Do Doctors Induce Demand?

Beomsoo Kim

The Institute of Economic Research - Korea University

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Beomsoo Kim
Department of Economics
Korea University
T:82-2-3290-2204
kimecon@korea.ac.kr

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ABSTRACT

There exists a large variation in the provision of medical care across the U.S. In addition, the supply of medical care is positively correlated with the demand. According to a widely held view, physicians induce the demand by leveraging their superior medical knowledge. This paper examines supply induced demand in medicine using an exogenous negative income shock to obstetrics/gynecologists that was caused by a declining number of births in their practice location. The number of births in the U.S. had declined by more than 8% from 1990 to 1999; as such, the physicians might have been motivated to suggest a cesarean section procedure instead of a vaginal delivery because cesarean section represents a higher reimbursement rate. The physicians might also have provided more prenatal care than was medically necessary under the fee-for-service reimbursement mechanism to compensate for their decreasing income. The results of this study indicate some evidence of induced demand in the practice pattern of the OB/GYN group. The results also suggest an increase in cesarean section procedures by 4.1 percentage points for one unit decline in the birth rate per 100 population. The results indicate no change in excessive prenatal care visits.

Keywords: Supply Induced Demand, Cesarean Section, Excessive Prenatal Care, Fertility

JEL codes: I12, I19, J13

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1. INTRODUCTION

There exists a large variation in the provision of medical care across the U.S. For example, the supply of medical care, measured by beds per 1,000 population, was reported as 2.4 (3.2) for the lowest (highest) quintile of hospital referral regions in 1996 (Fisher et al., 2003). The ratio of the highest to lowest quintile was 1.32, even after controlling for observables such as demographic factors. The utilization of medical care was positively correlated with the supply of medical care for the regions. The End-of-Life Expenditure Index (measured in the last 6 months of life for Medicare enrollees aged 65-99 years by quintile) was $9,074 for the lowest quintile and $14,644 for the highest quintile in 1996, after adjusting age-sex-race for fee-for-service spending on hospital and physician services. The highest quintile spent 161% of the lowest quintile. Basic demographic factors were taken into account in the determination of these variations. Cross-sectional variations in supply and demand have also been found in various levels such as physicians per capita and procedure usage (Fuchs, 1998: Cromwell and Mitchell, 1986).

This positive correlation, however, does not indicate causality. If supply is provided where demand is high, there will be a positive correlation. Another explanation, as suggested by induced demand theory, is that demand may be induced by supply. Roemer (1961) proposed this hypothesis from the observation that areas with greater hospital bed supply showed greater hospital utilization. Doctors have superior medical knowledge than their patients; thus, patients depend on their doctors for treatment decisions. Induced demand theory is based on this information asymmetry and principal-agent relationship. Doctors might exploit this situation by suggesting higher reimbursement procedures or providing excessive care (i.e. the provision of more procedures than necessary when reimbursements are made on a per-procedure basis) to maximize their own interests. For example, cesarean section (c-section) represented $500 more in income to physicians than vaginal delivery in 1989 (Health Insurance Association of America, 1989). This early supply induced demand model is limited; under the model, doctors would induce demand at the maximum level at all times. Several hypotheses were introduced to make this model more realistic. The target income model (Newhouse, 1970) assumes that doctors might exploit this relationship with their patients when they face a negative income shock because they have a target income that they want to maintain. Introducing the disutility of inducing demand (Gruber and Owings, 1996) is another method. With the inclusion of the disutility in doctor's utility function, doctors will not induce demand unless their utility gain is larger than the disutility from the inducement. In this setup, doctor's utility consists of income as well as the disutility of inducing demand.The induced demand theory has been empirically tested extensively using various exogenous shocks, but the results have been somewhat mixed. Rice (1984) and Yip (1998) found evidence in support of the induced demand model using a change in the Medicare fee system for coronary artery bypass surgery. Gruber and Owings (1996) also found that OB/GYNs performed more c-section deliveries as their income decreased, using the National Hospital Discharge Survey during the 1970-1982 fertility decline period. However, Hurley, Labelle, and Rice (1990), found mixed evidence using a fee reduction case in Ontario, Canada.

This study tests the induced demand model by using the possible exogenous shock of fertility decline that Gruber and Owings (1996) had used and applying it to a different time period. The U.S. fertility rate had declined sharply in the 1960s and 1970s, and afterward, it had increased continuously until 1989. In the early 1990s, there was another less significant drop. This study uses the 1990s fertility drop to identify the model. This paper contributes to current research in four ways. First, the census of all U.S. births is used, which is truly representative in comparison to a survey method. The use of the U.S. Natality Detail Files affords detailed information such as patient condition and the method of delivery since 1989. The Files also identify counties with a population greater than 100,000. The incomes of OB/GYNs depend on the prevailing fertility rates in the locations where they practice. Previous studies have defined the relevant medical market at the state level probably because identifying a smaller region could have been difficult (Gruber and Owings, 1996). Based on the delivery and residency area information on birth certificates, a more relevant medical market for delivery may be defined at a level lower than the state level, such as at the county level. Garrett (2003) showed that the sign and significance of coefficient estimates from regressions using aggregated data can differ from those of regressions using less aggregated data.

Second, this paper examines, for the first time, another possible outcome of induced demand: excessive prenatal care. The utilization of prenatal care has steadily increased in the 1980s and early 1990s (Kogan et al., 1998). This may be explained by the induced demand theory because additional prenatal care under fee-for-service would increase physician income. Performing more prenatal care procedures might be an easy decision for OB/GYNs because providing additional prenatal care involves no potential harm to patients in comparison to suggesting potentially unnecessary c-section over vaginal delivery.

Third, a number of sub-samples are explored because doctors' behaviors may depend on the sub-samples. For example, c-section may be more likely for higher risk pregnancies as a result of a negative income shock. No previous study has examined in-depth the different sub-samples probably due to limited number of observations.

Fourth, the study uses a dataset representing a more recent period. There were some insurance reforms to equalize the reimbursement fees for the vaginal and cesarean delivery procedures in the early 1990s (Gruber et al., 1999; Keeler and Fok, 1996). As such, this study measures, using the recent dataset, the existence and magnitude of delivery method choices under an exogenous income shock to OB/GYNs.

Section 2 reviews prior literature. Section 3 describes the empirical methodology. Section 4 presents the results. Section 5 concludes with a discussion.

2. LITERATURE REVIEW

Roemer (1961) suggested that there is a positive correlation between hospital bed supply and hospital utilization. The concept of induced demand became more popular with the work of Evans (1974) and Fuchs (1998). However, Roemer's simple correlations cannot show whether there is a demand induced supply (i.e., hospitals are built where there is a strong demand in the area) or a supply induced demand (i.e., doctors admit unnecessary patients to fill hospital beds).

To empirically test the induced demand hypothesis, two approaches have been widely employed. The first uses the exogenous drop in prices which will reduce physicians' income. Yip (1998) used the Medicare fee change for "overpriced procedures" provisions under the Omnibus Budget Reconciliation Act of 1987 (OBRA87). As a result, coronary artery bypass surgery (CABG) reimbursements declined substantially, and physicians who experienced reduced incomes performed a higher volume of CABGs under both Medicare and private insurance. Even though it was a rare direct test of the induced demand hypothesis, the price cut has been shown to simultaneously produce the income and substitution effects. The income effect refers to an increased volume of a price-impacted procedure as physicians' income declines; the substitution effect refers to a decreased volume of a price-impacted procedure and a corresponding increase in the volume of a substitute procedure that has not been impacted by a price reduction. Most studies have assumed that the income effect dominates the substitution effect (Gruber and Owings, 1996). Gruber et al. (1999) used Medicaid fee differences from 11 states over a four-year period and found that a lowered fee difference between c-section and vaginal delivery decreased the c-section rate.

The second approach uses the exogenous shift in aggregate demand (Gruber and Owings, 1996). Compared to the first approach, this identification strategy has the advantage of measuring the income effect in isolation. Gruber and Owings found that a 10% decline in the fertility rate is associated with a .97 percentage point increase in the c-section rate, which is quite high. However, their study has several limitations. First, a state might be too large as a medical market area. Second, even though the National Hospital Discharge Survey is a representative survey of 400 hospitals and covers approximately 20,000 births out of around 3 million births per year, the data are somewhat limited and make it difficult to perform any sub-sample analysis due to limited information.

