Consequences of withdrawal: Free condoms and birth rates in the Philippines

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Abstract

This paper presents new evidence on the role of subsidized contraceptives in influencing fertility behavior. It draws on two types of disruptions that affected the public supply of free contraceptives in the Philippines: a sharp reduction induced by the phase out of contraceptive donations to the country from an external donor coupled with a government policy that shirked public funding to fill the supply shortfall, and substantial fluctuations in the shipment of free contraceptives to the country's provinces that were brought about by supply chain issues. It finds that birth rates were responsive to both broad and transitory changes in public contraceptive supply: provinces which experienced bigger declines in the supply of free contraceptives also had larger increases (or smaller decreases) in birth rates, while temporary supply drops (increases) were followed by rising (falling) birth rates. It also identifies poor, less educated, and rural women as the groups which were least able to cope with short-term gaps in public contraceptive supply.

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1 Introduction

Family planning programs have been a consistent component of development plans since the 1960s because of the belief that the wide availability and affordability of modern contraceptives will allow couples to manage their fertility, which in turn could improve their families' socioeconomic outcomes and increase their investment per child. This belief, together with an interest in promoting the reproductive health of women and children,[1] underpin the substantial amount of international aid given to developing countries to subsidize the provision of contraceptives. However, clear evidence that supports or negates the belief that contraceptive subsidies affect fertility has been lacking, and recent work has shown diverging results on the effect of contraceptive subsidies on related margins of contraceptive use and induced abortions.[2]

The benefits of planning childbearing are large, while the costs associated with contraception, monetary and otherwise, are usually much smaller. Thus, it would seem natural to expect that contraceptive subsidies are unimportant for fertility behavior. However, if couples face liquidity problems or credit constraints, poorly assess the odds of getting pregnant, underestimate the lifetime costs of having a child, or get weighed down by the cognitive load of attending to their most basic needs, this could push the relative cost of contraception high enough such that fertility may be responsive to changes in contraceptive subsidies.

This paper presents new evidence on the role of the supply of subsidized contraceptives in developing countries in influencing fertility behavior. It draws on two types of disruptions that affected the public supply of contraceptives in the Philippines: the first was the phase out of contraceptive donations to the country coupled with a government policy that shirked public funding to fill the supply gap, and the second was the erratic and intermittent shipment of contraceptive supplies to the provinces brought about by supply chain issues.

[1] Modern contraceptives allow for safe and effective birth spacing and limiting practices that help reduce the risk of maternal and infant mortality.

[2] McKelvey, Thomas, and Frankenberg (2012) demonstrate that contraceptive use was little affected by substantial changes in contraceptive prices (net of subsidies) and household incomes both induced by the 1997 financial crisis in Indonesia. In contrast, Bendavid, Avila, and Miller (2011) evaluate the reinstatement in 2001 of the Mexico City Policy (MCP), a U.S. government policy that prohibits giving funding to nongovernmental organizations that perform or promote abortion services, most of which also provide subsidized contraceptives. They find that induced abortion rates in sub-Saharan Africa went up in countries that were relatively more reliant on U.S. assistance for family planning and reproductive health, and this impact was accompanied by a slower increase in contraceptive use compared to less-reliant countries. Jones (2011) provides corroborating evidence in Ghana where rural women had more pregnancies and induced abortions during the different periods the MCP was in effect.

The Philippines is well-suited for investigating the importance of contraceptive subsidies because of several institutional features. First, the public sector relies entirely on commodity donations from international aid agencies for its contraceptive supply,[3] and hence public supply is vulnerable to exogenous shocks related to donation receipt. Second, the public sector provides family planning services and contraceptives for free, and so changes in public supply have a stark connection to contraceptive use. Third, while more than two-thirds of modern contraceptive users obtained their supply from public health facilities before the supply phase out, at least a quarter of them purchased it from the commercial market, so that substitution possibilities between the public and private sectors exist.[4] Fourth, the availability of extant records on the quarterly shipment of donated contraceptives from the country's central warehouse to different local government health offices makes it possible to have a fine-grained measure of the public supply situation that prevailed in each province over close to a decade.

The substantial drop in the supply of free contraceptives induced by the phase out effectively resulted in a rollback of the family planning program. This episode is useful in assessing the extent by which couples undertake compensating behavior. Aside from switching to the private sector, couples could also adjust to the loss of free contraceptives by shifting to other methods of preventing births, such as inducing abortion,[5] undergoing sterilization,[6] using traditional methods like withdrawal and periodic abstinence, or engaging in sex less often. Since each of these margins alter the likelihood of childbearing in different ways, determining the impact on fertility is altogether an empirical question.

The irregularity of contraceptive shipments to the country's provinces placed the continuous availability of free family planning commodities at risk. While having an adequate and reliable supply of contraceptives is important in fostering uninterrupted contraceptive usage, it may well be the case that couples have an easier time adjusting to supply gaps that are temporary. I provide the first piece of evidence available on the consequences of having a weakly-managed supply

[3]Herrin (2007) posits that this situation arose because of persistent opposition to the family planning program from the country's Catholic bishops.

[4]The prices of contraceptives in the commercial market did not change much during the supply phase out, which suggests that either the private sector was capable of absorbing demand from previous users of free contraceptives, or that only a few of them switched to the private sector. Evidence presented later favors the second interpretation.

[5]Although abortion is legally prohibited in the Philippines, it is prevalent such that the clandestine abortion rate was estimated in 2000 to be 27 per 1,000 women aged 15-44 per year (Juarez, Cabigon, Singh and Hussain 2005); compare this with their estimated fertility rate in 2000 of 119 births per 1,000 women aged 15-44 per year.

[6]Sterilization services are available for free or at minimal cost from public health facilities.

chain and logistics system for delivering family planning commodities, an often-mentioned but seldom-studied shortcoming of family planning programs in many developing countries.

I find that fertility was responsive to both types of supply disruptions: provinces which experienced bigger reductions in the supply of free contraceptives also had larger increases (or smaller decreases) in birth rates, while temporary supply drops (increases) were followed by rising (falling) birth rates.

The estimated fertility effect of a 5 percentage-point reduction in annual contraceptive supply coverage, which I define as the share of women of childbearing age with provisions for a year's supply of free contraceptives, ranges from 2.0 to 3.6 additional births per 1,000 women per year and has an effect size of 2.4 to 4.5 percent. This translates to at least 33,000 to 77,000 additional births per year due to a supply reduction of such magnitude.[7]

Meanwhile, the estimated fertility effect of one standard deviation swings in quarterly contraceptive supply coverage, equivalent to 6 percentage points, ranges from 0.5 to 1.1 additional or averted births per 1,000 women per quarter and has an effect size of 2.4 to 5.8 percent. This implies that at least 10,000 to 25,000 births per quarter were at the mercy of happenstance due to supply chain inefficiencies.

While these estimated impacts were based on data for registered births, I check for the robustness of these effects by looking at changes in birth cohort sizes from two censuses, and by utilizing the pregnancy history of a sample of non-moving women from the Demographic and Health Survey (DHS). I find impact patterns that are similar in magnitude and statistical significance.

To understand the channels through which this effect operates, I use the DHS and yearly Family Planning Surveys (FPS) to shed light on the contraceptive usage dynamics that accompany fluctuations in public contraceptive supply. I find evidence suggesting that some women at or beyond the peak childbearing ages use free contraceptives when public supplies come in, and they substitute into using traditional methods, or sometimes not using any method at all, when public supplies run out. There is little evidence in the data supporting substitution between

[7]To provide perspective, the total number of registered births between 2006 and 2007 increased by almost 87,000 births. I explain in a later section that since it took about two years for the contraceptive supplies to actually reach the village health facilities and for any remaining inventories to run out, the full impact of the public supply reduction that occurred in 2004 likely came in in 2007 (this includes a one-year adjustment owing to pregnancy length).

public and private sources of contraceptive supplies.

Taken together, the evidence points to the presence of some couples who were not successful in fully adjusting to public supply losses, and even short-term supply gaps. To identify these affected groups, I examined the characteristics of births and women which exhibited fertility responses to fluctuations in the supply of free contraceptives. I find that supply fluctuations significantly affected the number of first and second births, and also the number of births before or outside of marriage. It also disproportionately affected the pregnancy risk of women from disadvantaged backgrounds: women who were living in rural areas, who belong to the poorest wealth quintile, or who had less than a high school education.

This paper adds to the literature on how positive prices affect the take-up of welfare-improving goods and services. It has been shown in experimental studies in several developing countries that even small changes in price generate substantial movements in the purchase and use of many life-enhancing commodities, such as deworming medication for school children, insecticide-treated bed nets in malaria-ridden areas, and water disinfectants in areas with poor sanitation.[8] The evidence I have compiled is consistent with the view that disadvantaged groups rely on subsidized contraceptives for managing their fertility and that they undertake incomplete compensating behavior when that subsidy is cut off.

