Women's Political Voice and Maternal Mortality

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Abstract

Societies with higher levels of gender inequality are slower and less likely to address women-specific health outcomes. In this paper we document that giving political voice to women is an under-appreciated way to reduce rates of death in childbirth. Using historical data from the United States and contemporary data from across the world we show how key events leading to increases in women's political representation have reduced rates of maternal mortality. First, we exploit variation in the proportion of female candidates in parliament resulting from the passage of quota laws reserving parliamentary seats for women. We show that these quota laws bring about sharp increases in the level of women in parliament and a concomitant drop in maternal mortality rates. We then examine the extension of the franchise to women in 20th century United States. Crossing this natural experiment with the arrival of Sulfa drugs (the first antibiotics), we demonstrate that maternal mortality fell much faster in the states that gave early suffrage to women compared to states which only gave suffrage to women much later when obligated by national law. In both cases we find evidence to suggest that increasing participation of women in national politics results in greater investments in, and uptake of, technologies recognised to reduce maternal deaths.

JEL codes: I14, I15, O15.
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1 Introduction

Maternal mortality, defined as death of women within 42 days of childbirth, is a leading public health issue in the developing world (Ceschia and Horton, 2016). Despite significant reductions over the last 25 years, the Maternal Mortality ratio (MMR) still remains shockingly high, at around 800 deaths a day. In 2013 alone, around 289,000 women died due to pregnancy or childbirth-related complications (WHO, 2014). Almost all these deaths (99%) are concentrated in developing countries. The United Nations Sustainable Development Goals (SDG) include a target of reducing MMR to less than 70 deaths per 100,000 live births by 2030, a goal that translates to a 7.2% reduction per annum (United Nations, 2015). The maternal mortality decline of 44% during 1990-2015, although impressive, fell short of the Millennium Development Goal (MDG) which targeted a 75% reduction. Despite failures to meet the MDG targets, the SDGs have laid down even more ambitious goals, underlining the importance of identifying new interventions that work.

We argue that empowering women politically may be a powerful, low-cost intervention to improve maternal health and reduce maternal mortality. We first hypothesize that if women politicians reflect the preferences of women citizens (Chattopadhyay and Duflo, 2004; Taylor-Robinson and Heath, 2003), then raising the share of women in government may shift policy priorities and hence policy investments in favour of otherwise neglected investments in maternal health. We test this by examining the effect of recent variation in the proportion of female candidates in national level legislature resulting from the passage of quota laws reserving parliamentary seats. We show that these quota laws bring about sharp, plausibly exogenous increases in the level of women in parliament in certain countries, with resulting reductions in rates of maternal mortality in those countries. We document that these reductions are the result of key policy decisions, including increased investments in birth attendance and antenatal care, which have been identified by the World Health Organisation as levers to reduce cases of maternal death.

We then examine historical data on voting and mortality from United States. The first two decades of the 20^{th} century saw a considerable extension in state-by-state women's suffrage laws, culminating in the ratification of the Nineteenth Amendment to the Consistution in 1920, extending the franchise to women nation-wide. Crossing the extension of the vote

to women with another natural experiments in the United States, we show how commitment to gender equality – as measured by political rights – determine the take-up and application of new technologies of particular salience to women. Specifically, we assess whether early adoption of women's political rights in the United States led to greater adoption and use of sulfonamide antibiotics. The exogenous arrival of sulfonamide drugs in the 1930s had immediate and large effects on rates of infant and maternal mortality (Jayachandran et al., 2010; Bhalotra and Venkataramani, 2014). We examine the effect of the arrival of this drug in early and late suffrage states. We find that with the arrival of the Sulfa drugs, MMR fell a lot faster in the early suffrage states compared to the late suffrage states.

For identification we rely on both a traditional differences-in-differences (DiD) regression framework and an event study approach. The DiD framework allows us to capture all country (or state in the case of the US sample) and year-specific factors as well as observable changes in potential confounding variables within countries/states over time. In particular in the cross country sample, we consistently control for income (GDP) and an indicator of the quality of institutionalized democracy. Importantly, we estimate an augmented equation including leads (i.e. maternal mortality rates in a series of years preceding the introduction of the quota). This event study approach allows us to test an essential premise of the DiD approach, which is that there were no significant pre-trends in the outcome. If, for instance, maternal mortality was already declining more rapidly in countries that introduced gender quotas, then it would be harder to attribute the post-quota decline to the quota.

We find that reservation of a share of seats for women resulted in an increase in the share of women in parliament of around 5 percentage points and a faster MMR decline of 8.3 to 10.4%. Crude estimates suggest that a similar 10% decline in MMR would require a 20% increase in GDP. With a view to identifying mechanisms driving our findings, we estimated whether gender quotas led to increases in antenatal care and skilled birth attendance. These are interventions that the WHO recommends universal access to and that are associated with MMR reduction. We found that the passage of gender quotas is associated with a statistically significant increase of 6.81 percentage points in birth attendance, and a more imprecisely estimated 4.71 percentage point increase in antenatal care.[1] To address concerns that world-wide

[1]There may be other mechanisms at play too, for instance, women politicians may also raise women's agency (Beaman et al., 2012), which may positively impact maternal health (Shen and Williamson, 1999). See also Ashraf et al. (2014) who show how women are more likely to use contraception, if they are able to conceal their decision

conditional panel estimates may suffer from important omitted variables, we run placebo tests using male mortality over the fertile age range. In this case we find little evidence to suggest that quotas have any significant effect on male mortality.

In considering a historical and well documented change in health technologies in USA, along with the heterogeniety in suffrage adoption by different states in the US, we document—using both event study and traditional difference-in-differences estimators—that reductions in gender neutral infant mortality after the arrival of sulfa drugs occurred in equal proportions in both late and early suffrage states. However, when considering women-specific health (MMR), sharp discrepencies arise. Those states which were early adopters of suffrage had larger immediate declines, and steeper declines over time in maternal mortality than those states which were later to adopt suffrage. Early adopters experience an 8.5% larger drop in MMR immediately upon introduction of antibiotics. The difference widens by 1.5% in each subsequent year. We find no such difference for pneumonia mortality rates which acts as a placebo given that it affects both genders (and indeed, affects boys slightly more than girls).

This paper contributes to several strands of the literature. First, this work suggests a direct policy contribution *viz* the Sustainable Development Goals (SDG). In particular, we suggest a new policy tool that works at scale to directly address SDG 3.1 which aims to reduce the global MMR to less than 70 per 100,000 live births by 2030. We do so by making use of recently released, state of the art Bayesian estimates of annual MMR made available by the the United Nations Mortality Estimation Inter-Agency Group (MMEIG). These data have been hitherto under-exploited, particularly in the economics literature.

We also interact with the literature that investigates the phenomenon of "missing women" Sen (1990). Recent estimates from the World Development Report show that around 6 million women are missing in the world every year (Wong, 2012), of which 21 percent are in their reproductive years. In fact, "other than pre-birth and in early childhood, women are most likely to be missing relative to men in childbearing years" (Duflo, 2011).[2] This is in line with the findings of (Anderson and Ray, 2010, 2012) who establish that unlike previously believed, the bulk of the excess female mortality is not confined at birth, infancy and early childhood,

from their husbands.

[2]23 percent are never born, 10 percent are missing in early childhood, 21 percent in the reproductive years and 38 percent above the age of 60 (Duflo, 2011).

but occurs at older ages. The results of this paper suggest that empowering women politically may partially close the mortality in reproductive ages.

Our results contribute to a growing literature on the importance of women's political and economic agency in influencing a range of health outcomes including child mortality, intimate partner violence and increases in aspirations and educational investments among girls (Bhalotra and Clots-Figueras, 2014; Beaman et al., 2012; Clots-Figueras, 2012; Ferreira and Gyourko, 2014). We take this literature forward by providing new evidence that gender quotas work and can be leveraged to accelerate the decline in maternal mortality. Given recent evidence suggesting that replacing men with women in parliament incurs no direct economic cost (Baskaran et al., 2015), legislative gender quotas may be both a powerful and low-cost means to modifying public health priorities and improving maternal health. While in developed countries like the UK, MMR has been falling over the years, there is recent evidence that MMR is on the rise in the US (MacDorman et al., 2016), further highlighting the importance of policy levers in this area.

Female suffrage has been shown to have a range of effects on various socio-economic outcomes. For instance, Lott and Kenny (1999) show how suffrage led to increases in state government expenditures and revenue and more liberal voting patterns in both houses of the congress. Miller (2008), shows that the implementation of suffrage at the state level led to sharp increases in public health spending and decreases in child mortality. Suffrage has also been associated with large increases in educational attainment for children from economically disadvantaged backgrounds (Kose et al., 2016), and increases in education expenditures and the passing of public health initiatives like the Promotion of the Welfare and Hygiene of Maternity and Infancy Act, commonly referred to as the Sheppard-Towner Act passed in 1921 (Moehling and Thomasson, 2012). We are the first paper to show that suffrage led to specific benefits for female health outcomes in the form of more rapid declines in maternal mortality.

As noted in the 2015 Global Burden of Disease Study, there is enormous variation in levels and rates of decline in MMR across countries (Kassebaum et al., 2016). It is recognized that this variation may be driven by access to trained birth assistance, antenatal care, and family planning, as well as women's education and agency (Grépin and Klugman, 2013; Kruk et al., 2016; Bhalotra and Clarke, 2013). However there is more limited recognition of the relevance of the political economy of resource allocation.

The average MMR in low income countries in 2010 was estimated to be 452 deaths per 100,000 births, similar to the rates that prevailed in England and Wales in 1930 before the introduction of antibiotics.[3] This is pertinent given that 40-50% of maternal deaths are on account of post-partum puerperal sepsis which is treatable with antibiotics. Infant mortality, which is also largely determined by infectious disease, claimed policy attention much earlier and, apparently with more commitment.[4] The historical results in this paper suggest that *even when life-saving technologies are available to women*, these are not fully utilised when women have a muted voice in political decision-making. This finding may explain the sluggishness of MMR decline despite the increasing availability and reduction in costs of potentially life-saving technologies.

Given its impacts on social and economic outcomes maternal mortality is of intrinsic value. There is a broad consensus in the literature that improving population health has implications for economic growth primarily via improvements in life expectancy and human capital accumulation.[5] Some recent papers have particularly underscored the importance of female health on different economic outcomes including female literacy (human capital accumulation) and female labour force participation. Albanesi and Olivetti (2009, 2014) demonstrate that medical advances in healthcare in the US that led to a huge decline in maternal mortality and increased the female–male differential in life expectancy at age 20, led to higher female labour force participation, and important effects on women's educational attainment relative to men. Similarly, Jayachandran and Lleras-Muney (2008) demonstrate that increases in female life expectancy resulting from decreases in maternal mortality led to an increase in literacy rates (human capital accumulation) among girls relative to boys in Sri Lanka.[6] Reducing MMR has

[3] 452 per 100,000 is the average MMR for the 35 low income countries (World Bank classification). The MMR for England and Wales was 440, for Denmark it was 380 and for the US it was 673 in the year 1930 (Loudon, 1992).

[4] While infant mortality rates have been falling steadily in the last few decades, there is widespread perception in the literature that progress with MMR has been slow (and non-existent in some countries) till about the 1990s (see Hogan et al. (2010) and references therein.) In fact, international policy initiatives to reduce maternal mortality began as late as 1987 with the Safe Motherhood Initiative and international commitment towards maternal health was further strengthened by the 1994 International Conference on Population and Development in 1994 (Hogan et al., 2010). However, anemic progress in estimated figures led to the launch of the Every Woman Every Child initiative in 2010 and the creation of the Commission on Information and Accountability for Women's and Children's Health (Kassebaum et al., 2014).

[5] For example, see Weil (2005); Ashraf et al. (2008); Bloom et al. (2004); Shastry and Weil (2003); Lorentzen et al. (2008); Aghion et al. (2010). Acemoglu and Johnson (2006), however, find that exogenous improvement is life expectancy have only modest implications for growth.

[6] Duflo (2011) underscores the important interrelations between gender equality, health outcomes, and economic growth.

implications for the overall economy.

This paper is organized as follows. In section 2 we provide background on both the implementation of contemporaneous gender quotas, and the historical passage of suffrage for women. In section 3 we discuss data sources, including the newly available yearly measures of maternal mortality world-wide. In the first part of section 4 we show how reserved seats led to an increase in women in parliament and a concomitant decline in MMR, and in the second section document how an early adoption of female franchise led to more rapid declines in MMR in the US. Finally in section 5 we conclude.

2 Background

2.1 The Implementation of Quotas

We examine the effect of recent variation in the proportion of female candidates in national-level legislature resulting from the passage of quota laws reserving parliamentary seats. Since the early 1990s twenty countries—spanning Africa, the Middle East, and South and East Asia (see Appendix Figures A1 and A2 for temporal and geographical variation)—have implemented a quota which explicitly reserves seats in parliament for women, and constitutionally protect these laws. It has been argued that the timing of these quotas, as well as their size, owes in large part to the signing of the Beijing Platform for Action by all UN delegates at the Fourth World Conference on Women in 1995 (Inter-Parliamentary Union, 2015; Chen, 2010; Krook, 2009).[7]

The unanimous signing of the Beijing Declaration and Platform for Action in September of 1995 has been described as the "origins" of recent quota laws (Krook, 2009, p. 3), however various mediating factors have been described as determinats of the definition and take-up of these laws. The systematic review of Krook (2009) points to four frequently proposed explanations; women's movements, perceived advantages of adoption for political elites, evolving norms of equality and representation, and pressure from international organisations. Nonetheless,

[7]The Beijing Platform of Action, coming out of this UN conference explicitly set a 30% target for the participation of women in decision making, as well as much wider set of goals in its "agenda of women's empowerment (UN Women, 1995). This is reflected in gender quotas which are frequently set at 30% of seats.

these explanations are not universal, and are questioned in many cases, (Krook, 2009, pp. 25-26). Other authors have also suggested that as well as frequently following-on from the recommendations of international organisations, quota adoption often occurs when countries are in democratic transition or post-conflict reconstruction, or otherwise undertaking constitutional reform (Baines and Rubio-Marin, 2005).