This study uses fertility decline as a possible exogenous shock and employs a census of births. The detailed data provide a certain degree of freedom in the examination of various sub-samples such as high risk group and an opportunity to examine, for the first time, excessive prenatal care as an outcome.

3. EMPIRICAL METHODOLOGY

3.1 Data

The U.S. Natality Detail Files, which represent the census of all U.S. live births, were used in this study. A live birth represents the complete expulsion or extraction of the infant from its mother as a product of conception, irrespective of the duration of pregnancy, which, after such separation, breathes or shows any other evidence of life, such as breathing of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached (Natality Detail File, 1991). This data date back to

1968, but the format has been substantially changed in 1989. The U.S. government revised the standard certificate of live birth in 1989, and the new version includes a wide variety of new information on maternal and infant health characteristics (Natality Detail File, 1991). For example, the detailed method of delivery was added as a question so that vaginal birth, vaginal birth after previous c-section, primary c-section, and repeat c-section can be separately recorded.[1]

The data also contain demographic information about the mother (age, education, marital status, race, and ethnicity), characteristics of pregnancy (parity, plurality, gestation, maternal weight gain, smoking and drinking during pregnancy, prenatal visits, breech presentation, high blood pressure, and gestational diabetes), and who attended the delivery, such as a midwife or a medical doctor (Kim, 2007). In this study, only the births attended by a medical doctor were used, because midwives cannot perform certain medical procedures such as c-section. Within the data period selected for this study (data from 1989 to 1999 which include almost 39 million births), midwives had delivered less than 5.4% of total births.

The Natality Detail Files identify counties with a population of over 100,000 and aggregate unidentified small counties as one unidentified county for each state.[2] The geographic areas of this study will be at the county level. This is because, based on the 1994 birth records, 82% of births match a residing county and a delivery county. Based on this information, a county represents an appropriate proxy of the relevant geographic area, because, in most of cases, people usually deliver in their residing county. For example, County A experiences a declining fertility rate, but the adjacent County B might be facing an increasing fertility rate. If Counties A and B were to be combined into one market, no fertility change would be indicated because the two fertility changes would cancel each other. As such, a medical area that is defined at the state

[1] Before 1989, there was no information on the method of delivery.
[2] The data period represents 531 counties, including residuals within a state.

level (as in prior literature) might cover the medical market too broadly, impeding a closer examination.

Although more recent birth certificate information is available, the use of such data can result in an omitted variable bias problem; this is because the medical market profile would change dramatically if post-1999 data were to be used. One of the most striking and relevant changes occurred in the late 1990s: the increasing market share of managed care organizations (MCOs). An MCO often uses different reimbursement mechanisms, such as capitation. Under capitation, doctors are reimbursed based not on the number of procedures they perform but on the number of enrolled patients. Therefore, changing practice patterns will not change doctors' income. Unfortunately, the Natality Detail Files contain information neither on reimbursement mechanisms nor on payers. Therefore, it is not possible to determine whether someone has a health insurance or what type of health insurance the insured has. MCOs have rapidly increased their market share since 1994, registering a peak in 1999; the share has since been declining in many states (Baumgarten, 2003). Including the increase and decrease of the managed care enrollment period can make the estimates of this study difficult to interpret. Therefore, to minimize omitted variable bias, only the data until 1999 had been used in this study. Increased managed care will work against this study because, over time, fewer doctors will be offered financial incentives to change their practice pattern; this is because MCOs usually use a capitation reimbursement scheme. Therefore, if the results of this study were statistically significant, the continued existence and magnitude of induced demand could be measured.

3.2 Measuring OB/GYN's Income

The key independent variable is the fertility rate in a county, which is the proxy for an income shock to OB/GYNs. Using the Natality Detail Files, the number of births in the identified counties can be calculated. The fertility rate is calculated as the number of births per 100 population.[3] The estimated county population figures by the U.S. Census Bureau were used in this study. The fertility rate is a normalized measure because it takes into account the population of a county.[4] The fertility rate outliers that were below 0.5 of the 1st percentile and double the 99th percentile had been dropped.

An ideal measure of an exogenous income shock can be the average income of OB/GYNs in the same medical market; however, such data could not be obtained. Therefore, the area fertility rate is used to generate an exogenous income shock to the model. The bottom of Table 1 presents the fertility rate (births per 100 population in a county); the average was 1.61, with a standard deviation of 0.7.

3.3 Measures of Outcomes

The method of delivery is the first outcome considered in this paper because c-section can be suggested instead of vaginal delivery as a result of induced demand. There is also suggestive evidence that c-section is performed as supply induced demand. The World Health Organization recommended that c-section rates should not go above 15% in any country. The national U.S. c-section rate was 4.5% in 1965 when it was measured for the first time (Taffel et al., 1987). The c-section rate had increased to 31.1% by 2006.

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[3] No detailed data exist on the number of practicing doctors in a given geographical area by specialty. Therefore, the average number of babies delivered by an OB/GYN, which would have been the best measure, could not be calculated. However, if the number of OB/GYNs per population is stable, the fertility rate can be considered a proxy of income.

[4] A decline of the same number of births can have a very different effect, depending on the population size of an area. For example, 1,000 less births out of 10,000 births versus 100,000 births will result in very different income shocks to OB/GYNs.

Table 1 shows a 23% c-section rate for all births. Based on the condition of mothers recorded on birth certificates, the following sub-samples were considered. The first group included women who had complications such as diabetes, hypertension, and multiple births. Hypertension includes both chronic and pregnancy-related hypertension. Multiple births occur when more than one fetus is carried to term in a single pregnancy. The second group included women with or without an individual c-section history. Within the medical profession, there is a substantial disagreement on the costs and benefits of vaginal births after c-sections (VBACs), and as a result, a consensus guideline for treatment has not yet been reached (Kim, 2007). The old concept can be summarized by the phrase "once cesarean, forever cesarean." (Kim, 2007). Since there is no consensus among professional groups, it is likely that there will be a group of women who will be impacted by induced demand. Therefore, sub-samples of women who did not have a cesarean history and those who had a cesarean history were examined. Multiple births and previous c-section sub-samples showed 89% and 77% c-section rates, respectively.

The other key outcome variable is the excessive prenatal visit. Prenatal care visits monitor changes in the health of a pregnancy, encourage preventive health, and determine potential risk factors to the mother or fetus (Evans and Lien, 2005). The American College of Obstetrics and Gynecologists recommends 13 visits: 1 visit per month during the weeks 4 to 28, 2 visits per month during the weeks 28 to 36, and 1 visit per week during the weeks 36 to the time of birth.[5] The recommended prenatal care schedule is nonlinear, with kink points at the 28th and 36th gestational week. Unlike c-section, which may possibly have a negative impact on patients because it is a major abdominal surgery, increased prenatal care does not represent any

[5] Since vaginal delivery is 40 weeks, there are 13 visits. The recommended number of prenatal care visits varies from institution to institution. For example, high-risk women are recommended 14 prenatal care visits during the 40 week pregnancy, and an expert panel on the content of prenatal care, comprised of professionals from many sectors of the health care community, recommends 8-10 visits as an adequate number of visits (Evans and Lien, 2005).

possible harm to patients.[6] This paper focuses on the level of prenatal care as an outcome when there is an exogenous negative income shock; this is because, under the traditional fee-for-service reimbursement scheme, more prenatal care means higher income to OB/GYNs.

Three indices measure prenatal care visits. The Institute of Medicine (IOM) index, initiated by Kessner, uses the information on the trimester in which care began and has been criticized as painting an incomplete or inaccurate picture of prenatal care utilization (Alexander and Kotelchuck, 1994). The other two indices, which are based on the full ACOG recommendations, are R-GINDEX and the Adequacy of Prenatal Care Utilization (APNCU) index. R-GINDEX classifies intensive, adequate, intermediate, inadequate, and missing information for a range of prenatal care for each gestational age in which the trimester care began. The APNCU index calculates the expected number of visits using the month when prenatal care began and the gestational age. The index classifies the intensive, adequate, and inadequate level of care as a fraction of the expected to actual number of prenatal care. For example if the actual prenatal care is 10% higher than expected, it represents intensive care.

