.	136.
Female opportunities index	105.	42.4

Table 4 (continued)

Notes:

Standard deviations are given in parentheses beneath means.

NA = not available.

[a]Regional age-specific observations are weighted by the number of women in that region of the ages under consideration.

[b]Number of children 0-4 per 1000 women 15-49.

[c]Number of children 5-9 per 1000 women 15-49.

[d]The means and standard deviations given here were computed by weighting the observations by the number of women 12 years of age or older in the region. Since these are not the proper weights for these variables, the values presented here are not accurately representative of the population characteristics.

Chile.[1] The vital rates in the Demographic Yearbooks are given for the 87 departamentos of Chile; unfortunately this classification does not directly correspond to the urban-rural provincial breakdown of the Census data. Wages by industrial sector are available only at the province level. The method used to construct vital rates and wages for urban and rural areas of provinces is explained in Appendix B.

Although the quality of demographic data in most developing countries is usually quite poor, many demographers regard Chilean data as the most reliable in Latin America and indicate that, in particular, the 1960 Census of Chile is certainly above average in terms of completeness and accuracy.[2] Nonetheless, the data used in this study would probably compare unfavorably with those for many developed countries. Though without an intimate knowledge of Chile or the specific strengths and shortcomings of its statistics, I have not found evidence to suggest that the regional data I analyze here are not suitable for my purposes. The validity of the subsequent study is not really dependent upon the completeness of the enumeration but rather relies on the absence of particular regional biases that would distort the relationships investigated here.

SPECIFICATION AND ESTIMATION OF THE MODEL

To estimate the parameters of the model, multivariate regression analysis is used; this technique enables estimation of the direction, magnitude, and statistical significance of the association between a "dependent" variable and each explanatory variable while holding constant other factors that may also influence the dependent variable. There are several reasons for preferring this technique to a series of two-way graphs or tables (such as those in Appendix A) illustrating the individual relationships between each of the explanatory variables

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[1] Republica de Chile, Estadísticas 1960, Servicio de Seguro Social, Santiago (n.d.).

[2] Arriaga (1968) says that the 1960 Chilean Census "was, in general, accurate and complete" (p. 47). Collver (1965), however, thinks that the Census requires an adjustment for undernumeration of five percent. Both authors feel that deaths are accurately recorded but that birth registration is still incomplete.

and a dependent variable. First, data are not always available by all the cross-classifications necessary to construct these graphs or tables. Second, since several factors together may influence the dependent variable, it may not be possible to determine their joint impact on the dependent variable unless all of them are considered together. Whenever the explanatory variables are intercorrelated, as they often are, the total effect of all these variables acting together will not be the same as the sum of the associations derived from bivariate relationships between the dependent variable and each of the explanatory variables. Finally, a bivariate relationship does not permit determination of the extent to which other factors are influencing or accounting for the observed relationship between the two variables being considered.

The hypotheses presented in Section III are based on a consistent structure of propositions or a theory that enables us to consider a complex chain of cause and effect relationships involving direct and indirect influences on a dependent variable. For example, I hypothesize that a woman's education influences the wage she can earn and that this in turn affects her likelihood of participating in the labor force; this is an indirect effect of education on female labor force participation. However, I also anticipate that education will exert a direct effect on female labor force participation by influencing the difference in utility she receives from work in the labor force compared with housework. The positive relationship between the educational attainment of women and their labor force participation illustrated in Fig. A-1 shows the total effect of education on female labor force participation but does not enable us to ascertain whether, or to what extent, this is expressing a direct effect of education on female labor force participation or whether the relationship is due to the intervening influence of some other factor, such as the wage rate, that is a function of education. Multivariate analysis will help us to decompose these direct and indirect effects.

Because the spheres of family behavior investigated here are interrelated and influence one another, I use a multiple regression

method appropriate for estimating simultaneous jointly determined equations. Ordinary least squares (OLS), the most commonly used regression technique, yields best linear unbiased estimators only when certain conditions are satisfied (the Gauss-Markov "BLUE" theorem). One of these conditions is that the explanatory variables appearing in an equation are exogenous, that is, predetermined outside the model, and are uncorrelated with the stochastic disturbance (error) term. If any of the explanatory variables are determined within the model, that is, endogenous to the model, it is very likely that they will be correlated with the error term in that equation, and if this is the case, OLS will produce biased and inconsistent estimates.[1]

Two-stage least squares (TSLS) is a regression technique suitable for estimating simultaneous equations. In the "first stage" each of the explanatory endogenous variables is regressed on all of the predetermined variables (instruments); these estimated values of the explanatory endogenous variables will be independent of the error term (the actual values of these variables were correlated with the disturbance term). In the "second stage" each explanatory endogenous variable is replaced by its reduced form estimate obtained in the first stage and then each equation is estimated by OLS. Because the explanatory variables are no longer correlated with the error term, TSLS will yield consistent estimators, although their variances will be larger than those of corresponding OLS estimates. Thus, the OLS estimators are more "efficient" than those produced by TSLS, but this smaller variance is around an asymptotically biased mean.

Estimated parameters for the eight equations in the model are presented in Tables 6-13 below. For each equation, coefficients have been estimated by TSLS and by OLS. The discussion of the regression results indicates that TSLS in general yields coefficients more accordant with a priori expectations than does OLS.

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[1] "Inconsistency" means that the bias persists even for infinitely large samples. In more technical jargon, an estimator is "consistent" if the probability limit of the estimator is equal to the true value of the parameter it is estimating.

Female labor force participation, the female wage, legal marriage, consensual marriage, separation, fertility, child labor force participation, and child school attendance are considered to be subject to family choice and hence endogenous to the model. The model is closed since I specify and estimate an equation for each of these endogenous variables. Female average schooling, male average schooling, the male wage, the male unemployment rate, infant mortality, the sex ratio, the urban dummy, the crude death rate, and population density are considered to be outside the family's control, or exogenous to the model; they are treated as instruments in the TSLS estimation.

The theory and hypotheses do not give sufficient information for the specification of the precise functional forms appropriate for the various equations. For simplicity each equation is assumed to be linear in all variables and to include a constant (intercept) term.[1]

The specification of each equation in the model is presented in Table 5. TSLS and OLS estimates for all age groups of the parameters to each of these equations are presented below in Tables 6-13. Additional equations for female labor force participation and fertility, which include the urban dummy as an explanatory variable, are reported in Appendix C.[2]

In most cases the reasons for including in each equation the variables listed in Table 5 and the particular hypothesis each variable is intended to test are clear from the discussion in Section III. I deal here only with the shortcomings of the final equations, which are mainly caused by inadequacies in the available data.

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[1] Although linearity is obviously an unrealistic assumption, linear equations often do provide a convenient approximation to the true relationships in the range of interest.

[2] For each equation, many different specifications have been explored. In choosing the equations to present in this report, I tried to balance the advantages of including many variables (so as to hold constant the other factors that influence the dependent variable and assess the independent influence of each variable) and the disadvantages (multicollinearity, which makes it difficult to disentangle independent influences of variables, and the loss of degrees of freedom).

Table 5

THE MODEL: A LIST OF THE VARIABLES[a]

For each age group k (k = 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 12+, and 15-49) the following equations will be estimated:

Female labor force participation (k) is estimated as a function of:

- Currently legally married (k)[b]
- Currently consensually married (k)[b]
- Fertility (k)[b]
- Female wage (k)[b]
- Male wage (k)
- Female average schooling (k)
- Urban dummy[c]

Female wage (k) is estimated as a function of:

- Female labor force participation (k)[b]
- Female average schooling (k)
- Urban dummy

Currently legally married (k) is estimated as a function of:

- Female wage (k)[b]
- Male wage
- Male unemployment
- Sex ratio (k)
- Female average schooling (k)
- Male average schooling

Currently consensually married (k) is estimated as a function of:

- Female wage (k)[b]
- Male wage
- Male unemployment
- Sex ratio (k)
- Female average schooling (k)
- Male average schooling

Table 5 (contd.)

Separated (k) is estimated as a function of:

Female wage (k)[b]
Male wage
Female average schooling (k)

Fertility (k) is estimated as a function of:

Currently legally married (k)[b]
Currently consensually married (k)[a]
Child labor force participation[b]
or
Child school attendance[b]
Female wage (k)[b]
Male wage
Infant mortality
Urban dummy[c]

Child labor force participation is estimated as a function of:

Fertility (k)[b]
Female wage (k)[b]
Male wage
Female average schooling (k)

Child school attendance is estimated as a function of:

Fertility (k)[b]
Female wage (k)[b]
Male wage
Female average schooling (k)

Table 5 (contd.)

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[a]Only variables that appear in the following tables of regression equations (in the text or in Appendix C) are listed here. The performance of some variables that are not included here will be mentioned in the text.

These equations are estimated by two-stage least squares and also by ordinary least squares. In the two-stage estimation female average schooling, male average schooling, the male wage, the male unemployment rate, the infant mortality rate, the sex ratio, the urban dummy, the crude death rate, and population density are considered to be exogenous to the model and are treated as instruments in the estimation.

[b]This variable is an endogenous explanatory variable in the two-stage estimation of this equation.

[c]This variable is included in regression equations presented in Appendix C. The urban dummy is included as a correction for anticipated biases in the female wage (see p. 57) and is expected to have the same sign as the coefficient of that variable.

In constructing the urban and rural wage measures, urban and rural wages were assumed to be equal for each industrial sector in each province (see Appendix B). This is undoubtedly an unrealistic assumption, for even in the same industry, wages are probably higher in urban areas of the province than in rural. To adjust for this presumed downward bias in urban wages, which is believed to be more serious for women than for men,[1] the urban dummy has been introduced into all equations and has been included in the female wage equations presented in the text where its coefficients give us an indication of the magnitude of this bias.[2]

Because sufficient data were not available to specify and identify separate supply and demand relationships for the various markets investigated here, for example, the market for female labor services or the marriage market, each estimated equation cannot be interpreted as either a demand or a supply relationship but must be thought of only as a locus of equilibria. For example, the female labor force participation equation includes some factors that primarily affect supply (e.g., marital status and fertility) but others that influence both supply and demand (e.g., the female wage). If the coefficient of the female wage is positive (as it is in the estimates in Tables 7 and C-1), this does not mean that we are estimating a supply equation or even a supply response to wage changes, but rather that in the female wage-female

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[1] Since the industries used here are the (10) United Nations single-digit industries, there will be much variation in the types of work done in any one industry in a province, so that the typical job in a given industry in an urban area may be quite different from the typical job in the same industry in a rural area. Because migration is often rural-to-urban, and women migrants outnumber men migrants by more than 3-2 for persons 14 years of age and older and by nearly 2-1 for persons in the high migration propensity ages, 15-24 (Herrick (1965), p. 73), it appears that the benefits of migration, which include wage differences, are greater for women than for men, probably even when the job at destination is in the same industry as the former job at origin.

[2] Female labor force participation and fertility equations that include the urban dummy are presented in Tables C-1, C-2, and C-3. The versions of the other equations that included the urban dummy as an explanatory variable are not presented because its addition did not substantially change those equations.

labor force participation rate plane, the demand schedule is shifting relatively more than the supply schedule.[1]

Only current (1960) levels of variables (with the exception of the infant mortality rate, which is lagged two years) are used in the estimation of the model. As noted in Section III, several of the dependent variables (legal and consensual marriage and fertility) measure stocks that were partly formed in the past, and these are therefore related to previous as well as current levels of the explanatory variables. It is hoped in these cases that the current levels, say, of wages are also representative of those that influenced decisions in the past.

In the child economic activity and schooling equations, the dependent variables refer to all children 12-14 years old or 10 years old, respectively, and not just to the children of women in the various female age groups considered (except for the aggregate cohort of women 12 or older). Child labor force participation and child school attendance equations are estimated for each of the age groups of women because they are needed to close the model. However, differences in the magnitude of estimated coefficients for various cohorts have no particular significance.

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[1] Or it may be that the market is out of equilibrium and we are observing a series of points moving toward equilibrium from or toward the southwest.

V. EMPIRICAL ESTIMATION OF THE MODEL

FEMALE LABOR FORCE PARTICIPATION

Estimated female labor force participation equations are presented in Table 6 and Appendix Table C-1. The expected inverse relationship is observed between female labor force participation rates and the prevalence of legal marriage, a relationship that becomes increasingly strong as older women are considered. Consensual marriage, except for the youngest age group, also exerts a negative influence on female economic activity and again one that is much stronger for women over 25 years of age. In fact, when the simultaneity of the system is taken into account (the equation is estimated using TSLS) marriage of either form exerts very little independent effect on the labor force participation of women under 25 years of age, except for a positive and fairly significant relationship betw the percent of women 15-19 years old who are consensually married and the labor force participation rate of this age group.

Since the legal marriage variable is much larger in absolute magnitude and exhibits greater variability than the consensual marriage measure (see Table 4), elasticities defined at the means and beta coefficients,[1] which take these differences into account, are more appropriate than the magnitudes of estimated coefficients as measures of the relative responsiveness of participation to the two forms of marriage.[2] Since for most age groups the absolute magnitude

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[1]The beta coefficient, which is defined as

$$\beta = b \frac{\sigma x}{\sigma y}$$

where b = regression coefficient of independent variable x
σx = standard deviation of x
σy = standard deviation of the dependent variable y,
expresses the effect on y of a "typical" or "equally likely" change in x. The beta coefficient is described by Goldberger (1966, pp. 197-198).

[2]The magnitudes of the coefficients show absolute changes in the dependent variables, and elasticities and beta coefficients indicate relative changes. Although the former are relevant for the design of policy,

Table 6

AGE-SPECIFIC FEMALE LABOR FORCE PARTICIPATION EQUATIONS--I[a]

(dependent variable is age-specific female labor force participation rate)

Age Group and Method of Estimation	Constant	Currently Legally Married[e]	Currently Consensually Married[e]	Fertility[e]	Female Wage[e]	Male Wage	Female Average Schooling	Significance of Equation F(6,3)	R^2
15-19									
TSLS[b]	22.8	-.391	5.21	-.174	30.3	-8.84	2.48	11.9**	
	(2.42)	(-0.42)	(1.85)	(-2.31)	(2.56)	(-1.65)	(1.46)		
OLS[c]	14.2	-.880	-.581	-.0492	24.0	-7.78	3.32		.797
	(2.44)	(-1.63)	(-0.45)	(-1.24)	(3.08)	(-2.09)	(2.95)		
20-24									
TSLS	50.5	-.261	-.368	-.0355	12.4	-3.55	3.57	11.2**	
	(4.09)	(-0.62)	(-0.34)	(-2.28)	(0.95)	(-0.61)	(1.87)		
OLS	36.5	-.494	-1.30	-.0138	10.7	-4.83	5.24		.904
	(4.28)	(-1.99)	(-2.85)	(-1.51)	(1.56)	(-1.11)	(3.91)		
25-29									
TSLS	85.2	-.698	-2.02	-.0128	18.3	.109	.946	26.3***	
	(4.74)	(-2.73)	(-2.91)	(-2.23)	(2.11)	(0.03)	(0.41)		
OLS	54.3	-.688	-1.35	-.00379	9.42	-2.94	5.06		.950
	(6.17)	(-4.44)	(-5.06)	(-1.25)	(2.28)	(-1.12)	(4.75)		
30-34									
TSLS	83.7	-.810	-1.91	-.00485	15.5	-3.78	2.41	32.9***	
	(5.90)	(-4.20)	(-4.34)	(-1.152)	(2.71)	(-1.18)	(1.56)		
OLS	66.9	-.863	-1.53	-.000516	9.16	-4.15	4.83		.955
	(7.72)	(-6.72)	(-7.06)	(-0.31)	(3.06)	(-1.92)	(5.69)		
35-39									
TSLS	106.	-.983	-1.83	-.00465	20.0	-4.12	.176	84.5***	
	(5.21)	(-4.64)	(-3.61)	(-1.55)	(3.12)	(-1.12)	(0.09)		
OLS	79.1	-.894	-1.36	-.00130	8.57	-3.15	3.22		.952
	(7.72)	(-6.87)	(-6.60)	(-0.96)	(2.94)	(-1.42)	(3.53)		
40-44									
TSLS	93.7	-.883	-1.37	-.00370	19.0	-5.31	.371	85.6***	
	(6.09)	(-4.37)	(-3.50)	(-1.64)	(2.97)	(-1.63)	(0.27)		
OLS	84.8	-.893	-1.51	-.00167	9.88	-1.32	1.49		.950
	(8.52)	(-7.23)	(-6.98)	(-1.54)	(3.41)	(-0.59)	(1.76)		

Table 6 - continued

Age Group and Method of Estimation	Constant	Currently Legally Married[e]	Currently Consensually Married[e]	Fertility[e]	Female Wage[e]	Male Wage	Female Average Schooling	Significance of Equation F(6,3)	R^2
45-49									
TSLS	91.6	-.738	-1.01	-.00480	13.1	-5.63	-.620	201.***	
	(5.53)	(-4.46)	(-2.56)	(-2.04)	(2.04)	(-1.94)	(-0.43)		
OLS	76.0	-.778	-1.27	-.00147	6.97	-2.64	1.26		.951
	(8.18)	(-7.61)	(-6.56)	(-1.45)	(2.58)	(-1.36)	(1.53)		
12+									
TSLS	71.9	-5.09	-1.05	-.0144	12.0	-5.00	.577	83.8***	
	(6.72)	(-2.33)	(-1.94)	(-3.59)	(1.70)	(-1.92)	(0.49)		
OLS	54.9	-.629	-1.42	-.00706	10.7	-3.73	2.14		.949
	(7.80)	(-5.03)	(-5.66)	(-3.47)	(3.18)	(-1.95)	(2.84)		
15-49-A[d]									
TSLS	80.8	-.703	-1.90	-.0454	38.8	-6.54	-.997	26.8***	
	(4.17)	(-2.68)	(-2.65)	(-1.93)	(3.43)	(-1.70)	(-0.32)		
OLS	50.4	-.796	-1.59	-.00849	16.2	-4.57	4.07		.945
	(5.82)	(-5.66)	(-5.73)	(-0.93)	(3.74)	(-1.87)	(3.41)		
15-49-B[d]									
TSLS	90.6	-.662	-1.84	-.0559	27.3	-4.49	-1.79	33.6***	
	(5.11)	(-3.03)	(-3.08)	(-2.69)	(3.52)	(-1.32)	(-0.69)		
OLS	61.6	-.698	-1.51	-.0250	14.9	-4.05	2.48		.951
	(6.76)	(-5.36)	(-5.72)	(-2.55)	(3.76)	(-1.75)	(2.04)		

[a] Definitions of the variables are given in Table 3 and their means and standard deviations in Table 4.

