New Evidence on Taxes and the Timing of Birth*

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Abstract

This paper uses data from the universe of tax returns filed between 2001 and 2010 to provide new evidence on the extent to which taxpayers are willing to shift births from the beginning of January to the end of December in order to claim child-related tax benefits in an earlier tax year. Filers have an incentive to shift births, through induction or cesarean delivery, into December because child-related tax benefits are not prorated. We find evidence of a positive but very small effect of tax incentives on birth timing, which contrasts sharply with previous research. In addition, we leverage variation in birth timing and the relationship between household structure and tax incentives to provide novel evidence of tax evasion. As compared to those with an early-January newborn, low-income filers with a late-December newborn are substantially more likely to report income that maximizes their benefits from the Earned Income Tax Credit. This difference, which is driven entirely by self-employment income not subject to third-party verification, is inconsistent with real labor supply differences and is likely driven by strategic misreporting.

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1 Introduction

Economists have documented behavioral responses to taxation in myriad contexts. Existing research indicates that responses are especially strong when only an intertemporal response is required to gain a tax benefit (Slemrod 1992) or when marginal choices have discrete welfare implications because of tax notches (Kleven and Waseem 2012; Ramnath 2010; Sallee and Slemrod Forthcoming). It is not surprising, therefore, to find that taxpayers are quick to change the date of an easily shifted action when doing so delivers first-order tax benefits. Examples include the explosion of capital gains realizations ahead of a rate increase that took effect on January 1, 1987 (Burman, Clausing and O'Hare 1994) and the surge in used vehicle donations just before the January 1, 2005 tightening of rules governing deductibility (Ackerman and Auten 2011). Perhaps more surprising is that temporal responses to taxation have been documented even for actions that seem impossible or difficult to shift in time, including death (Kopczuk and Slemrod 2003) and birth (Dickert-Conlin and Chandra 1999).

The primary aim of this paper is to revisit this last finding—that parents strategically time the birth of children in response to tax incentives—using a panel of tax returns. For parents having a child near the turn of the year, there are tax savings associated with timing the birth for late December rather than early January. A December 31 birth allows a family to qualify for several child-related tax benefits for the entire tax year. A delay of one day in the birth of the child, to January 1, is associated with a delay of one year in receipt of these benefits. It is possible to shift birth timing through cesarean delivery or induction, but doing so is costly in dollar terms and carries some health risks.[1]

Previous research suggests that taxes exert a strong influence on birth timing. Dickert-Conlin and Chandra (1999) consider a sample of 170 births occurring in either the last week of December or the first week of January. They find that a 10 percent increase in

[1] Data from the Healthcare Cost and Utilization Project carried out by the Agency for Healthcare Research and Quality indicate that, in 2010, the mean charge for a vaginal delivery was $10,166 while the mean charge for a cesarean delivery was $17,052. Data are available at http://hcupnet.ahrq.gov. Naturally, insurance can shield a patient from paying this cost difference out-of-pocket.

child-related tax benefits (from \$401 to \$441 in 1996 dollars) increases the probability of a December birth by 1.4 percentage points (from 51.6% to 53%). They predict that the implementation of a \$500 child tax credit, a proposal being considered by Congress at the time of their analysis, would cause a dramatic rise in strategic timing so that late-December births would account for 65.5% of births in the two-week window around the turn of the year. The \$500 child tax credit was enacted in 1997, and was expanded to a maximum value of \$1,000 in 2003. Yet, aggregate birth records indicate that December's share of all births in the two-week window was not responsive to these changes, instead holding steady around 51%.[2] More recent evidence comes from Maghakian and Schulkind (2011), who use data from birth certificates. They impute income and tax values using Census data, and estimate a much smaller effect of taxes on birth timing. Their estimates suggest that a \$500 increase in the tax savings from a December birth increases the probability of a birth in the last week of December by only 0.8 percentage points.

Our paper re-examines the relationship between tax benefits and birth timing using micro data from the *universe* of tax returns filed between 2001 and 2010, augmented with exact date of birth for dependent children. Our data offer two important advantages compared to that used in Dickert-Conlin and Chandra (1999) and Maghakian and Schulkind (2011). First, we have a sample of more than 800,000 births occurring in either the last week of December or the first week of January, which greatly improves precision and allows us to experiment with several identification strategies. Second, we have highly reliable income data, taken from actual tax returns, which is critical for calculating the tax savings associated with a December birth. We find that larger tax savings are associated with a very small, but statistically significant, increase in December births. An additional \$1,000 of tax savings is associated with a 1 percentage point increase in the probability that a birth occurs in

[2]This calculation is based on aggregate birth counts by exact date of birth, which are publicly available in the Internet releases of *Vital Statistics of the United States, Volume I, Natality* for various years. This information appears in Table 1-16 for years 1994 through 2003. We note that it is possible that supply constraints could limit the degree to which an aggregate shift in demand for birth timing might translate into aggregate shifts.

the last week of December, which is one-thirtieth the size of the estimates of Dickert-Conlin and Chandra (1999). Put differently, we estimate that a $1,000 increase in tax savings is necessary to generate the same amount of shifting that Dickert-Conlin and Chandra (1999) find will be induced by a $33 increase. Our estimates are similar to the magnitudes found in Maghakian and Schulkind (2011).

The use of tax return data is an important strength of this paper, but it also raises the possibility of biased estimates if taxpayers misreport income in response to the birth of a child.[3] A secondary aim of our paper is to use variation in birth timing as part of a novel strategy for measuring tax evasion. The Earned Income Tax Credit (EITC) subsidizes earned income, including self-employment income. The subsidy schedule is a function of the number of qualifying children. Thus, the addition of a child to a tax return changes the incentive for EITC recipients to report additional earned income.

We demonstrate that filers in the EITC phase-in range who have a child at the end of December have significant increases in income, as compared to those with January newborns, that are consistent with strategic misreporting aimed at maximizing the value of the EITC. The difference across filers with December and January newborns is isolated to self-employment income claimed on Schedule C of the tax return, which is generally not subject to third-party verification and is thus relatively easy to manipulate without detection. Prior research has documented strategic reporting of Schedule C income in response to the EITC's incentives (Saez 2010; Chetty, Friedman and Saez 2012; LaLumia 2009). However, our findings are the first to use panel data to identify misreporting using variation in incentives driven by the timing of birth.

Our paper proceeds as follows. In section 2 we review previous evidence on the extent to which parents strategically choose birth timing, and in section 3 we briefly outline our empirical strategy. Section 4 describes our tax return data, details our estimation of the

[3] This is similar to a point made in Blank, Charles and Sallee (2009), which argues that administrative records about age at marriage from before 1980 are less accurate than retrospective survey data because individuals who were too young to marry legally had an incentive to misinform public officials.

tax value of children, and compares our data to Vital Statistics records. Section 5 provides evidence of strategic misreporting using birth timing as a source of identification. Section 6 presents results, and the final section concludes.

2 Previous Evidence on Strategic Birth Timing

In assessing the plausibility that parents strategically time births in response to tax incentives, it is important to note that there is compelling evidence that the timing of birth can in fact be manipulated. There are significantly fewer children born per day on weekends than weekdays, presumably due to physician and patient convenience.[4] In Taiwan, cesarean births are more likely on days traditionally thought to be auspicious and less likely on days thought to be inauspicious (Lo 2003), and cesarean births are avoided in the lunar month of July, which is considered an unlucky time to have surgery (Lin, Xirasagar and Tung 2006).

In the United States, birth counts were significantly higher in the first week of January 2000 than in the same week of earlier years. Gans and Leigh (2009b) document the same fact in Australia and argue that this indicates that parents timed births to occur just at the start of the new millennium. Moreover, idiosyncratic examples of birth timing abound, including anecdotes about women inducing labor to avoid the possibility of going into labor during sporting events that their husbands plan to attend (Associated Press 2007).

The key research challenge for those seeking to establish a birth timing response to *taxation* is obtaining a data set that includes the exact date of birth of children, has sufficient income information to accurately estimate tax values, and contains a sufficiently large sample to include many children born just before or after the January 1 cutoff. Dickert-Conlin and Chandra (1999) use the National Longitudinal Survey of Youth-1979. They limit their sample to mothers who gave birth between December 25 and January 7 of years 1979 to

[4] This fact is noted by Dickert-Conlin and Chandra (1999), and we show that is true in both the Vital Statistics birth records and our tax data in Figure A2.

1993. After dropping reported non-filers and respondents with missing or zero income, the authors analyze a sample of 170 births, with 88 occurring in the last week of December and 82 in the first week of January. They use self-reported income information to impute the tax saving each household stands to gain from claiming an additional child dependent and run probit models of December births on this estimated tax value and demographic controls. They find that higher tax values are associated with an increased probability of a child being born in December. The authors predict that a $500 increase in child-related tax benefits would lead to a 13.9 percentage point increase in the probability of a late-December birth, from 0.516 to 0.655.

Additional evidence on the tax sensitivity of birth timing comes from Maghakian and Schulkind (2011), who use publicly available birth data from the U.S. Vital Statistics between 1990 and 2000. These data cover all U.S. births and report method of delivery. However, they lack any information on income and, in the publicly available version, omit exact date of birth. The authors use census data to impute average income and child-related tax benefits for cells defined in terms of demographic variables. They estimate that a $500 increase in child-related tax benefits would cause a cell initially containing 1,000 December births and 1,000 January births to instead contain 1,004 December births and 996 January births. If this shifting consists entirely of births being moved from the first week of January to the last week of December, December's share of births occurring in the two-week window around the turn of the year would increase by 0.8 percentage points for a $500 increase in tax value.[5] This is much smaller than the Dickert-Conlin and Chandra (1999) estimate but agrees closely with our findings.

Gans and Leigh (2009a) also document a significant timing response to pecuniary incentives generated by the Australian "baby bonus," a payment of 3,000 Australian dollars given to parents of children born on or after July 1, 2004. The implied effect of a $500 increase

[5] Suppose that, before the tax increase, this cell included 250 births per week. If all of the shifted births move from the first week of January to the very end of December, the last week of December now includes 254/500=50.8% of all births in the two-week window. Its share of births has risen by 0.8 percentage points.

in 1996 U.S. dollars is a 4.6 percentage point increase in the share of births occurring in the bonus-eligible half of the two-week window centered around the policy change.[6] This is about one-third the effect estimated by Dickert-Conlin and Chandra (1999). Estimates from other countries indicate substantial shifting in response to a benefit change in Germany (Neugart and Ohlsson Forthcoming) and mixed evidence on tax-motivated shifting in Japan (Kureishi and Wakabayashi 2008). Dickert-Conlin and Elder (2010) find no evidence that U.S. parents shift births forward to occur just before school eligibility cutoff dates, despite the reduced child care costs associated with sending a child to kindergarten a year earlier.

There is a related literature investigating the responsiveness of overall fertility to child-related tax benefits. The time series analysis of Whittington, Alm and Peters (1990) suggests that a \$100 increase in the tax value of the personal exemption increases the fertility rate by 2.1 to 4.2 births per 1,000 women at risk. Crump, Goda and Mumford (2011) update and extend this analysis, however, and find a much smaller effect. Their results suggest that child-related tax benefits affect the timing of births over the lifecycle, but they have minimal effect on the overall level of fertility.

3 Empirical Strategy

Our empirical strategy uses individual-level data to relate the probability that a particular filer has a December birth to the size of the tax benefit they receive from adding a dependent child to their return. We restrict attention to births that took place in the two-week period around the turn of the year, from December 25 to January 7, and estimate regressions in which the dependent variable is a dummy, *DecBirth*, set equal to one if a birth occurred in

[6] At a 2004 exchange rate of 0.7, 3,000 Australian dollars would have been equivalent to \$2,100 U.S. dollars. Using the U.S. CPI to adjust for inflation, this corresponds to \$1,744 in real 1996 U.S. dollars. A bonus of \$500 would have produced an effect 500/1,744 = 29% as large as the actual Gans and Leigh estimate.

the month of December. These regressions take the form:

$$DecBirth_i = \alpha + \beta TaxValue_i + \gamma \mathbf{X}_i + \epsilon_i, \tag{1}$$

where $TaxValue_i$ is the tax savings associated with a December birth for filer i and $\mathbf{X}$ is a vector of controls. Our main coefficient of interest is β. If parents with greater tax benefits from a December birth are more likely to have children in December, then β will be positive. We estimate equation 1 using both linear probability models and probits. This closely follows the strategy developed in Dickert-Conlin and Chandra (1999).