The calculation of excessive prenatal care is as follows: the recommended number of prenatal care by ACOG subtracted from the actual number of prenatal care a patient received.[7] Birth certificate data provide detailed information on the month of when prenatal care began and the gestation week at the time of delivery. Therefore, the data contain all of the information needed to measure recommended prenatal visits. The actual number of prenatal visits is also recorded with a top code of 49. The difference between the recommended number of prenatal

[6] There are ongoing debates with regard to whether increasing prenatal care can enhance new born health outcome. Some empirical results show a limited positive impact, and others found insignificant changes (Evans and Lien, 2005; Strong, 2000). However, the relationship between prenatal care and birth outcome is not within the scope of this paper.

[7] The following measure was also examined as an outcome:

$$\frac{\text{(the actual number of prenatal care - the recommended number of prenatal care)}}{\text{the recommended number of prenatal care}}$$

The results were robust.

care and the actual number of prenatal care is the measure of excessive prenatal care by the unit of visit. A positive number indicates more care than the ACOG recommended number, and a negative number indicates less care than recommended. Since this measure is a continuous measure, it contains more information in comparison to other measures such as R-GINDEX. Kogan et al. (1998) found a steadily increasing trend toward more prenatal care utilization between 1981 and 1995; in particular, they found an increased utilization of intensive prenatal care using R-GINDEX and APNCU.[8] However, no previous research has examined the cause of the increased intensive prenatal care. Supply induced demand due to a declining fertility rate in the 1990s may explain the increased use of prenatal care.

As shown in Table 1, the number of actual prenatal care visits for all births was 11.5 visits. The number of recommended prenatal visits for the same population was 12.1 visits. For All Births, prenatal care began in the 2.6 month of the pregnancy, and a baby was delivered in the 39th week. Overall, people received 0.5 visits less than recommended.

According to the second column, diabetes patients received 13 prenatal visits (versus 11.7 recommended prenatal visits), where prenatal care began 0.2 month early and the gestational week was 0.6 week shorter in comparison to All Births. The multiple births show interesting differences in the fourth column. Prenatal care started early (1.8 months) in comparison to other sub-samples, but babies were delivered much earlier than those of other sub-samples. The average gestational week was 32.8 weeks, which was 6.6 weeks earlier than that for All Births. On the other hand, the actual prenatal visits were more frequent than that for All Births, perhaps due to the higher risk pregnancy.

[8] Prior literature has found different patterns or trends based on the measure of prenatal care (Alexander & Kotelchuck, 1996: Kogan et al., 1998). This has mainly been due to differences in the information represented by the indices used. R-GINDEX and APNCU show a similar pattern because they use the same information.

3.4 Econometric Model

This paper examines whether the declining fertility rate in a medical market increases the intensity of the medical care rendered by measuring the c-section rate and excessive prenatal care through the use of the linear probability model and Ordinary Least Squares (OLS), respectively.

$$Y_{ijt} = \beta_1 X_{ijt} + \beta_2 \text{Fertility}_{ijt} + \Theta_t + \alpha_j + \varepsilon_{ijt},$$

where Y_{ijt} is the procedure choice (i.e., a binary choice of 1 if a baby is delivered by c-section or a continuous variable for excessive prenatal care visits) for patient i in county j in year t. X_{ijt} denotes the mother's observable characteristics such as age, race, educational level, and marital status. Θ_t is a year fixed effect that captures the year specific shock to the entire U.S. α_j is a county fixed effect. The intention is not to compare across geographic areas because there are many area specific factors that cannot be observed. Instead of comparing across areas, this paper uses within county over the time variation to identify the model.

The model assumes that the fertility rate is exogenously decided, which makes sense from the OB/GYN perspective. OB/GYNs' income is partially dependent on the number of babies they deliver. Therefore, a decline in the fertility rate lowers OB/GYN's income. The model also assumes that OB/GYNs do not change the location of their practice as a result of the income fluctuation. For example, OB/GYNs do not move from a low fertility rate county to a high fertility rate county. Although this assumption cannot be directly verified with the data, it can be argued that, once doctors establish their practice in a certain location, moving to another location can be prohibitively costly as they will need to acquire a new office, new patients, and hospital privileges, among others.

The timing of OB/GYNs' response to the decreasing number of births is crucial to identify the proposed model. OB/GYNs can determine the number of deliveries that they will perform as early as 7-8 months before the deliveries; this is because patients usually make visits for prenatal care first. This means that OB/GYNs can detect almost immediately any decrease in the number of pregnant women, allowing the OB/GYNs to respond quickly. Therefore, the county level fertility rate will impact the outcome variables during the same year.

Other control variables are age, race, marital status, and the education level of the mother. The age of the mother had been categorized as less than 20, between 20 and 25, 25 and 30, 30 and 35, 35 and 40, and over 40. Table 1 shows that complications from childbirth were more common for old age pregnancy. For example, 33.6% of All Births were women over 30, whereas 65% of multiple births were women over 30.

The economic environment such as the unemployment rate or the average income per capita might also affect the method of delivery. This study incorporates the unemployment rate and the average income per capita by county; the information was obtained from the regional economic accounts data of the Bureau of Economic Analysis. However, the county level unemployment rate data are available only from January 1990 because the new CPS population controls took effect in 1990. Although the Bureau of Labor statistics has old data series, such data will not be completely comparable with the new series. Therefore, for consistency, 10 years of data were used to make an extrapolation for 1989. The study results can be interpreted with confidence because only one year was extrapolated (out of 11 years). The county level total income and the population for each year were extracted to calculate the average income per capita. The income per capita was adjusted using the Consumer Price Index.

4. RESULTS

Table 2 shows the impact of a declining fertility rate (births per 100 population) on c-section. Since it is difficult to analyze the full sample of approximately 37 million births computationally, a 35% random sample was used.[9] The first column includes age, race, marital status, and the educational level of the mother; the year and county fixed effects are also included. Year dummies are reported in the Table, but county dummies are not shown due to space limitations.[10] The number of observations for All Births was 13.2 million births. If the fertility rate were to decline by a unit, c-section would increase by 2.4 percentage points, which is 10% of the sample mean of 23%. With regard to the categorical age coefficient (as people become older), the c-section probability increased substantially in comparison to the omitted age category of less than 19. Mothers between 20 and 24 showed a c-section rate that was 3.0 percentage points higher, and mothers between 25 and 29 showed a probability that was 6.7 percentage points higher. The c-section rate increased monotonically as the mother's age increased. For mothers greater than 40, the probability of c-section was 18.3 percentage points higher in comparison to mothers less than 20.[11] Less than high school is the omitted category for the mother's educational level. In comparison to the omitted category, high school graduates and college graduates showed a higher c-section rate with 2.2 and 2.4 percentage points, respectively. However, a higher level of education (i.e., more than college) increased the c-section probability by only 0.5 percentage points under ceteris paribus. Marital status did not significantly change the c-section rate. To capture the year specific common shock throughout the whole country, year dummies were used.

The second column includes the real average income per capita and the unemployment rate at the county level. The coefficient for fertility changed minimally; it became -0.026 from -0.024. These county level economic situations did not increase the explanatory power measured by R^2. If the average income per capita were to increase by 100 dollars, the c-section rate would

[9] A 35% random sample of the full dataset was considered large enough to draw reliable conclusions.
[10] There were 531 counties.
[11] Instead of using an age dummy as a category of 5 years, dummies for each age can be constructed. For example, ages 20, 21, 22, etc. can be used as covariates. This alternative specification did not change the results; these results are available upon request to the author.

increase by 2.0 percentage points (statistically significant at 10% level). The unemployment rate was not statistically significant.

