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Married Couples' Time Allocation Decisions and Marital Stability

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Abstract The Panel Study of Income Dynamics (PSID), 1985–1992, are the data used to simultaneously examine the role of family stability to both market and household time allocation for both spouses and the role of couples' time allocation in their probability of divorce. The study found that increases in the probabilities of divorce were only significantly correlated with decreases in wife's housework time. It was also found by the study that increases in the husband's market work hours and increases in the wife's household work hours had negative effects on the probability of divorce.

Keywords Divorce · Market work · Household production

Introduction

During the past several decades, two major transitions in the structure of American families have received much public attention: increasing rates of married women's employment and divorce. In 1955, the labor force participation rate of married women over 16 years old was 28.5%, peaking at 61.6% in 1997 (U.S. Census Bureau 1997). This large increase has implications for the labor market and household decisions with regard to the division of labor inside and outside the home. Coincident with this trend, the divorce rate for all married women age 15 years and over increased from 14.9 per 1000 population in 1970 to

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20.7 in 1988, when it began to decrease slightly (U. S. Census Bureau 1992, Table 127). As divorce greatly affects the financial status of women, since their portion of the shared household resources is often reduced after divorce, the increasing divorce rate has important implications for both social policy makers and family professionals. Divorced women are significantly more likely to be poor, regardless of age, than are divorced men, and it is well known that female poverty is heavily concentrated among those who are widowed, divorced, or separated.

A possible option to help relieve the potential economic distress following a potential divorce is involvement in the labor market. Montalto (1994) and Gerner et al. (1990) discusses the labor force participation of married women as a form of insurance against the economic distress resulting from divorce. Johnson and Skinner (1986), using the Panel Study of Income Dynamics (PSID) 1968–1978, presaged this result in finding the average working hours for women, who subsequently experience marital dissolution, to dramatically increase prior to divorce. Given this, there appears to be a *hedging action* by married women, devoting more hours to market production to decrease the negative economic consequences of divorce.

While a hedging action by the wife is certainly a possibility, it is also possible that each spouse, when faced with increased divorce probabilities, decides to reduce their individual efforts to both the market and the household. Doing so further reduces the gains from marriage as the economic product of the family declines and increases the probability of divorce. From the perspective of the total economy, marital stability is more than a family issue. Divorce becomes an issue of national importance, if household members are found to reduce their market and/or household productivity due to marital instability. Marital instability reduces the national product.

Alternatively, the way each spouse allocates time to production and leisure could raise the probability of future divorce. Women who work in the market always face the dilemma of balancing work and family roles. This is especially true for the dual-earner family. The trade-off between the wife's time allocation to the labor market and to household production can be expected to have profound effects on the marital relationship. This is no less true of the husband who balances market work with demands for household production and marital responsibilities.

A great deal of research has been done to analyze the direction of causation between market work time allocation and divorce. Some see the causation running from the probability of divorce to time allocation (Greene and Quester 1982; Johnson and Skinner 1988; Montalto 1994), while others view the causation as the effect of time allocation on the probability of divorce (Spitze and South 1985; Cherlin 1979; Becker et al. 1977; Bryant 1990). However, few researchers (Johnson and Skinner 1986; Gray 1995; Trzcinski 1996) have studied the mutual causation between them. Moreover, fewer still (Trzcinski 1996) have included time allocation to household production in the analysis and none have any included the simultaneous time allocation decisions of the husband in the analysis. This work addresses these shortcomings.

Despite past literature addressing the link between marriage and labor market activity, Spitze and South (1985) suggest further examination of how household tasks and functions are being fulfilled while exploring the relationship between time expenditures in the labor market and marital stability. Household member market labor supply, household labor supply, and the probability of marital dissolution can be seen as endogenous and determined simultaneously. Therefore, a simultaneous equations model is employed to test the interrelationships among these decisions. Given the above, three research questions are addressed in this study:

Question 1: Do time allocations to the labor market affect the probability of divorce?
Question 2: Do time allocations to household production affect the probability of divorce?
Question 3: Does the probability of future divorce affect market work time and the household production time of spouses, hence reducing the national product?

Theoretical Framework

This section presents a model of the economic theory of marriage focused on the household's time allocation to both market work and home production. The inherent weakness of traditional consumer demand theory is its inability to predict behavioral decisions related to nonmonetary factors such as nonmarket time allocation. Economic variables may not completely explain the variation in the demand function, as differences are often due to relative preferences associated with age, gender, race, religion, and other observed variables (Killingsworth 1983).

The household production function (Becker 1965) supplements traditional demand theory by providing a richer analysis of family behavior. While the household production function produces commodities that generate household utility through combining the inputs of purchased goods and services with household members' time, it also provides the conceptual basis for the inclusion of measures that affect productivity in the empirical analyses.

The conceptual model presented here views the household's time allocation behavior in relation to decisions regarding future marital dissolution. Contemplate the wife and husband, allocating their time to competing demands for both market and household production, and their expenditures for market goods in the current period. These choices are made to maximize utility, where purchased goods and services, the individuals' leisure times, and home produced goods and services generate satisfaction. Current utility from consumption and time allocation decisions is assumed to be directly related to the probability of martial dissolution, as dissatisfaction with the household product increases marital dissatisfaction.

Similarly, a stressed marital union can affect the time the individuals allocate to both market and household production, as commitment to the shared product of the household or the desire to enhance market specific human capital impinge on time decisions. In short, it is clear that there is a fixed amount of time for married couples to allocate to life spheres; household production, market work, and leisure; and that a choice to increase the allocation of time to one directly reduces the time available to allocate to the others. As such, time allocations are clearly simultaneous. One only has to consider any household in which the marriage has failed to accept the notion that how the couple ''spent their time'' changed the probability of divorce or was it the probability of divorce that changed how those people ''spent their time''? Since both are possibilities, simultaneous modeling of time allocations and divorce probabilities is warranted.