Tax values are not assigned randomly to individuals—they are a function of filer characteristics and features of the tax code. As we detail in section 4.2, we construct *TaxValue* for each filer by taking the difference between her estimated income tax liability with and without a marginal dependent. The addition of a dependent changes tax liability because of the personal exemption, the EITC, the Child Tax Credit and changes to filing status.[7] Depending on the control variables included, identifying variation in *TaxValue* comes from legislated changes in federal tax benefits over time; nonlinearities in the relationship between income, number of children claimed, and tax benefits; and cross-state differences in tax law.

The relationship between income and the tax savings from claiming a child has changed over time. The expansion of the EITC in the early 1990s and the introduction of the Child Tax Credit in 1997 were the main drivers of change. Figure 1 illustrates this by plotting *TaxValue* by AGI for tax years 1986 and 2005 for a hypothetical married couple living in Virginia and claiming their first child. These years are the midpoints of the time periods analyzed in the Dickert-Conlin and Chandra paper and in our paper. In both years, the EITC creates a bump in *TaxValue* at low levels of AGI. In 1986, for incomes above the

[7] Another important provision, the Child and Dependent Care Tax Credit, is not relevant to our calculations because it can only be claimed against the cost of child care that allows a parent to work. A child born at the very end of the year will not have been present long enough to generate more than a few days worth of child care costs, so these benefits will be negligible in our sample of newborns.

EITC range, tax savings rise steadily with income. By 2005, because of income-related phaseouts of various child-related tax benefits, filers with high levels of AGI do not have particularly high tax savings from claiming a first dependent. In fact, the real value of claiming a first child is essentially stagnant between 1986 and 2005 for those with real AGI above $130,000.

Taxation is not the only reason that individuals may prefer to give birth in late December instead of early January. Parents and doctors may wish to avoid being in the hospital and delivering a child during the New Year's holiday. As a result, if parents who have a strong non-pecuniary preference for a December birth, or who have lower costs of shifting their birth (perhaps because they have already decided to induce or have a c-section on a specific date), also happen to have higher (or lower) tax values, our estimates could be biased.

To avoid such bias, we want to include in $\mathbf{X}$, our vector of controls, anything that might be correlated with strategic birth timing and tax values. Women who have had a c-section are very likely to have a c-section for subsequent births.[8] Because strategic shifts in the timing of birth are less costly for deliveries that are already intended to be c-sections, we might expect higher parity births to be more likely to end up in December, even without a tax motivation. Thus, we control for the number of prior own child dependents claimed. Women who are older are also more likely to have c-sections or induced delivery because of medical complications, so we control flexibly for maternal age.[9]

We suspect that higher income individuals are more likely to have control over their medical procedures and to schedule deliveries, in part because low-income individuals are less likely to have health insurance and c-section rates are somewhat lower among the uninsured (Aron, Gordon, DiGiuseppe, Harper and Rosenthal 2000). We account for this by controlling for a smooth polynomial or spline in income, which nevertheless leaves some

[8]In 2003, 88.7% of women giving birth after a prior cesarean birth had another cesarean delivery. For comparison, 23.6% of women giving birth for the first time had a c-section (Menacker 2005).

[9]Among women classified as low risk (first-time mothers with full-term singleton births), the rate of cesarean delivery in 2003 was 20.9% for women under 30 years, 32.7% for women ages 30 to 39, and 46.8% for women ages 40-54 (Menacker 2005).

residual relationship between taxable income and tax values as identifying variation. Alternatively, we can control non-parametrically for taxable income and use the remaining sources of variation—from birth order, geography and time—for identification.

Geography provides useful variation in tax values that stems from state tax policy differences, but it may also introduce spurious correlation because medical practices often differ across locations, hospitals and individual physicians (Baicker, Buckles and Chandra 2006). To account for geographic differences, we run specifications that include state fixed effects, zip code fixed effects, or either set of fixed effects interacted with year. Finally, the average tax benefit of children is changing over time, and medical practices may also follow secular trends. To account for this, we can control for year fixed effects, or year fixed effects interacted with other variables. Including year fixed effects isolates the tax value variation to within-year variation, but, as detailed below, we also conduct other specifications that allow changes to the tax code to identify the coefficient of interest.

In sum, variation in tax values is related to, albeit through a complicated function, factors that might also correlate with December births for non-tax reasons. Our strategy for dealing with any resulting biases is to utilize a variety of specifications that isolate different sources of identifying variation and look for robustness across these results.

4 Data Description

4.1 Data Sources and Sample Restrictions

Our data are drawn from the universe of tax returns filed between 2001 and 2010, supplemented with information from the Social Security Administration. We begin with a Social Security Administration dataset, made available to the U.S. Department of Treasury, which reports the date of birth and Social Security Number (SSN) for all SSN-holders in the United States. We identify children born between 2001 and 2010, and we search for all tax returns that include these children's SSNs (as dependents) in the year of their births.[10] Approximately 86% of the newborns in the SSA data are claimed in the year of birth. This is a close match to the estimate of Orszag and Hall (2003) that 87% of households filed a return in 1999.

We impose a number of restrictions to arrive at our final estimation sample. First, we limit the sample to births that occur between December 25 and January 7. Next, we keep only those cases in which the primary filer claiming the newborn also filed a tax return in the year prior to the newborn's birth. We do this to preserve symmetry between our December and January samples. For a child born in January, to calculate the tax benefit that would have been realized if that child had been born in December, we need tax information in the year *before* the birth actually occurred. Thus, to appear in our sample, a filer claiming a January-born child must appear in the year of birth and the year before. To avoid differential selection of households that may not file in all years, we limit our December sample in a parallel way, dropping filers who claimed December-born children if they did not file a tax return in the prior year.

Next, we keep only returns that used a filing status of single, head of household, or married filing jointly in the year of birth and in the prior year. This eliminates a small number who were married filing separately. We are especially concerned about controlling for the mother's demographic characteristics, so we drop returns on which there is no female taxpayer between the ages of 16 and 50 listed as either the primary or secondary taxpayer in the year of the birth. Adoptive parents likely have little control over the precise timing of a child's birth, so we drop cases in which an adoption credit is claimed in the year of

[10]An SSN is required to claim a dependent, but we are relatively unconcerned about a parent being unable to claim her child on a tax return because the child lacks an SSN. A large majority of infants are currently issued SSNs through the Enumeration at Birth program, implemented nationwide in 1989. This program makes SSN application part of the birth certificate issuance process carried out at hospitals at the time a child is born. In 2004, the Social Security Administration issued 3,927,676 SSNs via the Enumeration at Birth program (Government Accounting Office 2005). This represents 95.5% of children born in the U.S. in 2004. For an analysis of how the Social Security Number reporting requirement revealed fraudulent dependent claiming, see LaLumia and Sallee (Forthcoming).

the newborn's birth. To ensure that we are able to control for geographic factors, we drop returns filed by U.S. citizens living outside of the 50 states and the District of Columbia. Finally, we drop data from January 2001 and December 2010, so that our data represent paired December and January samples that each span the same New Year.

4.2 Estimating Tax Values

We use the National Bureau of Economic Research's TAXSIM program to compute *Tax-Value*, the tax savings associated with a December birth. This calculation is straightforward for December births. We compute the filing unit's actual tax liability as a function of income, filing status, and actual number of dependents claimed. We then compute the counterfactual liability, as if the birth occurred in January, by subtracting one from the number of dependents (or subtracting more than one when we observe a multiple birth) and by changing head of household filing status to single if the newborn is the only dependent child.[11]

The procedure for calculating *TaxValue* is slightly different in the case of January births. If a child is born in January of year t, we are interested in the tax value that would have been realized had the child been born in the previous month, December of year $t-1$. Thus, we identify January births using year t tax returns, but we do not use those returns to calculate the tax value. Instead, we locate the year $t-1$ return of the filer and compute tax liability using TAXSIM. Then, we add one dependent to the tax return (or more in the case of multiple births), changing those with a single filing status to head of household, and calculate the counterfactual tax liability. As with December births, the difference in the two tax liabilities is our estimate of *TaxValue*.

Ninety-three percent of the filers in our sample have a constant filing status across the

[11] We do observe some taxpayers claiming a dependent exemption for a newborn while simultaneously using single filing status. These people may be leaving money on the table, although there are situations in which a parent is entitled to claim a dependent exemption for her child but is not entitled to use the head of household filing status. In order to file as head of household, an individual must satisfy the household maintenance test, by providing over half the costs of maintaining a home. There is no household maintenance test that must be satisfied in order to claim a dependent exemption (Holtzblatt and McCubbin 2003).

two years of returns, but the remainder experience some change. For December births, we simply use the filing status and household structure as it appears in the year of the child's birth, which is also the year for which the tax value is computed, but we must make a more difficult choice about January births when filing status changes. For consistency and clarity, we have assumed in all cases that a child born in January would have been claimed by the primary tax filer had the child been born in December. For example, the most common transition is the case where the filer was single or head of household in the year prior to the child's birth and married filing jointly in the year of the birth. Four-point-five percent of January births fit this description. In these cases, we assume that the person who is the primary filer in the birth year would have claimed the child. Our assumption is imperfect because it is possible that if the child had been born in January that the filer would have accelerated their change in marital status into the prior tax year, or that the child would have been claimed by the secondary filer, but we do not see a superior alternative.

4.3 Descriptive Statistics

One of our goals is to construct estimates that replicate those of Dickert-Conlin and Chandra (1999) as closely as possible. To that end, we construct variables that match those available in the NLSY-79. We use information from W-2 forms to construct a control for mothers' wage income. Wage income is measured in the calendar year of the birth in the case of December births and in the calendar year prior to birth in the case of January births. We construct an indicator for living in an urban area based on a filer's zip code.[12] We control for adjusted gross income measured at the level of the filing unit. Unlike Dickert-Conlin and Chandra, we have no measures of maternal education or race. As these variables are not particularly strong predictors of a December birth in the Dickert-Conlin and Chandra analysis, it is unlikely that our inability to control for them has a large impact on our results.

[12]To map zip codes into rural or urban status, we rely on the Rural Urban Commuting Area classification established by the Economic Research Service of the United States Department of Agriculture.

Table 1 presents descriptive statistics for births in the last week of December or the first week of January. After applying the restrictions described above, we have data on 819,850 births, of which 405,252 (49.4%) take place in December. In our data, December mothers have slightly higher income and attachment to the labor force. December mothers have an average adjusted gross income (AGI) of approximately $69,500 while January mothers have an average AGI of approximately $67,400. The share of December mothers with positive wage income in the tax year prior to the newborn's birth is 76.8, while the corresponding value for January mothers is 75.4.

A comparison of sample means shows that December births have slightly higher average tax savings than January births, a value of $1,772 versus $1,742. Figure 2 offers further information on this point. It plots the average *TaxValue* by day of birth for all days in December and January. The average tax savings for births occurring in the last few days of December are higher than the average tax savings for births occurring in the first few days of January. This is consistent with tax-motivated shifting of births. But, it could also be explained by high-tax-value parents choosing to strategically move births forward to avoid the New Year's Day holiday; the pattern of tax values preceding Christmas is similar to the pattern preceding New Year's Day.

4.4 Comparison of Tax Returns and Vital Statistics

Not everyone files a tax return, so not all newborns appear in tax return data. To understand differences between our sample and the full population of newborns, this section compares the set of births observed in tax return data to official birth records from the National Vital Statistics System. These data are maintained by the National Center for Health Statistics and are generally considered the gold standard for data on births.

