

# What can we learn from babies born during health-worker strikes?

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PRELIMINARY: Please do not circulate

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## **Abstract**

We study what happens when children are born during health-worker strikes in sub-Saharan Africa. We create a retrospective panel of births using Demographic and Health Surveys and link this with a record of strikes from the Social Conflict in Africa Database (SCAD). The timing of health-worker strikes are reasonably assumed to be exogenous with respect to women's prior decisions to become pregnant. This panel lets us control for variation in unobservable factors across time and place to identify the impacts of health-worker strikes. In addition to estimating the impacts of the strikes themselves, this will also provide insights about the benefit - or lack thereof - of access to different types of health facilities in improving maternal and child outcomes. We find that babies born during strikes are less likely to have survived until the time of the survey, less likely to have been born in health facilities, more likely to have been born at home, and more likely to have died within the first month.

## **1 Introduction**

In the last few years, a few prominent health-worker strikes in sub-Saharan Africa garnered broad media attention, highlighting situations in which health-workers were not paid or insufficiently paid or otherwise not given the resources they asked for to provide health services. This paper uses these instances of limited health-service availability to study the

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benefits of health-service availability on maternal and infant health outcomes.

The idea that health-worker strikes could have devastating consequences on the health of individuals seeking services has been popular with the media. The following headlines appeared in newspapers from sub-Saharan Africa in the last few years:

- “Babies die as Pumwani Maternity Hospital strike bites,” September 11, 2013, *Daily Nation*, Kenya.
- “Man dies after being kicked out of hospital”, December 13, 2013, *Standard*, Kenya.
- “GABON: Health workers strike ‘has cost lives’,” April 9, 2009, *IRIN*, Gabon.
- “Doctors in Ghana continue to strike over salary dispute,” April 12, 2013, *BBC Africa*, Ghana.
- “Health workers’ strike bites harder, meeting deadlocked,” August 27, 2013, *Star Africa*, Nigeria.
- “Uganda: Nodding syndrome patients suffer as Pader health-workers strike” October 22, 2012, *The Daily Monitor*, Uganda.
- “HIV/AIDS Patients Hit Hard By Health Workers Strike,” October 21, 2013, *Red Pepper*, Uganda.
- “Kenya medics call for strike after talks flop,” December 10, 2013, *Standard*, Kenya.

These titles point to a few common themes in popular press articles about strikes. The first three make claims that the strikes result in loss of life, and this is the primary claim that this study will test. The second two talk about the most common grievance reported by striking workers - low salaries or non-payment of salaries. With very few exceptions, these are the complaints. The final two suggest that certain groups of patients may be hard hit by strikes. This study will focus primarily on babies born during health-worker strikes in large part because the pre-determined timing of childbirth means that whether these

happen during or just before or after a strike is largely exogenous with respect to individual characteristics.

The impact of strikes on health outcomes is not obvious. Health care access should improve health outcomes. A strike could result in a woman about to give birth being turned away from a facility or delivering in an understaffed facility, either with fewer providers or providers working fewer hours and skipping some usual services. If a woman knows in advance that there is a strike, she may choose to deliver at home or at a lower quality facility, even if she would have otherwise made a different choice. However, there are also risks associated with delivering in facilities, particularly those with limited resources. Therefore, one could imagine that the impacts of access to facilities varies dramatically, and in some areas, it could even be negative.

Previous research has looked at the impacts of strikes on the explicit targets of strikes. For example, Schmidt and Berri (2004) look at consumer demand in the context of professional sports strikes. Huet-Vaughn (2013) looks at the impact of large protests on political concessions in France.

There is some evidence of the impact of medical-worker strikes on health outcomes in developed countries, but it is quite limited. Cunningham et al. (2008) conduct a meta-analysis of seven articles, looking at 5 physician strikes in developed countries lasting between 9 days and 17 weeks, and none of these studies find a reduction in mortality during the strikes. They explain this through postponing elective surgeries, continuing emergency care during the strikes, and difficulty in the identification of long-term outcomes resulting from short strikes. The focus on childbirth outcomes could yield different results because childbirth cannot be as easily postponed and does not tend to be overseen by emergency medical staff. In contrast with the earlier studies covered by the meta-analysis, Gruber and Kleiner (2012) find a substantial increase in in-hospital mortality during nurses' strikes in New York State.

A few medical case studies find impacts of strikes on health outcomes. For example, Gyamfi (2011) find a decline in patient outcomes during a nurses' strike at a hospital in

Ghana. Bhuiyan and Machowski (2012) find a decline in mortality during a strike in a single facility in South Africa, but an increase in mortality per patient. Extrapolating from the patients who visit a facility during and before/after a strike - as these studies do - raises some complications that do not arise when using population surveys, as in this study.

Our paper is more similar to others have used strikes or other breaks in service as an exogenous source of variation in service provision. For example, Luallen (2006) uses teacher strikes to measure the impact of forcing students to be in school on subsequent criminal activity. More recently, Okeke and Godlonton (2014) study the impacts of a law in Malawi that made Traditional Birth Attendants illegal on birthplace and infant mortality. Pinto et al. (2013) use a labour disruption in Toronto that reduced sexual health service provision to estimate the value of these services, and they find a small resulting increase in chlamydia infections among young women following the disruption.

This is also similar to other work that uses other sources of variation in access to health facilities to identify the impact of health-service provision. For example, Mwaliko et al. (2014) show that women who are farther from a health facility in Kenya are more likely to deliver at home. In the US, there is also evidence that distance to a health facility hurts health outcomes (for example, see Li (2014)), and the supply of doctors increases health outcomes (for example, see Piérard (2014)). Dobkin (2003) finds that despite lower staffing on weekends, hospitals do not experience excess inpatient mortality during these days.

This paper estimates the impact of health-worker strikes on where women deliver children, who is present, and what health-related outcomes are associated with these behavior choices. We combine survey data regarding the experiences and outcomes of delivery among a large sample of women from six sub-Saharan African countries (from DHS) with a record of the timing of health-worker strikes in each of these countries (from SCAD).

This paper makes two primary contributions. First, it sheds light on the impacts of health-worker strikes, an important phenomenon in many countries. Second, and perhaps more importantly, it investigates the impacts of access to health services at the time of

deliveries, by looking at what happens when these services are temporarily unavailable.

## 2 Data

The data for this paper comes from two sources, which are linked based on country and month. Information about strikes comes from the Social Conflict in Africa Database (SCAD), which lists strikes reported in the media, with information about who was striking, and the timing and location of the strikes.

### 2.1 Social Conflict in Africa Database (SCAD)

The Social Conflict in Africa Database was designed to fill a gap in data about conflict by including information from the news media about non-armed and even non-violent conflict (Salehyan et al. (2012)). One of the important categories included in this dataset, unlike other conflict datasets, is strikes. For this analysis, we include all strikes in which health-workers are striking. This was hand-coded and includes doctors and nurses and any other medical professionals. Some health-worker strikes may not have been included if the strikes was a part of a larger movement and health-care workers were not separately listed as actors.

For each strike, SCAD lists the start of the strike and the duration within each month. From this, we have constructed a database of all months between 1990 and 2012 and the number of days within each month in which there was a health-worker strike in each country. For now, we do not distinguish between national and subnational strikes, although future iterations of this analysis will be able to separate this using the SCAD information about the locations of strikes. If some areas did not experience the health-worker strikes but they are incorrectly coded as such, this will bias our estimates of the impacts of strikes toward zero. For reference, 51% of strikes are listed as being national strikes, and another 10% are listed as an "unknown" location.

SCAD also lists the primary issue of each strike. For 91% of the strikes in the data used

in this paper, the issue is listed as “economy, jobs.” The rest are “food, water, subsistence” and “other.” The details consistently list pay and wages as the subject of the strike. In all but one strike, the target is listed as either the government or the health ministry. The one exception is a nurse’s strike in Freetown, Sierra Leone, which lists “Hospital Management” as the target of the strike.

The Social Conflict in Africa Database has been widely used to study causes and impacts of violence. For example Pierskalla and Hollenbach (2013) use it to study how cell phone availability facilitates collective action in the form of political violence. To our knowledge, we are the first to use this data to look at the impact of health-worker strikes.

## 2.2 DHS

Demographic and Health Surveys are population surveys conducted all over the developing world with the original goal of providing information necessary to estimate future population trends. In the service of this goal, the surveys respondents to report extensive details of their fertility histories. This includes the timing of all previous births, the actions of the mother and services sought both before and after the birth, and initial and long-term health outcomes of the children. This information is collected for all children born in the previous 5 years to the DHS’s nationally representative sample of women ages 15-49. A few questions are asked of all previous births, including whether the child is still alive.

Using the timing of these births, we can construct a retrospective panel of births, which we link with the strikes data. For each birth reported in the DHS, we know whether there was a health-worker strike in that country during the month of the birth, and during the previous months. We also know the duration of the strike.<sup>1</sup>

Table 2 summarizes the survey rounds included and the long-duration (more than two weeks) national strikes in each country included in the analysis. Countries were chosen which had at least one strike of 2 weeks or longer in the five years before a DHS survey. These are

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<sup>1</sup>We do not know the exact timing within the month of the birth, and so our measure of having experienced a strike will be over-stated, which may bias our estimates of the impacts of strikes toward zero.

countries with high infant and maternal mortality rates, as shown in Table 1. The data used in the analysis is from 1997-2012.

## 2.3 Outcome variables

The ultimate goal of this analysis will be to look at the health impacts of children born in times of limited access to health facilities and personnel. We have included two outcome variables that reflect this:

- *childalive* is an indicator for whether the child is still alive at the time of the survey. This question is asked of all respondents for all previous births.
- *childdiedmonth1* is an indicator for whether the child died within the first month after birth. This is the highest risk time in places with high infant mortality, and outcomes may be related to inputs at the time of delivery. This question is also asked of all respondents for all births.