With respect to the probability of divorce, both economic theory and family studies are helpful. The economic theory approach is based on the economic assumption that the individuals involved in a marriage make rational, utility maximizing decisions. The basis of the economics of marriage is that partners will stay married if their satisfaction levels are greater being married than if they relinquish the marital bond; if not, they will separate/divorce. Moreover, as discussed in Becker (1991), two assertions may be checked with our

approach. The first, do high-productivity men tend to marry high-productivity women in order to find equilibrium, where high-productivity people marry one another? In this way, each is compensated for their greater level of productivity. The second, gains from marriage are greater, the greater the degree of specialization within the household (Michael 1996). Taken to its extreme, one member should specialize in market production while another specializes in household production.

The objective of the household is to maximize household satisfaction across the two periods subject to constraints. There are economic and sociological constraints: time to be allocated to household work, leisure, and market work; income; household production technology, as well as socio-cultural, religious, and legal factors. The formal model follows.

The probability of divorce is presumed to be a function of both socio-demographic factors and the household's time allocations to home production, leisure, and market work in period one. To incorporate the probability of future marital dissolution into the framework, the probability of divorce, π, is modeled by a two period utility function. We argue that the probability of divorce by period two affects period one household time allocations; while the period one time allocations also affect a household's decision regarding marital dissolution within two years.

There are two marriage scenarios that are possible for period two. Either the household stays married or is divorced/separated. The complete household utility model is shown by Eq. 1. Household utility is a function of a vector (denoted by bold font) of market purchased goods and services, **C**, leisure time of the spouses, **L**, and home produced goods and services, **Z**. The household utility is divided into two periods: u_1 and u_2. In period one, the couple is married; therefore, the household utility function in period one u_1 is a function of vectors of market goods and services, $\mathbf{C_1}$, the vector of each spouses' leisure time, $\mathbf{L_1}$, and home produced goods and services in period one, $\mathbf{Z_1}$. $\mathbf{Z_1}$ represents the home produced goods and services in period one, produced through a household production function utilizing spouses' home time, $\mathbf{H_1}$, as well as purchased goods and services in period one, $\mathbf{X_1}$, as input factors.

In period two, the household could either remain married or get divorced. The probability of divorce (π) is a function of both socio-demographic factors and the household's time allocation to leisure, home production, and market production in period one. If the household remains married, the household utility in period two is multiplied by the probability of remaining married, i.e., $(1-\pi)(u_2(\mathbf{C_2}, \mathbf{L_2}, \mathbf{Z_2}))$. Period two household utility, u_2, is formed as in period one. If the household breaks up in period two, the individual utilities (a function of each individual's consumption of composite goods and services, C_{2i}, [i = f,m], individual leisure time, l_{2i}, [i = f,m], and each individual's home produced goods and services, Z_{2i}, [i = f,m]) are assumed to be additive for, if they are divorced, each prior spouse's utilities are independent, able to be added, and multiplied by the probability of divorce of the household, π $[u_{2f}(C_{2f}, l_{2f}, Z_{2f}) + u_{2m}(C_{2m}, l_{2m}, Z_{2m})]$. The individual home production function in period two, $\mathbf{Z_{2i}}$, i = f,m, is defined the same as the household production function in period one, $\mathbf{Z_1}$, except as a function of each individual's home time, h_{2i}, (i = f,m), the individual's purchased goods and services input, X_{2i}, (i = f,m), combined with the individual's productive capacity.

There are both economic constraints (time, income, and household production technology) and sociological constraints (SD) (socio-cultural, religious, and legal). Two time constraints in vector form are shown in Eqs. 2 and 3. The total time, T, is allocated to the household, **H**, leisure, **L**, and market work, **M**. Time constraints are needed for both period one (Eq. 2) and period two (Eq. 3). Thus, the household maximizes (1)

$$U = u_1(\mathbf{C_1}, \mathbf{L_1}, \mathbf{Z_1}(\mathbf{H_1}, \mathbf{X_1})) + (1 - \pi(\mathbf{H_1}, \mathbf{L_1}, \mathrm{SD}))(u_2(\mathbf{C_2}, \mathbf{L_2}, \mathbf{Z_2}(\mathbf{H_2}, \mathbf{X_2})) + \pi(\mathbf{H_1}, \mathbf{L_1}, \mathrm{SD})[u_{2f}(C_{2f}, l_{2f}, Z_{2f}(h_{2f}, X_{2f})) + u_{2m}(C_{2m}, l_{2m}, Z_{2m}(h_{2m}, X_{2m}))] \quad (1)$$

subject to (2) and (3)

$$\mathbf{H_1} + \mathbf{L_1} + \mathbf{M_1} = \mathbf{T} \quad (2)$$

$$\mathbf{H_2} + \mathbf{L_2} + \mathbf{M_2} = \mathbf{T} \quad (3)$$

The home production constraints for the intact family in the first and second period are $\mathbf{Z_1}$ and $\mathbf{Z_2}$ (Eqs. 4, 5), while the individual household member production constraints in period two are Z_{2f} and Z_{2m} (Eqs. 6 and 7).

$$\mathbf{Z_1} = z(\mathbf{H_1}, \mathbf{X_1}; \mathbf{E}), \frac{\partial \mathbf{Z_1}}{\partial \mathbf{H_1}} > 0, \frac{\partial \mathbf{Z_1}}{\partial \mathbf{X_1}} > 0, \frac{\partial (\mathbf{Z_1})^2}{\partial^2 \mathbf{H_1}} < 0, \frac{\partial (\mathbf{Z_1})^2}{\partial^2 \mathbf{X_1}} < 0 \quad (4)$$

$$\mathbf{Z_2} = z(\mathbf{H_2}, \mathbf{X_2}; \mathbf{E}), \frac{\partial \mathbf{Z_2}}{\partial \mathbf{H_2}} > 0, \frac{\partial \mathbf{Z_2}}{\partial \mathbf{X_2}} > 0, \frac{\partial (\mathbf{Z_2})^2}{\partial^2 \mathbf{H_2}} < 0, \frac{\partial (\mathbf{Z_2})^2}{\partial^2 \mathbf{X_2}} < 0 \quad (5)$$

$$Z_{2f} = z(h_{2f}, X_{2f}; \mathbf{E}), \frac{\partial Z_{2f}}{\partial h_{2f}} > 0, \frac{\partial Z_{2f}}{\partial X_{2f}} > 0, \frac{\partial (Z_{2f})^2}{\partial^2 h_{2f}} < 0, \frac{\partial (Z_{2f})^2}{\partial^2 X_{2f}} < 0 \quad (6)$$

$$Z_{2m} = z(h_{2m}, X_{2m}; \mathbf{E}), \frac{\partial Z_{2m}}{\partial h_{2m}} > 0, \frac{\partial Z_{2m}}{\partial X_{2m}} > 0, \frac{\partial (Z_{2m})^2}{\partial^2 h_{2m}} < 0, \frac{\partial (Z_{2m})^2}{\partial^2 X_{2m}} < 0 \quad (7)$$

The household production function is assumed to be a concave function of household members' time, **H**, purchased goods and services, **X**, and the environment factor, **E**.

