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Bargaining Over Labor: Do Patients Have Any Power?

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ABSTRACT

Bargaining Over Labor: Do Patients Have Any Power?*

We provide a new method of identifying the level of relative bargaining power in bilateral negotiations using exogenous variation in the degree of conflict between parties. Using daily births data, we study negotiations over birth timing. In doing so, we exploit the fact that fewer children are born on the "inauspicious" dates of February 29 and April 1; most likely, we argue, reflecting parental preferences. When these inauspicious dates abut a weekend, this creates a potential conflict between avoiding the inauspicious date (the parents' likely preference), and avoiding the weekend (the doctor's likely preference). Using daily births data, we estimate how often this conflict is resolved in favor of the physician. We show how this provides an estimate of how bargaining power is distributed between patients and physicians.

JEL Classification: I11, J13

Keywords: timing of births, weekend effect, bargaining power

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1. Introduction

Bargaining theory – most notably Nash bargaining – has seen a resurgent application in policy work. In labor, family, and health economics, applied analyses use the Nash bargaining solution as the basis for evaluating policy outcomes. Invariably, however, researchers are forced to make assumptions regarding the distribution of bargaining power between agents so as to derive quantitative predictions of the consequences of various policy interventions.[1] However to date, there are few, if any, direct approaches that can empirically validate whether a particular assumption about relative bargaining power is reasonable or not.

Of course, researchers have utilized approaches that are either laboratory-based or more indirect calibrations. For example, by studying protocols such as the ultimatum game, economists have gained insights regarding whether agents engage in strategies consistent with subgame perfection or find it more difficult to separate themselves from a wider social context.[2] As Samuelson (2005) argues, an issue which arises in the study of bargaining under carefully designed protocols is whether experiments are truly testing the theory or some more basic assumptions regarding behavior.

In other approaches, the data required to make inferences about bargaining power parameters is more onerous. Sieg (2000) examines medical malpractice disputes using a detailed dataset on settlement outcome and is able to parameterize a particular extensive-

[1] For example, see Pezzin and Steinberg Schone (1999) on informal caregiving, Maude-Griffin, Feldman and Wholey (2004) on bargaining with HMOs, and Stevenson and Wolfers (2006) on marriage and divorce laws.

[2] The classic study was by Guth, Schmittberger and Schwarze (1982) and has been replicated and enriched by many others. See Samuelson (2005) for a review.

form game. Yashiv (2003) examines labor market outcomes and infers key bargaining power parameters from detailed aggregate data. Flinn (2006) uses detailed data about firm profit information and other labor market variables to calibrate bargaining power in a matching model. However, each of these approaches requires access to detailed information on both the outcome and the distribution of surplus from negotiations.

The purpose of this paper is to propose a method by which information on the distribution of bargaining power can be extracted from data based *solely on the outcomes of bilateral negotiations*. The identification method uses a source of exogenous variation in *the degree of conflict* between two parties in a negotiation. Combining this with bargaining outcomes, we can identify the share of the surplus each party will receive on average. The idea is that - in some situations - both, one or the other, or neither party will be indifferent as to a particular outcome. That variation will allow us to determine whether other sources of variation as distinct from variation in preferences are driving observed agreements. Importantly, in utilizing this, we rely on Nash bargaining theory in its axiomatic form rather than any well-defined protocol of offer and acceptance.[3] Consequently, we generate an estimate of bargaining power free of issues associated with the structure of negotiating environments, as this is something we do not observe.

The context we apply this method to is doctor-patient negotiations with regard to birth timing decisions. This is an application of independent policy interest in health economics. It is generally thought that physicians have power to determine patient

[3] The axiomatic nature of Nash bargaining means that the underlying theory motivating our empirical identification strategy is independent of strong behavioural assumptions common in some applications of bargaining theory using non-cooperative game theory. Specifically, it requires that agents have a utility function and that they act to find Pareto improving deals. However, the only key assumptions – as discussed below – are that doctors have a modest preference for weekday deliveries while patients are indifferent as to the day of the week but have modest preferences for avoid certain days of the year.

treatment (in all its facets) for medical reasons and that these take precedence over non-medical motivations for treatment. This issue has emerged in relation to elective cesarean procedures and choices of these over vaginal birth with official pronouncements discouraging this choice for non-medical or convenience purposes.[4] However, there is also evidence that the timing of births themselves may be somewhat motivated by non-medical factors (Dickert-Conlin and Chandra, 1999; Lo, 2003; Gans and Leigh, 2009). This has called into question the degree of physician power in driving treatment decisions.[5]

From a bargaining perspective, the difficulty with previous studies of birth timing is that they identify reasons why patients might impact on scheduling, but at the same time do not offer any reason why physicians might object to these changes in birth timing. The shifting that occurred was based on individual tax incentives (Dickert-Conlin and Chandra, 1999; Gans and Leigh, 2009; Tamm, 2009; Neugart and Ohlsson, 2009) or cultural factors (Lo, 2003) which are both considerations that are likely to have been regarded as irrelevant by physicians. Absent any conflict, it should not be surprising that patient preferences might be taken into account. As such, these studies do not provide conclusive evidence of patient power (relative to their physicians) as they do not necessarily identify situations in which patient and doctor preferences come into conflict.