In the two-stage least squares (TSLS) estimation of this model, female labor force participation, the female wage, currently legally married, currently consensually married, separated, fertility, child labor force participation, and child school attendance are endogenous. These variables are noted with an "e". All other variables in the model (female average schooling, male average schooling, the male wage, the male unemployment rate, infant mortality, the sex ratio, the urban dummy, the crude death rate, and population density) are considered to be exogenous to the model and are treated as instruments in the two-stage estimation.

t-statistics are given in parentheses beneath regression coefficients; these are not adjusted according to Dhrymes' suggestion. For the two-stage least squares equations the t-test is only an asymptotic test of significance, as is the F-test. The F-statistic used here is that described in P. J. Dhrymes, "Alternative Asymptotic Aspects of 2SLS and 3SLS Estimated Parameters," The Review of Economic Studies, Vol. 36, No. 2, April 1969, pp. 213-226. The significance levels for the F-test are denoted by *(10 percent), **(5 percent), and ***(1 percent).

[b] TSLS = Two-stage least squares estimates.

[c] OLS = Ordinary least squares estimates.

[d] The fertility variable is number of children 0-4 years old per 1,000 women 15-49 years old in set A of the 15-49 age group equations and the number of children 5-9 per 1,000 women 15-49 in set B.

[e] Endogenous variable.

of the elasticity (or beta coefficient) of legal marriage is larger than that of consensual marriage, these measures of responsiveness usually confirm the hypothesis that consensual marriage (though still a deterrent to labor force participation for all but the youngest age group) is more compatible with labor force activities than legal marriage.[1]

The negative coefficients of the fertility variables indicate that the child-care responsibility (substitution) effect of children predominates over the consumption requirements (income) effect. This is what we would expect since most of the women who have children are currently married. The income effect is much weaker for currently married women than for women who are single, separated, or widowed, because other family income is usually much larger. Very little weight is given to the groups of women whose participation is increased by the presence of children (recall Figs. 3 A-H). The TSLS coefficients of the fertility variable tend to decrease with advancing age of women as expected. For women over 30 an additional child reduces the likelihood that the woman will participate in the labor force by 4.5 percentage points on average. Beta coefficients and elasticities defined

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the latter seem more appropriate for evaluating the validity of the hypotheses implied by theory.

[1]The hypothesis that, other things being equal, consensually married women are more likely to participate in the labor force than women who are currently legally married must be rejected on the basis of the magnitudes of the coefficients of the variables in Table 6. In fact, a t-test of the differences shows the coefficient of consensual marriage to be significantly larger in absolute magnitude for several age-groups. This may be the more relevant finding for those concerned with implications for policymaking.

The percent of women who are separated, divorced, or whose marriages have been annulled (the variable "separated") was also tried in the female labor force participation equation (as an endogenous variable). Its coefficient was usually positive, but since it was never significant and the coefficients of other variables usualy less significant when it was included, these results are not reported here The percent of women who are widows, when included as an explanatory exogenous variable, also usually had a positive, but insignificant, coefficient.

at the means reveal a decreasing influence of children prior to age 35, but an increasing influence for the older age groups.[1]

The wage variables always behave as expected for a supply equation -- a positive substitution effect of the female wage and a negative income effect of the male wage.[2] The substitution effect of the female wage is increased in magnitude, though not in significance, when the more appropriate TSLS method of estimation is used, as is the income effect of the male wage in the oldest age groups.

Once the effect of education on the female wage is properly accounted for with the use of TSLS, the independent influence of education of women on their labor force participation is reduced, in both magnitude and significance, though still positive as was hypothesized.

In Appendix Table C-1 the urban dummy was added in the hope that it would adjust for a presumed downward bias in the urban wage. (The female wage equations discussed below confirm this bias.) The dummy

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[1] Responsiveness of age-specific female labor force participation rates to fertility:

Age Group	Elasticity at Means	Beta Coefficient
15-19	-.883	-.746
20-24	-.964	-.529
25-29	-.893	-.413
30-34	-.580	-.272
35-39	-.708	-.389
40-44	-.606	-.386
45-49	-.816	-.592

Note that elimination of the 30-34 and 45-49 values does produce the hypothesized decreasing influence of children with advancing female age.

[2] This relationship must be interpreted as a "quasi-supply" schedule for it is merely a locus of equilibria. The positive relationship between price and quantity here implies that the demand for female labor services schedule is shifting relatively more than the corresponding supply schedule. This is to be expected since most of the other variables in this female labor force participation equation, for example, the two marriage variables and fertility, adjust for shifts in the supply schedule.

has a positive coefficient in all of the TSLS equations.[1] The wage coefficients are larger in absolute magnitude and usually more significant when the urban dummy is added. The greatest increases in the significance of the coefficient of the female wage occur for the two youngest age groups. (In the equations explaining the female wage, these are the age groups for whom the downward bias in the female urban wage is largest.) The coefficients of the male wage are more significant for all age groups when the urban dummy is included, but other variables are in general less significant when the dummy is added. The coefficient of the female schooling variable becomes negative in the TSLS equations, but is never significant at the 10 percent level. When the wages are more properly measured by adjusting with the urban dummy, education appears to exert no independent effect on participation.

One interesting result of adding the urban dummy to these equations occurs in the OLS regressions. When the urban dummy is added to the equation for the 15-19 cohort, the coefficient of the schooling variable becomes negative (it remains positive for all other age groups). Once the urban dummy is added to correct for the bias in wages, a role the education variable probably played in its absence since the urban dummy and female education variable are highly correlated, the education variable can exert its own independent influence of depressing female labor force participation rates in areas where a large proportion of the young women are still in school.[2]

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[1] In addition to (or instead of) indicating a downward bias in measured urban wages, the positive coefficient of the dummy could also (or alternatively) be reflecting greater working opportunities for women in urban areas or the migration to cities of women with a "taste" for work.

[2] In the two-stage estimation, where the indirect effects of education on the other factors that affect female economic activity are taken into account, such a reversal in the sign of the coefficient of the 15-19 education variable does not occur. In fact, the coefficients of the education variables for all age groups are negative, though never significant, in the simultaneous estimation when the urban dummy is included. When the index of female economic opportunities (defined in Table 3) was included in the female labor force participation equation, its coefficient was usually very significant statistically,

FEMALE WAGE

In Table 7 education appears to exert a very strong positive influence on the wage women can earn. Increased educational attainment will shift up the demand schedule for female labor services, for it increases a woman's marginal productivity.

The urban dummy is included in this equation to adjust for a bias that probably exists in the urban wages used here (see page 57). The significant negative coefficient of the urban dummy confirms my belief that urban wages are underestimated by the wage measure. For all women over twelve years of age, the urban wage is underestimated an average of .34 escudos per day, or 50 percent of the average daily wage for all women. The absolute and relative magnitude of this downward bias is greatest for the two youngest age groups (84.8 percent for the 15-19 age groups, 58.3 percent for the 20-24 group) and is fairly constant (around 40 percent) for the rest of the five-year cohorts considered.

The female labor force participation rate usually has a negative coefficient, but it is never significantly different from zero, implying that wages for women are relatively independent of female participation rates.

CURRENT LEGAL AND CONSENSUAL MARRIAGE

Equations for the two forms of marriage are presented in Tables 8 and 9. TSLS estimates indicate a negative (though never statistically significant) effect of the female wage on the prevalence of legal marriage for all the age groups but the youngest.[1] Women with good labor market opportunities tend to postpone or reject legal marriage. Some apparently choose to enter a consensual union, as evidenced by the positive, though never significant, relationship between consensual marriage and the female wage for women between the ages of 20 and 40. The hypothesis that attractive economic

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especially for the youngest age groups, but it tended to purge the other independent variables of their explanatory power. These results are not reported here.

[1]Note that the coefficients of the female wage in the legal marriage equations are always positive in the OLS estimation.

Table 7

AGE-SPECIFIC FEMALE WAGE EQUATIONS[a]

(dependent variable is age-specific female median daily wage in escudos)

Age Group and Method of Estimation	Constant	Female L.F. Participation[e]	Female Average Schooling	Urban Dummy	Significance of Equation F(3,6)	Significance of Equation R^2
15-19						
TSLS	-.204 (-2.48)	.00435 (1.33)	.182 (7.57)	-.470 (-5.38)	6.59**	
OLS	-.204 (-2.51)	.00424 (1.60)	.182 (7.62)	-.469 (-5.54)		.704
20-24						
TSLS	-.719 (-0.84)	-.00158 (-0.51)	.193 (6.77)	-.383 (-3.69)	9.49***	
OLS	-.717 (-0.84)	-.00175 (-0.65)	.193 (6.91)	-.381 (-3.76)		.663
25-29						
TSLS	.0269 (0.32)	-.00348 (-0.83)	.206 (5.58)	-.298 (-3.21)	11.1***	
OLS	.0215 (0.26)	-.00448 (-1.25)	.212 (6.11)	-.291 (-3.18)		.646
30-34						
TSLS	.0549 (0.61)	-.242 (-0.48)	.202 (4.92)	-.313 (-3.07)	9.70***	
OLS	.0421 (0.47)	-.00470 (-1.11)	.214 (5.60)	-.304 (-3.00)		.622

Table 7 - continued

Age Group and Method of Estimation	Constant	Female L.F. Participation[e]	Female Average Schooling	Urban Dummy	Significance of Equation F(3,6)	R^2
35-39						
TSLS	.100	-.00140	.187	-.317	9.49***	
	(1.16)	(-0.03)	(4.26)	(-2.95)		
OLS	.0807	-.00418	.209	-.307		.630
	(0.95)	(-0.90)	(5.23)	(-2.89)		
40-44						
TSLS	.141	.00168	.165	-.289	8.00**	
	(1.66)	(0.29)	(3.63)	(-2.68)		
OLS	.125	-.00192	.185	-.287		.610
	(1.51)	(-0.41)	(4.53)	(-2.68)		
45-49						
TSLS	.129	-.000897	.180	-.295	10.2***	
	(1.74)	(-0.14)	(4.25)	(-2.93)		
OLS	.125	-.00365	.193	-.292		.647
	(1.69)	(-0.73)	(5.15)	(-2.91)		
12+						
TSLS	.0122	-.00396	.213	-.340	13.9***	
	(0.18)	(-0.79)	(6.69)	(-4.10)		
OLS	.0124	-.00378	.213	-.341		.722
	(0.19)	(-0.90)	(7.11)	(-4.15)		
15-49						
TSLS	-.0333	-.00376	.219	-.328	13.2***	
	(-0.45)	(-0.91)	(6.72)	(-3.86)		
OLS	-.0328	-.00358	.218	-.329		.715
	(-0.45)	(-1.03)	(7.10)	(-3.92)		

[a]See notes to Table 6.

Table 8

AGE-SPECIFIC FEMALE MARITAL STATUS EQUATIONS--CURRENT LEGAL MARRIAGE[a]

(dependent variable is percent of women of specified age who are currently legally married)

Age Group and Method of Estimation	Constant	Female Wage[c]	Male Wage	Male Unemployment	Sex Ratio	Female Average Schooling	Male Average Schooling	Significance of Equation F(6,3)	R^2
15-19									
TSLS	-3.50	4.86	2.04	-.239	.0823	1.02	-.806	59.9***	
	(-1.53)	(1.78)	(1.70)	(-1.69)	(4.73)	(2.01)	(-1.50)		
OLS	-3.33	6.75	1.67	-.205	.0780	1.07	-.989		.788
	(-1.47)	(3.18)	(1.46)	(-1.18)	(4.64)	(2.13)	(-1.96)		
20-24									
TSLS	11.2	-5.15	8.62	-.778	.216	4.43	-3.13	9.38**	
	(1.53)	(-0.47)	(1.95)	(-1.36)	(3.56)	(2.70)	(-1.82)		
OLS	13.5	7.01	5.46	-.562	.179	4.40	-4.06		.709
	(2.02)	(1.40)	(1.61)	(-1.09)	(3.60)	(2.86)	(-2.80)		
25-29									
TSLS	46.1	-13.7	10.8	-1.20	.139	7.47	-5.02	6.46*	
	(7.38)	(-1.26)	(2.31)	(-2.04)	(2.88)	(2.74)	(-2.17)		
OLS	44.8	4.46	6.07	-.776	.112	6.82	-5.77		.595
	(8.37)	(0.95)	(1.77)	(-1.66)	(2.82)	(2.92)	(-2.94)		
30-34									
TSLS	59.3	-15.2	7.08	-1.03	.125	5.62	-3.17	3.75	
	(9.49)	(-1.44)	(1.50)	(-1.76)	(2.55)	(2.14)	(-1.30)		
OLS	58.6	3.46	2.27	-.580	.0917	5.76	-4.78		.493
	(11.3)	(0.83)	(0.68)	(-1.30)	(2.39)	(2.65)	(-2.51)		
35-39									
TSLS	67.6	-10.4	5.59	-1.16	.0897	3.77	-2.30	4.32	
	(12.6)	(-1.17)	(1.38)	(-2.35)	(2.13)	(1.70)	(-1.04)		
OLS	67.4	3.32	2.05	-.861	.0647	4.32	-3.92		.573
	(14.4)	(0.39)	(0.67)	(-2.14)	(1.86)	(2.26)	(-2.22)		
40-44									
TSLS	68.4	-11.4	4.95	-1.01	.0901	2.46	-1.54	4.33	
	(12.8)	(-1.17)	(1.14)	(-2.04)	(2.20)	(1.08)	(-0.66)		
OLS	68.2	3.05	.824	-.713	.0642	3.31	-3.38		.624
	(14.6)	(0.78)	(0.27)	(-1.77)	(1.94)	(1.71)	(-1.87)		

Table 8 - continued

Age Group and Method of Estimation	Constant	Female Wage[a]	Male Wage	Male Unemployment	Sex Ratio	Female Average Schooling	Male Average Schooling	Significance of Equation F(6,3)	R^2
45-49									
TSLS	73.2	-9.04	4.01	-1.36	.0567	1.75	-1.42	9.09**	
	(16.0)	(-0.94)	(1.04)	(-2.97)	(1.61)	(0.82)	(-0.64)		
OLS	73.2	4.26	.564	-1.09	.0334	2.25	-2.94		.773
	(18.1)	(1.12)	(0.20)	(-2.92)	(1.19)	(1.21)	(-1.69)		
12+									
TSLS	34.7	-4.67	7.07	-1.28	.0870	4.67	-2.83	15.0**	
	(8.10)	(-0.73)	(2.58)	(-3.72)	(2.57)	(2.92)	(-2.02)		
OLS	35.4	4.14	4.67	-1.05	.0679	4.27	-3.22		.693
	(9.02)	(1.31)	(2.19)	(-3.63)	(2.32)	(2.94)	(-2.52)		
15-49									
TSLS	35.6	-5.43	8.21	-1.32	.110	6.43	-4.01	9.63**	
	(7.17)	(-0.69)	(2.41)	(-3.11)	(2.87)	(3.26)	(-2.38)		
OLS	36.0	5.30	5.28	-1.06	.0895	5.97	-4.50		.675
	(7.88)	(1.35)	(1.98)	(-2.92)	(2.69)	(3.32)	(-2.94)		

[a] See notes to Table 6.

