Use of Labor Economic Theory to Examine Hours Worked by Male and Female Pharmacists

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Purpose. The objectives of this study were to develop a theoretically derived model of hours worked by pharmacists and estimate the model separately for male and female pharmacists.
Methods. A systematic random sample of 1,600 pharmacists from four states was mailed a survey asking about current and past employment information. Two dependent variables were studied: weekly hours worked and annual hours worked. Independent variables were categorized as economic variables (hourly wage rate, other income, total debt) and demographic variables (employment position, age, degree earned, marital status, number of children at home). A two equation multiple regression model was estimated with two-stage least squares regression.
Results. A total of 541 pharmacists responded to the survey and data from 442 of the respondents were used in the analysis. Hourly wage rates were negatively associated with weekly hours worked for males. Other income and total debt were significantly negatively and positively associated, respectively, with annual hours worked by female pharmacists. The number of young children at home significantly reduced weekly and annual hours worked by female pharmacists. Female pharmacists earning a Pharm.D. degree worked significantly more hours weekly and annually. Age was significantly negatively associated with male pharmacists weekly and annual hours worked.
Conclusions. Economic variables had a relatively small effect on hours worked by male and female pharmacists suggesting that increased wage rates may not increase hours worked. Strategies to increase hours worked by females likely should focus on benefits to help females handle childcare issues.

KEY WORDS: pharmacy workforce; labor supply; labor economics.

INTRODUCTION

The adequacy of the supply of pharmacists has been a topic of considerable importance in the pharmacy profession for many years.(1) The importance of this topic is fueled by the increased demand for pharmaceuticals from which the demand for pharmacists is derived. Additional importance of pharmacist workforce issues stems from the potential costs of an insufficient number of pharmacists to employers in terms of increased labor costs, to patients in terms of reduced access to pharmaceuticals and to pharmacists in terms of reduced quality of work life.(2)

Several indicators suggest that the supply of pharmacists is inadequate. Two reports empirically estimated that a shortage of pharmacists existed both regionally and nationally between 1983 and 1991.(3,4) Additionally, *Drug Topics* pharmacist salary surveys show that pharmacist salaries increased 46.4% between 1988 and 1996 which may be suggestive of a shortage as employers raise wages to attract scarce labor resources. Recently, the American Society of Health-System Pharmacists reported that 47% of institutional pharmacy directors had vacant pharmacist positions and 85% of respondents reported the vacancy rate was the same or worse than five years ago. Also, the National Association of Chain Drug Stores reported over 3,800 vacant pharmacist positions.

Solutions to a pharmacist shortage include reducing the demand for pharmacists by expanding the use of technical personnel and the adoption of automation for dispensing functions.(5) On the supply side, solutions to a pharmacist shortage include increasing enrollments in pharmacy schools and building new pharmacy schools. However, before expanding the number of pharmacists, a means of evaluating the potential impact of expanding enrollments or building new pharmacy schools is examining various characteristics of the present pharmacy workforce. The American Association of Colleges of Pharmacy *Profile of Pharmacy Students* shows that since 1985 a majority of students graduating from pharmacy schools has been female. Research has shown that women pharmacists work fewer hours than male pharmacists and are more likely to leave the workforce temporarily for family-related reasons.(6–9) Additionally, the percentage of all licensed pharmacists working part-time increased from 14.4% in 1990 to 19% in 1995.(7,10) These trends suggest current pharmacists may not be working to their full capacity. Thus, understanding factors that are associated with the number of hours pharmacists work may provide insight into the impact of expanding the number of pharmacists and/or mechanisms to promote hours worked by pharmacists. The economic theory of labor supply, previously used by researchers to exam labor supply decisions of other health professionals (11–13), was used to guide the selection of factors to include in an analysis of pharmacist labor supply, here conceptualized as the number of hours worked.

Conceptual Model of Labor Supply

Economic theory concerning labor supply (hours worked) focuses on the allocation of time available during the day to time spent working and time spent in leisure activities.(14) According to the theory, a person attempts to maximize utility from time spent in leisure or work subject to a budget constraint. A person is theorized to determine how much to work or not work based on what he/she consumes and the resources available for consumption. If the person has limited resources available for consumption, he/she must work to gain resources to use for consumption. Conversely, if adequate resources exist for consumption without working, less time will be allocated to work.

When discussing the allocation of time, it is just as valid to discuss the demand for leisure time as the supply of work time. Economic theory conceptualizes the supply of labor as a demand for leisure time, examining the association of the price of leisure with the quantity of time spent on leisure activities. The theory describes how wage rates (price of leisure) are associated with the number of leisure hours a person is willing to give up to work (labor supply).

The economic theory of the decision to work is centered on two concepts related to how changes in wage rates (increases and decreases) affect the number of hours worked.

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The first concept is the substitution effect of a wage change. Suppose a pharmacist's wage rate increases. As a result, an hour of leisure for the pharmacist is more expensive than before the wage increase. Thus, an hour of work is more attractive to a pharmacist due to the increase in cost for the same hour of leisure time. The pharmacist will substitute more work for leisure time. Thus, the substitution effect will result in more hours worked when the wage rate increases.

The second concept is the income effect of a wage change. Given the same wage increase, the pharmacist earns more income as a result of the wage increase. With more income the pharmacist is able to consume additional amounts of goods. Goods that are consumed in greater quantities as income increases are termed normal goods. If leisure is a normal good, the pharmacist will purchase more leisure time and work fewer hours when the wage increases. The wage increase makes the pharmacist better off, so he/she can afford to consume more leisure time and reduce the number of hours spent working. Thus, the income effect of a wage increase will decrease hours worked.

A wage change will result in both substitution and income effects. Since the substitution and income effects have opposite influences on hours spent working, the net effect of the two effects will depend on whether the positive substitution effect on labor supply outweighs the negative income effect or vice versa holding all else constant. The direction of the net effect (pharmacists increasing hours worked or reducing hours worked) cannot be predicted a priori and must be estimated empirically with appropriate models.

