

Examining the Determinants of Divorce: A State-Level Analysis

by

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Abstract

This goal of this thesis is to empirically examine the effects of certain determinants of divorce using state-level data between 2005 and 2009. Microeconomic theory is used to both predict and analyze the outcomes of the chosen variables. By using an approach that combines aspects of both fixed- and random-effects models, this paper shows a unique combination of results in comparison to the existing literature.

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CHAPTER I

INTRODUCTION

Over the past century, marriage rates have been declining and divorce rates have been climbing in the United States. In 1900, the marriage rate was 9.3 and the divorce rate was 0.7.¹ In 2009, the marriage rate was 6.8 and the divorce rate was 3.4.² In other words, over the past 109 years the marriage rate has declined by nearly 27 percent while the divorce rate has increased by almost 400 percent. What has happened to bring about such changes? Marriages used to be torn apart by death, whether that death occurred from war, illness, childbirth, or other causes. Today, divorce is among the leading causes of separation.

Other than an increase in life expectancy, what has contributed to the significantly high probability of divorce? Economists, sociologists, and psychologists have been trying to answer this question for decades. Some researchers look at the effects of divorce laws for answers. The no-fault unilateral divorce laws of the late 1960's, for example, changed the requirements for divorce thereby dramatically increasing the ease of obtaining a divorce. Prior to the enactment of these laws, divorce could only be granted if a person could show fault in his or her spouse. One would have to plead that their spouse had committed a culpable act, and then the accused spouse

¹ These rates represent the number of marriages and divorces per 1000 population and include annulments. Data provided by the U.S. Department of Health and Human Services and the National Center for Health Statistics (2007)

² These rates are expressed as the number of marriages and divorces per 1000 people. The divorce rate represents data from 44 reporting states and the District of Columbia. Data provided by the National Center for Health Statistics (2009) Website at <http://www.cdc.gov/nchs/fastats/divorce.htm>

could plead a variety of defenses. Governor Ronald Reagan set the stage for a change when he signed the Family Law Act of 1969 in California. This act replaced the earlier requirements for divorce by allowing one member of the marriage to seek divorce on the grounds of irreconcilable differences. In other words, divorce could be filed for without the showing of fault. Decades later in 2010, all fifty states and the District of Columbia allow no-fault divorce.

Although changes in divorce laws may have significantly contributed to the increase in the divorce rate, there is still debate over which factors within the family structure increase the risk of divorce. Research has looked into which types of marriages last the longest based on demographic factors such as race, religion, income, education, and family size to name a few. The literature, which will be discussed in Chapter II, typically agrees on the effects of specific variables and argues over the effects of others.

The purpose of this paper is to empirically analyze the effects of certain determinants of divorce using state-level data between 2005 and 2009. The results find that divorce is significantly affected by all but one of the variables investigated. Although the economic model presented includes factors used in other papers, the combination of variables is unique to this paper. The findings are generally consistent with the conclusions found in the existing literature, but some different discoveries have been made as well.

In Chapter II, the literature review, several papers on marriage and divorce are discussed. The ideas by Gary S. Becker are analyzed extensively due to his hefty contribution of the microeconomic theory behind divorce. Several papers, including one by Becker, that involve a more empirical analysis are then examined. The ideas and results of the papers discussed in the literature review provide insight into which variables should be included in the model. A paper

by Ekelund, Jackson, Ressler, and Tollison is also analyzed due to its similar nature in data. The econometrics from this paper are therefore investigated and utilized in this thesis

In the Chapter III the model is presented. Predictions on how the variables in the model affect divorce are hypothesized and the econometric methods that will be implemented are discussed. Then, in Chapter IV, the empirical results are revealed. The paper concludes with an interpretation of the results in Chapter V.

CHAPTER II

LITERATURE REVIEW

The factors that affect marriage and divorce have been frequently discussed in economics, psychology, and marriage and family literature. Different fields take different approaches, but many of the theories and opinions about the determinants of divorce overlap.

One of the most influential economists in this area of analysis is Gary S. Becker. His papers, including “A Theory of Marriage: Part I”, “A Theory of Marriage: Part II”, and “An Economic Analysis of Marital Instability” provide insight into the microeconomic theory behind marriage and divorce. “An Economic Analysis of Marital Instability”, which he co-wrote in 1977 with Elisabeth M. Landes and Robert T. Michael, not only looks at the determinants of divorce in a theoretical manner, but also uses cross-sectional data to look at them empirically.

Becker, in an earlier paper, uses utility theory to explain marriage and divorce. A person will marry when the utility of being married exceeds that of the utility of being single. They will divorce when the utility of staying married is less than the utility of splitting up. He also analyzes “optimal sorting” between mates as a matter of comparative advantages and specialization. A successful marriage will occur when the husband and wife each specialize in different skills. Most importantly, one mate should specialize in market skills by being successful in the working world, advancing their education in that department, and earning an income to support the family. The other mate should therefore have a comparative advantage in non market skills, such as raising children and taking care of the home. This specialization makes the division of labor within the marriage equal. When this equal division of labor does

not occur, Becker believes that an unhappy marriage will ensue and a possible divorce may occur.