Table 9

AGE-SPECIFIC FEMALE MARITAL STATUS EQUATIONS--CURRENT CONSENSUAL MARRIAGE[a]

(dependent variable is percent of women in specified age group who are currently consensually married)

Age Group and Method of Estimation	Constant	Female Wage[e]	Male Wage	Male Unemployment	Sex Ratio	Female Average Schooling	Male Average Schooling	Significance of Education F(6,3)	Significance of Education R^2
15-19									
TSLS	-.182	-2.17	.288	.0997	.0228	-.950	.794	2.25	
	(-0.16)	(-1.60)	(0.49)	(1.13)	(2.64)	(-3.78)	(2.98)		
OLS	-.0402	-.636	-.0149	.127	.0193	-.909	.644		.425
	(-0.03)	(-0.62)	(-0.03)	(1.50)	(2.35)	(-3.72)	(2.61)		
20-24									
TSLS	1.42	.895	.366	.393	.0384	-2.02	.903	1.53	
	(0.39)	(0.16)	(0.17)	(1.37)	(1.27)	(-2.46)	(1.05)		
OLS	1.63	2.00	.0779	.412	.0351	-2.02	.818		.341
	(0.46)	(0.75)	(0.04)	(1.51)	(1.33)	(-2.47)	(1.06)		
25-29									
TSLS	7.29	5.41	.343	.292	.00497	-4.28	1.95	1.66	
	(2.29)	(0.98)	(0.14)	(0.98)	(0.20)	(-3.08)	(1.66)		
OLS	7.42	3.55	.829	.249	.00775	-4.21	2.02		.357
	(2.36)	(1.28)	(0.41)	(0.90)	(0.33)	(-3.07)	(1.76)		
30-34									
TSLS	4.66	2.63	1.37	.272	.0205	-3.07	1.35	0.80	
	(1.51)	(0.50)	(0.59)	(0.95)	(0.84)	(-2.37)	(1.12)		
OLS	4.67	2.62	1.46	.264	.0212	-3.07	1.38		.275
	(1.52)	(0.91)	(0.73)	(0.99)	(0.92)	(-2.37)	(1.22)		
35-39									
TSLS	3.83	2.24	1.63	.339	.0268	-3.64	1.82	1.33	
	(1.22)	(0.43)	(0.68)	(1.17)	(1.08)	(-2.77)	(1.39)		
OLS	3.84	1.73	1.76	.328	.0278	-3.66	1.88		.320
	(1.22)	(0.69)	(0.85)	(1.20)	(1.19)	(-2.83)	(1.58)		
40-44									
TSLS	1.05	-.949	2.01	.355	.0480	-2.95	1.65	1.44	
	(0.38)	(-0.19)	(0.90)	(1.39)	(2.27)	(-2.51)	(1.36)		
OLS	1.03	.873	1.49	.392	.0447	-2.84	1.42		.390
	(0.37)	(0.38)	(0.82)	(1.66)	(2.30)	(-2.50)	(1.33)		

Table 9 – continued

Age Group and Method of Estimation	Constant	Female Wage[e]	Male Wage	Male Unemployment	Sex Ratio	Female Average Schooling	Male Average Schooling	Significance of Education F(6,3)	Significance of Education R^2
45-49									
TSLS	-.785	-3.90	2.51	.262	.0587	-2.62	1.85	3.16	
	(-0.35)	(-0.81)	(1.31)	(1.15)	(3.36)	(-2.47)	(1.69)		
OLS	-.776	-.796	1.71	.325	.0533	-2.50	1.49		.442
	(-0.35)	(-0.38)	(1.12)	(1.58)	(3.46)	(-2.45)	(1.56)		
12+									
TSLS	-1.21	1.59	.112	.299	.0449	-2.33	1.38	2.18	
	(-0.50)	(0.44)	(0.07)	(1.56)	(2.35)	(-2.59)	(1.74)		
OLS	-1.20	1.64	.0977	.300	.0448	-2.33	1.38		.372
	(-0.50)	(0.85)	(0.08)	(1.69)	(2.49)	(-2.62)	(1.76)		
15-49									
TSLS	1.55	2.20	.285	.308	.0357	-2.96	1.60	1.50	
	(0.56)	(0.50)	(0.15)	(1.30)	(1.69)	(-2.70)	(1.71)		
OLS	1.56	2.33	.251	.311	.0355	-2.97	1.60		.346
	(0.56)	(0.98)	(0.16)	(1.43)	(1.77)	(-2.73)	(1.73)		

[a]See notes to Table 6.

opportunities have a greater inhibiting influence on legal than on consensual marriage is supported for all but the 15-19 age group.

The income effect of the male wage is positive for both forms of marriage, though much larger and more significant for the legal marriage equations as was anticipated.[1] Consensual marriage is not a low income phenomenon (negatively related to income) as it is sometimes thought to be, but rather appears to be nearly independent of the level of male incomes in the younger age groups. In the older age groups, the positive income effect on consensual marriage is strengthened. The income effect of the male wage on legal marriage is strongest in the younger age groups, the ones most likly to be marrying.[2]

The form of marriage chosen is very sensitive to the employment status of men. Unemployment tends to discourage legal marriage and encourage a shift to consensual marriage.[3]

Other things being equal, the availability of men, as measured by the sex ratio, increases the proportions of women who are legally or consensually married. For legal marriage the sex ratio exerts its most significant effect on the marriage behavior of the youngest age groups of women. When women are relatively scarce, and the competition among men for brides is greater, more women marry legally at a younger age. For consensual marriage, the availability of men has its greatest positive influence on the very youngest and very oldest groups of

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[1]Thus, of couples deciding to marry the percent choosing the legal form is positively related to average income of males.
Note that the income effect of the male wage on legal marriage is strengthened by the use of TSLS.

[2]For the older age groups the current level of male wages may not be representative of the past levels that influenced the marriage decisions of these women.

[3]When the urban dummy was added to these equations, the coefficients of the male unemployment measure increased in absolute magnitud and significance and the coefficient of the urban dummy had the opposite sign of the unemployment coefficient. This may be because of a downward bias in <u>measured</u> rural unemployment rates.

women. The sex ratio has a greater absolute effect on legal marriage but a greater relative effect on consensual marriage.

An increase in female education induces women to shift out of consensual unions and into legal unions. Educated women are more apt to be informed of and to appreciate the legal and social advantages of a legal union. Also, female educational attainment may be a proxy for the permanent income of women, which will be positively related to their propensity to marry legally if legal marriage is a normal good

The behavior of the male education variable is curious -- an increase in male education has a negative effect on legal marriage and a positive effect on consensual marriage. Perhaps educated men tend to postpone legal marriage while they are receiving their education.[1] An alternative explanation is that the male education variable is negatively related to the average age of men (25 or older) because of secular trends of more education over time and that younger men are less likely to be legally married (and more likely to be consensually married) than older men.[2]

On balance, attractive economic opportunities for women will decrease the percentage of women who are currently married (either legally or consensually), except for the youngest age group, whereas high wages and low levels of unemployment for males and increased availability of men will increase the percentage of women married. Increases in female educational attainment will cause shifts out of

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[1] Or could it be that educated men are more aware of and are discouraged by the legal and financial responsibilities that accompany legal marriage?

[2] In regressions not reported here, the percent of births that are illegitimate was very significant (as an endogenous explanatory variable) in explaining the variation in the incidence of consensual marriage (see footnote 1 on page 27). However, this is partly true by definition because children born to consensually married parents are considered to be illegitimate. However, even the percent of single women who have children, a measure of illegitimacy that does not have this problem, is statistically significant (t-ratios over 2.0) in explaining the percentage of women who are consensually married. It was an exogenous explanatory variable.

consensual unions into legal marriage, with the net result being an increase in marriage (except for the two oldest age groups), and increases in male schooling will have the opposite effect.[1]

SEPARATION

Our equations explain the variation in the percent of women who are separated (which includes women who are divorced and whose marriages have been annulled) extremely well, accounting for over 90 percent of the variance for all but the two youngest groups in the OLS equations in Table 10.[2] All coefficients have the expected signs, and all are usually quite significant. There is a positive income and substitution effect of the female wage and a negative income effect of the male wage, indicating that spouses are more likely to terminate a marriage the more capable the woman and the less capable the man financially.[3] Both wage effects are increased in magnitude (and often significance) by the use of TSLS.

The female schooling variable is usually very significant and its importance is diminished very little even when its influence on the female wage is accounted for by the use of TSLS estimation. The positive sign of the schooling variable is consistent with the evidence from the United States presented in Section III showing separation rates to be higher among educated women.[4]

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[1]Nerlove and Schultz (1970) use adolescent schooling, the percent of children (both males and females) 14-17 years of age in school, as the measure of education in their marriage equations for Puerto Rico and find it, like our male education variable, to have a negative influence on legal marriage and a positive influence on consensual marriage, with a net negative effect on marriage in general.

[2]The reader should be reminded, however, that I am estimating the percent of women who classify themselves as separated -- a group likely not only to be smaller than that of women who actually are separated, but also to behave differently as well.

[3]Notice that the same factors that decrease the propensity of a woman to enter a legal marital relationship -- a high female wage and a low male wage -- also increase the likelihood that the marriage will not last.

[4]It is also possible that educated women are more likely to admit to the census taker that they are separated. When the male education

Table 10

AGE-SPECIFIC FEMALE MARITAL STATUS EQUATIONS--SEPARATION[a]

(dependent variable is percent of women in specified age group whose marriages have been annulled or who are separated or divorced)

Age Group and Method of Estimation	Constant	Female Wage[e]	Male Wage	Female Average Schooling	Significance of Equation F(3,6)	R^2
15-19						
TSLS	.0973	.396	-.0492	.0154	37.1***	
	(-2.86)	(4.20)	(-1.08)	(1.67)		
OLS	-.0720	.282	-.0151	.0158		.593
	(-2.28)	(3.56)	(-0.36)	(1.75)		
20-24						
TSLS	-.715	1.58	-.269	.157	46.7***	
	(-5.52)	(4.45)	(-1.44)	(4.62)		
OLS	-.606	1.16	-.120	.159		.848
	(-5.74)	(5.14)	(-0.77)	(4.83)		
25-29						
TSLS	-1.43	1.85	-.262	.474	53.4***	
	(-6.89)	(3.35)	(-1.03)	(8.23)		
OLS	-1.28	1.33	-.115	.486		.921
	(-7.98)	(4.11)	(-0.53)	(8.81)		
30-34						
TSLS	-2.43	3.16	-1.02	.832	49.6***	
	(-7.55)	(3.70)	(-2.38)	(8.85)		
OLS	-1.99	1.59	-.537	.872		.927
	(-8.76)	(3.58)	(-1.64)	(10.6)		
35-39						
TSLS	-2.85	4.03	-1.86	1.15	54.3***	
	(-7.89)	(3.99)	(-3.53)	(10.3)		
OLS	-2.44	2.47	-1.36	1.19		.934
	(-9.20)	(4.54)	(-3.23)	(11.9)		

Table 10 - continued

Age Group and Method of Estimation	Constant	Female Wage[e]	Male Wage	Female Average Schooling	Significance of Equation F(3,6)	R^2
40-44						
TSLS	-3.49 (-6.84)	5.60 (3.88)	-2.35 (-3.09)	1.27 (8.66)	44.4***	
OLS	-2.79 (-7.94)	3.03 (4.08)	-1.45 (-2.55)	1.32 (10.2)		.916
45-49						
TSLS	-2.78 (-5.82)	4.05 (2.87)	-1.36 (-1.95)	1.20 (8.53)	56.0***	
OLS	-2.31 (-6.66)	2.30 (2.98)	-.808 (-1.44)	1.24 (9.55)		.916
12+						
TSLS	-1.77 (-8.35)	3.20 (4.91)	-1.18 (-3.70)	.657 (9.54)	59.0***	
OLS	-1.49 (-9.10)	2.01 (5.09)	-.823 (-3.18)	.686 (11.1)		.932
15-49						
TSLS	-2.09 (-9.62)	3.34 (5.13)	-1.03 (-3.28)	.639 (9.24)	65.4***	
OLS	-1.81 (-10.7)	2.13 (5.45)	-.665 (-2.64)	.668 (10.8)		.936

[a]See notes to Table 6.

FERTILITY

In Tables 11 and 12 the legal and consensual marriage variables, measures of past and present exposure to the risk of pregnancy, have the positive coefficients anticipated.[1] Because of legal and social benefits to which only children born to legally married parents are entitled, legally married couples may be expected to desire more children than consensually married couples, other things being equal. Less frequent exposure to the risk of pregnancy was hypothesized also to reduce the number of children born to a consensually married woman Although the regression coefficients themselves often do not support these hypotheses,[2] adjusting for the rather large difference in the magnitudes and variability of the two marriage variables by considering

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variable was included in the separation equation, it usually had a negative (though never significant) coefficient, also consistent with the United States evidence.

[1]The percent of women who are separated or divorced, or whose marriages have been annulled, which is a measure of past exposure to the risk of pregnancy, was included in regressions that are not reported here as an endogenous explanatory variable. Its coefficient was never significant and was often negative. A negative coefficient implies the separated women have fewer children than single women. (Since all mutually exclusive marital status variables always add up to 100, the coefficient of any one of these must be interpreted as the incremental increase (or decrease) in the dependent variable for a percentage point increase in that marital status variable when there is, at the same time, a percentage point decrease in the number of women in the omitted marital status group(s). All other included marital statuses are being held constant.) Although this is possible, since couples are more likely to separate when they have no children, it seems unlikely. When the urban dummy was also added to the equation, the coefficient of the percent of women separated usually was positive, and was often larger than those of the other two marriage variables -- also a very unlikely possibility. The coefficient of the percent of women who are widows (an exogenous variable) also behaved erratically and was never significant. These puzzling results may be due to spurious correlations in the data.

[2]Actually the hypotheses about fertility refer to desired number of children, and the data are on actual fertility. Since I do not hold constant for birth control knowledge and practice, the difference between desired and actual fertility may vary over the sample under consideration and could bias some of the empirical results.

In some countries, in Puerto Rico (Stycos, 1968, Ch. 13) for example, the age-specific fertility of consensually married women does exceed that of legally married women.