The labor supply decisions of a pharmacist also can be influenced by a pure income effect. This occurs when a pharmacist obtains income from non-labor sources (e.g., spouse's earnings, stock sales, rental income). As a result of receiving more income, the number of hours spent working is reduced. This is termed a pure income effect because a pharmacist's wage rate is unchanged. For example, a pharmacist earns significant investment income and subsequently has enough additional resources to purchase goods (including leisure time) without working. Thus, income from non-labor sources is hypothesized to reduce the number of hours a pharmacist supplies to the labor market.

Figure 1 shows graphically the relationship between wages and hours worked. The vertical axis represents the wage rate and the horizontal axis represents hours worked. The curved line depicts the theoretical relationship between wages and hours worked. Between wage rate w1 and w2, the relationship between hours worked and wages is positive as represented by the positive slope of the curve. In terms of labor economic theory, the substitution effect of a wage increase dominates the income effect. Between wage rates w2 and w3 the curve is vertical suggesting that the substitution and income effects cancel each other: increased wages have no effect on hours of work supplied to the labor market. However, between wage rates w3 and w4 the curve is directed back toward the y-axis. The relationship between wage rate and hours worked is negative in this wage range. Here the income effect dominates the substitution effect and pharmacists will supply fewer hours of labor as the wage rate increases. The curve is said to bend backward, suggestive of a backward bending labor supply curve.

Demographic characteristics of workers also are hypothesized to be associated with hours supplied to a labor market.(14) Characteristics of workers that influence the number of hours worked include age, gender, and education. Various life cycle factors, derived from human capital theory, such as work experience, employment position, marital status, and number and ages of children are hypothesized to account for differences in the number of hours a person works in the labor market. These are factors that determine the value of a person in the market and the time they can allocate to work.

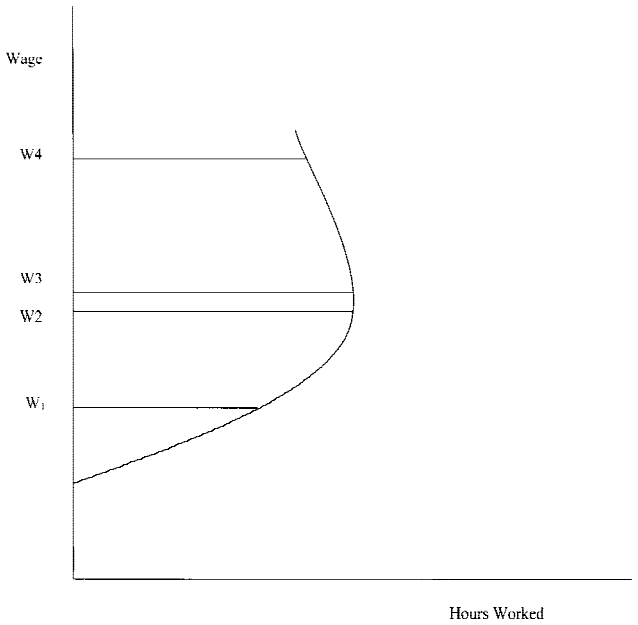

Fig. 1. Relationship between hours worked and wage rate.

Past Studies

Although empirical analysis of labor supply (hours worked) is a well studied area in labor economics,(14) in the context of pharmacy labor, a review of the literature found no study that has empirically examined pharmacist labor supply based on labor economic theory and econometric modeling. Additionally, labor economics focuses on differences between males and females in terms of how factors are associated with hours worked. A literature review revealed no studies comparing factors associated with hours worked for males and females.

Empirical studies of pharmacists have documented the number of hours worked by pharmacists according to various demographic variables and the adequacy of pharmacist supply.(3,4,6–10,15) In terms of economic variables, only one empirical study has shown the influence of market wage rate on hours worked per week and two empirical studies have shown the influence of non-labor income on pharmacists' labor supply decisions.(16–18) Multivariate studies examining the association between weekly hours worked and demographic variables showed that females work fewer hours than males, managers work more hours than staff pharmacists, young children reduce the hours of work by females and age is negatively associated with hours worked.(16,19–23) The present study adds to the results of past studies by coupling theoretically relevant economic variables (e.g., market wage, other income) with policy relevant demographic variables to

determine associations with the labor supply (hours worked) decisions of pharmacists.

This study has three objectives. The first objective was to develop a theoretically based, econometrically appropriate labor supply model relating economic and demographic variables with hours worked by pharmacists. The second and third objectives were estimating the labor supply model separately using data collected from actively practicing male and female pharmacists.

METHODS

Study Design

A cross-sectional, descriptive survey design was used for collecting and analyzing data. The study population was defined as licensed pharmacists in four randomly selected states (Ohio, Alabama, Massachusetts, Oregon) from the four U.S. census regions. Each census region was sampled to promote generalizabilty. The sampling frame was mailing labels of licensed pharmacists obtained from each selected state's board of pharmacy. Following sample size calculations, a systematic random sample of 200 male and 200 female pharmacists from each state was chosen for a total sample of 1,600 pharmacists. The sampling plan over-sampled female pharmacists to insure adequate numbers of female respondents for analysis by gender.

A survey instrument was developed to collect information regarding pharmacists' current employment situation (practice setting, position, secondary employment), personal characteristics (age, gender, race, years of experience as a pharmacist, degrees obtained, estimated population of practice area and state of employment), hours worked, earnings, family characteristics (marital status, number, ages and grade of children at home, family income, and total debt), and work history. Sampled pharmacists in each state received a survey packet containing a cover letter, the survey, a postage paid return envelope and an envelope containing a card to enter a $100 lottery as incentive to participate. The survey instrument was pilot tested in June 1997 using a sample of 80 pharmacists (10 males and 10 females from each state) to test for item clarity and response. A total of 29 pilot surveys were returned. No changes were made to the survey instrument and the 29 returned pilot surveys were included in the analysis sample. Following the pilot test, surveys were mailed in August 1997. A follow-up post card was mailed one week after mailing the surveys.