Our tax data track the Vital Statistics data closely—the correlation between monthly raw counts of births is .93 in the raw data and .92 in our restricted sample. Our data also closely match the weekly cycle of births, where close to 10% of births occur on each weekend day and 16% of births occur on each weekday day. More details on these comparisons between data sources are included in the appendix.

Despite the high overall correlation across data sources, there is a seasonal pattern to the claiming of newborn dependents. Figure 3 plots the ratio of newborns appearing in tax return data to the corresponding monthly Vital Statistics count. The upper line shows the ratio with no restrictions on the tax data, while the lower line incorporates the regression sample restrictions. In both cases, the ratio of tax-based newborn counts to Vital Statistics counts is always smallest in December. The number of December births recorded on tax returns is, on average, 86.7% of the number of December births in Vital Statistics data. Once sample restrictions are imposed on the tax data, this percentage falls to 75.3%. In contrast, the number of January births measured in unrestricted tax data is 92.3% of the January Vital Statistics count. With sample restrictions imposed on the tax data, the tax percentage for January falls to 79.8%. A simple t-test rejects equality of these means for the December and January groups.[13] The fact that December newborns are statistically less likely to appear in tax return data presents some challenges for interpretation of our results. Importantly, though, the December gap is present in the full tax return data and is not an artifact of the sample restrictions we impose.

Part of the seasonal pattern in Figure 3 may be due to variation in demographic characteristics of mothers. Buckles and Hungerman (Forthcoming) use birth certificate data to show that mothers giving birth in the late spring tend to be the most advantaged group: they are more likely to be married, more likely to be white, more likely to have a high school degree, and less likely to give birth as teenagers. All of these characteristics are likely to be positively correlated with filing a tax return. This likely explains why the tax to Vital

[13]The test of equality of the December and January ratios in unrestricted tax data is rejected with a t-statistic of 7.7. The test of equality with the restricted tax data is rejected with a t-statistic of 10.2. This pattern is consistent with the fact that, as shown in Table 1, 49.4% of the births in our sample occur in December. In contrast, Vital Statistics counts by exact date of birth, available from 1994 through 2003, show that about 51% of births in the two-week window around New Year's Day occur in December.

Statistics birth count ratio for persistent tax filers (as represented by the restricted data line in Figure 3) is highest in the spring. Demographics, however, cannot explain a discontinuity at the New Year.

Figure 4 shows that seasonal patterns in newborn claiming are related to income. We divide our tax sample into four groups on the basis of AGI in the year prior to the child's birth. For each group, we calculate the ratio of monthly birth counts as observed in tax return data and as observed in Vital Statistics data. Income is not included in the Vital Statistics data, so in this exercise we are comparing tax-based counts for a particular income group to vital statistics data for the full population. This results in a smaller ratio for each income subgroup than for the four groups combined. As shown in Figure 4, the groups with highest AGI (above $60,000) show no discontinuity in the tax-to-Vital Statistics ratio between December and January births. The sharp December to January discontinuity in the ratio is present among those with AGI between $30,000 and $60,000 and is strongest among those with AGI less than $30,000.

Knowledge of the tax code may be important in explaining the December-January discontinuity in newborn claims. The parent of a December newborn has only about 4 months between the birth of her child and the first filing deadline at which she could claim her child, whereas the parent of a January newborn has 15 months. Perhaps some parents of December newborns have not learned the requisite information about child-related tax benefits before the April 15 deadline. If short-term learning is driving the claiming gap, there should be a difference only in the year that the child is born, not in subsequent years. We identify children aged three and five in our tax data and match them to earlier Vital Statistics counts from their month of birth. For example, counts of three-year-olds observed on 2010 tax returns are matched to Vital Statistics birth counts from 2007. As we did with newborns, we compute the ratio of the tax return count and the Vital Statistics count.[14] Figure 5 shows

[14] As new families move into the country and into the tax-filing population, the number of three- or five-year-olds observed in a given tax year may exceed the number of births recorded three or five years earlier in Vital Statistics data. This can produce a ratio greater than one, as visible in some years in the figure.

the results. Here the pattern is much smoother across the months of any given year. Three or five-year-olds born in December are not substantially more likely to be missing from tax return data than are their counterparts born one month later.

We cannot completely explain why the gap between Vital Statistics birth counts and tax-based birth counts is larger in December than in January. However, we believe it is unlikely that the "missing" December parents timed births in response to tax incentives (even if they were large), given that they did not capitalize on them by filing. Thus, if anything, these omissions should bias our estimates upwards by omitting many low value or unresponsive filers from the December group. We return to this point in section 6.4.

5 Newborns and Income Misreporting

The empirical methodology outlined in the prior section assumes that the tax value of a child is not a function of whether that child is born in late December or early in the next year. In most cases, this is an appealing assumption. A newborn might affect a filer's labor supply by influencing preferences for leisure (e.g., a parent takes leave from work or stops working to care for the child) or by changing tax incentives (e.g., filers respond to the EITC subsidy by working more, or work less because of an income effect). But, both of these channels should affect labor supply *after* the birth of the child. The tax values used in our estimation depend on income earned almost exclusively *before* the child's birth. Uncertainty about birth timing is resolved only at the end of the year. That is, parents of children born on December 31 and January 1 must have had very similar beliefs about the probability of having a child in late December throughout the year, when the relevant labor supply choices were made.

The scope for real labor supply changes at the very end of the year is limited, but filers claiming self-employment income can change their *reported* income up until the time that they file their returns. Schedule C income is not subject to third-party verification and is an important source of tax evasion. While the typical concern is that taxpayers under-report self-employment income to evade taxes, the wage-subsidizing EITC creates incentives for some taxpayers to over-report self-employment income. Studies using audit data from the 1980s and early 1990s found little evidence of over-reported self-employment income among EITC recipients (Joulfaian and Rider 1996; McCubbin 2000), but studies that look for bunching around kink points in the EITC schedule suggest that filers with Schedule C income are in fact strategically reporting (Saez 2010; Chetty et al. 2012). In this section we show that when the arrival of a December newborn changes an EITC recipient's incentives, there is a sharp change in reported self-employment income.

To demonstrate this, we first show the fraction of returns reporting Schedule C income by month of birth for our estimation sample, in table 2. The incentive to report additional income is restricted to those who are in the phase-in portion of the EITC. We divide the sample into those who are on the EITC phase-in region, and those who are beyond this point and thus do not have an incentive to report additional income. Among those with an incentive to report additional income, those with a December birth are three percentage points (on a base of 16.3%) more likely to report any Schedule C income. This is consistent with strategic reporting of self-employment income among those with a December newborn. But it is also consistent with the possibility that self-employed individuals are, on average, more tax sensitive and that, independently, they are particularly likely to time their births for late December. Note that, even among those with income beyond the EITC subsidy range, there is a statistically significant (but more modest) difference in the proportion of filers with any Schedule C income. This could be driven either by the differential selection of some individuals into the December sample, as discussed in section 4.4, or by a correlation between birth-timing sensitivity and self-employment.

We see more compelling evidence of noncompliance when examining the distribution of earned income for late-December and early-January births around the EITC kink points. Figure 7 shows the degree of bunching around the first EITC kink among those for whom the newborn in question will be the only dependent on the tax return. That is, in the tax year from which these income data are drawn, filers with January births claim zero dependents while filers with December births claim exactly one dependent. Figure 7a plots the difference between the filer's earned income and value of the first EITC kink point, where the size of the EITC is maximized. A value of zero implies that the filer's income is exactly the value of the first EITC kink. Strategic bunching would be indicated by a mass point at, or to the right of, zero; because of the EITC plateau, EITC amounts are maximized on a flat range of income several hundred dollars wide.

The figure shows the distribution separately for late-December births (left column) and early-January births (right column) as well as by whether the filer has any Schedule C income (top row) or no Schedule C income (bottom row). The figure is restricted to filers who are within $10,000 of the first EITC kink point. Comparing the bottom figures to the top, it is clear that bunching around the EITC-maximizing value is unique to filers who have some Schedule C income. The distribution for returns without Schedule C income shows no bunching around the first EITC kink point. Comparing the top left and top right figures, the bunching is much more dramatic for the December births. Compared to the births that take place in January, there is significantly more bunching around the kink point in the December schedule.

The difference in bunching across birth months is shown in figure 7b, which plots the difference in the distribution between December and January for Schedule C filers. That is, each bar height is equal to the percentage of observations in that income bin for December minus the corresponding percentage for January. This figure shows clearly that the excess December mass is clustered around and to the right of the kink point. It also shows that the excess mass at the kink point is drawn from the left tail of the distribution—that is, there are relatively few parents of December newborns who are reporting income below the EITC kink. The distributions are similar for values beyond a few thousand dollars above the kink.

Our preferred interpretation of this bunching is that birth timing (within the two-week window) is exogenous, at least for most filers, and that the difference in bunching across birth month is due to an endogenous response of reported income. That is, this is evidence of tax noncompliance. An alternative explanation is that many December filers know ahead of time that they will strategically time their birth so as to ensure a birth in December. In this case, it is conceivable that the differences in earned income reflect real labor supply responses that differ across the groups. In the extreme, suppose that all people who are willing to coordinate their earned income so as to maximize their EITC benefit are also willing to schedule their child's birth. In that case, it is possible that the difference between the figures represents actual labor supply responses as opposed to misreporting. As we discuss below, there are several reasons to be skeptical of this alternative.

The top right panel of figure 7a shows that there is bunching among filers with a January birth and Schedule C income, even though those returns do not have a child to make them eligible for the EITC. This would be consistent with the notion that some of the bunching is a real response: Knowing that they have a reasonable probability of having a child in December, these filers planned their labor supply throughout the year so as to maximize the EITC return. Some, however, ended up having their child in January. An alternative explanation for the bunching in the January figure is that we have misclassified some filers. We divide returns in this figure according to the number of dependent exemptions claimed. It is possible that some households have an EITC qualifying child other than the newborn, but cannot claim a dependent exemption for this child (Holtzblatt and McCubbin 2003). For example, a parent or guardian might fail to meet the support test, disqualifying them from claiming the dependent exemption, but still enabling them to claim the EITC. It could also be the result of some negotiation between parents who file separate returns and agree to divide up tax benefits related to their child. In ongoing work, we are investigating these possibilities directly by examining the EITC receipt of the filers in this subsample.

Figure 8 shows the same type of analysis for families for whom the newborn will become the second dependent child. Here a value of zero along the horizonal axis corresponds to the first kink point in the EITC schedule for families with two children. As in the prior case, there is no evidence of bunching among those without schedule C income, but there is bunching in the distribution of those with schedule C income. Among returns with December births, who indeed have a second child on the return in question, the bunching is dramatic and centered around the first kink point, as expected. Among those with January births, there is also bunching, but it is at a value several thousand dollars below the first kink point for filers with two children. This is approximately the location of the first kink point for filers with one dependent, suggesting that the bunching evident in this figure is primarily driven by filers locating at the kink point relevant to their number of dependents. Note that there is also a more modest bunching at the second-child kink point among the January filers, just as there is modest bunching at the first-child kink point in this sample in figure 7.

Finally, figure 9 shows analogous figures for filers who already have two dependents, and for whom the newborn will become the third dependent. The EITC kink point is the same for second and third children. Thus, what we expect to find in this figure is no clear difference between December and January births, but we do expect to see bunching around the kink point in both groups. This is exactly what is shown in figure 9, where bunching is evident among schedule C filers in both December and January. Figure 9b shows that there are no broad areas where the two distributions diverge.

Together, these figures paint a compelling portrait of strategic income reporting among EITC claimants. Among a population of filers who have a child within a two-week window of each other, those who happen to have the child in December are able to adjust their reported income so as to leave a significant fraction of observations very close to the minimum income required to maximize EITC payments.