The third column shows the results after dropping unidentified counties. For example, 7 counties in Alabama were identified in the Natality data, even though there were total 67 counties. The less populated 60 counties were not identified. However, there is no reason why these 60 remaining counties should be considered to be in the same medical market. Often, they are not even adjacent each other. It is difficult to imagine that people will travel to other small counties that are geographically apart. Therefore, remaining counties, which are the sum of residuals, are not likely to be in the same medical market, and by combining them together, the measurement error on independent variables may increase. Thus, eliminating these unidentified counties should result in the measurement of a clear relation of induced demand. As shown in the third column, the births per 100 population coefficient jumped as expected to -0.041 from -0.026. This indicates that a one unit decrease in the fertility rate will increase the c-section rate by 4.1 percentage points. The total sample size was reduced by 21% due to the elimination of residual counties, but the robust standard error decreased due to increased homogeneity within counties. Accordingly, the explanatory power increased from 0.107 to 0.110.

Table 3 shows three complications (i.e., diabetes, hypertension, and multiple births) and two birth histories (i.e., no previous c-section and c-section) sub-samples. The three complications samples were the full sample, and the two history samples were the 35% random sample, due to the computational limitation. The sub-sample of diabetes and multiple births, as presented in the first and third columns, showed a small magnitude in comparison to All births in Table 2 and was insignificant (even though it was in the expected direction). The number of observations was 800,000 births for diabetes; the number was 45,154 births for multiple births. The hypertension sub-sample is presented in the second column, with 1.1 million observations.

The coefficient of births per 100 population was negative and statistically significant. If births per 100 population were to decrease by a unit, the c-section rate would increase by 5 percentage points, which is 12.5 percent of the sample mean (40 percent).

Both the "no previous history" sample and the "previous history" sample in the last two columns showed statistically significant estimates on c-section. The estimates were -0.034 and -0.04 for "no previous history" and "previous history" samples, respectively. If the fertility rate were to decline by one unit, the c-section rate would increase by 3.4 percentage points; this is a huge impact, taking into account the 16 percent c-section rate for this group. For the previous history sample, the same shock would increase the c-section rate by 4.0 percentage points, which is 5.2 percent of the sample mean. The previous history sample already had a c-section rate of 77%, which is very high; thus, this did not leave much room for delivery method decisions.

Table 4 presents the effect of the fertility rate on excessive prenatal visits. In the first column, covariates of age, race, education, marital status, year, and county dummies are considered. The average income per capita and the unemployment rate are shown in the second column. The coefficient decreases substantially in the second column and then increases in the third column where the unidentified counties are dropped. The signs of the coefficients were all negative, indicating that a lowered fertility rate would increase excessive prenatal care. However, all were statistically insignificant. As shown in the third column if the fertility rate were to decline by one unit, excessive prenatal care would increase by 0.16 visits. This represents a small change since the average number of prenatal visit was 11.5. The mother's age variable did not show a monotonic change until the age of 30, but for mothers older than 30, the probability of excessive prenatal care increased with age. Blacks and Hispanics received significantly less prenatal care in comparison to Caucasians. Mothers with higher education received more prenatal care in comparison to high school dropouts.

The impact of induced demand may be different depending on the patient condition. Table 5 shows the analysis of five sub-samples for excessive prenatal care. Among the five sub-samples, diabetes and multiple births showed a positive sign, and the other three sub-samples showed a negative sign (none were statistically significant). The magnitude varied widely. Thus, no clear evidence of induced demand on prenatal care usage could be drawn.

The results were mixed for the impact of the fertility rate on the c-section rate and prenatal care. It might be useful to examine whether excessive prenatal care were not induced by a doctor even though prenatal visits changed depending on the situation. Therefore, this study examines the impact of the fertility rate on access to care, which is one of the key issues in prenatal care for many people. The month in which prenatal care begins has been commonly used to measure access to health care (whether patients need to wait to see a doctor after they become aware of - or when they need to check - their pregnancy). Teagle and Brindis (1998) found that 17% of patients encountered difficulty in securing the first appointment for prenatal care. State and national policy initiatives to improve pregnancy outcomes have focused on increasing the availability of and access to prenatal care services (Public Health Service, 1991). One goal of the 2010 Healthy People Program is to achieve the initiation of prenatal care in the first trimester for 90 percent of mothers (from 83 percent in 1998). This can also be used as a specification check to see whether the number of patients treated by an OB/GYN has decreased due to a declining fertility rate.

Access to care as an outcome variable is presented in Table 6. As the number of births decreases, patients will encounter less waiting time to see a physician. Therefore, access to care, measured by the month in which prenatal care begins, will be decreased with a declining fertility rate. The estimates were quite close to each other, at approximately 0.12. The first appointment would take place approximately 3.6 days earlier if the fertility rate were to decline by a unit in a county. All the estimates except the hypertension and multiple births samples were statistically significant.

Table 7 presents a comparison of results between aggregated data (the state level) and disaggregated data (the county level).[12] Gruber and Owings (1996) used the state level fertility rate, and this paper constructs the fertility rate at the disaggregated (county) level to identify the model. Garrett (2003) showed that the sign and significance of coefficient estimates from regressions using aggregated data can differ from those of regressions using less aggregated data. He also noted that residual sum of squares (RSS) from the aggregated regression can be larger or smaller than the sum of the RSS from less aggregated regressions depending on the covariance and correlation between cross-equation residuals.

The first column of Table 7 presents the county level fertility model, and the second column presents the state level fertility model. The coefficients for the fertility rate were very similar, even though the standard error doubled for the aggregated data. All of the other coefficients were almost identical, except for income and unemployment rate. Excessive prenatal care is shown in the next two columns. The coefficient for excessive prenatal care had changed substantially for the aggregated data (from -0.162 for disaggregated to -0.577), and the standard error had a three-fold increase. The other estimates were again very similar. There has been a concern that the medical price level will increase faster than the overall consumer price index. Accordingly, a doctor's income might not decrease as much as the decline in the fertility rate. As such, the medical care price index (or the professional service price index) and the consumer price index, measured by the Bureau of Labor Statistics, were added as additional controls in the regressions.[13] The impact of the fertility rate on c-section had changed from -

[12] The unit of observation is individual, but the key independent variable is measured by the state or county level in this paper.
[13] These results are not reported as a Table, but they are available upon request to the author.

0.041 to -0.398 (or -0.386) when the medical care price index (professional service price index) and consumer price index were controlled. Therefore, the results of this study are robust to faster medical care price increases.

5. DISCUSSIONS

There was a positive correlation between the supply and demand of medical care across a geographical area. One possible explanation is supply induced demand. This is especially plausible in medical care because physicians have some control over patients' medical decisions due to their superior knowledge. Therefore, if physicians' income declines, they can induce medical demand to compensate for the reduced income, even though it may not be necessarily useful to their patients. Although many previous studies have tested the supply induced demand, few have actually tested the hypothesis directly. Even in the case of the direct empirical test of Gruber and Owings (1996), an unrealistically broad geographic area (i.e. the state level) made it difficult to determine true estimates. This paper uses a pure exogenous income shock to one specialty, OB/GYNs, in a county level. The total number of births in the U.S. had declined by approximately 8 percent between 1990 and 1997. This fertility rate decline directly impacted the income of OB/GYNs. Between the two delivery methods (i.e., c-section and vaginal delivery), a higher reimbursement rate for the c-section procedure represents a financial incentive for OB/GYNs to perform more c-section procedures if their income declines.[14] This paper examines as an outcome not only c-section but also excessive prenatal care. If doctors are reimbursed based on a fee-for-service, a higher number of prenatal care will mean higher income for OB/GYNs. The probability of the c-section procedure would increase by 4.1 percentage points if

[14] Physician's time investment and workload do not provide any incentive to choose vaginal delivery (Gruber and Owings 1996)

births per 100 population were to decline by a unit in a county per year. If the log of the fertility rate is used as a specification, the result will be -0.073. Although a more relevant geographical area and better data were used, the magnitude was noticeably smaller than that (-0.923) of Gruber and Owings (1996). This is mainly because of the different period studied; changes in the reimbursement mechanism might be a significant change factor. For example, the prevalence of capitation with an increasing number of managed care enrollments might make physicians less responsive to a change in their practice pattern. Gruber et al. (1999) found that some Medicaid changed the fee schedule to reduce the incentive to choose c-section over vaginal delivery. These changes may decrease the magnitude. However, the statistically significant impact on c-section found in this paper should nonetheless be considered as meaningful.