In what follows, we test a number of potential explanations drawn from this literature, using data of adoption of quota laws reserving parliamentary seats for women. In table 1 we regress a variable indicating the passage of a quota law reserving seats for women in parliament on variables capturing or proxying the proposed explanations of quota adoption. We consider the importance of international organisations to a country using the size of overseas development assistance receipts (as a proportion of GDP), and the presence of peace-keepers in the country (as well as their first and second lags in alternative specifications). We proxy women's movements by examining changes in women's economic rights as coded in CIRI Human Rights Dataset (Cingranelli et al., 2013). Various political explanations including party effects, perceived benefits to elites or politicians in power, democratic innovation, or competition with competing parties are measured using the Database of Political Institutions (originally described in Beck et al. (2001)).

We observe some evidence in favour of the explanations of quota adoption across literatures. In particular, we observe that left wing rulers are more likely to adopt quotas (in line with the equality norms argument described bu Krook (2009)), and find some evidence that recent positive changes in women's rights, and countries recently (within the last 5 years) transitioning from autocratic to democratic regimes are more likely to adopt quota laws. We find that the presence of peace-keepers is higher in periods when quotas are adopted, providing partial support for the explanation that links with international organisations such as the UN are precursos for quota adoption. We return to these quota predictors in section 4 of this paper, where we discuss more comprehensively how this interacts with our empirical strategy aiming to identify the effects of quota adoption on (women's) outcomes.

2.2 Passage of Suffrage in the US

In this section we discuss the passage of suffrage in the US and highlight the factors that have been identified in the literature to explain the differences in the timing of suffrage adoption across states. Both Miller (2008) and Kose et al. (2016) provide detailed discussions on this issue and in this section we summarize some of the key points.

To start with there is a clear geographic pattern in the adoption of suffrage (See Figure 1). The states of Wyoming, Utah, Colorado, and Idaho, located in the so called "*wild west*" were the first states to give suffrage to women in the years 1869, 1870, 1893, and 1896, respectively. The reason for this spatial clustering of early suffrage states in the west has been attributed to the so called frontier conditions of the west by some historians. The harsh conditions of the wild west made it more difficult to sustain traditional gender roles (Brown, 1958; Grimes, 1967). Again others like Larson (1971) and Beeton (1986) have underscored the importance of idiosyncratic circumstances in each state for the passage of suffrage.

In general the quantitative literature has failed to identify robust correlates of suffrage (Cornwall et al., 2004), but there are two exceptions. The first is the share of women in non-agricultural occupations (King et al., 2005). And the second is the scarcity of women in these states, which might have reduced the political costs and risks for men, or suffrage might have also been a way to attract more women to these female scarce states (Braun and Kvasnicka, 2013). Other possible confounding legislation and factors from that period like regulations governing alimony and divorce, mother's pension, women's maximum hours, women's minimum wages, prohibition, worker's compensation, child labor, compulsory schooling, state literacy rate and manufacturing wages, have been ruled out by additional analysis undertaken by Miller (2008). Kose et al. (2016) on the other hand show that suffrage and the the generosity of New Deal spending were not correlated.

While the above discussion gives us more faith in the exogeneity of the passage of suffrage in the US states, the other key issue for our analysis is whether indeed the newly emancipated women exercised their right to vote post suffrage. The literature has found sharp rise in voter turnout following women's enfranchisement, to the tune of a 40% increase in voting among the adult population in both the gubernatorial elections (Lott and Kenny, 1999) and presidential

elections (Kose et al., 2016).[8]

2.3 Arrival of Sulfa Drugs

The arrival of the Sulfanomide drugs have been shown to reduce mortality rates in the US for several infectious diseases including puerperal sepsis (leading to maternal mortality), pneumonia and scarlet fever (Jayachandran et al., 2010). More pertinent to us is the fact that giving birth in a hospital only reduced MMR in the US once the sulfa drugs became widely available in 1937 (Thomasson and Treber, 2008).

While Jayachandran et al. (2010) provide a detailed description on the exogeneity in the arrival of the Sulfa drugs, in this section we provide a short discussion. The effectiveness of the compound sulfanomide was demonstrated to be effective against streptocci in the year 1932 by a German scientist called Gerhard Domagk. But the results were published only in 1935. However, the first major clinical trial involving sulfa drugs took place only in 1936 at Queen Charlotte's Hospital in England. This along with subsequent clinical trials in England and the rest of Europe established the effectiveness of Sulfa drugs. In the US while the Sulfa drugs were first used in 1935, it wasn't until 1936, when further testing established their effectiveness against scarlet fever and pneumonia. And Sulfa drugs received widespread press coverage and enthusiasm from pharmaceutical companies, only after a New York Times article in the December 1936, which reported that President Franklin D. Roosevelt's young son was cured of a deadly streptococcal infection. This led to the Sulfa drugs becaming widely known in the US. In the year 1937, the first large scale production and distribution of these drugs started and

[8] According to Miller (2008),

> "The most obvious pattern is geographic - all else equal, women in western states could vote before women elsewhere in America. Some historians suggest that frontier conditions were amenable to women's suffrage because women supported restrictions on common western vices (drunkenness, gambling, and prostitution) or because the harsh realities of frontier life made it impossible to maintain traditional gender roles (Brown, 1958; Grimes, 1967). Many others argue that idiosyncratic circumstances in each state resulted in the vote for women (Larson 1971; Beeton 1986), citing rich historical evidence in support of this view. Quantitative studies yield strikingly inconclusive results (Cornwall, Dahlin, King, and Schiffman 2004). The single robust correlate of suffrage law enactment emerging from these studies is the share of women working in non-agricultural occupations (King, Cornwall, and Dahlin 2005). Although this presumably reflects changing social norms about the role of women, it evolved very gradually over time (Smith and Ward 1985; Goldin 1990) and can be distinguished econometrically from abrupt year-to-year legislative changes governing women's right to vote."

they became widely available all through the US. Additional detail regarding the expansion and nature of the arrival of Sulfa drugs to the United States is available in Jayachandran et al. (2010) and Bhalotra and Venkataramani (2014).

3 Data

We construct two principal databases for the analyses in this paper. One based on recently constructed panel data by country from 1990 onwards, and another based on historical data from US states. In this section we briefly discuss each of these datasets in turn, describing the variables used, their sources, and their coverage. A more detailed description of how each variable is constructed is provided in Appendix C.

3.1 Cross Country Data

We collect data on the implementation of country-specific gender quotas reserving seats in parliament for women by aggregating data from a number of sources. We begin with the full list of quota laws described in Dahlerup (2005), and then update with any more recent law changes contained in the Global Database of Quotas for Women, a repository created and maintained by International IDEA, Inter-Parliamentary Union, and Stockholm University. This includes information on whether a country passed a parliamentary quota, the date of passage, and the share of seats set aside for women. We then merge this data to a comprehensive country-year panel on the share of women in parliament. We construct these measures by aggregating information from multiple sources, namely the World Development Indicators (WDI), the UN Millennium Development Goals (MDG) Indicators and the ICPSR dataset compiled by Paxton et al. (2008).

For maternal mortality we use estimates which have been recently made available from the United Nations Mortality Estimation Inter-Agency Group (MMEIG) and contain data for 25 years: 1990-2015, and 183 countries. These are widely considered the best MMR estimates to date, and were generated by combining data from vital statistics, special inquiries, surveillance sites, population-based household surveys (including Demographic Health Surveys, Multiple

Indicator Cluster Surveys, and Reproductive and Health Surveys), and census files. To our knowledge, this paper is the first to fully harness the power of recent extensions in coverage of these MMR data. These recently released data are widely considered the best MMR estimates to date, as they address known measurement difficulties in survey and vital statistics data on maternal mortality using Bayesian methods (Alkema et al., 2016, 2015). Prior to the release of these data in 2016, there were no annual MMR data available for such a comprehensive set of countries. Not surprisingly MMR is understudied.[9] The world distribution of average MMR for the period of 1990-2015 is represented in Figure A3.

When running a number of auxiliary tests described in more detail below, we require data on a range of time-varying controls, as well as intermediate outcomes and placebo outcomes. These variables are generally compiled from large cross-country databases like the World Bank Data Base, and at times have observations in only a subset of years. For example, when focusing on infant mortality by country and gender, we only observe measurements quinquennially from 1990 onwards. We provide full details of these additional variables in Appendix C, and full summary statistics for these and all variables are in appendix Table B1.

3.2 Historical US Data

Our measure of women's political rights derives from the history of women's suffrage. Nationally, suffrage was established in 1920, with the ratification of the 19th Amendment to the U.S. Constitution. The Suffrage data we use here is compiled by Miller (2008) and we have data on each of the 50 states and Washington D.C. Wyoming was the first state to give suffrage to women in the year 1869, followed by several other states in the following years and decades. 21 states (including DC) gave suffrage to women only in in the year 1920 as a result of the 19th amendment. Refer to the Figure 1 to see the passage of suffrage across the US states by year. We distinguish between those states which passed suffrage prior to the 19th amendment and those where suffrage was adopted after. We consider the early legislators to be the group more committed to gender equality.

For historical maternal mortality and pneumonia mortality rates we use the vital statistics data from Jayachandran et al. (2010). These data are available for all states but Alaska, Hawai

[9] In fact, even for the US MMR is understudied (Harkin, 2001)

and DC. For 21 states these data are available for the etire period of 1920 to 1950. For the remaining states mortality data is incomplete, and available only from a later year onwards.[10] As an additional control we calculate baseline differences in female labour force participation (FLFP) by state. This is calculated from the complete microdata of the 1930 US Census.

4 Empirical Specifications and Results

4.1 Reserved Seats for Women Candidates

In this section we examine the effect of recent variation in the proportion of female candidates in national-level legislature resulting from the passage of quota laws reserving parliamentary seats. Since the early 1990s twenty countries—spanning Africa, the Middle East, and South and East Asia (see Appendix Figures A1 and A2 for temporal and geographical variation)—have implemented a quota which explicitly reserves seats in parliament for women, and constitutionally protect these laws. It has been argued that the timing of these quotas, as well as their size, owes in large part to the signing of the Beijing Platform for Action by all UN delegates at the Fourth World Conference on Women in 1995 (Inter-Parliamentary Union, 2015; Chen, 2010).[11]

In order to examine the effect of the passage of a gender quota on, firstly, the proportion of women in parliament, and secondly, rates of maternal mortality, we estimate the following flexible differences-in-differences specifications:

$$WomenParliament_{it} = \theta_0 + \theta_1 Quota_{i,t-1} + \boldsymbol{\delta X_{it}} + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

$$\ln(MMR)_{it} = \alpha_0 + \alpha_1 Quota_{i,t-2} + \boldsymbol{\delta X_{it}} + \mu_i + \lambda_t + u_{it} \quad (2)$$

for country i in year t. The principal independent variable of interest is $Quota_{it}$, which takes the value of one if a quota was in place in year t, or zero otherwise. We include time-varying

[10] For 4 states from 1921 onwards, for 3 from 1922 onwards, for 1 from 1925, for 2 for 1926, for 5 from 1927, for 3 from 1928, for 2 from 1929, for 1 from 1932 and finally for 1 for from 1933 onwards.

[11] The Beijing Platform of Action, coming out of this UN conference explicitly set a 30% target for the participation of women in decision making, as well as much wider set of goals in its "agenda of women's empowerment (UN Women, 1995). This is reflected in gender quotas which are frequently set at 30% of seats.

covariates $\boldsymbol{X_{it}}$ which consist of GDP per capita, the type of political regime, and a score for the level of the democracy in the country from the Polity IV database. Full details on these controls is provided in the data appendix to this paper. Country- and time-specific factors are captured by fixed effects (μ_i and λ_t respectively), and as is typical, we cluster standard errors at the level of the country to capture auto-correlation in stochastic shocks over time.

In the main specifications 1 and 2 we use as our independent variable of interest the existence of quotas lagged once for women in parliament and twice for the log of the maternal mortality ratio respectively. These lags are chosen given that, firstly, typically quota laws are passed in years *prior* to elections, and hence we allow for a lag in any impacts on rates of women in parliament[12], and secondly, to allow for an additional year's lag in which the chosen representatives take office, and hence can have an impact on any outcome variables of interest. Nevertheless, we also document a full-event study to allow for a complete examination of the dynamics of the effects of gender quotas.

Finally, we estimate the same specification using a small number of alternative outcome measures. Firstly we conduct a placebo test in which the log of the maternal mortality ratio is replaced using the log of *male* mortality between the ages of 15-49. This outcome is used as it mirrors MMR in the age profile studied, and will capture any effects which generalise to the health of both genders, rather than our hypothesis of women-specific effects. Secondly, with a view to identifying mechanisms driving our findings, we estimated whether gender quotas led to increases in antenatal care, skilled birth attendance, health spending, and female-specific education (sources and definitions are provided in the Appendix). The first two variables are interventions recommended universally by the WHO to reduce maternal mortality. The latter have been documented in the literature as policy variables which respond to an increase in women leaders (Bhalotra and Clots-Figueras, 2014; Clots-Figueras, 2012).