Table 11

AGE-SPECIFIC FERTILITY EQUATIONS--I[a]

(dependent variable is children ever born per 1,000 women of specified age)

Age Group and Method of Estimation	Constant	Currently Legally Married[e]	Currently Consensually Married[e]	Child L.F. Participation[e]	Female Wage[e]	Male Wage	Infant Mortality	Significance of Equation F(6,3)	R^2
15-19									
TSLS	18.9	14.0	29.2	-3.63	15.7	-43.9	.194	5.08	
	(0.40)	(4.14)	(4.00)	(-0.93)	(0.30)	(-1.34)	(1.06)		
OLS	-3.36	11.0	20.3	1.40	-22.5	-1.65	.152		.828
	(-0.10)	(6.76)	(5.12)	(0.87)	(-0.64)	(-0.11)	(1.04)		
20-24									
TSLS	-224.	25.5	42.5	2.12	-223.	-25.7	1.13	7.12*	
	(1.16)	(5.04)	(3.33)	(0.14)	(-0.93)	(-0.18)	(1.35)		
OLS	-302.	24.5	26.9	4.73	-55.3	-66.3	1.77		.868
	(-2.03)	(8.41)	(4.13)	(0.62)	(-0.45)	(-0.91)	(2.77)		
25-29									
TSLS	-1187.	42.0	52.2	26.0	-351.	-18.6	3.50	5.94*	
	(-2.71)	(4.28)	(2.83)	(0.95)	(-0.96)	(-0.07)	(2.72)		
OLS	-1114.	41.4	45.2	23.2	-306.	-60.9	3.67		.865
	(-3.25)	(7.23)	(4.14)	(1.68)	(-1.50)	(-0.45)	(3.17)		
30-34									
TSLS	-1253.	38.0	55.5	88.8	-780.	276.	6.53	7.87*	
	(-1.24)	(2.14)	(1.96)	(2.19)	(-1.37)	(0.67)	(3.24)		
OLS	-1890.	54.8	57.3	42.0	-401.	-177.	6.59		.874
	(-2.97)	(5.63)	(3.41)	(2.11)	(-1.49)	(-0.90)	(3.86)		
35-39									
TSLS	-1325.	43.3	80.5	109.	-1211.	240.	8.88	13.5**	
	(-0.78)	(1.49)	(2.36)	(1.80)	(-1.67)	(0.44)	(3.41)		
OLS	-2683.	71.4	73.1	44.1	-598.	-356.	9.49		.908
	(-3.00)	(5.63)	(3.87)	(1.81)	(-1.87)	(-1.48)	(4.52)		
40-44									
TSLS	-1003.	47.1	101.	120.	-1839.	277.	8.61	16.0**	
	(-0.45)	(1.24)	(2.41)	(1.56)	(-1.78)	(0.39)	(2.51)		
OLS	-2514.	77.4	94.2	34.8	-546.	-663.	9.64		.903
	(-2.33)	(5.09)	(3.84)	(1.19)	(-1.33)	(-2.21)	(3.64)		

Table 11 - continued

Age Group and Method of Estimation	Constant	Currently Legally Married[e]	Currently Consensually Married[e]	Child L.F. Participation[e]	Female Wage[e]	Male Wage	Infant Mortality	Significance of Equation F(6,3)	R^2
45-49									
TSLS	-209.	33.3	148.	116.	-1881.	213.	10.0	26.6***	
	(-0.08)	(0.74)	(2.82)	(1.34)	(-1.68)	(0.34)	(2.67)		
OLS	-2620.	78.8	102.	18.3	-767.	-470.	12.0		.919
	(2.46)	(5.50)	(4.06)	(0.65)	(-1.86)	(-1.60)	(4.68)		
12+									
TSLS	-41.6	47.7	67.8	24.6	-1090.	-8.65	3.54	10.2**	
	(-0.06)	(2.42)	(2.29)	(0.69)	(-2.36)	(-0.03)	(2.09)		
OLS	-172.	46.5	48.6	17.9	-501.	-248.	4.76		.875
	(-0.40)	(4.89)	(2.86)	(1.17)	(-2.01)	(-1.64)	(3.64)		
15-49-A									
TSLS	-249.	6.97	19.3	31.4	-30.7	73.7	1.35	8.24*	
	(-1.27)	(1.35)	(2.24)	(2.62)	(-0.19)	(0.66)	(2.45)		
OLS	-272.	11.7	16.8	16.2	2.26	-46.3	1.46		.871
	(-2.06)	(4.40)	(3.52)	(3.09)	(0.03)	(-0.92)	(3.43)		
15-49-B									
TSLS	-109.	6.60	21.0	28.4	-286.	98.6	1.12	9.38**	
	(-0.55)	(1.27)	(2.43)	(2.36)	(-1.80)	(0.88)	(2.03)		
OLS	-205.	11.3	18.4	12.8	-125.	-61.9	1.48		.896
	(-1.64)	(4.49)	(4.05)	(2.58)	(-1.59)	(-1.29)	(3.67)		

[e] See notes to Table 6.

Table 12

AGE-SPECIFIC FERTILITY EQUATIONS--II[a]

(dependent variable is children ever born per 1,000 women of specified age)

Age Group and Method of Estimation	Constant	Currently Legally Married[e]	Currently Consensually Married[e]	Child School Attendance[e]	Female Wage[e]	Male Wage	Infant Mortality	Significance of Equation F(6,3)	R^2
15-19									
TSLS	16.9	11.1	25.7	-.228	3.22	-12.6	.175	4.78	
	(0.15)	(5.25)	(2.90)	(-0.22)	(0.07)	(-0.57)	(1.04)		
OLS	42.6	11.5	19.2	-.356	-2.48	-6.13	.142		.826
	(0.69)	(7.87)	(4.00)	(-0.59)	(-0.70)	(-0.43)	(0.97)		
20-24									
TSLS	173.	24.2	34.5	-3.80	-262.	22.8	1.15	7.49*	
	(0.36)	(6.87)	(2.23)	(-0.88)	(-1.08)	(0.21)	(1.38)		
OLS	-71.9	24.6	24.2	-2.10	-58.0	-69.7	1.76		.869
	(-0.25)	(9.57)	(3.03)	(-0.76)	(-0.47)	(-1.09)	(2.78)		
25-29									
TSLS	156.	42.4	37.5	-11.5	-481.	-7.39	3.27	6.23*	
	(0.13)	(5.42)	(1.54)	(-1.30)	(-1.19)	(-0.03)	(2.52)		
OLS	-458.	44.1	42.1	-5.77	-330.	-140.	3.44		.860
	(-0.67)	(8.03)	(3.04)	(-1.07)	(-1.60)	(-1.14)	(2.95)		
30-34									
TSLS	1833.	48.3	29.9	-29.4	-1024.	153.	5.50	8.60**	
	(0.93)	(3.48)	(0.88)	(-2.40)	(-1.66)	(0.44)	(2.69)		
OLS	-522.	59.7	49.1	-12.9	-449.	-273.	6.15		.870
	(-0.51)	(6.62)	(2.46)	(-1.74)	(-1.64)	(-1.51)	(3.61)		
35-39									
TSLS	2863.	53.0	42.5	-38.1	-1589.	170.	7.65	14.4**	
	(0.79)	(2.14)	(0.89)	(-1.85)	(-1.84)	(0.33)	(2.72)		
OLS	-1759.	78.6	69.2	-9.76	-617.	-504.	9.06		.903
	(1.15)	(6.42)	(2.92)	(-1.02)	(-1.88)	(-2.21)	(4.25)		
40-44									
TSLS	3093.	61.6	65.1	-39.6	-2273.	221.	7.30	16.8**	
	(0.70)	(1.98)	(1.24)	(-1.58)	(-1.84)	(0.32)	(1.98)		
OLS	-2173.	85.0	95.7	-4.47	-557.	-814.	9.19		.900
	(-1.26)	(5.92)	(3.23)	(-0.40)	(-1.34)	(-2.83)	(3.46)		

Table 12 - continued

ge Group and Method of stimation	Constant	Currently Legally Married[e]	Currently Consensually Married[e]	Child School Attendance[e]	Female Wage[e]	Male Wage	Infant Mortality	Significance of Equation F(6,3)	R^2
45-49									
TSLS	4406.	42.7	108.	-41.0	-2466.	260.	8.38	30.3***	
	(0.85)	(1.15)	(1.87)	(-1.49)	(-1.82)	(0.41)	(1.97)		
OLS	-2557.	83.1	105.	-1.36	-769.	-548.	11.8		.918
	(-1.49)	(6.11)	(3.55)	(-0.13)	(-1.85)	(-1.32)	(4.61)		
12+									
TSLS	962.	50.6	53.8	-9.06	-1195.	-17.4	3.29	10.5**	
	(0.60)	(3.44)	(1.47)	(-0.84)	(-2.28)	(-0.06)	(1.78)		
OLS	-414.	54.9	57.2	1.51	-522.	-384.	4.74		.871
	(-0.50)	(6.21)	(2.72)	(0.26)	(-2.06)	(-2.71)	(3.57)		
15-49-A									
TSLS	941.	10.7	5.48	-10.7	-149.	42.7	1.07	10.5**	
	(2.02)	(3.03)	(0.54)	(-3.26)	(-0.91)	(0.49)	(1.96)		
OLS	442.	12.6	8.79	-6.50	-18.1	-61.0	1.37		.876
	(1.73)	(5.41)	(1.52)	(-3.42)	(-0.22)	(-1.35)	(3.28)		
15-49-B									
TSLS	1019.	9.66	7.71	-10.1	-402.	79.1	.847	12.0**	
	(2.06)	(2.58)	(0.72)	(-2.89)	(-2.33)	(0.86)	(1.46)		
OLS	352.	12.1	12.2	-5.07	-141.	-74.7	1.41		.899
	(1.44)	(5.43)	(2.19)	(-2.78)	(-1.82)	(-1.73)	(3.53)		

[a] See notes to Table 6.

elasticities defined at the means and beta coefficients (defined on page 59) nearly always yields the anticipated result.

The behavior of the child labor force participation and child schooling variables (Tables 11 and 12, respectively) support the hypothesis that the costs and benefits of a child do influence the number of children parents desire.[1] These relationships, which are significant for women over 30, indeed the ones most likely to have children in school or at work, are strengthened by TSLS which increases the absolute magnitudes and often the significance of the coefficients of the child economic activity and schooling variables for all but the youngest age groups. The difference between the TSLS and OLS estimates becomes increasingly large as older women are considered.

The female wage, the measure of the opportunity cost of bearing and rearing children, has a negative influence on fertility (for all but the 15-19 age group), an effect that is increased in magnitude by TSLS estimation. The number of children a woman has borne becomes increasingly responsive, with advancing age, to the wage she could earn. The magnitude and significance of the wage coefficients, the elasticities defined at the means, and the beta coefficients all increase with age, indicating that women with good labor market opportunities stop having children earlier in order to return to the labor force.

A positive, though insignificant, income effect of the male wage is observed on the number of children ever born for all but the youngest age groups of women. This supports our hypothesis that children are a normal "good." As mentioned in Section III above, this cannot be interpreted as a "pure" income effect, because the male wage includes a price (time-cost) effect as well, though presumably less than for the female wage. The OLS estimates of the effect of the male wage are always negative and are even significant for some of the older age groups.[2]

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[1]The child economic activity and schooling variables do not appear together in the fertility equations because they are highly correlated (negatively).

[2]Nerlove and Schultz (1970) also found a similar reversal in the sign of their income coefficient when using simultaneous equations

The infant mortality rate always has the hypothesized positive sign and is significant for all but the two youngest age groups. The regression coefficients, elasticities at means, and beta coefficients all increase with age as was anticipated.[1]

The equations in Tables 11 and 12 explain the variation in fertility very well for the older age groups. In the younger age groups the prevalence of marriage, regardless of its form, is the primary explanation for the variation in fertility. There is some response to the time costs of children as measured by the female wage, but very little to the costs or benefits associated with child schooling or economic activity. It is plausible that only in later births would there be adjustments to accommodate a ceiling on desired family size and therefore a fertility response to these economic factors.[2]

The urban dummy is included in the estimates of the fertility equations reported in Tables C-2 and C-3. It has a negative coefficient and is statistically significant for all but the oldest age groups. Its inclusion in the equation increases the absolute magnitude and significance of the coefficients of female and male wages and of

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techniques rather than OLS to estimate their birth rate equation for Puerto Rico.

[1]Note that the infant mortality coefficients are positive and usually significant, even in the equations where proxies for surviving measures of fertility, child-woman ratios, are used as dependent variables. A smaller response of fertility to the infant death rate is observed in the equation where the 5-9 child-woman ratio is used, since it is more of a surviving measure of fertility than the 0-4 child-woman ratio. The fact that the coefficient of the infant mortality variable is usually significant even for the 5-9 child-woman ratio may indicate that parents are overcompensating for child deaths.

[2]However, many of these women are too young to have children old enough to work or attend school. (Recall that the child economic activity variable is the percent of children 12-14 years old in the labor force and that the child schooling measure is the percent of 10-year old children attending school.) It is possible that current levels of child schooling or child economic activity are not representative of the expectations or aspirations these younger parents have for their children.

the infant mortality rate; the coefficient for the male wage is sometimes statistically significant at the 10 percent level (t>1.3).[1] However, when the urban dummy is included, the child economic and schooling coefficients become insignificant and have the anticipated signs only in the older and aggregate age groups.

Female education was also introduced into the fertility equations as a proxy for birth control knowledge and parents' aspirations for their children's education. Its coefficient was always negative, as expected, though never very significant. When the male education variable was used instead, it also had a negative coefficient, and one that was nearly always very significant. However, most other variables were considerably less significant when one of the adult education measures was added.

CHILD LABOR FORCE PARTICIPATION[2]

The strong positive relationship between the economic activity of children and fertility in Table 13, Equation 1, is further evidence for the consumption requirements (income) effect of children, as is the significant negative relationship between the labor force participation of children and the male wage. The lower income per family member, whether it is because there are more persons in the family or because the wage of the family head is low, the more likely parents are to send some of their children to work in the labor force to supplement family income.[3]

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[1]Note that the coefficient of the female wage is now always negative and that of the male wage, with the exception of the equation for the 15-19 age groups in Table C-2, is always positive.

[2]Since the dependent variable, the percent of all children 12-14 years old who are in the labor force, is the same for all age groups, only the equations for the 35-39 age groups of women (who are likely to have children between the ages of 12 and 14) are presented in the text. The equations for the other age groups, needed to close the model for these age groups, are presented in Table C-4. The same is true for the child schooling equations, which are presented in Table 13 for the 35-39 age group of women and in Table C-5 for all other age groups.

[3]Recall that, except for the substitution (child-care) effect of children, these same factors -- a low male wage or a larger family --

Table 13

CHILD LABOR FORCE PARTICIPATION AND SCHOOL ATTENDANCE EQUATIONS[a]

(all age-specific independent variables are for women 35-39)

Dependent Variable, Equation Number, and Method of Estimation	Constant	Fertility[e]	Female Wage[e]	Male Wage	Female Average Schooling	Significance of Equation F	R^2
Child labor force participation (12-14 years Old)							
(1) TSLS	-2.74	.00288	9.67	-6.43		20.5***	
	(-0.63)	(4.02)	(2.46)	(-3.45)			
OLS	2.84	.00220	2.91	-4.84			.768
	(0.92)	(4.07)	(1.45)	(-3.62)			
(2) TSLS	4.97	.00159	9.40	-5.63	-.853	13.8***	
	(0.53)	(1.01)	(2.45)	(-2.80)	(-0.92)		
OLS	9.53	.00109	3.11	-3.56	-.956		.781
	(1.84)	(1.25)	(1.57)	(-2.31)	(-1.60)		
Child school attendance (10 years Old)							
(3) TSLS	133.	-.00972	-37.2	15.2		21.1***	
	(9.47)	(-4.23)	(-2.94)	(2.54)			
OLS	104.	-.00594	-8.78	10.1			.687
	(11.9)	(-3.86)	(-1.53)	(2.66)			
(4) TSLS	72.2	.00394	-35.1	8.94	6.70	43.0***	
	(2.82)	(0.09)	(-3.36)	(1.63)	(2.64)		
OLS	55.4	.00215	-10.3	.777	6.99		.797
	(4.54)	(1.04)	(-2.20)	(0.21)	(4.96)		

[a] See notes to Table 6.

Since children and women may tend to do similar types of work, the female wage may be a proxy for the attractiveness of economic opportunities available to children. If this is so, the positive coefficient of this wage is expressing a substitution effect or supply response by children.

When female education is added to the equation (Equation 2 in Table 13) to control for parents' aspirations for their children's education, its coefficient is negative, as expected, since schooling and labor force participation are often incompatible alternatives for a child. The fertility variable is much less significant, though still positive, when the female education variable is added.

CHILD SCHOOL ATTENDANCE[1]

The negative coefficient of the fertility variable and the positive coefficient of the male wage in Equation 3 in Table 13 indicate that parents are more likely to be able to send their children to school if they have fewer children and if other family income, as measured by the male wage, is adequate. Both can be viewed as income effects on the demand for schooling. However, when female schooling is added to the equation (Equation 4) on the premise that educated mothers desire better educated children, its coefficient is positive as expected and significant, but the fertility variable is no longer statistically significant.[2]

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also increase the likelihood that the mother will participate in the labor force. Because of child care responsibilities, a woman with many children may send some of her children to work rather than enter the labor force herself.

[1]See footnote 2, p. 84.

