THE "QUIET REVOLUTION" AND THE CESAREAN SECTION IN THE UNITED STATES[1]

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Abstract: This paper estimates how changes in family structure and women's labor market attachment during the last fifty years have affected the incidence of cesarean delivery in the United States. Both sets of factors are strongly related to cesarean utilization, and have generally changed so as to increase the rate of cesarean delivery over time. Altogether, changes in these factors, complemented by demographic changes, raised the U.S. cesarean section rate by eleven percentage points since 1977, nearly two-thirds of the increase over that period. Today's elevated cesarean section rate is, to a substantial degree, a social phenomenon.

Keywords: cesarean section; Quiet Revolution; women's employment; childbirth; Markov chain

JEL Codes: I11, I12, J13, J22

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> To the problem of present conduct [in America] are added all the perplexities introduced by varying concepts of marriage, the conflict between deferring marriage until competence is assured, or marrying and sharing the expenses of the home with a struggling young husband. The knowledge of birth control, while greatly dignifying human life by introducing the element of choice at the point where human beings have before been most abjectly subject to nature, introduces further perplexities. It complicates the issue from a straight marriage-home-and-children plan of life versus independent spinsterhood by permitting marriages without children, earlier marriages, marriages and careers, sex relations without marriage and the responsibility of a home. And because the majority of girls still wish to marry and regard their occupations as stop-gaps, these problems not only influence their attitude towards men, but also their attitude towards their work, and prevent them from having a sustained interest in the work which they are forced to do.
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> –Margaret Mead, *Coming of Age in Samoa* (1928)

The tension between work, marriage, and family is an enduring feature of American womanhood. To some degree, investment in human capital and the labor market limits investment in home and family, and vice versa.

Despite the enduring nature of these "perplexities," however, their resolution has not remained static over time. Over the last century, there have been tectonic shifts in the social and economic landscape negotiated by women in deciding how to balance work and family life. As a consequence of these shifts, the last fifty years have seen revolutionary changes in women's education levels, labor market attachment, and pay, accompanied by similarly vast changes in the size of families and the timing of family formation.

In this paper, we explore whether these changes can unravel another perplexity: the dramatic increase in the rate of cesarean section delivery in the U.S. Standing at 6% in 1969, this rate rose steadily in the ensuing decades until plateauing at around 32% in 2008 (Figure 1). This is more than twice the cesarean rate considered medically necessary by the World Health Organization (2015); given the cesarean's cost and prevalence, the excess amounts to a substantial waste of resources. Cesareans also generate health risks for the mother and baby (Shearer, 1993), leave mothers with a

less satisfactory birth experience (Lobel and DeLuca, 2007), have negative psychological effects on the parents (Mutryn, 1993), and require additional recovery time. Nonetheless, despite the importance of the issue and much study of the causes of cesarean delivery, discussed below, this increase in cesarean rates remains poorly understood.

In order to conduct this exploration, two things are needed: a fresh perspective on the cesarean section and a lot of data. The existing economic literature on the cesarean section has focused on the incentives facing providers, such as convenience, monetary gain, and the threat of lawsuits. Without disputing the validity of these factors, we focus instead on the mother herself. From her perspective, pregnancy inherently involves decisions about time allocation–when to get pregnant, what to do while pregnant, whether to stay home with the child once born. These decisions can affect the health of the mother and baby and, thus, the clinical need for a cesarean, along with the mother's desire to receive a cesarean, conditional on health. They are also intertwined with labor market attachment and hence to this period of transformation. Thus, the rise in the U.S. cesarean rate could be, in part, a *social phenomenon*.

The data demands are multifold. Estimating the effect of these influences on cesarean use requires relevant clinical and demographic information to be meshed with the labor market and family formation information that is associated with the revolutionary changes noted above. Then, with those estimates in hand, projecting the effect of changes in these factors on cesarean rates over this long period of increase requires decades of data on birthing mothers' labor market involvement and family structure.

No single data source can satisfy all these demands. We use three, one tailored to the first purpose and two tailored to the second. With this data, we provide the first comprehensive, national

analysis of how labor market factors affect cesarean use, and then determine how much these factors, changes in fertility behavior, and demographic shifts contributed to the increase in cesarean rates over the last half century. Their combined contribution is large, as each set of factors substantially affects cesarean use and exhibited substantial change over this period. A sizeable fraction of the increase in the U.S. cesarean rate over this period can be explained by these revolutionary changes in labor market attachment and family structure.

Section I. The Quiet Revolution.

According to Goldin (2006), the first two-thirds of the twentieth century involved intervals of evolutionary change, in which Mead's "perplexities" worked their way through American society. The constraints on married women's work eased, the elasticity of women's labor supply increased, and women's participation in the labor force grew. It was the slow unveiling of a new world for women. As the 1970s dawned, young women were able to anticipate this new world in making education, career, and family decisions. The stage for the final, "revolutionary" change was set (pp. 1-2):

> It was a change from [women] who work because they and their families "need the money" to those who are employed...because occupation and employment define one's fundamental identity and social worth. It involved a change from "jobs" to "careers," where the distinction between these two concepts concerns both [time] horizon and human capital investment... Those [women] in the evolutionary phases married early enough that their adult identity was formed *after* marriage, whereas those in the revolutionary phase married late enough that the identity formation could *precede* marriage. It was a change from passive actors, who take the income and time allocation of other members as given, to active participants who bargain somewhat effectively in the household and the labor market.

The social changes unleashed by this "Quiet Revolution" were multifaceted. They included women's "age at first marriage, divorce, number and timing of children, relative earnings, and labor market attachment" (p. 2). We focus on two groups of variables: "labor market factors," which include education, occupation, and employment, and "family formation factors," which include the number and timing of children.

A large literature supports the key elements of Goldin's narrative. Increases in women's relative wages have generated large increases in U.S. women's labor force participation and human capital investments, altering occupational choice accordingly.[2] Supplementary forces also expanded employment, including the birth control pill and reductions in the costs of child care and consumer durables that lessen the burden of housework.[3] Overall, these factors can explain the preponderance of changes in U.S. women's labor market attachment over this period.

Large changes in fertility behavior accompany these labor market developments, both in the number and timing of children. This topic has been investigated by careful econometric analyses that account for the state dependence and mutual causality of fertility and work, and also by detailed structural analyses that endogenize both decisions in trying to reproduce observed work and fertility behavior throughout adulthood.[4] Both find that increased labor market attachment significantly

[2] See Attanasio, Low, and Sanchez-Marcos (2008); Cardia and Gomme (2018); Heathcote, Storesletten, and Violante (2017); Jones, Manuelli, and McGrattan (2015); and Knowles (2013). On the role of occupation, see Adda, Dustmann, and Stevens (2017).

[3] See Attanasio, Low, and Sanchez-Marcos (2008); Bailey, Hershbein, and Miller (2012); and Cardia and Gomme (2018).

[4] In the U.S., see Caucutt, Guner, and Knowles (2002); Francesconi (2002); and Troske and Voicu (2013). Elsewhere, see Adda, Dustmann, and Stevens (2017); Heckman and Miller (1990); Jensen (2012); and Lien and Wang (2016).

decreases family size and substantially delays the onset of motherhood. The enhanced family planning abilities afforded by legalized abortion and the birth control pill further supported these developments (Ananat and Hungerman, 2012; Guldi, 2008; Myers, 2017). Overall, these analyses can explain the preponderance of changes in U.S. women's fertility behavior over this period.

In summary, Goldin's Quiet Revolution adequately explains the changes in family formation and women's labor market attachment that are observed over the last half century. We now consider how these changes should affect use of the cesarean section.

Section II. The Quiet Revolution and the Cesarean Section.

To think about the incidence of cesarean section delivery, it is useful to place all relevant influences into three groups: things that affect the health of the mother and fetus, and thus the clinical "need" for a cesarean; demand-side influences that affect the mother's desire to receive a cesarean, conditional on health; and supply-side influences that affect the physician's willingness to perform a cesarean, conditional on health.

The economic literature has focused on the third group, particularly those supply-side factors that provide an incentive for the physician to conduct a cesarean delivery. Generally, the literature finds that these factors have an effect, though it is modest in size. This claim holds for each of the three major factors that fall in this category: physician convenience (Brown, 1996; Spetz, Smith, and Ennis, 2001), financial incentives (Keeler and Brodie, 1993; Grant, 2009), and malpractice pressures (Dubay, Kaestner, and Waidmann, 1999; Grant and McInnes, 2004; Yang et al., 2009; Cano-Urbina and Montanera, 2017). Accordingly, these factors are unlikely to generate the large increase in

cesarean rates depicted in Figure 1, even if they have changed in a "favorable direction"–and it's not clear that they have.[5]

The Quiet Revolution, in contrast, involves the other two groups. It could affect the "demand" for a cesarean, conditional on health, in several ways. Changes in employment could alter women's insurance coverage, and thus the financial consequences of a cesarean delivery. In addition, maternal preferences for a cesarean section could change as her time grows in value, her household bargaining power increases, or she emphasizes child quality, a substitute for child quantity. The direction of effect is uncertain, however. Cesareans are more easily scheduled but harder to recover from, and the health effect of *marginal* cesareans on child health is unclear.

The evidence to date does not suggest that demand-side factors are sizeable. Since Medicaid was expanded to pregnant women in the late 1980s, most mothers have little financial reason to avoid a cesarean delivery; careful estimates indicate a small difference between public and private insurance (Tussing and Wojtowycz, 1994; Grant, 2005; the effect for lacking insurance is larger). Similarly small effects emerge from a complementary literature on maternal preferences (Gamble and Creedy, 2000; DeClercq et al., 2006; Gamble et al., 2007; McCourt et al., 2007).

The final set of factors are those that influence the health of the mother and fetus. These are theoretically linked to most labor market and family formation factors associated with the Quiet Revolution. Mothers who attend school to prepare for their career may acquire knowledge that produces fetal and maternal health during pregnancy. Also, career-oriented women planning to have

[5] Trends in these factors have not been formally measured, but could easily run in the opposite direction. The widespread adoption of group practices should lessen the "convenience factor," the widespread adoption of managed care should reduce financial incentives, and the widespread adoption of malpractice reforms should alleviate malpractice pressures.

small families may choose to emphasize child quality through fetal health. On the other hand, the physical and emotional demands of the workplace can reduce health production, as can the delay of motherhood, since older mothers tend to have more health problems. Further complicating matters, while improved maternal health should reduce the need for a cesarean, improved fetal health could work in either direction, as healthier babies are larger, which makes them more difficult to deliver. Thus, while the theoretical relevance of these factors is unquestioned, one cannot predict how the Quiet Revolution has affected the health-related "need" for cesarean delivery from theory alone.