In Tables 2 and 3 we provide baseline estimates of equations 1 and 2 (respectively). Column 1 documents the base-line diff-in-diff model only controlling for country income, while in column 2 we add a full set of dummies capturing the strength of democracy. As is expected, we observe large and significant effects of the passage of a quota reserving seats in national

[12]In appendix figure A4 we provide a plot of the rate of women in parliament in each country, along with the coded dates of the passing of a quota law based on the data described above. Visual inspection suggests that there is some heterogeneity in both timing and impact, but that generally quota laws are followed quite closely by a sharp up-tick in female representation. This is formally examined in the coefficient θ_1 of equation 1.

parliament on the proportion of women actually holding seats. This ranges from between a 4.8 to a 5.0 percentage point increase in women in parliament, depending on the time-varying controls included. Moving from column 1 to 2, a number of observations are lost given that measures of democratic strength are not recorded for all countries in all years. However, as we document in appendix table A2, results are largely unchanged if we consistently focus on the sample for which full controls are available.

In turning to Table 3 we observe that the implementation of quotas also results in a substantial reduction in rates of maternal morality in following years. Once again, depending on the specification used, results suggest that the passing of quotas leads to between an 8.3 and 10.4% reduction in the maternal mortality ratio. Our preferred specification is displayed in column 1, and we additionally include democratic strength controls in column 2. In these main specification we always use *un-weighted* regressions, where each country is given equal weight, however when we use country populations as weights, results are largely similar, if not slightly larger for MMR (refer to appendix table A2).

The credibility of these results rests, fundamentally, on the validity of the parallel trends assumption, or that rates of maternal mortality would have followed parallel trends between countries that adopted quotas and those that did not in the absence of the quota. This assumption would be violated, for example, if countries which were already adopting more gender-progressive policies were more likely to adopt quotas, or alternatively, if quotas result from particularly *poor* gender outcomes in previous years (analagous to an Ashenfelter Dip). In order to examine this we estimate a full event study. Here we interact the binary quota indicator with a dummy for each pre- and post-reform year, allowing us to determine the average difference between quota and non-quota countries before and after the reform as compared to a base year (one year prior to the adoption of quotas). This event study is displayed in Figure 2. We note that given that different countries have adopted quotas at different time periods, years long before or long after the implementation of quotas reflect both the main effect as well as selection to only a subset of countries. Nonetheless, we observe that a clear effect emerges from quotas in the years following the reform, with no notable divergence in pre-reform years. This is the case even for the years quite close to the adoption of quotas when selection is not an issue. In appendix Figure A5 we document a similar event study for the proportion of women in parliament, and observe a largely similar pattern, at least over the range where selection by

quota time is not an issue.

In table 4 we examine a placebo test, where rather than examining the effect of gender quotas on a *women*-specific health outcome, we focus on male mortality over the fertile age range. In this case we find little evidence to suggest that there is any significant effect on male mortality, at least in this sample and time period. In columns 1-2 we observe that if anything, effects are weakly positive, though in no case can we reject that they are equal to zero at typical levels.

As outlined in section 2.1, quota implementation, while owing in large part to the Beijing Declaration, depends in part on countries enacting the proposed quotas. In table A3 we examine how estimated results vary if we control for the full set of observed quota determinants. We replicate the main specification from table 3 in columns 1 and 3, and then in columns 2 and 4 provide estimates conditional on all collected social and political explanations. In column 2 we observe that if anything, the estimated impacts of quota adoption on maternal mortality are slightly larger when controlling for these explanations.[13] In this case our estimated point estimate rises from an effect of approximately -8% to an impact of -10%. In columns 3 and 4 we present similar unconditional and conditional estimates for the impact of quotas on women in parliament. In this case we find point estimates which are slightly smaller conditional on proposed explanations of quota adoptions. The estimated impact of quotas on women in parliament is a 5% increase in unconditional models, or a 4.7% increase when conditioning on political and social conotrols.

In appendix table A6 we present full IV results where the first stage is as displayed in columns 4-6 of table 3. While the IV results display the impact of women in parliament on maternal mortality (rather than the passage of quota laws), they provide a useful consistency check of our main results. In particular, we can examine the robustness of IV results *even* if the passage of quota laws was not cmompletely exogenous, but rather "plausibly exogenous" in the terminology of Conley et al. (2012). This analysis allows that the exclusion restriction can fail, but be 'close' to zero. We present bounds in the foot of the table where we allow the adoption of quotas to have a direct impact on maternal mortality of up to -1%, beyond its impact via women in parliament. This would be the case, for example, if quotas were adopted

[13]This effect is not simply due to the smaller sample in column 2. If we replicate column 1 using the sample from column 2 we observe slightly smaller and less statistically significant results.

in places which were already adopting measures that were favourable for women. In this case, we still find that bounds are informative, and generally bound effects between a 0.5% to 3.5% reduction in maternal mortality as the percent of women in parliament increases by 1 percentage point. Thus, the Conley et al. (2012) bounds provide a consistency check allowing for non-trivial violations of the exclusion restriction, still suggesting that women in parliament *reduce* rates of maternal death.

Finally, we briefly turn to consider mechanisms by which this effect may occur. Although rates of maternal mortality have historically been slow to fall, maternal mortality is largely preventable, and there are a series of well-identified policies which are recognised to reduce MMR. Among the headline policy recommendations of the WHO is the provision of skilled care before, during and after childbirth (WHO, 2014). We thus collated data on rates of skilled attendance in the antenatal period and at birth. While these measures are less widely available than maternal mortality, they nonetheless provide variation by quota and non-quota countries, and in the pre- and post-quota period. We replicate our main diff-in-diff specification, firstly for rates of antenatal care coverage and secondly for the percent of attended births. These results are presented in table 6. We find that the passage of gender quotas is associated with a statistically significant increase of 7.4 percentage points in birth attendance, and a more imprecisely estimated 4.9 percentage point increase in antenatal care. While these mechanisms suggest a plausible way in which the passing of laws to reserve seats for women in parliament may lead to reductions in maternal mortality, there may of course be other mechanisms at play, for instance, women politicians may also raise women's agency (Beaman et al., 2009) which may positively impact maternal health (Shen and Williamson, 1999).

4.2 Suffrage Extension, Antibiotic Take-Up, and Maternal Mortality

In this section, we examine whether a commitment to gender equality – as measured by political rights – determine the take-up and application of new technologies of particular salience to women. Specifically, we assess whether early adoption of women's political rights in the United States led to greater adoption and use of sulfonamide antibiotics. Miller (2008) shows that the implementation of suffrage at the state level led to sharp increases in public health spending and decreases in child mortality. The sulfa drugs – which were introduced nation-

wide in 1937 – were responsible for considerable short-run reduction in mortality from Streptococcus bacteria. In particular, sulfa drugs led to large declines in maternal mortality from puerperal sepsis, as well as infant and adult mortality from pneumonia and scarlet fever (Jayachandran et al., 2010). In this section we cross these two natural experiments.

Figure A6 plots raw trends in (logged) maternal mortality ratios (maternal deaths per 100,000 live births, hereafter MMR) using vital statistics data from Jayachandran et al. (2010). Both the early and late adopters of suffrage experienced declines in MMR starting in 1937. However, the gap between the two groups of states widened with the arrival of sulfa drugs. In contrast, the time series for pneumonia mortality, a disease that affected both genders and a wide range of ages (Britten, 1942) does not show this widening (Figure A7). This provides suggestive evidence that a commitment to gender equality leads to greater adoption and application of technologies of specific relevance to women's health.

We formalize the intuition in these figures by estimating the following model:

$$\begin{aligned} ln(MMR)_{st} &= \alpha_0 + \alpha_1 \times \mathbb{1}(PostSulfa_t) + \alpha_2 \times \mathbb{1}(PostSulfa_t) \times \mathbb{1}(EarlySuf_s) \\ &+\alpha_3 \times \mathbb{1}(PostSulfa_t) \times \mathbb{1}(EarlySuf_s) \times t + \alpha_4 \times \mathbb{1}(EarlySuf_s) \times t \\ &+\alpha_5 \times t + \phi_t + \theta_s + v_{st}. \end{aligned} \tag{3}$$

where s indexes states, t indexes years, $\mathbb{1}(PostSulfa_t)$ is a binary indicator for 1937 onwards, $\mathbb{1}(EarlySuf_s)$ indicates states that legislated women's suffrage prior to the 19th amendment, t is a linear indicator for time, and θ_s represent state fixed effects. Equation (3) is the same parametric trend break model estimated by Jayachandran et al. (2010), except here we allow for a differential level and trend break for states that adopted women's suffrage early (α_2 and α_3 respectively). We control for differential pre-existing trends in MMR for each set of states (α_4 and α_5). Miller (2008) argues that slowly evolving norms around gender equality may explaining differences in the timing of women's suffrage across. The differential trends in the model help account for any correlation between these factors and MMR.

We also estimate a non-parametric, "event study" version of this model, where we replace $\mathbb{1}(PostSulfa_t)$ with a vector of year specific binary indicators. This specification allows us to visually and statistically assess for differential pre-existing trends and confirm the presence of a true (differential) trend break starting in 1937. We also estimate our parametric and non-

parametric specifications using pneumonia mortality as our dependent variable. We treat this as a placebo test: as pneumonia affected both genders, we would not expect the impact of sulfa drugs to vary by the timing of women's suffrage. For all analyses, we use the vital statistics data collected by Jayachandran et al. (2010) over the same period they consider in their study (1925-1943, a period with few large-scale public health interventions, and prior to the arrival of penicillin). We weight observations by state population and cluster standard errors at the state level (Bertrand et al., 2004).

The estimates of equation (3) are provided in Table A11. We find strong differential level and trend breaks in sulfa-drug driven declines MMR by timing of suffrage (col 1). Early adopters experienced an 8.5% larger decrease in MMR right off the bat (α_2), with the difference widening each year by another 1.5% (α_3). In contrast, we find no such differential trend break for pneumonia (col 2).[14] The event study estimates, shown in Figure 3, are consistent with these results. We find no evidence of differential pre-sulfa trends. However, starting in 1937, we see a widening of the gap between early and late women's suffrage adopters that remains present 6 years after the arrival of sulfa drugs. We do not see this break from pneumonia (Figure 4), which supports our identifying assumption and our interpretation of the results.

5 Conclusion

In this paper we examine the potential impact that women's voice, as measured by participation in representative democracy, can have on women-specific health outcomes. We consider two key events which lead to sharp increases in women's participation in policy: first a recent and unprecedented wave of quota laws resulting in a sharp increases, often by more than 100%, in the seats occupied by women in national parliaments. Secondly, we consider the case of extending voting, rather than political positions, to women, with the passage of state-level suffrage laws in the US during the early 20th century.

In both cases we document that increasing women's voice in politics lead to substantive reductions in rates of death in childbirth. In the case of recent quota-lead increases in women's

[14]There are gaps in the MMR series for some states from 1925-1929 due to differences in the timing of joining the National Death Registration surveillance area. We estimated the same model for a balanced panel of states (Appendix Table 1) and found similar findings.

shares in parliament, we observe increases in a number of key policy variables: namely antental care coverage and birth attendance, and follow-on reductions in rates of maternal death. In the case of historical suffrage, we document that with the arrival of Sulfa drugs during the 1930s, providing the first antibiotics to address a key proximate cause of maternal death, this technology was used to reduce maternal death much more in states exposed to women's participation in voting for a longer period. In both cases we *do not* observe similar patterns in gender-neutral diseases such as Pneumonia, all sex infant mortality, or in male fertile-age mortality rates, suggesting that we are not simply capturing an increased propensity of women's voice to impact health spending and outcomes.

Preventable maternal mortality is still very high in many developing countries, even after falling by almost 50% from 1990. Prevailing popular logic suggests that an increase in investment levels will lead to a reduction in maternal deaths (Jamison et al., 2013). The results of this paper suggest that investment alone is not enough. We demonstrate that cultural change, specifically the extension of political rights to women, is a fundamental determinant of women's health. By various measures, policies increasing the participation of women in national politics have reduced rates of maternal mortality by as much as 10%. Indeed, taken together, these findings suggest that neither technological developments nor increases in country income levels are sufficient conditions for improvements in maternal health during gestation, birth and the puerperial period. This has stark implications for a wide range of health policies and their design, not least of all the recently lapsed Millennium Development Goals, and the recently launched Global Health 2035 report, and the ambitious Sustainable Development Goals. Any initiatives focusing on MMR reductions or increasing gender equality in health outcomes should be well aware of ingrained institutional social norms which challenge improvements in women's health.