Dependent Variables

Two dependent variables were studied: 1) weekly hours worked and 2) annual hours worked. Respondents were asked how many hours they worked, on average, each week and, on average, how many weeks they worked. Weeks worked per year were net of any time off for vacations and other time off of work. Annual hours worked were calculated by multiplying reported average hours worked per week by reported annual weeks worked per year in a respondent's primary place of employment. Both measures of hours worked were used to be consistent with past pharmacist studies using weekly hours worked. Annual hours worked is a common measure of labor supply used in the labor literature.(14)

Pharmacists may work in additional jobs as pharmacists. Respondents reported the setting, weekly pay and hours worked per week at additional jobs. The total number of weekly hours worked at secondary jobs was added to weekly hours worked at primary employment. The number of weeks worked per year at secondary jobs was not collected. Thus, secondary weekly hours were multiplied by weeks worked at primary employment and added to annual hours.

Independent Variables

Independent variables were classified as economic variables, and pharmacist demographic variables. In terms of economic variables, the first independent variable was hourly wage rate. Typically, studies estimating the association of labor supply with wage and income calculate hourly wage by dividing total annual income from work by total annual hours worked. However, the accuracy of the calculated wage is questionable if respondents overestimate or underestimate annual earnings or annual hours worked. The survey instrument used in this analysis asked respondents to report average gross weekly earnings and average weekly hours worked to increase precision in these estimates. The hourly wage rate was calculated by dividing weekly gross earnings by weekly hours worked. For respondents working in secondary jobs, the hourly wage rate was a weighted average wage using weekly hours worked at each job as weights.

The second economic variable was non-labor income and was measured with two variables. The first was total debt and was included as a negative income measure. It was hypothesized that more debt would result in more hours supplied to the labor market controlling for other variables. The second non-labor income variable was other income defined as income derived from sources such as a working spouse or investments.

In terms of demographic variables, a group of variables represented respondents' characteristics and family situation. The model included employment position (management or staff), age, and degree earned. Management pharmacists included those reporting their position as manager, director, assistant manager, assistant director, or supervisor. The position of pharmacists at secondary jobs was not collected. Respondent age was included in the model as a continuous variable. Pharmacists were categorized according to their highest earned degree (BSPHARM, PHARMD and ADVANCED). PHARMD represented respondents with either post-baccalaureate or entry-level Doctor of Pharmacy degrees. Pharmacists holding a master's degree and/or a doctorate (Ph.D.) were included in the advanced degree category. Marital status and the number of children between the ages of 0 to 5, 6 to 10, 11 to 15 and >15 at home were included in the model. Young children likely require more care from parents. Subsequently, parents may choose to stay home with children between these ages compared to older children.

Data Analysis

Means and frequency distributions of the dependent and independent variables were calculated for males and females and differences in means between males and females were

tested with t-tests. Chi-squared statistics were calculated to determine bivariate associations between categorical variables.

The labor supply model relates hours worked to economic variables and demographic variables. Estimating this model with ordinary least squares regression would result in biased coefficients for the wage variable. The bias results because wage rates were calculated from reported hours worked. When the wage rate is determined by dividing earnings by hours worked, any measurement errors related to reported hours worked will be repeated in the calculated wage rate.(14) Thus, the error term in the hours worked equation will be correlated with errors in the wage rate. Econometrically, the correlation of these errors would bias ordinary least squares estimates of the wage coefficient downward.(24)

To account for the correlation between the errors of the hours worked equation and the wage rate (endogeneity of the wage), an instrumental variable technique was used for estimating the labor supply model. The instrumental variable in this analysis was a predicted hourly wage rate that has the properties of being correlated with the calculated wage rate and uncorrelated with the error term in the hours worked equation. Thus, the analysis estimated the two- equation system listed below.

$$w = \alpha_0 + \alpha_1 x + \alpha_2 z + \nu \quad (1)$$

$$h = \beta_0 + \beta_1 y + \beta_2 w^p + \beta_3 x + \varepsilon \quad (2)$$

The first equation was used to determine the instrumental variable, predicted wage (w^p). The wage rates calculated by dividing weekly gross earnings by weekly hours worked were regressed on a set of variables (x and z) hypothesized to be associated with wage rates. The first vector of variables (x) are the demographic variables described above. The second set of variables (z) were used to identify the wage equation. These variables were hypothesized to be associated with wage rates but not associated with hours worked independent of any earnings effects. The coefficients of the wage equation (1) were fit to the corresponding characteristics of each respondent to calculate the predicted wage rate (w'). The variables contained in the set (z) were race (white or non-white), practice setting, and urbanization and regional variables. Setting variables were included due to differences in wage rates across settings reported in *Drug Topics* pharmacist salary surveys. Urbanization and regional variables accounted for differences in wage rates due to cost of living differences. Race was included due to setting and regional differences among pharmacists. (25) Practice setting was defined as three types: Independent/Small Chain, Large Chain, and Institutional. Independent/Small Chain represented pharmacists practicing in settings with ten or fewer units under common ownership, and clinic pharmacies. Large Chain consisted of pharmacists practicing in large chains (11 or more units under common ownership), mail order, grocery store and department store pharmacies. Institutional represented pharmacists practicing in hospitals, home health care settings, and long term care facilities. The degree of urbanization was represented by dummy variables representing the size of the population in which pharmacists practiced: small (< 50,000 people), medium (50,000 to 500,000 people) and, large (> 500,000 people). Census region dummy variables (East, Midwest, South, and West) controlled for regional differences.