The remainder of the paper is organized as follows. In Section 2, I provide a brief background of the family planning program in the Philippines. I also discuss the context surrounding the contraceptive supply disruptions that took place, which allows me to argue for a causal interpretation of my estimated fertility effects. In Section 3, I introduce the datasets I use and the empirical strategy that I employ. I discuss my findings in Section 4, and then explore the possible pathways that underlie the results in Section 5. I offer concluding remarks in Section 6.

2 Contraceptive supply disruptions in the Philippines

The pace of decline of the birth rate in the Philippines, a predominantly Catholic country, continues to be slow compared to its neighboring countries in Asia. It is considered one of the main reasons for its poor socioeconomic development (Pernia 2007). While its government has adopted

[8] See Kremer and Holla (2009) for a review of these studies.

an objective of reducing family size in the early 1970s, persistent opposition from the country's Catholic church hierarchy on the promotion and use of modern methods of contraception has brought about wavering policy thrusts[9] (Herrin 2002). This weak institutional environment for the country's family planning program has made it heavily reliant on international agencies for funding support.

The U.S. Agency for International Development (USAID), the primary donor of free contraceptives to the country since the 1970s,[10] started reducing its contraceptive donations to the Philippines in 2004. This action was part of a broader effort to encourage country ownership of family planning programs worldwide,[11] and complete phase out of contraceptive donations was scheduled in 2008.[12]

The government crafted a "contraceptive self-reliance" strategy that outlined how it would fill the impending shortfall in supply as early as 1999 (USAID 2003). However, a new president was installed via an uprising in 2001. Her administration decided to forgo the purchase of contraceptives by the national government,[13] and instead directed local governments to take responsibility for it. Because of limited resources and persistent pressure coming from the country's Catholic bishops, most local governments did not carry this out.[14]

To accommodate varying capabilities of local governments to cope with the phase out of donated pills and injectables, the national government devised an allocation scheme for the distribution of the gradually declining public sector contraceptive supply. The implementing guidelines of the phase out plan (Department of Health Administrative Order 158), which came out in July 2004, classified local governments as poor, middle income, or rich based on their rate of

[9]To highlight the influence of religious groups on government policy, two previous administrations focused resources on the promotion of traditional methods of family planning, i.e. variants of the rhythm/calendar method, the only form of contraception the Catholic church allows.

[10]Donations were always in commodity form; no funds were given for purchase of contraceptives.

[11]See Cromer, Pandit, Robertson and Niewijk (2004) and USAID (2005) for background information on the experiences of other countries' family planning programs which "graduated" from USAID commodity support.

[12]Because of the presence of a large commercial market for condoms, USAID condom donations were fully phased out beginning in 2004, so that distributions made in that year were leftover supplies. On the other hand, a commercial market for intrauterine devices (IUDs) was almost non-existent, so that USAID decided to exempt IUDs from the donation phase out, although it still saw a reduction in donations.

[13]This was viewed by many as a political accommodation to the domestic Catholic church during an election year (2004). The Catholic Bishops Conference of the Philippines (CBCP) has issued in the past pastoral statements, read during masses in all parishes, condemning the government's promotion of modern methods of family planning and discouraging the faithful from voting for candidates whose beliefs do not align with the church's view.

[14]This occurred despite the fact that public opinion surveys have consistently shown that an overwhelming majority of the adult population (upwards of 70% nationally and across broad regions and socioeconomic classes) think that the government should provide budgetary support for modern methods of family planning (Pernia 2007).

poverty incidence in 2000, and planned allocations were tailored such that full phase out would happen sooner for richer local governments and later for poorer ones.

The size of the supply reductions in each half-year under this scheme was tied to the average quantity of pills and injectables consumed in each local government in 2003.[15] Figure 1 illustrates the planned shipment schedule for each group of local governments, and below it was the actual shipment that took place. We can see that the progressive character of the allocation scheme was generally preserved in terms of relatively higher allocations distributed to poorer local governments in each period, but the calibrated drawdown over time was not implemented in practice. Thus, the actual supplies received by local governments from the national government were different from what they were expecting to get under the phase out plan.

The actual distribution differed from the phase out plan because of several reasons. The first reason was due to institutional adjustments that took place following the release of the implementing guidelines. This was evident in the fact that hardly any pills or injectables were distributed in the first half of 2004, when the plan was still being threshed out, and too few were distributed in the second half of the year, when the plan's implementation was supposed to start.

Another reason for the divergence was the late receipt of some contraceptive donations from USAID, which resulted in delayed distributions in some periods. Inventory miscalculations also played a part, as can be seen in the bump in pills distributed in the first half of 2008, which could be traced to the belated discovery of leftover supplies.

One practical aspect supply managers had to contend with was that contraceptive supplies came in fixed lot sizes, so that adjustments had to be made in translating the individual phase out schedules to quantities for distribution to local governments. This means that contraceptive shipments were sometimes below or above what the intended allocations were. It also increased the likelihood that some supplies, usually those small in size and earmarked for distribution in succeeding periods, were bundled together instead and shipped at the same time. This tended to make contraceptive shipments lumpy and spaced far apart.

These supply chain issues accompanied the substantial reduction in the supply of free con-

[15] Prior to the phase out, supplies were allocated based on forecasts and provisions for actual consumption of contraceptives. The planned allocation scheme was technically supposed to be based on similar forecasts and estimates of actual consumption, but reporting by local governments on consumption levels drastically deteriorated during the phase out period.

traceptives from 2004 to 2008 that was induced by the USAID donation phase out. There is no reason to expect, however, that delays in donation receipt, inventory mismanagement, and shipment indivisibilities only happened during this period. In fact, quarterly data since 2000 show that fluctuations in total shipments were even more pervasive before the phase out. Note that these general trends mask rich variation in timing and size of shipments at the local government level, and this variation is what I'll take advantage of in the analysis of possible fertility responses to supply fluctuations.

3 Data and empirical strategy

3.1 Data

I obtained data on the quantities of condoms, pills, injectables, and IUDs that were shipped from 2000 to 2008 by the Philippine Department of Health from its central warehouse in Manila to all 82 provincial health offices each quarter.[16] To facilitate the analysis, I use an aggregated measure of distributed contraceptive supply. I took the annual supply numbers and adjusted it by the number of units a woman is typically assumed to need in order to be protected from pregnancy for a year: 120 condoms, 15 pill cycles, 4 injections, or one intrauterine device (IUD). IUDs usually last for 3.5 years, so I also counted it once for each of the following 13 quarters. I interpret the sum across all four items as the number of women with provisions for a year's supply of free contraceptives.[17]

To estimate the number of women of childbearing age (15 to 49 years old) in each province each year, I follow standard practice and linearly interpolate population figures from the May 2000 and August 2007 censuses, with extrapolation up to 2009. I call the ratio between the two numbers, which is the share of women of childbearing age with provisions for a year's supply of free contraceptives, as the contraceptive supply coverage from the public sector.

[16] I treat the 4 districts in the National Capital Region (NCR) as separate provinces for this analysis. Aside from the 78 provinces, the national government also shipped contraceptive supplies directly to 36 chartered cities. Because my unit of analysis is at the provincial level, I integrate the data for these chartered cities into the province where they are situated. This approach has the advantage of mitigating concerns about spillovers; i.e. women living in the provinces near a chartered city may be getting their supply from the public health facilities located in the chartered city.

[17] This is called couple-years of protection (CYP) in the family planning program literature, where I also obtained the conversion factors listed above. Note that if this required number of units per year are overestimated, as is likely the case for condoms and pills, then slightly more women might be covered by the supply of free contraceptives.

To estimate the fertility impact of changes in contraceptive supply coverage, I primarily use data on registered births from the Vital Statistics to construct birth rates per 1,000 women of childbearing age.[18] I assign births to the recorded usual residence of the mother instead of the place of occurrence of the birth.

While natality records in the Philippines' vital registry system is considered good for a developing country, there is still a fair amount of underregistration, especially in certain less developed provinces. To guard against the possibility that my results may be driven by changes in birth registration that go in the same direction as birth rates, I also employ population counts from the 2007 and 2010 censuses to compute cohort sizes of recent births.[19] I use this with the corresponding cohort sizes of women of childbearing age to generate an alternative measure of the birth rate.[20,21]

To study more closely the characteristics of births and women affected by changes in contraceptive supply coverage, I utilized the Philippines' 2008 Demographic and Health Survey (DHS). This survey contains detailed pregnancy histories of regionally-representative samples of women of childbearing age, and also the date when these women moved into their latest residence. I also use the 2003 DHS and several Family Planning Surveys (FPS) to monitor regional movements in contraceptive usage that accompanied changes in the supply of free contraceptives.

For my set of controls, I compiled information on local government tax revenues and spending on health, nutrition, and population programs from the Bureau of Local Government Finance (BLGF); poverty and subsistence incidence from the National Statistical Coordination Board (NSCB); average family income and expenditures from the National Statistics Office (NSO); and agricultural wage rates and retail food prices from the Bureau of Agricultural Statistics (BAS). In the analysis of the fertility impact of the supply phase out, I also control for baseline demographic characteristics as recorded in the 2000 Census. Table 1a presents descriptive statistics for

[18] This is usually called the general fertility rate in the demography literature.