If there were an impact of health-worker strikes on maternal mortality, this data will most likely not allow us to see that, because women who do not survive will not be in the sample. If this impact were substantial, we could see a reduction in the number of women who report giving birth at all in certain months, but this would require a large sample to precisely measure this difference.

In order to estimate how strikes change women's health-seeking behavior and the services that they are able to offer, we look at impacts of strikes on where a woman delivers and who is present. All of these are based on questions asked of all respondents for all births in the five years before the survey. For location, these include:

- *delivhome* is an indicator for whether the woman reported that she delivered at home.
- *delivfacility* is an indicator for delivering in any type of formal health facility.

Many health-worker strikes include only public employees, and so women may be more substitute away from public facilities toward either private facilities or home-births.

To examine who was present, we use the following outcome:

- *birthdocnursepres* is an indicator for whether there was a doctor or a nurse present.

A few other outcome variables which could be effected were not used because they did not vary sufficiently to make it likely to see an impact. In particular, fewer than 5% of deliveries were reported to have involved a caesarian section, and fewer than 1% of respondents reported that they did not deliver in a facility because it was closed. As health-worker strikes often do not close facilities but instead leave them under-staffed, this does not imply that the strikes are going unnoticed.

Tables 3 and 4 reports the mean of each of these variables in each country, for deliveries that occurred when there was not a health-worker strike happening.

### 3 Empirical Strategy

The identification strategy compares babies born during health-worker strikes with babies born in the same countries, during the same years, but not during health-worker strikes. The validity of this strategy relies on the assumption that the timing of a birth with respect to the timing of a strike is exogenous. The fact that conception occurs 9 months before the birth makes this a reasonable assumption. Table 5 compares demographic characteristics of women who gave birth during and not during health-worker strikes. The differences are small and insignificant. The differences that are observed are likely to reflect differences across countries with higher and lower numbers of strikes. Estimating the difference with country-fixed-effects reduces the magnitudes.

This should eliminate worries about reverse causality: For the most part, women cannot choose to change the timing of their deliveries with respect to the timing of a strike. There are some exceptions to this. Particularly with the availability of induction and cesarean-

sections, it is absolutely possible for women to change the date of delivery, within a small window. It has been shown in developed countries that women do have some control over the timing of deliveries and respond to tax incentives Dickert-Conlin and Chandra (1999); Gans and Leigh (2009); Milligan (2005). There are a few reasons why this should be less of a concern in this context. First, while women can change the timing within a few days, it is unlikely that women can or would want to change the timing by a larger amount. This analysis relies on the month of birth, and thus this is not likely to be altered frequently in response to a health-worker strike. Second, inductions and cesarean sections are somewhat less common in the developing world, and thus these are somewhat less likely to be used to alter the date of delivery. Finally, we can test whether women are more or less likely to give birth when there are strikes to see to what degree women are changing the timing of delivery in response to strikes.<sup>2</sup>

The panel data structure which allows time and location fixed effects allows us to control for time-invariant location specific factors and time-varying factors, which are not place specific. This should eliminate many fears of bias from omitted variables.

We estimate the following equation:

$$Y_{ijcym} = \beta_1 * strike_{cmy} + \gamma_j + \delta_y + v_m + \epsilon_{ijcym}$$

$Y_{ijcym}$  is the outcome variable for a birth that occurs in country,  $j$ , in survey cluster,  $j$  and country  $c$ , during year  $y$ , and month,  $m$ . The coefficient of interest is  $\beta_1$  and  $strike_{cmy}$  is a dummy variable for whether or not there was a strike in country  $c$  during the birth month. The birth month is represented by the year,  $y$ , and the calendar month,  $m$ . Region fixed effects are represented by  $\gamma_j$ .

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<sup>2</sup>This test is somewhat complicated because there is under-reporting of miscarriages, stillbirths, and the births of children who have died in DHS data and other surveys Haws et al. (2010). If health-worker strikes lead to a larger number of miscarriages and stillbirths, then this will look similar to women changing the timing of their deliveries.

In some specifications,  $strike_{cmy}$  is represented by an indicator for whether there was a national strike that lasted at least two weeks. Births that happened during shorter strikes or subnational strikes are not included. In the second set of specifications,  $strike_{cmy}$  is included as the fraction of days in the month of birth during which there was a national strike.

A strike in an area with no health facilities is unlikely to matter at all. Similarly, in an urban area with many facilities available, a strike may not change decisions and outcomes as women have alternative options for where to give birth. All specifications restrict the sample to look only at women in rural areas where at least 20% of other women delivered in a facility. Future analysis will include the full sample to confirm that no impacts are estimated in areas where we would not expect to see one.

In the entire sample, 82% of respondents who have had any children have had more than one by the time of the survey. Looking only in the five-years before respondents were surveyed, 45% of those who had at least one child had more than one child. This allows for the possibility of using maternal fixed effects. In each of these sets, ten percent of births happened in the same month as a health-worker strike. Including mother fixed-effects removes mother-specific unobservable characteristics by comparing the experiences of mothers who have children both during and not during health-worker strikes. On the other hand, this specification identifies the coefficient of interest based on less than half of the data (the women with multiple births in the reporting period).

## 4 Results

The relationship between the timing of strikes and some of the key outcome variables are presented graphically for each survey. For recent surveys, this includes the five years leading up to the surveys, but for older surveys, the detailed questions about birth were only asked for the previous three years. Figures 1 and 2 show the total number of births per month. If maternal mortality went up during strikes, we might see a lower number of births during

the months of strikes. If women were able to time deliveries to avoid giving birth during a strike, then we would see lower numbers of births reported during the strikes and higher numbers just before or after. Neither of these patterns is obvious from visual inspection.

Figures 3 and 4 present the fraction born who are still alive, while Figures 5 and 6 show the fraction who died within the first month, respectively. Again this is overlaid with the timing of strikes, and again, there are not obvious patterns that appear in these figures. Figures 7 and 8 shows the fraction delivering at home, and Figures 9 and 10 shows the fraction delivering in any public or private facility. In Burundi, there is a clear trend away from home births and toward deliveries in public facilities, but the same patterns do not appear in the other countries.

Table 6 presents the results of the main estimation, limiting the sample to women who delivered within 6 months of a health-worker strike. Columns 1 and 2 show a statistically significant decrease in the likelihood of survival for women delivering in a month of a strike relative to those before and after. Columns 3 and 4 show a reduction in the likelihood of survival of an additional day of a national strike. Columns 1 and 3 include country fixed effects, while region fixed effects are included in columns 2 and 4.

Table 7 repeats the analysis of Table 6 but limits the sample further to focus on women delivering within two months of a national health-worker strike who had delivered in a facility for their previous birth. These women are relatively more likely to try to go to a facility, and therefore more likely to be affected by a strike.

Table 8 begins to look at mechanism. This estimates the same equations as 6 with the same sample selection, but putting decisions about the place of delivery on the left hand side. This shows a significant decrease in the likelihood of delivering in any type of facility and an increase in the likelihood of delivering at home. Table ?? shows a small increase in the likelihood that the child died within the first month and a decrease in the likelihood that a doctor or nurse was present at the time of the birth, although these are not statistically significantly different from zero.

Table 9 looks at the impacts on the health of surviving children. Looking at outcomes of all births within two months of a health worker strike, the point estimates are negative for the impact of strikes on weight-for-age and height-for-age.

Mother fixed effects are included in Table 9, using the full sample of all women who gave birth twice within the five years before a survey. The point estimates of the coefficients on strikes predicting child survival and having delivered in a facility are negative, consistent with the earlier findings, but the coefficients are not statistically significantly different from zero.

## 5 Conclusion

The analysis presented above demonstrates a meaningful impact of health-worker strikes on child survival. The demonstrated effects on place of delivery suggest that this is a likely mechanism through which the strikes increase infant mortality. These findings have a few implications. First, this can contribute to an assessment of health-worker strikes. However, there are many other factors that cannot be incorporated in this type of analysis. This analysis does not recognize any long-term benefits of the resolution of a strike. If it leads to demands of workers being met and this in turn increases motivation and attendance of health-workers, the long-term benefit could easily be positive.

Perhaps more importantly, the demonstration of an instantaneous cost of health-worker strike implies that there is an important value to the usual health services being provided. If there were not, we would not be able to see an impact on health when the services are removed.

There are quite a few factors that are likely to bias our results away from finding impacts in the full sample. A health-worker strike can happen in a country and many women delivering babies during that month could be completely unaffected. This could happen because the strike does not reach the area of the country where she lives, because the strike was

within the same month but not on the same days when she delivered, or because she was not planning to deliver in a health facility that is part of the strike. The majority of the women in this sample deliver at home, and most of these do not have a doctor or nurse present. Thus the strike does not reach them. On the other hand, maybe the carefully set plans to ensure that health-worker strikes do not put lives at risk function well and there are truly no health consequences of health-worker strikes for a large population who are likely to use public health services and who have very little control over the timing of when those services will be needed. The results presented above focus on the group that is most likely to be influenced, and thus the impacts cannot reasonably be extrapolated to the rest of the countries.

Moving forward, we hope to provide more robustness and nuance to the story of the impacts of health-worker strikes with more detailed analysis. In particular, we will incorporate geographic information on subnational strikes linked with geographic data from DHS records. We can also look at whether strikes among different types of health-workers (e.g.: doctors or nurses) differently change who is present at birth. We will incorporate more placebo checks confirming that those who should not be affected by a strike (e.g.: those who live far from any health facilities) do not show differences in outcomes as a function of national strike occurrences. The DHS data provides information about sibling mortality including the age and date of deaths, and - for sisters - whether she was pregnant and whether she died during childbirth. This can be incorporated to measure impacts on maternal mortality as well. Finally, we will complete our own search of local newspapers to find other instances of health-worker strikes that may not have been covered by international media.