Some evidence bears on this question. It is well-established that maternal age and parity strongly influence the use of cesarean section (see below). The effect of education on maternal health is positive for developing countries (Chou et al., 2010; Rowe et al., 2005), but the evidence for the U.S. is mixed (Currie and Moretti, 2003; McCrary and Royer, 2011). And employment decreases accompanying recessions or pregnancy leave are generally associated with better birth outcomes, partly through reductions in low birth weight babies.[6]

While these studies suggest that labor market factors will affect cesarean use, because maternal and fetal health affect the probability of receiving a cesarean, they do not relate the two variables directly. To our knowledge, only one previous study has done so: Tussing and Wojtowycz's (1992) analysis of births in upstate New York during 1986. Maternal employment was

[6] Menclova (2013) and Aparicio, Gonzalez, and Castello (2020) find that recessions improve birth outcomes, partly through increased birth weight, while Dehejia and Lleras-Mooney (2004) find that babies conceived in recessions have reduced malformations, post-neonatal mortality, and incidence of low birth weight. This latter finding is partially confirmed by Lindo (2015) but contradicted in Bozzoli and Quintana-Domeque (2014). Rossin (2011), Stearns (2015), and Butikofer, Riise, and Skira (2021) find that policies encouraging pregnant women to take more time off work increase birth weight and decrease the number of premature births. Dave and Yang (2020) find that "moderate-intensity" work while pregnant raises the incidence of fetal macrosomia.

associated with a two percentage point increase in the probability of receiving a cesarean. Our study will provide additional direct, micro evidence on this question, using a nationally representative survey that contains a wider set of demographic controls and measures of labor market attachment.

Thus, ultimately, the contribution of this paper is two-fold. First, it will provide the first detailed, national evidence on the effect of a broad set of labor market factors on the use of cesarean section delivery. Second, it will estimate the increase in cesarean rates over the period of the Quiet Revolution that can be attributed to these factors, family formation factors, and demographics.

Section III. The Effect of Labor Market and Family Formation Factors on Cesarean Delivery: Methods and Data.

To learn how labor market and family formation factors influence the use of cesarean section delivery, we estimate a basic linear probability model that relates a cesarean indicator to these factors and a variety of controls. This regression is specified as follows:

(1) $$C_m = \alpha L_m + \beta S_m + \gamma D_m + \delta F_m + \varphi Z_m + \varepsilon_m$$

where C is a dummy that equals one if mother *m* received a cesarean section and zero otherwise, ε is an error term, α, β, γ, δ, and ψ are parameters, and L, S, D, F, and Z represent vectors of independent variables that are described below. (This specification's linearity simplifies calculations conducted later in the paper. A logistic specification yields very similar results and significance levels.)

To estimate this model, we need a data set that is sufficiently large and has suitable labor

market and clinical information. Most surveys lack all three in conjunction.[7] The lone exception is a single, national cross section, fortuitously placed in the middle of the Quiet Revolution: the 1988 National Maternal Infant Health Survey (NMIHS). The NMIHS links Vital Statistics information to responses from three surveys, completed by the physician, hospital, and mother, producing the most comprehensive data set ever compiled about pregnancy and childbirth in the U.S. It contains extensive data on the parents' education, employment, earnings, and insurance, household composition and demographics, clinical factors affecting childbirth, and the mother's prenatal care, health behaviors, and birth history.

From an initial set of 10,023 observations, 288 were dropped because of missing information on maternal age or birth order and another 51 dropped because of inconsistent employment information,[8] leaving 9,684 observations on which to conduct estimation. Because of oversampling of blacks and low birth weight babies, weights are used for all calculations, descriptive statistics and regressions included.

The labor market variables in L include maternal and paternal education, occupation, and employment status, each measured in detail in the NMIHS. Over three hundred dummies record the three-digit occupation in the mother's and father's current or most recent job; these proxy for skill level, the value of time, and the degree of occupational stress, none of which are measured directly.

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[7] The following alternative U.S. data sources were considered: The CANDLE Study, The Fragile Families Survey, Listening to Mothers, The National Longitudinal Surveys, and The National Survey of Family Growth. Two of these have very limited clinical information, and the remainder have small samples (that contain all needed information). Several are not nationally representative. Further details are available from the author.

[8] The occupation code indicated that the mother had never worked, while she was coded as having worked during the year before delivery.

Four indicators of maternal labor force attachment are available: 1) whether the mother has ever worked, 2) whether she worked at any point in the year preceding the birth, 3) whether she worked during pregnancy, and 4) whether she worked post-birth. The first is subsumed in the occupation dummies, which indicate if the mother had never worked before becoming pregnant. The second and third closely overlap, so initially we include only the second measure and broaden this later. We utilize the fourth measure as well, tracking employment before, during, and after pregnancy.

The family structure variables in S include live birth order, maternal and paternal age, a dummy for whether the baby's father lived with the mother during pregnancy, and the number of other people in the household (beyond immediate family).[9] It thus incorporates information about household composition beyond the family formation factors stressed earlier: the number and timing of children.

The demographic variables in D include the race and ethnicity of the mother and father, region dummies, and a dummy for residence in a metropolitan area.[10] The financial variables in F include the log of family income and dummies for whether the costs of the delivery are paid for with private insurance, public insurance, or own funds (selfpay).[11] In 1988, the expansion of Medicaid

[9] The NMIHS does not directly ask if the mother and father were married prior to delivery, and only a rough approximation (which had worse explanatory power) was possible from the questions it does ask. Birth order and the number of other people are capped at ten, maternal age at 42, and paternal age at 51–in each case, the largest number with at least ten observations.

[10] State of residence was collected in the original surveys but not released in the final version of the NMIHS, in order to prevent the identification of mothers in the data.

[11] Income is reported in twenty categories; the midpoint of each category was used for all but the last, rarely-used, category, which was topcoded at $70,000. In addition, the Medicaid, privately insured, and selfpay categories are not mutually exclusive–respondents could and did choose more than one category. Thus all three are included in the regression.

to mothers within 133% of the poverty line had not been completed, so it was not unusual to have no third-party source of payment in the NMIHS.

The extensive clinical variables contained in Z are listed in the note to Table 2. They include all primary clinical indications for a cesarean, omitting three (dystocia, disproportion, and fetal distress) that are understood to be relatively subjective and thus potentially endogenous.

There is a different endogeneity problem, however, that cannot be avoided. Some women, anticipating problems with gestation or delivery, may stop working after getting pregnant in order to reduce their likelihood or magnitude. If these problems raise the probability that a cesarean is performed, the relevant employment coefficient will be biased downward. We do not have reliable instruments with which to address this problem directly. Instead, through careful analysis of various specifications presented below, we verify the presence of this bias and reveal how it operates. As it turns out, labor market attachment is estimated to have large, positive effects on cesarean use despite the presence of this unfavorable bias.

Section IV. The Effect of Labor Market and Family Formation Factors on Cesarean Delivery.

Descriptive Statistics. Simple description reveals the impact of the Quiet Revolution on pregnancy and motherhood in the U.S.

Table 1 shows how mothers transition through employment states before, during, and after pregnancy. There is considerable persistence in the first three, pre-birth states and somewhat less persistence post-birth, when one quarter of non-working mothers start working and one quarter of working mothers stop. This persistence allows the mothers in the NMIHS to be trifurcated according

to their degree of labor market attachment. "High Attachment" mothers worked, at least some, both in the year before delivery and after delivering. "Low Attachment" mothers worked in neither period, while the remainder fall in the "Intermediate" category. Half the women in the NMIHS fall in the High Attachment group and another quarter in the Low Attachment group.

Table 2 presents variable means for each group. Panel A includes factors associated with family formation and structure: maternal and paternal age, birth order, and whether the mother and father lived together. While age is similar for Low Attachment and High Attachment mothers, family size is not: the former have almost one more child than the latter do. Low Attachment women start their families earlier and end them later, resulting in a similar mean maternal age. High Attachment women, who invest more in human capital and work, have smaller families that are begun later in life (see Hymowitz et al., 2013).

This human capital difference is confirmed in Panel B, which presents labor market variables: schooling, paternal employment, and income. High Attachment mothers have more schooling, as do the fathers of their babies, and are substantially wealthier. Not surprisingly, then, they have much higher rates of private insurance, as Panel C shows. In addition, Panel D shows that High Attachment mothers are more likely to be white and less likely to be Hispanic.

Panel E considers behavioral factors. High Attachment mothers are more likely to attend childbirth classes and to reduce consumption of alcohol or cigarettes, consistent with their increased schooling and smaller families (and consequent emphasis on child quality). These and other behaviors help generate higher birth weights among High Attachment women, as shown in Panel F. The differences, however, are small, about two ounces, and are unmatched by substantial differences in fetal size or gestation. Similarly, there are few significant differences between the two groups'

incidence of birth complications, which Panel G assembles into six groups of related diagnoses.

In summary, then, High Attachment and Low Attachment women differ greatly in socioeconomic status, family structure, health behaviors, and demographics. However, some of these factors work to promote health and others to reduce it, so that birth complications and objective measures of fetal health differ only modestly between the two groups.

How, then, do their cesarean section rates compare? This question is answered in Panel H. The cesarean rate of High Attachment mothers is four percentage points above that of Low Attachment mothers. To appreciate the full magnitude of the difference between the two groups, however, we must also account for prior cesareans, as these generally necessitate a cesarean on the current birth (see below). Subtracting the rate of prior cesareans from the current cesarean rate approximates how many cesareans are performed beyond those attributable to a prior cesarean section. This difference is eight percentage points for Low Attachment mothers and twice that for High Attachment mothers: sixteen percentage points. This gap is truly vast. High Attachment women have a *higher* cesarean rate in the current delivery despite having a *lower* rate of prior cesareans (because they have had fewer children). Women's labor market attachment, the hallmark of the Quiet Revolution, is strongly associated with cesarean delivery.

Results. To see how these factors affect cesarean utilization, we estimate equation **(1)**. We begin with baseline estimates, which we discuss broadly, and then delve more deeply into the labor market and family formation factors that are of primary interest.

The baseline estimates are presented in Table 3. Clinical controls are excluded from the regression in the left half of the table and included in the regression in the right half. Where

applicable, coefficient estimates are presented for both the mother and the father, in adjoining columns; estimates for household-level variables are centered across these two columns. Taken in groups, the estimates yield five primary conclusions.

Labor Market Factors Matter. Maternal employment positively affects cesarean use: working in the year before delivery raises the probability of a cesarean by three percentage points. The occupation dummies are also highly significant, while maternal education has a marginally significant positive influence as well (as in Braveman et al., 1995, but larger than in Tussing and Wojtowycz, 1992).

Family Formation Factors Matter. Variables capturing changes in family size and timing are also strongly related to cesarean use. Maternal age increases cesarean incidence by about one percentage point per year (as in Tussing and Wojtowycz, 1992, for New York State, Braveman et al., 1995, for California, and Parrish et al., 1994, for Washington State; Grant, 2009, finds somewhat larger effects for nine states). The negative coefficient on birth order implies that cesareans are less likely in later births. We will qualify this finding and elaborate on it below.