[19] The census public use files only contain information on an individual's age. I label those who were recorded with an age of 0 as being born in the same year as the census, those who were recorded with an age of 1 as being born in the year prior to the census, and so on. To be precise, these labels don't correspond to a calendar year but the year-long period before the census interview date.

[20] I also adjust the denominator in the contraceptive supply coverage to match the re-defined birth rate.

[21] Note that while this addresses the problem of underregistration, the downside is it introduces measurement error due to children's and women's mortality, and also the incorrect residence assignment of women and children who have recently moved before the census was taken. I assume that these issues amount to classical measurement error, which would tend to attenuate my estimated fertility effects from estimation using census data. I am able to remedy the issues of migration and children's mortality using the sample of women from the DHS.

the main variables and economic controls used in this study, while Table 1b does the same for the population controls.

3.2 Empirical strategy

I take two approaches in estimating the fertility impact of changes in the supply of free contraceptives. In the first, I focus on the substantial supply reduction that was induced by the phase out of USAID donations by looking at broad changes in contraceptive supply coverage before and during the supply phase out and its relation to broad changes in birth rates. In the second, I examine if shorter-term fluctuations in contraceptive shipments have any detectable effect on birth rates.

In both cases, I carefully consider varying lag lengths in the time it took for the supplies to actually reach the village health facilities and for any remaining inventories to run out. Evidence from the annual Family Planning Surveys (FPS) indicate that nationally, modern contraceptive users' reliance on the public sector only appreciably dropped about two years after the phase out. This is most certainly because of the subsequent supply pipeline involved: supplies shipped to the provincial capital are distributed to the province's component cities and municipalities, which then deliver it to local public health facilities at the frontline.[22] In addition, any of the intermediate stages in the supply chain may have remaining inventories, and thus any fertility impact is not likely to occur immediately, at least not until buffer stocks get depleted.[23]

3.2.1 Evaluating broad changes before and during the supply phase out

Since the supply phase out happened at the same time for all provinces, the information that's available to identify its effect on fertility varies only at the cross-sectional level. It is thus appropriate to adopt a design that looks at changes in the contraceptive supply coverage over two periods that were on either side of the start of the phase out, and then link that to changes in the birth rate that correspond to the same two periods, taken a year later to account for gestation. I

[22] Distribution speeds would naturally vary depending on geography, i.e. how far and how accessible each destination is from an origin. On top of that, since each administrative level is responsible for the cost and trouble of transporting the contraceptive supplies that they receive, distribution speeds would also vary depending on the efficiency of each link in the supply chain.

[23] Anecdotal evidence points to the frequent inadequacy of stocks. If certain places had sufficient buffer stocks, it would lead to a bias towards finding no fertility impact.

estimate the following regression:

$$\triangle BirthRate_j = \alpha + \beta \triangle Supply_j + \gamma \triangle E_j + \mu P_j + \varepsilon_j, \quad (1)$$

where j indexes provinces, and E and P denote economic and population controls.[24] A negative estimate of β would imply that provinces which experienced bigger reductions in the supply of free contraceptives also had larger increases (or smaller decreases) in birth rates.

Because at this stage I am more interested in the fertility response to the supply loss and less on fertility responses that are related to transitory movements in the contraceptive supply coverage, I take the average of annual public supply levels and birth rates over three-year periods that straddle the start of the phase out in 2004. I also consider the moving average of annual birth rates up to two years ahead in order to account for the downstream distribution and inventory lags mentioned above.

Note that even though the public supply levels that materialized during the phase out period were unexpected, the size of changes in the contraceptive supply coverage induced by the phase out may still be systematically related to unobserved changes in the characteristics of the provinces, which in turn could also be influencing the fertility changes that are observed. For example, if developed areas, which may be more likely to experience increases in teen births in the first place, also faced bigger cuts in free supplies, one may mistakenly attribute all of the increase in observed birth rates to the decline in the supply of free contraceptives, discounting the contribution of other confounding factors.

To get credible estimates of the fertility impact, I control for important variables that might be correlated with both changes in the contraceptive supply coverage and in the birth rate, such as: changes in the average family income and expenditure; changes in male and female opportunity costs in the agricultural labor market; changes in economic conditions, as proxied by local government tax revenues and the incidence of poverty and subsistence; and changes in relevant local government spending that may be used to purchase contraceptives to augment the diminishing supply. I also control for demographic characteristics that prevailed in 2000, which include the share of the population of women of childbearing age that identify themselves as Catholic, a

[24] This specification is equivalent to a two-period panel regression with province and period fixed effects, and where baseline population controls are interacted with a period dummy.

proxy for how influential the Catholic bishops might be in their locality, and the share of the population of children 0-1 year old whose births were not registered with the civil registrar.[25]

One remaining concern is that the government tried to allocate a greater share of the declining supply of free contraceptives to poorer provinces, which might be expected to be more adversely affected by the supply phase out. This preference was embodied in a scheme, discussed in the previous section, which indexed the schedule of allocated supplies to the average consumption levels that prevailed in each province in 2003, the year immediately preceding the phase out, but with more favorable terms for poorer provinces. I incorporate the *essence* of this scheme by instrumenting the change in the contraceptive supply coverage by the average annual contraceptive supply coverage before the phase out period.

This instrument isolates the change in the contraceptive supply coverage that was solely due to the *mean* indexation that was implemented given the supply chain issues that occurred. For my purposes, it serves to take out the effect of the intentional targeting that was a key feature of the allocation scheme.[26] Because the purpose of the targeting was to blunt the possible negative impact of the supply phase out on the birth rate, I expect a more negative estimate for β once the change in contraceptive supply coverage is instrumented.

3.2.2 Exploiting idiosyncratic variation in supply distribution

In the previous section, I discussed the many issues that beset the shipment of contraceptives before and during the phase out period and which likely resulted in idiosyncratic variation in the contraceptive supply coverage. I present examples of these quarterly fluctuations in Figure 2 for a randomly-selected set of four provinces. While one could see that they share a broad temporal pattern, it is also clear that each had big swings in shipments that were unique. In addition, there were certain periods when each province hardly received any contraceptive shipments from the national government.[27]

[25] To the extent that some of these variables are linked to changes in the demand for children, I am able to account for demand-side factors that influence fertility. \

[26] Contrary to standard usage, I *do not* use instrumental variable estimation to secure causal interpretation; for identification, I continue to rely on the unexpected nature of the supplies that were shipped to the provinces during the phase out period, together with the (implicit) use of province and period fixed effects, which account for the influence of time-invariant and temporal unobservables, in the estimation.

[27] Note that because IUDs were counted as providing protection from pregnancy for 13 additional quarters after it was distributed, the aggregated series masks periods when the province did not get any other contraceptive shipment.

I take advantage of this rich quarterly variation in contraceptive supply coverage to ascertain if the supply of free contraceptives indeed has strong linkages to fertility outcomes. I estimate the following regression:

$$BirthRate_{j,t+3} = \alpha + \sum_{s=0}^{8} \beta_s Supply_{j,t-s} + \phi_j + \tau_t + X'_{jt}\theta + \lambda_j Qtr + \delta_j Trend + \varepsilon_{jt}, \quad (2)$$

where j indexes provinces as before, and t indexes time incremented in quarters. I allow current and previous values of the contraceptive supply coverage, up to 8 quarters behind, to affect the birth rate three quarters ahead. I rely on province fixed effects ϕ_j to soak up fixed province characteristics that might be related to the fertility level each province exhibits, and rely on time fixed effects τ_t to sweep out secular trends in the birth rate.

Negative estimates of β_s will imply that birth rates responded in the opposite direction to fluctuations in contraceptive supply coverage that happened s quarters ago. Different local public health facilities in each province will get their supplies delivered at varying times, and some of them may also have leftover inventories. Thus, β_s may be negative in several different periods, and one could sum up the coefficients from β_0 to β_s to obtain the cumulative effect of a change in the contraceptive supply coverage after s quarters.

I include in the regression the same set of time-varying economic controls used in the previous analysis, and supplement it with quarterly data on the provincial retail prices of 62 different food items, which I expect will pick up transient changes in local economic conditions. I also add province-by-calendar quarter fixed effects $\lambda_j Qtr$ to control for any confounding seasonality in the type of births and kind of mothers who give birth in each particular calendar quarter.[28] Lastly, I add controls for province-specific trends $\delta_j Trend$, which capture the effect of variables that move slowly over time, such as changes in demographic composition. I allow the trend to be either linear or quadratic.