## References

- Bhuiyan, MMZU and A Machowski**, “Impact of 20-day strike in Polokwane hospital (18 August-6 September 2010),” *SAMJ: South African Medical Journal*, 2012, *102* (9), 755–756.
- Cunningham, Solveig Argeseanu, Kristina Mitchell, KM Venkat Narayan, and Salim Yusuf**, “Doctors’ strikes and mortality: a review,” *Social Science & Medicine*, 2008, *67* (11), 1784–1788.
- Dickert-Conlin, Stacy and Amitabh Chandra**, “Taxes and the Timing of Births,” *Journal of Political Economy*, 1999, *107* (1), 161–177.
- Dobkin, Carlos**, “Hospital staffing and inpatient mortality,” *Unpublished Working Paper*, 2003.
- Gans, Joshua S and Andrew Leigh**, “Born on the first of July: An (un) natural experiment in birth timing,” *Journal of Public Economics*, 2009, *93* (1), 246–263.
- Gruber, Jonathan and Samuel A Kleiner**, “Do Strikes Kill? Evidence from New York State,” *American Economic Journal: Economic Policy*, 2012, *4* (1), 127–157.
- Gyamfi, Gerald Dapaah**, “Assessing the effects of industrial unrest on Ghana health service: A case study of nurses at Korle-Bu teaching hospital,” *International Journal of Nursing and Midwifery*, 2011, *3* (1), 1–5.
- Haws, Rachel A, Irene Mashasi, Mwifadhi Mrisho, Joanna Armstrong Schellenberg, Gary L Darmstadt, and Peter J Winch**, “These are not good things for other people to know: How rural Tanzanian womens experiences of pregnancy loss and early neonatal death may impact survey data quality,” *Social Science & Medicine*, 2010, *71* (10), 1764–1772.

- Huet-Vaughn, Emiliano**, “Quiet Riot: The Causal Effect of Protest Violence,” *Available at SSRN*, 2013.
- Li, Jing**, “The influence of state policy and proximity to medical services on health outcomes,” *Journal of Urban Economics*, 2014, *80*, 97–109.
- Luallen, Jeremy**, “School’s out forever: A study of juvenile crime, at-risk youths and teacher strikes,” *Journal of urban economics*, 2006, *59* (1), 75–103.
- Milligan, Kevin**, “Subsidizing the stork: New evidence on tax incentives and fertility,” *Review of Economics and Statistics*, 2005, *87* (3), 539–555.
- Mwaliko, Emily, Raymond Downing, Wendy OMeara, Dinah Chelagat, Andrew Obala, Timothy Downing, Chrispinus Simiyu, David Odhiambo, Paul Ayuo, Diana Menya et al.**, ““ Not too far to walk”: the influence of distance on place of delivery in a western Kenya health demographic surveillance system,” *BMC Health Services Research*, 2014, *14* (1), 1–9.
- Okeke, Edward and Susan Godlonton**, “Does a ban on informal health providers save lives? Evidence from Malawi,” 2014.
- Piérard, Emmanuelle**, “The effect of physician supply on health status: Canadian evidence,” *Health Policy*, 2014, *118* (1), 56–65.
- Pierskalla, Jan H and Florian M Hollenbach**, “Technology and collective action: The effect of cell phone coverage on political violence in Africa,” *American Political Science Review*, 2013, *107* (02), 207–224.
- Pinto, Andrew D, Effie Gournis, Dana Al-Bargash, and Rita Shahin**, “Impact of a Labour Disruption Affecting Local Public Health on the Incidence of Chlamydia Infections in Toronto,” *PloS one*, 2013, *8* (11), e79375.

**Salehyan, Idean, Cullen S Hendrix, Jesse Hamner, Christina Case, Christopher Linebarger, Emily Stull, and Jennifer Williams**, “Social conflict in Africa: A new database,” *International Interactions*, 2012, 38 (4), 503–511.

**Schmidt, Martin B and David J Berri**, “The impact of labor strikes on consumer demand: An application to professional sports,” *American Economic Review*, 2004, pp. 344–357.

## 6 Tables

Table 1: Infant mortality (deaths by age 1 per 1000), by country

Country	Infant Mortality		Maternal Mortality	
	2010	2014	2010	2014
Burkina Faso	70	64	4.4	4.0
Burundi	61	55	8.2	7.4
Gabon	43	39	2.6	2.4
Ghana	55	52	4.1	3.8
Kenya	52	48	4.6	4.0
Nigeria	82	74	6.1	5.6
Sierra Leone	114	107	12.0	11.0
Zambia	64	56	3.2	2.8
Zimbabwe	59	55	6.1	4.7
Argentina	13	12	.76	.69
China	14	11	.36	.32
Sweden	2	2	.05	.04
Turkey	20	17	.22	.20
Ukraine	10	9	.29	.23
US	6	6	.27	.28

Source: World Development Indicators

Table 2: Timing of DHS surveys and health-worker strikes, by country

Country	DHS	National Strike(s) (longer than 2 weeks)
Burkina Faso	2003	
Burundi	2010/2011	2009
Gabon	2012	2009
Ghana	1993/1994, 1998/1999, 2003	1998
Kenya	1998, 2003, 2008/2009	1997
Nigeria	2003, 2008, 2013	2001, 2004, 2005, 2009
Sierra Leone	2001/2002, 2007	
Zambia	2007	2003
Zimbabwe	2005/2006, 2010/2011	1996, 1999, 2003, 2007, 2008, 2009

Table 3: Means of outcomes among deliveries not during strikes, by country

	Burundi	Burkina Faso	Gabon	Ghana	Kenya
child is still alive	.935 (.246)	.882 (.323)	.949 (.22)	.921 (.269)	.927 (.261)
child died in the first month	.028 (.166)	.028 (.165)	.023 (.149)	.037 (.19)	.031 (.172)
delivery at home	.335 (.472)	.594 (.491)	.16 (.366)	.552 (.497)	.577 (.494)
delivery private facility	.049 (.217)	.006 (.078)	.013 (.112)	.09 (.286)	.12 (.325)
delivery public facility	.577 (.494)	.398 (.49)	.719 (.45)	.318 (.466)	.294 (.456)
doctor present at birth	.058 (.234)	.014 (.117)	.055 (.228)	.066 (.248)	.14 (.347)
nurse present at birth	.604 (.489)	.39 (.488)	.069 (.253)	.292 (.455)	.333 (.471)
doctor or nurse present at birth	.634 (.482)	.401 (.49)	.116 (.321)	.32 (.466)	.435 (.496)
c-section	.05 (.217)	.008 (.088)	.066 (.249)	.037 (.188)	.056 (.23)

Notes: Standard deviations in parentheses.

Table 4: Means of outcomes among deliveries not during strikes, by country

	Nigeria	Sierra Leone	Zambia	Zimbabwe
child is still alive	.895 (.307)	.896 (.305)	.893 (.309)	.933 (.251)
child died in the first month	.039 (.194)	.037 (.189)	.034 (.181)	.025 (.156)
delivery at home	.651 (.477)	.707 (.455)	.547 (.498)	.328 (.469)
delivery private facility	.125 (.331)	.03 (.171)	.071 (.256)	.076 (.265)
delivery public facility	.217 (.412)	.256 (.437)	.379 (.485)	.552 (.497)
doctor present at birth	.086 (.28)	.023 (.149)	.029 (.168)	.09 (.287)
nurse present at birth	.295 (.456)	.33 (.47)	.419 (.493)	.443 (.497)
doctor or nurse present at birth	.335 (.472)	.344 (.475)	.432 (.495)	.507 (.5)
c-section	.018 (.133)	.016 (.127)	.024 (.153)	.047 (.212)

Notes: Standard deviations in parentheses.

Table 5: Demographic characteristics of mothers giving birth

	Mean During Strikes	Mean Month Before/After	Difference
age at time of survey	28.994 (7.004)	28.925 (6.972)	-.069 (.318)
years of education	4.934 (4.85)	5.244 (5.108)	.31 (.297)
married	.833 (.373)	.831 (.375)	-.003 (.026)
urban	.288 (.453)	.292 (.455)	.004 (.015)
has electricity	.332 (.471)	.352 (.478)	.02 (.03)
has a radio	.625 (.484)	.635 (.481)	.01 (.022)
can read a sentence	.5 (.5)	.52 (.5)	.02 (.037)
wealth index	2.803 (1.405)	2.844 (1.418)	.041 (.046)
total children ever born	3.919 (2.452)	3.883 (2.475)	-.035 (.135)

Notes: Standard deviations in parentheses. These are based on one observation per woman, and estimates include only those who give birth in the month of a strike or in a month immediately before or after a strike.

Table 6: Impact of Strikes on Child Survival

VARIABLES	(1) childalive	(2) childalive	(3) childalive	(4) childalive
National strike, over 2 weeks	-0.0178** (0.00861)	-0.0183** (0.00869)		
Strike fraction of month			-0.0186** (0.00820)	-0.0201** (0.00837)
Observations	21,433	21,433	24,480	24,480
R-squared	0.024	0.014	0.024	0.015
Region FE	Y	N	Y	N
Survey FE	N	Y	N	Y
Year FE	Y	Y	Y	Y
Month FE	Y	Y	Y	Y
N_clust	373	373	420	420

Notes: Significant at 90% (\*), 95% (\*\*), 99% (\*\*\*) confidence. The standard errors of the estimates of the difference are clustered at the birth-month\*year\*country level. This table presents the results of estimates including all births that took place within 6 months of a strike.

Table 7: Impact of Strikes on Child Survival

VARIABLES	(1) childalive	(2) childalive	(3) childalive	(4) childalive
National strike, over 2 weeks	-0.0505* (0.0269)	-0.0489* (0.0258)		
Strike fraction of month			-0.0311 (0.0266)	-0.0354 (0.0263)
Observations	1,718	1,718	2,220	2,220
R-squared	0.092	0.046	0.081	0.041
Region FE	Y	N	Y	N
Survey FE	N	Y	N	Y
Year FE	Y	Y	Y	Y
Month FE	Y	Y	Y	Y
N_clust	156	156	202	202

Notes: Significant at 90% (\*), 95% (\*\*), 99% (\*\*\*) confidence. The standard errors of the estimates of the difference are clustered at the birth-month\*year\*country level. This table presents the results of estimates including all births that took place within 2 months of a health-worker strike with a woman who had previously delivered in a facility.