In this paper, we propose a test of the relative bargaining power of physicians and patients over birth timing. Our approach is as follows. First, we begin with the well-

[4] See, for example, ACOG, 1999 and NIH, 2006.

[5] To be clear, we have in mind situations in which patients' preferences conflict with those of doctors. We distinguish these from circumstances where the patient has a preference, and the doctor is largely indifferent. In most discussions between doctors and patients, the costs and benefits of the decision are borne almost entirely by the patient. What makes weekend births somewhat unusual (compared with other medical decisions) is that the patient is impinging upon the doctor's leisure time, without the doctor receiving any additional remuneration for working on the weekend.

studied notion of a ‘weekend effect’ in birth timing; that is, as elective birth procedures (elective cesareans and induction procedures) have become more widespread, fewer such births are scheduled for weekends than for weekdays. This is consistent with physicians’ preferring to enjoy their leisure time on weekends, to take advantage of complementarity in leisure consumption with their friends and family.

Second, we identify days of the year whereby patient preferences might be strong for non-medical reasons. We identify April 1 and February 29 as generating systematically fewer births. There appears to be no medical reason for this, and hence think it is likely that this represents a pure patient preference to avoid inauspicious dates.

Finally, we identify situations where patient preferences for avoiding inauspicious dates and physician preferences for avoiding weekends coincide. When these inauspicious dates occur on a Monday or Friday (abutting a weekend), patients may have a stronger preference for a weekend birth. Heterogeneity in these dates across years allows us to estimate the effect of increased conflict on the birth timing outcome; in particular, whether physician or patient preferences ‘win out.’ This provides us with an estimate of the relative power of physicians over patients in bargaining over labor.

Using daily births data, we apply our test. We find that when there is a conflict, it is resolved in favor of the inauspicious weekday about three-quarters of the time. This suggests that while physicians have greater relative power, it is not absolute and patient preferences can drive birth timing decisions for non-medical reasons. But significantly, we demonstrate how this can be interpreted as an estimate of the average Nash bargaining power parameter for such negotiations in the population.

The remainder of this paper is structured as follows. In Section 2, we review the available medical evidence on how technology can affect birth timing, and the economic literature on the factors that affect the timing of births. In Section 3, we show the trends in weekend births and identify inauspicious days. In Section 4, we present estimates of the relative bargaining power of doctors and patients. The final section concludes.

2. Medical and Economic Evidence on Birth Timing

The Science of Birth Timing

From a medical standpoint, there are three main ways in which the timing of birth can be affected. First, induction of labor can be performed, with the aim of achieving delivery before the time that it would naturally have occurred. This involves stimulating the uterus (eg. with cervically-applied prostaglandin, or an injection of synthetic oxytocin). Induction is typically performed in cases where the fetus is judged to be becoming too large, or the pregnancy is post-term (ie. 43 weeks or longer). Gans and Leigh (2008) estimate that the induction rate in Australia has risen from 20 percent in 1981 to 25 percent in 2005.

The second means of affecting birth timing is by performing a cesarean section. Cesarean sections are classified as elective (due to anticipated risks or maternal request), or emergency (due to birth complications). Gans and Leigh (2008) estimate that the cesarean section rate has risen from 12 percent in 1981 to 30 percent in 2005.[6] Of those

[6] Note that induction and cesarean section are not mutually exclusive. Gans and Leigh (2008) note that in 5 percent of cases, induction of labor was performed unsuccessfully, and the baby was ultimately delivered by cesarean section.

cesarean section procedures carried out in 2005, 59 percent were elective and 41 percent were emergency (Laws et al. 2007).

The third means of affecting birth timing is by administering drugs that delay birth (eg. tocolytic agents). This is typically done in cases where the fetus is pre-term (a pregnancy of 37 weeks or less). Such drugs typically only delay birth by a day or two, but this can provide time to transfer the mother to a more advanced hospital, or assemble an appropriately skilled medical team. Delaying birth in this manner is generally thought to be rare, though we have been unable to find statistics on its prevalence.

We expect that the use of medications that delay birth is unlikely to have more than a trivial impact on the overall distribution of births in Australia. However, this does not mean that births can only be brought forward. Doctors and patients frequently have discretion on when to schedule an induction or cesarean section, and it is perfectly possible that non-medical factors can bring these dates forward or backwards.

Evidence on Physicians' and Parents' Preferences

In our analysis, we make two key assumptions: that physicians prefer not to work on weekends (but parents are indifferent about a weekend or weekday birth), and that parents prefer not to have a child born on an inauspicious date (but physicians are indifferent about auspicious and inauspicious dates). We now turn to the evidence supporting these assumptions.

Several studies provide evidence about physicians' preference to deliver babies on regular working days. To begin, there is the simple empirical fact that in countries where weekends are traditional holidays, the number of births occurring on Saturdays and Sundays is significantly lower than on other days of the week. This pattern has been clearly demonstrated for several countries, including the US (Chandra et al., 2004), Germany (Neugart and Ohlsson, 2009) and Australia (Gans and Leigh, 2008). Studying Israel, where Saturday is a holiday but Sunday is a working day, Cohen (1983) found fewer births on Saturdays, but more births on Sundays. It has also been noted that major public holidays tend to coincide with a significant drop in the birth rate (see eg. Cohen, 1983; Chandra et al., 2004; Gans and Leigh, 2008). In addition, it has been shown that the number of births declines during annual obstetricians' conferences in Australia and the United States (Gans, Leigh and Varganova, 2007).