Using data from the sample of women in the 2008 Demographic and Health Survey (DHS) allows me to use conception rates instead of birth rates, which eliminates the need to account for the gestation lag. More importantly, it permits me to look at individual-level characteristics of women and their pregnancies that may be affected by fluctuations in the supply of free contra-

[28] Buckles and Hungerman (2010) show that in the United States, there are important differential patterns in mother characteristics based on the quarter when they give birth.

ceptives. The DHS also has information on when these women moved into their latest residence, which is useful because I want to correctly assign each woman to her province's contraceptive supply coverage. I estimate the following regression:

$$P(Conceive)_{i\bar{j}t} = \alpha + \sum_{s=0}^{8} \beta_s Supply_{\bar{j},t-s} + \phi_i + \tau_t + X'_{\bar{j}t}\theta + \lambda_{\bar{j}} Qtr + \delta_{\bar{j}} Trend + W'_{it}\psi + \varepsilon_{i\bar{j}t}, \quad (3)$$

where i indexes each woman and $\bar{j}$ makes it clear that I observe these women in only one location, their latest residence. The outcome I consider is the probability of conceiving conditional on being fecund (since this probability is trivial otherwise), which I define as not currently pregnant or concluding pregnancy. I also exclude periods after a woman is ligated.

Apart from the previous controls, I also include woman fixed effects ϕ_i in this specification so that time-invariant unobservables at the individual level that affect fertility and other life choices are taken cared of. I also control for time-varying woman-specific characteristics W_{it} that predict fertility such as dummies for single-year age and parity (the number of previous births) and an indicator that turns on when a woman has her first marriage or union. A negative estimate of β_s would imply that a given woman is more (less) likely to get pregnant if her province saw temporary drops (increases) in the supply of free contraceptives s quarters ago, and we can again sum up the coefficients to get cumulative estimates of the impact on individual pregnancy risk. I will also interact the contraceptive supply coverage with subgroup indicators to check for impact heterogeneity.

4 Results

Before turning to the results from the two main analyses, I first explore the graphical relationship between contraceptive supply coverage and birth rates using aggregate trends from 2000 to 2009,[29] followed by a presentation of aggregate trends in contraceptive use from 1998 to 2008.

Figure 3 shows that the annual supply of publicly-provided contraceptives dropped substantially in 2004, from an average quantity that was sufficient to cover the contraception needs of 8.7% of women age 15-49 in 2001-2003 to 3.0% in 2004-2008, the period when USAID contracep-

[29] 2009 is the latest year with available natality data from Vital Statistics.

tive donations were gradually phased out. The graph also shows that in general, the national birth rate had a declining annual trend from 2000 until 2006 when it dropped from 91.0 to 75.8, but it went up in 2007 by 2.4 births per 1,000 women (equivalent to a 3.2% change), three years after the start of the phase out.[30] The birth rate hardly changed in 2008, but it started dropping again in 2009.

Figure 3 also shows quarterly versions of the same graphs, where we clearly see that the birth rate started to reverse its downward trend in 2006. The pronounced quarterly pattern in the birth rate prevents one from easily seeing possible connections with swings in the contraceptive supply coverage, except for a sharp transitory supply drop in 2002:Q3 which may have led to a hump in the birth rate a year or two after.

Figure 4 shows aggregate trends in contraceptive use from the DHS and the FPS. The left panel shows that the use of supply-based contraceptives has been steadily increasing since 2000, but it went down in 2006, two years after the start of the phase out period, and it has barely picked up since then. It also shows that while the use of traditional methods over time has been quite noisy, there is a discernible upward trend starting in 2006.

The right panel of Figure 4 breaks down the most recent source of supply for supply-based contraceptive users. I find that since 1999 until 2006, the rate of use of contraceptives obtained from the public sector has been quite stable at around 9.0 percent, which is consistent with the average levels of contraceptive supply coverage seen between 2000 to 2003 in Figure 3.[31] The rate of use of free contraceptives started declining markedly in 2006. As argued in the previous section, this delay in the bite of the supply phase out could be attributed to lags associated with downstream distribution and the drawdown of any remaining inventories. Notice that the magnitude of the usage drops in 2006 and 2008 are both comparable to the corresponding increases in the use of traditional methods.

One can also see in the right panel of Figure 4 that the use of contraceptives obtained from the private sector has been growing unabated from 2001 up to the last data point in 2008, with a

[30] Note that data from the 1998, 2003, and 2008 DHS show a slow but steady downward trend in women's ideal number of children, which is inconsistent with the substantial increase in birth rates seen in 2007.

[31] As mentioned earlier, contraceptive supply coverage may be lower than the contraceptive use rate if the conversion factors I used were too conservative compared to actual use scenarios. The distributed supplies could also be subject to spoilage, leakage, or rationing. Since the discrepancy between the two series is very slight, these factors were likely to be unimportant.

seemingly consistent pace all throughout. The absence of increases around 2006 that go beyond previous trends suggests that there was little switching of supplies from the public sector to the commercial market.

4.1 Fertility effect of the supply phase out

For the analysis of the impact of the broad reduction in the supply of free contraceptives on fertility, I took averages for the three years immediately before and after the start of the phase out period. To provide intuition on the variables used, Figure 5 provides a scatterplot of changes in contraceptive supply coverage (on the horizontal axis) against changes in the birth rate (on the vertical axis). The three panels correspond to three different assumed distribution and inventory lags. As expected, almost all of the provinces experienced a decline in the average supply of free contraceptives. On the other hand, while many provinces recorded increases in the average birth rate, especially at longer distribution and inventory lags, many more chalked up decreases. However, there is a clear pattern that emerges: the bigger the drop in the average supply of free contraceptives, the more likely it is for that province to have had a bigger increase or a smaller decrease in the average birth rate.

Moving from Figure 5 to its equivalent specification in column 1 of Table 2, we see that the estimate of β is negative and significant across all three assumed distribution and inventory lags. We find that the addition of economic and population controls in columns 2 and 3 does not make this go away. The results are also not overly sensitive to dropping two outlying regions, one of which is the most developed region in the country (NCR), while the other is the region with the most conflict-affected areas (ARMM).

In tables available upon request, I instrument the change in the average contraceptive supply coverage by its average level before the phase out. I find that the instrument strongly predicts the change in supply in all cases (first-stage regression F-statistics were above 100 and usually much higher), and all the point estimates of β become more negative as I expected. This suggests that if one does not take into account progressive targeting of supplies, as reflected in the OLS estimates, one would likely find effects that are smaller, so that OLS estimates could be thought of as providing a lower bound.

The preferred estimates across OLS and IV estimates imply fertility effects that range from 2.0 to 3.6 additional children per 1,000 women of childbearing age per year from a 5 percentage-point reduction in the contraceptive supply coverage. This impact has an effect size of 2.4 to 4.5 percent.

I check for the robustness of these results using an alternative measure of the birth rate computed from cohort sizes in the 2007 and 2010 Censuses. In tables available upon request, I find similar estimates of β that are negative and statistically significant. Overall, preferred estimates across OLS and IV estimates imply fertility effects that range from 1.7 to 3.0 additional children per 1,000 women of childbearing age per year from a 5 percentage-point reduction in the contraceptive supply coverage. Given annual birth rates that are expectedly higher due to the inclusion of non-registered births, this represents an effect size of 1.5 to 3.0 percent.[32]

I also check for the conditional correlation of changes in the contraceptive supply coverage with birth rate changes five years prior, or the change in the average annual birth rate from 1995-2000 to 2000-05 from the 2010 Census. In a table available upon request, I obtained estimates of β which are still significant but now positive, which is consistent with the interpretation that the provinces which experienced larger increases (or smaller decreases) in birth rates during the phase out were historically the same provinces which experienced the largest declines in birth rates, and presumably this was because they had high contraceptive supply coverage even before 2000, same as in the period just before the phase out (in 2000-2003). The seeming break in the trend for these provinces from big declines in birth rates to big increases bolsters the case further for the responsiveness of fertility to changes in the supply of free contraceptives.

4.2 Fertility effect of supply fluctuations

After examining how substantial reductions in public contraceptive supplies affect broad movements in fertility, I now consider whether birth rates also respond to shorter-term movements in the supply of free contraceptives.

Using quarterly vital statistics data and the specification in equation (2), we see in column 1 of Table 3 that the estimates of β_s are negative and significant for the contraceptive supply coverage

[32]The estimates using census enumeration data fall within the same range as the estimates from the birth registration data, if not a bit smaller. The relatively smaller effect size, however, can be attributed to attenuation bias coming from measurement error, as explained in footnote 21.

that represent distributions made to provincial health offices two to seven quarters behind. These estimates get smaller but continue to be statistically significant with the addition of the economic controls, but every successive inclusion of additional controls do not appreciably change any of the estimates from hereon, such as the addition of retail prices, province-by-calendar quarter fixed effects, three-quarter leads in the supply measure, and province-specific linear or quadratic trends. This consistency in the estimates provides confidence in the assumption that these fluctuations in the contraceptive supply coverage are indeed idiosyncratic.

To better gauge if fertility responds differently to increases or decreases in the contraceptive supply coverage, I distinguish between positive and negative changes in the contraceptive supply coverage by interacting it with an indicator for whether it was an increase or decrease from the previous period.[33] I find that fertility responds similarly to either an increase or a decrease in the contraceptive supply coverage: it falls following an increase in contraceptive supplies, and it rises following a supply drop (relevant table available upon request). This suggests that fertility is indeed sensitive to changes in supply levels in either direction.