[2]When the percent of women completing secondary school was used in place of the average schooling measure, the coefficient of the fertility variable was negative and significant and the schooling variable insignificant. As mentioned in Section III, compulsory schooling laws, to the extent they are enforced, or limited schooling facilities would tend to weaken the expected negative relationship between fertility and child schooling. It is probable that this negative relationship is stronger or more likely to exist for older children for whom school attendance is voluntary and the opportunity costs

As mentioned above, the female wage may be a good proxy for the wage children can earn in the labor force. As such, it represents the opportunity cost of sending a child to school and has the expected negative sign.[1]

The factors discussed above primarily affect the demand for schooling. In a very crude attempt to account for supply shifts, population density was included in the child schooling equation in the belief that heavily populated areas are more likely to have schooling facilities than sparsely populated regions, partly because of lower costs of providing educational services. However, the opposite was found to be true. The coefficient of the density variable was negative and significant.[2] Obviously an investigation of the allocation of educational resources is needed for a better understanding of the factors affecting the supply of educational facilities. When the urban dummy was included, it did have a positive sign (as expected) and was significant, indicating that economically more developed regions, rather than just heavily populated regions, are more likely to have schooling facilities. It is also possible that compulsory schooling laws are more rigorously enforced in these urban areas.

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of schooling are higher. Unfortunately, the data on the schooling of older children were not available by the urban-rural breakdown and therefore could not be incorporated into the study.

[1]Recall that many other factors may also affect the relationship between child school attendance and the female wage (see footnote 1 on p. 38). We can only conclude that the joint influence of factors that contribute to a negative relationship between child school attendance and the female wage is stronger than that of factors that would cause a positive relationship.

[2]It is possible that schooling facilities are not adequate in the heavily populated areas. For example, if educational facilities are allocated on a geographical rather than on a population basis, this would be the case. Butland (1953) points out that "a conspicuous feature of even the most backward regions is a new school."

VI. POLICY IMPLICATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

POLICY IMPLICATIONS

The process of development involves increases in wealth and also changes in relative prices, the most important of which for this study are changes in the value of individuals' time relative to market goods. Although increases in wealth increase the quantity (and quality) of normal and superior goods demanded by individuals and families, increases in the value of time tend to have the opposite effect, especially for goods that are "time intensive." In the fertility equations presented here fertility is positively related to the male wage because children are normal "goods" (the wealth or income effect), but negatively related to the female wage because labor market opportunities for women raise the opportunity costs of bearing and rearing children (the substitution effect).[1] Earlier investigators ignored the opportunity cost of time and other price effects and mistakenly attributed the decrease in fertility that accompanies development to the increase in income (implicitly suggesting that children are inferior goods). This study, as well as others (for example, Nerlove and Schultz (1970)), which also attempt to hold constant for price effects, suggest that this earlier judgment is wrong. When proxies for the "price" of children -- time costs, expected expenditures on education, and so on -- are held constant and estimation techniques appropriate for estimating equations in a simultaneous system are used, there is a positive partial relationship between the number of children ever born and income.

If the public interest is served by slowing population growth, policy should focus on helping to bring about shifts in relative prices that tend to increase the relative attractiveness of alternatives to having children. Increased provision of educational services to women will increase the wage they can earn in the labor market and thus raise

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[1]Actually both wages will have income and substitution effects. It was hypothesized that the income effect of the male wage would be stronger than its substitution effect but that the opposite would be true for the female wage. These hypotheses are supported by the empirical results.

their opportunity costs of bearing and rearing children.[1] Since the average educational attainment of men in Chile currently exceeds that of women, policies seeking to narrow this gap will have the side effect of reducing fertility. If there is sex-discrimination in hiring in Chile, government policies to reduce this discrimination and increase the demand for female labor services will also have the indirect effect of decreasing fertility rates. It is possible that policy makers may view a higher female labor force participation rate, and the consequent increase in incomes and tax takes, as desirable in itself, although there may be some undesirable consequences for males (for example, lower wages or higher unemployment) if women are substituted for men or if wages are not flexible.

Policies that improve health conditions and reduce death rates will, with some lag, lead to lower fertility rates as parents adjust to the higher survival rates. Although such a policy may not necessarily lead to a reduction in the rate of population growth in the short run,[2] it may provide the preconditions for a further decrease in fertility to take place. When the probability of survival to older ages increases, individuals will become more "future oriented;" longer-term investments will be relatively more attractive than they were before

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[1]Increased educational attainment of women will have other indirect effects on fertility, some of which will work in opposing directions. For example, if the market wage available to women increases because they are more educated, unmarried women will tend to postpone marriage or not to marry at all; more will form consensual unions than previously. However, the direct effect on marriage of increased female educational attainment is to shift women out of consensual unions into legal ones, with the net direct effect being a slight increase in the prevalence of marriage. I have worked through the <u>total</u> effect on fertility in the empirical model of a one-year increase in the average number years of schooling completed by women. For women 25-29 a one-year increase in their educational attainment causes a 1 percent decrease in the average number of children ever born; for women 35-39 a one-year increase in average number of years of schooling is associated with a 10 percent reduction in fertility.

[2]Recall that the rate of natural increase is equal to the crude birth rate less the crude death rate. A given absolute decrease in the death rate must be accompanied by an even larger fall in the birth rate if it is to bring about a reduction in the rate of natural population growth.

the mortality decline. Parents will tend to invest more in themselves and in their children than they did before. Increased investments in themselves will enhance the attractiveness of alternatives to having children; increased investments in their children will tend to bring about a substitution of quality for quantity of children. Thus, in addition to reducing the number of children necessary to attain a given surviving family size, a mortality decline will tend also to decrease the number of (surviving) children parents desire (O'Hara, 1971). The long-run net effect on the rate of population growth of a reduction in the death rate is uncertain a priori; this very important empirical question merits further investigation.

SUGGESTIONS FOR FURTHER RESEARCH

The results of the research presented in this report are a mere beginning in the task of explaining and predicting family economic and demographic behavior in Chile. The primary goal of further work should be a more accurate specification of the model and improved measurement of the variables called for by the analytical framework.

Much work remains to be done on the equation explaining the education of children so this information can be used to predict the impact of educational expenditures on the schooling of current and future generations and on their subsequent marital, reproductive, and work choices.[1]

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[1]Information on the policies affecting the allocation of resources for education and data on the current distribution of these resources are needed to improve the ability to predict the amount of education a child in a given region is likely to receive. Data pertaining to the educational experiences of older children are also needed. Recall that the child education measure used here is the percent of ten-year-old children in school. Data on the school attendance of children past primary school (grades 1-6) were not available in the 1960 Chilean Census by the urban-rural breakdown needed for the model. If such information is not available in the 1970 Census, it may be necessary to estimate urban and rural schooling measures by using attendance figures for departamentos (there are 87 in Chile) given in the annual government publication Educación y Justicia and weighting these by the urban and rural subpopulations of the departamentos as was done here in the construction of urban and rural vital rates (see Appendix B).

In an earlier investigation of the model examined in this report, I considered alternative measures of adult education -- literacy, primary and secondary school completion -- in estimating the model. The object was to ascertain which level of education had the most pronounced effect on the various types of endogenous behavior.[1] Because information of this sort may be useful in deciding how to allocate resources among levels of education, this experiment should be repeated for the more complete form of the Chilean model presented here and should be performed for other countries to discern what regularities might exist at different stages in the development process.

Another direction to extend the work begun here is to investigate the determinants of age-specific birth and marriage rates and the relationship of these rates (flows) to the levels of the corresponding stocks examined here.[2] These age-specific demographic rates are

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[1] In ordinary least squares estimation of the female labor force participation, marital status, and fertility equations, one of the three female education measures was included in each equation. Of the three, secondary education always had the largest coefficient (presumably because of the relatively small average value of this variable) and literacy always had the largest elasticity defined at the means (probably because its mean is considerably larger than those of the other education measures) However, the t-statistics and beta coefficients did show differing responses of the dependent variables to the three measures of female education. The pattern, which was usually consistent for all age groups, was the same whether the t-statistic or the beta coefficient was the measure of responsiveness considered:

Dependent Variable	Type of Female Education with Statistically Most Significant Coefficient and Largest Beta Coefficient (sign of coefficient in parentheses)
Female Labor Force Participation	Secondary (+)
Current Legal Marriage	Secondary (-)
Current Consensual Marriage	Literacy (-)
Separation	Secondary (+)
Fertility	Primary (-)

Discussion of this pattern will be withheld until this exercise is repeated for two-stage estimation of the model specified in this report.

[2] A very preliminary investigation of the determinants of crude birth and marriage rates yielded rather unsatisfactory results. However, no adjustments for the differences in the age-sex composition among regions were made, and this may be partly responsible for the

available for the 25 Chilean provinces. A study of the determinants of age-specific marriage rates may be of use in improving the specification of the legal and consensual marriage equations presented here, which are the least satisfactory component of the model.

An investigation of individual-level survey data should enable one to verify at the household level the hypotheses put forth in this report, many of which have been tested here with aggregate data. Consideration of observations at the individual or household level could avoid many of the problems inherent in the use of aggregate data (for example, the unrealistic representative individual assumption) and avoid some specification problems. Also, individual level data may permit consideration of the important issue of tastes.

The Chilean data I have analyzed here exhibit many interesting patterns, most of which are consistent with the a priori expectations. Additional data, which are readily available, in conjunction with the forthcoming 1970 Chilean Census, could be used to extend this analysis of family decisionmaking in many promising directions.

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poor results. These crude demographic rates, which use total population as their denominator, are sensitive to the age-sex composition of a population. Incomplete registration could also systematically distort the interregional pattern of reported births or marriages. One interesting outcome of the investigation of the 1960 crude birth rate, which was regressed on the same variables as is the fertility variable in the model, was the very significant positive coefficient of the 1958 infant mortality rate, indicating a statistically significant flow adjustment to a stock disequilibrium.

Appendix A

EVIDENCE FROM SANTIAGO PROVINCE ON RELATIONSHIPS AMONG ECONOMIC AND DEMOGRAPHIC PHENOMENA IN CHILE AND COMPARISON OF THESE WITH PATTERNS IN THE UNITED STATES AND PUERTO RICO

In this appendix graphs and tables based on data from Santiago Province[1] are presented to illustrate the relationships among some of the economic and demographic variables discussed in Section III. In some cases the Chilean pattern is compared with that in the United States or Puerto Rico.

Cross-classified data are interesting because they give us a "picture" of a relationship over its entire spectrum (for example, for all levels of education or all numbers of children ever born) and illustrate nonlinearities (which we cannot capture in a linear regression model). However, data are seldom so finely cross classified that we can hold constant for all of the factors we believe are affecting a (dependent) variable under consideration. In a bivariate relationship, say between female labor force participation rates and female educational attainment, we cannot determine to what extent other factors are influencing or accounting for the observed relationship; it is impossible to separate the indirect and direct effects of one variable on the other.

FEMALE LABOR FORCE PARTICIPATION

The relationship between female labor force participation rates and female educational attainment in Santiago Province is illustrated in Fig. A-1; the patterns shown there tend to support the hypothesis

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[1] I was unable to obtain a copy of the summary volume of the Chilean Census, which would have enabled me to present these graphs and tables for Chile as a whole. I have chosen Santiago Province because it is the most developed province in Chile and I thought it would be interesting to analyze its demographic patterns and compare them with those in another developing country (Puerto Rico) and also in a developed country (the United States). It would be interesting to analyze the relationships among fertility, marital status, female labor force participation, educational attainment, and age separately for some of the less developed provinces of Chile as well.

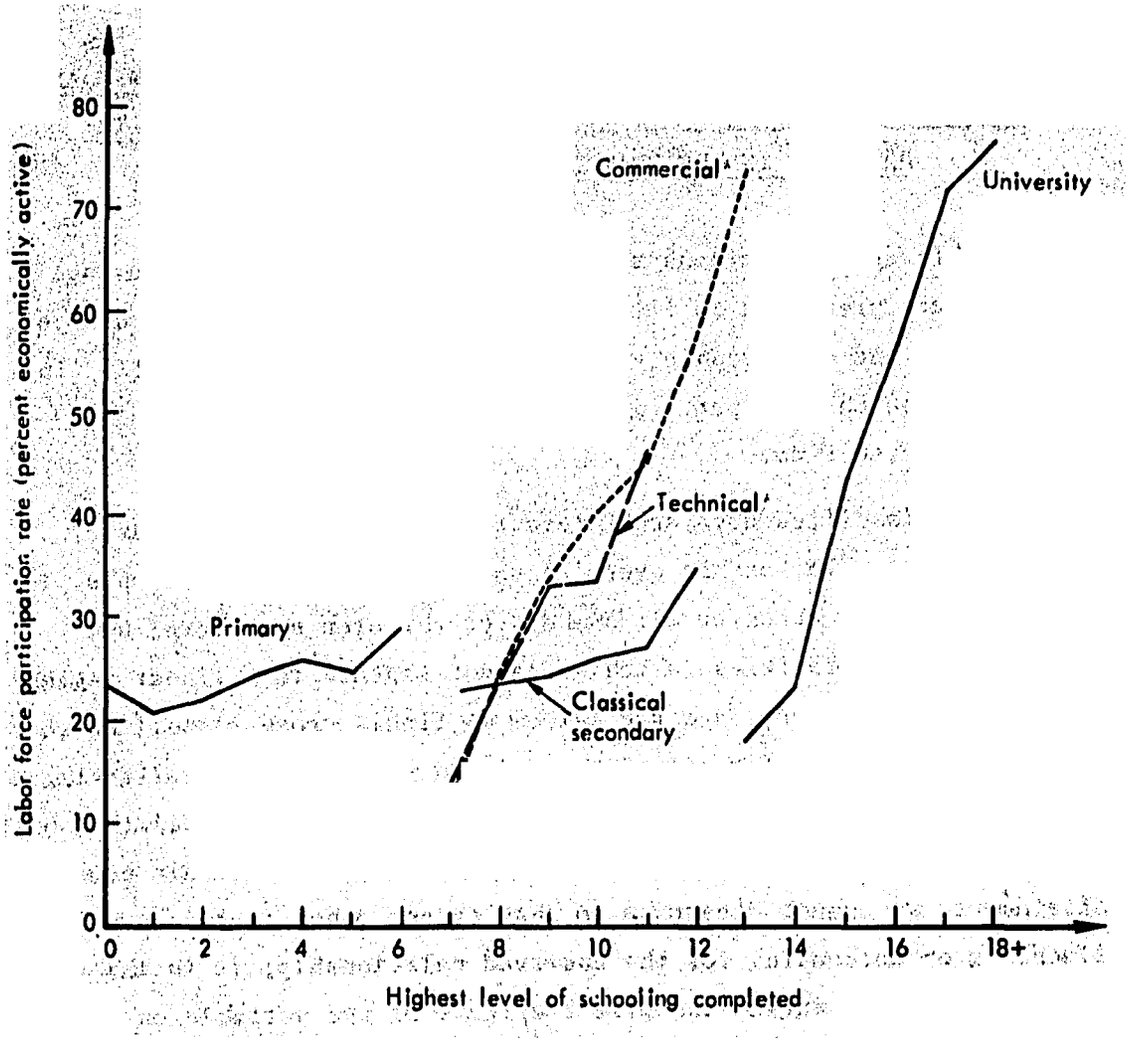

Fig.A-1 — Female labor force participation rates by educational attainment (for women 10 years of age or older in Santiago Province)

*Vocational school (commercial and technical [home economics]) is usually attended in lieu of "classical" secondary school

Source: Derived from 1960 census of Chile, Volume 7 (Santiago Province), Table 17 (pp. 104-5).

of a positive relationship between these two variables. However, the extent to which this relationship is due to higher wages resulting from greater amounts of education or to other factors (for example, marital status or "utility" received from labor market activities) that may vary with educational attainment and exert their own independent effects on female labor force participation rates cannot be ascertained here. For the United States, Bowen and Finegan (1965) found a positive relationship between female labor force participation rates and female educational attainment even when female earnings were held constant.

The rates in Fig. A-1 show that for any type of schooling,[1] labor force participation rates increase with each additional year of schooling and always take their greatest jump with the completion of the last year, implying that for women in Santiago Province, investments in education may be rather "lumpy."[2] Women who complete vocational school are more likely to participate in the labor force than women who graduate from regular secondary school.[3] Women who complete the last year of a given level of education and do not continue have a higher probability of working than women who go on through several years of the next level but do not complete it.[4]

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[1]Technical and commercial schools are vocational schools which are usually attended in lieu of regular secondary school. Technical school has a five-year program, commercial school a seven-year curriculum, and classical secondary school is usually attended for six years.

[2]Male labor force participation rates exhibit a similar pattern. However, since the data are on persons 10 years of age or older, they include many persons still in school. This could account for the lower participation rates of persons who have not completed the last year of a level of schooling.