Additional evidence on physicians' preferences also comes from studies that have looked at the number of births at different times of the day. Brown (1996) shows that the rate of unplanned cesarean section births rises sharply from 3pm to 9pm on Fridays, and attributes the 'Friday rush hour' effect to physicians' demand for leisure. Similarly, Spetz et al. (2001) find an increase in the probability of cesarean section procedures during the evening hours, when the leisure incentive is more likely to impact on obstetricians' decision-making.[7]

What evidence do we have about parents' aversion to inauspicious dates? Using a single year (1998) of birth data from Taiwan, Lo (2003) demonstrates that Chinese preferences over certain dates significantly impacted upon birth timing, with cesarean section births being particularly affected. Focusing on the discontinuous incentive created by the US child tax credit, Dickert-Conlin and Chandra (1999) demonstrate the shifting of births from the first week of January to the last week of December. Analyzing the introduction of the Australian 'Baby Bonus', Gans and Leigh (2009) find that it led births

[7] It is also plausible that doctors avoid weekend births for altruistic reasons: because they believe that weekend births are causally more dangerous. This would not affect doctors' incentives, but it would change the interpretation of our results.

to be delayed in order that parents could receive the bonus. Looking at a similar birth payment in Germany (the Elterngeld), Tamm (2009) and Neugart and Ohlsson (2009) find that a significant number of births were postponed so that parents were eligible for the payment. Since these tax credits and government payments did not affect physicians' remuneration, each of these studies assume that the change in birth timing was due to parents' preferences.

Possible Biases

In this sub-section, we have presented evidence that physicians prefer not to deliver babies on weekends and parents prefer not to have their children born on inauspicious dates. However, if our aim is to estimate a bargaining parameter, it must also be the case that parents are indifferent about weekday and weekend births, and doctors are indifferent between normal and inauspicious dates. As with all null proofs, this is a difficult standard to meet.

In the case of parents, our impression is that few have strong preferences between weekdays and weekends. Although there is evidence that infant mortality rates are higher on weekends, it is unclear whether this is due to selection or because weekends are causally more dangerous.[8] Regardless, our anecdotal impression is that parents do not perceive weekend births to be more dangerous.

In the case of physicians, our impression is that superstitious beliefs are rare.[9] Commonsense suggests that an obstetrician who refused to deliver babies on inauspicious dates would be regarded as an oddity by peers and hospital managers alike. Health

[8] See for example MacFarlane (1978); Mangold (1981); Hendry (1981); Mathers (1983); Dowding et. al. (1987); Gould et. al. (2003); Luo et. al. (2004); Hamilton and Restrepo (2006); Hong et. al. (2007).
[9] We have been unable to identify any datasets that would allow us to look at the prevalence of birth complications on inauspicious dates.

researchers who have looked at the influence of superstitions on patient care almost invariably adopt the standpoint that obstetricians do not believe in lucky and unlucky days (see eg. O'Reilly and Stevenson, 2000).[10]

However, it is also useful to note the direction of the bias in the case that the foregoing assumptions are incorrect. If parents are averse to weekend births, this will bias downwards our estimate of parents' bargaining power. If doctors are averse to inauspicious dates, this will bias upwards our estimate of parents' bargaining power.

3. Weekend Births and Inauspicious Days

To analyze births patterns, we use daily birth count data from the Australian Bureau of Statistics, covering the period 1975 to 2005. Our decision to study Australia was guided by the fact that we were only able to obtain daily births data for two countries – Australia and the United States.[11] However, because our empirical strategy relies on the interaction between inauspicious dates and weekends, it is necessary that a large share of births be moved off inauspicious dates. In Australia, approximately 10 percent of births are moved off the inauspicious dates of February 29 and April 1. By contrast, only about 3 percent of births are moved off these dates in the United States. Consequently, the United States 'inauspicious day' effects are too small for us to obtain precise estimates of

[10] Admittedly, it is possible to come up with reasons such as avoiding computer date difficulties (on February 29) or practical jokes (April 1). These effects are likely to be small relative to patient preferences.
[11] Other jurisdictions only provide monthly data that cannot identify the margin of negotiations we study here.

bargaining parameters (which are derived from looking at the interaction between inauspicious dates and weekends).[12]

Our identification strategy relies on having daily births data over a large number of years. Consequently, we are unable to break our data down by birth procedure (cesarean section, induction, etc.), since those more detailed data are only available on a daily basis for very recent years. This would not matter if the underlying daily birth count was uniform (ie. if the number of births per day was constant but for weekend and inauspicious date effects). However, in practice, it is likely that many other factors cause the daily birth count to fluctuate from day to day. Such factors might include randomness in the timing of conception, or extreme weather shocks that affect birth timing.[13] To the extent that these fluctuations are large, we expect that they will attenuate estimates of weekend births and inauspicious date effects towards zero.