Social Support Matters As Well. Robust evidence indicates that social support improves maternal and fetal health (Feldman et al., 2000; Nylen, O'Hara, and Engeldinger, 2013; Webster et al., 2000; Eisenbruch et al., 2007). Not surprisingly, it affects cesarean rates as well. Some paternal variables are statistically significant, and others nearly so; all indicate that the father's maturity, skill, and presence in the household reduce the need for cesarean section delivery. In addition, cesarean section rates fall slightly (though insignificantly) with the number of other people in the household,

suggesting that support from that quarter helps as well.[12]

Financial and Demographic Variables Also Matter, to Some Degree. Some financial variables matter, while others don't. The coefficient estimate on income is small and insignificant (as in Tussing and Wojtowycz, 1992, and Grant, 2009). Furthermore, while being publicly or privately insured has large effects, relative to being uninsured (as in Haas et al., 1993, and Grant, 2005), the estimates are similar for the two types of insurance (as in Tussing and Wojtowycz, 1992, and Grant, 2005). Thus, the switch from public to private insurance is inconsequential, as far as cesarean use is concerned. This is the most relevant comparison for today's purposes, as Medicaid has covered nearly all lower-income pregnant women since 1990.

Similarly, some demographics matter, while others don't. Race has no significant effect, though Hispanic ethnicity does. (These findings are similar to those in Grant, 2000, for Florida; smaller than those in Braveman et al., 1995, for California and in Tussing and Wojtowycz, 1992, for New York; and larger than those in Grant, 2009, for nine states.) The coefficients on the location dummies indicate higher cesarean use in the South and lower use in the Midwest, but metropolitan residence has no significant effect. The region estimates mirror longstanding regional differences in unadjusted cesarean rates.

These Effects Are Robust to the Inclusion of Diagnostic Controls. The clinical controls, not presented in the table, are generally highly significant and have effects that are in line with prior research. Nonetheless, their inclusion hardly affects the estimates of most remaining coefficients,

[12] The data separate these "other people" into types: the mother's parents, other relatives, and others. When these are entered separately in the model, the coefficient estimates are similar for each type, but precision is too poor to draw firm conclusions.

including those on the labor market and family structure variables.[13] As Table 2 suggested, the effects of the Quiet Revolution operate only modestly through documented clinical controls.[14]

Our estimates do not conflict with the literature, when they can be compared. Nevertheless, they paint a very different picture, showing that the cesarean decision is deeply woven into the fabric of the mother's family and work life. As this fabric changed during the Quiet Revolution, it would be natural for cesarean section rates to change too.

Section V. Extended Results.

Labor Market Factors. To further divine the effect of labor market factors, Table 4 presents the coefficients on select maternal labor market variables in a variety of alternative specifications. These establish the robustness of our primary findings, affirm the presence of endogeneity, and further illuminate how labor market involvement affects the rate of cesarean delivery.

To do so, we now incorporate an additional pre-birth employment measure: whether the mother worked while pregnant. By separating this from the original dummy indicating employment at any time in the year prior to delivery, we can now identify women who stopped working close to

[13] The primary exceptions, Hispanic ethnicity and source of payment, are not associated with the Quiet Revolution. The coefficient estimates on the "likely in school" variable also change notably, though these are far less precisely estimated.

[14] Additional insight comes from estimating a model with *only* the clinical variables (not presented in the table). The "fit" of this model, as measured by the R^2 value, is 0.34. The sum of this value and the R^2 of 0.20 for the model with only nonclinical variables almost sums to the fit of the model with both sets of variables, which has an R^2 of 0.47. This finding further testifies to the limited overlap between the clinical controls and the nonclinical variables in terms of their influence on the cesarean decision.

the date of conception: those mothers who worked during the year before delivery but *not* while pregnant. This measure is found in the first column of the left and right panels of Table 4, with employment while pregnant and post-delivery employment placed in the second and third columns of each panel. The specification changes in successive rows of the table are independent, not cumulative: each should be compared to the results in the first row.

The first row of the table replicates the specification in Table 3, replacing the single pre-birth employment variable with the two variables defined above. Both have similar coefficients, three or four percentage points, whether or not clinical controls are included. Nonetheless, comparing the two sets of results suggests the presence of the endogeneity posited above. If some women quit work because they anticipate a problematic delivery, the coefficient on pre-pregnancy employment should be biased upwards and its compatriot, on employment during pregnancy, downwards. Clinical controls partly account for this, so their inclusion should decrease the first estimate and increase the second. This is exactly what happens, by one percentage point each.

We account for these issues more fully in the second row of the table, with controls for the head circumference, length, and (as a quadratic) weight of the baby. The coefficient estimates nudge further in the same directions, further confirmation of endogeneity.

The third row of the table includes dummies for seven health behaviors that can influence fetal development or maternal health: quitting smoking, reducing alcohol consumption, taking multivitamins during pregnancy, engaging in sports during pregnancy, wanting the baby, going to childbirth classes, and beginning prenatal care during the first trimester. The influence of maternal employment on these behaviors is mixed, and half are associated with lower cesarean rates and half with higher rates. In the end, the net effect of controlling for these factors is almost nil.

The fourth and fifth rows allow the effect of the labor market variables to vary for mothers who are and are not having their first birth. The consequences are dramatic. First-time mothers, or primiparas, who worked during pregnancy are about six percentage points more likely to deliver by cesarean section; for multiparas, the effect is nil. These findings are roughly reversed for work before, but not during, pregnancy. These findings further confirm the endogeneity identified above and indicate that any reverse causality is, in large degree, experiential. Women's previous birth experience informs whether to anticipate problems with the current birth, which in turn influences whether they work during pregnancy. First-time mothers have no such experience to go by, so that endogeneity is much smaller or nil.[15]

Similar patterns obtain for the coefficient estimates on schooling, which are notably affected by the inclusion of clinical diagnoses or the size and weight of the baby and are dramatically affected by focusing on first time mothers. For these mothers, each year of schooling raises the chances of cesarean section by almost one percentage point, whether or not clinical factors are controlled for. The finding that birth weight mediates the effect of schooling comports with Currie and Moretti's (2003) finding that the latter causes the former to increase.

Finally, we examine the "employment after delivery" variable. This is included as an indicator of labor market attachment, as it cannot causally affect the cesarean decision. Across all specifications, this variable's coefficient estimates are reassuringly small and insignificant, especially when clinical factors are controlled for. This finding, like those above, suggests the effect of labor

[15] This conclusion is reinforced by supplementary regressions that isolate those clinical factors that, when included, most strongly affect the employment coefficient estimates: maternal diabetes, maternal hypertension, prior cesarean section, and breech birth. Except for the last, these all indicate (or are indicative of) serious, plausibly recurring conditions of gestation, labor, or delivery.

market attachment operates through health rather than through demand-side factors, for which the *timing* of employment should not matter.

Altogether, the findings indicate a robust, significant relationship between labor market factors and cesarean section delivery, especially among new mothers. For the most part, these effects are not mediated through health behaviors, fetal size, or diagnosed complications of pregnancy and childbirth. Instead, they operate through changes in the (unmeasured) severity of these diagnosed complications, the incidence of other (unmeasured) complications, and the choice of delivery method conditional on these complications. The effect of labor market factors occurs primarily outside the realm of objective, quantifiable elements of childbirth.

Family Structure and Timing. Semiparametric estimates not presented here affirm that the overall relationship between age and cesarean use is essentially linear, with a slight tapering off at higher ages. Without clinical controls, these estimates imply a sixteen percentage point increase in cesarean rates as maternal age increases from 18 (the 5^{th} percentile) to 36 (the 95^{th} percentile), as do the parametric estimates in Table 3; the results with clinical controls are slightly smaller. The effects of maternal age also occur mostly outside of quantifiable elements of pregnancy and childbirth.

As with employment, it helps to interact age with parity. When this is done, each year of age increases the probability of a cesarean by about 1.5 percentage points for primiparas, whether or not clinical factors are controlled for. The effect for multiparas is only one-third as large.

For our last variable, birth order, a mere discussion of a regression coefficient cannot suffice. That would ignore the essential dynamics of the cesarean section, namely, that a cesarean in one birth largely "locks in" the mother to cesareans on subsequent births. (In the NMIHS, the cesarean rate

of mothers with a prior cesarean section is 84%, which is somewhat smaller than the current rate of 87%.) To investigate further, we alter our basic regression model of Table 3 in two ways. First, we replace the integer-valued birth order variable with a set of dummies (using a single category for five or more births). Second, we include a dummy for prior cesarean section (but no other clinical controls).

The coefficient estimate on the prior cesarean dummy is 0.71, consistent with lock-in. The estimates on the birth order dummies are placed in the lowest, solid line in Figure 2, additively scaled so that new mothers' predicted and actual cesarean rates are equal. (The standard errors, omitted from the figure, are one or two percentage points.) Clearly, the main distinction is between primiparas and multiparas. First time mothers are far more likely to receive a cesarean than multiparous mothers without a prior cesarean section. To simplify, in subsequent regressions we replace the five birth order dummies with a single dummy for multiparous women.

Altogether, these findings imply that mothers' deliveries follow a simple Markov chain with three states: primiparous, multiparous with no prior cesarean, and multiparous with a prior cesarean. Cesarean sections occur over 80% of the time in the last category but just over 10% of the time in the middle category, consistent with the 0.71 coefficient estimate on the prior cesarean indicator. Each birth poses some risk of a cesarean delivery, locking the mother into the "multiparous, prior cesarean" category on all subsequent births.

How does this process play out? To illustrate, we use it to predict cesarean probabilities for a sequence of five births, holding constant all other maternal characteristics (including age, in order to focus on birth dynamics). The chance of a cesarean section in one birth increases the mean value of the prior cesarean dummy–and thus the probability of a cesarean–in the next birth. The finely

dashed line near the top of Figure 2 presents the results for a mother in her late twenties with a 30% probability of a first-birth cesarean. The chance of a cesarean increases by three percentage points or more on each subsequent birth. Larger families are associated with higher cesarean rates.

Because of these birth dynamics, anything that raises the "base" cesarean rate has a multiplier effect that magnifies its effect over the birth sequence. We show this in the top, solid line in Figure 2. This line represents the same mother as in the dashed line below it; however, the predicted cesarean rate, conditional on the prior cesarean dummy, has been raised by one percentage point. As the incidence of prior cesareans grows in birth order, so too does the deviation between this line and its compatriot, to a total of 2.7 percentage points by the 5th birth. Given the empirical distribution of birth order in the NMIHS, the overall multiplier is 1.6.

We now segue partway from theoretical dynamics to actual dynamics, by coupling our regression model to this Markov chain and using this combination to predict the cesarean probability for all births in the NMIHS. First, we estimate the Table 3 specification, except that a prior cesarean dummy is the only clinical control. Then we use this specification to predict the mother's cesarean probability in her current birth, retaining all of her characteristics except for the prior cesarean dummy. This is replaced with her probability of having a prior cesarean, which is generated for her birth sequence using this Markov chain (backdating maternal age appropriately). We then calculate the mean, current-birth cesarean probabilities by birth order. These are found in the solid line in the center of Fig. 2. Cesarean rates increase in birth order (except for fifth births, which are rare), but less rapidly than in the lines above it. This signifies "positive selection": women who have larger families tend to be healthier, diminishing the slope of this solid center line.