Must these patterns imply misreporting, or could they be consistent with real responses? There are two strong reasons to doubt the importance of real responses, and to instead believe that the effects shown here are the product of misreporting. First, if heterogeneous response was the driving force, we might expect to see bunching among the December births for those without Schedule C income. The data do not show this. Still, it is possible that all very tax sensitive filers have Schedule C income, or that non-Schedule C income is inflexible—that is, there might be a demand for strategic bunching among those without Schedule C income but they are unable to fine-tune their labor supply because of their employers' preferences.

Second, if real labor supply responses are important, we would expect to see differences in the distribution across birth months in figure 9, for filers having their third child. Suppose that the extra bunching of December parents visible in figure 7 reflects a correlation between being particularly likely to arrange labor supply patterns so as to maximize EITC payments and being particularly likely to schedule a late-December birth. If there is an underlying correlation between these two characteristics, it should not depend on the number of children a filer already has. Then we would expect to see more bunching for Schedule C filers with December newborns than for those with January newborns. Instead, we see in figure 9 that these distributions are very similar.

In the next section, we turn to our main results regarding the relationship between tax values and strategic birth timing. We demonstrate that the endogeneity of Schedule C income drives up our coefficients modestly.

6 Birth Timing Results

6.1 Baseline Results

Recall from section 3 that our main empirical strategy is to run regressions of a dummy variable coded as one if the birth takes place in December on the tax savings that a filer would experience from claiming an additional dependent child and a set of controls in our data set of returns with late-December and early-January births. Table 3 presents results from a number of such regressions estimated as linear probability models. A matching Table A1 that uses a logit model is included in the appendix. Marginal effects from logit estimation are very similar, which is not surprising because the predicted probabilities for all observations are close to .5.

Column 1 shows the most parsimonious specification. The only right-hand side variable is the tax savings associated with a December birth. This specification uses tax variation due to income, birth order, marital status, geography and time period to identify the coefficient. The estimate of 0.0094 indicates that a $1,000 increase in the tax value of a child is associated with approximately a one percentage point increase in the probability of a December birth, which is a 2% change on the base probability of 0.494. This is a small effect, and it is precisely estimated.

Column 2 adds controls for mother's earnings, marital status, birth order (third or higher-order birth is the omitted category), AGI, urban residence, mother's age and year fixed effects. This is the specification closest to Dickert-Conlin and Chandra (1999), differing only in our exclusion of mother's education and race, which are not available in our data set. This increases the tax coefficient slightly, to 0.0131. In sharp contrast, Dickert-Conlin and Chandra estimate a 0.344 marginal effect of a $1,000 increase in tax savings, which is 24 times larger than our estimate. Our estimates are quite close to the findings of Maghakian and Schulkind (2011), whose analysis indicates a marginal effect of around .016.

Additional columns in Table 3 probe the sensitivity of our results to alternative specifications. We control more flexibly for maternal age (replacing the linear age term with a full set of age dummies) and for AGI (replacing the linear AGI control with a 5-piece spline). These choices are motivated by the nonlinear relationships between maternal age, income, and the probability of cesarean birth. Once a filer schedules a c-section for medical or other reasons, the marginal cost of choosing a tax-advantaged birth date is lower. Column 3 includes state fixed effects and column 4 substitutes zip code fixed effects for state fixed effects. The goal in both cases is to account for time-invariant spatial variation in medical practices that might influence the probability of a late-December birth and that is spuriously correlated with tax values. The estimated coefficient on *TaxValue* changes very little. It is a precisely estimated

0.0155 in column 3 and a precisely estimated 0.0154 in column 4. Column 5 returns to the use of state dummies, and adds state-year interaction terms. In this case, no state-level policy variation is used in the identification of the tax effect. The *TaxValue* coefficient remains essentially unchanged.

Income may be correlated with birth timing for non-tax reasons relating to parental or physician preferences and the relationship between income and medical care. There is a strong, albeit nonlinear, relationship between income and the tax savings associated with a December birth. Thus, if a 5-piece spline in AGI fails to capture the relationship between income and non-tax drivers of birth timing, our estimates may be biased. To address this possibility, column 6 replaces the 5-piece AGI spline with dummies for each \$10,000 AGI bin. This has little impact on the *TaxValue* coefficient, which is now 0.0177.

Column 7 goes further in controlling for income and demographics and relying on policy variation for identification. In that specification, year dummies are dropped, and the \$10,000 AGI category variables are all interacted with marital status and dummies for first or second births, thereby controlling flexibly for household structure and income, which determine tax values within a given year. The goal of this specification is to isolate the tax variation that comes from policy changes over time. Variation related to a filer's household structure and income is removed. Again, the *TaxValue* coefficient changes very little. It is equal to 0.0159 in this specification.

The coefficients on other controls are generally stable across the specifications shown in Table 3. There is strong evidence of a relationship between birth parity and the probability of a late-December birth. Married mothers and mothers with higher levels of wage income have lower probabilities of late-December births.

Medically, it is easier to shift a birth by a day or two than by a week or more. Thus, we would expect to see less evidence of shifts in birth timing as we make the sample window around the New Year broader. Figure 6 shows the coefficients on the $TaxValue$ term from 31 separate regressions, each of which expands the sample window to include a different number of days.[15] The first regression, represented by the left-most point in the figure, includes only births occurring within one day of the turn of the year (that is, only December 31 and January 1). Moving rightward in the figure, the sample size gradually increases. The rightmost point is for a regression including all births from December 1 to January 31. As expected, the positive relationship between tax savings and the probability of a December birth is largest in very narrow windows around the turn of the year and gradually falls as the time frame increases.

Tax returns provide no information about the method of delivery, so we cannot limit the sample to cesarean and induced deliveries. However, there is substantial variation across states and over time in aggregate c-section rates.[16] We use this variation to test whether or not filers are more tax sensitive if they reside in areas where c-section rates are high, which may indicate that the cost of shifting birth timing is lower on average. Column 1 of Table 4 adds the annual state-level c-section rate to our baseline analysis. This has very little effect on the *TaxValue* coefficient or on other terms. Column 2 adds the interaction of *TaxValue* and the c-section rate. The *TaxValue* coefficient is no longer statistically different from zero, while the interaction term is positive. This suggests that mothers are more likely to consider the tax benefits of a December birth in making decisions about birth scheduling when they are more likely to have a c-section.

Mothers who have already had a c-section are much more likely to have a c-section in subsequent births. Thus, mothers who already have children may be more sensitive to tax values, as many will intend to schedule delivery even before considering tax benefits. To investigate this, we report results from our baseline specification but restrict the sample to higher-order births in column 1 of Table 5.[17] For this group, an additional $1,000 of

[15]These regressions include demographic controls, a full set of maternal age dummies, a 5-piece spline in AGI, and year dummies.

[16]We have collected data on annual state-level c-section rates from the *Births: Final Data* series of the National Vital Statistics Reports. In 2001 the cesarean delivery rate ranges from a low of 17.2% in Utah to a high of 29.9% in Louisiana. All states experience an increase over the next decade. By 2010 the low is 22.6% in Arkansas and the high is 39.7% in Louisiana.

[17]We do not observe birth order directly, but instead define a child as first-born if there are currently no

tax benefit is associated with a 2.2 percentage point increase in the probability of a late-December birth, which is, as expected, higher than our baseline that includes first births. (Other columns in Table 5 are discussed below.)

In sum, our tax data provide evidence that in recent years there is a small, but statistically significant, correlation between tax benefits and birth timing. This result is quite stable across specifications. The R^2 is low across all specifications, indicating that even our richest set of controls explains only a small portion of the variation in birth timing. In all specifications, our estimate of the tax effect is dramatically smaller than the estimates of Dickert-Conlin and Chandra (1999) and similar to that of Maghakian and Schulkind (2011). We have been unable to find any specification that raises the coefficient by an economically significant amount.

There are several potential limitations of our baseline estimates in table 3. First is the strategic misreporting of self-employment income that we discussed in section 5. If filers with a December newborn increased their self-employment income to increase EITC benefits, this will lead us to overestimate the tax effect in our baseline specification. Second, some patients or physicians may have a preference for timing births in December to avoid delivering a baby on New Year's Eve. If this "holiday avoidance" preference is correlated with tax values, our baseline specifications may be biased. Third, we documented above that there is a differential selection of newborns into the tax filing population around the New Year. Below, we explore these three issues in turn.

6.2 Noncompliance Biases Estimates Upward

The regression coefficients cited above are likely overestimates of the true tax effect because the regression coefficients represent a mixture of the true tax effect and a compliance effect. To demonstrate this, we first present results from placebo tests. We replicate our results from

other dependent children in the household besides the newborn.

Table 3 but use a sample drawn from the *first* week of December and *last* week of January. Children born in these windows were born at least 24 days from the New Year, making it very unlikely that strategic birth timing was relevant in these cases. That is, children born at the beginning of December are not likely to have been born then because their parents induced labor for tax reasons. Similarly, children born at the end of January likely had due dates too far from New Year's Eve to make a strategic birth timing in December feasible or medically safe. Thus, we would expect to find no correlation between taxes and December births in this sample if the only reason that December and January births differ in tax values was strategic timing.

Instead, however, we find a statistically significant coefficient on *TaxValue* that is roughly one-third the size of our main effect. Table 6 reports our results. Each coefficient (and standard error) in the table is the estimated coefficient on the child's tax value (in $1,000) from a separate regression. The columns represent different specifications that match Table 3, and the rows represent different samples. Table 6 first restates our main estimates of the effect of tax values across various specifications from table 3 in the top row, and then reports the same coefficient estimate from the placebo sample in the second row. In all cases, the placebo effect is positive and statistically significant, ranging from 0.004 to 0.007.

The third row in the table simply reports the coefficient estimate from the main sample minus the corresponding coefficient in the placebo sample (the value may differ from the difference implied by the reported coefficients by 1 unit due to rounding). Suppose that whatever data or compliance issues lead to a significant placebo effect in the early December and late January sample will have the same effect on estimates for the baseline late December and early January sample. Then a better estimate of the true tax effect will net out these data or compliance components, which is what the third row of Table 6 does. These effects are around one-third lower than the baseline estimates, though this varies somewhat across columns.

The placebo effect could be due to differential rates of filling across birth months, the noncompliance problem related to the EITC, or to some other unknown problem. What we show next is that noncompliance can account for the entire placebo effect.

In section 5, we argued that filers with a December newborn changed their reported income so as to maximize the value of the EITC. This will raise the average tax value of December births and bias our results upward. One simple approach to dealing with this issue is to estimate our main specification on the sample of those who do not have any schedule C income. Dropping those observations lowers our sample size by 148,047 (18%), with 73,123 (18%) coming from January and 74,924 (19%) coming from December.[18]

The fourth row of table 6 reports our estimated tax coefficient for the sample of filers with late December or early January births who report no Schedule C income. These estimates are somewhat smaller than our baseline estimates, as expected. Recall that the third row in table 6 shows the difference between our main estimate in the full sample and the estimated placebo effect. These differences, which represent an estimate of the true tax timing effect assuming the placebo effect can simply be netted out, are very similar—always within .001 or .002—to the estimates we get from estimating the main estimates on the sample without Schedule C income. Moreover, in the fifth row of table 6 we estimate the placebo effects on a sample of returns that have no Schedule C income. There, we see that the remaining effect is -.001 to .002, and the effect is not statistically significant (despite similarly small standard errors) in several specifications and is only marginally significant in others. This suggests that the placebo effect can be accounted for by Schedule C filers. As a result, we believe that the best estimates of the true tax timing effect come from our main estimates on the non-Schedule C sample. These estimates range from .006 to .013.

[18] We are investigating other approaches based on imputing a counterfactual Schedule C income for filers with January newborns. Our current approach of dropping the observations could possibly overcorrect for the placebo effect because it drops a larger fraction of December observations.