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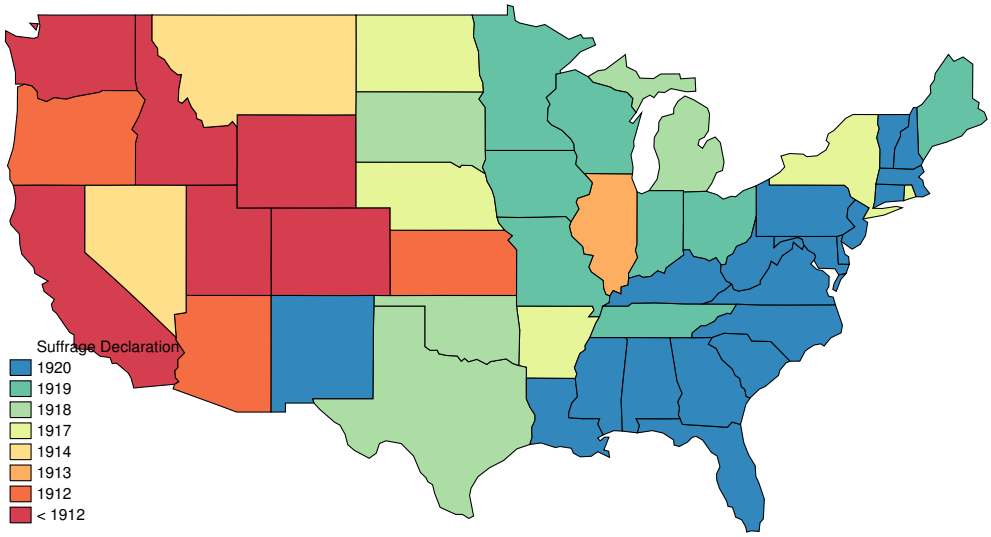
Figures and Tables

Figure 1: Suffrage Timing by State



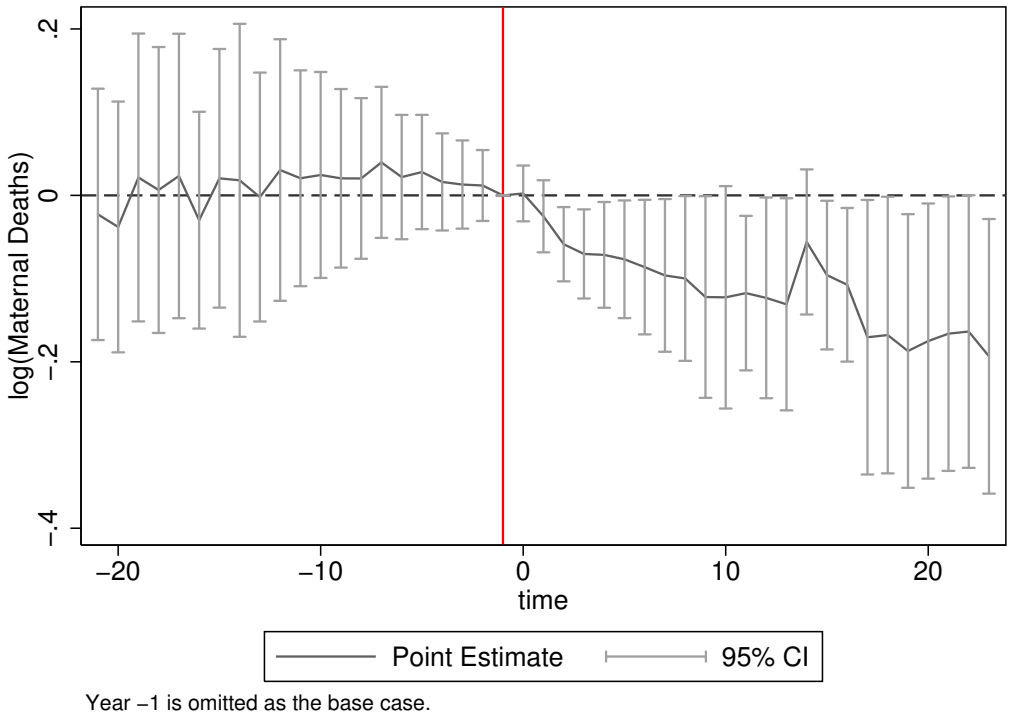
NOTES: States declaring Suffrage in 1920 with the passing of the 19th Ammendment (dark blue colour) are "late suffrage" states. Suffrage data is from Miller (2008).

Table 1: The Passage of Reserved Seat Legislation

	No Country Fixed Effects			Country Fixed Effects		
	(1)	(2)	(3)	(4)	(5)	(6)
Overseas Development Assistance	0.002	-0.007	-0.021	-0.028	-0.023	-0.035
	[0.016]	[0.020]	[0.029]	[0.020]	[0.031]	[0.036]
Peace Keepers	0.002	0.015**	0.018*	0.004**	0.017**	0.020**
	[0.001]	[0.008]	[0.010]	[0.001]	[0.008]	[0.009]
Change in Women's Rights	0.006*	0.006*	0.006*	0.006*	0.006*	0.006*
	[0.003]	[0.003]	[0.004]	[0.003]	[0.003]	[0.004]
Right Wing Executive	-0.001	-0.001	-0.001	-0.001	-0.000	-0.001
	[0.001]	[0.002]	[0.002]	[0.001]	[0.001]	[0.001]
Left Wing Executive	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
	[0.002]	[0.002]	[0.002]	[0.002]	[0.003]	[0.002]
Years in Power	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Herfindahl Index	-0.001	-0.003	-0.003	-0.003	-0.004	-0.004
	[0.005]	[0.005]	[0.005]	[0.007]	[0.007]	[0.008]
Vote Share Opposition	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Transitioning Regime	0.006	0.007	0.008	0.007	0.009	0.010
	[0.005]	[0.005]	[0.006]	[0.006]	[0.007]	[0.008]
First Lag (ODA)		0.025	0.003		0.003	-0.009
		[0.030]	[0.030]		[0.029]	[0.028]
First Lag (peace keepers)		-0.015*	-0.021		-0.015*	-0.022
		[0.008]	[0.015]		[0.008]	[0.015]
First Lag (Δ Womens Rights)		0.001	0.000		0.001	0.000
		[0.002]	[0.002]		[0.002]	[0.002]
Second Lag (ODA)			0.038			0.018
			[0.029]			[0.024]
Second Lag (peace keepers)			0.004			0.006
			[0.007]			[0.008]
Second Lag (Δ Womens Rights)			-0.001			-0.001
			[0.004]			[0.004]
Observations	2783	2626	2470	2783	2626	2470
R-Squared	0.019	0.037	0.040	0.018	0.035	0.038

Each column regresses a variable indicating whether a quota law was passed in a given year on proposed explanations of quota adoption. Each specification includes year fixed effects and standard errors are clustered by country. Overseas Development Assistance (ODA) measured as net inflows in current US dollars divided by GDP in current US dollars is generated from the World Bank Data Bank. Peacekeepers (measured in 1000s) are from the IPI Peacekeeping Database, changes in women's rights refer to changes in economic rights for women as compiled by the CIRI Human Rights Data Project, and political measures including the orientation of leader's party, the time in power, Herfindahl Index of parties, vote shares and regime types and changes are recorded by the Database of Political Institutions. Additional lags of relevant variables are included in columns 2 and 3, and 5 and 6. * p<0.10; ** p<0.05; *** p<0.01.

Figure 2: Event Study: Reserved Seats and Maternal Mortality



NOTES: Point estimates and confidence intervals are from the lag and lead terms in the event study specification: $\ln(MMR)_{it} = \alpha + \sum_{l=2}^{20} \beta_l^{lead} Quota \times 1\{lead = l\} + \sum_{k=0}^{20} \beta_k^{lag} Quota \times 1\{lag = k\} + \mu_t + \phi_i + u_{it}$. Country and year fixed effects are included, and standard errors are clustered by country. Controls are identical to those described in Table 3.

Table 2: The Effect of Reserved Seats on the Percent of Women in Parliament

	% Women in Parliament	
	(1)	(2)
Reserved Seats	5.064**	4.888**
	[2.004]	[2.160]
Constant	7.619	17.046*
	[9.580]	[9.590]
Observations	3846	3229
R-Squared	0.471	0.494
GDP Control	Y	Y
Democracy Indicators		Y

Refer to notes in Table 3. Identical specifications are estimated, replacing the natural logarithm of maternal mortality with the percent of women in parliament as the dependent variable. * p<0.10; ** p<0.05; *** p<0.01.

Table 3: Estimates of the Effect of Reserved Seats on Maternal Mortality

	ln(Maternal Mortality Ratio)	
	(1)	(2)
Reserved Seats	-0.083*	-0.104**
	[0.049]	[0.051]
Constant	7.093***	6.954***
	[0.458]	[0.443]
Observations	3846	3229
R-Squared	0.586	0.606
GDP Control	Y	Y
Democracy Indicators		Y

Each regression includes country and year fixed effects and clusters standard errors by country. A number of (small) countries do not have a democracy score from Polity IV, and so are omitted in column 2. Refer to Table A2 for the estimates consistently using the sample where all covariates are available. * p<0.10; ** p<0.05; *** p<0.01.

Table 4: The Impact of Reserved Seats on Male Reproductive Age Mortality

	ln(Male Mortality) 15-49	
	(1)	(2)
Reserved Seats	0.020	0.014
	[0.055]	[0.059]
Constant	5.700***	5.728***
	[0.425]	[0.501]
Observations	3972	3189
R-Squared	0.400	0.330
GDP Control	Y	Y
Democracy Indicators		Y

Columns 1-2 replace the logarithm of maternal mortality rates with the natural logarithm of male mortality in the same age group (15-49). All other details follow those described in Table 3. * p<0.10; ** p<0.05; *** p<0.01.

Table 5: The effect of Reserved Seats on Infant Mortality

	ln(Female IMR)		ln(Male IMR)	
	(1)	(2)	(3)	(4)
Reserved Seats	-0.085	-0.089	-0.064	-0.068
	[0.051]	[0.060]	[0.049]	[0.057]
Constant	6.049***	5.581***	6.206***	5.743***
	[0.442]	[0.531]	[0.443]	[0.526]
Observations	488	289	488	289
R-Squared	0.847	0.863	0.849	0.867
GDP Control	Y	Y	Y	Y
Democracy Indicators		Y		Y

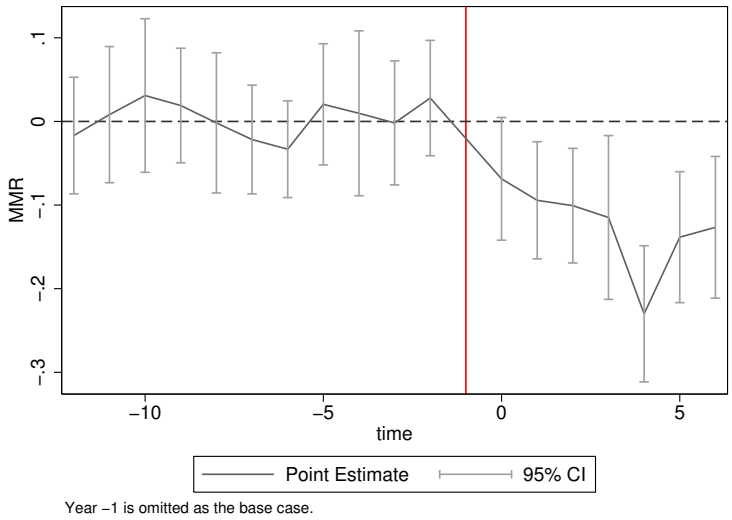
Diff-in-diff estimates of the effect of reserved seats on male and female infant mortality are displayed. Sex-specific mortality data are produced by the UN Inter-agency Group for Child Mortality Estimation (UNICEF, WHO, World Bank, UN DESA Population Division), and are only available for 1990, 2000, 2005, 2010 and 2015. Each regression includes country and year fixed effects and clusters standard errors by country. * p<0.10; ** p<0.05; *** p<0.01.

Table 6: The Effect of Reserved Seats on Intermediate Outcomes

	Antenatal Care		Attended Births		Health Spending		Women's Education	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Reserved Seats	4.964	4.652	7.423**	6.758*	0.590	0.611	0.333	0.229
	[3.403]	[3.366]	[3.103]	[3.429]	[0.441]	[0.469]	[0.206]	[0.213]
Constant	22.790	14.098	32.614	25.919	12.840***	12.932***	5.484***	4.877**
	[28.998]	[31.225]	[24.569]	[29.323]	[2.413]	[2.510]	[1.942]	[1.914]
Observations	655	539	1157	983	3117	2729	3228	2758
R-Squared	0.447	0.531	0.339	0.359	0.207	0.233	0.584	0.603
GDP Control	Y	Y	Y	Y	Y	Y	Y	Y
Democracy Indicators		Y		Y		Y		Y

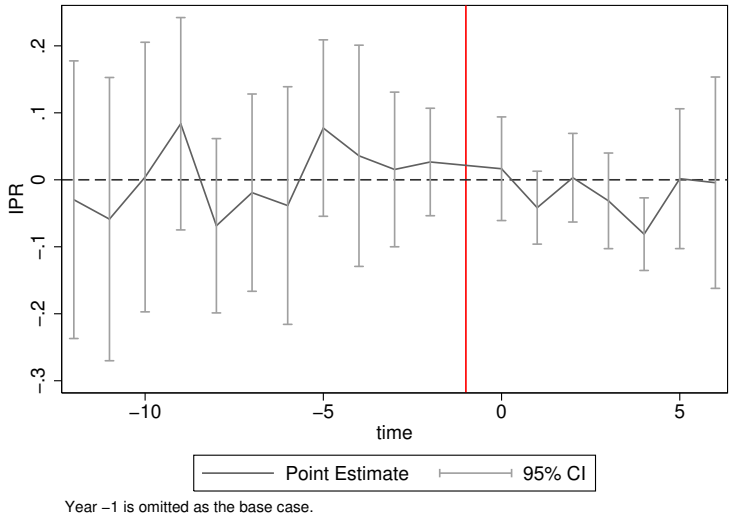
Identical diff-in-diff models are estimated as in Table 3, however dependent variables are now intermediate outcomes. Antenatal coverage and birth attendance refer to the percentage of coverage, are accessed from the World Bank databank, and are only available for a sub-sample of years. Health spending is measured as expenditure as a percent of GDP, and is produced by the World Health Organization Global Health Expenditure database. Women's education is provided by Barro and Lee (2012). Additional data descriptions are available in Appendix C. * p<0.10; ** p<0.05; *** p<0.01.