When excessive prenatal care was calculated (i.e., the difference between the actual number of prenatal visits and the recommended prenatal visits), no evidence of induced demand was found. However, a lowered fertility rate was found to give people better access to OB/GYNs.

Future study is warranted to further examine the mixed results of this study. One possible explanation is that the reimbursement for additional prenatal care is not large enough to induce demand, taking into account the disutility of performing unnecessary visits; however, the fee difference between c-section and vaginal delivery is still large enough to induce demand.

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Table 1. Descriptive Satistics

		Complications			History	
	All births*	Diabetes	Hypertension	Multiple births	No previous C-sec*	Previous C-sec*
Cesarean Section	0.23	0.38	0.40	0.89	0.16	0.77
Excessive Prenatal Visits	-0.52	1.37	1.06	7.72	-0.56	-0.24
	(1.72)	(2.54)	(3.03)	(6.86)	(1.75)	(2.54)
Actual Prenatal Visits	11.51	13.09	12.43	15.70	11.50	11.63
	(2.41)	(3.75)	(3.32)	(7.25)	(2.43)	(2.9)
Recommended Prenatal Visits	12.05	11.73	11.39	8.00	12.08	11.88
	(1.71)	(1.97)	(2.06)	(2.03)	(1.74)	(1.93)
Start Month for Prenatal Care	2.57	2.43	2.47	1.80	2.56	2.49
	(1.53)	(1.36)	(1.41)	(1.04)	(1.52)	(1.46)
Gestational Weeks	39.41	38.80	38.37	32.75	39.40	39.15
	(5.63)	(4.77)	(4.93)	(7.45)	(5.58)	(5.4)
Mother’s Age(%)						
Age <=19	12.47	4.08	12.92	1.62	13.65	3.17
20<= Age <=24	25.15	15.79	23.68	7.59	25.94	18.83
25<= Age <=29	28.73	28.00	27.02	25.79	28.57	30.07
30<= Age <=34	22.64	30.18	21.99	40.46	21.61	30.72
35<= Age <=39	9.35	17.60	11.51	20.59	8.68	14.67
Age >=40	1.67	4.35	2.88	3.95	1.55	2.54
Race of the Mother						
White	63.26	62.91	67.33	81.56	63.15	64.15
Black	15.11	13.50	17.45	7.74	15.14	14.89
Hispanic	15.80	15.38	10.93	6.89	15.78	15.90
Others	5.83	8.20	4.29	3.81	5.92	5.06

Married	0.70	0.78	0.70	0.91	0.69	0.77
Educational Level of Mother						
<high School	21.53	16.59	17.33	5.95	21.91	18.50
High School Graduates	34.39	35.50	35.93	23.70	34.23	35.80
College Graduates and Over	41.73	45.41	44.25	68.51	41.52	43.32
N	13,192,442	949,274	1,496,357	47,959	33,494,646	4,202,078

	Mean	5th	25th	50th	75th	95th
Births per 100 population in County	1.61 (0.66)	0.78	1.15	1.56	1.94	2.61

Note: The Natality Detail Files, which represent the census of all live births in the U.S. from 1989 to 1999, were used. Standard errors are in parenthesis. Excess prenatal visits are calculated by subtracting the recommended number of prenatal visits by American College of Obstetrics and Gynecologies based on the month prenatal care begins and gestational weeks from the actual number of prenatal visits. A positive number indicates excessive prenatal visits. No education information was available for approximately 2% of the sample.
* means the 35% random sample.

Table 2. Impact of the Fertility Rate on Cesarean Section, All Births

	Dependent Variable: Cesarean Section		
	(1)	(2)	(3)
Births per 100 Population in County	-0.0241***	-0.0255***	-0.0410***
	(0.00621)	(0.00658)	(0.00522)
Mother's Age 20-24	0.0299***	0.0298***	0.0284***
	(0.000935)	(0.000936)	(0.00101)
Mother's Age 25-29	0.0667***	0.0666***	0.0675***
	(0.00107)	(0.00107)	(0.00130)
Mother's Age 30-34	0.0988***	0.0987***	0.101***
	(0.00123)	(0.00123)	(0.00146)
Mother's Age 35-39	0.140***	0.140***	0.144***
	(0.00195)	(0.00196)	(0.00205)
Mother's Age 40-	0.183***	0.183***	0.190***
	(0.00354)	(0.00355)	(0.00346)
Black	0.0145***	0.0145***	0.0155***
	(0.00164)	(0.00165)	(0.00180)
Hispanic	0.000117	0.000138	0.000774
	(0.00394)	(0.00394)	(0.00430)
Others	-0.0196***	-0.0197***	-0.0220***
	(0.00256)	(0.00256)	(0.00258)
Married	0.000325	0.000363	0.000192
	(0.00103)	(0.00103)	(0.00125)
High School Graduates	0.0218***	0.0218***	0.0246***
	(0.00155)	(0.00155)	(0.00167)
College graduates	0.0243***	0.0243***	0.0281***
	(0.00217)	(0.00216)	(0.00231)
More than College	0.00491**	0.00493**	0.00755***
	(0.00244)	(0.00245)	(0.00267)
Education Missing	0.00548**	0.00557**	0.00796***
	(0.00234)	(0.00243)	(0.00268)
Year 1990	-0.00198**	-0.00154	-0.00168
	(0.000965)	(0.00113)	(0.00147)
Year 1991	-0.00399***	-0.00370***	-0.00567***
	(0.00136)	(0.00138)	(0.00167)
Year 1992	-0.00752***	-0.00817***	-0.0119***
	(0.00150)	(0.00166)	(0.00182)
Year 1993	-0.0156***	-0.0158***	-0.0202***
	(0.00187)	(0.00192)	(0.00219)
Year 1994	-0.0233***	-0.0235***	-0.0281***

	(0.00200)	(0.00212)	(0.00233)
Year 1995	-0.0271***	-0.0275***	-0.0330***
	(0.00236)	(0.00265)	(0.00291)
Year 1996	-0.0293***	-0.0302***	-0.0362***
	(0.00246)	(0.00284)	(0.00299)
Year 1997	-0.0286***	-0.0301***	-0.0360***
	(0.00258)	(0.00322)	(0.00337)
Year 1998	-0.0236***	-0.0264***	-0.0317***
	(0.00256)	(0.00369)	(0.00385)
Year 1999	-0.0142***	-0.0174***	-0.0228***
	(0.00265)	(0.00408)	(0.00430)
Real Average Income per Capita		0.0204*	0.0203**
		(0.0104)	(0.0102)
Unemployment Rate		0.0552	0.0938
		(0.0608)	(0.0660)
Constants	0.206***	0.174***	0.198***
	(0.0113)	(0.0179)	(0.0176)
Unidentified Counties	Y	Y	N
R^2	0.107	0.107	0.110
Observations	13,162,184	13,162,184	10,449,311

Note: The 35 percent random sample from the Natality Detail Files (from 1989 to 1999) was used. Robust standard errors are in parenthesis. Linear probability model has been used. County fixed effects are included. Age less than 19, White, and High school dropouts are the omitted categories for each group. Real average income per capita and unemployment rate were measured in the county level using regional economic accounts. The unemployment rate in 1989 was extrapolated using 1990 and forward data. Unidentified counties were aggregated to the state level. The unit of observation is individual.