6.3 Non-tax Convenience Effects Are Small

Parents and physicians may prefer to have a child born in late-December so as to avoid labor over the New Year's Eve holiday. If this preference for holiday avoidance is correlated with tax values, this could bias our estimates. To examine this possibility, we study the relationship between tax values and weekend births.

As noted earlier, average daily birth counts are higher on weekdays than on weekends. Weekdays tend to have greater numbers of hospital employees at work and lower risks of mortality from some causes (Bell and Redelmeier 2001). Some of the factors that influence whether a c-section or induction is scheduled to occur just before New Year's Day, such as medical risk or physician convenience, will also influence whether a birth is shifted to take place on a weekday instead of a weekend. On the other hand, there is no tax provision that treats weekday births more favorably than weekend births. Thus, any substantive relationship between the tax value of a newborn and the probability of a weekday birth must be picking up spurious correlation between child-related tax benefits and the non-tax-motivated propensity to schedule a birth for a time when hospitals are fully staffed.

Table 7 shows results of regressions predicting whether a birth occurs on a weekday. For this analysis, we use a sample of births occurring in the first week of December, a time frame without any significant holidays. The first week of December is also too early to plausibly contain births that have been shifted forward in time in response to tax incentives. In column 1, a weekday birth indicator is regressed on *TaxValue* with no additional controls. There is a significant and small negative relationship between the tax value of a newborn and the probability of a weekday birth. An additional $1000 of tax benefits is associated with a 0.6 percentage point decline in the probability that a child is born on a weekday. Adding controls to this regression shows that income and birth order explain this relationship. Column 2 controls for demographics (including a full set of maternal age dummies and a 5-piece spline in AGI) as well as year fixed effects. In this specification, there is no significant relationship between *TaxValue* and the probability of a weekday birth, and the point estimate of the tax term is very close to zero. This result supports the view that the December birth regressions are in fact indicating an effect of taxes on birth, rather than indicating some spurious correlation between the tax value of a newborn and the propensity to choose birth timing for reasons of convenience or medical risk.

6.4 Could Tax Filing Selection Influence Our Estimates?

In section 4.4, we showed that a smaller fraction of children born in December are claimed as dependents in their year of birth than are children born in January. Is it possible that the "missing" December births in our sample might bias our estimates? Similarly, our data selection procedure requires us to make stronger assumptions about the counterfactual filing status for filers whose status changes across years because, for January births, we have to determine who would have claimed the child in the prior year and whether the earlier birth of the child would have caused a change in marital status.

To investigate these data selection issues, we have run our baseline specifications on subsamples for which we believe that filing selection is unlikely to be an issue. We have also run a simple simulation to bound the bias that could arise from missing observations.

Our subsample regressions are reported in Table 5. Figure 4 shows that the differential selection of newborns into the tax system across birth months is a low-income phenomenon. In column 2 of Table 5, we restrict our sample to filers with AGI greater than $100,000 to eliminate the effects of sample selection. The tax coefficient is about one percentage point greater for this high-income subsample as for the full sample. An additional $1,000 of tax benefit is associated with a 2.6 percentage point increase in the probability of a late-December birth. This could indicate that data selection causes a small downward bias in our estimates, but it may also reflect heterogeneity. High-income filers may be more responsive to tax benefits because they are better informed about the tax system, because they have more influence over the medical process, or because they are more likely to have a scheduled delivery (which lowers the cost of any additional tax-motivated shifting).

Child born in December could be missing from the tax return data either because their parent or guardian did not file a tax return, or because their parent or guardian filed a tax return but failed to claim the child as a dependent, thereby foregoing the tax value. Either explanation seems unlikely to generate a downward bias in our estimates because a downward bias would come only from a situation where the missing December children have especially *large* tax values. It is unlikely (but not impossible) that filers who stand to gain especially more from claiming the child would simply fail to do so.

In either case, it is logically inconsistent to suspect that children who were not claimed on a tax return were born in December because of strategic timing, because the child's parents did not realize any tax benefits from the birth. If anything, we suspect that the omitted observations have *low* tax values (because they did not appear on tax returns) and including them would further drive down our estimate. Nevertheless, we can do some simple analysis to bound the bias that could arise from the missing observations. In ongoing work, we are bounding the potential bias by duplicating very high tax value returns from December and adding these observations to the data, until the ratio of December and January births matches the ratio from the Vital Statistics. Under the assumption that the missing observations have tax values within the support of the observed data, adding these observations to the data and re-estimating our regressions would provide a plausible upper bound on the effect of the missing observations.

This bounding exercise is still underway, but we have done a back-of-the-envelope simulation. We simulate a set of 800,000 births, 50% of which occur in December, with the mean tax savings observed in our sample. The simulated December births have a mean *TaxValue* of $1,767, the simulated January births have a mean *TaxValue* of $1,742, and both groups have a $1,000 standard deviation for *TaxValue*. We run a bivariate regression of the December birth dummy on *TaxValue* and get a coefficient estimate very similar to our main result. Then, we add 24,742 December births to our simulated sample, bringing December's share of all births in this two-week window to 51.5%, in line with the pattern observed in Vital Statistics data. We assign these births a *TaxValue* two standard deviations above the observed mean. That is, the "missing" observations have *TaxValue* equal to $3,754. Regressing the December birth dummy on the tax term for this sample generates a coefficient of 0.03 with a standard error of 0.005. Even this is an order of magnitude smaller than the estimate of Dickert-Conlin and Chandra (1999). This exercise suggests that including additional high-tax-value individuals in our set of December births can raise our estimate somewhat, but cannot fully close the gap between our estimate and that of Dickert-Conlin and Chandra (1999).

In ongoing work, we are performing the bounding exercise using the data duplication procedure described above. We are also linking tax returns across years to estimate the tax values of the "missing" December newborns based on their tax value in later years, when December births are not less likely to appear on tax returns (as shown in Figure 5). This will allow us to determine whether the missing observations arose because the parents of the child did not file tax returns, or because they filed tax returns but did not claim the child.

The final concern with our estimation procedure is the that we must make stronger assumptions about household structure for those who experience a change in marital status between years. To see how this might be influencing our results, in columns 3 and 4 of Table 5 we restrict the sample to returns with constant marital status in the year of birth and the previous year. Column 3 consists of cases in which the primary filer is married filing jointly in both years. Column 4 adds to this cases in which the primary filer is unmarried in both years. Column 4 differs from our baseline sample by dropping filers who change marital status in the years surrounding birth (7%). The point estimate on the *TaxValue* term is smaller than the baseline when restricting attention to those who file jointly in both years, and it is slightly larger than the baseline when considering those with no change in marital status. This suggests that our finding of a very small tax effect are robust.

7 Conclusion

Our results cast doubt on the hypothesis that, over the last decade, large numbers of parents have strategically shifted the timing of childbirth in response to tax incentives. Our research has the benefit of using actual tax return information, which greatly improves the accuracy of estimated tax values, and large estimation samples drawn from the universe of tax returns. Our results do show a positive correlation between tax values and the probability that a child is born in December, but that correlation is quite small and precisely estimated. These findings are similar to the conclusions of Maghakian and Schulkind (2011), but they differ greatly from the magnitude of the findings in Dickert-Conlin and Chandra (1999).

Our data come from the 2000s, whereas Dickert-Conlin and Chandra (1999) study data from two decades prior. In the intervening years, there has been a rise in scheduled deliveries. This suggests that individuals might have become more responsive to tax incentives, not less, over time. Nevertheless, it is possible that both our estimates and theirs are correct for their respective time periods. It may have become more difficult to shift birth timing in response to tax incentives than had been previously thought, particularly if everyone has the same incentives. Hospitals and physicians have limited availability, and even if every parent wished to have a late December birth, it would not be possible to accommodate all of them.

In addition to our main results regarding the relationship between taxes and strategic timing of birth, our analysis also documents a previously unknown empirical fact regarding differential claiming of dependents born on either side of the New Year. In ongoing work, we are investigating the cause of this difference. Finally, our work also provides a novel methodology for identifying EITC noncompliance. Our approach uses variation in EITC incentives due to differences in family structure and a comparison of filers with children born just before and just after the New Year to show that filers respond to EITC incentives by increasing their reported Schedule C income in order to maximize their receipt of the EITC. This is consistent with previous findings in the literature regarding the role of self-employment income with regards to the EITC, but it uses a different identification strategy.

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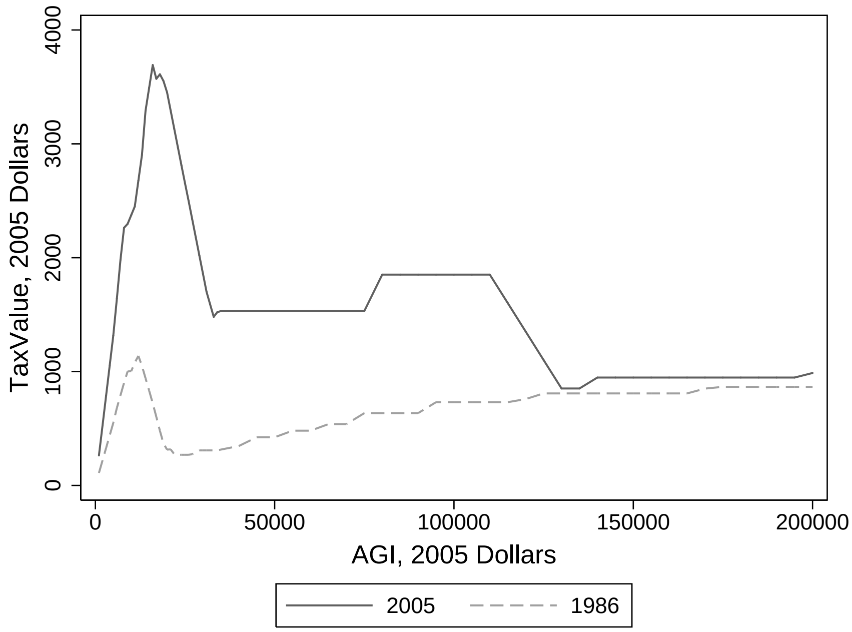
Appendix

Figure A1 compares monthly birth counts from the Vital Statistics and tax data, with and without our sample restrictions. The figure runs from January 2001 to December 2008, the period in which both data sources are available. The Vital Statistics series, the top dashed line, shows all births taking place within the 50 states and DC to U.S. residents. The middle line represents all newborns who appear on a tax return in their year of birth. The bottom line represents newborns appearing on tax returns that satisfy our regression sample restrictions, notably that the primary filer appears in the tax-filing universe in both the year of birth and the prior year. Because of non-filers, the tax data always show fewer births per month than the Vital Statistics data. Regardless of whether or not our sample restrictions are imposed, tax data closely reflect the seasonal and secular patterns in the Vital Statistics. The correlation between monthly Vital Statistics counts and the raw tax counts is 0.929, and the correlation between the Vital Statistics and restricted tax counts is 0.919.

Births appearing in tax return data match up reasonably well to stylized facts on birth timing. Vital Statistics data document fewer births per day on weekends than on weekdays. Tax return data show the same pattern. Figure A2 plots the fraction of births occurring on each day of the week. In both tax data and the Vital Statistics, about 10% of births occur on each weekend day and about 16% of births occur on each of Monday through Friday.[19] We have also tabulated birth counts by exact date of birth. Matching the stylized fact of low birth rates on holidays, tax return data show that December 24, December 25, and January 1 stand out as days with particularly low numbers of births.