We complete the segue from theory to empirics with the remaining line in the figure, which

presents the actual cesarean rate of the mothers in the NMIHS–not a regression, just means. In contrast to the upward-sloping lines from the Markov model, this thickly-dashed line slopes dramatically downward, though mothers with more births have had more "opportunities" to receive a prior cesarean and tend to be older. Nonetheless, the cesarean rate of mothers having their first child is nearly ten percentage points above that of mothers having their fifth.

This phenomenon is an unmistakable sign of cohort effects. As we will confirm below, the "propensity" to perform a cesarean section rose rapidly in the years prior to 1988, so much so that older women having their fifth child have received fewer (prior) cesareans than younger women having their second or third. This empirical "irregularity" accounts for the negative coefficient on birth order on the left side of Table 3.

These cohort effects imply that the cesarean rate would have risen after 1988 even if there was no change in maternal characteristics or the underlying propensity to perform a cesarean section, as older mothers completed their families and were "replaced" by mothers who were just starting them. To approximate the implied steady state, apply the birth order distribution observed in 1988 to the solid line in the center of Figure 2. The resulting value of 28.4% is four percentage points above the actual cesarean rate in the NMIHS. The *timing* of the increase in the cesarean rates during the Quiet Revolution is profoundly influenced by cohort effects, which take years to play out in full.

Ultimately, then, in contrast to the other effects of the Quiet Revolution, the decline in family size should decrease cesarean rates. However, this decline occurred wholly during the early years of our sample period, with the widespread adoption of birth control. Thereafter, family size was static and played no role in changing cesarean rates, up or down.

Section VI. The Impact of the Quiet Revolution on Cesarean Rates: 1968-2008.

We can now determine the degree to which the Quiet Revolution elevated U.S. cesarean rates over time. We do this by creating hypothetical time series of national cesarean rates, freezing (in time) some explanatory variables while allowing others to vary: various combinations of family formation, labor market, and demographic factors. To understand how this is done, it helps to first know how we measure changes in these factors over time. This is easily done for some factors, but not for others.

Temporal Changes in Labor Market Attachment and Family Formation. The NMIHS is a mere snapshot in time. To measure temporal changes in any factor, we must look elsewhere. As the data must span decades, we are limited to two primary sources: the U.S. Vital Statistics and the Current Population Survey (CPS; Flood et al., 2015). Both are available from 1968 forward, spanning the entirety of the Quiet Revolution. The Vital Statistics contains maternal education, age, race, and birth order for all U.S. births, but not employment, occupation, or a full birth history. These are supplied by the CPS. Each year's March Supplement (now called the Annual Social and Economic Supplement) contains complete information on the demographics, family structure, and previous calendar year's employment, occupation, and earnings for roughly 2,000 households containing an infant (most of whom will have been born in that previous calendar year). As Dave et al. (2015) note, this is (by far) the most complete U.S. data on pregnant women's labor market outcomes. Hispanic ethnicity is also reported beginning in 1970, earlier than in the Vital Statistics. (Weights are also used for all calculations on this data, to maximize national representativeness.)

In the CPS, questions about the extent that the mother worked the previous year can serve as proxies for employment in the year before giving birth. Even these indirect measures are an advance. The only extant time series comes from a far more limited survey, the Survey of Income and Program Participation (SIPP).[16] The Appendix contains means of selected variables for selected time periods across all four surveys (including the NMIHS). They are reasonably (but not perfectly) consistent with each other, and variable movements are reasonably consistent over time. The largest deviations are maternal age, which is higher in the CPS, and Hispanic ethnicity, which is lower.

Figure 3 illustrates various measures of labor market attachment in the CPS and the SIPP, separated by parity, as before. For primiparas, pre-birth employment measures grow substantially from the mid-1970s through the 1980s and are relatively static thereafter, as is working after delivery. Similar timing is exhibited by the no-work / part-year work variables, which do not move until the mid-1970s, when the number of non-workers begins falling. After the early 1990s, both measures cease to decline. For multiparas, the timing is both similar and different. Again, no variable moves until the mid-1970s, but labor market attachment continues to grow throughout the 1990s, tapering off only in the 2000s–another consequence of birth order dynamics. The magnitude of change is also larger for multiparous women. Altogether, these measures reveal large changes in pregnant women's labor market attachment during the Quiet Revolution, beginning in the late 1970s and playing out over the subsequent quarter-century.

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[16] The SIPP is not an adequate substitute for the CPS, for two reasons. First, it is "highly retrospective"–some respondents were asked about employment during pregnancies that were ten years or more in the past. Second, the survey only ever inquires about first and last births (and Laughlin reports only the former). See Laughlin (2011) for further details. Attanasio, Low, and Sanchez-Marcos's (2008, p. 1524) calculations of the same quantity from the same source closely, but not perfectly, resemble Laughlin's.

Our employment proxy is a dummy for whether the mother worked at least thirteen weeks in the previous calendar year. This measure is theoretically reasonable; very few such mothers could log so much work without working in the year before delivery.[17] It is also empirically reasonable: in Figure 3, increases in the mean value of this measure are fully offset by reductions in non-work "for family reasons." Furthermore, for primiparas, this measure's mean values correspond reasonably well with the analogous SIPP numbers in the top panel of Figure 3.

To measure temporal changes in family size and timing, we turn to the Vital Statistics, which reports birth order and maternal age for each birth in the U.S. each year. Here, however, the "structural" effects of the Quiet Revolution are confounded with another effect that is demographic in origin. Changes in mean maternal age and birth order over time will reflect both.

To illustrate the "structural" effect, we use the Markov model and the central birth rates in the Vital Statistics to predict the overall cesarean rates of a large set of *maternal* birth cohorts, based only on age and birth order. (To be clear, each cohort's rate is the grand mean of all births occurring in that cohort.) These are graphed in Figure 4. Cross-cohort differences in this rate accrue from cross-cohort differences in family size and timing that are associated with the Quiet Revolution. As a result, the predicted cesarean rate of mothers born in 1970, who delivered most of their children in the 1990s and early 2000s, is three percentage points higher than that of mothers born in 1940, who delivered most of their children in the 1960s and early 1970s.

However, the size of each maternal cohort also varies, as Figure 4 shows as well. This demographic change, which is unrelated to the Quiet Revolution, reinforces these "structural"

[17] Mothers of infants who are almost one year old were pregnant in the winter of the previous year; mothers of some younger infants will have had their entire pregnancy during the previous year. Thus, these infants' mothers were pregnant one-quarter to three-quarters of the previous year.

effects. As the baby boomers born in the 1950s began to have children in the 1970s, their large cohort size reduced average maternal age and, thus, the cesarean rate. As this cohort matured through the 1980s into the 1990s, it began to pull up average maternal age and the cesarean rate, complementing the structural effects of the Quiet Revolution. This fact will complicate the calculation of our hypotheticals, below.

Other Demographic Changes. The Baby Boomer motherhood bulge is not the only demographic factor affecting cesarean rates. Others include race, ethnicity, region, and metropolitan residence.

The left panel of Table 2 lists positive coefficient estimates for nonwhite race and Hispanic ethnicity, though only the latter approaches statistical significance. The Appendix shows that an increasing fraction of mothers belong to each group over time.

Residence in a metropolitan area, which has also become more common over time, has a marginally significant positive effect. This is complemented by another locational effect: the migration of mothers from (especially) the Midwest to the South. The region dummies show that cesarean rates are smallest for the first region, ceteris paribus, and largest for the second.

Altogether, then, these demographic shifts all contribute to the increase in cesarean rates over the course of the Quiet Revolution. Individually, their magnitudes are modest, but their accumulated effects, after accounting for the multiplier effect of birth dynamics, are noticeable.

Methods. We calculate three hypothetical time series of national cesarean rates. The first freezes (in time) all independent variables except for the labor market and family formation factors that are associated with the Quiet Revolution: schooling, employment, and occupation in the former group,

and age and birth order in the latter. This hypothetical estimates the change in the national cesarean rate that can be attributed to changes in these factors alone. The other two hypotheticals allow demographics to change as well. These quantify the increase in cesarean rates that can be attributed to social factors generally. The remaining, "residual" change in cesarean rates must accrue to other factors, including changes in clinical practice, reimbursement rates, and policy.[18]

These hypotheticals are computed in three steps: a regression that relates the independent variables in the NMIHS to the probability a mother will receive a cesarean section; the Markov model that applies these estimates to the birth sequence of each mother in the CPS, in order to predict the probability that she will have a cesarean section on her most recent birth; and an averaging of these individual-level predictions into a time series of annual, national cesarean rates, which incorporates Vital Statistics data. We now lay out the methods used in each step.

Regression. Our regression specification begins with the specification used for Table 3 and incorporates the advances developed subsequently, along with a few simplifications that have no material effect on the outcome. Accordingly, we replace the continuous birth order variable with a first birth dummy, interact that dummy with maternal age and employment variables, and drop the "employed while pregnant" dummy in favor of "employed in the year prior to delivery" variable, in order to alleviate endogeneity concerns. We also eliminate employment after delivery variable and combine the dummies for private and public health insurance coverage into a single "covered by insurance" variable. Of course, a dummy for a prior cesarean section is included in the model as well (but no other clinical controls). The coefficient estimates from this regression are used in

[18] None of these hypotheticals account for the effect of employment-driven changes in income or insurance coverage; instead, this is discussed separately at the end of this section.

computing all three hypotheticals.

Markov Model. Once the regression estimates are in hand, they are applied to all mothers of infants in the CPS. For each such mother, the Markov model predicts the probability of a cesarean section for her full birth history, culminating in the birth of the infant present on the survey date. To form these predictions, we assume the mother's occupation and actual or prescribed demographics (see below) are time-invariant, and appropriately backdate maternal age and the employment proxy for all preceding births.[19] Accordingly, for each mother m, the full Markov model is as follows:

$$\textbf{(2)} \qquad \begin{aligned} \hat{C}_b &= (\hat{\mu}_0+\hat{\mu}_1\bar{X})+\hat{\theta}\hat{Prior}_b+\hat{\rho}\cdot 1(b=1)+\hat{\tau}_1 A_b\cdot 1(b=1)+\hat{\tau}_2 A_b\cdot 1(b>1)+\hat{\psi}W_b+\hat{\lambda}H \\ \hat{Prior}_b &= \hat{Prior}_{b-1}+(\hat{C}_{b-1}\,|\,Prior_{b-1}=0)(1-\hat{Prior}_{b-1}) \text{ , } for\ b\geq 2,\ with\ \hat{Prior}_1=0 \end{aligned}$$

where A represents maternal age, b=1..B indexes births, so that B is birth order on the most recent birth, Prior is a dummy variable indicating whether the mother has a prior cesarean section as of birth b, W is the employment proxy, H contains the mother's schooling, occupation, and demographics, and X includes other variables, such as paternal characteristics, that are frozen at their 1988 means in order to "take them out of the equation." All Greek letters signify coefficients that are estimated in the first step regression.