In Australia, the birth rate has declined over recent decades, while the population has risen. As a result, the number of births has risen only modestly (from 232,682 births in 1975 to 258,187 in 2005). We therefore opt to focus on the raw number of births, rather than on the birth rate (births/population). This has the added advantage that we do not introduce noise into our series through mis-measurement of the total population, which is only available on a monthly basis.

Before introducing our methodology to estimate physician-parent bargaining power, it is useful to document patterns in weekend births in our dataset and establish the validity of the inauspicious days we have identified.

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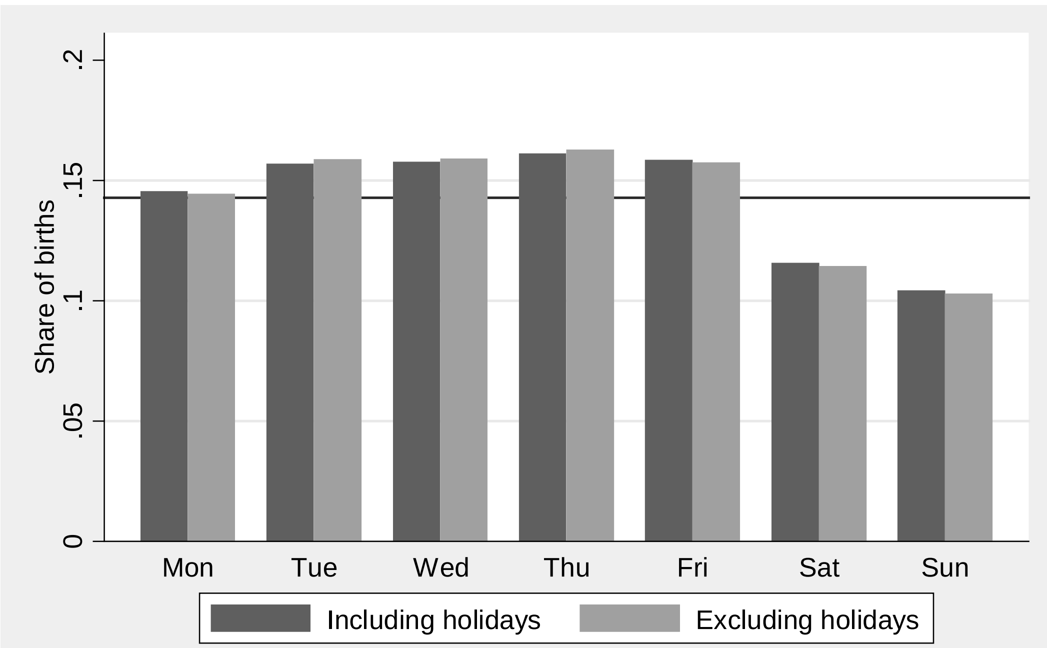
[12] This could be an indication of a lack of patient power even on days when no conflict arises but it could also indicate less power in a patient's preference. Hence, our focus is on Australia where the power of that preference is demonstrated.

[13] On the impact of weather conditions on birth timing, see Driscoll (1995); Yackerson, Piura and Sheiner (2008).

Weekend Births

To begin, we outline the patterns of weekend births. Figure 1 shows the distribution of births across the week. Under a uniform distribution (shown by the solid line), 14 percent of babies would be born on each day of the week. The actual data show that around 16 percent of births occur each weekday, but only 11 percent occur each weekend day. (All differences in birth rates by day are highly statistically significant.) Excluding public holidays makes no substantive difference to the analysis. In Table 1, we show birth counts by day of week for the full period 1975-2005.

Figure 1: Distribution of Births Over the Week



Data source is Australian births from 1975 to 2005.
Horizontal line denotes the distribution in the absence of a weekend effect
Holidays are those uniformly observed in Australia: New Year's Day, Australia Day, Anzac Day, Good Friday, Easter Monday, Christmas Day, and Boxing Day.

Table 1: Birth counts by day of the week (excluding holidays)

	Minimum	Maximum	Mean	Median
Mon	463	864	691.20	696

Tue	509	903	742.61	748
Wed	500	940	744.87	749
Thu	566	1005	762.27	766
Fri	508	928	752.27	755
Sat	414	701	546.72	548
Sun	375	619	492.30	490
Weekday	463	1005	738.79	743
Weekend	375	701	519.53	519
Total	375	1005	676.71	710

Note: Data source is Australian births from 1975 to 2005. Holidays are those uniformly observed in Australia: New Year's Day, Australia Day, Anzac Day, Good Friday, Easter Monday, Christmas Day, and Boxing Day.

The 'weekend effect' has grown larger over time. In 1975, 22 percent fewer births occurred on weekends than would be expected from a uniform distribution. In 2005, 31 percent fewer births occurred on weekends than an even distribution would predict. Formal tests confirm that the weekend effect has grown significantly larger over time, and we discuss these trends in more detail in Gans and Leigh (2008).[14] The magnitude of the Australian weekend effect is similar to Chandra et al. (2004), who found that the weekend effect in the US widened from -10 percent in 1973 to -25 percent in 1999.[15]

Inauspicious Days

We turn now to the issue of parent preferences in birth timing. To identify this, we hypothesize that parents may have preferences over auspicious or inauspicious dates.