Another possible source of divorce, according to Becker, happens when one settles for a less than optimal mate. This can occur because searching for a compatible mate has costs, including both time and money.

One very important theory Becker comes to is that of marital-specific capital. Marital-specific capital is a term that represents investments made by married persons that would be significantly less valuable if those persons were single. Examples of this include the specialized market/nonmarket skills that are more useful when married, “sexual adjustment with one’s spouse”, and most importantly – children (p. 1152). Children are a type of marital-specific capital because after divorce, one parent typically sees the child less. Therefore, an investment in this type of capital typically decreases the probability of divorce.

The empirical analysis of the determinants of divorce by Becker, Landes and Michael (1977) looks at men and women (aged 35-55 at the time of the survey) separately. For each gender, they “constructed eight separate data files pertaining to the stability of each person’s first marriage, in 5-year marriage duration intervals beginning with the date of marriage and running through the twentieth anniversary of the marriage” (p. 1158). The men’s regression model looks at the effects of age at marriage, schooling level, age, and earnings on the probability of divorce, by marriage duration interval. The women’s model estimates the effects of age at marriage, schooling level, age, and fertility on the probability of divorce, by marriage duration interval. Their reasoning for the different explanatory variables is as follows: “Unlike the function estimated for men, the equations for women do not include earnings (since many of these

married women did not work in 1967), but they do include the number of children at the beginning of each interval and a premarital pregnancy variable” (p. 1164).

In the past few decades, however, one of the most looked at determinants of divorce is female labor force (FLF) participation. Its effect on divorce is widely argued, with about one third of the literature saying it has a positive effect, one third saying it has a negative effect, and one third saying it has no effect on divorce.

In the publication “Causes and Consequences of Divorce: Cross-National and Cohort Differences, an Introduction to this Special Issue”, Jaap Dronkers, Matthijs Kalmijn, and Michael Wagner (2006) utilize economic reasoning for divorce to make a hypothesis. They state, “An economic tradition attributes the rise in divorce rates to changes in the balance between the cost and benefits of marriage for both husband and wife. If this is true, there should be a higher divorce rate among women with high-income jobs, because a high income facilitates [the ability] to bear the costs of divorce, and women with a high income are economically more independent from their spouse” (p. 479).

William Sander (1985), in his paper “Women, Work, and Divorce”, uses data from the United States farm sector in an attempt to validate his belief that “the divorce rate is significantly and substantially affected by the earning ability of women in market work” (p. 519). To set the stage for his model, Sander begins by explaining his economic theory of divorce. The theory behind his beliefs actually stems from the work of Becker, who was discussed earlier in the literature review. He states “the most important aspect of the [Becker’s] theory, though, is that high-wage women gain less from marriage relative to other women because the gains from specialization within marriage (the wife in household work and the husband in market work) are less” (p. 519). He notes another commonly used reason for divorce among working women that

“an increase in the earning ability of women enables them to leave an unhappy marriage and either remain divorced or remarry” (519).

Sander continues by enlightening the reader about the farm sector. Divorce rates are lower in the farm sector than they are in urban and rural nonfarm locations. This statistic complies with economic theory because “there is a greater sexual division of labor in the farm household relative to the nonfarm household” (p. 520). Wives on the farm typically specialize in household and on-farm work while women who work in urban or nonfarm locations obviously work in off-farm markets. This division of labor “increases the gains from marriage for farm wives relative to other wives, to the extent that specialization appreciably affects the gains from marriage” (p.520).

Farm men, Sanders notes, have increased their earning ability over time in comparison to men in the nonfarm sector. This means that a difference in income cannot be cited as the reason for low divorce rates in the farm sector. Instead, “the relatively low level of specialization by farm women in market work explains a substantial part of the farm-rural nonfarm divorce gap” (p. 520).

Finally, Sanders explains his data and model. He models the male farm divorce rate by state instead of the female farm divorce rate because “it better reflects the real farm rate” due to the fact that divorced farm women typically migrate to more urban locations (p. 520). The variables that Sanders believes would affect divorce are the husband’s income, the value of the wife’s time in market work and household (including on-farm) work, and religion. However, data was not available for these variables so he uses alternative variables in an attempt to model the same phenomenon.

As the first explanatory variable, he includes the rural nonfarm divorce rate. Because the farm and rural nonfarm economies are so integrated, this rate “should pick up the net effect of many of the determinants of the farm divorce rate in a state” (p. 520). He believes the rural nonfarm divorce rate will account for the level of schooling in the farm sector, the effects of the earning ability of farm men, and other variables that affect divorce costs like religion.

Sander’s goal of the paper is to show how the earning ability of women affects the divorce rate, and he believes that “the difference and the variability in the difference between the farm and rural nonfarm divorce rates for men is primarily a product of differences in the earning ability of farm wives in market work relative to rural nonfarm wives” (p. 521). In an attempt to measure this difference in incomes, Sander includes the labor force participation rate for farm women and population density as his next two explanatory variables. He notes that farm women and rural nonfarm women had about the same amount of schooling, so education is not a reason why farm wives participate less in off-farm market work. Population density is used because Sander found it to be the only factor with significant correlation to the labor force participation rate of farm women. He supports this association by reasoning that farm women in the labor force are typically in the off-farm market, and their travel time to their off-farm job will be shorter in more densely populated states. Therefore, “the effect off-farm wage rate would tend to be higher for farm women in more densely populated states because location is a key determinant of the acquisition of market-specific capital by farm women” (p. 521).