Table 8: Mechanisms: Impact of Strikes on Deliveries

VARIABLES	(1) delivfacility	(2) delivfacility	(3) delivhome	(4) delivhome
Strike fraction of month	-0.0459* (0.0245)	-0.0546** (0.0270)	0.0480* (0.0261)	0.0567** (0.0279)
Observations	2,214	2,214	2,214	2,214
R-squared	0.172	0.090	0.140	0.062
Region FE	Y	N	Y	N
Survey FE	N	Y	N	Y
Year FE	Y	Y	Y	Y
Month FE	Y	Y	Y	Y
N_clust	201	201	201	201

Notes: Significant at 90% (\*), 95% (\*\*), 99% (\*\*\*) confidence. The standard errors of the estimates of the difference are clustered at the birth-month\*year\*country level. This table presents the results of estimates including all births that took place within 2 months of a health-worker strike with a woman who had previously delivered in a facility.

Table 9: Impacts of Strikes in Survivor Health

VARIABLES	(1) wtht	(2) wtht	(3) wtage	(4) wtage	(5) htage	(6) htage
Strike fraction of month	-0.656 (1.117)	-0.956 (1.103)	-2.075* (1.195)	-2.128* (1.193)	-2.835*** (1.018)	-2.667** (1.027)
Observations	9,229	9,229	9,225	9,225	9,225	9,225
R-squared	0.113	0.084	0.139	0.118	0.145	0.117
Region FE	Y	N	Y	N	Y	N
Survey FE	N	Y	N	Y	N	Y
Year FE	Y	Y	Y	Y	Y	Y
Month FE	Y	Y	Y	Y	Y	Y
N_clust	214	214	214	214	214	214

Notes: Significant at 90% (\*), 95% (\*\*), 99% (\*\*\*) confidence. The standard errors of the estimates of the difference are clustered at the birth-month\*year\*country level. This table presents the results of estimates including all births that took place within 2 months of a health-worker strike.

Table 10: Impact of Strikes on Delivery and Child Survival - Mother Fixed Effects

VARIABLES	(1) childalive	(2) childalive	(3) delivfacility	(4) delivfacility
National strike, over 2 weeks	-0.0191 (0.0199)		-0.00757 (0.0196)	
Strike fraction of month		-0.0244 (0.0167)		-0.0103 (0.0184)
Observations	27,406	29,250	27,186	29,012
R-squared	0.549	0.527	0.807	0.793
Year FE	Y	Y	Y	Y
Month FE	Y	Y	Y	Y
N_clust	903	950	903	950

Notes: Significant at 90% (\*), 95% (\*\*), 99% (\*\*\*) confidence. The standard errors of the estimates of the difference are clustered at the birth-month\*year\*country level. This table presents the results of estimates including all births to women who gave birth twice in the five years preceding a survey.

## 7 Figures

Figure 1: Number of births per month, timing of health-worker strikes

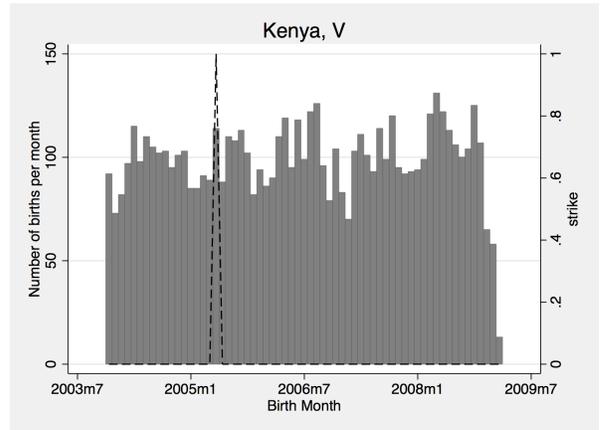
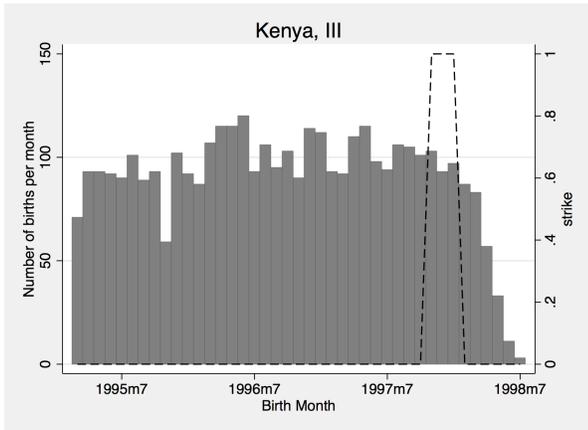
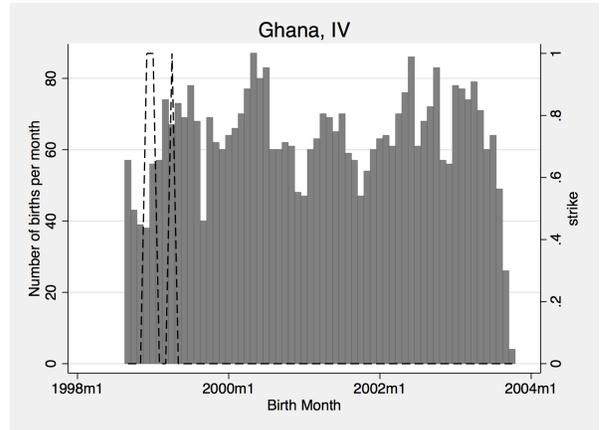
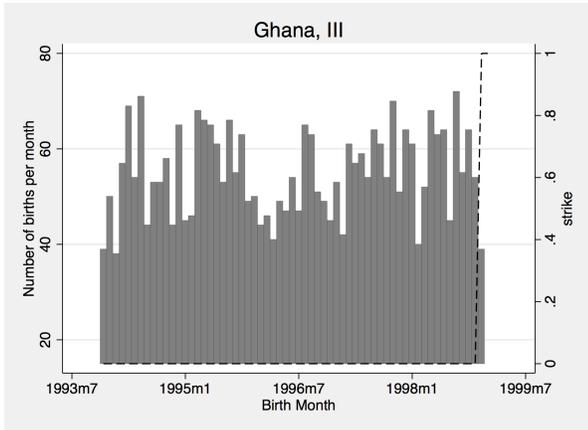
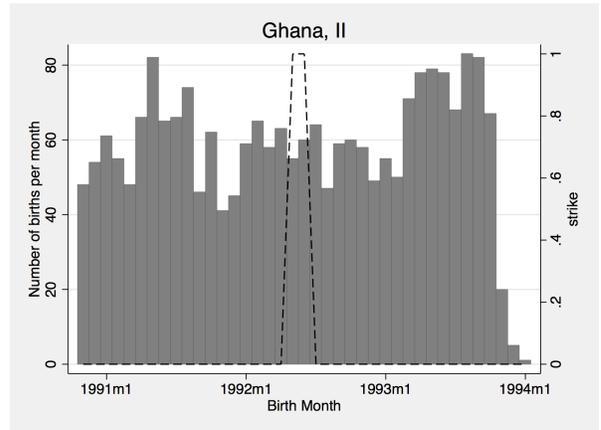
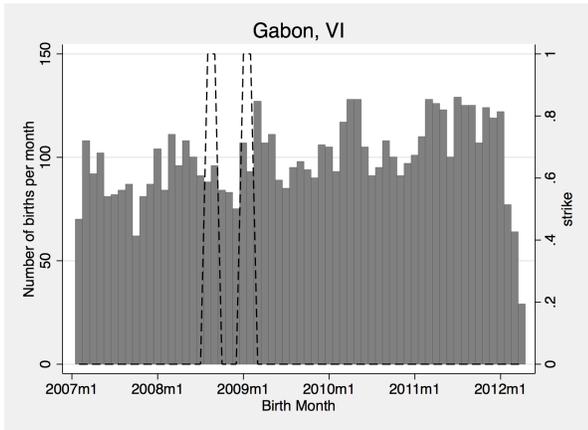
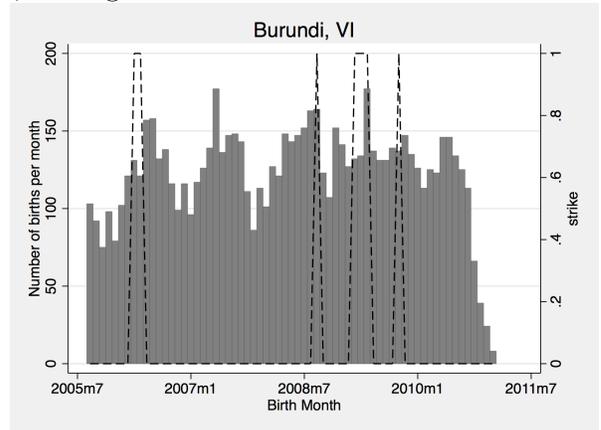
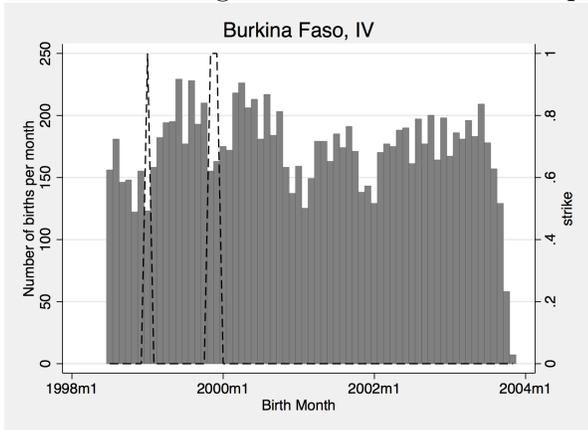