Two income constraints exist—the household income constraint if married (Eq. 8) and the individual income constraints if the marriage dissolves (Eqs. 9 and 10).

$$\mathbf{X_2 P_2'} = \mathbf{M_2 W_2'} + (1 + r)(\mathbf{M_1 W_1'} - \mathbf{X_1 P_1'} + \mathbf{V_1}) \quad (8)$$

$$P_2 X_{2f} = W_{2f} m_{2f} + S(1 + r)(\mathbf{M_1 W_1'} - \mathbf{X_1 P_1'} + \mathbf{V_1}) \quad (9)$$

$$P_2 X_{2m} = W_{2m} m_{2m} + (1 - S)(1 + r)(\mathbf{M_1 W_1'} - \mathbf{X_1 P_1'} + \mathbf{V_1}) \quad (10)$$

If the household remains married in period two, the income constraint (Eq. 8) shows that the expenditure of the household in period two, $\mathbf{X_2} P_2'$ equals the sum of total household earned incomes in period two, $\mathbf{M_2} W_2'$, plus the total savings from period one, given interest rate r, $(\mathbf{M_1} W_1' - \mathbf{X_1} P_1' + \mathbf{V_1})(1 + \mathrm{r})$. If the marriage breaks up prior to period two, the individual income constraints for both the wife and husband, shown in the Eqs. 9 and 10, are similar to the household's full income constraint in the Eq. 8, except that the share of total saving left over from period one needs to be considered, once the marriage dissolves. If divorced by period two, the wife's share of the saving from period one is S and the husband's share is (1-S).

The objective of the household is to maximize utility in the two periods subject to time, income, and technology constraints. Assuming (i) $\mathbf{P_1} = \mathbf{P_2} = 1$, and (ii) a concave utility function, i.e., $\frac{\partial u_i}{\partial A} > 0, \frac{\partial^2 u_i}{\partial A^2} < 0$, $A = \mathbf{C_i}, \mathbf{L_i}, \mathbf{Z_i}, \mathrm{i} = 1, 2$, and (iii) a concave production function, $\frac{\partial Z_i}{\partial B} > 0, \frac{\partial^2 Z_i}{\partial B^2} < 0$, $\mathrm{B} = \mathbf{H_i}, \mathbf{X_i}, \mathrm{i} = 1, 2$, the first order conditions follow from a Lagrangian maximization.

$$\frac{\partial \Omega}{\partial l_{1f}} = \frac{\partial u_1}{\partial l_{1f}} + \frac{\partial \pi}{\partial l_{1f}}(u_{2f} + u_{2m} - u_2) - [\lambda_1 + \lambda_2 S + \lambda_3(1-S)](1+r)W_{1f} = 0 \quad (11)$$

$$\frac{\partial \Omega}{\partial l_{1m}} = \frac{\partial u_1}{\partial l_{1m}} + \frac{\partial \pi}{\partial l_{1m}}(u_{2f} + u_{2m} - u_2) - [\lambda_1 + \lambda_2 S + \lambda_3(1-S)](1+r)W_{1m} = 0 \quad (12)$$

$$\frac{\partial \Omega}{\partial h_{1f}} = \frac{\partial u_1}{\partial Z_1}\frac{\partial Z_1}{\partial h_{1f}} + (u_{2f} + u_{2m} - u_2)\frac{\partial \pi}{\partial h_{1f}} - [\lambda_1 + \lambda_2 S + \lambda_3(1-S)](1+r)W_{1f} = 0 \quad (13)$$

$$\frac{\partial \Omega}{\partial h_{1m}} = \frac{\partial u_1}{\partial Z_1}\frac{\partial Z_1}{\partial h_{1m}} + (u_{2f} + u_{2m} - u_2)\frac{\partial \pi}{\partial h_{1m}} - [\lambda_1 + \lambda_2 S + \lambda_3(1-S)](1+r)W_{1m} = 0 \quad (14)$$

From the first order condition, some inferences follow. Equation (15) (Eq. [11] divided by Eq. [13]) provides implications of how the wife allocates her home time and her leisure. The opportunity cost for the couple to remain married is $u_{2f} + u_{2m}$ and, vice versa, the opportunity cost for both the husband and the wife to get divorced is u_2. Therefore, the left hand side is the difference of opportunity cost of the couple between staying married and getting a divorce, $u_{2f} + u_{2m} - u_2$, multiplied by the difference of the marginal probability of divorce due to an additional hour of both her leisure and her home time in period one. The right hand side is the difference of marginal utility between the additional hour of her home time as an input in the production function and the additional hour of her leisure in period one. In equilibrium, the right hand side is equal to the left hand side.

$$\frac{\text{Eq. (11)}}{\text{Eq. (13)}} : (u_{2f} + u_{2m} - u_2)\left(\frac{\partial \pi}{\partial l_{1f}} - \frac{\partial \pi}{\partial h_{1f}}\right) = \frac{\partial u_1}{\partial Z_1}\frac{\partial Z_1}{\partial h_{1f}} - \frac{\partial u_1}{\partial l_{1f}} \quad (15)$$

Equation (16), which is Eq. (11) divided by Eq. (12), indicates how the husband's period one leisure trades off with the wife's first period leisure. In the numerator of Eq. 16, the change of her leisure in period one not only changes the household's utility in period one, $\frac{\partial u_1}{\partial l_{1f}}$, but also affects the probability of divorce by period two, $\frac{\partial \pi}{\partial l_{1f}}(u_{2f} + u_{2m} - u_2)$. In the denominator of Eq. 16, the husband's first period leisure time affects both the household's utility in period one ($\frac{\partial u_1}{\partial l_{1m}}$) and the probability of divorce ($\frac{\partial \pi}{\partial l_{1m}}(u_{2f} + u_{2m} - u_2)$). Therefore, the probability of divorce is a factor to consider when the rate of substitution between the wife's and the husband's leisure is analyzed, the theoretical underpinning of this research.