[14] A spate of studies has analyzed the question of whether weekend births are more dangerous (see for example MacFarlane, 1978; 1979; Mangold, 1981; Hendry, 1981; Mathers, 1983; Dowding et al., 1987; Gould et al., 2003; Luo et al., 2004; Hong et al., 2007). The majority of these papers find that while the infant mortality rate is higher on weekends, this does not necessarily mean that it is more dangerous for a given child to be born on a weekend. Controlling for risk factors such as birth weight and maternal age, the mortality gap narrows significantly, implying that births which are moved from weekends to weekdays are disproportionately healthy.

[15] Indeed, we cannot reject that the share of births moved off weekends has followed precisely the same trajectory in both countries over time. In Australia in 1999, 25 percent of births that would have occurred on a weekend (if distributed uniformly throughout the week) were moved onto a weekday. Omitting public holidays, the share of would-be weekend births moved to a weekday was 24 percent.

In Appendix 1, we show our estimates of birth patterns on 12 possible dates. From these, we selected two – February 29 and April Fool's Day (April 1). Our rationale for selecting this pair of dates is threefold. First, we find a highly significant fall in births on these dates. Second, it seems highly likely that the fall is driven by parent preferences rather than physician preferences. And third, these dates fall on different days of the week, allowing us to see how they interact with weekends.

It is not difficult to envisage why parents might avoid having their child born on February 29 or April 1. Since February 29 only occurs every four years, people born on that date must celebrate their birthday on another date in non-leap years. Parents might therefore think that their child would be better off not being born on February 29. April 1 is an 'inauspicious' date, since parents might worry (perhaps irrationally) that having 'the fool's birthday' has the potential to stigmatize the child at school and in later life.

Since births are likely to be 'moved' only a small number of days, parental aversion to having their child born on February 29 and April 1 is likely to lead to an increase in the number of births on the days before and after. In the case of February 29, one would expect this to lead to an increase in the number of births on February 28 and March 1 in leap years. Likewise, parental aversion for an April 1 birthday is likely to lead to an increase in the number of births on March 31 and April 2.

As discussed in Section 2, we can think of few reasons why physicians (or maternity hospitals) should be averse to delivering babies on either February 29 or April 1. Holding constant the day of the week, doctors (like other employees), should be indifferent between working on these dates and on the dates immediately preceding and following them.

To test the extent to which parents are averse to having their child born on inauspicious dates, we estimate the following regressions, using daily births data for Australia from 1975-2005, and restricting the sample to the potentially inauspicious day, the day before, and the day after. Formally, we run the regression:

$$Births_t = \beta I_t^{\sim Inauspicious} + I_t^{DayOfWeek} + I_t^{Year} + \varepsilon_t \qquad (1)$$

where $I^{\sim Inauspicious}$ is an indicator variable denoting that the date precedes or follows an 'inauspicious' date. In the case of February 29, the variable $I^{\sim Inauspicious}$ equals 0 on February 29, and 1 for the day before and the day afterwards (in leap years only). In the case of April 1, the variable $I^{\sim Inauspicious}$ is an indicator equaling 0 for April 1, and 1 for the day before and the day afterwards. The variables $I^{DayOfWeek}$ and I^{Year} are indicators for the day of the week (taking account of the regular weekly births cycle) and the calendar year (capturing other factors that cause the birth rate to change from year to year).

It is useful for our strategy to define the indicator variable as *Not February 29*, and *Not April 1* (rather than *February 29* and *April 1*). To the extent that parents dislike inauspicious dates, then these beta coefficients will be positive, as births will be shifted off these two inauspicious dates, and onto the adjoining days. (Our results are fairly similar if we estimate the regressions using a longer window – for example if we compare births one week before and after the inauspicious date instead of one day before and afterwards.)

For February 29, we use births data from February 28 to March 1 on all leap years. For April 1, we use births data from March 31 to April 2 in all years. To avoid confounding effects of the Easter holidays, we drop from our analysis the Easter holiday period (Good Friday to Easter Monday).

Table 2 shows the results of estimating these regressions. We present two different specifications, expressing the dependent variable in levels and logs. In each case, we find effects that are statistically and substantively significant, as well as being quite consistent across specifications. Between 71 and 73 births are moved off these inauspicious dates, which is equivalent to 10−11 percent of all babies who would have been born on those dates.

Table 2: Do Parents Avoid Inauspicious Dates?

	(1)	(2)
Panel A: Dependent variable is number of births		
Not Feb 29	73.023***	
	[12.510]	
Not April 1		70.856***
		[10.640]
Observations	24	79
R-squared	0.97	0.934
Panel B: Dependent variable is log(number of births)		
Not Feb 29	0.111***	
	[0.018]	
Not April 1		0.100***
		[0.014]
Observations	24	79
R-squared	0.976	0.954

Notes: Standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. All specifications include day of week fixed effects and year fixed effects. Feb 29 sample is February 28 to March 1 on leap years. April 1 sample is March 31 to April 2 in all years (excluding Easter holidays).

Has the share of births that are shifted off February 29 and April 1 grown over time? To test this, we interact the *Not Feb 29* and *Not April 1* terms with a linear year term (results not shown). We find that the 'Not Feb 29' effect has grown by about 0.2 percentage points per year, while the 'Not April 1' effect has increased by about 0.1 percentage points per year.