Another determinant of the difference between the farm and rural nonfarm divorce rates, Sander states, could be the better division of labor between the spouses within the farm household. He states, “the gains from marriage might be higher for farm wives if they had acquired more marital-specific capital relative to their rural nonfarm counterparts” (p. 521). The

way Sander chooses to represent the farm wives' marital-specific capital is with farm assets (the fourth and final explanatory variable). He notes that farm assets not only reflect the gains from specialization, but also the wealth that is gained when the farm wives enter the marriage.

Therefore, Sander's state-level analysis models the effects of the rural nonfarm divorce rate for men, farm assets, population density, and the labor force participation rate for farm women on the farm divorce rate.

Another common determinant of divorce that is argued over in the economic literature is the presence of children. One example is "On the Variation of Divorce Risks in Europe: Findings from a Meta-Analysis of European Longitudinal Studies" by Michael Wagner and Bernd Weiss (2006). Again, the work of Becker et al. is central to the microeconomic theory behind the paper. They, along with most economists mentioned in this literature review, utilize Becker's belief that a successful marriage stems from a good division of labor, investments in marital-specific capital, and a partnership with an 'optimal mate'. Wagner and Weiss specifically acknowledge that children, being a prime example of marital-specific capital, increase the gains from marriage and the costs of divorce. Becker's idea of 'search costs' is also mentioned, because if these costs are too high, a person might jump into a less than optimal marriage. "At the time of marriage not all attributes of the partners are known, but the higher the premarital level of information about the partner is, the better is the partner match and the lower the divorce risk" (p. 484).

After establishing their microeconomic theory behind divorce risks, Wagner and Weiss reveal the purpose of their paper. They wish to look at macro-level data to test whether the determinants of divorce vary across countries, and why. The risk factors they choose to assess in

a comparative meta-analysis across countries in Europe are the presence of children, premarital cohabitation, and the stability of parents' marriage.

In "State Variations in United States Divorce Rates", Bill Felton (1971) reveals the importance of specific state and regional characteristics on the probability of divorce. He begins by telling the various claims associated with the topic, such as "divorce rates of states and regions of the United States generally increase in going from East to West" and a "frontier atmosphere" exists which is "conducive towards divorce in these locations" (p. 321). Felton's paper proceeds by acknowledging that different states have different tolerances towards divorce due to that state's characteristics and the social costs of divorcing in that state. His hypothesis is that "divorce rates are more likely to be high in states having high migration rates than in states having low migration rates" because states with more migrants are less socially integrated, and will therefore have lower social costs of divorce (p. 323). Felton finds that "the 'frontier atmosphere' explanation of high divorce rates in western areas of the United States was at least partially vindicated" which indicates that for the model of this paper, something must be done to account for these regional differences.

The papers that have been discussed thus far shed light on certain variables that will be used in this thesis. Every paper, however, uses different econometric methods to achieve their results. None of these methods can be implemented in this thesis because of the specific nature of the data. The model presented in this thesis (which will be discussed in the following chapter) uses state-level panel data to look at the effects of certain variables on divorce and how the results compare to results in the literature. Panel data is typically analyzed using fixed-effects or random-effects models. The difficulty here lies in the fact that neither of these methods will fully describe the data in the nature we desire. Robert B. Ekelund, John D. Jackson, Rand W.

Ressler, and Robert D. Tollison (2006) encounter almost the exact same problem in their paper “Marginal Deterrence and Multiple Murders”. Therefore, the econometrics methods used in their paper will be examined in the following paragraphs, and utilized in this thesis.

In “Marginal Deterrence and Multiple Murders”, Ekelund *et al.* examine the impact of capital punishment on multiple murder rates. Through the use of state-level data from 1995 to 1999 and an estimation technique combining aspects of fixed-effects and random-effects models, they show that “executions reduce the single murder rate and that the use of electrocution reduces the murder rate beyond that resulting from lethal injection” (p. 521). State-level data is used instead of national data because the heterogeneity of deterrence practices across the states can lead to questionable findings. Ekelund *et al.* “avoids the implicit truncation problems” that would occur if they attempted to model the murder rate by state by modeling the log odds of being murdered instead (p. 530). In other words, trying to model the murder rate (which is usually expressed as the number of murders per 1000 people) “ignores left-truncation at zero, and the inflation resulting by multiplying murders per capita by 10^i obfuscates a corresponding right-truncation problem” (p. 530). To correct for these truncation problems, they convert the probability of being murdered to the log odds of being murdered by the following equation:

$$(1) y = \ln [(P(\text{murder}) / (1 - P(\text{murder})))]$$

This type of measure allows the dependent variable to range from negative to positive infinity, which is much easier to interpret.