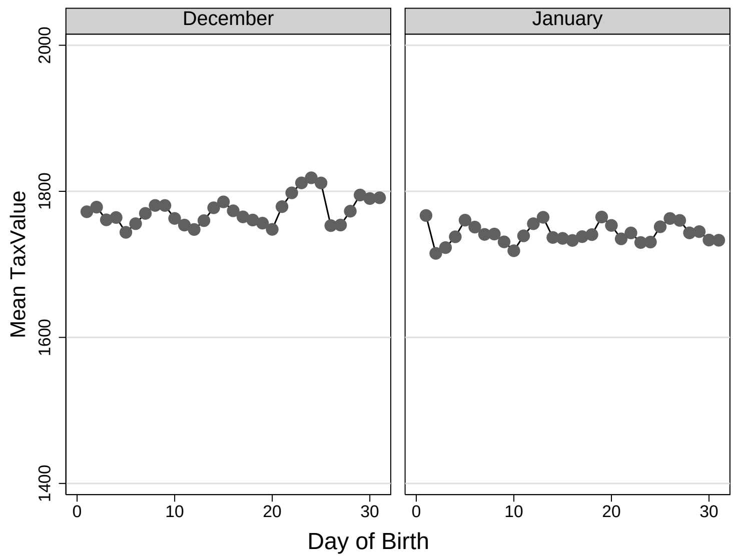
[19]This figure is for December and January births only. The corresponding figure for births occurring in all twelve months shows a nearly identical pattern.

Figure 1: Tax Savings from a December Birth, by AGI



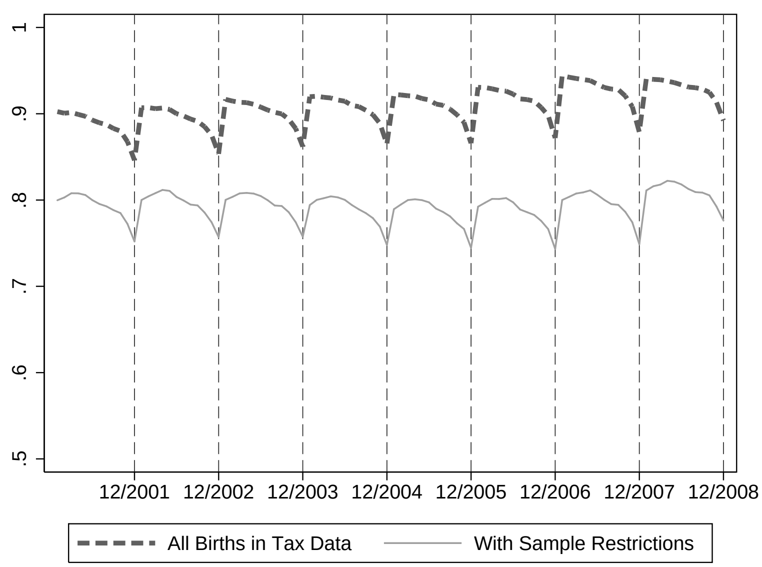
The figure plots the combined federal and state tax savings associated with claiming a first dependent, for a married couple filing in Virginia. Dollar amounts are reported in 2005 dollars.

Figure 2: Tax Value by Date of Birth



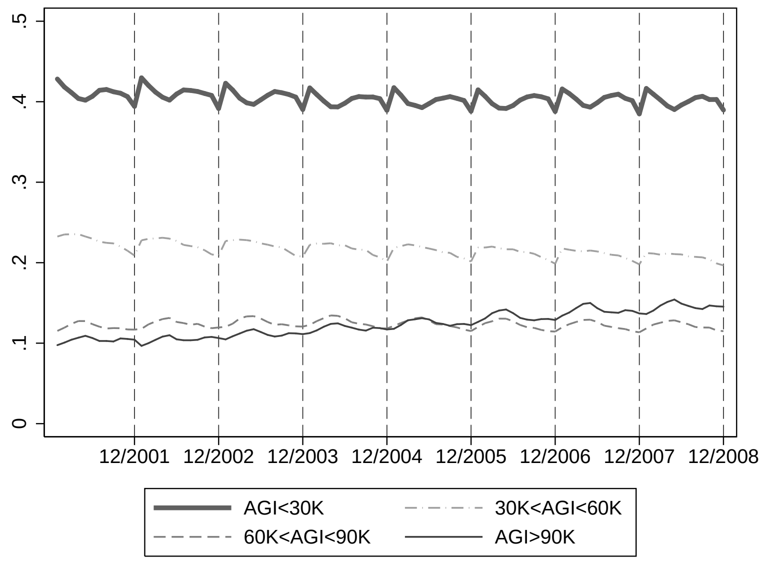
This figure plots the mean value of combined federal and state tax savings associated with a December birth, by the child's date of birth, for all December and January births meeting the sample restrictions.

Figure 3: Ratio of Tax-Based Count to Vital Statistics Count



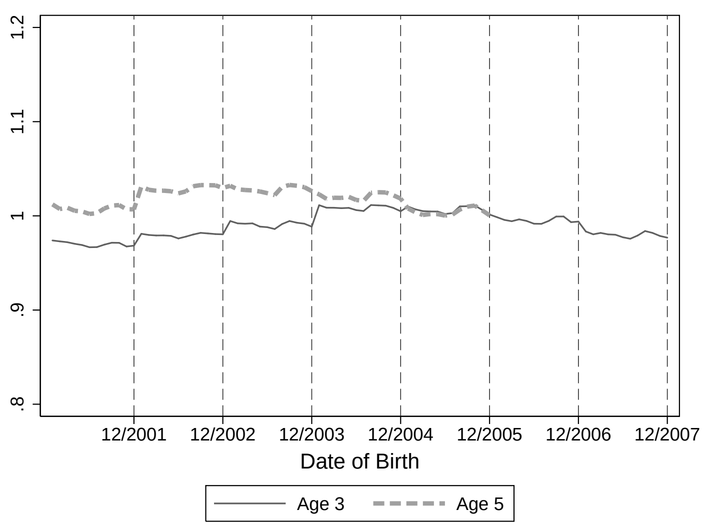
Each line shows the ratio of month-specific counts of newborns appearing in tax return data to corresponding month-specific counts from Vital Statistics data.

Figure 4: Ratio of Income-Specific Tax Counts to Total Vital Statistics Counts



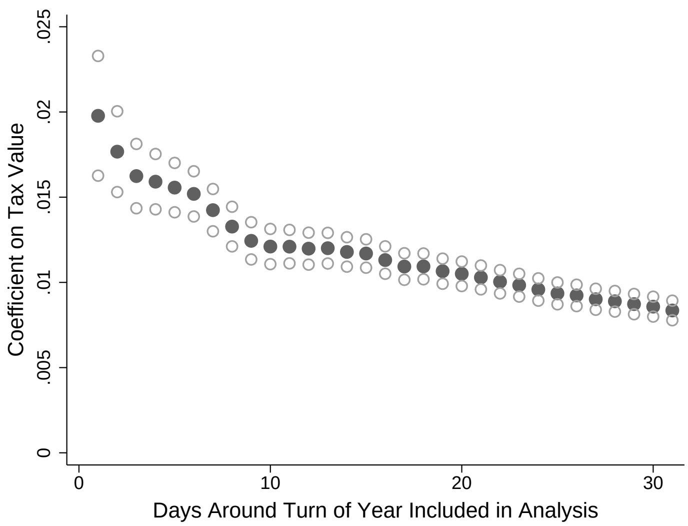
Each line shows the ratio of the number of newborns claimed by parents in a particular AGI category to the corresponding month-specific count of all births appearing in Vital Statistics.

Figure 5: Ratio of Tax-Based Counts of Older Children to Vital Statistics Counts from Corresponding Month of Birth



Each line shows, by month of birth, the ratio of the number of children in a particular age group and claimed on tax returns to the number of births recorded in Vital Statistics data three or five years earlier.

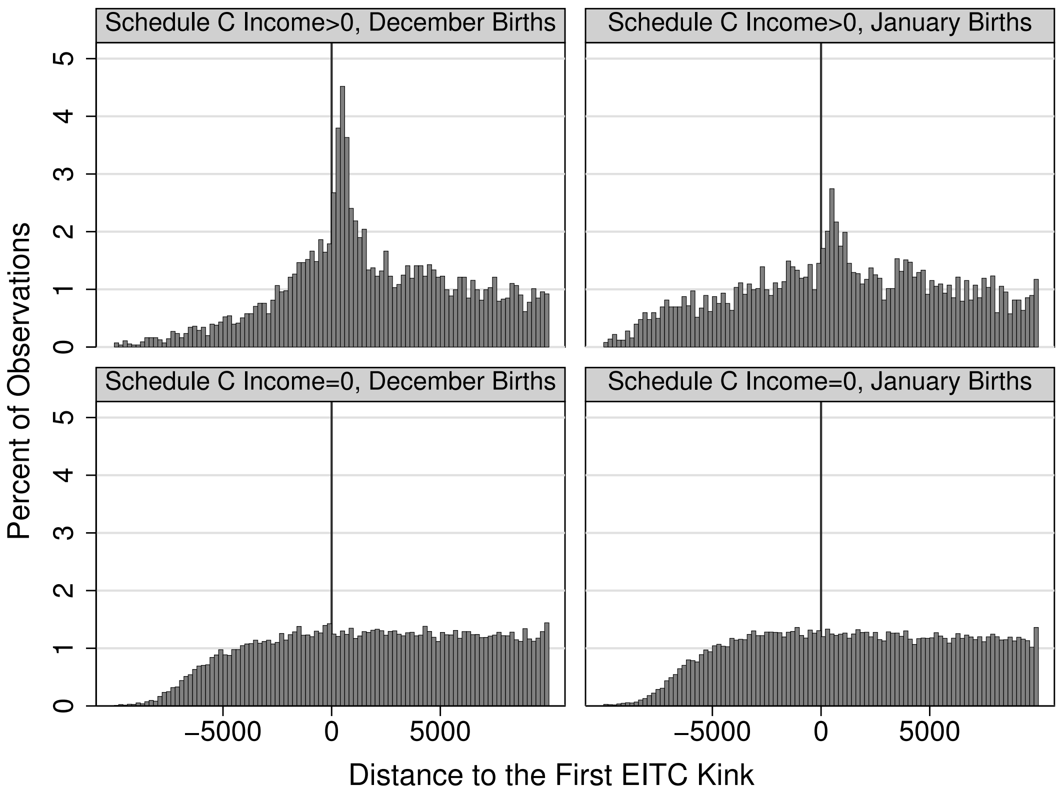
Figure 6: Coefficient on Tax Value, by Days Included in Sample



Each solid circle represents the coefficient on *TaxSavings* from a linear probability model predicting December birth. The hollow circles show 95% confidence intervals. The number of birth dates included in the regression gradually increases from births at most one day from the turn of the year on the left-hand side of the figure (that is, December 31 and January 1 births only) to births up to 31 days from the turn of the year on the right-hand side of the figure (that is, all births occurring in the months of December and January).