In equilibrium, the marginal rate of substitution between the wife's leisure in period one and the husband's first period leisure equals the ratio of her wage rate to his wage rate.

$$\frac{\text{Eq. (11)}}{\text{Eq. (12)}} : \frac{\frac{\partial u_1}{\partial l_{1f}} + \frac{\partial \pi}{\partial l_{1f}}(u_{2f} + u_{2m} - u_2)}{\frac{\partial u_1}{\partial l_{1m}} + \frac{\partial \pi}{\partial l_{1m}}(u_{2f} + u_{2m} - u_2)} = \frac{W_{1f}}{W_{1m}} \quad (16)$$

The equilibrium of the time allocation of husband's leisure and home time in period one refers to Eq. (17). The inference is similar to that for Eq. (15).

$$\frac{\text{Eq. (12)}}{\text{Eq. (14)}} : (u_{2f} + u_{2m} - u_2)\left(\frac{\partial \pi}{\partial l_{1m}} - \frac{\partial \pi}{\partial h_{1m}}\right) = \frac{\partial u_1}{\partial Z_1}\frac{\partial Z_1}{\partial h_{1m}} - \frac{\partial u_1}{\partial l_{1m}} \quad (17)$$

There are four household input demand functions that are obtained through maximizing the household utility function subject to the full income and household production constraints. The four demands are work time at home and leisure time for the husband and the

wife, h_{1f}, h_{1m}, l_{1f}, l_{1m}. It is assumed that the demand functions satisfy properties of adding-up, homogeneity, negativity, and symmetry. Moreover, the equilibrium conditions support four demand functions, obtained as a function of the exogenous variables, husband's wage rate, wife's wage rate, each one's share of saving in period one, both husband's and wife's unearned income, and other socio-cultural variables, such as age, education, religion, race, etc. Moreover, each household member's time is modeled as being simultaneously determined and to directly affect the time allocations of the other member, as well as their own. Given the above backdrop of theory and literature, the hypothesized relationships of each independent variable to each of the five dependent variables are discussed below.

Age is expected to have a positive relationship with market hours, a negative relationship with both home hours and the probability of divorce. The older the spouse, the greater will be market productivity relative to home productivity and more hours will be spent in the labor market and less in home production. Age squared is entered to capture the concave shape of the work-age profile. The older the wife is, using her age as a proxy for length of marriage, the less likely is divorce (Becker et al. 1977).

Education is expected to have a positive relationship with each spouse's market work time. Greater education enhances productivity both to the market and to the home, but education is expected to increase market productivity more, thus each spouse would be expected to increase market work hours to increase total utility. Moreover, when holding each spouse's market work hours and wage rate constant, education is expected to have a negative independent relationship on divorce probabilities as the stock of human capital allows for greater communication skills.

Being white, for wives, is expected to have a negative relationship with market work hours, as past research has found that white females are less likely to be employed. The opposite has been found for white males and is expected. Moreover, if the spouses are of different races their probability of divorce would be greater as racial differences reduce the number of shared socio-cultural traits (Becker et al. 1977).

Preferences regarding household production and marital cohesion are often associated with religions. Catholic or Mormon religious doctrines emphasize the family. Affiliation with either of these religions is expected to have a positive relationship with household production time. However, if the spouses are of different religions, a greater probability of divorce is expected due to socio-cultural differences.

The greater the number of children (including turning from no child to child), the greater the expected household hours and the less the expected market work hours, since more children increases home productivity and thus increases the allocation of time to home production and decreases working time. For wives, more children may cause her to work more both in the market and at home to meet both the monetary and care needs of children. From the perspective of human capital theory, children may be viewed as marital specific human capital, lowering the probability of divorce (Becker et al. 1977). Lillard and Waite (1993), however, found that greater numbers of children increase divorce probabilities.[1]

[1] Waite and Lillard (1991) concluded that ''although a simple measure of number of children born does not reflect the complex effect of children on the chances that a marriage will end, use of such a variable -or even no measures of marital child bearing-has little effect on conclusions about the strength of other factors.'' Given this conclusion it was the decision of the researchers to control for the presence of children, the number of children, as well as the age of the youngest child, in order to address this important factor. However, as the focus of this paper is the inter-relationships between time allocations and divorce, no attempt was made to model fertility as a simultaneous choice.

The older the age of the youngest child, the greater are expected market work hours and fewer the expected household work hours. Younger children increase the productivity of household work time resulting in fewer hours being given to the labor market. As the youngest child ages, the child is more independent. Therefore, the growing dependence on other social institutions, such as schools, reduces the marital specific function of parents with young children (U.S. Department of Education 2005). Thus, marriage becomes less necessary and divorce probabilities increase.

Home ownership is expected to have a positive relationship with housework hours, and a negative relationship with divorce. If a family owns a home, we expect more hours to be spent in household production. Home ownership will dissuade a married couple from divorce due to the shared financial capital represented by the home (Spitze and South 1985; Becker et al. 1977).

Market work hours can be expected to vary by the work experience for the wife and the county unemployment rate. The greater the wife's work experience, measured by number of years worked since age 18, the greater her market productivity. Hence, she increases her market work hours relative to others. On the other hand, because of greater work experience, she can finish the same amount of work in less time, thus spending less time in the market. Overall, our hypothesis is that greater work experience is positively related to greater market work. The county percentage unemployment rate is expected to have a negative relationship with market work hours. Johnson and Skinner (1986) concluded that county unemployment rate is significantly and negatively correlated with the wife's working hours if her previous work experience is not considered. Gerner and Zick (1983) found that states' unemployment rates significantly and negatively affected labor force participation.