Instead of using a traditional fixed-effects or random-effects model to estimate the panel data, Ekelund *et al.* uses a multiplicative heteroscedasticity approach. They explain the reasons for choosing this method as follows: in a one-way fixed-effects model, the intercept may differ across states, but each state’s intercept does not vary over time. In other words, it assumes that

all of the differences between states can be summarized by differences in the model's intercept by creating a dummy variable for each state. This method is clearly problematic because there would be 50 dummy variables alongside all of the explanatory variables with only 255 observations. The issues that could stem from this model, including a degrees of freedom problem and multicollinearity to name two, do not allow for any confidence about the estimates being robust. A one-way random effects model "assumes a common intercept and summarizes all cross-state heterogeneity in a state-specific component of the model's stochastic disturbance, leading to a heteroscedastic disturbance covariance specification and a generalized-least-squares (GLS) remedial approach" (p. 530). In other words, this method assumes there is one intercept that represents the mean value of all the states and the individual differences in the intercept values of each state are reflected in the error term. The first differences approach is an alternative procedure that "obviates the need to analyze variables for a given state that do not change over time" (p. 530). However, this method is irrelevant because the degrees of freedom that remain after the deletion of the observations are just as small as they were with the fixed-effects specification.

Therefore, Ekelund *et al.* choose to estimate a model that allows for both fixed- and random-effects. They group the states into nine regions that are used by the U.S. Bureau of the Census which "reduces the number of required parameter estimates for the fixed-effects specification, but it also spawns potential unobserved heterogeneity within each region and hence blurs the distinction between the fixed- and random-effects specifications" (p. 530). They also decide to assume a one-way approach which models heterogeneity across states, rather than a two-way approach which also models heterogeneity over time. The time effects are instead included in the model as a time trend variable.

“Marginal Deterrence and Multiple Murders” concludes by running the multiplicative heteroscedasticity model which jointly estimates a regression and variance function. Ekelund *et al.* include the regional dummies in both the regression function and the variance function which incorporates “both the differential intercept aspect of a traditional fixed-effects model concurrently with the cross-region variation in the disturbance variance aspect of a traditional random-effects model” (p. 531).

Through reading the literature on the economics of divorce and analyzing papers with models similar to the model in the given paper, a set of explanatory variables has been decided on as well as a method of execution.

CHAPTER III

THE MODEL

Through the reading and analysis of the literature in the previous chapter, the model of this paper was developed. From the reading of Becker, microeconomic theories about divorce have been established for this paper as well as several of the variables that will be used in the model. The choosing of the remaining explanatory variables, as well as the realization about the nature of the data, is supported by several of the papers that followed. The econometric methods used are based off of Ekelund *et al.*'s paper because of the similar nature of the data between the two models.

The sample for this model is panel data that consists of five years of observations (2005-2009) on each of the variables for 44 states. Information about divorce rates or number of divorces was not available for California, Georgia, Hawaii, Indiana, Louisiana, or Minnesota. Information about educational attainment, specifically the percent of the population who have attained a bachelor's degree, was not available for the District of Columbia. Therefore, data from these six states and one district were not included in the model.

Models discussed in the literature review provide insight for several of the determinants of divorce specified in the model; however, the model used in this paper is unique in its combination of independent variables. The following equation is specified:

$$(2) \text{ LOGDIV} = \alpha + \beta_1(\text{FLF}) + \beta_2(\text{BACH}) + \beta_3(\text{AGEF}) + \beta_4(\text{FAMINC}) + \beta_5(\text{BLACK}) + \beta_6(\text{SIZE}) + \beta_7(\text{DUMNE}) + \beta_8(\text{DUMMA}) + \beta_9(\text{DUMENC}) + \beta_{10}(\text{DUMWNC}) + \beta_{11}(\text{DUMSA}) + \beta_{12}(\text{DUMESC}) + \beta_{13}(\text{DUMWSC}) + \beta_{14}(\text{DUMMOUNT}) + \varepsilon$$

As discussed in Ekelund *et al.*'s paper, the dependent variable will be the log odds of being divorced rather than the divorce rate by state. To transform the data, the probability of being divorced (the number divorced in that state divided by the population of the state) is divided by one minus the probability of being divorced, and logged. In other words,

$$(3) \text{ LOGDIV} = \ln [P(\text{divorced})/(1-P(\text{divorced}))]$$

FLF, which represents the female labor force participation rate by state, is used in the model in an attempt to clarify its impact on divorce. Since the literature has such a debate over the significance and sign of this variable, it will be interesting to see the results in this model. Using economic reasoning, there is reason to believe both sides of the story. On the one hand, an increase in the women work force could increase the log odds of being divorced because unless the husband takes care of the domestic duties, there is no specialization of work within the marriage. As was established by the analysis of Becker, marriage is believed to be successful when the husband and wife specialize in different skills (one in market and the other in nonmarket skills). When both the husband and wife are in the work force, and no one is left at home to take care of the home and children, this usually stable division of labor is thrown off which can lead to stress and increase the risk of divorce. Also, if the wife is more successful than her husband, this can potentially threaten his position of being the family's provider which may also lead to marital problems. Another reason, which was pointed out by Dronkers, Kalmijn, and Wagner, is that a working woman might end up in a divorce because she can actually afford the divorce (lawyers, court fees, etc) due to her having her own income. One reason divorce was not as prevalent in the 1940's and 50's is that women could not get divorced unless the decision was mutual. Women who did not work could not afford the costs of divorce, and therefore were forced to stay in their unhappy marriages.