The second equation relates hours worked (h) with the vector of income variables (total debt, other income) (y), the predicted wage (w^p), and the vector of demographic variables (x). The two equation system was estimated separately for male and female respondents to examine the association of independent variables with weekly hours worked and annual hours worked. Two-stage least squares regression was used to estimate the two-equation system.

RESULTS

Of the 1,600 surveys mailed, 35 were returned as undeliverable. Of the surveys assumed to be delivered (1,565), a total of 541 were returned for an adjusted response rate of 34.6%. Because the number of subjects sampled from each state and by gender was known, response rates adjusted for undeliverable surveys can be determined. The response rate for subjects in Ohio, Massachusetts, Alabama, and Oregon was 39.7%, 29.8%, 28.9%, and 40.1%, respectively. In terms of gender, the response rate for females was 38.3% and for males the response rate was 30.6%. There was variability in response rates by gender across the four states. For females response rates were 44.8%, 34.9%, 29.5%, and 44.7% for Ohio, Massachusetts, Alabama and Oregon, respectively. For males response rates were 35.1%, 24.9%, 27.8%, and 34.8% in Ohio, Massachusetts, Alabama and Oregon, respectively.

Of all respondents, 476 (88.0%) were actively practicing pharmacy, 21 (3.9%) were retired, 27 (5.0%) were not working, and 17 (3.1%) were working outside of the pharmacy profession. A majority of actively practicing respondents was female (55.7%) and the mean age of actively practicing respondents was 41.4 years. Most respondents were white (93.5%) and 77.9% were married. In terms of practice setting, 43.6% practiced in large chain settings, 32.4% in institutional settings, 20.8% in independent/small chain settings and 3.2% were in other settings. *The National Pharmacist Workforce Survey: 2000* report showed that 44.8% of actively practicing pharmacists were female, had an average age of 43.6 years, 76.0% were married and 41.0% practiced in large chain settings, 21.6% in independent/small chain settings, 30.7% in institutional settings and 6.7% in other settings.

Respondents were included for analysis in the present study if they met three inclusion criteria. First, respondents had to be actively practicing, employee pharmacists. Thus, the 65 respondents either retired, not working or working outside of the pharmacy profession were excluded. Pharmacists who owned businesses (n = 18 (3.8%)) were excluded because they did not meet the criteria as employee pharmacists. Lastly, respondents working in settings not providing direct patient care (e.g., non-clinical academicians, professional sales representatives) (n = 13 (2.8%)) were excluded. Three respondents did not provide their gender. Thus, a total of 442 respondents were included in the analysis. Table I contains a summary of variables used in the analysis for the entire sample and for males and females. The characteristics of males and females in the study sample were similar to characteristics of corresponding males and females from the *National Pharmacist Workforce Survey: 2000*. A total of 38 respondents (8.6%) held additional jobs as pharmacists and the mean number of hours worked weekly at additional jobs was 11.0. In terms of gender a total of 17 males (9.1%) worked additional jobs for an average of 10.2 hours weekly and 21 females (8.2%) worked additional jobs for an average of 11.7 hours weekly.

Table I. Sample Means for Total Sample and by Gender

Variable	Total sample (n = 442)	Males (n = 186)	Females (n = 256)
Labor Supply			
Hours Worked per Week	38.6 (9.89)[a]	40.2 (9.96)[b]	37.5 (9.72)[b]
Weeks Worked Per Year	49.2 (5.44)	48.8 (6.50)	49.6 (4.51)
Annual Hours Worked	1,951.1 (596.0)	2,002.0 (595.6)	1,915.1 (595.8)
Wage and Income			
Hourly Wage	26.97 (4.57)	27.42 (5.62)[c]	26.63 (3.60)[c]
Non-labor Income	35,075.4 (31,973.2)	26,307 (26,830)[b]	41,487 (33,940)[b]
Total Debt	95,182.6 (67,713.6)	88,154 (70,014)	100,582 (65,603)
Pharmacist and Practice Characteristics			
Percent Married	0.78 (.42)	0.81 (.40)	0.75 (.44)
Mean Number of Children Age 0–5	0.31 (.64)	0.19 (.51)[b]	0.39 (.71)[b]
Mean Number of Children Age 6–10	0.22 (.51)	0.21 (.48)	0.23 (.53)
Mean Number of Children Age 11–15	0.24 (.53)	0.26 (.59)	0.22 (.48)
Mean Number of Children Age ≥16	0.15 (.45)	0.20 (.54)[b]	0.11 (.37)[b]
Mean Age	41.0 (12.0)	47.1 (13.1)[b]	36.5 (8.9)[b]
Percent Female	0.58 (.50)	—	—
Percent White	0.93 (.25)	0.93 (.26)	0.93 (.25)
Percent with Highest Degree			
BS	0.87 (.33)	0.88 (.32)	0.86 (.35)
Pharm.D.	0.08 (.26)	0.06 (.24)	0.09 (.29)
Advanced	0.05 (.22)	0.06 (.24)	0.05 (.23)
Percent in Staff Position	0.74 (.44)	0.68 (.47)[d]	0.79 (.41)[d]
Percent in Practice Setting			
Indep/Sm Chain	0.19 (.38)	0.17 (.37)	0.20 (.40)
Large Chain	0.46 (.50)	0.53 (.50)[d]	0.42 (.49)[d]
Institutional	0.35 (.48)	0.30 (.46)	0.38 (.49)
Urbanization and Regional Characteristics			
Percent in Practice Population			
Small	0.32 (.47)	0.33 (.47)	0.32 (.47)
Medium	0.40 (.49)	0.40 (.49)	0.41 (.49)
Large	0.28 (.45)	0.27 (.45)	0.27 (.45)
Percent in Location			
South	0.23 (.42)	0.29 (.46)	0.25 (.43)
Midwest	0.40 (.49)	0.25 (.43)	0.23 (.42)
East	0.21 (.40)	0.15 (.36)	0.21 (.41)
West	0.16 (.37)	0.31 (.46)	0.31 (.46)

[a] Standard deviations in parentheses.
[b] Significant t-test of means by gender, $p < 0.05$.
[c] Significant t-test of means by gender, $p < 0.10$.
[d] Significant chi-squared test by gender, $p < 0.05$, 1 d.f.