*** p<0.01, ** p<0.05, * p<0.1

Table 3. Impact of the Fertility Rate on Cesarean Section, Various Sub-Samples

	Complications			History	
	Diabetes	Hypertension	Multiple births	No previous C-sec†	Previous C-sec†
	(1)	(2)	(3)	(4)	(5)
Births per 100 Population in County	-0.0153	-0.0495***	-0.0199	-0.0344***	-0.0401***
	(0.0105)	(0.00874)	(0.0233)	(0.00459)	(0.0142)
Mother's Age 20-24	0.0390***	0.0435***	0.0211	-0.00754***	0.0374***
	(0.00363)	(0.00213)	(0.0239)	(0.000856)	(0.00418)
Mother's Age 25-29	0.0634***	0.0799***	0.0359	0.00348***	0.0693***
	(0.00358)	(0.00238)	(0.0237)	(0.00131)	(0.00597)
Mother's Age 30-34	0.0887***	0.116***	0.0628***	0.00945***	0.0920***
	(0.00362)	(0.00252)	(0.0230)	(0.00145)	(0.00639)
Mother's Age 35-39	0.122***	0.154***	0.0744***	0.0346***	0.125***
	(0.00365)	(0.00308)	(0.0238)	(0.00185)	(0.00703)
Mother's Age 40-	0.157***	0.196***	0.0875***	0.0853***	0.158***
	(0.00427)	(0.00411)	(0.0243)	(0.00328)	(0.00861)
Black	0.0366***	0.0215***	-0.0551***	0.00164	0.00810**
	(0.00339)	(0.00361)	(0.0151)	(0.00128)	(0.00344)
Hispanic	-0.00299	0.0187***	-0.00142	-0.00579**	0.00425
	(0.00622)	(0.00492)	(0.00737)	(0.00274)	(0.00511)
Others	-0.0521***	-0.00150	-0.0261	-0.0108***	-0.0195***
	(0.00448)	(0.00314)	(0.0164)	(0.00166)	(0.00528)
Married	0.0146***	-0.000375	-0.0281**	0.0105***	-0.00654***
	(0.00204)	(0.00196)	(0.0131)	(0.000904)	(0.00246)
High School Graduates	0.0368***	0.0365***	0.00617	0.0310***	0.0147***
	(0.00322)	(0.00237)	(0.0133)	(0.000821)	(0.00292)
College Graduates	0.0418***	0.0395***	0.0100	0.0449***	0.00843***
	(0.00349)	(0.00324)	(0.0133)	(0.00145)	(0.00313)
More than College	0.0225***	0.0268***	0.00217	0.0460***	-0.0316***
	(0.00397)	(0.00383)	(0.0126)	(0.00180)	(0.00403)
Education Missing	0.0260***	0.0263***	-0.0686**	0.0244***	-0.0138**
	(0.00526)	(0.00495)	(0.0270)	(0.00208)	(0.00608)
Year 1990	-0.0110***	0.00120	-0.0290**	-0.00114	-0.0117***
	(0.00387)	(0.00329)	(0.0142)	(0.00114)	(0.00323)
Year 1991	-0.0171***	-0.0109***	-0.0221	-0.00326**	-0.0291***
	(0.00384)	(0.00352)	(0.0151)	(0.00163)	(0.00348)
Year 1992	-0.0287***	-0.0260***	-0.0110	-0.00916***	-0.0466***
	(0.00399)	(0.00461)	(0.0146)	(0.00165)	(0.00417)
Year 1993	-0.0272***	-0.0364***	-0.0184	-0.0148***	-0.0659***
	(0.00388)	(0.00429)	(0.0131)	(0.00190)	(0.00428)

Year 1994	-0.0320***	-0.0456***	-0.0244*	-0.0204***	-0.0900***
	(0.00425)	(0.00536)	(0.0135)	(0.00194)	(0.00442)
Year 1995	-0.0307***	-0.0548***	-0.0266*	-0.0237***	-0.103***
	(0.00517)	(0.00586)	(0.0152)	(0.00237)	(0.00548)
Year 1996	-0.0352***	-0.0638***	-0.0160	-0.0262***	-0.111***
	(0.00551)	(0.00611)	(0.0151)	(0.00240)	(0.00686)
Year 1997	-0.0300***	-0.0659***	-0.00670	-0.0281***	-0.101***
	(0.00580)	(0.00677)	(0.0161)	(0.00263)	(0.00865)
Year 1998	-0.0282***	-0.0641***	-0.00763	-0.0259***	-0.0877***
	(0.00728)	(0.00734)	(0.0186)	(0.00296)	(0.0111)
Year 1999	-0.0156*	-0.0527***	-0.0113	-0.0210***	-0.0555***
	(0.00838)	(0.00811)	(0.0204)	(0.00322)	(0.0113)
Real Average Income Per Capita	0.0290	0.0741***	-0.0380	0.0355***	0.00294
	(0.0229)	(0.0195)	(0.0523)	(0.00823)	(0.0396)
Unemployment Rate	0.266*	0.659***	0.00751	0.0745	0.171
	(0.156)	(0.149)	(0.472)	(0.0627)	(0.161)
Constants	0.249***	0.249***	0.968***	0.139***	0.806***
	(0.0393)	(0.0318)	(0.105)	(0.0150)	(0.0778)
Unidentified Counties	N	N	N	N	N
R^2	0.037	0.063	0.072	0.053	0.086
Observations	768459	1126117	45154	9295317	1153994

Note: See notes on Table 2 for additional information on data and estimation model.
† means 35% random sample

Table 4. . Impact of the Fertility Rate on Excessive Prenatal Visits, All Births

	Dependent Variable: Excessive Prenatal Visits		
	(1)	(2)	(3)
Births per 100 Population in County	-0.152	-0.0752	-0.162
	(0.117)	(0.0955)	(0.162)
Mother's Age 20-24	-0.129***	-0.129***	-0.139***
	(0.0205)	(0.0204)	(0.0240)
Mother's Age 25-29	-0.0271	-0.0278	-0.0359
	(0.0255)	(0.0255)	(0.0298)
Mother's Age 30-34	0.0895***	0.0893***	0.0906***
	(0.0229)	(0.0228)	(0.0273)
Mother's Age 35-39	0.311***	0.312***	0.323***
	(0.0185)	(0.0182)	(0.0220)
Mother's Age 40-	0.605***	0.606***	0.633***
	(0.0186)	(0.0185)	(0.0191)
Black	-0.0629**	-0.0638**	-0.0422
	(0.0300)	(0.0299)	(0.0335)
Hispanic	-0.505***	-0.506***	-0.485***
	(0.0708)	(0.0713)	(0.0783)
Others	-0.399***	-0.399***	-0.380***
	(0.0314)	(0.0312)	(0.0346)
Married	-0.195***	-0.195***	-0.187***
	(0.0194)	(0.0193)	(0.0234)
High School Graduates	0.473***	0.473***	0.509***
	(0.0362)	(0.0360)	(0.0432)
College Graduates	0.646***	0.646***	0.698***
	(0.0468)	(0.0469)	(0.0552)
More than College	0.584***	0.586***	0.639***
	(0.0543)	(0.0547)	(0.0620)
Education Missing	0.524***	0.528***	0.563***
	(0.0803)	(0.0815)	(0.0917)
Year 1990	0.0537***	0.0424*	0.0477*
	(0.0172)	(0.0216)	(0.0288)
Year 1991	0.122***	0.0959***	0.0962***
	(0.0230)	(0.0233)	(0.0289)
Year 1992	0.171***	0.181***	0.176***
	(0.0286)	(0.0298)	(0.0384)
Year 1993	0.282***	0.280***	0.272***
	(0.0343)	(0.0317)	(0.0414)
Year 1994	0.333***	0.347***	0.330***
	(0.0420)	(0.0436)	(0.0529)
Year 1995	0.408***	0.441***	0.422***

	(0.0466)	(0.0544)	(0.0655)
Year 1996	0.436***	0.496***	0.473***
	(0.0548)	(0.0709)	(0.0850)
Year 1997	0.560***	0.655***	0.632***
	(0.0605)	(0.0870)	(0.104)
Year 1998	0.585***	0.751***	0.731***
	(0.0611)	(0.113)	(0.132)
Year 1999	0.628***	0.821***	0.808***
	(0.0631)	(0.125)	(0.146)
Real Average Income Per Capita		-0.998**	-1.017**
		(0.415)	(0.436)
Unemployment Rate		-0.912	-0.612
		(1.544)	(1.818)
Constants	-0.880***	0.559	0.823
	(0.199)	(0.695)	(0.830)
Unidentified Counties	Y	Y	N
R^2	0.205	0.205	0.209
Observations	12,960,329	12,960,329	10,277,106

Note: Excess prenatal visits are calculated by subtracting the number of prenatal visits by American College of Obstetrics and Gynecologies based on the month prenatal care begins and gestational weeks from the actual number of prenatal visits. A positive number indicates excessive prenatal care. See notes on Table 2 for additional information.