[3]As mentioned above, this relationship may be due to other factors influencing female labor force participation -- other family income, for example -- and may have nothing to do with vocational vs. regular secondary school *per se*.

[4]It may be that the same factors that cause these women to drop out of school (for example, marriage, pregnancy, or lesser ability) may also lessen their likelihood of participating in the labor force, although Bowen and Finegan (1966) found that similar "dips" in United States data were eliminated when they excluded persons still attending school.

Female labor force participation rates by educational attainment for the United States and Santiago Province, Chile, are compared in Fig. A-2.[1] The relationship is usually a positive one in each country Although probable differences in the educational systems make comparison difficult, several interesting differences in the effect of education on labor force participation rates do appear. In the United States the relationship is nearly linear; completion of additional years of college exert approximately the same marginal effect on labor force participation rates as do years at lower levels of education. For Chile years completed of primary and secondary school, except for the last year of secondary, have very little influence on female labor force participation rates. However, higher levels of education exert a greater marginal effect on the labor force participation rates of women in Santiago Province than they do for the United States. This difference in the impact of higher education may indicate that higher education is less of a consumption good (more of an investment good) for women in Chile compared with women in the United States. Also, since fewer women receive advanced education in Chile than in the United States, a relatively greater premium may be paid to a highly educated woman in Chile than in the United States. It is somewhat surprising that primary and secondary education exert so little effect on labor force participation of women in Chile since a considerably lower percentage of women have attended even primary school in Chile than in the United States. It is possible

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[1]In Fig. A-2 vocational schooling has been treated as a type of secondary education (grades 7-12). The first year of classical secondary, technical, and commercial school are all treated as grade 7. The last year of technical and the last two years of commercial education have been treated as grade 12. The system of grouping grades (1-4, 5-7, 9-11, and 13-15) is that used in the United States Census of Population and may not necessarily be the most appropriate for the Chilean educational system. Available data indicate that five years may be the customary length of attendance at a Chilean university rather than four as in the United States. The Chile-2 curve in Fig. A-2 gives the Chilean female labor force participation rates that best correspond to the United States rates if Chilean universities are usually attended for five years. (The female labor force participation rates plotted for 13-15, 16, and 17+ years of schooling in the Chile-2 curve are actually those for women who have completed 13-16, 17, and 18+ years of education, respectively.) The Chile-1 curve assumes a four-year university curriculum.

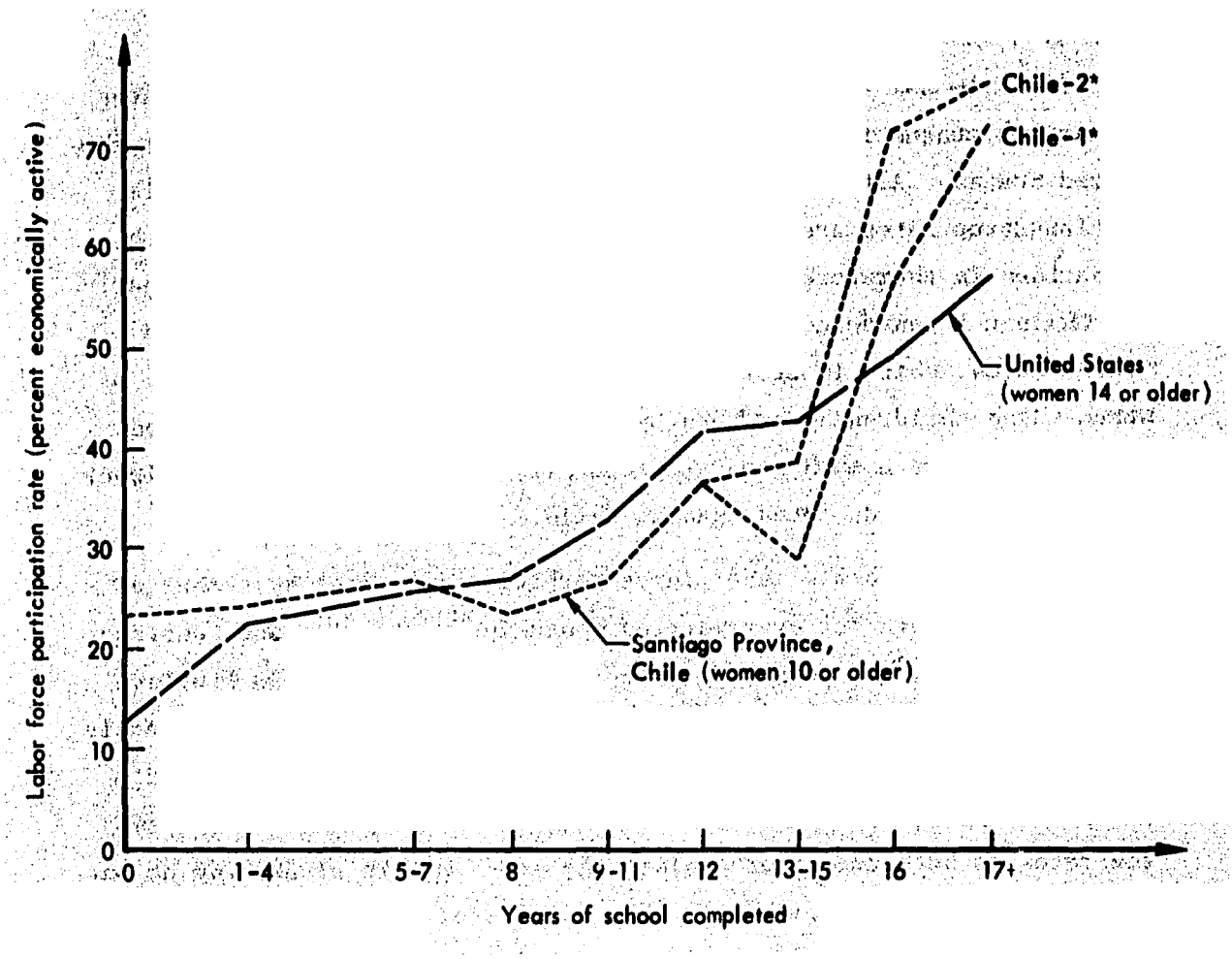

Fig.A-2—1960 female labor force participation rates by educational attainment for Chile (Santiago Province) and the United States

* Vocational schooling has been treated as secondary education (grades 7-12) (See footnote 1, p.96, for more information on the treatment of vocational schooling). The Chile-2 curve gives the Chilean labor force participation rates that best correspond to the United States rates if the customary length of attendance at a Chilean University is five years rather than four as in the United States. The Chile-1 curve assumes a four-year curriculum.

Sources: Chile - 1960 census of Chile, Volume 7 (Santiago Province), Table 17 (pp. 104-5).
United States - United States Census of Population: 1960, Subject Reports, Educational Attainment, Final Report PC (2)-5B, Table 5 p. 71.

that other factors, for example number of children, that are related to education are exerting their own independent influences on the tendency of these women to participate in the labor force.

In Table A-1 age-specific female labor force participation rates by marital status for Santiago Province are compared with those of the United States. Although many of the other factors affecting female participation rates are not controlled for and interpretation of this comparison is therefore difficult, one main difference emerges clearly The Chilean rates do not exhibit the bimodal pattern of the United States rates, which is attributed to the return to the labor force of women whose children have grown up.[1] For all marital status groups, older women have a much greater propensity to participate in the labor force in the United States than in Chile.

In Fig. A-3 female labor force participation rates by number of children ever born for ever-married women in Puerto Rico and Santiago Province, Chile, are compared. The fact that only Santiago Province is used for Chile tends to shift the Chilean rates upward since female labor force participation rates are higher in the highly urbanized province of Santiago than in the rest of the country. Nevertheless, the rates of both countries exhibit the same pattern of peaking at one child and declining thereafter. The samples of ever-married women are fairly similar in marital status composition:

	Puerto Rico	Chile (Santiago Province)
Percent Legally Married	78.9	88.8
Percent Consensually Maried	13.4	5.3
Percent Widowed, Separated or Divorced	7.7	5.9
	100.0	100.0

[1] We do observe a very slight bimodal pattern for currently married Chilean women when five-year age groups are considered (see Fig. 3H).

Table A-1

COMPARISON OF UNITED STATES AND CHILEAN 1960 AGE-SPECIFIC FEMALE LABOR FORCE PARTICIPATION RATES BY MARITAL STATUS

Age of Women	United States				Chile (Santiago Province)			
	All	Single	Married	Other[a]	All	Single	Married[b]	Other[a]
14-19[c]	25.5	25.3	25.3	37.3	30.2	32.3	9.7	51.7
20-24	44.3	73.4	30.0	54.6	43.2	63.3	13.5	53.6
25-34	34.5	79.9	27.7	55.5	35.3	73.9	16.9	61.0
35-44	42.4	79.7	36.2	67.4	30.9	71.6	17.2	58.7
45-54	48.4	80.6	40.5	68.2	27.3	50.8	16.3	42.9
55-64	35.2	67.0	24.3	50.7	19.2	41.3	10.0	20.5
65 & over	10.1	21.6	5.9	11.0	8.8	21.0	4.8	6.7
14 & over[d]	34.8	44.1	30.5	40.0	30.3	51.2	15.4	30.0

[a]Widowed or divorced (for Chile includes women who are separated or whose marriages have been annulled).

[b]Includes consensually married.

[c]15-19 for Chile.

[d]15 or over for Chile.

Sources: United States: Jacob Mincer, "Labor Force Participation" in the International Encyclopedia of Social Sciences, Vol. 8, p. 479. Chile: Derived from 1960 Census of Chile, Vol. 7 (Santiago Province), Table 9.

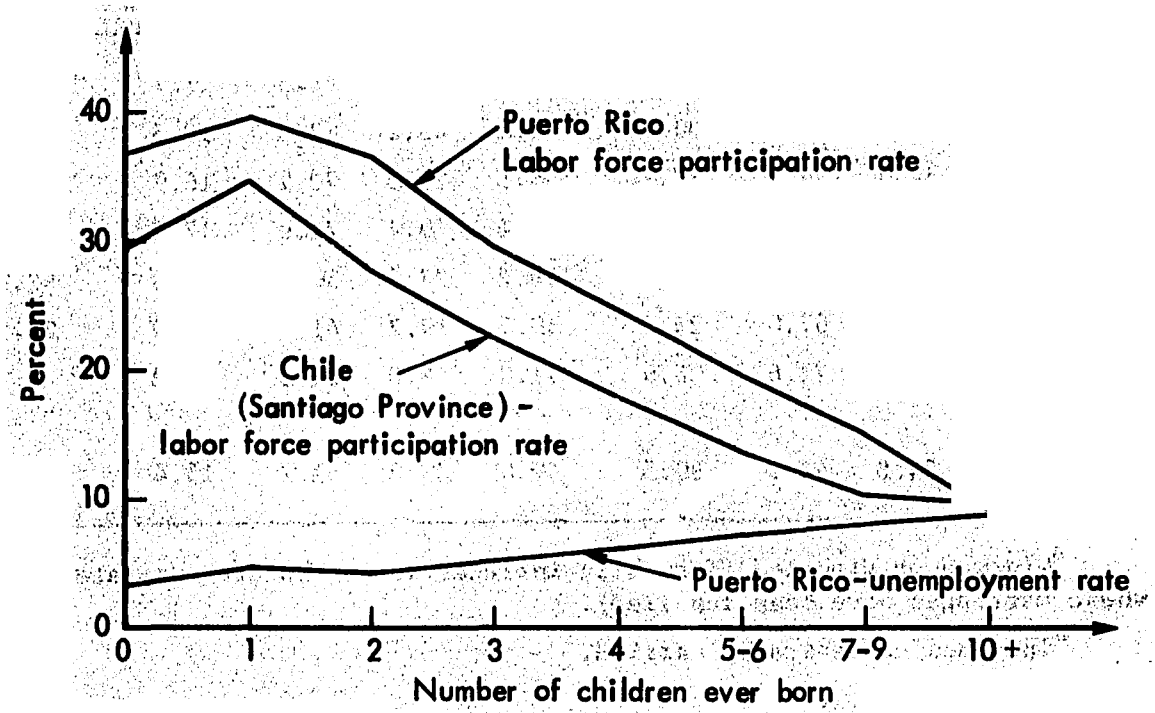

Fig. A-3 — 1960 female labor force participation rates for ever-married women 35-44 by number of children ever born for Chile (Santiago Province) and Puerto Rico and Puerto Rican unemployment rate for these women by number of children ever born

Sources: Chile: Derived from 1960 census of Chile, Volume 7 (Santiago Province), Table 9.
Puerto Rico: U.S. Census of Population: 1960, Vol. 1, Part 53 (Puerto Rico), Table 95, p. 277.

The fact that more of the Puerto Rican women are not currently legally married may explain why Puerto Rican participation rates are higher.[1]

In Fig. A-3 I have given female unemployment rates by number of children ever born for Puerto Rico because they probably give a good indication of what the relationship is in Chile (for which similar data could not be found). They show that female unemployment rates increase with the number of children ever born (except for a slight drop at two children). Three factors may be causing this: (1) women with many children may be less employable, either because of the large number of children (this would be true for live-in maids for example) or other related factors, such as less education; (2) women with many children may report themselves as seeking work but search less diligently than women with fewer children because the opportunity costs of search are higher; or (3) women with more children may have a greater "need" to supplement family income (the consumption requirements or income effect of children) and may continue searching for work longer (are less likely to be discouraged out of the labor force) than women with fewer children.

FERTILITY

Fig. A-4 shows the number of children ever born per woman by age and current marital status. This figure plots observations on different age and marital status cohorts at a given point of time (1960); it does not trace the longitudinal experience of a given marital status cohort over time. Therefore, it is not logically inconsistent for women 45-49 years old to have borne fewer children than women 40-44. Although it is possible that this slight drop in the fertility of the older women is due to under-reporting by this age group, there is another possible explanation for the observed pattern. Women who were 45-49 years old

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[1] It has been shown for Chile that the participation rates of widowed and separated "other" women are considerably higher than those of currently married women. In the Chilean sample the married category included both legally and consensually married women. It is possible that consensually married women are more likely to participate in the labor force than legally married women (see discussion of consensual marriage in Section III). Nerlove and Schultz (1970) found this to be the case in Puerto Rico.

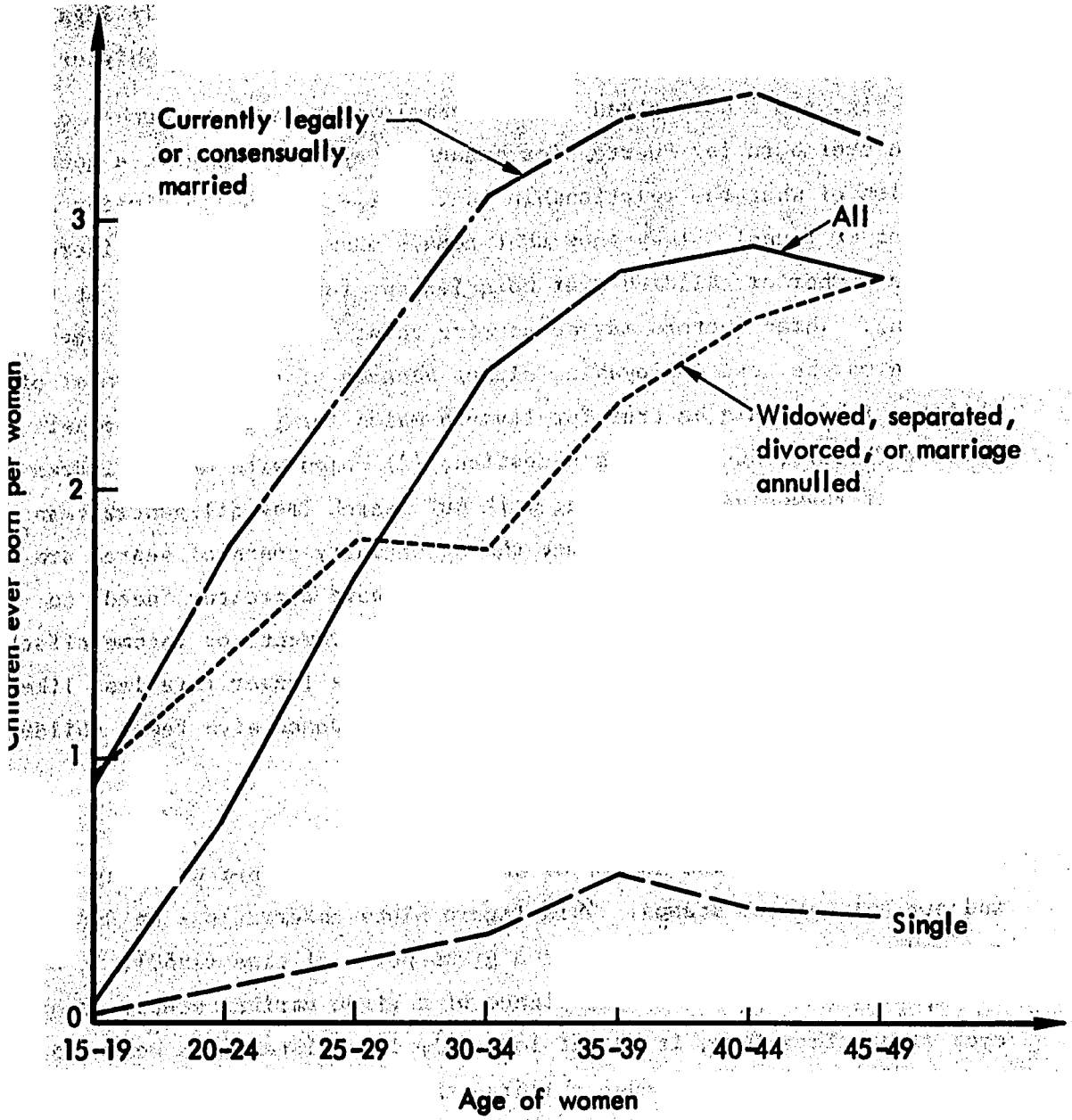

Fig. A-4 — Average number of children ever born per woman by age and marital status for women in Santiago Province

Source: Derived from 1960 census of Chile, Volume 7 (Santiago Province), Table 9.

in 1960 were just beginning to be of marriageable and childbearing age when the Depression struck; it is quite possible that the unfavorable economic conditions caused them to delay marriage and childbearing. Recall from Fig. 1 that both marriage and birth rates fell during the Depression.