There were no statistically significant differences in annual hours worked between males and females. However, females worked significantly fewer hours per week relative to males. The gender difference in weekly hours likely was due to a greater proportion of females (19.5%) working part-time (less than or equal to 1,560 hours per year (30 hours per week for 52 weeks)) compared to males (14.5%).

The mean value for other income was significantly higher for females compared to males. One source for this income is earnings of a working spouse. Higher mean other income for females likely is due to the increased prevalence of college-educated women to marry men who are better educated or to marry men with similar education (26). Males reported higher hourly wages than females. Explanations for this are that men are more likely to work in chain settings and are more likely to be in management positions.

In terms of demographic variables, females reported having a significantly higher number of children between the ages of 0 and 5 at home compared to male respondents. Male respondents reported a significantly higher number of children ≥16 at home compared to females. These results correspond with the significantly younger age of female (36.5 years) relative to male (47.1 years) respondents.

Hausman tests confirmed the endogeneity of the wage rate and thus the use of two-stage least squares regression versus ordinary least squares regression as an estimation technique (24). Table II contains the results of the wage equation for males and females. Age was significantly associated with wage rates for both males and females. Regional variables were associated with wage rates for males whereas setting was associated with wage rates for females.

Tables III and IV contain the results of two-stage least squares regression models relating weekly hours worked and annual hours worked to economic and demographic variables for males and females, respectively. Appendix A and Appendix B contain the ordinary least squares results for males and females, respectively. Results for models for weekly and annual hours worked are presented with the wage

Table II. Regression Results for Hourly Wage Rate for Male and Female Pharmacists[a]

Variable	Males	Females
Constant	4.05 (.78)	23.7** (14.8)
Non-labor Income (1,000s)	.0003 (.02)	–.003 (–.38)
Total Debt (1,000s)	.004 (.70)	.008** (2.27)
Married	–1.56* (–1.35)	–.41 (–.57)
Children Age 0–5	.23 (.29)	–.05 (–.13)
Children Age 6–10	.63* (.75)	–.24 (–.54)
Children Age 11–15	–1.55** (–2.36)	–.28 (–.55)
Children Age ≥16	–.24 (–.33)	–.45 (–.65)
Age	1.15** (5.97)	.13** (4.35)
Age2	–.01** (–6.21)	—
Degree		
B.S. Pharmacy	.63 (.39)	–.04 (–.05)
Pharm.D.	Reference	Reference
Advanced	1.82 (.79)	–1.31 (1.01)
Staff	–.73 (–.82)	–1.76** (–3.13)
White	–2.00 (1.29)	–.14 (–.15)
Region		
East	–.30 (–.24)	.25 (.36)
South	–.22 (–.21)	.64 (.97)
Midwest	Reference	Reference
West	3.04** (2.89)	.43 (.70)
Population Size		
Small	.32 (.30)	.03 (.04)
Medium	–.08 (–.08)	.01 (.02)
Large	Reference	Reference
Setting		
Independent	.49 (.42)	–1.83 (–2.91)**
Institutional	–.04 (–.04)	–1.16 (–2.08)**
Chain	Reference	Reference
Adjusted R2	.28	.11

[a] t-statistics are in parentheses; *significant at $p < 0.10$; **significant at $p < 0.05$.

variable and other independent variables and the wage and wage squared variables in addition to the other independent variables. The existence of a backward bending labor supply curve is implied with a significant negative wage squared coefficient. The degree variable was dummy coded and one level (PHARMD) served as the comparison group and was excluded from the regression models. Therefore, the regression coefficients for degree are interpreted relative to respondents with a Pharm.D. degree.

Wage rate was significantly negatively related to weekly hours worked for male pharmacists. However, a $1 change in wage reduced weekly hours worked only by 1.02 hours. For both males and females, wage was not significantly associated with annual hours worked suggesting that the substitution and income effects of a wage change cancelled each other. For both males and females, the coefficient for the wage squared term was negative but not significant. A concern with models including a wage squared term is multicollinearity which inflates the standard errors of the coefficients for the wage and wage squared variables. (27) Problems of multicollinearity are avoided by focusing on the results of the models without the wage squared variable.

Both males and females reduced annual hours worked due to an increase in other income and females reduced weekly hours worked when other income increased. Consistent with labor economic theory other income exerts a pure income effect on labor supply, reducing the number of hours supplied to the labor market. A one standard deviation change in other income results in a reduction of 80 hours annually for males and 128 hours annually for females.

Weekly and annual hours worked by females were associated with total debt. Debt had a positive influence on hours worked as hypothesized. A one standard deviation change in total debt ($65,603) increased weekly and annual labor supply of females by 1.3 and 120 hours, respectively.

The number of children at home between the ages of 0 and 5 and 6 and 10 was significantly negatively associated with weekly hours and annual hours worked by females. Each child under the age of six reduced weekly hours by almost four hours and five 40-hour work weeks (222 hours). Each child between the ages of 6 and 10 reduced the hours worked by females by 2.8 hours weekly and 169 hours annually.

Hours worked annually by males were significantly negatively associated with the number of children between age 0 and 5. The reduction in annual hours was approximately one-half that of females (111 hours). Weekly hours worked by males was significantly positively associated with the number of children at home over age 15.

The degree that a female pharmacist earned was significantly associated with weekly and annual hours worked. Females earning B.S. Pharmacy degrees worked approximately 5.7 hours less per week and 323 hours less per year relative to female pharmacists earning Doctor of Pharmacy degrees. Also, female pharmacists earning advanced degrees worked 5.4 and 261 hours less per week and annually, respectively relative to female Doctor of Pharmacy degree holders. This is a rather large effect considering age, number and age of children and position (manager/staff) were held constant.