Figure 2: Number of births per month, timing of health-worker strikes

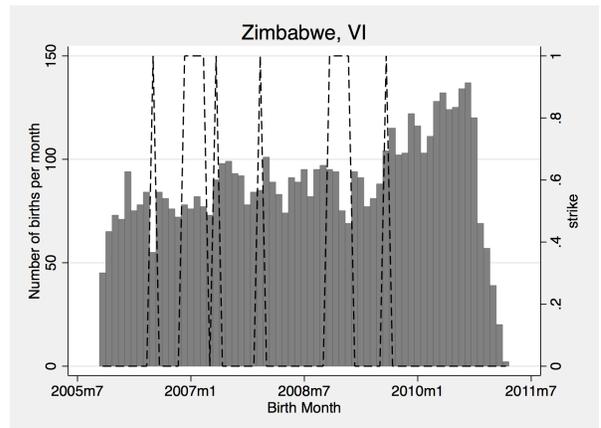
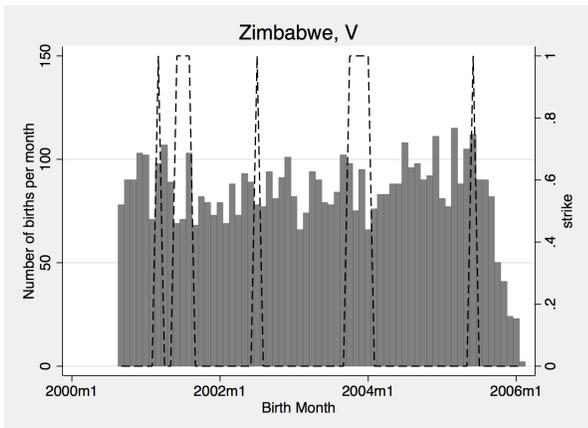
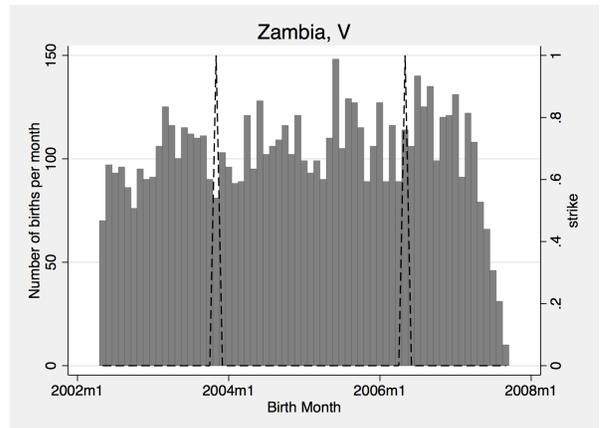
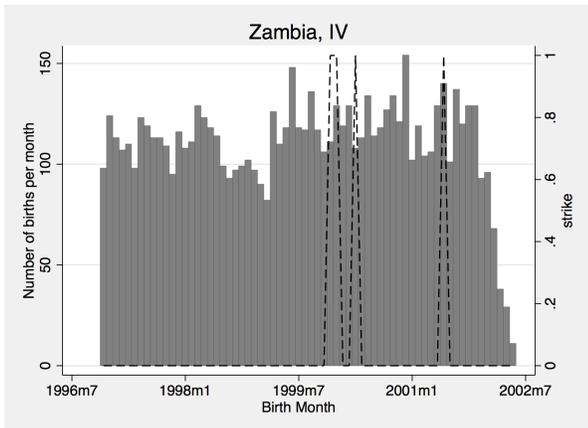
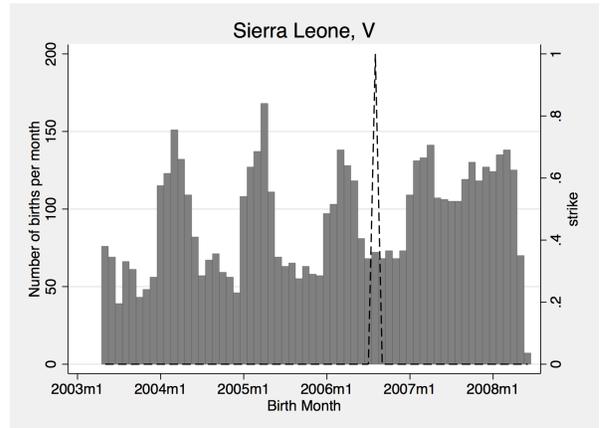
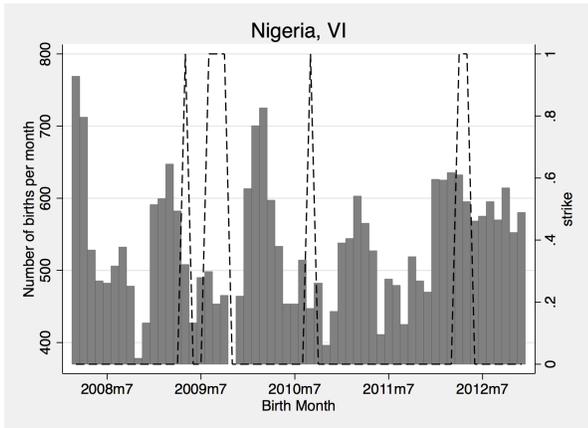
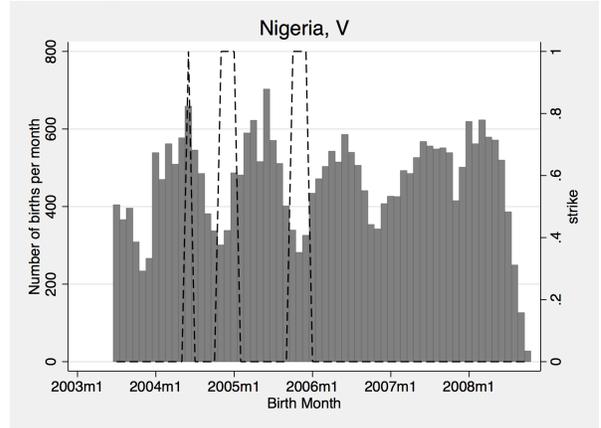
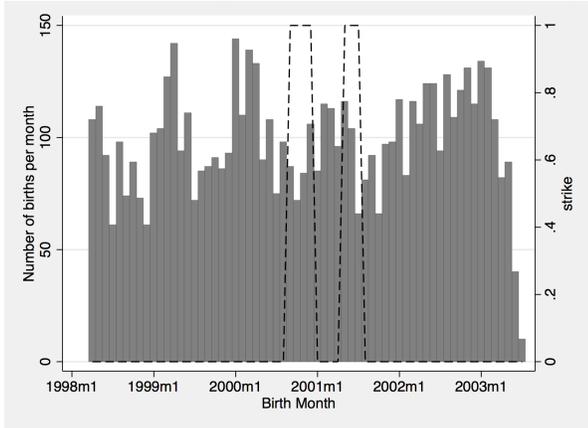


Figure 3: Fraction still alive (at time of survey) by birth-month, timing of health-worker strikes

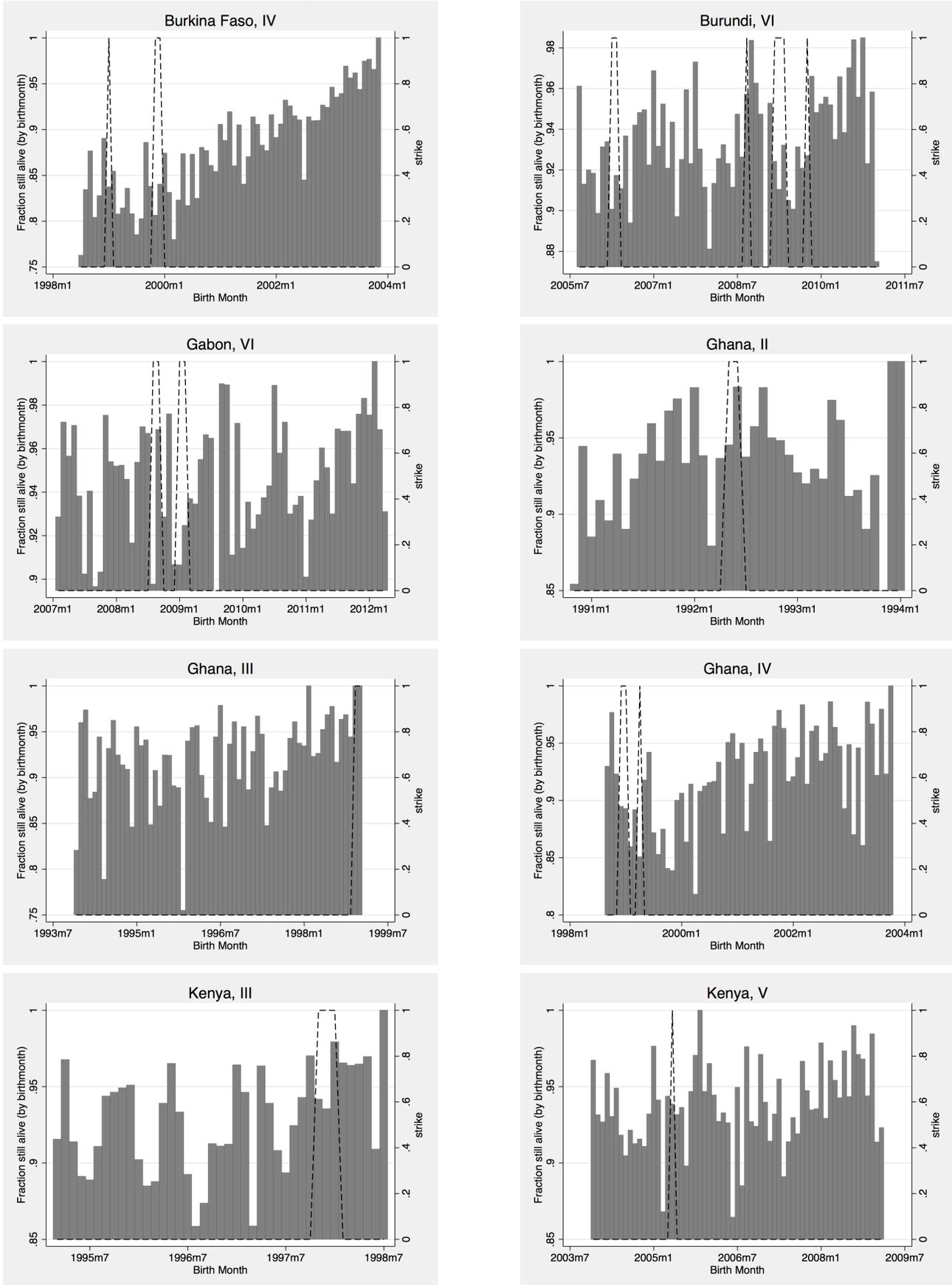


Figure 4: Fraction still alive (at time of survey) by birth-month, timing of health-worker strikes