As the degree of substitutability between market-purchased goods and home-produced goods has not been explicitly assumed, the wage rate of each spouse is expected to have an ambiguous relationship with their own market work and household hours. Looking at the cross-wage rate effect between spouses, the cross-wage rate effect is expected to be much greater with respect to the effect of average variations in the husband's wage rate on the wife's time allocation than vice versa, as men traditionally are fully market employed and cultural constraints make it difficult to exhibit a response to changes in her wage rate. An increase in either spouse's wage rate is expected to increase the demand for the other's leisure if that leisure is a substitute for the leisure of the spouse whose wage rate increases. This would be indicated by a negative coefficient on the cross wage rate effect for both the market and housework equations of the other spouse. If their average leisure times were complementary goods, a positive sign results.

The unearned income of the family, as measured by the sum of rents, interest, dividends, and other asset income, is expected to have a negative effect on all work hours and on the probability of divorce. The higher the unearned income, the greater the couple's demand for leisure time, if leisure is a normal good. Greater unearned income, *ceteris paribus*, would increase the cost of divorce to at least one spouse and, as such, would be expected to lower divorce probabilities (Becker et al. 1977 and Levinger 1979).

The mutually endogenous variables of hours of market work and hours of household work, for both husband and wife, as well as the probability of divorce are the focus of this work. Each of them is modeled to be a function of the other four. As such, we will address each in turn, beginning with the effect of divorce probabilities on time allocation.

An increase in the probability of future divorce can be expected to affect time allocations of both spouses. Previous research has supported the notion that women increase the time they allocate to the market, as they work to increase their labor market experience as a

hedge against the economic loss from the divorce (Montalto 1994; Trzcinski 1996). On the other hand, when one controls for the missing variables in other research—the time allocated to the household by both spouses, as well as the husband's time allocation to the market—the effect could move in the opposite direction. Such a result could indicate a choice toward greater leisure, given greater probabilities of divorce, as the focus spouse takes time to be engaged in activities unrelated to the shared household commodities. Taken together, there is no *a priori* expectation with respect to the sign on the probability of divorce on market work.

Much previous research has ignored the effect of divorce probabilities on the time spent in household production, with the exception of Trzcinski (1996). Given that most household production time results in products that are shared among household members, consistent with Trzcinski, it is expected that greater divorce probabilities will reduce wives' time spent in household production. Husband's time spent in household production time may increase, in cases where their wife's household production decreases and he has to replace necessary housework, or decrease, as the shared household product is less important (Douthitt 2000).

Time allocations are expected to affect divorce probabilities in the following ways. First, time spent at market work is time that produces income to finance consumption, implying that increases in market work time could reduce divorce probabilities. Moreover, for the wife, time spent in market work could reduce divorce probabilities, as she is able to fully employ her human capital to her advantage while within the marriage. Time allocated to household production produces household specific commodities to be shared by household members. An increase in average household production time, by either spouse, is expected to reduce the probability of divorce.

A simple test of the positive assortative mating hypothesis is provided in this research. One would expect that an increase in a spouse's time in one area of production would decrease the time spent in the other sphere of production. If spouses sort according to productivity, then we expect that an increase in a spouse's productive time in either sphere of production, household or market, would increase the time spent in production by their spouse. For, if one holds market productivity constant (measured by the wage rate), the increased production time would measure increases in the total product.

Methodology

The statistical tool of simultaneous equations estimation is employed with the five mutually endogenous dependent variables of the probability of divorce/separation and both the annual market work hours and the annual household work hours of the spouses.[2] Each of the structural equations to be estimated is over identified and, since there are several predetermined variables excluded from each equation, a two-stage procedure of estimation is, thus, the preferred method of estimating (Gujarati 2003). Probit estimation is used for the divorce probability equation, double-hurdle Tobit is employed for the wife's market

[2] See Gujarati, D.N., Basic Econometrics (2003). Also, see Johnston, Econometric Methods (1972).

hours equation (Cragg 1971), while ordinary least squares is employed for both household work hours equations and the husband's market hours equation.[3]

Data from the Panel Study of Income Dynamics (PSID) 1985–1992 were used and a sample defined as married couples with wives aged 17–65 who were married at any time between 1985 and 1990 (t_i) and completed the survey for each period $t_i + 1$ and $t_i + 2$. Only two groups of people were included in the sample: the married group included those who remained married in continuous years t_i, $t_i + 1$ and $t_i + 2$, the divorced group included those who were married in time t_i, but were divorced by time $t_i + 2$. We define two situations as divorced: (1) *divorced and no wife or husband present in the family unit*; (2) *separated*,[4]*legally married but no wife or husband present in the family unit*.

While the Panel Study of Income Dynamics goes back to 1968, the decision was made to limit the years of selection to 1985–1992 for three reasons. The first was to reduce the effect of changes in the overall socio-cultural environment that, over time, can alter decisions regarding divorce and time allocation. Secondly, the shorter selection period represents a relatively calm economic period in U.S. history that reduces the need to control for confounding factors. Most importantly, the PSID data of these years are out of public release II, where similar questionnaires were used and the definitions of variables are directly comparable. Thus, there is good continuity of the data over these years.

After deleting cases with missing information and setting the five groups of data (1985/87–1990/92) together, there were 11,786 continuously married couples and 376 divorced couples for a total of 12,162 couples. No attempt to artificially weight the sample by disproportionate sampling was done. As the focus is clearly on the testing of theoretical relationships, rather than prediction, the resulting known increase in the probability of a Type II error was deemed superior to an unknown increase in the probability of a Type I error.

Descriptive Statistics

The variable definitions, mean values, and standard deviations of each dependent and independent variable are shown in Table 1.