As expected male and female staff pharmacists worked significantly fewer hours weekly and annually relative to pharmacists in management positions. In terms of age, a variable representing the squared value of age was included in the models of male pharmacists to account for reduced hours of work as males age. The significant and negative age-squared term suggests an inverted U-shaped relationship with age and hours worked for males. According to the model, at the early stages of their careers, hours worked annually by males are positively related to age, reaching a peak at approximately age 37; males then reduce hours worked annually.

DISCUSSION

The objective of this study was to examine the association of economic and demographic variables with hours worked by male and female pharmacists. Althoguh wage rates were negatively associated with weekly hours worked by males, in general, wage rates had little effect on hours worked. In terms of annual hours worked, the results suggest that male and female pharmacists are located on the vertical portion of their labor supply curves suggesting that increased wages will not increase hours worked (Figure 1). One previous study found that wage rates were not significantly associated with weekly hours worked by pharmacists in 1983, 1985, 1989, 1991, and 1995 (16). This is a significant finding considering the growth in wage rates for pharmacists. Reports of a pharmacist shortage have driven wage rates up as employers attempt to attract scarce labor resources. Although increased pay may help attract or retain a pharmacist, increased pay may not result in more hours worked annually (28).

Table III. Two-Stage Least Squares Regression Results for Weekly Hours Worked and Annual Hours Worked by Male Pharmacists[a]

Variable	Hours per week	Hours per week	Annual hours	Annual hours
Constant	3.12 (3.96)**	18.6 (1.49)	2105.2 (4.64)**	1554.5 (2.11)**
Wage	−1.02 (−2.71)**	.76 (.53)	−38.8 (−1.79)	39.1 (.46)
Wage∗Wage	—	−.02 (−1.29)	—	−1.07 (−.95)
Non-labor Income (1000s)	−.02 (−0.94)	−.008 (−.31)	−3.0 (−2.06)**	−2.3 (−1.44)
Total Dept (1000s)	.01 (1.33)	.008 (.74)	.41 (.72)	.18 (.28)
Married	−.09 (−0.05)	.51 (.27)	170.2 (1.54)	196.5 (1.72)*
Children Age 0–5	−1.26 (−0.98)	−1.29 (−1.01)	−111.7 (−3.31)**	−113.0 (1.51)
Children Age 6–10	−1.09 (−0.80)	−.29 (−.20)	−73.6 (−.94)	−38.8 (−.45)
Children Age 11–15	−1.66 (−1.41)	−1.22 (−1.02)	−22.8 (−.34)	−3.90 (−.06)
Children Age ≥16	2.12 (1.77)*	2.27 (1.91)*	87.8 (1.27)	94.1 (1.34)
Age	2.31 (4.09)**	1.51 (1.81)*	82.4 (2.53)**	47.5 (.97)
Age∗Age	−.03 (−4.84)**	−.02 (−2.23)**	−1.11 (−3.32)**	−.74 (−1.42)
Degree				
B.S. Pharmacy	−1.28 (−0.50)	−2.37 (−.89)	−182.8 (−1.25)	−230.1 (−1.47)
Pharm.D.	Reference	Reference	Reference	Reference
Advanced	−1.08 (−0.29)	−2.64 (−.69)	−117.3 (−0.55)	−185.6 (−.82)
Staff	−4.99 (−3.60)**	−4.39 (−3.05)**	−256.5 (−3.21)**	−230.5 (−2.71)**

[a] t-statistics are in parentheses; *significant at $p < 0.10$; **significant at $p < 0.05$.

Hours worked by female pharmacists were associated with other income and total debt. Consistent with labor economic theory, as the amount of other income and total debt increased, female pharmacists reduced and increased, respectively, the number of hours supplied to the labor market. This result is consistent with previous research finding that female pharmacists worked fewer hours when spousal income was sufficient and they were not the primary wage earners in a family.(10,17) The responsiveness of females to debt and other income may imply that females' labor supply decisions are based more on family parameters than market conditions (i.e., wage rates). Females may seek employment that is more flexible, more satisfying and requires no weekend work to meet better family needs rather than to maximize earnings. Additionally, their annual hours worked may fluctuate throughout their careers as other income and debt levels change. Understanding the dynamics of female labor supply decisions appears to be an important area of research given the increase in the proportion of females in pharmacy schools and estimates that females will be the majority of practicing pharmacists in the year 2003 (29).

No existing studies examining the association of economic variables with labor supply prevents determining whether the association between labor supply and economic variables has changed. One factor likely influencing the results for economic variables in this study was the state of the overall economy in 1997. Unemployment, which influences pharmacists' spouses, was low (5.0%) and decreasing. Low unemployment for spouses likely increases income from other sources for a family. This would translate into a larger income effect of either a wage change or the effect of other income on annual hours worked: pharmacists would work fewer hours

Table IV. Two-Stage Least Squares Regression Results for Weekly Hours Worked and Annual Hours Worked by Female Pharmacists[a]