Averaging. Once each mother's predicted cesarean probability is determined, calculating the predicted national, annual cesarean rate is a matter of averaging.

To separate changes in maternal age that are demographic in origin from those that stem from

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[19] The CPS records the value of the employment proxy for the most recent birth. For all previous births, W takes the mean value of the employment proxy within age*birth order*time cells, using five year intervals for age (16-20, and so on) and four year intervals for time (1976-1979, and so on). Most of these cells had well over one hundred entries, sharply reducing any sampling error.

the Quiet Revolution, the averaging is conducted in two steps. First, we organize mothers into cells, based on maternal age, A, birth order, B, and the year they gave birth, Y, and calculate each cell's predicted cesarean rate:

(3)
$$\bar{C}_{A,B,Y} = \sum_{m=1}^{M_{A,B,Y}} \hat{C}_{m,B} \; / \; M_{A,B,Y}$$

where $\hat{C}_{m,B}$ represents mother m's predicted probability of receiving a cesarean, given her age and birth order, from equation **(2)**, $\bar{C}$ represents the predicted, cell-wise cesarean rate, and M represents the number of mothers in each cell. Then, given a set of weights, ω, that sum to one each year, year Y's hypothetical cesarean rate is a weighted average of these cell-wise rates:

(4)
$$\bar{C}_Y = \sum_A \sum_B \omega_{A,B,Y} \bar{C}_{A,B,Y}$$

Variation in the hypotheticals extends from variation in ω and H.

The first of our three hypotheticals sets the weights to be proportional to the central birth rates published in the Vital Statistics by age x birth order each year. These account for Quiet Revolution changes in family size and timing but leave out demographic changes in maternal cohort size. Furthermore, in calculating $\hat{C}_{m,B}$, the maternal demographics in H are held constant over time, by setting the race, ethnicity, and location dummies to their mean values in 1988. The resulting time series depicts the hypothetical cesarean rate if only the labor market and family formation factors associated with the Quiet Revolution change, while demographics are held constant.

The second hypothetical sets the weights to be proportional to the actual number of births in each year, by age x birth order. In calculating $\hat{C}_{m,B}$, it also lets maternal demographics vary over time, taking their actual values for each mother. The resulting time series represents the hypothetical

cesarean rate when both demographic factors and the Quiet Revolution variables change. The final hypothetical uses these same $\hat{C}_{m,B}$ values, but sets the weights to the value of M for each cell, thus recreating the predicted cesarean rate among the mothers in the CPS. If the CPS is representative of new mothers, then this hypothetical should resemble the one generated by the second method. As CPS and Vital Statistics differ somewhat, however, the two series need not match.

Results. The results are presented in Figure 5. The top panel presents our three hypotheticals; the bottom panel replicates the second hypothetical, described above, in which both demographic and Quiet Revolution variables change, along with the residual between this rate and the overall U.S. cesarean rate. This residual represents the (additively scaled) cesarean rate net of demographic and Quiet Revolution factors.

Our time frame, survey years 1968-2019 (corresponding to birth years 1967-2018), covers the inception of all demographic and economic changes that are associated with the Quiet Revolution. While Goldin (2006) dates the beginning of the Quiet Revolution to the late 1970s, she documents that increases in women's rates of college graduation, enrollment in professional and graduate education, expectations of employment, attachment to the workplace as a source of personal fulfillment, age at first marriage, and use of contraception (in particular, the birth control pill) all date from the late 1960s or early 1970s. Our extended time frame allows the timing of any predicted change in cesarean rates to be established empirically.

All time series in Figure 5 use 1988 as a base year, as that is the year from which our coefficient estimates are generated. This year falls in the middle of the time period over which our hypotheticals are presented, increasing the degree to which our coefficient estimates are

"representative" of this period. While suitable estimation data are not available for other years, Section III took pains to establish that none of our key estimates were at odds with the literature.

During the graph's first decade, 1967-1977, both demographic and Quiet Revolution factors push cesarean rates slightly downward. Here, any upward thrust from increases in maternal schooling and employment is moderated by the aforementioned decreases in family size and average maternal age. These forces, however, are overwhelmed by a large, positive secular trend in cesarean rates, observable in the residual. This represents a change in the "propensity" to perform a cesarean section, conditional on (observed) characteristics.

This situation reverses in 1978, coincident with Goldin's (2006) dating of the Quiet Revolution. At this point, both demographic and Quiet Revolution factors begin to push the cesarean rate up. Over the next three decades, Quiet Revolution factors alone raise it by six percentage points, while demographics contribute an additional increase of two percentage points. From 1978 to 2008, the U.S. cesarean rate rose 17 percentage points. The eight percentage point rise explained by Quiet Revolution and demographic factors represents half of this increase. The fraction approaches two-thirds if one looks beyond then to the present, as these factors have continued to exert upward pressure.

The residual, or unexplained, portion of the cesarean rate follows a different path over this period. After ending its meteoric rise in the late 1980s, it turns into an upside-down sine wave with an amplitude of five percentage points and a period of thirty years, falling, rising, and falling again. Its second decline, during the 2010s, offsets the upward push from Quiet Revolution and demographic factors, resulting in the plateau experienced over this period. According to this residual, the underlying "propensity" to perform a cesarean section in the U.S. is roughly where it

was thirty years ago. Any increase in the cesarean rate since then can be traced to demographics and the Quiet Revolution.

These results help explain some empirical regularities that have been observed in the cesarean literature. The first is the finding that U.S. physician-level, risk-adjusted cesarean rates increase (roughly) synchronously over time (Grant and McInnes, 2004; Epstein and Nicholson, 2009), which is a surprising degree of uniformity. The factors identified in this paper could plausibly provide the general upward push needed to make this happen. Second, national cesarean rates have largely resisted repeated efforts to bring them down. This is more understandable if these efforts face a rising tide of demographic and Quiet Revolution factors. Third, cesarean rates have risen steadily across most industrialized countries over the same time period (Notzon, Placek, and Taffel, 1987; Chen, 2013). These countries experienced a similar period of social change (Brewster and Rindfuss, 2000). More generally, broadly similar changes were also occurring in developing countries, as part of the demographic transition (e.g., Heath and Mobarak, 2015; Lien and Wang, 2016). Cesarean rates have risen there too.

Additional Findings. Some additional findings are worth mentioning in brief. First, we imputed the effect of maternal labor market factors alone, holding constant all family formation factors (and demographics). This is awkward to do, as the "simulated" employment histories in equation **(2)** above vary with birth order. Our approach was to calculate these histories as before, again freezing all demographic variables, but to use the central birth rates (by age and birth order) from 1988 as the weights for all years in computing the averages in equation **(4)**. The result of this exercise was a predicted increase in cesarean rates of two to three percentage points, not trivial, but far from

dominant. As far as cesarean use is concerned, the indirect effects of increased labor market attachment, operating through family formation, outweigh the direct effects.

Another set of indirect effects has not been accounted for at all: those operating through the financial variables, health insurance and income. The effects of both, though small, reinforce the direct effect of labor market attachment. In both the NMIHS and the CPS, maternal employment and schooling increase the likelihood of health insurance coverage and substantially increase household income (controlling for maternal and paternal characteristics and location, and including year dummies for the CPS). Both of these variables positively affect the chances of receiving a cesarean, in Table 3 and in the amended regression used in creating our hypotheticals (though the income coefficient is small and insignificant in both). Tracing through the implied causal chain–from employment and schooling to income and insurance coverage to cesarean use, accounting for the multiplier effect–the net indirect effect of Quiet-Revolution-caused changes in insurance coverage and income, combined, is less than a quarter of a percentage point.

Last, we mention the role of social support. In our estimates, four proxies of social support for the mother all decrease cesarean rates (to varying degrees of significance): the father's age and education, and the presence of the father and the number of people in the mother's household. Over this period, two of these increased and the other two fell, for a small net effect on cesarean rates–a reduction of perhaps half of a percentage point. At the least, there is no sign that increases in cesarean utilization result from decreases in maternal support.

Section VII. Conclusion.

Labor market, family formation, and demographic factors substantially influence the rate of cesarean delivery, ultimately explaining one-half to two-thirds of the increase in cesarean rates since the onset of the Quiet Revolution in the late 1970s. Many factors contribute to this result: increases in maternal age, education, and employment, coupled with complementary changes in race and residence. The increase in U.S. cesarean rates is partly a clinical phenomenon, partly a response to economic and policy incentives, partly the result of demographic changes, and partly the consequence of a revolution–slow, steady, and quiet–in women's roles in society. The increase in the U.S. cesarean section rate is, to a substantial degree, a social phenomenon.

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Table 1. Transition Matrices.

		EMPLOYED IN YEAR BEFORE DELIVERY			EMPLOYED AFTER DELIVERY		
		yes	no				*means*
EVER WORKED	yes	0.80	0.20				*0.86*
	no	0.00	1.00				*0.14*
		⇓					
EMPLOYED WHILE PREGNANT	yes	0.92	0.08	⇒	0.78	0.22	*0.63*
	no	0.00	1.00		0.24	0.76	*0.37*
means		*0.69*	*0.31*		*0.58*	*0.42*	

Note: Transitions are calculated using weights from the 9,684 observations in the NMIHS that were used in estimation. They unfold in chronological order: ever working to employment in the year before delivery to employment while pregnant to employment after delivery.

Table 2. Selected Means, Full Sample and by Labor Market Attachment.

	Full Sample	High Attachment	Low Attachment	Inter-mediate
Panel A: Mother's Age at Delivery	26.2	26.9*	26.2	24.8
Father's Age at Delivery	30.1	30.4	30.5	29.0
Live Birth Order	1.99	1.78*	2.48	1.83
Mother and Father Lived Together During Pregnancy	0.82	0.87*	0.76	0.78
Panel B: Mother's Schooling in Years	13.0	13.6*	12.1	12.6
Father's Schooling in Years	13.2	13.5*	12.7	13.0
Father Employed in Year before Delivery	0.93	0.96*	0.88	0.92
Log(Total Income)	9.86	10.11*	9.56	9.68
Panel C: Private Insurance	0.61	0.75*	0.44	0.50
Medicaid	0.20	0.10*	0.32	0.28
Panel D: Mother Nonwhite	0.20	0.17*	0.24	0.20
Mother Hispanic	0.12	0.10*	0.15	0.14
Panel E: Attended Childbirth Classes	0.62	0.69*	0.52	0.57
Consumed Less Alcohol During Pregnancy	0.44	0.52*	0.31	0.40
Quit Smoking While Pregnant	0.17	0.19*	0.13	0.19
Panel F: Birth Weight (g)	3364	3392*	3344	3328
Head Circumference (cm)	34.3	34.3	34.3	34.2
Gestation (weeks)	39.3	39.4*	39.2	39.2
Panel G: Clinical Diagnoses ‡				
Premature	0.07	0.06	0.07	0.08
High / Low Birth Weight	0.02	0.02	0.03	0.02
Biomechanics	0.06	0.05*	0.07	0.06
Multiple Births	0.02	0.02	0.02	0.02

Diseases of Pregnancy	0.07	0.08	0.07	0.07
Malpresentation	0.05	0.05	0.04	0.05
Panel H: Received Cesarean	0.24	0.26*	0.22	0.23
Prior Cesarean	0.11	0.10*	0.14	0.09
Unweighted Sample Size (see note)	9684	4515	2908	2261
Weighted Fraction of Sample	1.00	0.49	0.28	0.23

Note: sample size is reduced for birth weight, head circumference, and length of gestation. Weights used to calculate all means. In the test for equality of means between high attachment and low attachment women, * = $p < 0.05$. ‡ The diagnosis categories are as follows: "biomechanics" includes placenta previa, abruptio placentae, uterine hemorrhage, cervical incompetence, uterine rupture, and cord prolapse; "diseases of pregnancy" includes mild and severe pre-eclampsia, diabetes, hypertension, and herpes; and "malpresentation" includes breech birth, face/brow presentation, and oblique/transverse presentation.