The estimates could be summarized in terms of the cumulative effect of a change in the contraceptive supply coverage after 8 quarters, and preferred estimates from the last three columns of Table 3 (and the corresponding columns in the asymmetric version) range from 0.5 to 1.1 additional or averted births per 1,000 women of childbearing age given one standard deviation swings, equivalent to 6 percentage points, in the supply measure. This represents an effect size of 2.4 to 5.8 percent.

In tables not shown (available upon request), I replace the dependent variable with conception rates from the sample of non-moving women in the 2008 DHS. In this analysis, done at the regional level to coincide with the representativeness of the DHS sample, I find that conception rates for pregnancies that ended in live birth, the counterpart to the birth rate, also significantly responded in the opposite direction to changes in the contraceptive supply rate.[34] This effect carried over to the conception rate for all pregnancies, although on its own I did not find signifi-

[33]The contraceptive supply coverage in the first quarter of the sample was assumed to be unchanged from the previous period.

[34]I find that the pregnancy rate has been following a downward trend right until 2006, when it started to go up. This break in trend aligns well with the birth rate increase around 2007 seen in Figure 3. Formal analysis using a fixed effects regression on regional panel data shows that the birth rates from vital statistics and the pregnancy rates from the DHS are highly correlated.

cantly negative effects on the conception rate for pregnancies that did not end in live birth.[35]

5 Mechanism pathways

In order to better understand how the supply of free contraceptives affected birth rates, one needs to study the possible mechanism pathways behind these results. I conducted further analysis of the microdata to confirm if contraceptive usage and sexual activity changed in ways that are consistent with the fertility impacts that I estimated. I also looked at the characteristics of births and of women who gave birth to get a sense of the possible reasons for this implied incompleteness in compensating behavior.

5.1 Changes in contraceptive usage

I pooled regional cross-sectional data on contraceptive use rates from the 2003 and 2008 DHS and the Family Planning Surveys (FPS) that were conducted in 2002, 2004, 2005, and 2006. Because these numbers only refer to current contraceptive use, I only assigned them to the quarters the survey interviews were conducted. I separately looked at contraceptive use behavior of women aged 15-24, 25-34, and 35-44 years old, and these results are presented in Tables 4a, 4b, and 4c.

I did not detect any significant changes in contraceptive use in response to fluctuations in the contraceptive supply coverage for the younger group of women.[36] I did find, however, that women from the middle and older age groups responded positively to the availability of free contraceptives from the public sector, with the middle age group substituting out of traditional methods and from considering sterilization when free supplies were available and vice versa. Meanwhile, older women (35-44 years old) seem to be actively switching between using free contraceptives or traditional methods on the one hand, and not using any method or undergoing sterilization on the other.[37] There is no evidence in the data supporting substitution between public and private sources of contraceptive supplies.

[35] These are also called terminated pregnancies and it comprises induced abortions, miscarriages, and still births.

[36] Notice that less than ten percent of women from this age group were practicing contraception. Because the majority of births in the Philippines are marital births and women's median age at first marriage is 22 years old, most of these women have just begun childbearing.

[37] This different pattern for older women might have something to do with their perceptions about their age-related decline in fecundity.

I also note trends from the DHS (table available upon request) which show that recent sexual activity modestly decreased after the supply phase out, which suggests that the increase in births I found did not operate through a mechanical increase in sexual frequency. This also points to the possibility that some women who were previously getting their supply from the public sector decided to have sex less often in response to the supply reduction.

5.2 Characteristics of affected births and affected women

In this analysis, I used data on the pregnancy history of women interviewed in August 2008 for the DHS. I only consider women who have stayed in their current residence since 2000 so that I can properly assign their province's contraceptive supply coverage to them. I also require that women's age be between 15 to 41 years old so that the average age of the sample during the period I look at remains constant.[38]

In tables available upon request, I find that supply fluctuations significantly affected the number of first and second births. This also holds true for the number of births before or outside of marriage and those within six months of marrying, or what's usually called shotgun marriages. While the cumulative impacts are also negative for more generic marital births and fourth births or higher, I could be hindered in detecting their statistical significance by small sample concerns given that this is a regional analysis.[39]

In Table 5, I turn to estimating a woman-level version of the main regressions, which corresponds to specification 3 above. A negative estimate of β_s would now be interpreted as implying that a given woman is more (less) likely to get pregnant if her province saw temporary drops (increases) in the supply of free contraceptives s quarters ago. The cumulative estimates in column 1 show negative effects of a change in the contraceptive supply coverage on the probability of conceiving up to a year after. I explore the possibility that more severe impacts are masked by substantial subgroup heterogeneity. I interacted the contraceptive supply rate with indicators for various characteristics of a woman: her poverty status (defined as belonging or not belonging to the lowest wealth quintile using the DHS' wealth index),[40] educational level (has or has not

[38] This is important given the known age gradient in fecundity and fertility.

[39] Only 17 geographical units are available in the regional analysis, as opposed to 82 units in the provincial analysis.

[40] While this refers to the status at the time of the interview, it is valid to use this if one assumes that the wealth classification is slow-changing or persistent over time. This is likely to be the case given that the DHS considers assets

attended high school, which should be age-accessible even for the youngest women in the sample since high school education in the country starts at age 12), or residence type (living in an area classified as either rural or urban).

The results for these subgroup analyses show that many estimates are negative and statistically significant for various lags, but consistently so only for the subgroups with a disadvantaged background: rural,[41] poor, or less educated women. The mean cumulative impact after two years associated with a 6-percentage point swing in the quarterly contraceptive supply coverage is quite high for these disadvantaged subgroups, with pregnancy risk changing by 15% for rural residents, 44% for the less educated, and 55% for the poor.

Notice that significantly negative effects started early and continued to grow for the poor and the less educated, which suggests that they were particularly responsive to transitory changes in supply. This implies that they relied extensively on public contraceptive supplies to regulate their fertility,[42] and that they had a hard time undertaking offsetting actions that would prevent or delay childbirth when those supplies became scarce, even temporarily.

6 Concluding remarks

In this paper, I found support for a positive impact on fertility of broad reductions in the supply of free contraceptives. The phase out of USAID's contraceptive donations to the Philippines and the distribution issues that accompanied it constituted a plausibly exogenous event that severely disrupted the country's public sector contraceptive supply. I found that it led provinces which experienced bigger declines in the supply of free contraceptives to also have larger increases (or smaller decreases) in birth rates, at least in the short-run.[43]

I also found support for the responsiveness of fertility to transitory changes in the supply of free contraceptives that were idiosyncratic. Part of this sensitivity could be attributed to the reliance of disadvantaged groups like rural residents, the poor, and the less educated on

owned instead of income received in the construction of the wealth index.

[41] Note that there were significantly negative cumulative estimates for urban women after 1-2 quarters of contraceptive shipments, which is consistent with those supplies reaching them sooner relative to their rural counterparts.

[42] It is interesting to note that the estimates also suggest that the pregnancy rate differentials that exist based on the indicated poverty status and educational level can be substantially reduced by the provision of an adequate supply of free contraceptives to these disadvantaged groups.

[43] There are indications in Figure 3 and the bottom panel of Figure 5 that some couples (and provinces) may have made eventual adjustments (in 2009) to cope with the reduced supply of free contraceptives.

the public sector and their incapability to fully manage pregnancy risks in the absence of free supplies.

These findings support the view that supply-side factors can significantly affect fertility behavior in developing countries, especially for disadvantaged groups. While the use of contraceptives can be relatively expensive in these resource-poor settings,[44] it is also possible that many other non-monetary factors, like present-biasedness or cognitive load, play a role in this result. Future work should delve deeper into understanding the mechanisms behind the public sector reliance and incomplete compensating behavior exhibited by disadvantaged groups, which would aid in the design of sound interventions that enable couples to effectively manage their fertility.

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[44] In the Philippines, an annual supply of pills, the most used modern contraceptive method, costs about 500 pesos, which is equivalent to five times the average daily agricultural wage or 4% of the annual per capita poverty threshold. Note that spending on food typically dominates all other expenditures in the household budget of the poor, so that such an outlay is considered prohibitive.