4. Estimating Bargaining Power

We are now in a position to describe and implement our methodology for measuring physician-patient relative bargaining power. We first utilize a simple bargaining model to motivate our approach. We then describe our estimation strategy before presenting our results.

Bargaining model

While not all birth timing can be planned, we assume here that negotiations over timing take place. This is for exposition of the theoretical model. In the empirical analysis below, no such presumption is made and statistical results must be achieved without being able to sort the data along these lines. A richer model might incorporate the institutional structure of birth timing. However, since our empirical analysis is confined to countries where timing is more commonplace, we omit such complications here.

In this simple model, we suppose that a single doctor and a single patient are negotiating over one of two days upon which to have a birth. We assume that the marginal benefit that the patient has for day 1 (a weekend) over day 2 (a potentially inauspicious day) is Δ_P while the doctor's marginal preference is $-\Delta_D$. We assume that $\Delta_D \geq 0$. With probability *p*, $\Delta_P > 0$; otherwise $\Delta_P \leq 0$. Thus, with probability (1- *p*) there is no conflict and day 2 is chosen.[16]

If there is a conflict then the patient and doctor bargain over days 1 and 2. We utilize the Nash bargaining solution (Nash, 1950) assuming that instead of engaging in explicit payments, the doctor and patient agree to a randomization rule; that is, they negotiate over the choice of *p* which is the probability that the birth takes place on day 1 (the patient's preferred day). Let $\alpha \in [0,1]$ be a measure of the patient's bargaining

[16] Each of these parameters is specific to individual patient-doctor negotiations but we drop any subscript for notational simplicity. Recall from Section 2 that we make four assumptions: (a) doctors prefer weekday births to weekend births; (b) patients are indifferent between weekday and weekend births; (c) patients dislike inauspicious dates; and (d) doctors are indifferent between regular dates and inauspicious dates. For simplicity, we model these preferences by focusing on the choice between a weekend date (which we assume the doctor dislikes) and an inauspicious date (which we assume the patient dislikes). In Section 2, we discuss the direction of the bias in our empirical analysis if the indifference assumptions (b) and (d) do not hold.

power. Then, the doctor and patient solve: $\max_p (p\Delta_P)^\alpha ((1-p)\Delta_D)^{1-\alpha}$. This yields the first order condition:

$$\begin{aligned}&\alpha p^{\alpha-1}(1-p)^{1-\alpha}\Delta_P{}^\alpha \Delta_D{}^{1-\alpha} = p^\alpha (1-\alpha)(1-p)^{-\alpha}\Delta_P{}^\alpha \Delta_D{}^{1-\alpha}\\ &\Rightarrow \alpha(1-p) = (1-\alpha)p \Rightarrow \alpha - \alpha p = p - \alpha p\\ &\Rightarrow p^* = \alpha\end{aligned} \tag{2}$$

Thus, by measuring *p* (the probability that a patient 'wins' conditional on there being a conflict) we have an estimate of the patient's bargaining power. We can also test whether this is significantly different from 0.[17]

Estimation Procedure

To estimate the strength of relative patient bargaining power, we proceed on the assumption that the effects observed in Table 2 reflect only parental preferences, and focus on a particular scenario: instances in which our inauspicious dates (February 29 and April 1) happen to fall on a Friday or Monday. Such instances provide a natural experiment that allows us to compare the bargaining power of doctors and patients when there is a conflict. We utilize the incidence of these inauspicious dates falling on a weekday as a measure of (1-*p*), the probability that there is no conflict.

We now estimate the following regression:

$$Births_t = \beta I_t^{\sim Inauspicious} + \gamma\left(I_t^{\sim Inauspicious} \times I_t^{Weekend}\right) + I_t^{DayOfWeek} + I_t^{Year} + \varepsilon_t \tag{3}$$

[17] This model is simplified because we effectively normalize the utility a doctor or patient has for their non-preferred days to 0. If instead, the patient's and doctor's utilities from having the birth on day 2 were u_P and u_D respectively, then $p^* = \max\left[\alpha \frac{U_D}{\Delta_D} - \frac{u_P}{\Delta_P}, 0\right]$. Notice then that even if $\alpha = 0$, then it still may be the case that births are shifted from inauspicious days to weekends if $\Delta_P < 0$; that is, patients also prefer not to have babies on weekends. In practice, we believe that it is unlikely that patients will prefer weekday births, since a weekend birth will generally involve shorter travel times to the hospital and lower foregone earnings for the father, but will not affect the size of the medical bill.

In this equation, the variable $I^{Weekend}$ is an indicator that equals 1 for Saturdays and Sundays, and 0 for Monday through Friday. β represents the extent to which births are shifted onto the day before and after an inauspicious date. γ represents the differential effect when these dates fall on a weekend. Since the regression includes day of week fixed effects, it is unnecessary to include a separate weekend indicator, and since we are only looking at a single 3-day period each year, it is unnecessary to also include month indicators. Thus, $\beta+\gamma$ is the number of births shifted off inauspicious dates if that date occurs on a weekend.