Figure 3: Event Study: Sulfa Drugs and Early versus Late Suffrage (Maternal Mortality)



Notes: Event study plots differential rates of reduction of change of maternal mortality ratios in early and late suffrage states, surrounding the arrival of Sulfa drugs (year 0). All estimates are with respects to the prevailing differential one year prior to the reform. States are weighted by their population, and standard errors associated with the 95% confidence intervals are clustered by state.

Figure 4: Event Study: Sulfa Drugs and Early versus Late Suffrage (Pneumonia Placebo)



Notes: Event study plots differential rates of reduction of change of pneumonia mortality rates in early and late suffrage states, surrounding the arrival of Sulfa drugs (year 0). All estimates are with respects to the prevailing differential one year prior to the reform. States are weighted by their population, and standard errors associated with the 95% confidence intervals are clustered by state.

Table 7: Difference-in-differences estimates of the effect of Sulfa Drugs

	(1) ln(MMR)	(2) ln(Pneumonia)
Constant	1.689***	-0.046***
	[0.012]	[0.015]
Post Sulfa	-0.092***	0.009
	[0.030]	[0.022]
Early Suffrage × Post Sulfa	-0.085**	-0.046
	[0.036]	[0.028]
Early Suffrage × Post Sulfa × Time	-0.015**	-0.007
	[0.006]	[0.013]
Early Suffrage × Time	0.001	0.005
	[0.003]	[0.008]
Time	-0.023***	-0.029***
	[0.002]	[0.006]
Post Sulfa × Time	-0.089***	-0.061***
	[0.005]	[0.011]
Observations	868	868
R-Squared	0.951	0.780

Each regression includes state fixed effects and clusters standard errors by state. States are weighted by their population. * p<0.10; ** p<0.05; *** p<0.01.

A Appendix Figures and Tables

Table A1: Summary Statistics for Reserved Seat Analysis

	N	Mean	Std. Dev.	Min	Max
% Women in Parliament	3846	14.04	10.31	0.00	63.80
Maternal Mortality Ratio	3846	226.72	312.76	3.00	2820.00
Reserved Seats	3846	0.05	0.21	0.00	1.00
ln(GDP per capita)	3846	8.87	1.22	5.51	11.81
Male Mortality Rate (15-49)	3799	143.75	100.03	27.00	658.00
Percent of Pregnancies Receiving Prenatal Care	651	84.08	17.85	15.40	100.00
Percent of Births Attended by Skilled Staff	1152	83.22	24.31	5.00	100.00
Health Expenditure as a % of GDP	3111	6.24	2.39	0.72	17.10
Women's Education in Years	3091	8.38	3.26	0.54	15.30
Female Infant Mortality Rate (per 1,000 births)	331	30.93	28.53	1.70	134.70
Male Infant Mortality Rate (per 1,000 births)	331	37.06	33.45	2.00	151.30

NOTES: Refer to data appendix for a full description of each variable and its source. Maternal Mortality Ratio is measured as deaths per 100,000 live births. For comparison, male mortality rate for 15-49 year olds is expressed as per 100,000 population. Reserved seats is a binary variable taking one for each country and year pair where a quota was implemented, and 0 otherwise.

Figure A1: Reserved Seat Quota Timing: 1990-2012

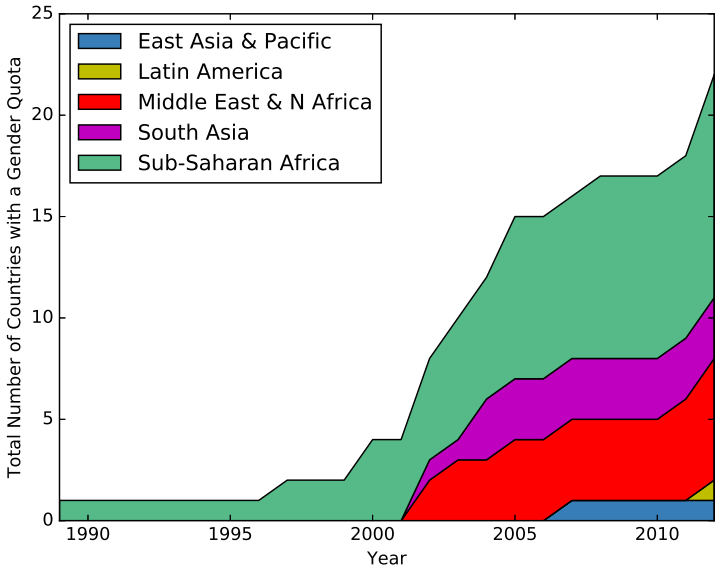


Figure A2: Reserved Seat Quota Coverage: 1990-2015

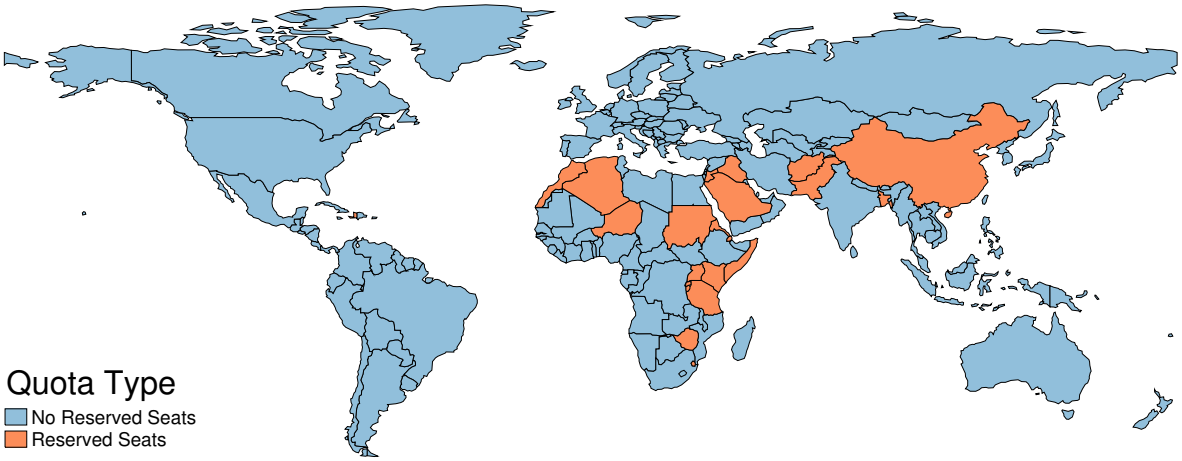
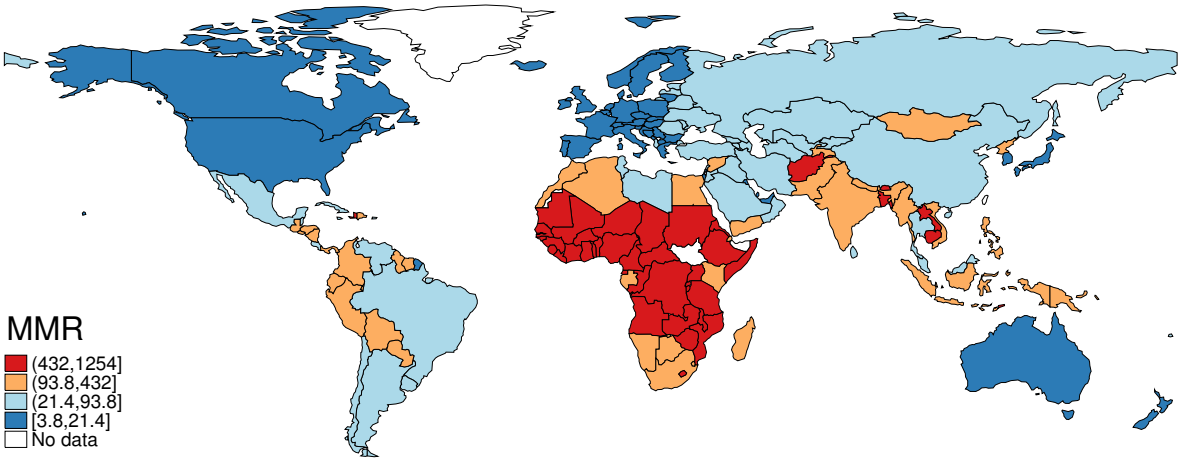
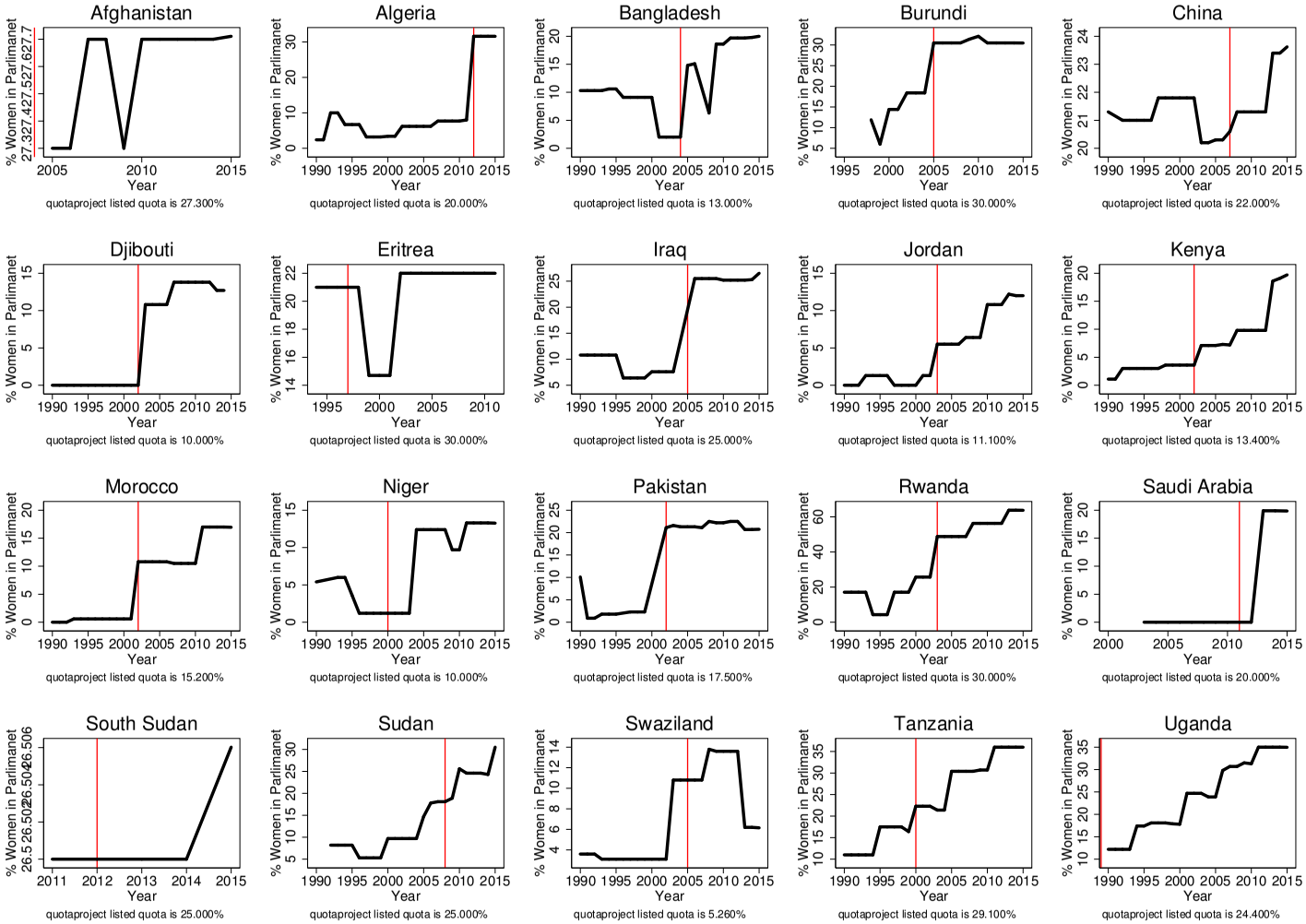


Figure A3: Maternal Mortality Ratio: 1990-2015



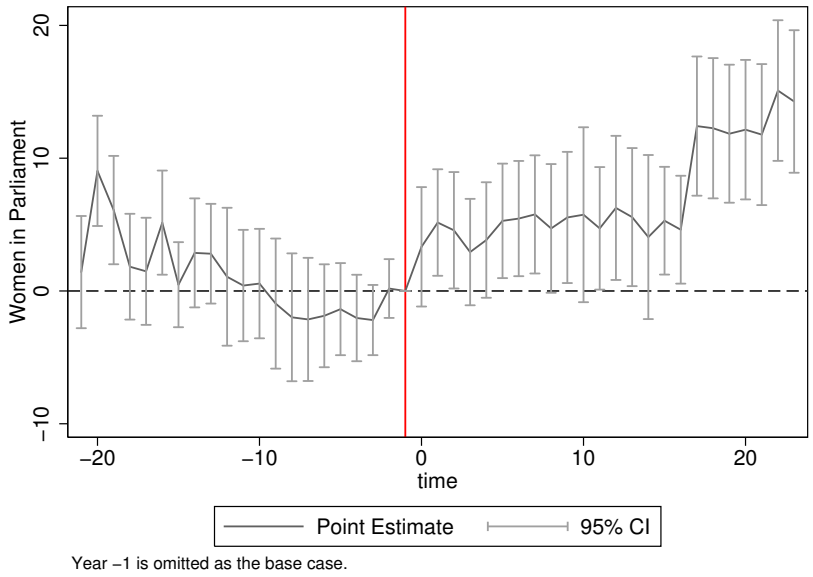
Notes: Average figures are displayed for each country for the period 1990-2015. Values are calculated as deaths per 100,000 live births, and are provided by WHO, UNICEF, UNFPA, World Bank Group, and the United Nations Population Division.