The wife's market work hours are measured by the total annual hours in the labor market including overtime work, while household work hours are the total annual hours spent in household production defined as cooking, cleaning, etc. The average, non-zero

[3] The methods employed by the research were as follows. First, the Heckmann (1979) technique was employed to estimate wage rates for those women who were not employed in the labor market. Second, a probability of market work equation was estimated as a function of exogenous variables expected to have an effect on the probability of a wife entering the labor market. From this equation, estimates of the wife's probability of market work were calculated to use in the double-hurdle Tobit model for wife's hours of labor market participation. The suitability of the double-hurdle Tobit model was tested using the method prepared by Cragg (1971). The test statistic resulted a χ^2-value of 169.62 with 17 degrees of freedom. As such, the hypothesis of the regular Tobit being equivalent to the double-hurdle Tobit was rejected. For each of the four mutually endogenous regressors, husband's hours of market and home production and wife's hours of market and home production, reduced form equations were estimated where each were employed as dependent variables in equations estimated as a function of all exogenous regressors. From these, estimated values were calculated from the exogenous variables to be employed in the second stage estimation of the structural equations to be presented. The use of estimated values in the second stage ordinary least squares and logit regressions are expected to result in conservative estimates of t-statistics as the standard errors may be inflated. On the other hand, the use of Tobit in a simultaneous system produces standard errors that may be biased downward, as well as upward.

[4] Separation was included with divorce as an indicator of marital instability.

Table 1 Mean value and definitions of variables

Definition of variables	Mean	SD
1 = divorce/separated two years later, 0 = continuously married	0.031	0.174
Wife's annual market work hours	1170.070	891.499
Wife's annual household hours	1238.890	786.881
Husband's annual market work hours	2156.070	641.001
Husband's annual household hours	452.949	414.410
Age of the wife	36.221	10.670
Age of the wife squared	1396.480	823.941
Age of husband	38.702	11.190
Age of the husband squared	1588.400	931.446
Wife's years of school completed	12.879	2.400
Husband's years of school completed	13.047	2.740
Wife's race, 1 = white, 0 = others	0.736	0.441
Wife's race, 1 = black, 0 = others	0.229	0.420
Husband's race, 1 = white, 0 = others	0.739	0.439
Husband's race, 1 = black, 0 = others	0.232	0.422
Husband and wife different race	0.034	0.181
Wife religion (1 = Catholic or Mormon, 0=not)	0.254	0.435
Husband religion	0.253	0.435
Mixed religion marriage = 1, 0 if not	0.317	0.465
Marital history: 1 = married before, 0 = not	0.184	0.387
Husband's real hourly wage* in dollars	12.067	9.223
Wife's real hourly wage rate* in dollars	6.926	5.264
Wife's years worked since age 18	8.019	7.978
Family's unearned income* in $1,000	3.793	11.158
Age of the youngest child	4.081	4.849
Number of children in family	1.425	1.243
No children present (1 = no children, 0 = 1 +)	0.307	0.461
Home ownership, 1 = own, 0 = other	0.699	0.459
Percentage county unemployment rate	5.815	2.463

* The money value has been adjusted to 1985 dollars

annual market work hours and average annual household work hours of the wife are 1170.07 h and 1238.89 h, respectively. The average market work hours and household work hours of the husband are 2156.07 h and 452.95 h annually, respectively. For the sample to be analyzed, approximately 3.1% were divorced two years following time t_i, the time at which all other variables are recorded.

The demographics of the spouses were similar to national statistics. The average ages of the husband and wife are approximately 38.70 and 36.22 years old, respectively. Average educational levels are similar for each spouse, 12.88 years and 13.05 years for the education of the wife and husband, respectively. In this sample, 73.6% of wives are white, 22.9% black, and 3.5% of other race; among husbands, 73.9% are white, 23.2% black, and 2.9% of other race. Mixed race marriages made up 3.4% of the sample. The religious

affiliation for approximately 25.4% of wives and 25.3% of husbands is either Catholic or Mormon, while 31.7% of the sample represented a husband and wife from different religions.

The average husband's wage rate was $12.07 after all dollars have been converted to reflect 1985 dollars. The hourly wage rate for all wives, including an estimated wage rate for nonworking wives, is $6.93. The average working years, since age 18, for the wives was approximately 8 years. Average family unearned income in terms of 1985 dollars, is $3,793 per year. The average age of the youngest child is about 4 years old; the average number of children is 1.43, while 30.7% of the sampled households had no children at home. Approximately 70% of the families were homeowners. The average unemployment rate of the residence county was found to be 5.81%. Around 18.4% of the women in sample were previously married.

Empirical Results

Table 2 gives the results of the structural equations for the time allocations of both spouses, as well as the results for the probability of divorce equation. While many coefficients are presented, the focus will be on the significant variables that appear in the model, following a brief discussion of the socio-demographic variables in the model.

Older couples, with the age of the wife as proxy, had a lower probability of divorce. As men and women aged, they increased their market work time at a decreasing rate but their age had no significant effect on their home production time.

Greater education reduced the probability of divorce, indicating some gains from communication and consumption skills. Husbands with greater education were found to work more hours in the market, with no significant effect on their home production time. Wives, on the other hand, with greater education reduced their home production time with no significant effect on market work time. Perhaps, greater productivity as measured by her education increased the efficiency of her household production.

Racial differences were found to exist. Non-white women worked significantly more hours, while non-white men worked significantly fewer hours, in market production.

Religion changed home production time allocations with the finding that wives and husbands, being either Mormon of Catholic, worked more time in the household. Such results support the strong family ethic that predominates in the doctrines of these religions.

The greater the number of times a wife had been married, the greater the likelihood of divorce. Children, interestingly, were found to add to divorce probabilities, while controlling for other factors. Children also had an effect on time allocations. Having no children present in the household, as one would expect, reduced both spouse's household production time and increased the market work time of both spouses. Adding children, significantly reduced market work time for the husband, while increasing both his and her home production time. As expected, older children increased the market work times of both the male and female while reducing their household production times.

Homeownership reduced the probability of divorce, while increasing both spouses' home production time. These results indicate the importance of shared physical capital, such as a home, to the marital bond, as well as the additional work required by a home.