Table 5. . Impact of the Fertility Rate on Excessive Prenatal Visits, Various Subsamples

	Complications			History	
	Diabetes	Hypertension	Multiple births	No previous C-sec†	Previous C-sec†
	(1)	(2)	(3)	(4)	(5)
Births per 100 Population in County	0.0512	-0.103	0.863	-0.157	-0.168
	(0.237)	(0.164)	(1.004)	(0.161)	(0.180)
Mother's Age 20-24	0.0622	0.141***	-0.331	-0.165***	0.253***
	(0.0490)	(0.0288)	(0.492)	(0.0250)	(0.0320)
Mother's Age 25-29	0.109**	0.399***	0.220	-0.0849***	0.448***
	(0.0503)	(0.0292)	(0.497)	(0.0313)	(0.0378)
Mother's Age 30-34	0.147***	0.689***	0.291	0.0279	0.583***
	(0.0498)	(0.0285)	(0.484)	(0.0287)	(0.0384)
Mother's Age 35-39	0.381***	0.984***	0.205	0.251***	0.829***
	(0.0431)	(0.0284)	(0.497)	(0.0241)	(0.0358)
Mother's Age 40-	0.691***	1.371***	0.823	0.567***	1.120***
	(0.0489)	(0.0476)	(0.610)	(0.0204)	(0.0454)
Black	0.0565	-0.256***	-1.152***	-0.0392	-0.0978***
	(0.0722)	(0.0423)	(0.254)	(0.0339)	(0.0322)
Hispanic	-0.594***	-0.713***	-1.439***	-0.493***	-0.436***
	(0.0846)	(0.0921)	(0.358)	(0.0791)	(0.0711)
Others	-0.744***	-0.467***	-0.985***	-0.370***	-0.424***
	(0.0720)	(0.0531)	(0.357)	(0.0340)	(0.0462)
Married	-0.0557	-0.295***	-1.442***	-0.179***	-0.241***
	(0.0384)	(0.0239)	(0.266)	(0.0233)	(0.0289)
High School Graduates	0.507***	0.563***	1.339***	0.520***	0.421***
	(0.0787)	(0.0425)	(0.239)	(0.0436)	(0.0409)
College Graduates	0.761***	0.858***	1.640***	0.718***	0.574***

	(0.0914)	(0.0543)	(0.276)	(0.0561)	(0.0510)
More than College	0.689***	0.822***	2.027***	0.676***	0.445***
	(0.0939)	(0.0612)	(0.261)	(0.0629)	(0.0591)
Education Missing	0.600***	0.608***	2.089***	0.571***	0.521***
	(0.119)	(0.0739)	(0.603)	(0.0925)	(0.0908)
Year 1990	0.0622	0.141***	-0.331	-0.165***	0.253***
	(0.0490)	(0.0288)	(0.492)	(0.0250)	(0.0320)
Year 1991	0.109**	0.399***	0.220	-0.0849***	0.448***
	(0.0503)	(0.0292)	(0.497)	(0.0313)	(0.0378)
Year 1992	0.147***	0.689***	0.291	0.0279	0.583***
	(0.0498)	(0.0285)	(0.484)	(0.0287)	(0.0384)
Year 1993	0.381***	0.984***	0.205	0.251***	0.829***
	(0.0431)	(0.0284)	(0.497)	(0.0241)	(0.0358)
Year 1994	0.691***	1.371***	0.823	0.567***	1.120***
	(0.0489)	(0.0476)	(0.610)	(0.0204)	(0.0454)
Year 1995	0.0565	-0.256***	-1.152***	-0.0392	-0.0978***
	(0.0722)	(0.0423)	(0.254)	(0.0339)	(0.0322)
Year 1996	-0.594***	-0.713***	-1.439***	-0.493***	-0.436***
	(0.0846)	(0.0921)	(0.358)	(0.0791)	(0.0711)
Year 1997	-0.744***	-0.467***	-0.985***	-0.370***	-0.424***
	(0.0720)	(0.0531)	(0.357)	(0.0340)	(0.0462)
Year 1998	-0.0557	-0.295***	-1.442***	-0.179***	-0.241***
	(0.0384)	(0.0239)	(0.266)	(0.0233)	(0.0289)
Year 1999	0.507***	0.563***	1.339***	0.520***	0.421***
	(0.0787)	(0.0425)	(0.239)	(0.0436)	(0.0409)
Real Average Income Per Capita	0.269	-0.156	-0.566	-1.043**	-0.758**
	(0.420)	(0.324)	(1.736)	(0.445)	(0.371)
Unemployment Rate	3.629	1.023	-10.64	-0.558	-1.064
	(2.856)	(2.417)	(16.60)	(1.800)	(2.134)
Constants	-0.106	0.407	4.999	0.840	0.392
	(0.881)	(0.604)	(3.840)	(0.843)	(0.749)

Unidentified Counties	N	N	N	N	N
R^2	0.087	0.110	0.162	0.201	0.098
Observations	762,870	1,111,002	44,450	9,137,565	1,137,491

Note: See notes on Table 4 for additional information on data and the estimation model.
† means the 35% random sample

Table 6. Impact of the Fertility Rate on Access to Care

	All births†	Complications			History	
		Diabetes	Hypertension	Multiple births	No previous C-sec†	Previous C-sec†
Births per 100 Population in County	0.120**	0.187***	0.0876	0.163	0.120**	0.121**
	(0.0568)	(0.0678)	(0.0601)	(0.139)	(0.0569)	(0.0586)
Mother's Age 20-24	-0.125***	-0.110***	-0.197***	-0.0136	-0.128***	-0.245***
	(0.00589)	(0.0123)	(0.00847)	(0.104)	(0.00610)	(0.0131)
Mother's Age 25-29	-0.304***	-0.245***	-0.343***	-0.191**	-0.305***	-0.469***
	(0.00846)	(0.0133)	(0.0109)	(0.0955)	(0.00876)	(0.0152)
Mother's Age 30-34	-0.333***	-0.251***	-0.354***	-0.214**	-0.330***	-0.531***
	(0.0100)	(0.0147)	(0.0121)	(0.0966)	(0.0104)	(0.0155)
Mother's Age 35-39	-0.308***	-0.223***	-0.305***	-0.162*	-0.301***	-0.525***
	(0.0105)	(0.0158)	(0.0125)	(0.0966)	(0.0109)	(0.0153)
Mother's Age 40-	-0.219***	-0.118***	-0.181***	-0.255**	-0.208***	-0.455***
	(0.0128)	(0.0211)	(0.0184)	(0.102)	(0.0136)	(0.0155)
Black	0.281***	0.265***	0.285***	0.283***	0.276***	0.307***
	(0.0114)	(0.0127)	(0.0121)	(0.0392)	(0.0114)	(0.0129)
Hispanic	0.341***	0.342***	0.322***	0.255***	0.340***	0.346***
	(0.0119)	(0.0115)	(0.0134)	(0.0380)	(0.0117)	(0.0174)
Others	0.310***	0.302***	0.283***	0.191***	0.313***	0.282***
	(0.0157)	(0.0167)	(0.0196)	(0.0418)	(0.0157)	(0.0186)
Married	0.363***	0.330***	0.372***	0.409***	0.359***	0.413***
	(0.00927)	(0.0114)	(0.00928)	(0.0517)	(0.00926)	(0.0131)
High School Graduates	-0.305***	-0.320***	-0.276***	-0.312***	-0.305***	-0.289***
	(0.0122)	(0.0155)	(0.0110)	(0.0574)	(0.0121)	(0.0143)
College Graduates	-0.453***	-0.468***	-0.410***	-0.425***	-0.453***	-0.429***
	(0.0108)	(0.0110)	(0.0103)	(0.0593)	(0.0108)	(0.0129)
More than College	-0.567***	-0.599***	-0.528***	-0.494***	-0.569***	-0.522***