Figure A4: Country-Specific Changes in Women in Parliament after Reserved Seat Quotas



NOTES: Women in parliament are plotted based on the sources described in data appendix C. Red vertical lines display the recorded date of the passage of a reserved seat quota for women in the national parliament.

Figure A5: Event Study: Reserved Seats and Women in Parliament



Notes: Refer to figure 2 for full notes. Event study specification depicts the proportion of women in parliament around the adoption of reserved seat quotas.

Table A2: Alternative Specifications of Difference-in-Difference Estimates of the Effect of Reserved Seats

	Base Specification		Population Weights		Balanced Sample		MMR in Levels	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Maternal Mortality								
[1em] Reserved Seats	-0.083*	-0.104**	-0.099	-0.141**	-0.084	-0.104**	-99.918**	-98.911**
	[0.049]	[0.051]	[0.063]	[0.070]	[0.051]	[0.051]	[42.779]	[45.508]
Constant	7.093***	6.954***	8.519***	8.438***	7.101***	6.954***	1080.318***	1152.625***
	[0.458]	[0.443]	[0.831]	[0.870]	[0.483]	[0.443]	[349.558]	[389.896]
Observations	3846	3229	3775	3161	3229	3229	3846	3229
R-Squared	0.586	0.606	0.601	0.616	0.596	0.606	0.305	0.366
Panel B: % Women in Parliament								
[1em] Reserved Seats	5.064**	4.888**	6.096***	5.693***	4.609**	4.888**		
	[2.004]	[2.160]	[1.631]	[1.459]	[2.124]	[2.160]		
Constant	7.619	17.046*	1.141	12.637	13.685	17.046*		
	[9.580]	[9.590]	[16.667]	[16.179]	[9.691]	[9.590]		
Observations	3846	3229	3775	3161	3229	3229		
R-Squared	0.471	0.494	0.541	0.573	0.484	0.494		
Country and Year FES	Y	Y	Y	Y	Y	Y	Y	Y
GDP Controls	Y	Y	Y	Y	Y	Y	Y	Y
Democracy Controls		Y		Y		Y		Y

Notes: Alternative specifications of difference-in-difference estimates of the effect of quotas reserving seats for women are presented. The original specification from Tables 3 and 2 are displayed for comparison in columns 1 and 2. Unless otherwise noted, all specifications follow those described in Table 3. In columns 3 and 4 population weights are used. In these specifications India and China are removed from the estimation, sample otherwise regression results are largely driven by these two countries which have a population an order of magnitude larger than the remaining countries. Columns 5 and 6 use a balanced sample both with and without democracy controls. Columns 7 and 8 present the impact on maternal mortality in levels, rather than natural logarithms. This is only estimated in panel A, where maternal mortality is the outcome of interest.

Figure A6: Raw Trends in ln(MMR) by Early or Late Suffrage

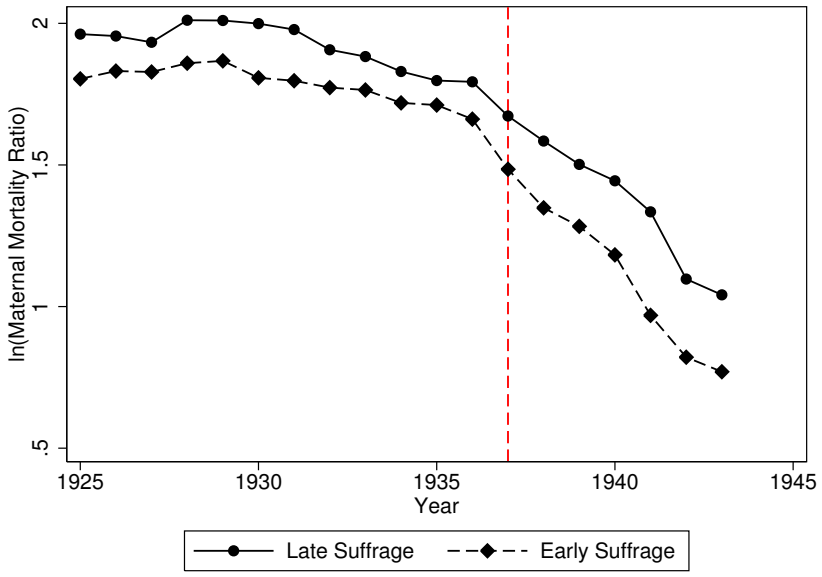


Figure A7: Raw Trends in ln(Pneumonia Rate) by Early or Late Suffrage

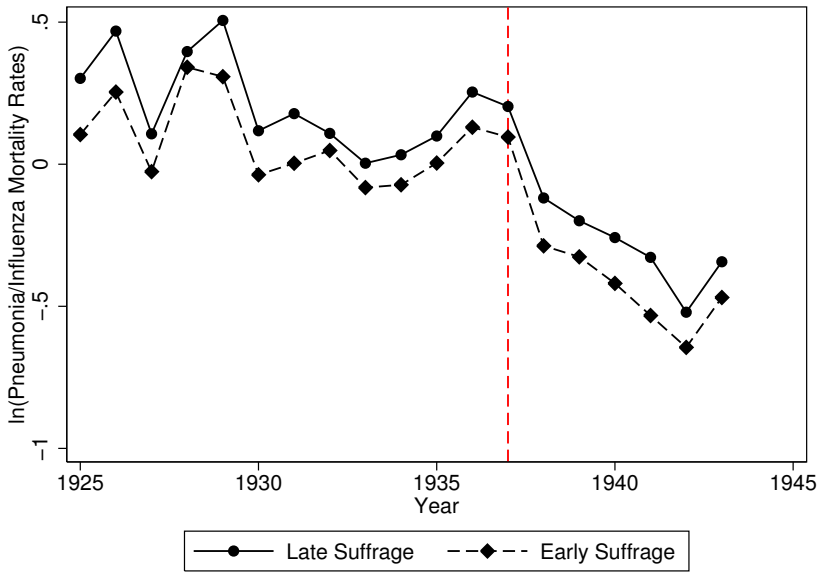


Table A3: Estimates Including All Potential Quota Predictors

	ln(Maternal Mortality Ratio)		% Women in Parliament	
	(1)	(2)	(3)	(4)
Reserved Seats	-0.083*	-0.105**	5.064**	4.659**
	[0.049]	[0.052]	[2.004]	[2.061]
Overseas Development Assistance		0.136		-6.295
		[0.128]		[5.259]
Peace Keepers		0.001		0.059
		[0.004]		[0.205]
Change in Women's Rights		0.000		-0.028
		[0.006]		[0.182]
Right Wing Executive		0.008		-0.075
		[0.021]		[0.452]
Left Wing Executive		-0.045		0.351
		[0.028]		[0.672]
Years in Power		-0.002		0.029
		[0.001]		[0.035]
Herfindahl Index		-0.037		1.044
		[0.051]		[0.974]
Vote Share Opposition		-0.001*		-0.013
		[0.000]		[0.011]
Transitioning Regime		-0.022		1.206***
		[0.016]		[0.431]
First Lag (ODA)		0.086		-5.994**
		[0.070]		[2.881]
Second Lag (ODA)		0.046		-2.945
		[0.085]		[1.897]
First Lag (peace keepers)		0.001		0.025
		[0.005]		[0.184]
Second Lag (peace keepers)		-0.005		0.051
		[0.005]		[0.141]
First Lag (Δ Womens Rights)		0.005		0.089
		[0.007]		[0.203]
Second Lag (Δ Womens Rights)		0.003		-0.191
		[0.006]		[0.180]
Observations	3846	2063	3846	2063
R-Squared	0.586	0.608	0.471	0.522
GDP Control	Y	Y	Y	Y
Proposed Predictors		Y		Y

Each regression includes country and year fixed effects and clusters standard errors by country. A full series of controls are included based on the quota predictors described in section 2.1 and Table 1. Specifications for both the impact on maternal mortality (columns 1-2) and the percent of women in parliament (columns 3-4) are shown. * p<0.10; ** p<0.05; *** p<0.01.

Table A4: Intensive Margin Impacts of Reserved Seats (By Quota Size)

	ln(Maternal Mortality Ratio)		% Women in Parliament	
	(1)	(2)	(3)	(4)
Reserved Seats × Quota Size	-0.005*	-0.007**	0.310***	0.306**
	[0.003]	[0.003]	[0.118]	[0.132]
Constant	7.076***	6.931***	8.633	18.112*
	[0.455]	[0.438]	[9.409]	[9.467]
Observations	3846	3229	3846	3229
R-Squared	0.587	0.607	0.479	0.502
GDP Control	Y	Y	Y	Y
Democracy Indicators		Y		Y

We present estimates of the impact of the *size* of a reserved seat quota on maternal mortality (columns 1-2) and women in parliament (columns 3-4). The independent variable of interest (the size of the quota) is equal to zero whenever reserved seats for women are not in place in a country, and equal to the size of the quota when a reserved seat quota is implemented. Coefficients are thus interpreted as the effect of an additional 1 percent of seats reserved for women on rates of maternal mortality and the percentage of women in parliament. Each regression includes country and year fixed effects and clusters standard errors by country. * p<0.10; ** p<0.05; *** p<0.01.

Table A5: Intensive Margin Impacts of Reserved Seats (By Quota Time)

	ln(Maternal Mortality Ratio)		% Women in Parliament	
	(1)	(2)	(3)	(4)
Reserved Seats × Quota Time	-0.010*	-0.013**	0.567***	0.626***
	[0.006]	[0.006]	[0.196]	[0.217]
Constant	7.090***	6.951***	7.833	17.199*
	[0.458]	[0.443]	[9.328]	[9.377]
Observations	3846	3229	3846	3229
R-Squared	0.586	0.605	0.470	0.495
GDP Control	Y	Y	Y	Y
Democracy Indicators		Y		Y

We present estimates of the impact that the *time* that a reserved seat quota has been in place on maternal mortality (columns 1-2) and women in parliament (columns 3-4). The independent variable of interest (the time of the quota) is equal to zero whenever reserved seats for women are not in place in a country, and equal to the prevailing period of the quota when a reserved seat quota has been implemented. Coefficients are thus interpreted as the effect of an additional year of reserved seat quotas being in place on rates of maternal mortality and the percentage of women in parliament. Each regression includes country and year fixed effects and clusters standard errors by country. * p<0.10; ** p<0.05; *** p<0.01.

Table A6: Reserved Seats as an IV for Women in Parliament

	(1) ln(MMR)	(2) ln(MMR)
% Women in Parliament	-0.016**	-0.021***
	[0.007]	[0.007]
Constant	9.050***	8.789***
	[0.346]	[0.357]
F-Statistic First Stage	6.096	4.872
p-value First Stage	0.015	0.029
95% CI from Conley et al. (2012)	[-0.028;-0.003]	[-0.033;-0.007]
Observations	3,846	3,229
GDP Control	Y	Y
Democracy Indicators		Y

Instrumental variables regressions are run where the existence of a reserved seat law is used to instrument women in parliament. The first stage regression of women in parliament on reserved seats is displayed in columns 4-6 of table 3. F-Statistic of the first stage and the associated p-value are traditional tests of instrumental relevance. Displayed coefficients give the effect of an additional percentage of women in parliament on rates of maternal mortality, where women in parliament is instrumented with reserved seats. The 95% confidence interval from Conley et al. (2012) is a robustness test, where we allow the instrument to be imperfect in the sense that the exclusion restriction is only close to holding. These confidence intervals are associated with the estimates where quotas are able to have a direct positive effect on MMR *not* mediated by women in parliament of 0.01 (or 1%) using Conley et al. (2012)'s Union of Confidence Interval (UCI) approach. Each regression includes country and year fixed effects and clusters standard errors by country. * p<0.10; ** p<0.05; *** p<0.01.

Table A7: Difference-in-differences estimates of the effect of Sulfa Drugs (Balanced Data)

	(1) ln(MMR)	(2) ln(Pneumonia)
Constant	1.650***	-0.102***
	[0.012]	[0.015]
Post Sulfa	-0.116***	-0.016
	[0.027]	[0.015]
Early Suffrage × Post Sulfa	-0.090***	-0.033
	[0.032]	[0.028]
Early Suffrage × Post Sulfa × Time	-0.014*	-0.003
	[0.007]	[0.012]
Early Suffrage × Time	0.000	0.003
	[0.003]	[0.007]
Time	-0.021***	-0.031***
	[0.002]	[0.007]
Post Sulfa × Time	-0.090***	-0.055***
	[0.006]	[0.011]
Observations	646	646
R-Squared	0.954	0.788

Each regression includes state fixed effects and clusters standard errors by state. States are weighted by their population. In these specifications only states with mortality data for all years are used, resulting in a balanced panel of 34 states from 1925-1934. * p<0.10; ** p<0.05; *** p<0.01.