Table 3. Linear Probability Model Results (100*coefficient estimates, 100*standard errors in parentheses, * = $p < 0.05$). Dependent variable: Dummy for Delivery by Cesarean Section.

	NO CLINICAL CONTROLS		CLINICAL CONTROLS	
Labor Market Variables	*Mother*	*Father*	*Mother*	*Father*
Years of Schooling Completed	0.58* (0.26)	-0.39 (0.23)	0.24 (0.21)	-0.33 (0.19)
Likely in School During Pregnancy[A]	-5.21* (1.69)	1.72 (3.07)	-0.94 (1.37)	4.03 (2.49)
Employed in the Year Before Delivery	3.19* (1.34)	-2.09 (2.17)	4.07* (1.09)	-0.68 (1.76)
Employed After Delivery	1.26 (1.08)	N/A[C]	-0.24 (0.87)	N/A[C]
Three-Digit Occupation Dummies: F-stat / p-value	2.64* (0.00)	2.38* (0.00)	2.79* (0.00)	1.95* (0.00)
Family Timing & Structure Live Birth Order	-3.72* (0.46)	N/A	-6.30* (0.35)	N/A
Age at Delivery	0.96* (0.14)	-0.19 (0.11)	0.87* (0.12)	-0.10 (0.09)
Baby's Father Lived with Mother During Pregnancy	-1.72 (1.46)		-1.75 (1.18)	
Total Number of Other People in the Household	-0.46 (0.43)		-0.21 (0.35)	
Demographic Variables Nonwhite Race	1.63 (2.30)	0.35 (2.29)	0.84 (1.87)	1.04 (1.86)
Hispanic Ethnicity	3.71 (1.91)	0.66 (1.92)	6.35* (1.55)	-3.41* (1.56)
Four Region Dummies (F-statistic, p-value)	12.29* (0.00)		9.22* (0.00)	
Household Resides in a Metropolitan Area	1.56 (1.10)		-0.61 (0.89)	
Financial Variables[B] Private Insurance	5.69* (1.31)		2.94* (1.06)	
Medicaid	6.16* (1.54)		2.77* (1.25)	

Selfpay	0.04 (1.08)	0.59 (0.88)
Log of Household Income	0.46 (0.59)	0.31 (0.48)
R^2	0.20	0.47

Notes: N = 9,684. Estimates obtained using weighted least squares. All clinical controls are listed in the text. Others in household includes the mother's parents, other relatives (besides the father and children), and unrelated household members.

[A] Determined by whether the individual's years of schooling plus seven is less than their age at delivery.
[B] The private insurance, Medicaid, and selfpay variables are not mutually exclusive. Some respondents chose more than one of these categories as contributing to the costs of the delivery.
[C] Not measured in the data.

Table 4. Extended Regressions: Results for Selected Labor Market and Family Variables (100*coefficient estimates, 100*standard errors in parentheses, * = $p < 0.05$). Dependent variable: Dummy for Delivery by Cesarean Section.

	NO CLINICAL DIAGNOSES INCLUDED				CLINICAL DIAGNOSES INCLUDED			
	Mother Worked:			*Mother's Schooling*	*Mother Worked:*			*Mother's Schooling*
	Just Before Pregnancy (Only)	During Pregnancy	After Delivery	(in years)	Just Before Pregnancy (Only)	During Pregnancy	After Delivery	(in years)
Baseline	4.48*	2.97*	1.40	0.57*	3.16	4.22*	-0.34	0.25
	(2.20)	(1.37)	(1.09)	(0.26)	(1.78)	(1.12)	(0.89)	(0.21)
Control for the Size and Weight of Baby	3.04	4.44*	1.37	0.28	2.83	4.82*	-0.36	0.10
	(2.62)	(1.65)	(1.32)	(0.33)	(2.12)	(1.34)	(1.07)	(0.26)
Control for Seven Behaviors (see note)	4.17	3.11*	1.28	0.63*	2.97	4.42*	-0.37	0.29
	(2.20)	(1.38)	(1.09)	(0.27)	(1.78)	(1.12)	(0.89)	(0.22)
Primiparous Mothers‡	3.19	7.20*	0.88	0.84*	0.98	5.47*	0.69	0.92*
	(3.36)	(2.15)	(1.59)	(0.37)	(2.70)	(1.73)	(1.28)	(0.30)
Multiparous Mothers‡	6.37*	-0.01	2.46	0.45	5.12*	1.43	-0.34	0.08
	(2.81)	(1.68)	(1.49)	(0.30)	(2.26)	(1.35)	(1.20)	(0.24)

Note: N = 9684, except for the "control for size and weight" regressions, for which N = 6876. The seven behaviors, each coded with a dummy variable, are as follows: quitting smoking, reducing alcohol consumption, taking multivitamins during pregnancy, engaging in sports or exercise during pregnancy, wanting the child, going to childbirth classes, and beginning prenatal care during the first trimester. The size and weight controls are the baby's head circumference, length, and birth weight, and birth weight squared.

‡ These coefficients come from a single regression that interacts each of the employment and mother's schooling variables with a dummy for primiparous mothers (also included as a stand-alone variable).

Figure 1. History of U.S. Cesarean Section Rates.