Economic variables, such as wage rates, and unearned income, are explicit to the theoretical model. We will first discuss the effect of the exogenous variables of wage rates and unearned income on both time allocations and divorce probabilities, followed by

Table 2 Multivariate results for divorce probability, market work hours, and household production hours' equations

	Probability of divorce (Probit coefficients)	Wife's market	Husband's market	Wife's home production	Husband's home production
Intercept	2.185*** (0.750)	222.227 (249.808)	178.563 (167.956)	1286.514*** (255.697)	610.045*** (120.049)
Wife's age	−0.022*** (0.005)	20.030*** (7.176)		4.479 (6.669)	
Wife's age squared		−0.396*** (0.096)		−0.013 (0.088)	
Husband's age			55.159*** (5.369)		−1.553 (4.547)
Husband's age squared			−0.734*** (0.065)		0.041 (0.058)
Wife's education	−0.035* (0.017)	0.644 (6.054)		−22.294*** (4.273)	
Husband's education			38.891*** (2.897)		−0.157 (3.110)
Mixed race marriage	0.151 (0.118)				
Wife white race		−92.123*** (25.036)			
Husband white race			68.149*** (19.240)		
Mixed religion marriage	−0.008 (0.050)				
Wife Mormon or Catholic				47.339** (24.010)	
Husband Mormon or Catholic					60.068*** (10.494)
Marriage history	0.489*** (0.068)				
Age of youngest child	−0.005 (0.011)	30.290*** (3.906)	6.324*** (2.325)	−9.816*** (3.519)	−7.737*** (1.422)
Number of children	0.097** (0.042)	0.162 (16.634)	−30.347*** (10.230)	63.719*** (13.288)	27.687*** (7.044)
No Children present	−0.288** (0.142)	442.141*** (60.068)	70.075** (32.154)	−196.220*** (41.774)	−76.706*** (21.556)
Home ownership	−0.124* (0.073)			47.106* (25.870)	46.194*** (13.152)
Wife's years of work experience		13.554*** (2.135)			
County unemployment rate (%)		4.576 (3.324)	−8.191*** (2.344)		
Wife's wage rate ($)	−0.013* (0.007)	6.362*** (2.333)	2.793* (1.575)	−7.754*** (1.552)	−0.843 (1.009)
Husband's wage rate ($)	−0.008* (0.004)	−7.415*** (1.226)	−8.431*** (0.879)	−2.610** (1.280)	−1.976** (.880)
Unearned income ($1,000)	−0.001 (0.003)	−1.247* (0.697)	1.445*** (0.543)	−1.258** (0.630)	−0.177 (0.374)
Predicted wife's annual market work hours (100s hours)	−0.023 (0.017)		11.968** (4.880)	−31.257*** (2.741)	4.780* (2.494)

Table 2 continued

	Probability of divorce (Probit coefficients)	Wife's market	Husband's market	Wife's home production	Husband's home production
Predicted husband's annual market work hours (100s hours)	−0.047* (0.026)	19.498*** (7.042)		15.807** (7.128)	−11.138* (6.420)
Predicted wife's annual household hours (100s hours)	−0.110*** (0.039)	−45.483*** (12.625)	37.077*** (12.378)		1.524 (6.679)
Predicted husband's annual household hours (100s hours)	0.042 (0.094)	93.467*** (23.757)	−0.053 (24.503)	36.091 (33.159)	
Probability of divorce		−445.784 (375.813)	473.701 (311.927)	−1366.933*** (334.678)	286.822 (191.817)
Double hurdle control (Lambda)		12.164*** (1.565)			
	X^2 = 154.023	R^2 = 0. 2015	R^2 = 0. 0882	R^2 = 0. 1474	R^2 = 0. 0188

* Significant at the .10 level

** Significant at the .05 level

*** Significant at the .01 level

addressing the primary research questions related to the effect of the mutually endogenous variables on one another.

The economic variables of wage rates, for both spouses, and unearned income appeared in all five equations in the system. In the equation for divorce probability, both the husband's and the wife's wage rates, on average, demonstrated a significant and negative effect on the probability of divorce. When either wage rate increases, we observe a lower chance of marital dissolution. As market hours are being held constant, this result supports the notion of economic gains from the marriage being important to maintaining the marital bond.

The wife's wage rate has a positive effect on her and her husband's market hours and a negative, significant effect on her own household work time. As the lone significant effect of her wage rate on the time allocation of the husband was a positive relationship between the price of her leisure and his market work time, this increase in his work time, *ceteris paribus*, will decrease his leisure time. We conclude that his leisure is a complement to her leisure time. The gross effect of $1 increase in her wage rate turned out to be 7.75 h reduction in her home production time and 6.36 h increase in her market work hours. Thus, an increase of approximately 1.39 more hours of leisure per year was found.

The husband's wage rate had significant effects on every dependent variable. When the husband's wage rate was increased, the couples' probability of divorce decreased, again supporting the fact of the importance of economic gains to marital stability. As his wage increased, on average, both his market working hours and his home production hours decreased. Clearly, the implication of these results is that his leisure is a normal good and that, as it's price increases, the substitution away from leisure is less than the increase in purchasing power resulting from the increase in income. Every $1 increase in his wage rate will cause him to work about 8.43 h less at market production per year and 1.98 h less on household production per year. The husbands demand more leisure, on average, with greater wages.

Of interest, while the husband's leisure time was found to be a complement to the wife's, such was not the case with the average wife's time response to changes in the average price of the husband's time. For both market work and household work hours, a greater average husband's wage rate decreased the time she allocated to both areas of production. Every $1 increase in his wage rate will cause her to work 7.42 h less at market production and 2.61 h less at home production. Given this result, we conclude that the wife's leisure is, on average and contrary to his response to changes in her wage rate, seen as a substitute good to the husband's leisure. On average, wives earning higher rates of wages induces an average increase in the productive time of husbands while, to the contrary, greater husbands' earnings reduced the productive time inputs of the average wife, as her leisure is found to be a substitute for his.[5]

Greater unearned income was unexpectedly found to have no effect on divorce probabilities. Greater unearned income had differing effects on the husbands and wives' time allocations. Greater unearned income increased his time spend in market production, perhaps a result of additional simultaneity issues, with no significant effect on his home production time. It did have the expected negative effects on the time allocated to her productive activities. Greater unearned income was found to significantly decrease both wives' market hours and home production hours, thus increasing her leisure time, indicating that her leisure is a normal good in the average household utility function.