Variable	Hours per week	Hours per week	Annual hours	Annual hours
Constant	60.6 (3.43)**	−66.4 (−.71)	3439.4 (3.07)**	−3700.9 (−.65)
Wage	−.26 (−0.36)	9.53 (1.35)	−28.5 (−0.61)	522.2 (1.22)
Wage∗Wage		−.20 (−1.41)		−11.0 (−1.30)
Non-labor Income (1000s)	−.07 (−3.48)**	−.09 (−2.87)**	−3.78 (−2.89)**	−4.63 (−2.51)**
Total Debt (1000s)	.02 (2.12)**	.03 (1.93)*	1.83 (2.78)**	2.24 (2.43)**
Married	.65 (0.37)	−1.66 (−.58)	−40.3 (−0.37)	−170.3 (−.97)
Children Age 0–5	−3.89 (−4.69)**	−4.02 (−3.51)**	−222.1 (−4.22)**	−229.2 (−3.30)**
Children Age 6–10	−2.83 (−2.60)**	−3.47 (2.22)**	−169.8 (−2.46)**	−206.0 (−2.17)**
Children Age 11–15	−1.02 (−0.83)	−1.55 (−.90)	−74.3 (−0.95)	−104.1 (−.99)
Children Age ≥16	−.19 (−.12)	−1.93 (−.75)	42.1 (0.40)	−56.0 (−.36)
Age	−.10 (−0.93)	.19 (.74)	−2.56 (−0.37)	13.6 (.89)
Degree				
B.S. Pharmacy	−5.73 (−2.87)**	−5.49 (−1.99)**	−323.0 (−2.55)**	−309.4 (−1.85)*
Pharm.D.	Reference	Reference	Reference	Reference
Advanced	−5.42 (−1.75)*	−8.88 (−1.81)*	−261.4 (−1.33)	−456.0 (−1.53)
Staff	−5.80 (−2.85)**	−7.60 (−2.47)**	−302.7 (−2.35)**	−403.8 (−2.16)**

[a] t-statistics are in parentheses; *significant at $p < 0.10$; **significant at $p < 0.05$.

because their spouses may be working or investment income is higher. For males the increased income effect was seen in the negative wage effect for weekly hours worked and the negative association of other income. For females, the increased income effect of a wage change cancelled the substitution effect, resulting in no wage effect. Also, the significant other income effect may be due to spouses of female pharmacists earning more thus reducing the time females need to spend working as pharmacists and increasing time in other activities (leisure activities, children and family responsibilities). An important policy issue is whether pharmacists increase the amount of labor supplied to the market when the economy experiences a recession. Future research could continue to monitor the association of economic variables with pharmacist labor supply decisions and how economic conditions influence these factors.

The result that hours worked by female pharmacists is associated negatively with the number of young children at home is consistent with past multivariate studies examining weekly hours worked and reasons for leaving the profession.(9,21,22) One explanation for why females can reduce hours worked when children are at home is a pharmacist shortage in the labor market. During a shortage, wage rates increase as employers attempt to attract workers. Artificially high wage rates allow a pharmacist to work fewer hours and still maintain a pre-determined level of income, *all else equal*. Additionally, during a shortage, it is more difficult for employers to find workers. Thus, there may be more opportunities to work and the worker has some power in determining the work schedule since the employer may be willing to hire someone to work at least part-time to alleviate the shortage situation.

One implication of the association of young children with hours worked is that it may provide a means to increase the hours worked by females with young children who are working. Although research has shown the importance of various employer policies and benefits to female pharmacists with children, (30) it is unknown whether altering policies and/or benefits will induce female pharmacists who already are working to work more. For example, does paying for child care or having it more readily accessible increase hours worked and to what extent? It is possible that the opportunity to work part-time for female pharmacists allows them to balance family and work situations better than females in other professions. As such, hours worked may be non-responsive to employer policies and benefits. A better understanding of the attitudes and desires of female pharmacists with young children and the interface between family-life and work for these pharmacists would be valuable as would inter-profession (i.e. pharmacy versus nursing) comparisons of such variables.

A result not found in previous pharmacist labor studies was that female pharmacists who had earned a Doctor of Pharmacy (Pharm.D.) degree worked significantly more hours per year relative to pharmacists who had earned a Bachelor's Degree (B.S.). The influence of the Pharm.D. degree on annual hours worked may be due to characteristics of a person (i.e., career motivations or professional values) which induced that person to self-select into a degree pathway as a means of informing potential employers that they are better pharmacists. If pharmacists self-selected into Pharm.D. programs to differentiate themselves, mandatory degree changes likely will not result in increased hours worked by pharmacists with a Pharm.D. degree. A trend to monitor is the annual hours worked by pharmacists once all graduating pharmacists earn the Pharm.D. degree.

Age was significantly negatively associated with male labor supply but not female labor supply. The age variable reflects the behavior of older pharmacists to semi-retire and reduce the hours that they work. The difference between males and females likely is due to the greater mean age of males compared to females. Since 1985, a majority of new graduates from pharmacy schools have been female, thus much of the female labor force is much younger than the male labor force. An important question for future research is the labor supply of female pharmacists as they age. If females do re-enter the labor market as children age, when will they semi-retire or reduce hours worked? Do males semi-retire or reduce hours worked at an earlier age than females and has the age at which males reduce hours worked decreased? These are important questions for future labor research because they concern reductions in pharmacist labor supply and reductions in supply of more experienced pharmacists.

The result that pharmacists in management positions, regardless of gender, work more hours than staff pharmacists is consistent with past studies.(6–8,16,19–21,23) Also, the small difference between coefficients for males and females suggests that females could be promoted to increase labor supplied to the market. However, pharmacists must accept an offer of promotion implying an understanding of the factors that lead to the acceptance of a promotion. Females may desire the flexibility, in terms of hours worked, that a staff position offers, especially if young children are at home. Future research could examine the desire of females to become managers and the costs and benefits to females of accepting such positions.

Limitations

Limitations of this study are highlighted to address potential sources of bias. Data were collected from pharmacists licensed in four states. Additionally, the reponse rates in each state varied. Thus, the generalizability of the results is limited. Additionally, the sampling plan oversampled females resulting in the overrepresentation of females in the entire sample. However, a goal of the study was estimating labor supply models for males and females separately, limiting the bias resulting from oversampling females.