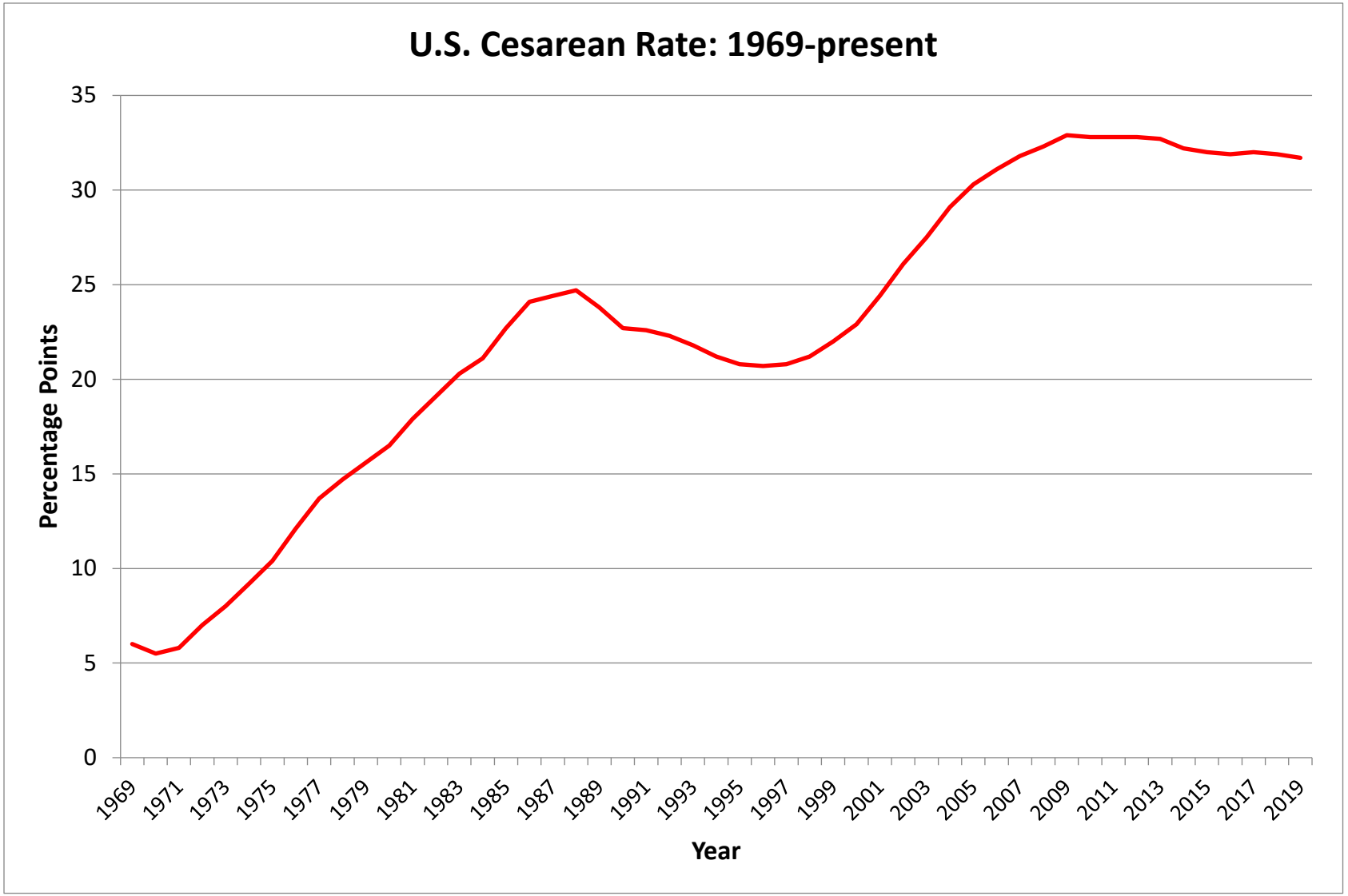
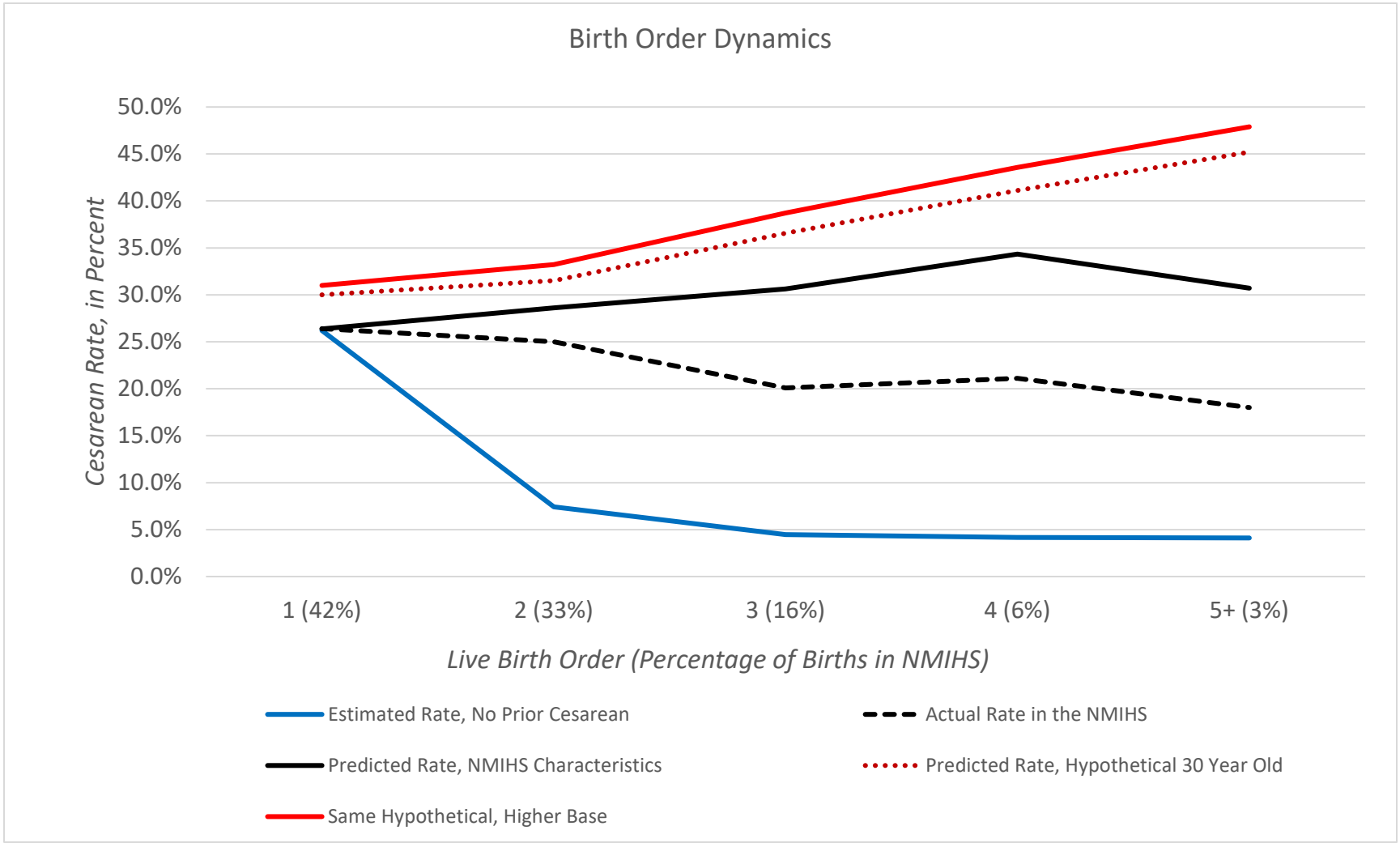
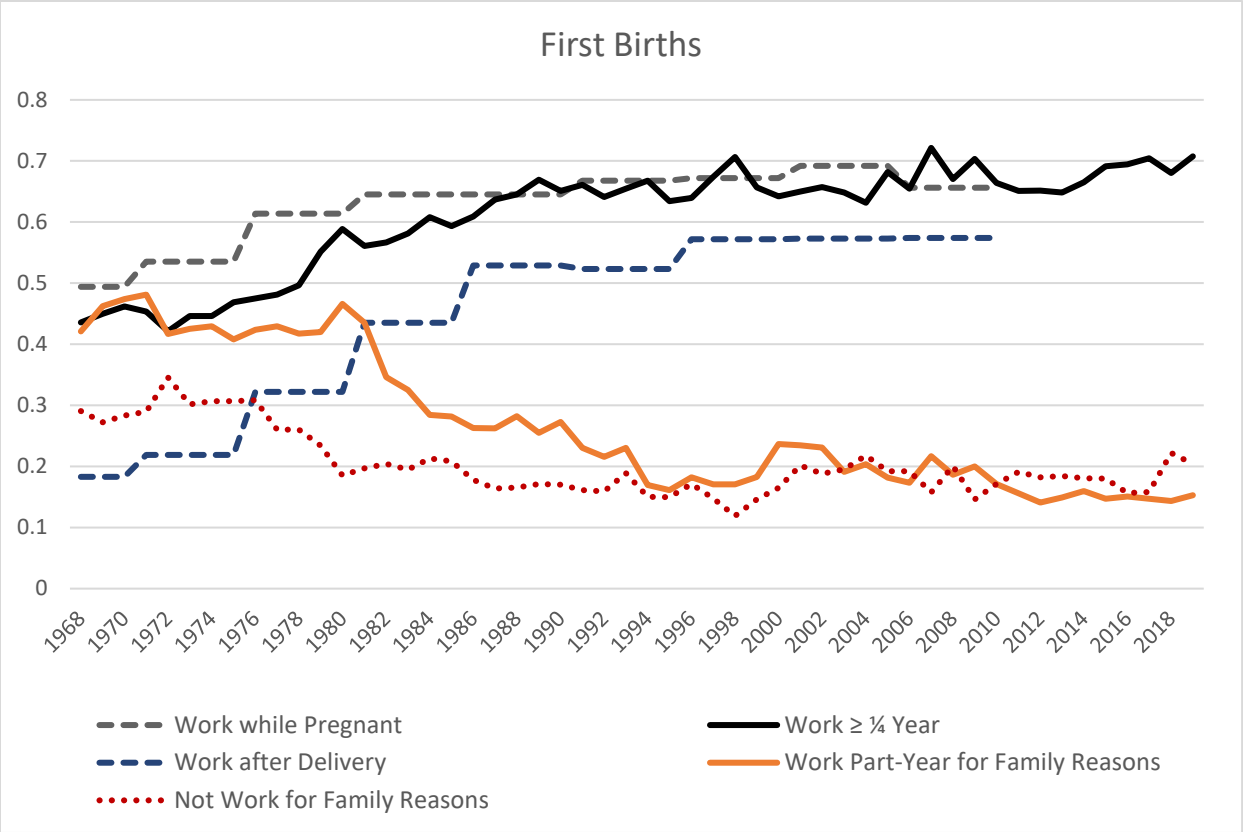


Figure 2. Birth Order Dynamics of Cesarean Section Rates.



Note: The estimated rate comes from the coefficients on live birth order dummies in a regression that also controls for a prior cesarean section, as described in the text. All predicted rates are calculated using the Markov model described in the text. The "higher base" line comes from applying the Markov model to the same hypothetical 30 year old, increasing the probability of cesarean for all mothers by one percentage point.

Figure 3. Trends in Employment Measures, by Parity.