[5] Symmetry, in economic theory, requires the Slutsky substitution effects to be equal, not the total cross-price effect.

The conceptual model is that spouses work at home and in the market for the purpose of maximizing household utility. They decide who will go to the market to work, for how long, as well as who performs household tasks. Decided simultaneously, they balance work and family roles. Moreover, if one spouse is engaged in a home production activity such as cooking, it is clear that the other spouse may be otherwise engaged in the care of children, lawn care, leisure, or other activity. How each of these allocations influence the other time allocations and divorce probabilities and, in particular, how divorce affects time allocations is the subject of the remainder of the discussion of the results.

The research questions focus on the effect of time allocations to both the market and the home, by both the husband and the wife, on divorce probabilities, and on the effect of divorce probabilities on time allocations. Before we focus on our answers to these questions, a brief discussion of the husband and wife's time allocations on each other is in order.

Spousal market production hours were found to be significant in seven of eight cases. The market production time of the wife was found to significantly reduce her time spent in household production. Of great interest is that her market time allocation significantly increased the average husband's time allocation to both spheres of production. Increases in the husband's average time in market production were found to have a significant effect in each equation in which it appeared. Every additional 100 h he engaged himself in market work decreased his hours of home production by around 11.14 h. Simultaneously, an additional 100 h of market work by him encouraged her to work 15.8 h more at home and 19.5 h in the market. The expectation of positive assortative mating, as posited by Becker (1991), where highly productive persons tend to marry one another, is confirmed.

Turning attention to the effect of spouses' time allocations to household production, it was found, similar to the above, that an increase in her household production time significantly increased his market production time. Only in the case of her market time was husbands' household time found to make a significant difference. Here, an increase in his household work time significantly increased her market work, indicating that his greater contribution to household tasks increased the time she, *ceteris paribus*, chose to employ in the market. It is clear that each spouse's own work in either sphere was found to reduce work in the other sphere, indicating the importance of controlling for all spheres of time allocation. Similarly, greater work by each spouse in each sphere of production was found, on average, to increase the time spent working by his or her spouse in both spheres of production. These results, clearly, support the hypothesis that marital partners within this sample sort by productivity and highly productive people seek to marry other highly productive people.

The primary research questions were (1) the effect of market time allocations on divorce probabilities, (2) the effect of household time allocations on divorce probabilities, and (3) the effect of divorce probabilities on both market and household time allocations. With respect to question (1), the more time he spent, on average and *ceteris paribus*, on market work, the less likely they would divorce. The wife's time spent in market work was not significant to the decision to divorce over the next two years. With respect to question (2), the husband's time in household production was not significant in effecting a change in divorce probabilities. The wives' annual housework hours, on the other hand, significantly decreased the divorce probabilities. This result seems to suggest that, for this period in history (1985–1992), increases in the production time of each spouse to more traditional roles helped keep the marriage stable—a measure of the gains from the union and to specialization of function. Regarding the effect of greater divorce probabilities on each spousal sphere of time allocation, greater probabilities of divorce only had a significant

effect on the wife's household hours, where it decreased her household production hours. Previous research indicated an increase in the probability of divorce induced the wife to work more in the market as a *hedging action* against financial loss after divorce. On first glance, this result may not appear to support this, but the effect is to increase her market work time, indirectly, through her reduction in household work time. It is indicated that a hedging action occurs, therefore, following from her reduction in household work time and from apparent increases in her husband's work times, rather than directly through the increase in the probability of divorce. One is left to conjecture about why these results are, on average, occurring in households with greater average probabilities of divorce. Could it be that wives sense the greater probabilities of divorce and they reduce their working time in the household, while increasing it to the market? Undoubtedly, further research is needed.

Discussion

The empirical results from this sample indicate several conclusions that must be interpreted in light of the time period of the study, the choice of the sample, and a clear focus on theoretical tests. The purpose of the study was not to prescribe behavior or policy, though such implications are inevitable. Rather, the focus will be on what was learned and, in instances, where that information may be employed in public discussions with regard to the family. We openly encourage discussion and replication using other data from other points in time.

We found the probability of divorce to be reduced by greater time spent by the wife in household work and, through a lower probability of divorce, an increase in wives' household work time. These results are striking and point, on the one hand, to the importance of household stability to society. Public policies that work to strengthen American families and reduce divorce are, therefore, important to the economic vitality of America through enhanced household production, as well as market work. Recent moves to allow workers greater flexibility with market work times; such as, leaves to address family crises are a start. The research clearly supports policy imperatives designed to focus on the family as a social institution that is integral to overall societal wellbeing and the total economic product of the nation.

Another important point to highlight is how important time allocations are to the stability of the family. It was found that greater engagement in the traditional household roles by both spouses—husband to the market and wife to the household—reduced the probability of divorce in the average sample household. It could be true, on the other hand, that wives who are heavily, perhaps solely, engaged in household production would have much less incentive to choose divorce. It is often the case that the financial resources of the wife, including her power to earn, is constrained by her lack of participation in market work and her share of household resources is, as a result, less certain. To reiterate, this research does not say that traditional roles are the only factors that matter. Rather, the results again point to the importance of economic gains from the marriage being important to the stability of the marriage. Specialization in production is far from being mandated. Rather, the finding that both spheres of production time are important, while holding human capital constant by controlling for wages, implies that younger generations need to build human capital in both spheres, as a means to enhance the social capital of a nation, as well as to achieve their individual potentials.

This research provides insight to the study of household members' time allocation and family stability by including both spouses' time allocations to both the market and household production activities in a simultaneous equation system with the probability of divorce. Previous research in the area has largely ignored both the wife's household production time and both time allocations of the husband and, in so doing, has ignored the fact that a marriage is, by definition, made up of two individuals who must make decisions in the context of each other. Past research made the implicit assumption that the wife makes her decisions while taking the husband's time allocation decisions as given. Certainly, this is an increasingly unrealistic assumption and to assume that one spouse fails to take into account the commitments of the other spouse in decisions regarding production would be seen as naive, if judged by a modern family juggling both work and household responsibilities.

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