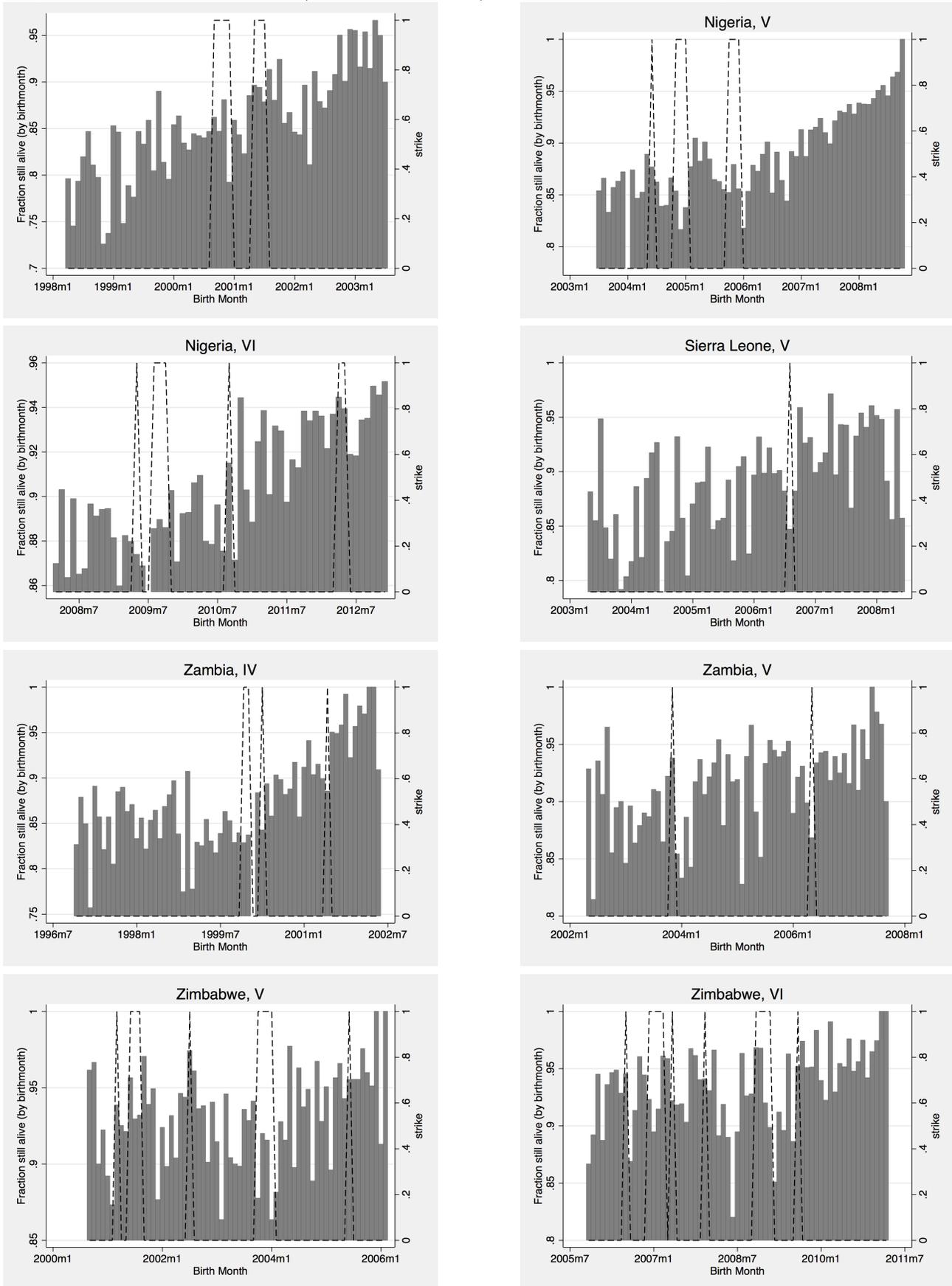


Figure 5: Fraction of children died in first-month, timing of health-worker strikes

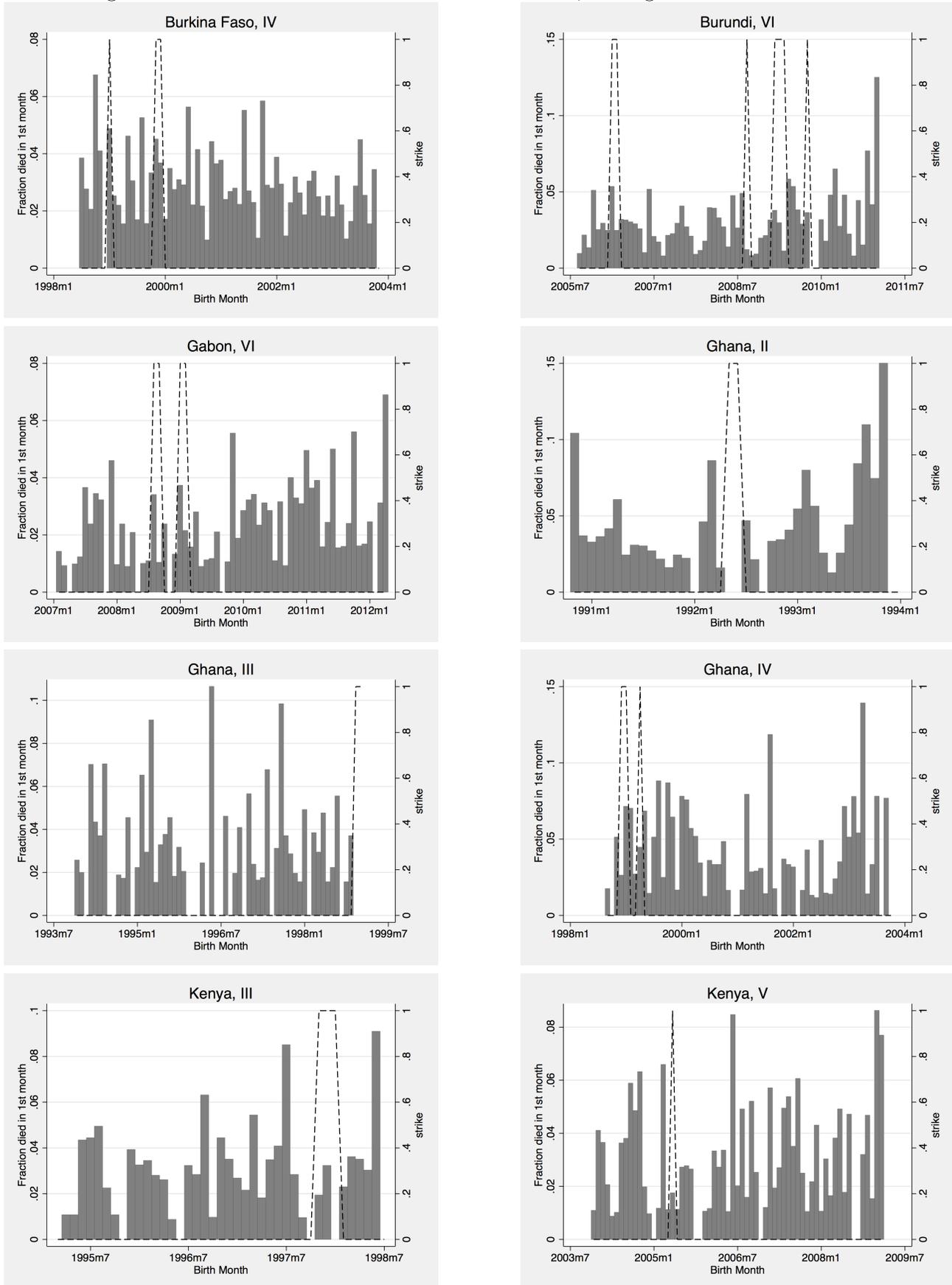


Figure 6: Fraction of children died in first-month, timing of health-worker strikes