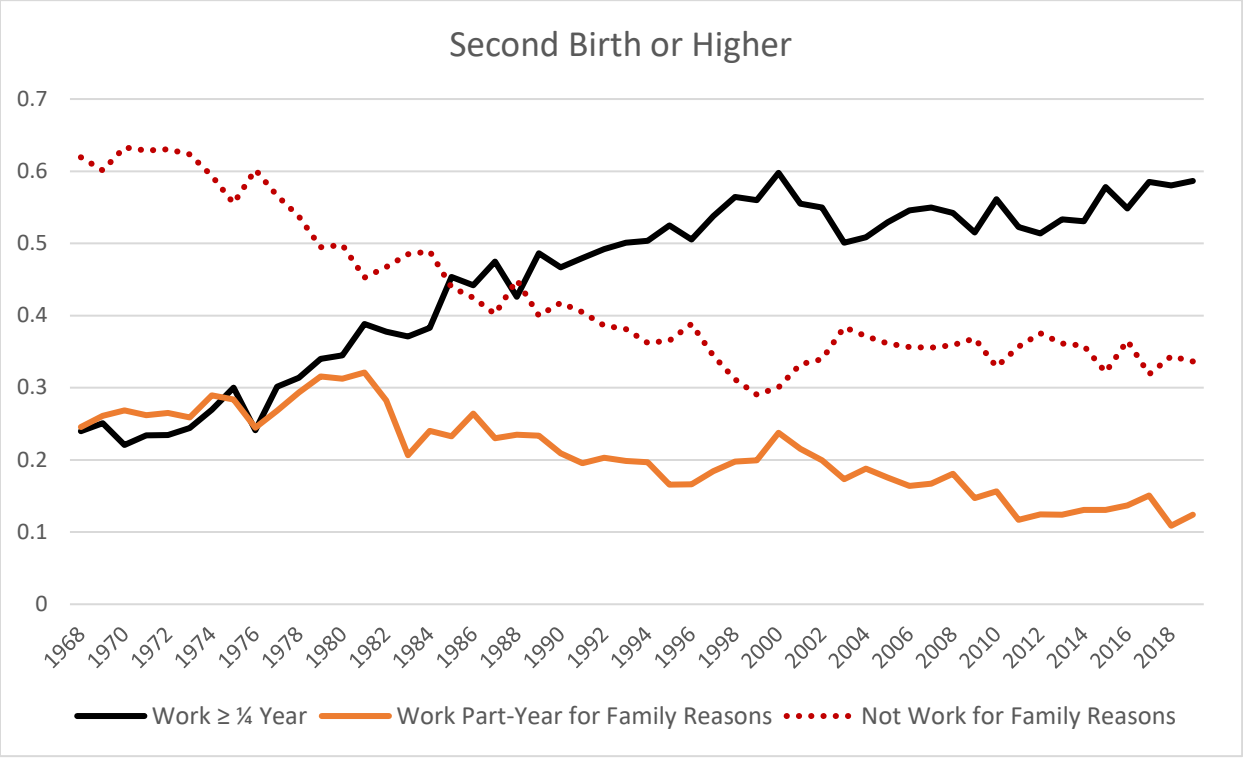
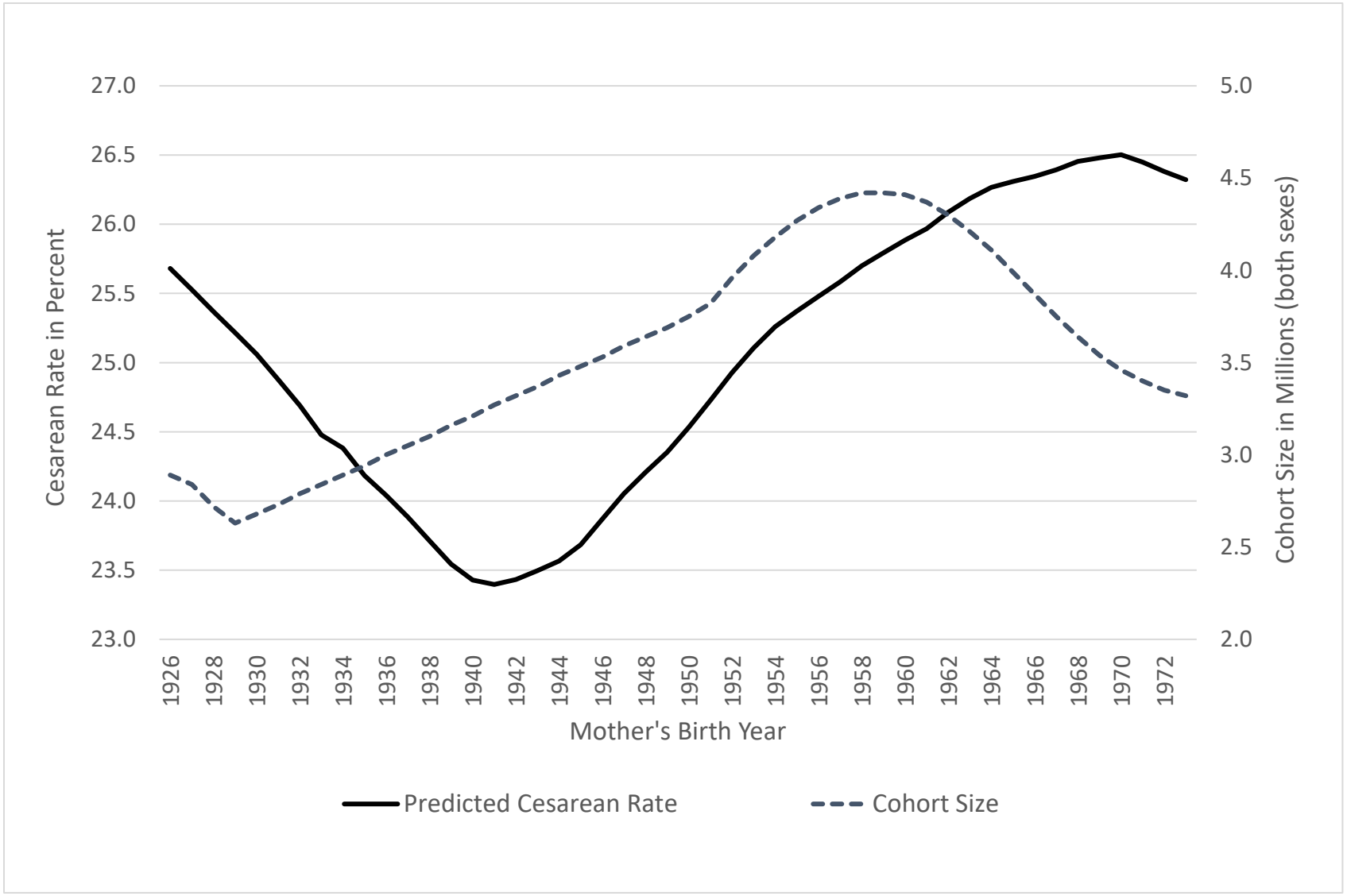
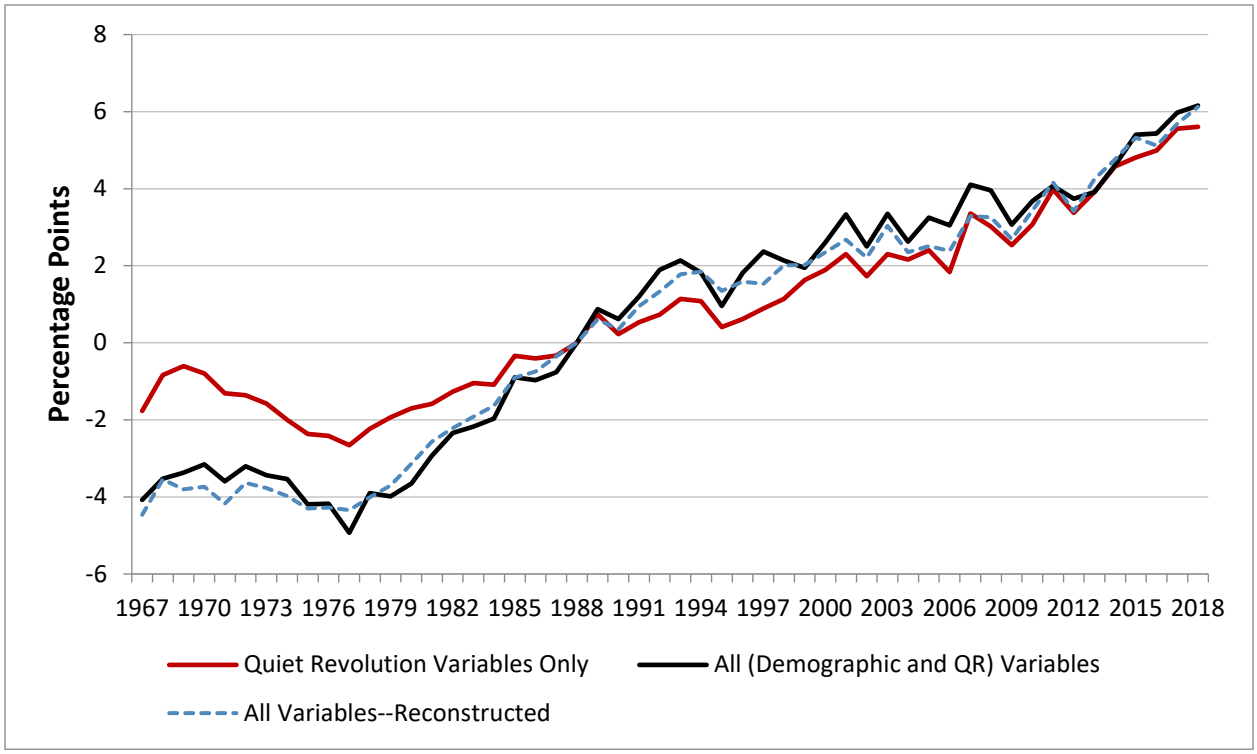


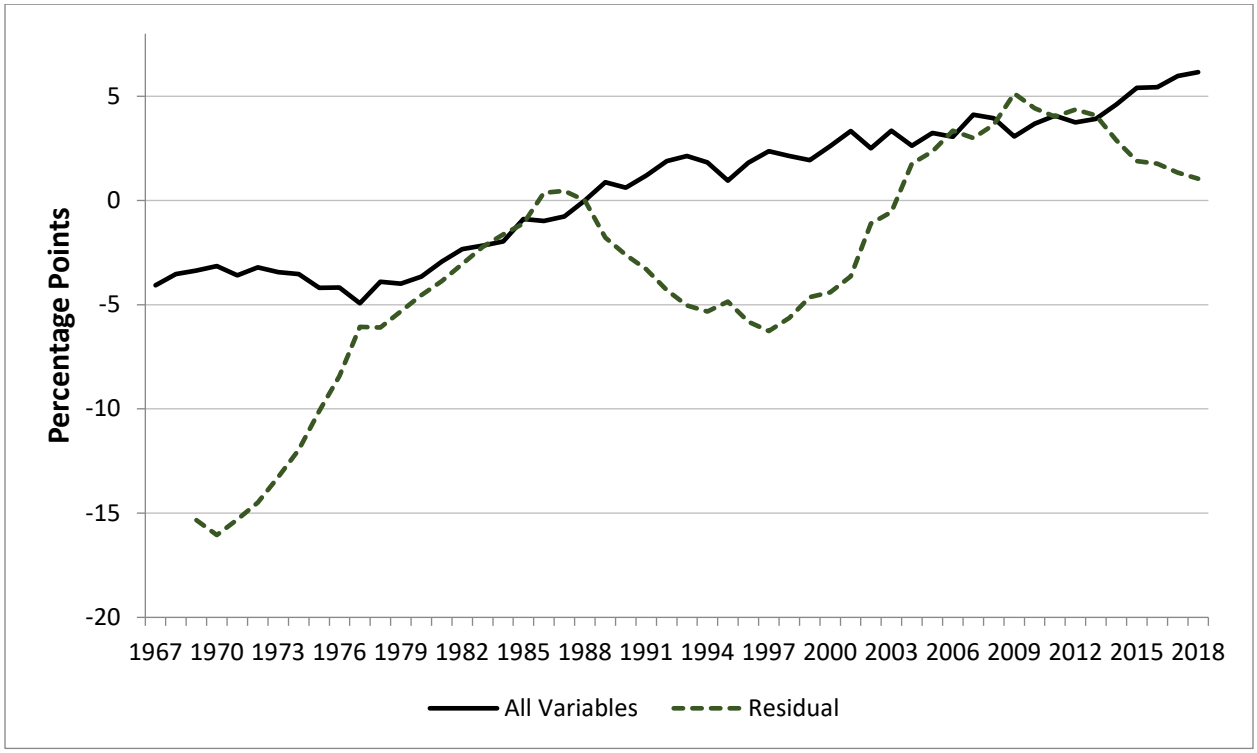
Figure 4. Predicted Cesarean Rates by Maternal Cohort, along with Maternal Cohort Size.



Note: In this graph only, maternal cohort size is measured at birth, and doesn't include deaths, in-migration, or out-migration.

Figure 5. Three Hypothetical, and One Residual, Time Series of U.S. Cesarean Rates.





Note: The "reconstructed" line in the top figure weights cells by the number of births in the Vital Statistics; the unreconstructed lines in the top and bottom figures weights by the sample size in the CPS. See the text for details. Year refers to the year of the birth, not (necessarily) the survey.

Appendix: Means and Net Effect of Variable Groups and Selected Individual Variables (effects in percentage points).

Variable Set Selected Variables	Vital Statistics / SIPP			March CPS			NMIHS
	1969-1972	1987-1990	2005-2008	1969-1972	1987-1990	2005-2008	1988
Location							
Metro Area	67.5	78.9	84.7	65.4	79.9	84.6	74.0
Race/Ethnicity							
Nonwhite	17.1	20.5	22.5	14.3	19.4	19.5	19.6
Hispanic	----	14.7	24.5	6.1	9.3	15.6	12.1
Social Support[#]							
Dad at Home				87.8	78.0	80.6	78.9
HH Size				4.7	4.3	4.2	4.4
Economic							
Insurance[#]				--	88.2	88.4	80.8
Log(Income)[#]				10.0	10.0	10.1	9.9
Schooling	11.8	12.6	13.1	11.8	12.6	13.3	13.0
Employment[#]							
Primiparous	51.5	64.5	66.5	44.6	65.0	68.2	75.1
Multiparous				23.5	46.3	54.2	54.8
Caring for Home/Family				50.7 / 33.4	31.8 / 24.3	28.7 / 17.9	
Family Form.							
Age[#]	21.4 / 26.6	24.1 / 27.8	25.1 / 29.0	22.0 / 27.0	24.7 / 28.2	26.4 / 29.5	24.0 / 27.8
Birth Order	2.32	2.02	2.07	2.35	2.03	1.99	1.99

[#] Social support measures are post-birth. Insurance measures coverage, whether public or private. Household income is in 1988 dollars. Maternal Age is first listed for primiparous women, then for multiparous women. The "caring for home/family" first lists the percentage of all mothers who were not in the labor force last year and listed their major activity as caring for home/family, then the percentage of all mothers who worked only part of the year (less than fifty weeks) and cared for home/family during the period of non-work. The CPS employment measure is the percentage of mothers who worked more than 13 weeks in the previous year.