On the other hand, an increase in the women work force could decrease the log odds of being divorced. The husband may appreciate the wife's contribution to the family income, because with a higher combined income, more luxuries could be afforded, resulting in increased happiness. This could be particularly true if both the husband and wife have a high income, because they can then afford to pay a third party (a housekeeper or babysitter) to take care of the domestic duties.

After weighing the potential happiness and unhappiness a marriage may face due to a working wife, the prediction is that the sign of FLF will be positive. This hypothesis is supported by the belief that the loss of productivity from the unstable division of labor outweighs the additional income. Because of these conflicting views, however, the coefficient on FLF may be insignificant.

BACH, or the percentage of the state's population ages 25 to 64 who have attained a Bachelor's Degree, is expected to be negative. Some may disagree and expect this coefficient to be positive because if both the husband and wife are increasing their education, there is a high probability that there is less specialization between them because, as Becker et al. points out, typically "more educated women participate more in the labor force" (p. 1147). This may not be the case, however, because an increase in education for both spouses increases their levels of market and nonmarket skills which increases the gain from marriage. Also, the additional education for the couple increases their information about themselves and their spouse prior to marriage, thereby enabling them to make a more educated decision about getting married.

AGEF is a variable that represents the median age at first marriage for women, by state. The coefficient on this variable is expected to be negative, for many of the same reasons that BACH is expected to be negative. Females when they are older are typically more wise and

mature than they were when they were younger. A female in her early twenties may believe she has found “the love of her life” and may marry him on a whim. An older and more mature female, however, is able to make a more educated decision about marriage because she has an increased knowledge of both her and her potential spouse. This adheres to the reasoning that a person may settle for a less than optimal mate because they deemed the search costs of finding them too high. Women and men marrying young may also not have established who they are and who they want to be yet; So, the person they marry might completely change over the course of their marriage, leading to a potential divorce.

FAMINC, which represents the median family income by state, is expected to be negative but has conflicting views to think about as well. A higher income may lead to divorce because the couple can afford the costs of divorce (as discussed earlier). However, a high income family most likely indicates a more educated family which, as suggested earlier, leads to better decision making while choosing a mate.

BLACK is the percent of a state’s population who are Black or African American. This variable is expected to be positive because it is commonly believed that black people marry less and divorce more frequently than any other race. “The Topography of the Divorce Plateau” by Kelly Raley and Larry Bumpass state that “70 percent of black women’s first marriage will end in divorce as will 47 percent of white women’s marriages”.³

SIZE, which represents the average household size in the given state, is expected to be negative but there are conflicting views about this variable. On the one hand, having too many children for one’s situation (either personally or financially) could lead to stressful parents, which makes for a stressful marriage, and increases the risk of divorce. On the other hand, it is quite logical that having children reduces the probability of divorce because, as discussed in the

³ Information found in an article by Don Moore on www.divorce360.com but the date of the article is not known.

literature review, children are the best example of marital-specific capital. The value of a couple's children is substantially greater when they are together, versus if they were to separate. Parents may want a divorce, but will work through their problems to make a better life for their kids.

The last eight variables in the model are dummy variables that are included to account for some of the differences in the characteristics of each state. The importance of including these regional dummies are discussed in both Ekelund *et al.*'s and Fenelon's papers. The states were grouped into the nine regions defined by the United States Bureau of the Census: New England (DUMNE), Middle Atlanta (DUMMA), East North Central (DUMENC), West North Central (DUMWNC), South Atlanta (DUMSA), East South Central (DUMESC), West South Central (DUMWSC), and Pacific. The final region, Pacific, is used as the base category which means there is no dummy variable assigned to it. This is to prevent falling into the dummy variable trap, or the situation of perfect collinearity. Because there are nine census divisions, there should be eight regional dummies. Otherwise, as stated, there will be exact linear relationships among the variables (perfect collinearity). Therefore, the states included in the Pacific region will have values of 0 assigned to them for every regional dummy.

There are several different ways to estimate the model shown above, but due to the specific nature of the data, many of these methods must be ruled out. A multiplicative heteroscedasticity approach, which was used by Ekelund *et al.*, is implemented because in the original Ordinary Least Squares approach, the model had heteroscedasticity. This model estimates a regression function and a variance function where the logarithm of the variance is assumed to be a function of a different set of explanatory variables, which may or may not be in the regression function. This method begins by estimating the regression function using ordinary

least-squares (OLS) to obtain the residuals. The variance function is then also estimated with OLS, using the log of the square of these residuals as the dependent variable. The predicted values from this estimate of the variance function are then used as weights in a generalized least-squares (GLS) estimation of the regression function. The log of the square of these residuals are the new dependent variable for a new estimate of the variance function. The predicted values of this new estimate are then used as weights for a second GLS estimate of the regression function. This process between the estimates of the regression function and the variance function is iterated until the coefficient estimates of both models converge and stabilize. The parameter estimates that result are maximum-likelihood estimates.