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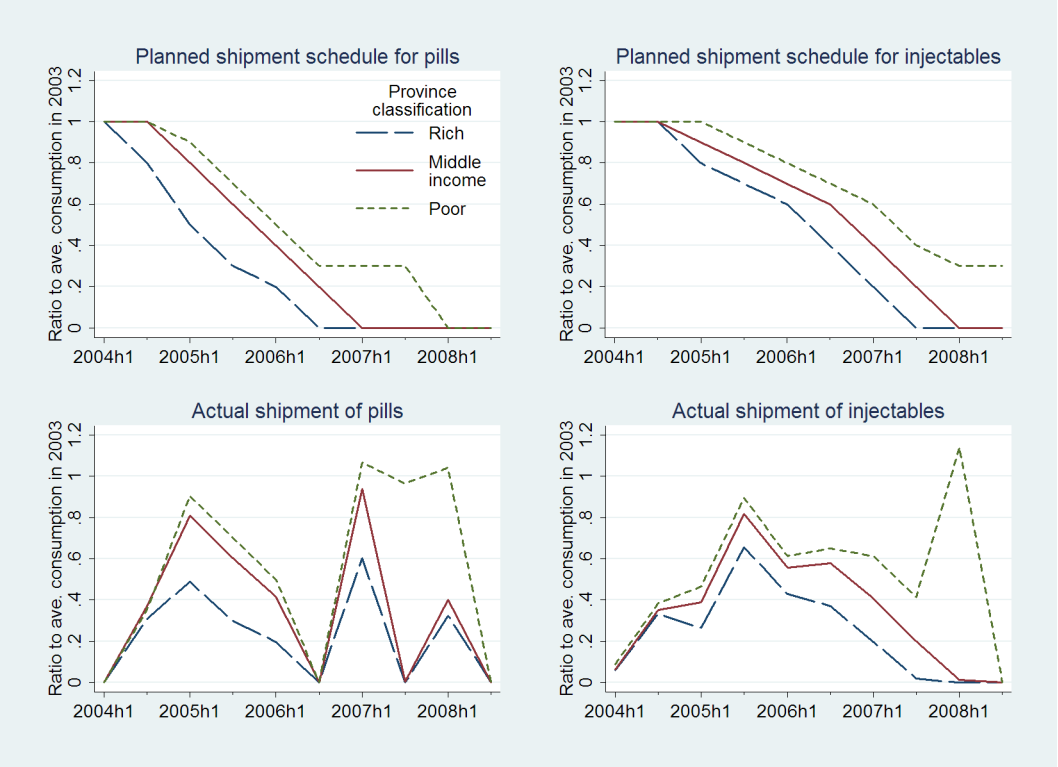
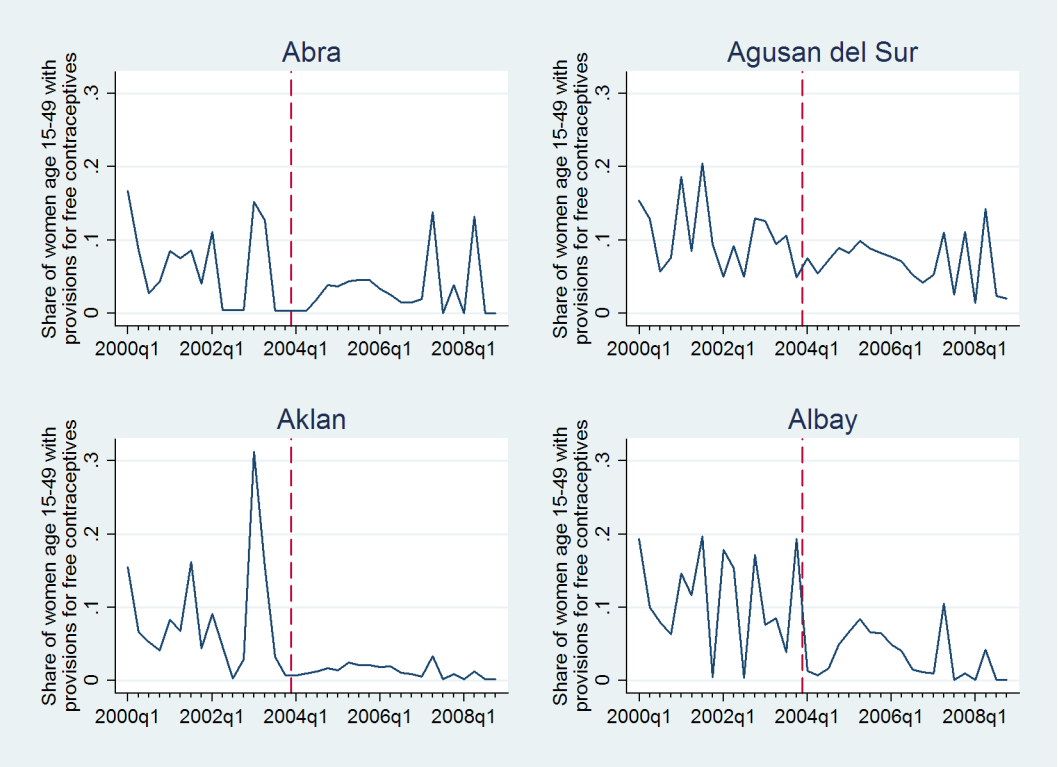
Figure 1: Planned shipment schedule and actual shipments of pills and injectables during the supply phase out



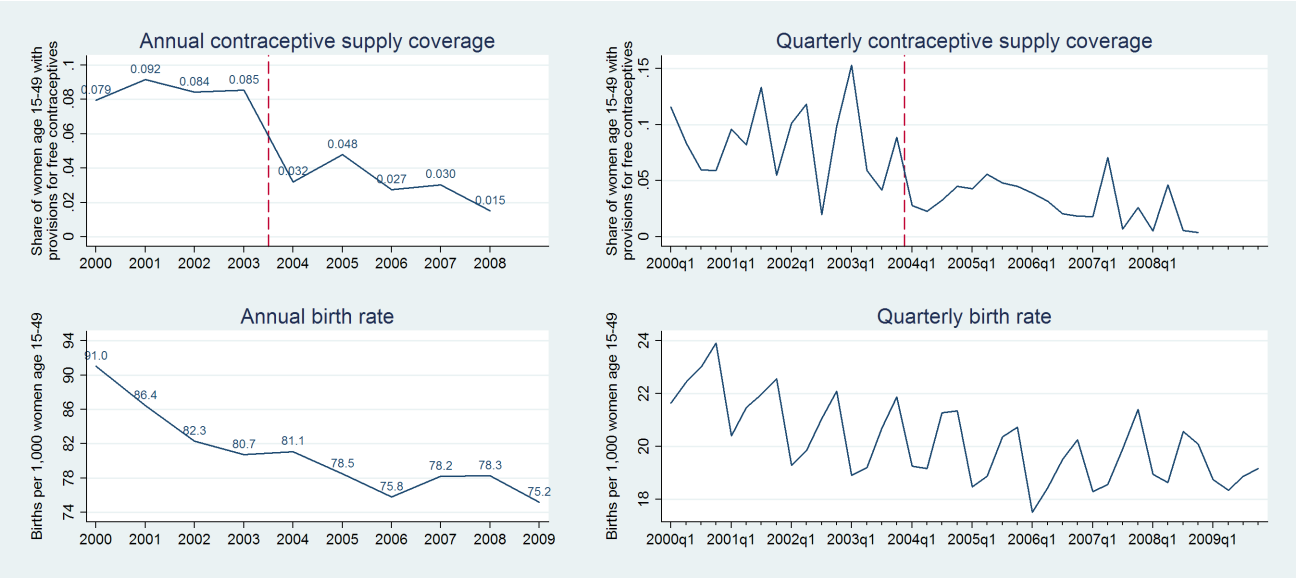
Notes: Graphs show the intended and actual shipments of free contraceptives (pills and injectables) from the Department of Health to all provincial and (charter) city government health offices during the phase out period. The planned shipment schedule was indexed to quantities consumed in 2003 and was supposed to gradually decline every half-year, with varying pace and ending periods across provinces based on its poverty incidence classification in 2000.

Figure 2: Idiosyncratic quarterly shipments of free contraceptives to the provinces



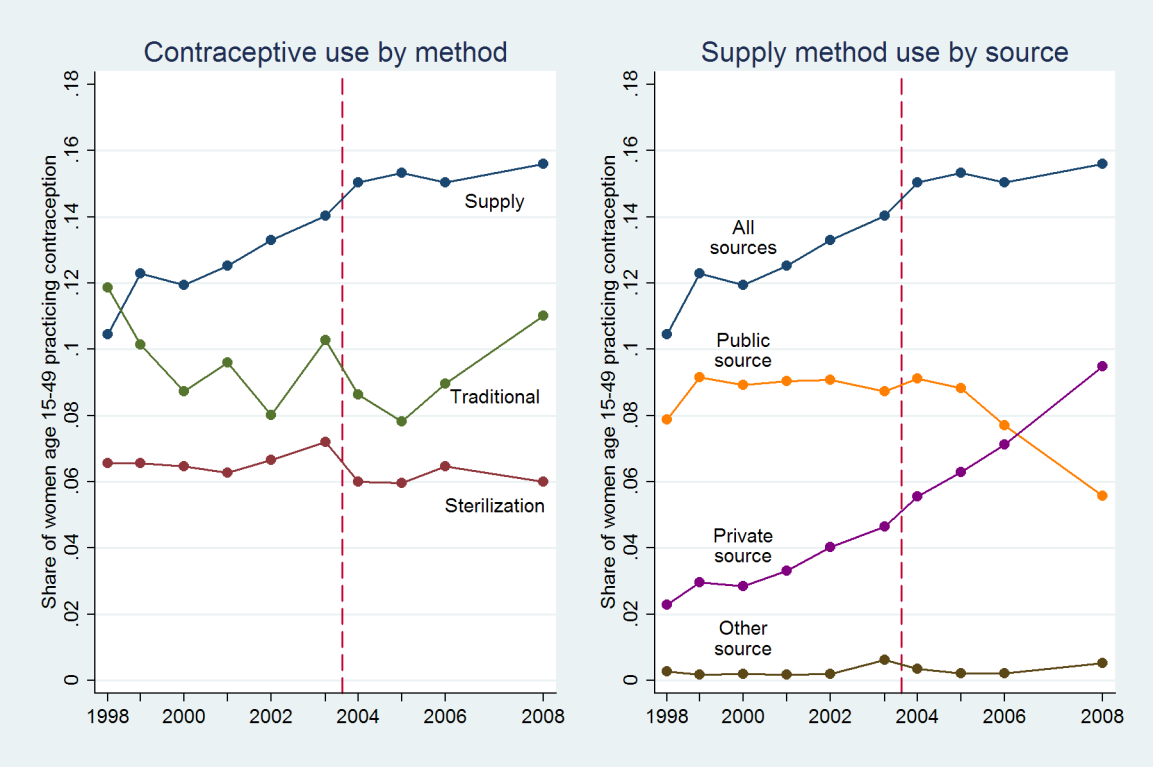
Notes: Graphs show the contraceptive supply coverage to four randomly-selected provinces. The contraceptive supply coverage aggregates the quantities of free contraceptives shipped by the Department of Health to each provincial health office every quarter, divided by the number of women of childbearing age (age 15-49) at mid-quarter. Quantities of condoms, pills, and injectables were adjusted by the number of units a woman is assumed to need in order to be protected from pregnancy for a quarter (30 condoms, 3.75 pill cycles, 1 injection), while IUDs were counted as providing protection for 3.5 years following its shipment. The number of women of childbearing age was linearly interpolated from the May 2000 and August 2007 population censuses, with extrapolation up to 2008.