Given this, our estimate of *p*, being the probability that the patient wins if there is a conflict, is as follows:

$$p = 1 - (probability\ patient\ loses\ on\ an\ inauspicious\ Friday\ or\ Monday)$$

$$= 1 - \frac{\beta-(\beta+\gamma)}{\beta} = 1 + \frac{\gamma}{\beta} \qquad (4)$$

Intuitively, if 100 births are shifted when April 2 is a weekday (β = 100), and only 25 births are shifted when April 2 is a weekend (γ = -75), then the probability of not shifting the date when April 2 is a weekend - assuming that they would have shifted if it was a weekday - must be 75%. Thus, the probability that the patient loses is $-\gamma/\beta$ while the probability that the patient wins is $1+\gamma/\beta$.

Results

The results of this estimation are shown in Table 3. In all specifications, the coefficients on *Not Feb 29* and *Not April 1* are larger than in Table 2, indicating that parents' propensity to shift births off inauspicious dates is larger on weekdays. However, the interaction terms are large and negative, indicating that parents are much less able to shift births off 'inauspicious dates' when the adjoining date is a weekend. The interaction term is negative and statistically significant in all specifications.

If we regard β (the coefficient on *Not Feb 29* and *Not April 1*) as reflecting parent preferences, and γ (the coefficient on *Not Feb 29*×*Weekend* and *Not April 1*×*Weekend*) as reflecting doctor preferences, then we can estimate the relative bargaining strength of each side as $-\gamma/\beta$. These estimates are shown in the second-last row of each panel. These estimates range from 61% to 91%, suggesting that when the preferences of doctors conflict with the preferences of patients, the issue is resolved in favor of the doctor approximately three-quarters of the time.

In the last row of each panel, we test the hypothesis that doctors have 100 percent of the power (formally, a one-tailed test of the hypothesis that $-\gamma/\beta = 1$). For the February 29 specifications, the p-values are less than 0.1, indicating that we can reject (at the 10% level or better) the hypothesis that doctors have all the power. For April 1 specifications, we cannot reject this hypothesis at standard levels of statistical significance. These results suggest that doctors do not have all the power to choose the timing of births.

We have also explored the way in which doctor and parent power has changed over time, by interacting both the β and γ terms with a linear time trend. In each of our four specifications, the results suggest that both weekend effects and inauspicious date effects have grown larger in magnitude over time (statistically significant in most specifications). The increase in both coefficients is similar, suggesting that the doctor power share has not changed substantially over time (results available on request).

Table 3: Parents Versus Doctors

	(1)	(2)
Panel A: Dependent variable is number of births		
Not Feb 29	97.655***	
	[9.566]	
Not Feb 29×Weekend	-72.310***	
	[17.475]	
Not April 1		97.438***
		[10.892]
Not April 1×Weekend		-88.388***
		[20.729]
Observations	24	79
R-squared	0.990	0.955
Implied doctor power share (-γ/β)	74%	91%
F-Test that doctor power share is 100% (P-value)	0.056	0.300
Panel B: Dependent variable is log(number of births)		
Not Feb 29	0.140***	
	[0.018]	
Not Feb 29×Weekend	-0.085**	
	[0.033]	
Not April 1		0.131***
		[0.015]
Not April 1×Weekend		-0.105***
		[0.028]
Observations	24	79
R-squared	0.987	0.966
Implied doctor power share ($-\gamma/\beta$)	61%	80%
F-Test that doctor power share is 100% (P-value)	0.041	0.131

Notes: Standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. All specifications include day of week fixed effects and year fixed effects. Feb 29 sample is February 28 to March 1 on leap years. April 1 sample is March 31 to April 2 in all years. F-tests are against the null hypothesis that $-\gamma/\beta=1$. We use a one-tailed test, on the assumption that doctors' power share cannot exceed 100%.

5. Conclusion

At some point in their lives, many people will find themselves in conflict with their physician over the manner or timing of their treatment. Yet there exists surprisingly little quantitative evidence of the relative power balance in such situations. Our analysis focuses on a particular conflict – occasions when parents and physicians bargain over the timing of births. By exploiting the fact that parents are averse to having their child born on February 29 and April 1, we test what happens when parents' desire to avoid an inauspicious birthdate conflicts with doctors' desire to avoid working on a weekend.

Our results suggest that the physician-patient negotiations are tipped in favor of the physician, but allow us to reject the hypothesis that doctors have all the power in this particular context. Indeed, the fact that patients 'win' at all is significant as it suggests that physicians' preferences may not necessarily drive all medical decisions.

One potential reason for the power imbalance is the fact that weekend births are costlier for hospitals and disliked by physicians – yet the amount that patients or their insurers pay is typically the same on weekdays and weekends. Indeed, while most of the babies in our sample were delivered in public hospitals, even parents in the private system are generally unable to pay more to secure a weekend birth. A healthcare pricing system that enabled hospitals to impose differential costs on parents for weekday or weekend births would have the potential to increase the wellbeing of doctors and patients alike.