This multiplicative heteroscedasticity approach for the model can be employed by using the program LIMDEP. By using the HREG option, the user is able to control the variables in both the regression and variance functions. The regression function includes all of the explanatory variables and regional dummies. The variance function only includes FLF and six regional dummies: DUMNE, DUMMA, DUMWNC, DUMSA, DUMWSC, and DUMMOUNT. The latter only includes some of the variables because with any more variables, the model would not converge. Only the significant dummy variables were included in the variance function. The descriptive statistics of the data are shown in Table 3.

CHAPTER IV

RESULTS

The maximum-likelihood estimates from the multiplicative heteroscedasticity model are provided in Table 4 for both the basic regression function and the variance function. The joint significance of the slope coefficients in both the regression and variance function is shown by the chi-square statistic associated with the likelihood ratio test. At a 95% confidence level with 21 degrees of freedom, the critical chi-square value is 32.67. The computed chi-square statistic for the model is 320 meaning the data rejects the null hypothesis. In other words, the null hypothesis of zero-slope coefficient vectors for the regression and variance functions can be rejected at any reasonable level. LLF is the logarithm of the overall likelihood function. BP stands for the Breusch-Pagan statistic which follows the chi-square distribution and tests for heteroscedasticity in the initial OLS estimate of the regression function. This statistic of 148.8496 at nine degrees of freedom clearly exceeds the critical chi-square value at any level of significance which means that the hypothesis of homoscedasticity can be rejected. In other words, the Breusch-Pagan statistic strongly indicates the presence of heteroscedasticity in the initial OLS estimates of the regression function, implying the use of the multiplicative heteroscedasticity model was a good decision since it corrected for the inefficiency of the parameter estimates and the bias in their standard error estimates.

The female labor force participation variable, FLF, is statistically insignificant. This correlates with what was expected since there may be two conflicting ideas at work. Regardless of the reason, it appears from this model that there is no significant correlation between the

female labor force participation rate and the log odds of being divorced. William Sander shows that the female labor force participation rate is significantly positively related to the divorce rate; however, it must be recognized that his data is from 1970. He also was only able to show this significance if population density was excluded from the regression. Therefore, the results obtained from this regression about the female labor force participation variable may be considered representative of the current data. This may indicate changing attitudes, and the corresponding implications on individual and joint utility functions, associated with female participation in market activity. Perhaps the traditional division of labor between husband and wife is no longer the strong indicator of a successful marriage as it was in the past.

BACH, and AGEF are uniformly negative and statistically significant at a 99% confidence level. In other words, as BACH and AGEF increase the log odds of getting a divorce decreases. This statement implies that a more educated couple is less likely to be divorced, which concurs with the prediction. Becker finds the level of schooling to be insignificant for both the men and women's regression in his empirical analysis, but in his theoretical analysis he admits that "marriages between highly educated individuals have greater gains because of the spouses' high levels of market and nonmarket skills" (p. 1146). The negative relationship between LOGDIV and AGEF implies that the lower the age of females at marriage, the higher the log odds of being divorced. So, as predicted in the hypothesis, women that marry at younger ages are more likely to get divorced than women who marry when they are older. This finding is not surprising since it complies with the theories of the general public, as well as other research. Becker *et al.*'s paper, for example, also finds that the age at marriage for females is statistically significant and negative in correlation with divorce.

Not much of the literature looks at race as being a predictor of divorce, but BLACK is positive and statistically significant at a 95% confidence level, as predicted.

FAMINC is positive and statistically significant at 95% confidence level which contradicts the predictions. This coefficient implies that as family income increases, the log odds of being divorced increases meaning that divorce is more common among wealthy families. This could be a result of no-fault divorce laws mentioned earlier. Before these laws were passed, the husband, if he was the bread-winner, had a lot to lose in terms of community property if he divorced. Losses are not as drastic now, thanks to no-fault divorce. This discovery somewhat agrees with Becker *et al.*'s finding that "earnings are consistently negatively related to the probability of divorce up to an earnings level of at least \$40,000, and become positively related at high levels" (p. 1160). A variable of $(FAMINC)^2$ was included in the regression function to see if results like Becker *et al.*'s could be obtained. Similar conclusions could be made if the coefficient on FAMINC were negative and the coefficient on $(FAMINC)^2$ were positive. After running the regression, the signs were correct but neither coefficient was significant.

The coefficient on SIZE is negative and statistically significant at a 95% confidence level. The sign on this variable was predicted, but the significance comes as a pleasant surprise. It implies that as the household size increases (or as the number of children increase), the log odds of being divorced decreases. These results mimic the findings of Wagner and Weiss that suggest the presence of children "strongly decreases the risk of divorce" (p. 490). Becker *et al.*, however, finds this relationship insignificant. He discovers certain effects of children affecting divorce due to the specific nature of his fertility variables, but "these effects are not linear with respect to either number or age" (p. 1166). They find, for instance, that "younger children discourage divorce more than older children do and the first two children discourage divorce

more than additional children do” (p. 1166). Another interesting find occurs when Becker et al. add an additional variable for the interval between the twentieth and twenty-fifth years of marriage into their OLS regression: the number of children over age 17. The largest effect was seen when there were no younger children left in the family. In other words, they find divorce to be more likely for older couples who are “empty nesters”. This interesting result concurs with theory supported in this paper that marital-specific capital plays a huge part in the risk of divorce. Children who have matured into adults are no longer as marriage-specific as they were when they were young, so divorce becomes more likely. Also, some women may decide to divorce, but delay the legal procedure until the children are grown.