Table A8: Difference-in-differences estimates of the effect of Sulfa Drugs (FLFP controls)

	Original Regressions		FLFP Controls	
	(1) ln(MMR)	(2) ln(MMR)	(3) ln(MMR)	(4) ln(MMR)
Constant	1.689***	1.650***	1.689***	1.650***
	[0.012]	[0.012]	[0.011]	[0.011]
Post Sulfa	-0.092***	-0.116***	0.038	-0.059
	[0.030]	[0.027]	[0.107]	[0.085]
Early Suffrage × Post Sulfa	-0.085**	-0.090***	-0.100**	-0.095***
	[0.036]	[0.032]	[0.039]	[0.034]
Early Suffrage × Post Sulfa × Time	-0.015**	-0.014*	-0.015**	-0.014*
	[0.006]	[0.007]	[0.006]	[0.007]
Early Suffrage × Time	0.001	0.000	0.001	0.001
	[0.003]	[0.003]	[0.004]	[0.004]
Time	-0.023***	-0.021***	-0.026**	-0.021*
	[0.002]	[0.002]	[0.012]	[0.011]
Post Sulfa × Time	-0.089***	-0.090***	-0.089***	-0.090***
	[0.005]	[0.006]	[0.005]	[0.006]
FLFP × Post Sulfa			-0.391	-0.172
			[0.294]	[0.240]
FLFP × Time			0.008	0.001
			[0.033]	[0.032]
Observations	868	646	868	646
R-Squared	0.951	0.954	0.951	0.954

Each regression includes state fixed effects and clusters standard errors by state. States are weighted by their population. Columns 1 and 2 replicate original regressions for the full sample and balanced mortality data sample. Columns 3 and 4 add indicators for baseline female labour force participation rate (from the 1930 census microdata file) interacted with the post-Sulfa dummy and a linear time trend. * p<0.10; ** p<0.05; *** p<0.01.

Table A9: Difference-in-differences estimates of the effect of Sulfa Drugs

	(1) ln(MMR)	(2) ln(Pneumonia)
Constant	1.668***	-0.019
	[0.014]	[0.018]
Post Sulfa	-0.174***	0.250***
	[0.036]	[0.088]
Years since Suffrage × Post Sulfa	0.002*	-0.014***
	[0.001]	[0.005]
Years since Suffrage × Post Sulfa × Time	-0.000	0.001
	[0.000]	[0.001]
Years since Suffrage × Time	-0.001***	0.001**
	[0.000]	[0.000]
Time	-0.017***	-0.033***
	[0.003]	[0.005]
Post Sulfa × Time	-0.077***	-0.104***
	[0.012]	[0.028]
Observations	868	868
R-Squared	0.948	0.784

Each regression includes state fixed effects and clusters standard errors by state. States are weighted by their population. * p<0.10; ** p<0.05; *** p<0.01.

Table A10: Difference-in-differences estimates of the effect of Sulfa Drugs (FLFP controls)

	Original Regressions		FLFP Controls	
	(1) ln(MMR)	(2) ln(MMR)	(3) ln(MMR)	(4) ln(MMR)
Constant	1.668***	1.622***	1.667***	1.622***
	[0.014]	[0.016]	[0.014]	[0.017]
Post Sulfa	-0.174***	-0.214***	-0.170	-0.263*
	[0.036]	[0.038]	[0.128]	[0.131]
Years since Suffrage × Post Sulfa	0.002*	0.003**	0.002	0.004**
	[0.001]	[0.001]	[0.002]	[0.002]
Years since Suffrage × Post Sulfa × Time	-0.000	-0.000	-0.000	-0.000
	[0.000]	[0.001]	[0.000]	[0.001]
Years since Suffrage × Time	-0.001***	-0.001***	-0.001***	-0.001***
	[0.000]	[0.000]	[0.000]	[0.000]
Time	-0.017***	-0.014***	-0.014*	-0.011
	[0.003]	[0.003]	[0.008]	[0.008]
Post Sulfa × Time	-0.077***	-0.082***	-0.077***	-0.082***
	[0.012]	[0.015]	[0.012]	[0.015]
FLFP × Post Sulfa			-0.009	0.143
			[0.372]	[0.365]
FLFP × Time			-0.008	-0.010
			[0.027]	[0.027]
Observations	868	646	868	646
R-Squared	0.948	0.951	0.948	0.951

Each regression includes state fixed effects and clusters standard errors by state. States are weighted by their population. Columns 1 and 2 replicate original regressions for the full sample and balanced mortality data sample. Columns 3 and 4 add indicators for baseline female labour force participation rate (from the 1930 census microdata file) interacted with the post-Sulfa dummy and a linear time trend. * p<0.10; ** p<0.05; *** p<0.01.

Table A11: Difference-in-differences estimates of the effect of Sulfa Drugs

	(1) ln(MMR)	(2) ln(Pneumonia)
Constant	1.690***	-0.046***
	[0.013]	[0.015]
Post Sulfa	-0.140***	-0.013
	[0.021]	[0.015]
Yrs Suffrage till 1920 × Post Sulfa	-0.002	-0.003
	[0.002]	[0.002]
Yrs Suffrage till 1920 × Post Sulfa × Time	-0.001	-0.001
	[0.000]	[0.001]
Yrs Suffrage till 1920 × Time	-0.000	0.000
	[0.000]	[0.000]
Time	-0.021***	-0.027***
	[0.002]	[0.004]
Post Sulfa × Time	-0.097***	-0.064***
	[0.004]	[0.007]
Observations	868	868
R-Squared	0.947	0.780

Each regression includes state fixed effects and clusters standard errors by state. States are weighted by their population. * p<0.10; ** p<0.05; *** p<0.01.

Table A12: Difference-in-differences estimates of the effect of Sulfa Drugs (FLFP controls)

	Original Regressions		FLFP Controls	
	(1) ln(MMR)	(2) ln(MMR)	(3) ln(MMR)	(4) ln(MMR)
Constant	1.690***	1.650***	1.690***	1.650***
	[0.013]	[0.013]	[0.013]	[0.013]
Post Sulfa	-0.140***	-0.168***	-0.107	-0.188*
	[0.021]	[0.020]	[0.111]	[0.107]
Yrs Suffrage till 1920 × Post Sulfa	-0.002	-0.001	-0.002	-0.001
	[0.002]	[0.002]	[0.002]	[0.002]
Yrs Suffrage till 1920 × Post Sulfa × Time	-0.001	-0.000	-0.001	-0.000
	[0.000]	[0.000]	[0.000]	[0.000]
Yrs Suffrage till 1920 × Time	-0.000	-0.000*	-0.000	-0.000
	[0.000]	[0.000]	[0.000]	[0.000]
Time	-0.021***	-0.020***	-0.022***	-0.019**
	[0.002]	[0.002]	[0.008]	[0.008]
Post Sulfa × Time	-0.097***	-0.098***	-0.097***	-0.098***
	[0.004]	[0.004]	[0.004]	[0.004]
FLFP × Post Sulfa			-0.107	0.062
			[0.367]	[0.351]
FLFP × Time			0.003	-0.002
			[0.027]	[0.026]
Observations	868	646	868	646
R-Squared	0.947	0.950	0.947	0.950

Each regression includes state fixed effects and clusters standard errors by state. States are weighted by their population. Columns 1 and 2 replicate original regressions for the full sample and balanced mortality data sample. Columns 3 and 4 add indicators for baseline female labour force participation rate (from the 1930 census microdata file) interacted with the post-Sulfa dummy and a linear time trend. * p<0.10; ** p<0.05; *** p<0.01.

B Candidate Quotas and Reserved Seats

Table B1: Summary Statistics for Quota Analysis

	N	Mean	Std. Dev.	Min	Max
% Women in Parliament	3846	14.04	10.31	0.00	63.80
Maternal Mortality Ratio	3846	226.72	312.76	3.00	2820.00
Reserved Seats	3846	0.05	0.21	0.00	1.00
Legislated Candidate Quota	3846	0.09	0.29	0.00	1.00
ln(GDP per capita)	3846	8.87	1.22	5.51	11.81
Male Mortality Rate (15-49)	3799	143.75	100.03	27.00	658.00
Percent of Pregnancies Receiving Prenatal Care	651	84.08	17.85	15.40	100.00
Percent of Births Attended by Skilled Staff	1152	83.22	24.31	5.00	100.00
Health Expenditure as a % of GDP	3111	6.24	2.39	0.72	17.10
Women's Education in Years	3091	8.38	3.26	0.54	15.30
Female Infant Mortality Rate (per 1,000 births)	331	30.93	28.53	1.70	134.70
Male Infant Mortality Rate (per 1,000 births)	331	37.06	33.45	2.00	151.30

NOTES: Refer to data appendix for a full description of each variable and its source. Maternal Mortality Ratio is measured as deaths per 100,000 live births. For comparison, male mortality rate for 15-49 year olds is expressed as per 100,000 population. Reserved seats and Candidate Quotas are binary variables taking one for each country and year pair where this quota was implemented, and 0 otherwise.

Figure B1: Quota Timing: 1990-2012 (Reserved Seats and Candidate Lists)

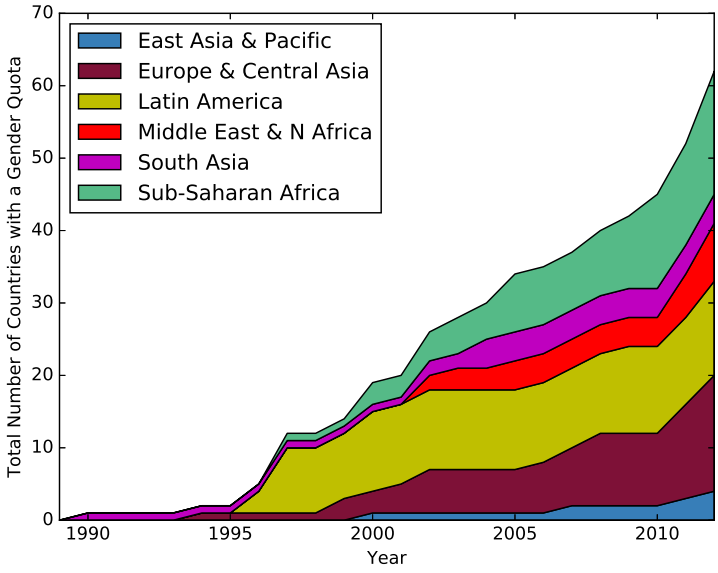


Figure B2: Quota Coverage: 1990-2012 (Reserved Seats and Candidate Lists)

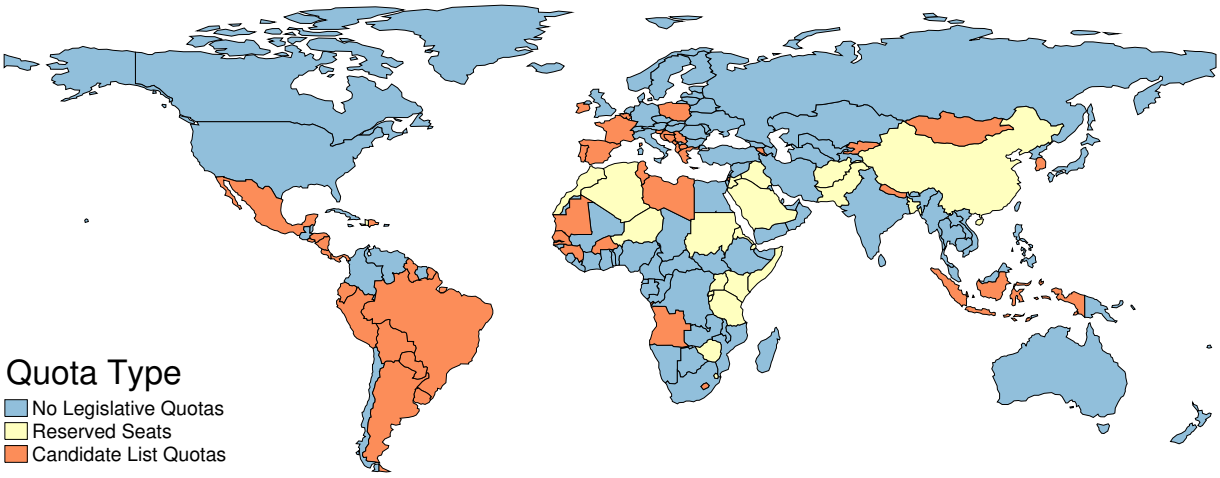


Table B2: Estimates of the Effect of Quotas on Maternal Mortality

	ln(Maternal Mortality Ratio)	
	(1)	(2)
Reserved Seats	-0.078	-0.099*
	[0.049]	[0.051]
Candidate Quota	0.045	0.042
	[0.043]	[0.048]
Constant	7.107***	6.952***
	[0.460]	[0.444]
Observations	3846	3229
R-Squared	0.586	0.606
GDP Control	Y	Y
Democracy Indicators		Y

Each regression includes country and year fixed effects and clusters standard errors by country. A number of (small) countries do not have a democracy score from Polity IV, and so are omitted in column 2. Refer to table B7 for the estimates consistently using the sample where all covariates are available. * p<0.10; ** p<0.05; *** p<0.01.

Table B3: The Effect of Quotas on the Percent of Women in Parliament

	% Women in Parliament	
	(1)	(2)
Reserved Seats	5.595***	5.244**
	[1.992]	[2.146]
Candidate Quota	4.648***	3.620***
	[1.048]	[1.137]
Constant	9.030	16.875*
	[8.994]	[9.370]
Observations	3846	3229
R-Squared	0.491	0.506
GDP Control	Y	Y
Democracy Indicators		Y

Refer to notes in table B2. Identical specifications are estimated, replacing the natural logarithm of maternal mortality with the percent of women in parliament as the dependent variable. * p<0.10; ** p<0.05; *** p<0.01.