A limitation of our analysis here is that we have only considered a single population of economic transactions and so have generated one point estimate of average bargaining power.[18] While this yields some insight into those negotiations, it would be interesting to find contexts where a distribution of bargaining power estimates could be generated so as to determine what factors might drive relative bargaining power and understand what creates an imbalance in power. Nonetheless, we believe that by utilizing

[18] As one referee noted, births are more routine than many medical procedures. Consequently, it is possible that patients' power share might be lower in other settings.

variation in the degree of conflict as we have done here, researchers will be able to estimate bargaining power in richer environments and, in the future, discover those factors which drive distributional variables.

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Appendix 1: Testing Auspicious and Inauspicious Dates

To test the extent of auspicious and inauspicious dates on births, we use daily birth count data to analyze the impact of other dates. We excluded from our analysis dates that are designated as nationwide public holidays, since it is quite likely that public holidays will have an independent effect on the birth rate.

Our dates are of two types – those that fall on different days of the week, depending on the year, and those that always fall on the same day of the week.

Dates that fall on different days of the week:

- Chinese New Year
- Valentine's Day (February 14)
- Leap Year (February 29)
- April Fool's Day (April 1)
- May Day (May 1)
- Halloween (October 31)
- Remembrance Day (November 11)

Dates that fall on a consistent day of the week:

- Mother's Day (2nd Sunday in May)
- Father's Day (1st Sunday in September)
- Melbourne Cup Day (1st Tuesday in November)
- Friday 13th
- Federal Election dates (the election date is chosen by the governing party, but elections are always held on a Saturday)

Our identification strategy differs for these two types of dates. For the first set of dates, we compare the number of births on the day immediately before and the day immediately after, in a regression with day of week fixed effects. For example, our February 14 effect is identified from a dummy variable equal to 1 on February 14, and 0 on February 13 and 15.

For the second set of dates, we compare the number of births on the day with the number of births on the same day the previous and following weeks. For example, our Mother's Day effect is identified from a dummy equal to 1 on Mother's Day, and 0 on the Sunday a week before Mother's Day and the Sunday a week after Mother's Day. We estimate equation (1), shown in the body of the paper. The results for February 29 and April 1 are identical to those shown in Table 2, and are re-presented here merely for ease of comparison.

In all cases, we estimate the effect using two dependent variables: the raw birth rate and the log of the birth rate.

The results are shown in Appendix Table 1. In addition to February 29 and April 1, we find statistically significant effects for Valentine's Day, Friday 13, Election Day, and Melbourne Cup Day.

However, we take the view that these other dates are unsuitable for our analysis, since they may affect doctors' preferences as well as patients' preferences. Australian obstetricians may prefer to stay home to watch the Melbourne Cup; may prefer to be working rather than sitting home alone on Valentine's Day; and may feel that since they must cast their ballot on election day (voting is compulsory in Australia), they might as well be at work. In the case of Friday 13th, this date is not suited to our empirical approach, which relies on exploiting the fact that the inauspicious dates of February 29 and April 1 fall on different days of the week.

We therefore restrict our analysis to just two inauspicious dates: February 29 and April 1.

Appendix Table 1: Auspicious and Inauspicious Dates

Panel A: Dates that fall on different days of the week (dep var is births)

	Chinese NY	**Feb 14**	**Feb 29**	**April 1**	**May 1**	**Oct 31**	**Nov 11**
(In)auspicious date dummy	-6.541	19.273***	-73.023***	-70.856***	8.405	-3.577	-3.936
	[7.608]	[7.210]	[12.510]	[10.640]	[6.477]	[6.658]	[6.367]
Observations	93	93	24	79	93	93	93
R-squared	0.941	0.943	0.97	0.934	0.956	0.961	0.957

Panel B: Dates that fall on a consistent day of the week (dep var is births)

	Mother's Day	**Father's Day**	**Melbourne Cup**	**Friday 13th**	**Federal Elections**
(In)auspicious date dummy	6.968	0.258	-34.468***	-55.192***	15.375*
	[5.153]	[5.553]	[6.152]	[7.816]	[7.652]
Observations	93	93	93	156	36
R-squared	0.735	0.748	0.779	0.568	0.836

Panel C: Dates that fall on different days of the week (dep var is log births)

	Chinese NY	**Feb 14**	**Feb 29**	**April 1**	**May 1**	**Oct 31**	**Nov 11**
(In)auspicious date dummy	-0.013	0.029**	-0.111***	-0.100***	0.012	-0.006	-0.008
	[0.011]	[0.011]	[0.018]	[0.014]	[0.009]	[0.010]	[0.010]
Observations	93	93	24	79	93	93	93
R-squared	0.947	0.944	0.976	0.954	0.963	0.969	0.961

Panel D: Dates that fall on a consistent day of the week (dep var is log births)

	Mother's Day	**Father's Day**	**Melbourne Cup**	**Friday 13th**	**Federal Elections**
(In)auspicious date dummy	0.013	0.002	-0.048***	-0.077***	0.028*
	[0.010]	[0.011]	[0.008]	[0.011]	[0.015]
Observations	93	93	93	156	36
R-squared	0.732	0.745	0.785	0.554	0.829

Notes: Standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. Sample for Panels A and C is the (in)auspicious date, plus the day before and after. Sample for Panels B and D is the (in)auspicious date, plus the same day of the week one week before and after. All specifications are estimated from an OLS regression, including day of week fixed effects and year fixed effects.