Figure 3: Annual and quarterly trends in contraceptive supply coverage and the birth rate



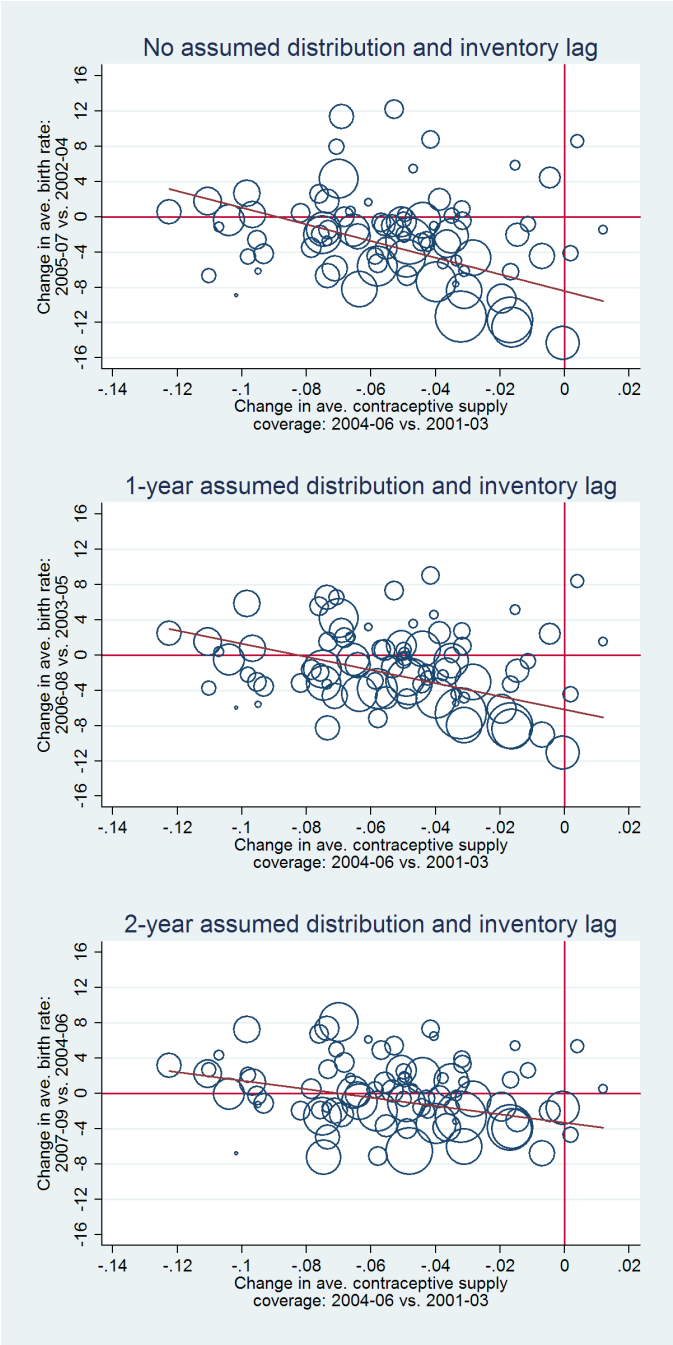
Notes: The contraceptive supply coverage aggregates the quantities of free contraceptives shipped by the Department of Health to all provincial and (charter) city government health offices every year (or quarter), divided by the number of women of childbearing age (age 15-49) at mid-year (or mid-quarter). Quantities of condoms, pills, and injectables were adjusted by the number of units a woman is assumed to need in order to be protected from pregnancy for a year (or quarter), while IUDs were counted as providing protection for 3.5 years following its shipment. The birth rate is the number of births in each year (or quarter) per 1,000 women of childbearing age at mid-year (or mid-quarter). The number of births only includes births registered with the civil registrar up to March of the year following a child's birth. The number of women of childbearing age was linearly interpolated from the May 2000 and August 2007 population censuses, with extrapolation up to 2009.

Figure 4: Trends in contraceptive use



Notes: Graphs show contraceptive use at time of interview, which was in the third quarter in 1998, 2003, and 2008 (from the Demographic and Health Surveys) and in the second quarter in the intervening years (from the Family Planning Surveys). There was no survey conducted in 2007. Supply methods consist of pills, injectables, condoms, and IUDs. Sterilization refers mostly to women's tubal ligation; the use rate for vasectomy by the woman's partner was never higher than 0.1%. Traditional methods consist of withdrawal, all variants of periodic abstinence, lactational amenorrhea, and other methods. Supply method users were asked where they last obtained their supply, and their source was classified as belonging to the public sector, the private sector, or neither.

Figure 5: Relationship between provincial changes in contraceptive supply coverage and associated changes in the birth rate



Notes: Graphs show the cross-sectional relationship between changes in average annual contraceptive supply coverage induced by the supply phase out that started in 2004 and the changes in the average annual birth rate observed one (top panel), two (middle panel), or three (bottom panel) years after (inclusive of a one-year gestation lag). See Panel A and the notes in Table 3 for more details. Each bubble represents a province. The relative sizes of the bubbles signify the relative population counts of women age 15-49 in 2003. The regression line corresponding to column 1 in Table 4 is superimposed in each graph.

Table 1a. Descriptive statistics

	Before phase out (2001-03)	During phase out (2004-08)	Full period (2001-08)
Main variables			
No. of women of childbearing age, or aged 15-49 years old, at mid-year (W)	246,968 (224,104)	267,621 (247,912)	259,876 (239,297)
No. of registered births (B)	20,528 (21,333)	20,966 (21,274)	20,802 (21,281)
Birth rate per 1,000 women (= 1000 × B/W), computed a year later	81.4 (19.7)	77.6 (18.2)	79.0 (18.8)
No. of women with provisions for a year's supply of free contraceptives (C)	21,525 (19,570)	8,137 (7,426)	13,157 (14,825)
Contraceptive supply coverage from the public sector (= C/W)	0.087 (0.048)	0.031 (0.023)	0.052 (0.044)
Economic controls			
Local govt. tax revenue per capita, in pesos	522.4 (708.0)	678.4 (901.9)	619.9 (837.3)
Local govt. spending on health, nutrition and population programs per capita, in pesos	204.1 (93.6)	226.1 (111.6)	217.9 (105.6)
Poverty incidence, in percent	25.2 (16.3)	25.6 (16.0)	25.4 (16.1)
Subsistence incidence, in percent	11.4 (9.9)	11.0 (9.1)	11.2 (9.4)
Average family income, in thousand pesos	128.5 (53.5)	127.2 (47.1)	127.7 (49.6)
Average family expenditure, in thousand pesos	106.6 (43.6)	108.0 (39.5)	107.5 (41.1)
Agricultural wage rate for males, in pesos per day	117.6 (54.8)	112.1 (52.6)	114.1 (53.5)
Agricultural wage rate for females, in pesos per day	98.8 (46.2)	101.5 (46.9)	100.5 (46.6)
Observations	246	410	656

Notes: The entries denote the mean of the variable for the indicated period. Standard deviations are reported in parentheses. All variables are measured annually at the provincial level, except for average family income and expenditure and agricultural wage rates which are only available at the regional level. (W) was linearly interpolated from population figures from the May 2000 and August 2007 censuses, with extrapolation up to 2009. Vital Statistics provide data on (B), which includes births registered with the local civil registrar up to March of the year following a child's birth. In computing (C), the quantities of contraceptives shipped by the Department of Health to provincial health offices were adjusted by the number of units a woman is typically assumed to need in order to be protected from pregnancy for a year: 120 condoms, 15 pill cycles, 4 injections, or one intrauterine device (assumed to last for 3.5 years, so also counted once for each of the following 13 quarters). Poverty and subsistence incidence and average family income and expenditure were each linearly interpolated from data available for 2000, 2003, 2006, and 2009. Average family income and expenditure and agricultural wage rates are expressed in real values (constant 2000 prices). The observations for the birth rate, the contraceptive supply coverage, and the economic controls were weighted by the population of women aged 15-49 in 2003.