The response rate to the mailed survey instrument was 34.6% raising the issue of non-response bias. Economic and demographic variables for the first 20% of respondents and the last 20% of respondents were compared assuming that late respondents were similar to non-respondents. There were no statistically significant differences between early and late respondents. One explanation for the low response rate may have been respondent burden. In addition to current work information the survey requested information about pharmacists' past employment which may have prevented pharmacists from responding due to recall and time issues. Additionally, the sensitive nature of the other income and debt question may have reduced the response rate. The significance of these variables in the regression models suggests the importance of mechanisms to increase response rate when these variables are collected in surveys.

The economic theory of labor supply used in this study does not consider additional economic variables that may be

associated with hours worked. For example, the model does not control specifically for fringe benefit policies (i.e., level of benefits for part-time work) that may be associated with hours worked. It may be costly for a pharmacist to reduce hours worked due to the fear of losing certain fringe benefits (i.e., health insurance). The model estimated in this study controls somewhat for these effects through the other income and marital status variables. Although not the purpose of this study, future research could examine the role of employers' fringe benefits policies in pharmacists' work decisions, perhaps using a longitudinal study design.

CONCLUSION

The goal of this study was to determine the association of economic and demographic variables with hours worked by male and female pharmacists. Wage rates were not associated with annual hours worked for either males or females, males responded to non-labor income levels and females responded to non-labor income and debt levels. The number of young children significantly reduced hours worked by female pharmacists and age reduced hours worked by male pharmacists. Changes in the composition of the population of practicing pharmacists coupled with economic and demographic factors associated with labor supply suggest continued examination of pharmacist labor issues.

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Appendix A. Ordinary Least Squares Regression Results for Weekly Hours Worked and Annual Hours Worked by Male Pharmacists[a]

Variable	Hours per week	Hours per week	Annual hours	Annual hours
Constant	30.8 (4.43)**	28.6 (3.81)**	2094.0 (4.76)**	1554.5 (2.11)**
Wage	−.27 (−2.44)**	.01 (.03)	−16.4 (−2.34)**	−11.0 (−.47)
Wage∗Wage	—	−.004 (−.78)	—	−.08 (−.24)
Non-labor Income (1000s)	−.02 (−1.04)	−.02 (−.91)	−3.0 (−2.12)**	−2.9 (−2.05)**
Total Debt (1000s)	.01 (1.08)	.009 (.99)	.30 (.54)	.28 (.51)
Married	.90 (.55)	.96 (.59)	199.7 (1.92)*	200.8 (1.93)*
Children Age 0–5	−1.16 (−1.02)	−1.17 (−1.02)	−108.7 (−1.51)	−108.8 (−1.51)
Children Age 6–10	−1.59 (−1.34)	−1.43 (−1.19)	−88.5 (−1.18)	−85.4 (−1.12)
Children Age 11–15	−.72 (−.75)	−.69 (−.72)	5.06 (.08)	5.71 (.09)
Children Age ≥16	2.31 (2.18)**	2.33 (2.19)**	93.4 (1.39)	93.7 (1.39)
Age	1.36 (4.47)**	1.26 (3.83)**	54.2 (2.81)**	52.3 (2.50)**
Age∗Age	−.02 (−5.93)**	−.02 (−5.11)**	−.82 (−4.18)**	−.80 (−3.72)**
Degree				
B.S. Pharmacy	−1.64 (−0.73)	−1.81 (−.80)	−193.4 (−1.36)	−196.7 (−1.37)
Pharm.D.	Reference	Reference	Reference	Reference
Advanced	−2.05 (−0.63)	−2.28 (−.70)	−14.61 (−0.71)	−150.6 (−.73)
Staff	−4.16 (−3.55)**	−4.10 (−3.48)**	−231.9 (−3.12)**	−230.6 (−3.09)**

[a] t-statistics are in parentheses; *significant at $p < 0.10$; **significant at $p < 0.05$.

Appendix B. Ordinary Least Squares Regression Results for Weekly Hours Worked and Annual Hours Worked by Female Pharmacists[a]

Variable	Hours per week	Hours per week	Annual hours	Annual hours
Constant	60.7 (12.4)**	77.6 (4.95)**	3222.6 (10.4)**	3912.3 (3.95)
Wage	−.28 (−1.79)*	−1.47 (−1.39)	−20.5 (−2.07)**	−69.0 (−1.03)
Wage∗Wage		.02 (1.14)		.85 (.73)
Non-labor Income (1000s)	−.07 (−3.57)**	−.07 (−3.52)**	−3.86 (−3.00)**	−3.82 (−2.96)**
Total Debt (1000s)	.02 (2.62)**	.02 (2.66)**	1.81 (3.31)**	1.82 (3.34)**
Married	.79 (0.47)	.97 (.58)	−23.1 (−0.22)	−15.6 (−.15)
Children Age 0–5	−4.09 (−4.97)**	−4.07 (−4.95)**	−230.8 (−4.45)**	−230.0 (−4.43)**
Children Age 6–10	−2.86 (−2.70)**	−2.83 (−2.67)**	−168.5 (−2.52)**	−167.2 (−2.49)**
Children Age 11–15	−1.16 (−0.97)	−1.15 (−.95)	−78.3 (−1.03)	−77.5 (−1.02)
Children Age ≥16	−.16 (−.10)	−.05 (−.03)	47.7 (0.47)	52.1 (.51)
Age	−.10 (−1.38)	.11 (1.56)	−3.15 (−0.72)	−3.72 (−.84)
Degree				
B.S. Pharmacy	−5.44 (−2.82)**	−5.44 (−2.82)**	−315.5 (−2.59)**	−315.3 (−2.59)*
Pharm.D.	Reference	Reference	Reference	Reference
Advanced	−5.09 (−1.71)*	−4.89 (−1.64)	−238.6 (−1.27)	−230.3 (−1.22)
Staff	−5.92 (−4.45)**	−6.03 (−4.52)**	−290.5 (−3.46)**	−294.9 (−3.50)**

[a] t-statistics are in parentheses; *significant at $p < 0.10$; **significant at $p < 0.05$.

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