The coefficients on DUMNE, DUMWSC, and DUMMOUNT are insignificant, indicating no significant difference in the log odds of being divorced between these regions and the Pacific region. The remainder of the regional dummies are all statistically significant at the 99% level. This indicates a lower log odds of being divorced for the Mid-Atlantic, East North Central, West North Central, South Atlantic, and East South Central regions than for the Pacific region. The results on the regional dummies suggest that a fixed-effects specification may have some merit. The generally high significance of these variables reflect the importance of including them in the regression, an idea supported by Fenelon’s paper and used in “Marginal Deterrence and Multiple Murders”.

The variance function includes FLF and many of the regional dummies. FLF is statistically significant and positive at a 95% confidence interval. It is interesting that FLF did not significantly affect the regression function, yet it did significantly affect the variance function. This implies that although the female labor force participation rate does not affect the log odds of being divorced, it does affect how variable the log odds of being divorced are

amongst the states. States with a higher FLF have a higher variance in the odds of divorcing than those with a lower FLF. All of the included regions demonstrated a larger variance than the Pacific region, with coefficient estimates that are all positive and statistically significant at a 95% confidence level. These generally significant results of the regional dummies support the use of random-effects specification.

Overall, the model appears to fit the data very well. As stated earlier, the chi-square statistic indicates the presence of non-zero coefficients for the regression and variance functions and the Breusch-Pagan statistic shows the presence of heteroscedasticity in the initial OLS regression function. The maximum-likelihood estimates from the multiplicative heteroscedasticity model show statistically significant relationships between the log odds of being divorced and all but one of the explanatory variables. FLF, one of the most discussed determinants of divorce in the literature, is interestingly not significant in the regression function, but clearly significant in the variance function.

The differences in the results of this paper and the results of the papers discussed in the literature review may be attributed to changes over time. The effect of a woman working on divorce is a good example of this. This paper found insignificant results of FLF while Sander found a significant relationship between the earning ability of women and the divorce rate. This difference, as discussed earlier, could be due to the fact that the data is from the 1970's and only looks at farm women. The results of this paper and the results of Becker *et al.*'s study agree in the negative and statistically significant relationship on the age of women at marriage. Becker *et al.*'s paper used data from the 1970's which implies that over the past few decades, females who marry young are still more likely to get divorced than those who wait till they are older. Their study, however, found no relationship between the level of schooling and divorce while this

paper did. This difference could be attributed to a number of things, such as the differences in the data. Becker et al. used years of schooling and distinguished between men's and women's education, as well as different marriage duration intervals. This paper uses a percentage of people who have attained a bachelor's degree, aggregates both sexes' education, and looks at this data by year. Any of these differences may have lead to a different conclusion, not to mention the different time periods of the data. Differences in the data may also have lead to the different results in the effect of family income on divorce. Becker et al. looks at different income levels as well as marriage duration intervals and only observes the man's income. This thesis does not differentiate between income levels and looks at the income of the family as a whole, not just the husband's contribution. The results on SIZE agree with one study (Wagner and Weiss) but disagree with Becker et al.'s study. This, again, could be due to a difference in the nature of the data, specifically the years used. In general, most of the differences in the results between this paper and the papers discussed in the literature review may be attributed to the differences in the data.

CHAPTER V

CONCLUSION

Divorce is an important and controversial topic that will continue to be analyzed by researchers in many fields. Regardless of the quality and quantity of research done in this area, divorce will still occur. Hopefully, however, the studies that are accomplished and the papers that are written will enlighten the population. Maybe then the divorce rates will drop down to a more reasonable level.

This thesis examined the effects of specific demographic and life course variables that are frequently suggested as important factors in divorce. State-level data from 2005 to 2009 shows results that both agree and conflict with the examined literature. The unique combination of variables and the use of the most recent data available allows for a more thorough and conclusive analysis than previous literature offered. Empirically, we found that the age of the wife at marriage, education level, family income, race, and the number of children have a significant effect on divorce. The most controversial determinant in the literature, the participation of women in the work force, had no significant effect on divorce. It does, however, affect the variability of divorce among the states. We arrived at these conclusions by applying an econometric method that combines aspects of fixed- and random-effect models.

The results of this paper provide insight into the effects of certain variables on divorce, but the scope of this analysis is limited. Isolating all the determinants of divorce in general and using that analysis to predict the outcome of a particular marriage is clearly unrealistic. Reasons

for divorce are different for every couple, and aggregating the variables at a state-level does not allow for the broad range of reasons that really exist.

Economic theory has proved useful in the past at providing insight into the forces motivating divorce, and it continues to do so. This thesis confirms that, but it also suggests attitudes, institutions, etc. evolve over time, so that an updating of received analyses, from time to time, is essential to keeping our understanding of this phenomenon current.