	(0.0123)	(0.0126)	(0.0121)	(0.0544)	(0.0124)	(0.0143)
Education Missing	-0.304***	-0.293***	-0.283***	-0.479***	-0.304***	-0.288***
	(0.0223)	(0.0325)	(0.0226)	(0.0795)	(0.0224)	(0.0256)
Year 1990	-0.0180**	-0.0237*	-0.0191**	-0.0437	-0.0195**	-0.00487
	(0.00758)	(0.0132)	(0.00917)	(0.0641)	(0.00800)	(0.00818)
Year 1991	-0.0250***	-0.0252*	-0.0408***	-0.0165	-0.0265***	-0.0110
	(0.00903)	(0.0129)	(0.0116)	(0.0627)	(0.00925)	(0.0102)
Year 1992	-0.0698***	-0.0446***	-0.0775***	-0.0933	-0.0718***	-0.0529***
	(0.0121)	(0.0159)	(0.0153)	(0.0616)	(0.0123)	(0.0133)
Year 1993	-0.104***	-0.0665***	-0.107***	-0.0596	-0.108***	-0.0751***
	(0.0139)	(0.0167)	(0.0161)	(0.0600)	(0.0140)	(0.0159)
Year 1994	-0.145***	-0.105***	-0.149***	-0.107*	-0.148***	-0.116***
	(0.0150)	(0.0187)	(0.0171)	(0.0640)	(0.0152)	(0.0158)
Year 1995	-0.173***	-0.132***	-0.181***	-0.0934	-0.178***	-0.128***
	(0.0184)	(0.0239)	(0.0217)	(0.0662)	(0.0186)	(0.0187)
Year 1996	-0.192***	-0.146***	-0.196***	-0.00104	-0.198***	-0.137***
	(0.0225)	(0.0299)	(0.0258)	(0.0733)	(0.0229)	(0.0218)
Year 1997	-0.235***	-0.165***	-0.233***	-0.139*	-0.242***	-0.174***
	(0.0274)	(0.0341)	(0.0302)	(0.0826)	(0.0279)	(0.0263)
Year 1998	-0.262***	-0.182***	-0.258***	-0.120	-0.270***	-0.197***
	(0.0354)	(0.0410)	(0.0364)	(0.0950)	(0.0362)	(0.0325)
Year 1999	-0.281***	-0.198***	-0.268***	-0.148	-0.290***	-0.204***
	(0.0407)	(0.0442)	(0.0392)	(0.102)	(0.0414)	(0.0377)
Real Average Income Per Capita	0.185	0.00528	0.106	0.183	0.190	0.159
	(0.118)	(0.107)	(0.106)	(0.219)	(0.119)	(0.112)
Unemployment Rate	-0.483	-0.636	-0.342	-2.032	-0.535	-0.0240
	(0.493)	(0.719)	(0.638)	(1.616)	(0.496)	(0.501)
Constants	2.474***	2.577***	2.616***	1.851***	2.473***	2.616***
	(0.223)	(0.165)	(0.168)	(0.446)	(0.228)	(0.202)

Unidentified Counties	N	N	N	N	N	N
R^2	0.116	0.113	0.119	0.176	0.116	0.119
Observations	10,449,311	768,459	1,126,117	45,154	9,295,317	1,153,994

Note: The dependent variable is the month prenatal care begins. OLS was used for estimation.
The Natality Detail Files (from 1989 to 1999) was used. Robust standard errors are in parenthesis. County fixed effects are included. Age less than 19, White, and High school dropouts are the omitted categories for each group. Real average income per capita and unemployment rate were measured at the county level using regional economic accounts. The unemployment rate in 1989 was extrapolated using the 1990 and forward data. Unidentified counties were aggregated to the State level.
† means the 35% random sample
*** p<0.01, ** p<0.05, * p<0.1

Table 7. Aggregated data and disaggregated data

	Cesarean section		Excessive prenatal care	
	(1)	(2)	(3)	(4)
Births per 100 Population in County	-0.0410***	-0.0434***	-0.162	-0.577
	(0.00522)	(0.0118)	(0.162)	(0.486)
Mother's Age 20-24	0.0284***	0.0294***	-0.139***	-0.134***
	(0.00101)	(0.000672)	(0.0240)	(0.0214)
Mother's Age 25-29	0.0675***	0.0654***	-0.0359	-0.0289
	(0.00130)	(0.00117)	(0.0298)	(0.0264)
Mother's Age 30-34	0.101***	0.0970***	0.0906***	0.0932***
	(0.00146)	(0.00235)	(0.0273)	(0.0216)
Mother's Age 35-39	0.144***	0.138***	0.323***	0.318***
	(0.00205)	(0.00377)	(0.0220)	(0.0191)
Mother's Age 40-	0.190***	0.181***	0.633***	0.605***
	(0.00346)	(0.00632)	(0.0191)	(0.0315)
Black	0.0155***	0.00944***	-0.0422	-0.0416
	(0.00180)	(0.00240)	(0.0335)	(0.0564)
Hispanic	0.000774	0.00508	-0.485***	-0.498***
	(0.00430)	(0.00407)	(0.0783)	(0.0394)
Others	-0.0220***	-0.0219***	-0.380***	-0.387***
	(0.00258)	(0.00389)	(0.0346)	(0.0288)
Married	0.000192	-0.000527	-0.187***	-0.200***
	(0.00125)	(0.00266)	(0.0234)	(0.0229)
High School Graduates	0.0246***	0.0217***	0.509***	0.478***
	(0.00167)	(0.00201)	(0.0432)	(0.0427)
College Graduates	0.0281***	0.0234***	0.698***	0.672***
	(0.00231)	(0.00292)	(0.0552)	(0.0588)
More than College	0.00755***	0.00134	0.639***	0.629***
	(0.00267)	(0.00323)	(0.0620)	(0.0759)
Education Missing	0.00796***	0.00687	0.563***	0.605***
	(0.00268)	(0.00527)	(0.0917)	(0.169)
Year 1990	-0.00168	-0.00215*	0.0477*	0.0680**
	(0.00147)	(0.00108)	(0.0288)	(0.0264)
Year 1991	-0.00567***	-0.00475	0.0962***	0.109***
	(0.00167)	(0.00299)	(0.0289)	(0.0407)
Year 1992	-0.0119***	-0.0117***	0.176***	0.242***
	(0.00182)	(0.00360)	(0.0384)	(0.0594)
Year 1993	-0.0202***	-0.0194***	0.272***	0.283***
	(0.00219)	(0.00286)	(0.0414)	(0.0701)
Year 1994	-0.0281***	-0.0272***	0.330***	0.326***
	(0.00233)	(0.00275)	(0.0529)	(0.0781)
Year 1995	-0.0330***	-0.0322***	0.422***	0.407***
	(0.00291)	(0.00345)	(0.0655)	(0.0884)
Year 1996	-0.0362***	-0.0362***	0.473***	0.482***
	(0.00299)	(0.00396)	(0.0850)	(0.0929)
Year 1997	-0.0360***	-0.0375***	0.632***	0.665***
	(0.00337)	(0.00448)	(0.104)	(0.107)

Year 1998	-0.0317***	-0.0364***	0.731***	0.847***
	(0.00385)	(0.00582)	(0.132)	(0.113)
Year 1999	-0.0228***	-0.0283***	0.808***	0.942***
	(0.00430)	(0.00624)	(0.146)	(0.123)
Real Income per Capita	0.0203**	6.13e-06**	-1.017**	-0.000252***
	(0.0102)	(2.73e-06)	(0.436)	(5.59e-05)
Unemployment Rate	0.0938	0.00152	-0.612	-0.0488**
	(0.0660)	(0.00108)	(1.818)	(0.0231)
Constants	0.198***	0.135***	0.823	3.773***
	(0.0176)	(0.0436)	(0.830)	(1.330)
Unidentified counties	N		N	
Unit of Observation for Fertility	county	state	county	state
R^2	0.110	0.113	0.209	0.191
Observations	10,449,311	13,544,290	10,277,106	13,337,741

*** p<0.01, ** p<0.05, * p<0.1