Figure 7: Distribution of Distance Between Income and First EITC Kink by Self-Employment and Birth Month: Filers For Whom Birth is First Child

(a) Distribution By Month and Schedule C Status



(b) Difference in Distribution Across Months for Schedule C Filers

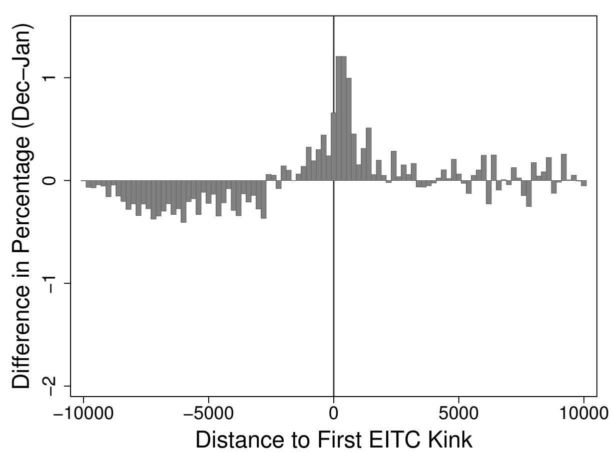
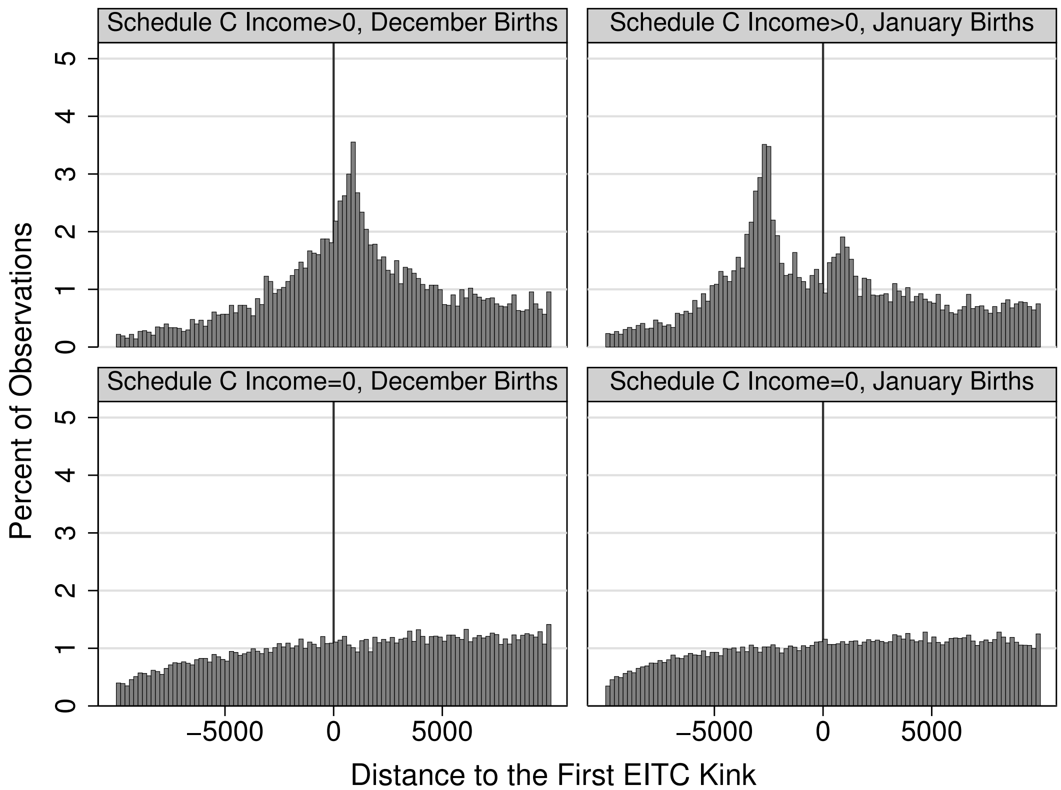


Figure (a) plots the distribution of the difference between earned income in year t and the minimum amount of earned income that would maximize the EITC receipt for the filer had the child been born in that year.

Figure 8: Distribution of Distance Between Income and First EITC Kink by Self-Employment and Birth Month: Filers For Whom Birth is Second Child

(a) Distribution By Month and Schedule C Status



(b) Difference in Distribution Across Months for Schedule C Filers

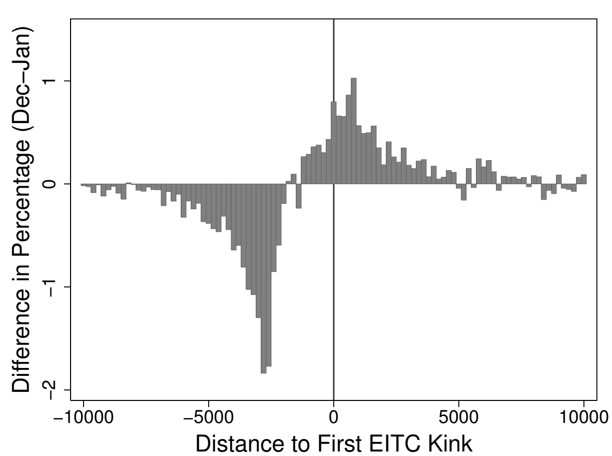
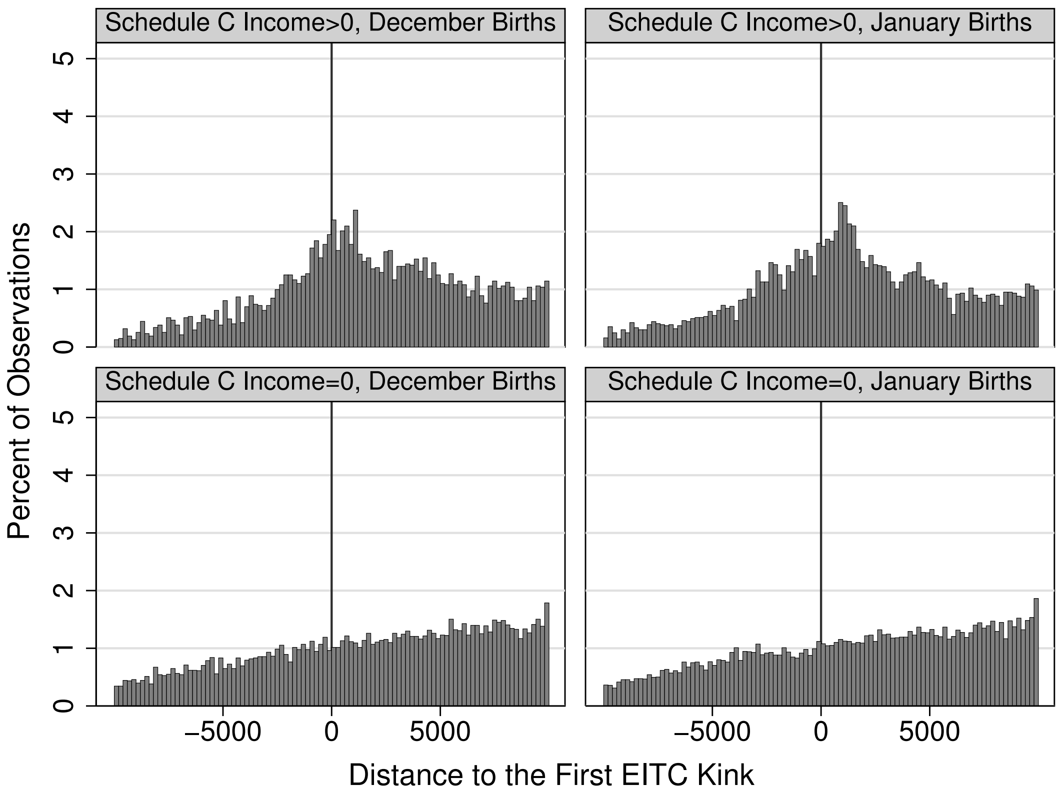


Figure (a) plots the distribution of the difference between earned income in year t and the minimum amount of earned income that would maximize the EITC receipt for the filer had the child been born in that year.

Figure 9: Distribution of Distance Between Income and First EITC Kink by Self-Employment and Birth Month: Filers For Whom Birth is Third Child

(a) Distribution By Month and Schedule C Status



(b) Difference in Distribution Across Months for Schedule C Filers

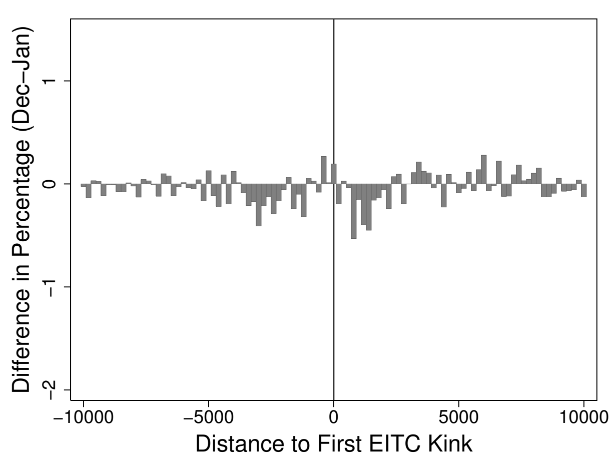


Figure (a) plots the distribution of the difference between earned income in year t and the minimum amount of earned income that would maximize the EITC receipt for the filer had the child been born in that year.

Table 1: Descriptive Statistics

	Full Sample	December Births	January Births
Tax value	1760.30	1779.44	1741.59*
	(1004.05)	(985.41)	(1021.59)
AGI	68461.64	69517.56	67429.52*
	(341,486)	(350,824)	(332,102)
Mother has wages>0	76.1	76.8	75.4*
	(42.7)	(42.2)	(43.1)
Mother's wages	21417.64	21846.88	20998.08*
	(34897.43)	(36148.69)	(33624.16)
First child	40.1	39.9	40.2*
	(49.0)	(49.0)	(49.0)
Second child	37.6	37.8	37.4*
	(48.4)	(48.5)	(48.4)
Third child	16.5	16.5	16.6
	(37.1)	(37.1)	(37.2)
Fourth child	5.3	5.3	5.3
	(22.3)	(22.3)	(22.3)
Fifth or greater child	0.6	0.6	0.7*
	(7.9)	(7.6)	(8.3)
Married	74.2	74.3	74.1
	(43.7)	(43.7)	(43.8)
Mother's age	29.4	29.5	29.3*
	(6.4)	(6.3)	(6.5)
Child is male	51.1	51.1	51.1
	(50.0)	(50.0)	(50.0)
Urban	81.4	81.6	81.3*
	(38.9)	(38.8)	(39.0)
Observations	819,850	405,252	414,598

A star in the last column indicates that the means for December and January births are significantly different at the 5% level. For January births, characteristics are measured in the tax year prior to the birth.

Table 2: Percentage of Filers Claiming Any Schedule C Income by Birth Month and EITC Eligibility

	December Births	January Births	Sample Size
Filers in EITC Phase-in or Plateau	19.1%	16.3%	113,559
Other Filers	18.5%	17.9%	706,291
All Filers	18.5%	17.6%	819,850

Differences across birth months are statistically significant at the 1% level for all three samples.

Table 3: Predicting December Birth, OLS Results

	No Controls	Closest to DCC	Alternative Specifications				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tax Value	0.0094***	0.0131***	0.0155***	0.0154***	0.0156***	0.0177***	0.0159***
(in $1000s)	(0.0006)	(0.0006)	(0.0006)	(0.0007)	(0.0006)	(0.0007)	(0.0009)
Mom's Wages,		0.00015***	-0.0001***	-0.0001***	-0.0001***	$-9.98{\cdot}10^{-5}$***	-0.0001***
$(t-1)$		$(1.95{\cdot}10^{-5})$	$(2.61{\cdot}10^{-5})$	$(2.63{\cdot}10^{-5})$	$(2.62{\cdot}10^{-5})$	$(2.53{\cdot}10^{-5})$	$(2.80{\cdot}10^{-5})$
Married		0.0054***	-0.0425***	-0.0458***	-0.0425***	-0.0372***	
		(0.0013)	(0.0017)	(0.0018)	(0.0017)	(0.0017)	
1st or 2nd Kid		-0.0053***					
		(0.0015)					
First Kid			-0.0191***	-0.0201***	-0.0192***	-0.0251***	
			(0.0068)	(0.0070)	(0.0068)	(0.0068)	
Second Kid			-0.0121*	-0.0121*	-0.0122*	-0.0159**	
			(0.0067)	(0.0069)	(0.0067)	(0.0067)	
Urban		0.0027**	-0.0020		-0.0021	-0.0049***	-0.0051***
		(0.0014)	(0.0015)		(0.0015)	(0.0014)	(0.0014)
AGI		$2.87{\cdot}10^{-6}$					
		$(1.70{\cdot}10^{-6})$					
Mother's Age		0.0013***					
		$(9.29{\cdot}10^{-5})$					
Year Dummies		Yes	Yes	Yes	Yes	Yes	
Mom's Age Dummies			Yes	Yes	Yes	Yes	
5-Piece Spline in AGI			Yes	Yes	Yes		
State Dummies			Yes		Yes		
Zip Code Dummies				Yes			
State Year Interactions					Yes		
Flexible AGI Controls						Yes	Yes
Interact Income with Married, Kids							Yes
N	819,850	819,850	819,850	819,850	819,850	819,850	819,850
R^2	0.0001	0.001	0.006	0.046	0.006	0.005	0.006

Each column shows the result of a linear probability model predicting December birth. Columns 3 though 8 also include dummies for third- and fourth-order births.