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Table 1: Variable Definitions

Variable	Definition
LOGDIV	<p>The log odds of being divorced for the observed state. Created using data from the number of divorces in that state and the population of that state.</p> <p>Source: U.S. Census Bureau</p>
FLF	<p>Female labor force participation rate by state. In other words, the proportion of the female population ages 15-64 that is economically active (all people who supply labor for the production of goods and services during a specified period.</p> <p>Source: U.S. Bureau of Labor Statistics, Current Population Survey, Geographic Profile of Employment and Unemployment</p>
BACH	<p>Percentage of the state's population ages 25 to 64 who have attained a Bachelor's Degree. Does not include data for District of Columbia.</p> <p>Source: Population Reference Bureau, analysis of data from the U.S. Census Bureau, 2005 through 2009 American Community Survey</p>
AGEF	<p>The median age at first marriage for women for the observed state.</p> <p>Source: U.S. Census Bureau, 2005-2009 American Community Survey</p>
FAMINC	<p>The median household income for the observed state.</p> <p>Source: U.S. Census Bureau, 2005-2009 American Community Survey</p>
BLACK	<p>The percent of the state's population who are Black or African American alone.</p> <p>Source: U.S. Census Bureau, 2005-2009 American Community Survey</p>

Table 1 (continued): Variable Definitions

SIZE	The average household size in the observed state. Source: U.S. Census Bureau, 2005-2009 American Community Survey
DUMNE	A dichotomous variable equal to 1 if the data refer to Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, or Connecticut; equal to 0, otherwise.
DUMMA	A dichotomous variable equal to 1 if the data refer to New York, New Jersey, or Pennsylvania; equal to 0, otherwise.
DUMSA	A dichotomous variable equal to 1 if the data refer to Delaware, Maryland, Washington, D.C., Virginia, West Virginia, North Carolina, South Carolina, Georgia or Florida; equal to 0, otherwise.
DUMESC	A dichotomous variable equal to 1 if the data refer to Alabama, Mississippi, Tennessee, or Kentucky; equal to 0, otherwise.
DUMWSC	A dichotomous variable equal to 1 if the data refer to Louisiana, Arkansas, Oklahoma, or Texas; equal to 0, otherwise.
DUMENC	A dichotomous variable equal to 1 if the data refer to Ohio, Indiana, Illinois, Michigan, or Wisconsin; equal to 0, otherwise.
DUMWNC	A dichotomous variable equal to 1 if the data refer to Missouri, Iowa, Minnesota, North Dakota, South Dakota, Nebraska, or Kansas; equal to 0, otherwise.
DUMMOUNT	A dichotomous variable equal to 1 if the data refer to New Mexico, Arizona, Colorado, Utah, Nevada, Wyoming, Idaho, or Montana; equal to 0, otherwise.

Table 2: Sign Hypothesis for the Explanatory Variables

Explanatory Variable	Expected Sign
FLF	+
BACH	-
AGEF	-
FAMINC	-
BLACK	+
SIZE	-

Table 3: Descriptive Statistics of the Variables⁴

Variable	Mean	Median	Maximum	Minimum	Standard Deviation
FLF	60.8	61.1	70.1	49.2	4.228122
BACH	18.6	19.0	25.0	11.0	2.954322
AGEF	25.8	25.8	29.0	22.1	1.22441
FAMINC	48776.21	47437	70545	27576	8422.999
BLACK	9.567727	6.7	37.5	0.1	8.926473
SIZE	2.543091	2.51	3.17	2.22	0.144978

⁴ Descriptive statistics do not include the regional dummy variables.

Table 4: Maximum Likelihood Estimates⁵

Variable	Coefficient	Standard Error	T-statistic
Constant	-1.661	.545	-3.047
FLF	-.003	.004	-.697
BACH	-.039	.005	-7.820
AGEF	-.086	.015	-5.560
FAMINC	.493x10⁻⁵	.228x10⁻⁵	2.160
BLACK	.003	.001	2.424
SIZE	-.386	.111	-3.487
DUMNE	-.076	.043	-1.745
DUMMA	-.246	.054	-4.562
DUMENC	-.301	.027	-10.949
DUMWNC	-.282	.039	-7.314
DUMSA	-.168	.041	-4.135
DUMESC	-.160	.039	-4.072
DUMWSC	-.081	.046	-1.789
DUMMOUNT	.096	.060	1.593

Variance Function

Variable	Coefficient	Standard Error	T-statistic
Sigma	.010	.009	1.122
FLF	.060	.030	2.028
DUMNE	1.887	.339	5.560
DUMMA	2.277	.414	5.500
DUMWNC	1.260	.379	3.327
DUMSA	2.173	.307	7.077
DUMWSC	1.657	.419	3.959
DUMMOUNT	3.484	.297	11.737

χ^2 : 320

BP: 148.8496

LLF: 170

Number of Observations: 220

Iterations completed: 41

Degrees of freedom: 21

⁵ Critical values for the standard normal distribution are 1.645 for $\alpha = 0.10$, 1.96 for $\alpha = 0.05$, and 2.54 for $\alpha = 0.01$, assuming two-tailed tests