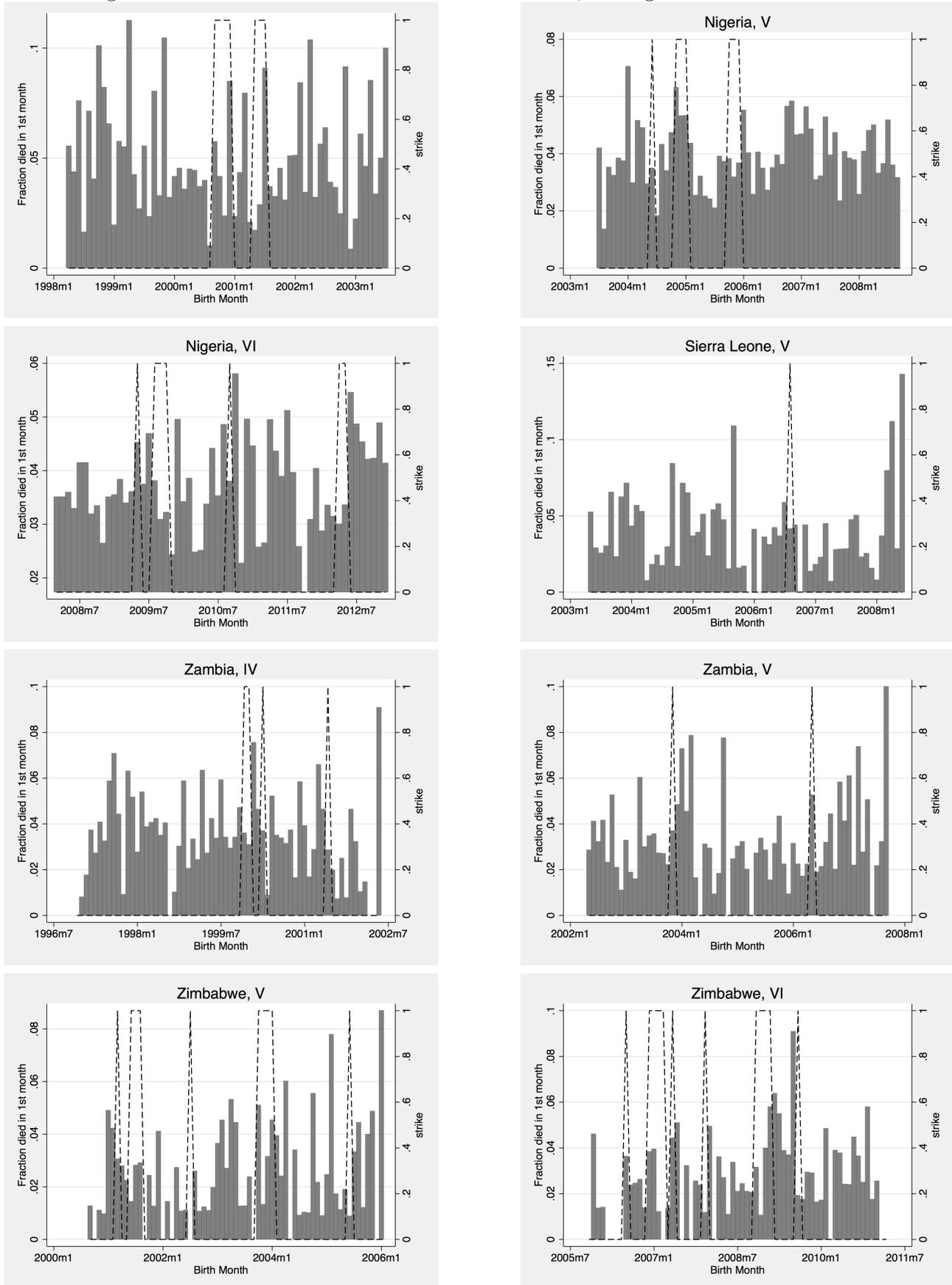


Figure 7: Fraction of deliveries in a facility, timing of health-worker strikes

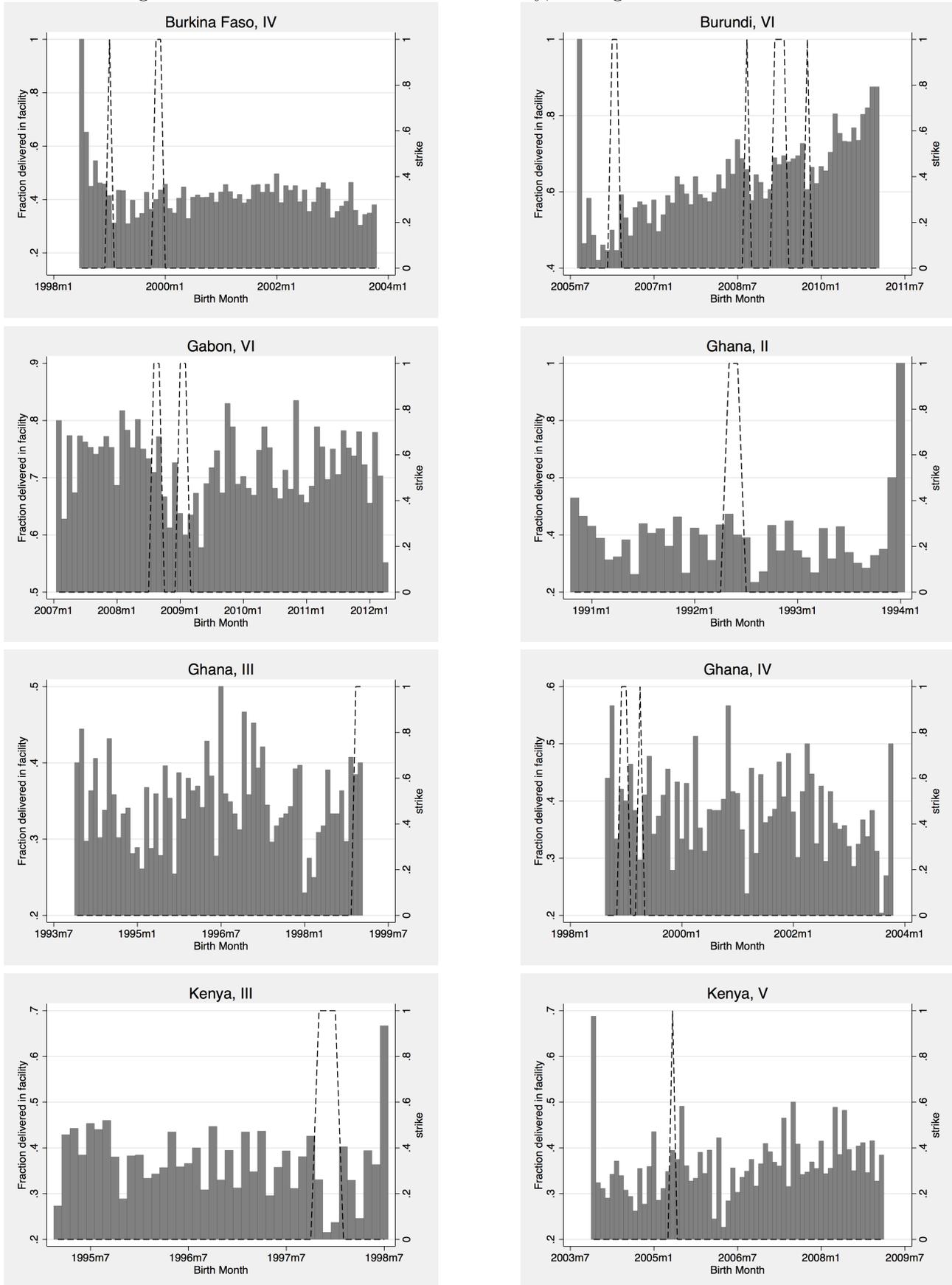


Figure 8: Fraction of deliveries in a facility, timing of health-worker strikes

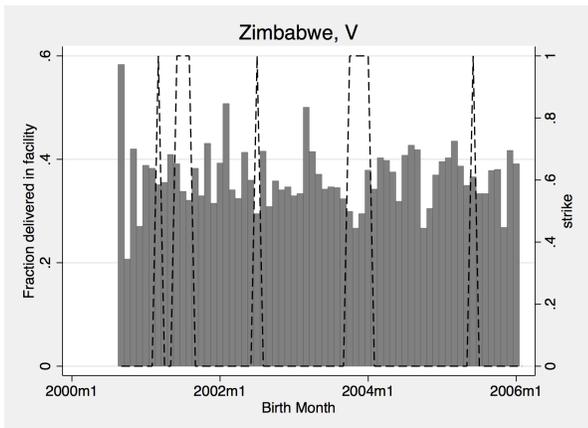
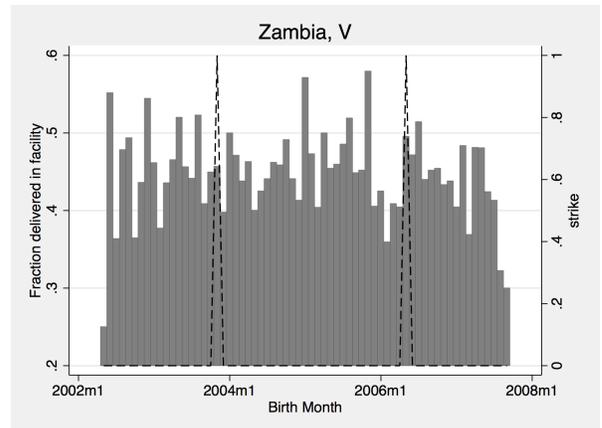
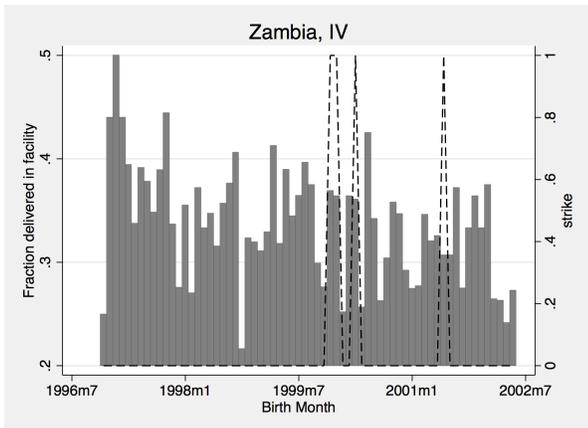
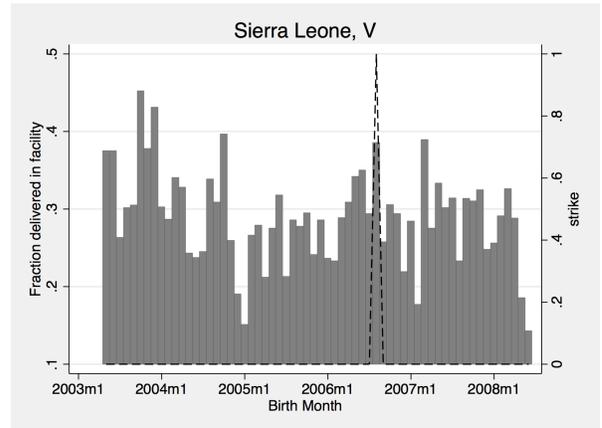
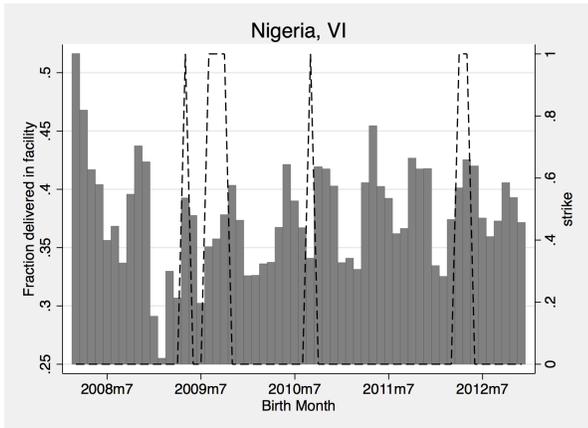
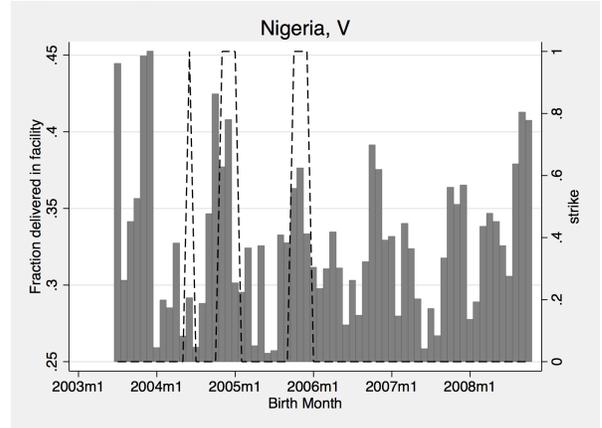
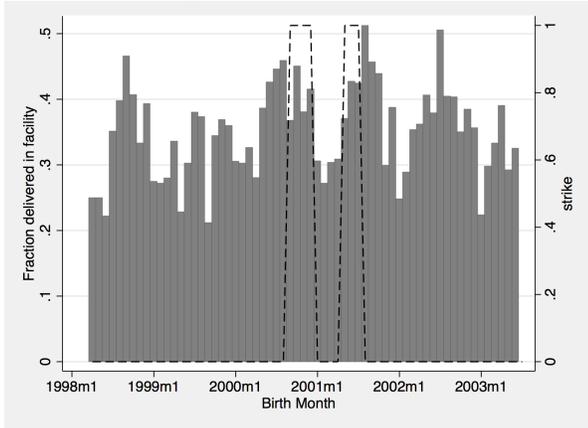