Fig. A-5 illustrates the relationship between the number of children a woman has borne and her age, marital status, and current labor force status. For currently married women the average number of children ever born is always smaller for economically active women than for women not in the labor force. If it is assumed that the women who are participating in the labor force can earn higher wages than those who are not and that the number of children ever born is indicative of the number desired, this evidence supports the hypothesis that the desired number of children is negatively related to the opportunity cost of a woman's time. Married women who are not in the labor force have 50 to 100 percent more children than economically active married women of the same age. However, in some of the younger age groups, single and "other" women who are in the labor force have more children than women of the same age and marital status not economically active. Here, I believe, the net causation must be interpreted as running the other way -- these women are working in order to support their children; the consumption-requirements, or income, effect of children is influencing female labor force participation. Figure 3A-H showed consistent evidence that single or "other" women with one child (and sometimes two or more) are more likely to belong to the labor force than childless women of the same age and marital status.

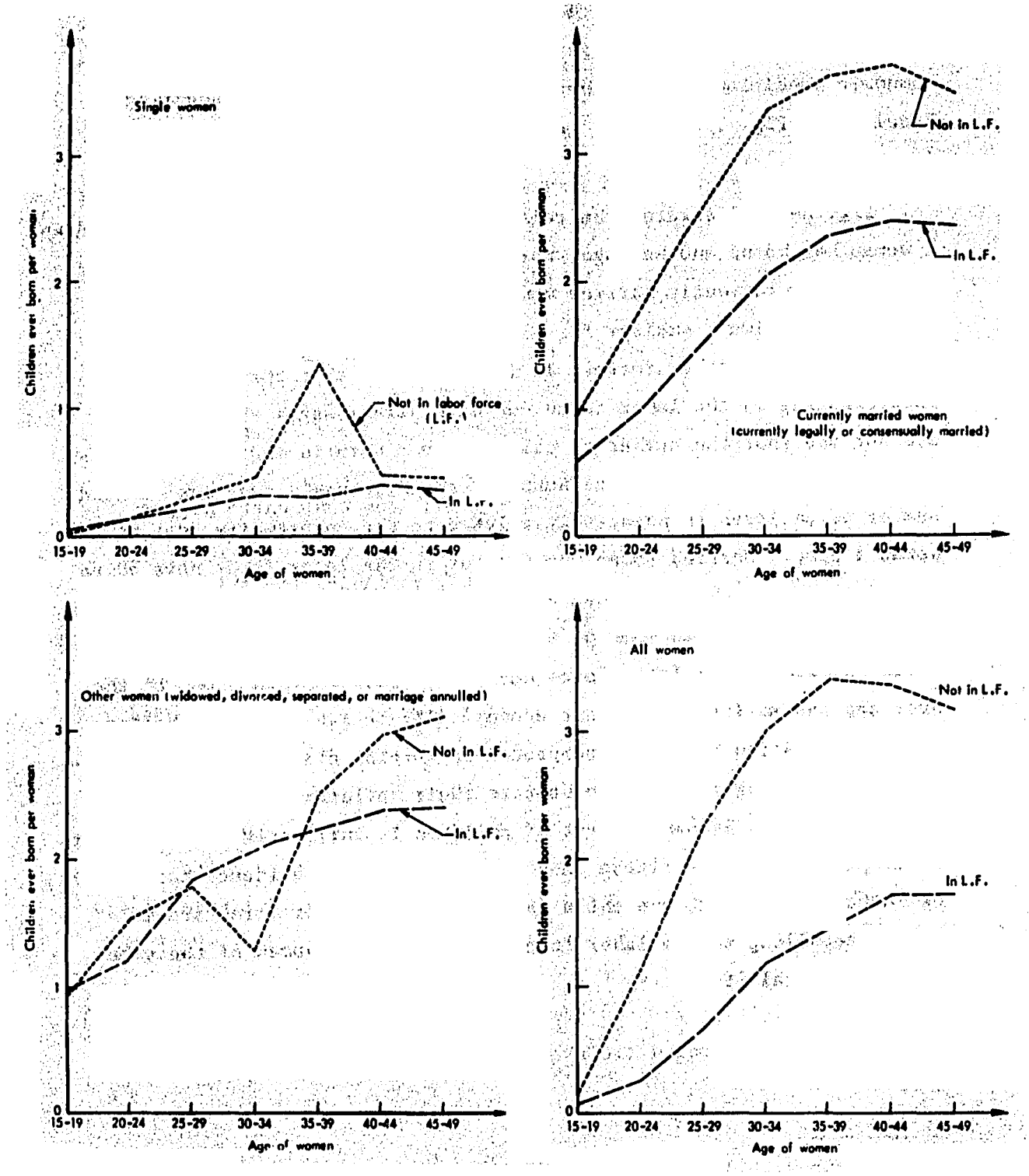

Fig.A-5 —Average number of children ever born per woman by age, marital status and labor force status for women in Santiago Province

Source: Derived from 1960 Census of Chile, Volume 7 (Santiago Province), Table 9.

Appendix B

DATA DERIVATION

FEMALE AND MALE AVERAGE SCHOOLING

For each age group of women and for men 25 or older the following percentages were recorded:

Persons who completed primary school and did not go on to higher levels of schooling (P_1);

Persons who completed primary school and did go on to higher levels of education (P_2);

Persons who completed secondary school and did not go on (S_1);

Persons who completed secondary school and went on to higher levels of education or who attended vocational schools (S_2).[1]

The female or male primary education variables in Tables 3 and 4 are the sums of the first two education measures (P_1 and P_2); the secondary measures are the sums of the last two (S_1 and S_2).

The number of persons of a given age group who never attended school is almost identical to the number in that group who are classified as illiterate. All persons classified as literate (L) were assumed to have attended some school. Subtracting the percent of persons who at least completed primary school (P_1 and P_2) from the percent who attended some school (L) gives the percent of persons who attended primary school but did not complete sixth grade ($L-P_1-P_2$). Using a similar procedure, the percentage of persons who attended secondary school but did not complete twelfth grade can be constructed ($P_2-S_1-S_2$). Now numbers are available for the percentage of persons who:

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[1]Since data for vocational school are always given below secondary school, I mistakenly thought vocational school to be a post-secondary type of schooling rather than a type of education usually received in lieu of regular secondary education.

Never attended school (100-L),

Attended but did not complete primary school ($L-P_1-P_2$),

Completed primary school but did not continue their education (P_1),

Attended but did not complete secondary school ($P_2-S_1-S_2$),

Completed secondary school but did not go on (S_1),

Went beyond secondary school (S_2).

In the construction of the average years of schooling variables each of these percentages (which add up to 100) was weighted by the average number of years of school persons in each of these six categories was assumed to have attended. Those who began a given level of education but did not complete it were assumed to have finished half of that level on average. These weighted percentages are then added (and the sum divided by 100 to adjust for the fact that percentages rather than fractions are used). For the male and female 25 or older age groups, the average years of schooling variables are each defined as:

$$[0\cdot(100-L) + 3\cdot(L-P_1-P_2) + 6\cdot P_1 + 9\cdot(P_2-S_1-S_2) + 12\cdot S_1 + 15\cdot S_2]/100.$$

For the 20-24 age group of women, S_2 is weighted by 14 instead of 15 because many of the women in S_2, women who completed secondary school and have gone on for further education, are still attending school. For the 15-19 age group of women S_1 and S_2 figures were not available. For this youngest age group the female average schooling variable is defined as:

$$[0\cdot(100-L) + 3\cdot(L-P_1-P_2) + 6\cdot P_1 + 10\cdot P_2]/100.$$

For all of the five-year age groups for women 25 or older and the aggregate age groups of women the magnitude of the average years of female schooling variable is not truly representative of the schooling experience of the age groups in question, because only the literacy percentages are truly age specific. The P_1, P_2, S_1 and S_2 figures are only available for women 25 or older as a group and are assumed to be the same for all of the age cohorts 25 or older. Since the educational attainment of the population has been increasing over time, the years of schooling variable will be biased downward for the younger age groups

and upward for the older age groups. It is likely, however, that the pattern of regional variation in this variable is still representative of that of the actual average number of years of schooling.

WAGE DATA

Wages for 1960 are available by province, industrial branch, and sex in the booklet of statistics published by the Chilean Social Security Service. The wages given are the median daily salaries of employed (as opposed to self-employed) persons covered by Social Security. They are assumed to be representative of the wages of all persons of that sex, industrial branch, and province, with one exception.[1]

The urban and rural female age-specific and male wages used in the estimation of the model presented here are weighted averages of the wages given in the Social Security Service booklet. For each age group the female wage was constructed by weighting each sectoral female wage by the fraction of economically active women in that age group who are classified as working in that sector. Since the sectoral weights are available for urban and rural areas, separate urban and rural wages could be constructed. In so doing, the assumption that for each industrial sector urban and rural wages are equal (equal to the provincial wage) was implicitly made. For males, the published wages were weighted by the sectoral distribution of men aged 12 or over.

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[1] For all industrial sectors except agriculture and domestic services the wages of self-employed ("independientes") insured (covered by Social Security) workers are lower than those of employed ("apatronados") insured workers. However, since the proportion of insured workers (the only ones for whom wage data are available) who are self-employed is very small for all but one industrial sector, no special adjustment is made for the wage of self-employed in these sectors. Twenty percent of all insured workers in commerce are self-employed, and their wages are lower than those of corresponding employed workers (the national wage of self-employed men in commerce is 70 percent of the wage of employed workers; for women the corresponding figure is 82 percent). In computing the weighted average rural and urban wage variables, the commerce wages are adjusted downward to account for the lower wages of the self-employed workers.

INDEX OF FEMALE OPPORTUNITIES

This variable is a weighted average of a region's industrial structure. For each industrial sector, the percentage of the region's total labor force (males and females) working in that sector is weighted by the percentage of all Chilean workers in that sector who are women (see definition in Table 3). The industrial sectors and corresponding weights used in the construction of this variable are as follows:

Sector	Weight (Wi)[1]
Agriculture	3.59
Mining	1.76
Light Manufacturing	32.33
Heavy Manufacturing	6.77
Construction	0.65
Electricity, Gas, and Water	4.36
Commerce	24.34
Transport and Communication	5.40
Domestic Services	92.32
Non-domestic Services	37.82

VITAL RATES AND ILLEGITIMACY

Vital rates (crude death rates and infant mortality rates) and the illegitimacy rate were available for the 87 departamentos of Chile. Urban and rural province level vital rates were derived by weighting the departamento rates by the urban or rural departamento sub-populations. For each province i the urban vital rate V_i^u was computed as

$$V_i^u = \frac{\sum_{j=1}^{J_i} V_{ij} \cdot U_{ij}}{\sum_{j=1}^{J_i} U_{ij}}$$

[1] The weight is the percentage of workers in this sector who are women.

where V_{ij} = vital rate in jth departamento of province i

U_{ij} = urban population in departamento j of province i

J_i = total number of departamentos in province i

and similarly for rural rates. In using this procedure, I implicitly assume that urban and rural rates in a given departamento are equal (to the departamento rate).

POPULATION DENSITY

Population density (number of persons per square kilometer) figures are available in the 1960 Census for the 297 comunas in Chile For each province i, the urban population density D_i^u was computed as

$$D_i^u = \frac{\sum_{k=1}^{K_i} U_{ik}}{\sum_{k=1}^{k_i} \frac{U_{ik}}{D_{ik}}}$$

where U_{ik} = urban population in comuna k of province i

D_{ik} = population density in the kth comuna of province i

K_i = total number of comunas in province i

and similarly for the rural densities. The denominator computes the total urban (rural) area in the province on the assumption that the proportion of the total area in a comuna that is "urban" ("rural") is equal to the proportion of the total comuna population that is "urban" ("rural").

AGE-SPECIFIC FEMALE LABOR FORCE PARTICIPATION EQUATIONS--II[a]

Age Group and Method of Estimation	Constant	Currently Legally Married[e]	Currently Consensually Married[e]	Fertility[e]	Female Wage[c]	Male Wage	Female Average Schooling	Urban Dummy	Significance of Equation F(7,2)	Significance of Equation R^2
15-19										
TSLS	20.7	-.462	4.19	-.0996	54.8	-18.0	-1.90	20.2	182.***	
	(2.49)	(-0.56)	(1.67)	(-1.37)	(3.76)	(-2.97)	(-0.80)	(2.40)		
OLS	18.3	-.843	-1.13	-.00855	42.7	-13.9	-1.67	20.0		.857
	(3.62)	(-1.83)	(-1.03)	(-0.24)	(5.35)	(-3.99)	(-1.09)	(4.19)		
20-24										
TSLS	50.8	-.558	-1.23	-.0192	62.6	-17.8	-2.96	24.2	13.8*	
	(3.51)	(-1.10)	(-0.92)	(-0.98)	(2.39)	(-1.95)	(-0.83)	(2.35)		
OLS	38.7	-.621	-1.28	-.0135	18.9	-7.19	2.21	11.4		.916
	(4.78)	(-1.78)	(-2.97)	(-1.55)	(2.61)	(-1.71)	(1.26)	(2.50)		
25-29										
TSLS	77.2	-.561	-1.95	-.0130	50.1	-9.92	-3.77	15.0	61.2**	
	(3.03)	(-1.54)	(-2.00)	(-1.62)	(2.46)	(-1.27)	(-0.94)	(1.95)		
OLS	53.9	-.652	-1.32	-.00383	12.6	-4.15	3.79	4.55		.953
	(6.27)	(-4.27)	(-5.06)	(-1.30)	(2.85)	(-1.56)	(2.98)	(1.75)		
30-34										
TSLS	74.3	-.680	-1.86	-.00484	34.8	-10.2	-.664	10.3	79.6**	
	(3.61)	(-2.43)	(-2.98)	(-1.08)	(2.73)	(-1.83)	(-0.25)	(1.96)		
OLS	66.9	-.845	-1.52	-.000603	10.7	-4.66	4.11	2.46		.957
	(7.75)	(-6.56)	(-7.01)	(-0.36)	(3.28)	(-2.12)	(3.91)	(1.15)		
35-39										
TSLS	98.7	-.861	-1.81	-.00496	27.8	-6.81	-1.28	4.92	104.***	
	(3.89)	(-3.07)	(-2.97)	(-1.38)	(2.58)	(-1.33)	(-0.46)	(1.02)		
OLS	79.7	-.916	-1.38	-.00119	7.98	-2.91	3.60	-1.32		.950
	(7.68)	(-6.72)	(-6.57)	(-0.86)	(2.57)	(-1.27)	(3.22)	(-0.59)		
40-44										
TSLS	89.2	-.778	-1.37	-.00420	25.6	-7.68	-1.02	4.40	104.***	
	(4.83)	(-3.06)	(-2.98)	(-1.56)	(2.70)	(-1.76)	(-0.50)	(1.14)		
OLS	85.0	-.910	-1.52	-.00154	9.32	-1.08	1.86	-1.22		.950
	(8.46)	(-7.10)	(-6.95)	(-1.37)	(3.03)	(0.47)	(1.73)	(-0.57)		
45-49										
TSLS	89.1	-.672	-1.03	-.00514	16.4	-6.50	-1.38	2.21	159.***	
	(4.77)	(-3.12)	(-2.37)	(-1.94)	(1.78)	(-1.83)	(-0.66)	(0.56)		
OLS	77.4	-.843	-1.32	-.00104	5.62	-2.17	2.24	-3.30		.954
	(8.47)	(-7.85)	(-6.87)	(-1.02)	(2.03)	(-1.13)	(2.24)	(-1.68)		
12+										
TSLS	67.1	-.411	-1.09	-.0140	25.8	-9.29	-1.54	6.85	159.***	
	(5.16)	(-1.55)	(-1.73)	(-3.00)	(1.93)	(-2.08)	(-0.73)	(1.32)		
OLS	54.9	-.628	-1.42	-.00707	10.7	-3.73	2.14	.0206		.949
	(7.64)	(-4.54)	(-5.51)	(-3.40)	(2.90)	(-1.81)	(2.17)	(0.01)		
15-49 - A										
TSLS	73.9	-.528	-1.82	-.0458	68.2	-16.3	-5.61	14.5	50.7**	
	(2.48)	(-1.27)	(-1.66)	(-1.28)	(2.61)	(-1.86)	(-0.99)	(1.49)		
OLS	49.6	-.788	-1.58	-.00785	16.8	-4.88	3.90	.880		.945
	(5.46)	(-5.44)	(-5.60)	(-0.83)	(3.53)	(-1.83)	(2.95)	(0.31)		
15-49 - B										
TSLS	80.3	-.545	-1.73	-.0503	53.2	-13.4	-5.24	12.9	60.8**	
	(3.04)	(-1.69)	(-2.00)	(-1.66)	(2.75)	(-1.83)	(-1.22)	(1.64)		
OLS	61.0	-.684	-1.49	-.0248	15.6	-4.39	2.25	.986		.951
	(6.54)	(-5.01)	(-5.56)	(-2.49)	(3.52)	(-1.76)	(1.63)	(0.38)		