Table B4: The Impact of Quotas on Male Reproductive Age Mortality

	ln(Male Mortality) 15-49	
	(1)	(2)
Reserved Seats	0.014	0.007
	[0.055]	[0.059]
Candidate Quota	-0.045	-0.073**
	[0.028]	[0.034]
Constant	5.688***	5.733***
	[0.416]	[0.492]
Observations	3972	3189
R-Squared	0.403	0.337
GDP Control	Y	Y
Democracy Indicators		Y

Columns 1-2 replace the logarithm of maternal mortality rates with the natural logarithm of male mortality in the same age group (15-49). All other details follow those described in Table B2. * p<0.10; ** p<0.05; *** p<0.01.

Table B5: The Effect of Quotas on Infant Mortality

	ln(Female IMR)		ln(Male IMR)	
	(1)	(2)	(3)	(4)
Reserved Seats	-0.091*	-0.089	-0.071	-0.068
	[0.052]	[0.061]	[0.049]	[0.058]
Candidate Quota	-0.048	0.007	-0.052*	0.000
	[0.029]	[0.052]	[0.030]	[0.052]
Constant	6.064***	5.577***	6.223***	5.743***
	[0.438]	[0.531]	[0.439]	[0.526]
Observations	488	289	488	289
R-Squared	0.848	0.863	0.850	0.867
GDP Control	Y	Y	Y	Y
Democracy Indicators		Y		Y

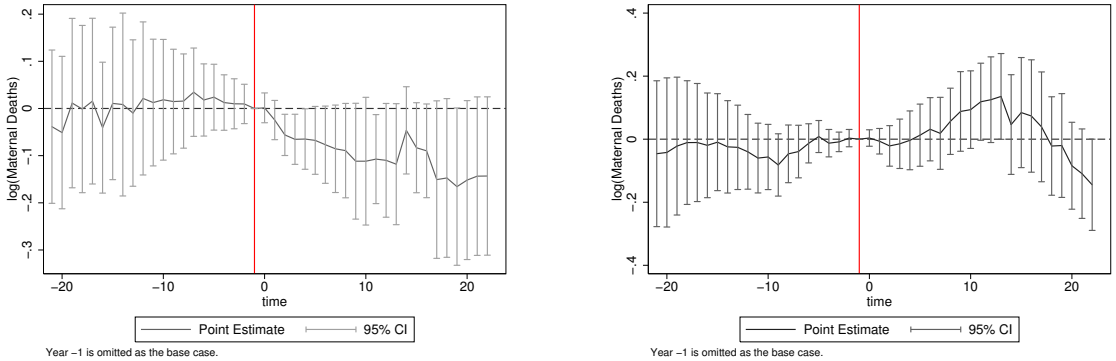
Diff-in-diff estimates of the effect of reserved seats on male and female infant mortality are displayed. Sex-specific mortality data are produced by the UN Inter-agency Group for Child Mortality Estimation (UNICEF, WHO, World Bank, UN DESA Population Division), and are only available for 1990, 2000, 2005, 2010 and 2015. Each regression includes country and year fixed effects and clusters standard errors by country. * p<0.10; ** p<0.05; *** p<0.01.

Table B6: The Effect of Quotas on Intermediate Outcomes

	Antenatal Care		Attended Births		Health Spending		Women's Education	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Reserved Seats	4.597	4.511	7.311**	6.773*	0.607	0.611	0.333	0.226
	[3.384]	[3.347]	[3.115]	[3.432]	[0.440]	[0.469]	[0.207]	[0.214]
Candidate Quota	-2.533	-1.155	-0.889	0.152	0.191	-0.006	-0.001	-0.034
	[2.106]	[2.248]	[1.476]	[1.663]	[0.246]	[0.227]	[0.139]	[0.138]
Constant	21.608	14.599	32.118	25.898	12.877***	12.933***	5.483***	4.869**
	[28.904]	[31.333]	[24.735]	[29.309]	[2.404]	[2.515]	[1.926]	[1.908]
Observations	655	539	1157	983	3117	2729	3228	2758
R-Squared	0.449	0.531	0.339	0.359	0.208	0.233	0.584	0.603
GDP Control	Y	Y	Y	Y	Y	Y	Y	Y
Democracy Indicators		Y		Y		Y		Y

Identical diff-in-diff models are estimated as in Table B2, however dependent variables are now intermediate outcomes. Antenatal coverage and birth attendance refer to the percentage of coverage, are accessed from the World Bank databank, and are only available for a sub-sample of years. Health spending is measured as expenditure as a percent of GDP, and is produced by the World Health Organization Global Health Expenditure database. Women's education is provided by Barro and Lee (2012). Additional data descriptions are available in Appendix C. * p<0.10; ** p<0.05; *** p<0.01.

Figure B3: Event Study Analysis of Quotas on Maternal Mortality



(a) Quotas Reserving Seats

(b) Candidate List Quotas

Notes: Point estimates and confidence intervals are from an event study specification interacting reserved seat quotas and candidate list quotas with a full series of lags and leads, along with identical controls as in Table B2. These interactions for both quota type are included in the same specification. Country and year fixed effects are included, and standard errors are clustered by country.

Table B7: Alternative Specifications of Difference-in-Difference Estimates of the Effect of Quotas

	Base Specification		Population Weights		Balanced Sample		MMR in Levels	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Maternal Mortality								
[1em] Reserved Seats	-0.078	-0.099*	-0.106	-0.144*	-0.080	-0.099*	-95.369**	-95.356**
	[0.049]	[0.051]	[0.069]	[0.073]	[0.051]	[0.051]	[42.757]	[45.422]
Candidate Quota	0.045	0.042	-0.056	-0.033	0.041	0.042	39.807***	36.179***
	[0.043]	[0.048]	[0.070]	[0.073]	[0.048]	[0.048]	[12.227]	[11.449]
Constant	7.107***	6.952***	8.529***	8.471***	7.102***	6.952***	1092.402***	1150.911***
	[0.460]	[0.444]	[0.838]	[0.909]	[0.485]	[0.444]	[341.824]	[384.821]
Observations	3846	3229	3775	3161	3229	3229	3846	3229
R-Squared	0.586	0.606	0.603	0.616	0.597	0.606	0.312	0.372
Panel B: % Women in Parliament								
[1em] Reserved Seats	5.595***	5.244**	6.395***	5.832***	5.027**	5.244**		
	[1.992]	[2.146]	[1.601]	[1.417]	[2.114]	[2.146]		
Candidate Quota	4.648***	3.620***	2.333	1.749	3.759***	3.620***		
	[1.048]	[1.137]	[1.911]	[2.221]	[1.158]	[1.137]		
Constant	9.030	16.875*	0.728	10.931	13.841	16.875*		
	[8.994]	[9.370]	[16.058]	[15.411]	[9.374]	[9.370]		
Observations	3846	3229	3775	3161	3229	3229		
R-Squared	0.491	0.506	0.547	0.576	0.497	0.506		
Country and Year FES	Y	Y	Y	Y	Y	Y	Y	Y
GDP Controls	Y	Y	Y	Y	Y	Y	Y	Y
Democracy Controls		Y		Y		Y		Y

Notes: Alternative specifications of difference-in-difference estimates of the effect of quotas reserving seats for women are presented. The original specification from Tables B2 and B3 are displayed for comparison in columns 1 and 2. Unless otherwise noted, all specifications follow those described in Table B2. In columns 3 and 4 population weights are used. In these specifications India and China are removed from the estimation, sample otherwise regression results are largely driven by these two countries which have a population an order of magnitude larger than the remaining countries. Columns 5 and 6 use a balanced sample both with and without democracy controls. Columns 7 and

C Data Appendix

C.1 Data for Reserved Seat Analysis

Our estimation sample included 3229 county-year observations (from 156 of 195 countries in the world) between 1990 and 2015. Appendix Table 1 provides a list of countries included and non-included in our analyses.

Maternal Mortality Data We used recently released estimates of the maternal mortality ratio (MMR) per 100,000 live births produced by the Maternal Mortality Estimation Inter-Agency Group (MMEIG) and published in the World Bank World Development Indicators (WDI, indicator SH.STA.MMRT). These estimates were available for 183 countries annually for the period 1990-2015. Maternal mortality is identified using ICD-10 codes O00-O99 (Pregnancy, childbirth and puerperium); the official definition is "the number of women who die from pregnancy-related causes while pregnant or within 42 days of pregnancy termination per 100,000 live births." These recently released data are widely considered the best MMR estimates to date, as they address known measurement difficulties in survey and vital statistics data on maternal mortality using Bayesian methods (Alkema et al., 2016, 2015).

Political Gender Quota Data We collated measures for each country of whether the country has a legislated and binding reserved seat quota for women, its year of implementation, and the size of the quota measured as number of seats divided by all seats in the uni- or bi-cameral chamber. To create the database, we started with measures provided by Dahlerup (2005) and completed the most recent years from the online quotaproject.org database developed and maintained by the International Institute for Democracy and Electoral Assistance (IDEA), the Inter-Parliamentary Union, and Stockholm University. This database was consulted on 19th of July, 2016, and the full data coding is provided in the paper's data repository.

Women in Parliament Data Three distinct annual-level measures of women in parliament were used construct a comprehensive panel of the percentage of women occupying seats in the national parliament. These were the WDI indicator SG.GEN.PARL.ZS ("Proportion of seats held by women in national parliaments (%)"), The UN Millennium Development Goals (MDG) Indicators ("Seats held by women in national parliament, percentage"), and the Interuniversity Consortium for Political and Social Research (ICPSR) dataset compiled by (Paxton et al., 2008) ("Women in Parliament, 1945-2003: Cross-National Dataset").

The first two of these datasets had partially-complete coverage for the years 1990, and then 1997-2015, while the latter had partially-complete yearly coverage for each year starting in 1945, and ending in 2003. In order to construct as comprehensive a series as possible, we began with the WDI data, and then imputed missing years where available from the MDG indicators, and Paxton et al. (2008) data. When a missing WDI year was available in both the MDG and the ICPSR dataset, we favored the MDG measure, which was estimated using the same sample and year.

Covariates We adjusted for the natural logarithm of PPP adjusted GDP per capita measured in 2011 international dollars, and a score for the level of democracy in the country, in all models. In additional sensitivity tests, we also adjusted for the average years of education of women aged above 25 years in each country and total health expenditure as a share of GDP.

Data on GDP per capita (measured in 2011 Purchasing Power Parity adjusted international dollars) was obtained from the World Development Indicators (WDI) database. Our measure of democracy was gleaned from the Polity IV project database.A8 This database records information on the political regime in 167 countries, between 1800 and 2014. The democracy indicator is available annually, and is a 0-10 scale based on measures of competitiveness of political participation, openness and competitiveness of executive recruitment and constraints on executive powers. Higher values reflect more open, democratic societies.

We consulted three alternative sources to construct our measure of women's education. We began with measures of mean years of schooling for females aged 25 and above from Barro and Lee's cross-national database (Barro and Lee, 2012) which are available quinquennially from 1950 to 2010, and provide data for 146 countries. This leaves 39 countries in which MMR is measured without any measure of education. For these 39 countries, we followed the United Nations Development Porgram Human Development ReportA5 recommendations by replacing missing values by their most recent value based on microdata estimates from the Demographic and Health Surveys (DHS), the UNESCO Institute for Statistics (UIS) or the Multiple Indicator Cluster Survey (MICS): three nationally representative surveys which record education for a large sample of women in different countries. This enabled us to gather alternative data for 21 additional countries. Missing values within a country where at least some years of education are available are imputed following a multiple imputation procedure. A univariate Bayesian multiple imputation was conducted for the missing countries, with values imputed using a truncated linear regression which bounds years of education at 0 on the left, and 100 iterations of the imputation procedure are used. This procedure was also impute observations

for each year within the five-year intervals for which the data was available. (Specifically, the procedure use log(GDP per capita) and its square, as well as year and continent fixed effects to impute missing observations.)

Health expenditure at the country-year level was taken from the World Health Organization the National Health Accounts (NHA) data series. These provide a measure of total health expenditure as a percent of GDP, and are available for the years 1995-2013. For countries in which data exists for the majority of the analysis period, an identical multiple imputation procedure to that previously described is followed to extrapolate expenditure data to the years 1990-1994 and 2014-2015.

Quality of Maternal Care Data Recent data from the World Bank Data Bank allow us to examine the state of maternal health care in a sub-set of countries and years. We use the two policy-relevant indicators measuring the percent of pregnant women receiving prenatal care (indicator SH.STA.ANVC.ZS) and the percent of all births attended by skilled health staff (indicator SH.STA.BRTC.ZS). These data are constructed and released by the World Bank using comparable measures from each country: specifically data from UNICEF, the State of the World's Children, ChildInfo, and the Demographic and Health Surveys. As such, these measures are only available in years and countries for which surveys were conducted, resulting in fewer observations than the yearly measures of maternal mortality. In our analysis we use the full set of data released in the World Bank Data Bank.

Placebo Outcomes Data on male mortality for 15-49 year olds – the identical age range over which maternal mortality is collected – were taken United Nations World population prospects database. This data is available for 193 countries at a 5 yearly intervals, from years "1955-1960" to years "2010-2015". We linearly imputed this data to construct country-year measures following the procedure described in the World Bank Data Bank (indicator SP.DYN.AMRT.MA).