Figure 9: Fraction of deliveries at home, timing of health-worker strikes

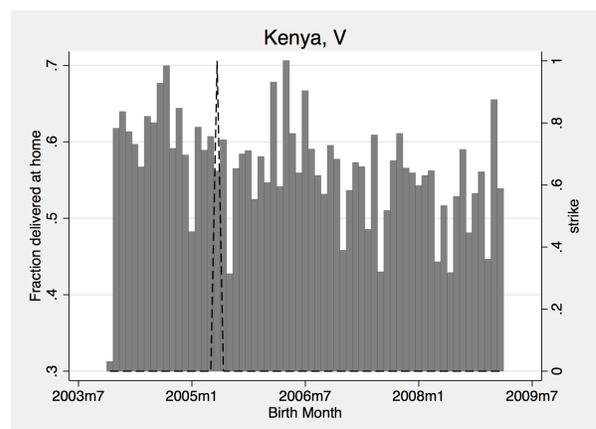
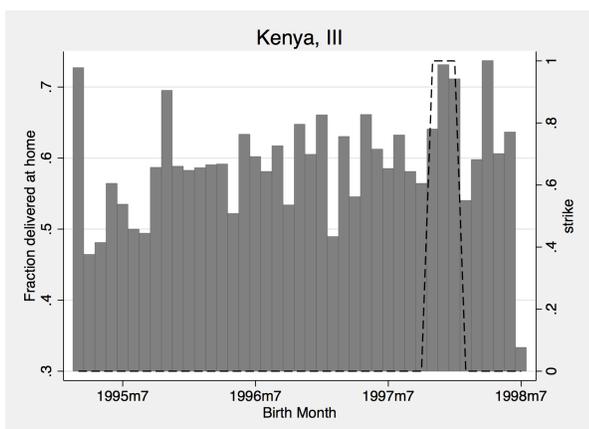
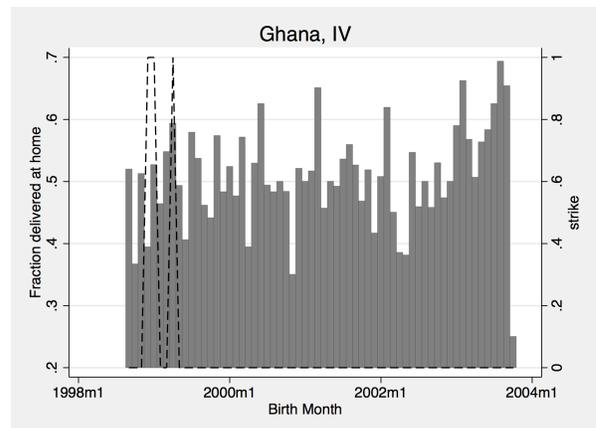
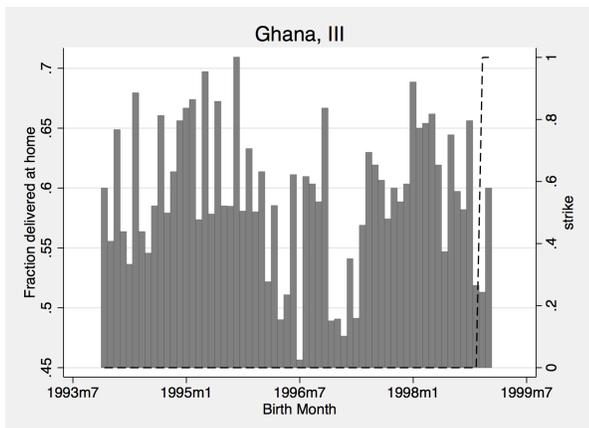
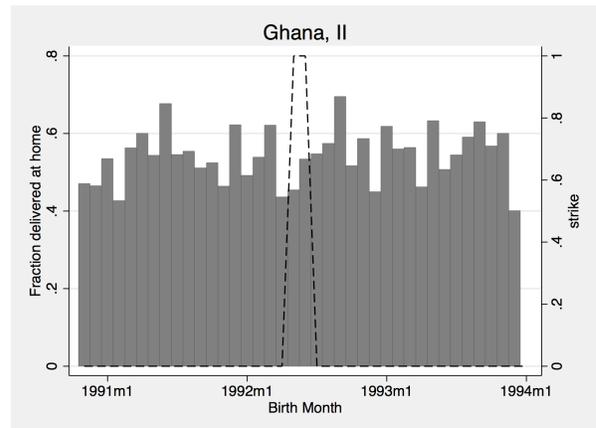
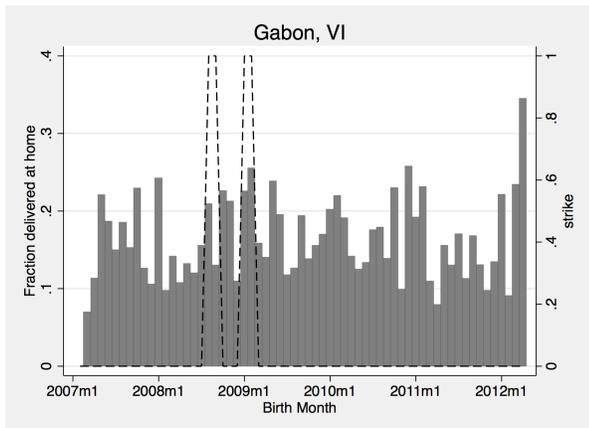
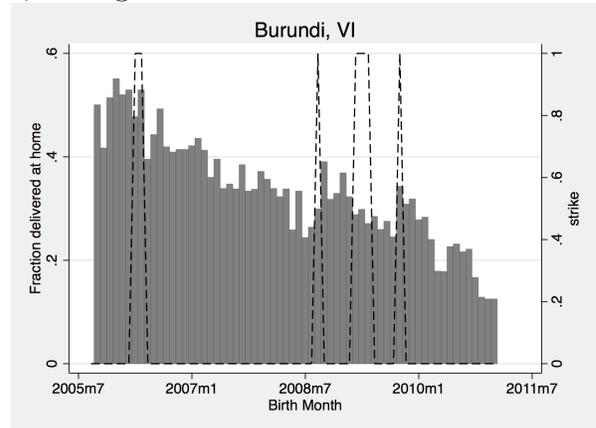
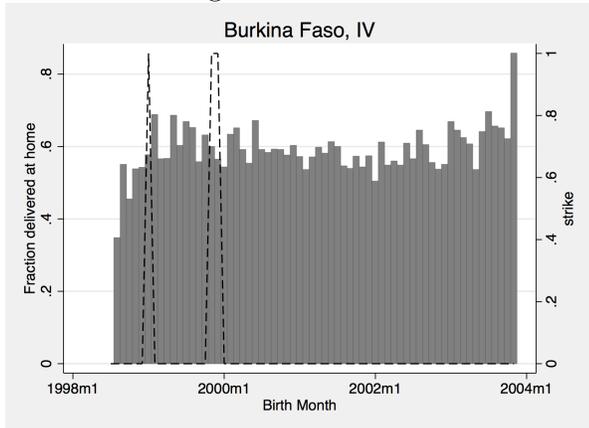


Figure 10: Fraction of deliveries at home, timing of health-worker strikes