[a]See notes to Table 6.

Table C-2

AGE-SPECIFIC FERTILITY EQUATIONS—III[a]

Age Group and Method of Estimation	Constant	Currently Legally Married[c]	Currently Consensually Married[c]	Child L.F. Participation[c]	Female Wage[c]	Male Wage	Infant Mortality	Urban Dummy	Significance of Equation F(7,2)	R^2
15-19										
TSLS	74.4	11.7	20.3	-4.95	-16.4	-12.2	.155	-41.3	4.57	
	(1.52)	(3.67)	(2.70)	(-1.38)	(-0.33)	(-0.38)	(0.93)	(-2.43)		
OLS	32.1	9.14	15.4	.126	-32.5	22.9	.151	-36.6		.858
	(0.96)	(5.64)	(3.87)	(0.08)	(-1.00)	(1.38)	(1.13)	(-3.00)		
20-24										
TSLS	119.	25.3	23.1	-16.3	-357.	54.7	1.22	-212.	6.56	
	(0.54)	(5.38)	(1.66)	(-1.01)	(-1.56)	(0.39)	(1.57)	(-2.61)		
OLS	-101.	22.0	19.0	-3.34	-89.9	32.1	1.90	-169.		.892
	(-0.66)	(7.90)	(2.92)	(-0.45)	(-0.79)	(0.42)	(3.23)	(-3.02)		
25-29										
TSLS	94.7	35.8	5.49	-18.8	-782.	230.	3.84	-547.	5.45	
	(0.14)	(3.25)	(0.20)	(-0.54)	(-1.79)	(0.76)	(2.71)	(-2.34)		
OLS	-603.	36.3	31.7	8.10	-347.	94.4	4.01	-291.		.884
	(-1.59)	(6.30)	(2.75)	(0.57)	(-1.80)	(0.87)	(3.65)	(-2.56)		
30-34										
TSLS	106.	42.3	2.75	-7.33	-1121.	356.	6.64	-765.	7.69	
	(0.10)	(2.46)	(0.08)	(-0.14)	(-1.99)	(0.89)	(3.43)	(-2.56)		
OLS	-1051.	48.7	36.3	12.77	-469.	47.3	7.02	-470.		.895
	(-1.61)	(5.28)	(2.13)	(0.61)	(-1.88)	(0.24)	(4.44)	(-2.92)		
35-39										
TSLS	278.	39.4	33.6	36.0	-1529.	404.	9.02	-694.	10.8*	
	(0.16)	(1.46)	(0.84)	(0.53)	(-2.21)	(0.79)	(3.75)	(-1.94)		
OLS	-1400.	59.1	47.9	17.3	-641.	-100.	10.0	-537.		.920
	(-1.37)	(4.59)	(2.36)	(0.69)	(-2.13)	(-0.41)	(5.03)	(-2.56)		
40-44										
TSLS	-511.	54.8	70.0	52.3	-1912.	269.	8.89	-474.	10.2*	
	(-0.24)	(1.53)	(1.43)	(0.54)	(-2.00)	(0.41)	(2.81)	(-1.02)		
OLS	-1454.	67.6	70.1	9.32	-606.	-429.	10.3	-492.		.910
	(-1.21)	(4.29)	(2.57)	(0.30)	(-1.51)	(-1.35)	(3.96)	(-1.83)		
45-49										
TSLS	855.	30.6	121.	67.3	-2116.	321.	9.92	-463.	18.4**	
	(0.32)	(0.73)	(2.17)	(0.73)	(-1.98)	(0.53)	(2.81)	(-1.04)		
OLS	-1124.	63.4	76.7	-5.70	-838.	-244.	12.4	-574.		.927
	(-0.91)	(4.10)	(2.84)	(-0.19)	(-2.11)	(-0.81)	(5.01)	(-2.17)		
12+										
TSLS	743.	43.5	29.3	-5.30	-1314.	152.	3.39	-366.	8.11	
	(0.94)	(2.18)	(0.81)	(-0.14)	(-2.74)	(0.45)	(1.99)	(-1.86)		
OLS	413.	37.3	30.3	7.67	-537.	-82.0	4.73	-275.		.887
	(0.83)	(3.68)	(1.63)	(0.50)	(-2.23)	(-0.49)	(3.75)	(-2.09)		
15-49-A										
TSLS	171.	4.88	1.37	16.4	-171.	169.	1.27	-191.	10.3*	
	(0.87)	(1.18)	(0.16)	(1.58)	(-1.30)	(1.82)	(2.89)	(-3.46)		
OLS	72.8	7.16	6.34	8.89	-23.8	63.5	14.9	-180.		.921
	(0.59)	(3.15)	(1.48)	(2.03)	(-0.36)	(1.40)	(4.41)	(-5.17)		
15-49-B										
TSLS	322.	4.45	2.56	13.0	-431.	197.	1.03	-196.	12.2*	
	(1.43)	(0.94)	(0.26)	(1.10)	(-2.87)	(1.86)	(2.07)	(-3.13)		
OLS	98.1	7.36	9.18	6.42	-178.	34.7	1.51	-159.		.931
	(0.80)	(3.27)	(2.16)	(1.47)	(-2.27)	(0.77)	(4.51)	(-4.59)		

AGE-SPECIFIC FERTILITY EQUATIONS—IV[a]

Age Group and Method of Estimation	Constant	Currently Legally Married[a]	Currently Consensually Married[a]	Child School Attendance[a]	Female Wage[a]	Male Wage	Infant Mortality	Urban Dummy	Significance of Equation F(7,2)	R^2
15-19										
TSLS	-86.9	9.29	23.9	1.35	-10.7	.926	.182	-49.0	4.29	
	(-0.82)	(4.67)	(2.99)	(1.24)	(-0.24)	(0.43)	(1.20)	(-2.79)		
OLS	-29.0	9.61	17.7	.753	-33.0	18.9	.156	-45.4		.863
	(-0.49)	(6.73)	(4.06)	(1.19)	(-1.04)	(1.28)	(1.19)	(-3.34)		
20-24										
TSLS	-379.	22.7	27.1	4.52	-381.	125.	1.31	-231.	6.39	
	(-0.78)	(7.01)	(1.90)	(0.88)	(-1.63)	(1.17)	(1.75)	(-2.46)		
OLS	-440.	22.1	22.8	3.70	-98.5	37.1	1.89	-205.		.895
	(-1.52)	(9.03)	(3.15)	(1.20)	(-0.88)	(0.55)	(3.30)	(-3.22)		
25-29										
TSLS	-688.	33.6	10.2	7.73	-746.	281.	4.06	-588.	5.51	
	(-0.54)	(3.83)	(0.38)	(0.65)	(-1.75)	(1.12)	(2.97)	(-2.49)		
OLS	-1040.	38.4	37.7	5.54	-370.	47.1	3.90	-388.		.885
	(-1.57)	(7.12)	(2.94)	(0.89)	(-1.94)	(0.37)	(3.61)	(-2.99)		
30-34										
TSLS	-57.1	41.0	4.00	1.68	-1115.	378.	6.71	-761.	7.68	
	(-0.03)	(3.07)	(0.12)	(0.10)	(-1.93)	(1.12)	(3.39)	(-2.30)		
OLS	-1463.	51.7	41.0	5.06	-483.	-14.0	6.92	-586.		.895
	(-1.43)	(6.03)	(2.24)	(0.58)	(-1.94)	(-0.08)	(4.41)	(-3.17)		
35-39										
TSLS	1317.	44.9	25.2	-10.8	-1596.	331.	8.65	-680.	10.7	
	(0.39)	(1.97)	(0.57)	(-0.44)	(-2.06)	(0.71)	(3.33)	(-1.65)		
OLS	-2358.	63.9	57.5	10.8	-648.	-194.	9.93	-739.		.921
	(-1.68)	(5.27)	(2.62)	(0.98)	(-2.17)	(-0.84)	(5.05)	(-3.10)		
40-44										
TSLS	1359.	61.9	566.	-19.1	-2095.	223.	8.21	-417.	10.3	
	(0.29)	(2.18)	(1.45)	(-0.54)	(-1.82)	(0.36)	(2.29)	(-0.75)		
OLS	-2793.	70.8	80.5	15.8	-606.	-501.	10.3	-745.		.913
	(-1.69)	(4.81)	(2.85)	(1.18)	(-1.53)	(-1.67)	(4.03)	(-2.48)		
45-49										
TSLS	3344.	40.5	102.	-26.1	-2379.	282.	8.94	-334.	18.6	
	(0.65)	(1.17)	(1.87)	(-0.73)	(-1.87)	(0.47)	(2.19)	(-0.59)		
OLS	-2803.	63.7	90.7	19.6	-814.	-281.	12.6	-831.		.931
	(-1.76)	(4.42)	(3.26)	(1.56)	(-2.11)	(-1.00)	(5.25)	(-2.80)		
12+										
TSLS	-12.0	44.3	33.6	7.48	-1235.	123.	3.69	-642.	8.37	
	(-0.01)	(3.24)	(0.97)	(0.58)	(-2.61)	(0.47)	(2.19)	(-1.94)		
OLS	-693.	42.5	46.5	12.3	-565.	-156.	4.82	-446.		.895
	(-0.92)	(4.73)	(2.38)	(1.93)	(-2.45)	(-1.05)	(3.98)	(-3.12)		
15-49 - A										
TSLS	641.	8.19	-2.05	-4.91	-149.	114.	1.18	-169.	9.77	
	(1.55)	(2.60)	(-0.21	(-1.36)	(-1.39)	(1.45)	(2.52)	(-2.55)		
OLS	270.	8.87	5.20	-1.87	-35.4	32.0	1.44	-181.		.915
	(1.26)	(4.16)	(1.06)	(-0.98)	(-0.52)	(0.74)	(4.14)	(-4.42)		
15-49 - B										
TSLS	704.	7.06	-.209	-3.98	-450.	154.	.959	-178.	11.8	
	(1.51)	(1.98)	(-0.02	(-0.98)	(-2.85)	(1.73)	(1.82)	(-2.37)		
OLS	195.	8.71	8.91	-.858	-157.	10.1	1.48	-165.		.928
	(0.92)	(4.17)	(1.85)	(-0.46	(-2.37)	(0.24)	(4.32)	(-4.11)		

[a]See notes to Table 6.

Table C-4

CHILD LABOR FORCE PARTICIPATION EQUATIONS[a]
(dependent variable is not age-specific)

Age Group	Constant	Fertility[e]	Female Wage[e]	Male Wage	Female Average Schooling	F(4,5)
15-19	12.5	.0181	8.20	-5.55	-1.10	18.7***
	(4.56)	(1.43)	(2.54)	(-3.68)	(-2.26)	
20-24	9.23	.00414	9.91	-6.54	-.921	20.0***
	(2.38)	(1.50)	(2.61)	(-3.32)	(-1.63)	
25-29	7.73	.00216	10.5	-6.32	-1.09	16.5***
	(1.30)	(1.10)	(2.61)	(-3.31)	(-1.42)	
30-34	6.57	.00169	10.1	-6.09	-1.03	15.9***
	(0.88)	(1.06)	(2.66)	(-3.09)	(-1.30)	
35-39	4.97	.00159	9.40	-9.40	-.853	13.8***
	(0.53)	(1.01)	(2.46)	(-2.80)	(-0.92)	
40-44	4.82	.00137	10.6	-6.17	-.796	13.7***
	(0.49)	(0.96)	(2.36)	(-2.70)	(-0.86)	
45-49	11.0	.000415	10.3	-5.73	-1.42	12.4***
	(0.94)	(0.25)	(2.25)	(-2.65)	(-1.24)	
12+	4.57	.00274	13.2	-6.72	-1.04	19.2***
	(0.55)	(1.13)	(3.28)	(-3.37)	(-1.27)	
15-49 - A	1.92	.0131	7.30	-6.22	-.214	23.1***
	(0.27)	(1.75)	(1.57)	(-3.78)	(-0.21)	
15-49 - B	2.14	.0123	10.9	-6.71	-.386	21.5***
	(0.24)	(1.40)	(2.77)	(-3.70)	(-0.34)	

[a]Equations were estimated by two-stage least squares.
See notes to Table 6

Table C-5

CHILD SCHOOL ATTENDANCE EQUATIONS[a]
(dependent variable is not age-specific)

Age Group	Constant	Fertility[e]	Female Wage[e]	Male Wage	Female Average Schooling	F(4,5)
15-19	69.4	-.0245	-23.3	4.79	5.45	45.1***
	(11.5)	(-0.88)	(-3.27)	(1.44)	(5.05)	
20-24	69.5	-.000190	-31.5	6.58	5.97	48.8***
	(7.39)	(-0.03)	(-3.42)	(1.38)	(4.36)	
25-29	65.1	.00293	-40.1	8.58	7.65	43.0***
	(3.98)	(0.55)	(-3.64)	(1.64)	(3.64)	
30-34	69.2	.00105	-36.6	9.13	6.97	49.2***
	(3.46)	(0.25)	(-3.58)	(1.73)	(3.28)	
35-39	72.2	.000394	-35.1	8.94	6.70	43.0***
	(2.82)	(0.09)	(-3.37)	(1.63)	(2.64)	
40-44	77.8	-.000255	-38.0	11.6	5.84	44.5***
	(2.98)	(-0.07)	(-3.16)	(1.90)	(2.35)	
45-49	70.7	.000886	-39.7	10.8	6.91	41.8***
	(2.20)	(0.19)	(-3.16)	(1.81)	(2.19)	
12+	69.7	.00137	-42.8	11.1	7.04	68.8***
	(3.20)	(0.22)	(-4.08)	(2.14)	(3.29)	
15-49 - A	68.6	.00409	-43.5	10.7	7.39	69.0***
	(3.11)	(0.18)	(-3.08)	(2.14)	(2.35)	
15-49 - B	65.7	.00684	-42.9	10.5	7.71	70.3***
	(2.65)	(0.28)	(-3.88)	(2.06)	(2.39)	

[a]Equations were estimated by two-stage least squares.
See notes to Table 6.

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