Table 4: Using Variation in C-Section Rates

	(1)	(2)
Tax Value (in $1000s)	0.0155***	-2.33 $\cdot 10^{-6}$
	(0.0006)	(0.0042)
C-Section Rate	-0.0001	-0.0012
	(0.0010)	(0.0010)
TaxValue · C-Section Rate		0.0005***
		(0.0001)
Mom's Wages, $(t-1)$	-0.0001***	-0.0001***
	($2.61 \cdot 10^{-5}$)	($2.61 \cdot 10^{-5}$)
Married	-0.0425***	-0.0425***
	(0.0017)	(0.0017)
First Kid	-0.0191***	-0.0182***
	(0.0068)	(0.0068)
Second Kid	-0.0121*	-0.0113*
	(0.0067)	(0.0067)
Third Kid	-0.0076	-0.0079
	(0.0067)	(0.0067)
Fourth Kid	-0.0018	-0.0013
	(0.0070)	(0.0070)
Urban	-0.0020	-0.0020
	(0.0015)	(0.0015)
Year Dummies	Yes	Yes
Mom's Age Dummies	Yes	Yes
5-Piece Spline in AGI	Yes	Yes
N	819,850	819,850

The table shows results of linear probability models predicting December birth.

Table 5: Results for Other Samples of Late December and Early January Births

	Higher-Order Births	AGI>100K	Joint in Both Years	No Change in Joint Status
	(1)	(2)	(3)	(4)
Tax Value	0.0215***	0.0256***	0.0087***	0.0189***
(in $1000s)	(0.0010)	(0.0021)	(0.0010)	(0.0007)
Mom's Wages,	$1.21\cdot10^{-5}$	$6.45\cdot10^{-5}$***	$-7.31\cdot10^{-5}$***	-0.0001***
$(t-1)$	$(2.14\cdot10^{-5})$	$(1.92\cdot10^{-5})$	$(2.40\cdot10^{-5})$	$(2.97\cdot10^{-5})$
Married	-0.0070***	-0.0022		-0.0780***
	(0.0022)	(0.0160)		(0.0018)
First Kid		-0.0315	-0.0580***	-0.0502***
		(0.0263)	(0.0077)	(0.0070)
Second Kid	-0.0098	-0.0476*	-0.0120	-0.0251***
	(0.0068)	(0.0262)	(0.0076)	(0.0070)
Third Kid	-0.0058	-0.0471*	-0.0070	-0.0139**
	(0.0068)	(0.0263)	(0.0076)	(0.0070)
Fourth Kid	-0.0011	-0.0280	-0.0017	-0.0041
	(0.0070)	(0.0268)	(0.0079)	(0.0073)
Urban	-0.0026	0.0018	-0.0086***	-0.0059***
	(0.0018)	(0.0053)	(0.0018)	(0.0015)
Year Dummies	Yes	Yes	Yes	Yes
Mom's Age Dummies	Yes	Yes	Yes	Yes
5-Piece Spline in AGI	Yes	Yes	Yes	Yes
N	491,493	139,824	552,833	762,304

The table shows results of linear probability models predicting December birth.

Table 6: *TaxValue* Coefficients, Alternative Samples

	No Controls	Closest to DCC	Alternative Specifications				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Baseline	0.009***	0.013***	0.016***	0.015***	0.016***	0.018***	0.016***
	(0.0006)	(0.0006)	(0.0006)	(0.0007)	(0.0006)	(0.0007)	(0.0009)
Placebo: Early Dec	0.004***	0.005***	0.005***	0.005***	0.005***	0.007***	0.007***
and Late Jan	(0.0005)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0007)	(0.0008)
Baseline - Placebo	0.005	0.008	0.010	0.010	0.010	0.011	0.008
No Schedule C	0.006***	0.009***	0.011***	0.011***	0.011***	0.013***	0.007***
	(0.0006)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0008)	(0.0010)
Placebo	0.001*	0.001**	0.001**	0.001*	0.001**	0.002***	-0.001
No Schedule C	(0.0006)	(0.0006)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0009)
Year Dummies		Yes	Yes	Yes	Yes	Yes	
Mom's Age Dummies			Yes	Yes	Yes	Yes	
5-Piece Spline in AGI			Yes	Yes	Yes		
State Dummies			Yes		Yes		
Zip Code Dummies				Yes			
State Year Interactions					Yes		
Flexible AGI Controls						Yes	Yes
Interact Income with Married, Kids							Yes

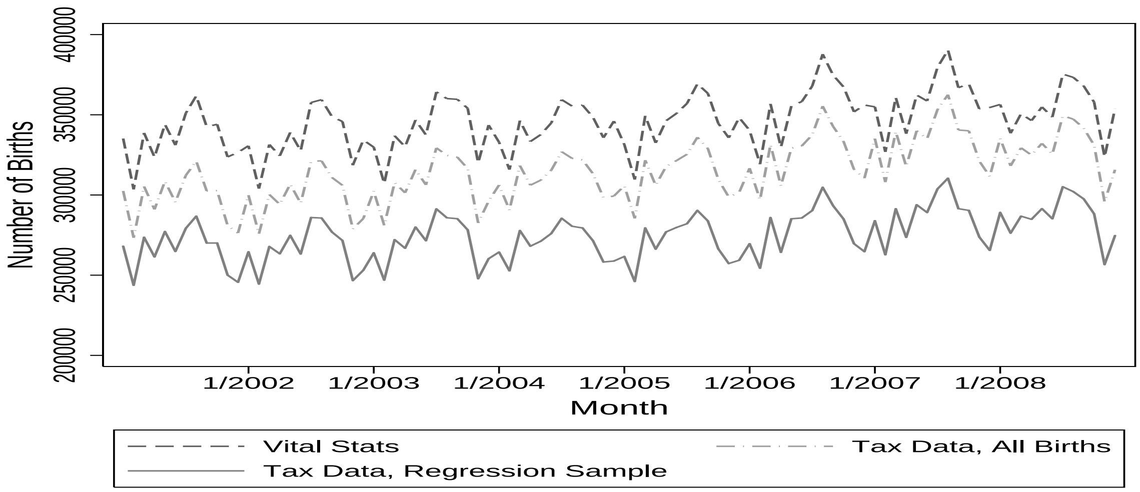
Each coefficient estimate (standard error in parentheses) shows the coefficient on the tax value (in $1,000) in a linear probability model with a dummy for a December birth on the left-hand side. The first row replicates the first row of results from table 3, our baseline (N=819,850). The second row estimates the same set of regressions the sample of births that take place in the *first* week of December and *last* week of January (N=884,200). The third row is the difference in coefficient between the first two rows. The fourth row is our baseline sample (last week of December and first week of January), but the sample is restricted to returns that do not have any schedule C income (N=671,618). The last row is our placebo sample, restricted to those with no schedule C income (N=725,207).

Table 7: Predicting Weekday Birth, OLS Results

	No Controls	Baseline Controls
	(1)	(2)
Tax Value (in \$1000s)	-0.0063***	0.0008
	(0.0006)	(0.0007)
Mom's Wages, $(t-1)$		$-1.53{\cdot}10^{-5}$
		$(1.77{\cdot}10^{-5})$
Married		0.0011
		(0.0019)
First Kid		-0.0232***
		(0.0077)
Second Kid		0.0085
		(0.0076)
Third Kid		0.0119
		(0.0077)
Fourth Kid		-0.0004
		(0.0079)
Urban		-0.0224***
		(0.0015)
Year Dummies		Yes
Mom's Age Dummies		Yes
5-Piece Spline in AGI		Yes
N	435,977	435,977

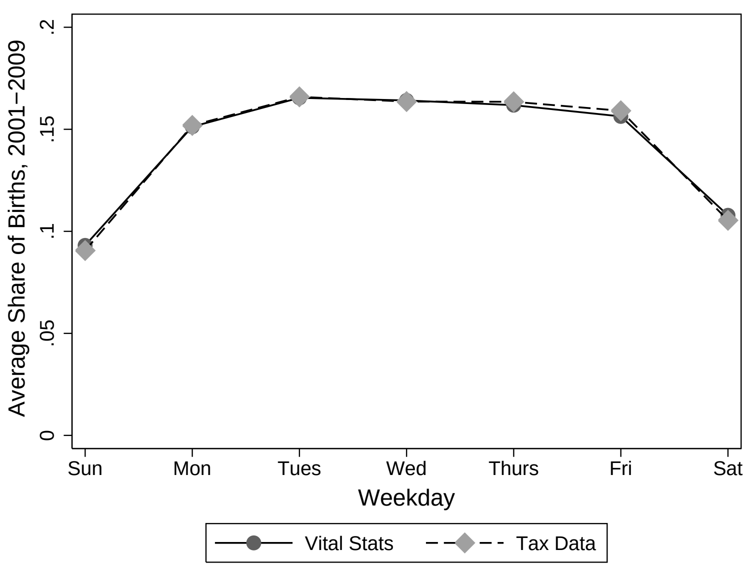
The table shows results of linear probability models predicting birth on a weekday, Monday through Friday. The sample is births occurring in the first week of December, as observed on returns filed for tax years 2001 through 2009.

Figure A1: Birth Counts by Month and Year



The Vital Statistics line is based on births to U.S. residents occurring in calendar years 2001 through 2009. The middle line shows counts of all newborns appearing in the tax return database. The bottom line shows counts of newborns once we impose all sample restrictions, other than having a December or January birth month.

Figure A2: Share of Births by Day of Week



This figure is based on births occurring only in the months of December and January. The pattern is very similar when all birth months are included.

Table A1: Predicting December Birth, Logit Results

	No Controls	Closest to DCC	Alternative Specifications				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tax Value	0.0094***	0.0132***	0.0155***		0.0156***	0.0177***	0.0160***
(in $1000s)	(0.0006)	(0.0006)	(0.0006)		(0.0006)	(0.0007)	(0.0009)
Mom's Wages,		0.00017***	-0.0001***		-0.0001***	-0.0001******	-0.0001***
$(t-1)$		$(2.13\cdot10^{-5})$	$(2.71\cdot10^{-5})$		$(2.71\cdot10^{-5})$	$(2.72\cdot10^{-5})$	$(2.92\cdot10^{-5})$
Married		0.0054***	-0.0428***		-0.0428***	-0.0375***	
		(0.0013)	(0.0017)		(0.0017)	(0.0017)	
1st or 2nd Kid		-0.0056***					
		(0.0015)					
First Kid			-0.0189***		-0.0190***	-0.0250***	
			(0.0068)		(0.0068)	(0.0068)	
Second Kid			-0.0120*		-0.0121*	-0.0159**	
			(0.0067)		(0.0067)	(0.0068)	
Urban		0.0026*	-0.0020		-0.0021	-0.0049***	-0.0051***
		(0.0014)	(0.0015)		(0.0015)	(0.0014)	(0.0014)
AGI		$3.15\cdot10^{-6}$					
		$(2.07\cdot10^{-6})$					
Mother's Age		0.0013***					
		$(9.33\cdot10^{-5})$					
Year Dummies		Yes	Yes	Yes	Yes	Yes	
Mom's Age Dummies			Yes	Yes	Yes	Yes	
5-Piece Spline in AGI			Yes	Yes	Yes		
State Dummies			Yes		Yes		
Zip Code Dummies				Yes			
State Year Interactions					Yes		
Flexible AGI Controls						Yes	Yes
Interact Income with Married, Kids							Yes
N	819,850	819,850	819,850	819,850	819,850	819,850	819,850

Each column shows the result of a logit model predicting December birth. Columns 4 though 8 also include dummies for third- and fourth-order births.