Table 1b. (continued) Descriptive statistics

	2000 Census
Population controls	
Share of population which are men aged 15 years old and above	0.315 (0.011)
Share of population which are women of childbearing age (15-49 years old)	0.256 (0.023)
Share of women of childbearing age which are married	0.587 (0.036)
Share of women of childbearing age with primary education and below	0.268 (0.103)
Share of women of childbearing age who attended college and beyond	0.236 (0.055)
Share of women of childbearing age which are literate	0.946 (0.058)
Share of women of childbearing age which are Roman Catholic	0.806 (0.186)
Share of children aged 0-1 year old whose births were not registered	0.192 (0.144)
Observations	82

Notes: The entries denote the mean of variables measured at the provincial level. Standard deviations are reported in parentheses. The observations were weighted by the population of women aged 15-49 in 2003.

Table 2. Impact of reduction in supply of free contraceptives on fertility

	All provinces			Without NCR	Without NCR and ARMM
	Dependent variable: Change in ave. annual birth rate				
	(1)	(2)	(3)	(4)	(5)
	A. No assumed distribution and inventory lag				
Average annual birth rate before phase out		81.4		79.8	83.5
Change in ave. annual contra-ceptive supply coverage	-94.2***	-44.7***	-62.2***	-41.0**	-39.4**
	(23.1)	(16.4)	(18.1)	(19.1)	(18.6)
R-squared	0.237	0.583	0.718	0.526	0.578
	B. 1-year assumed distribution and inventory lag				
Average annual birth rate before phase out		80.2		79.3	83.0
Change in ave. annual contra-ceptive supply coverage	-74.6***	-39.9**	-56.6***	-47.1**	-47.6**
	(17.3)	(17.9)	(18.7)	(20.6)	(20.6)
R-squared	0.238	0.455	0.639	0.489	0.570
	C. 2-year assumed distribution and inventory lag				
Average annual birth rate before phase out		78.7		78.3	82.0
Change in ave. annual contra-ceptive supply coverage	-47.9***	-38.7**	-47.4**	-40.3*	-47.9**
	(14.0)	(16.0)	(19.6)	(22.3)	(22.0)
R-squared	0.123	0.254	0.511	0.494	0.579
Change in economic controls	No	Yes	Yes	Yes	Yes
Population controls in 2000	No	No	Yes	Yes	Yes
Observations	82	82	82	78	73

Notes: The estimates presented in each cell are from separate least squares regressions. Robust standard errors are reported in parentheses. Averages of the annual contraceptive supply coverage were taken for the three years immediately before (2001-03) and after (2004-06) the start of the supply phase out. The following years were used in computing the associated change in the average annual birth rate, which incorporate a 1-year gestation lag plus additional lags related to downstream distribution from the provincial capital and the drawdown of any remaining inventories: 2002-04 versus 2005-07 in Panel A (no assumed lag), 2003-05 versus 2006-08 in Panel B (1-year assumed lag), and 2004-06 versus 2007-09 in Panel C (2-year assumed lag). The years used when computing the change in the economic controls correspond to the years for the birth rate but shifted a year earlier. Observations were weighted by the population of women aged 15-49 in 2003. See Table 1 for the list of control variables used. Sensitivity to inclusion of outlying observations was evaluated by excluding districts comprising the National Capital Region (NCR) and provinces belonging to the Autonomous Region of Muslim Mindanao (ARMM).

Asterisks indicate statistical significance: * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 3. Impact of quarterly fluctuations in supply of free contraceptives on fertility

	Dependent variable: Quarterly birth rate, 3 quarters ahead						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mean of quarterly birth rate				19.7			
Quarterly contraceptive supply coverage:							
3 quarters ahead					-1.0		
					(0.7)		
2 quarters ahead					-0.7		
					(0.6)		
1 quarter ahead					-0.4		
					(0.8)		
Current quarter	0.1	0.9	0.8	-0.6	-0.4	-0.02	-0.6
	(1.3)	(1.2)	(0.9)	(0.9)	(0.9)	(1.0)	(0.8)
1 quarter behind	-1.5	-1.0	-0.8	0.1	0.1	0.2	-0.3
	(0.9)	(0.9)	(0.8)	(0.7)	(0.7)	(0.8)	(0.6)
2 quarters behind	-2.7***	-2.1**	-1.8**	-1.5***	-1.6***	-0.9*	-1.7***
	(0.9)	(0.9)	(0.8)	(0.6)	(0.6)	(0.6)	(0.6)
3 quarters behind	-3.0***	-2.4**	-3.0***	-2.5***	-2.5***	-1.8**	-2.6**
	(1.1)	(1.0)	(0.7)	(0.7)	(0.7)	(0.7)	(1.1)
4 quarters behind	-2.9**	-2.3**	-2.6***	-3.0***	-2.9***	-2.3***	-3.2***
	(1.2)	(1.2)	(0.8)	(0.7)	(0.7)	(0.7)	(1.0)
5 quarters behind	-2.9***	-2.2***	-2.0***	-1.9***	-1.9***	-1.4**	-1.8***
	(0.7)	(0.8)	(0.7)	(0.6)	(0.6)	(0.6)	(0.6)
6 quarters behind	-3.6***	-3.1***	-2.4***	-2.1***	-2.0***	-1.7***	-2.2***
	(0.9)	(0.9)	(0.7)	(0.7)	(0.7)	(0.6)	(0.8)
7 quarters behind	-2.3***	-1.6**	-2.2***	-1.3**	-1.3**	-0.7	-1.4**
	(0.9)	(0.8)	(0.6)	(0.5)	(0.5)	(0.6)	(0.6)
8 quarters behind	0.4	0.9	0.9	-0.4	-0.3	0.02	-0.5
	(0.8)	(0.8)	(0.7)	(0.5)	(0.5)	(0.4)	(0.5)
Cumulative impact of change after 8 quarters	-18.4***	-13.0***	-13.1***	-13.2***	-12.8***	-8.6**	-14.2***
	(5.0)	(4.4)	(3.4)	(3.3)	(3.3)	(3.8)	(4.9)
Province fixed effects (82)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects (28)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Economic controls	No	Yes	Yes	Yes	Yes	Yes	Yes
Retail prices	No	No	Yes	Yes	Yes	Yes	Yes
Province × qtr. fixed effects	No	No	No	Yes	Yes	Yes	Yes
Province trend	No	No	No	No	No	Linear	Quadratic
R-squared	0.934	0.937	0.955	0.980	0.980	0.985	0.989
Observations	2296	2296	2296	2296	2296	2296	2296

Notes: The estimates presented in each column are from a least squares regression. Standard errors (reported in parentheses) were clustered by province. Observations were weighted by the population of women aged 15-49 in 2003. The sample period was from 2002:Q1 to 2008:Q4. See Table 1 for the list of economic controls used. Retail prices denote deflated average quarterly prices of 62 food commodities at the provincial level. The cumulative impact after 8 quarters sums up the estimates from 8 quarters behind up to the current quarter.
Asterisks indicate statistical significance: * p<0.10, ** p<0.05, *** p<0.01.

Table 4a. Impact of quarterly fluctuations in supply of free contraceptives on contraceptive usage of women aged 15-24 years old

	Dep. variable: Contraceptive use rate at time of interview, pooled cross-sections from the DHS and the FPS				
	Not using any method	Using traditional methods	Using sterilization	Using supply methods	
				Public source	Private source
	(1)	(2)	(3)	(4)	(5)
Mean of dep. variable	0.908	0.027	0.001	0.034	0.028
Cumulative impact of change in quarterly contraceptive supply coverage:					
Current quarter	0.132	0.002	-0.023*	-0.177*	0.048
	(0.163)	(0.078)	(0.012)	(0.098)	(0.071)
After 1 quarter	0.088	0.004	-0.008	-0.053	-0.058
	(0.151)	(0.110)	(0.014)	(0.115)	(0.059)
After 2 quarters	-0.037	0.064	-0.018	0.001	-0.036
	(0.197)	(0.130)	(0.017)	(0.148)	(0.077)
After 3 quarters	-0.233	0.123	-0.026	-0.003	0.091
	(0.237)	(0.128)	(0.020)	(0.181)	(0.113)
After 4 quarters	-0.117	0.140	-0.012	0.012	-0.065
	(0.201)	(0.125)	(0.023)	(0.166)	(0.088)
After 5 quarters	-0.072	0.093	-0.015	-0.002	-0.051
	(0.241)	(0.141)	(0.027)	(0.185)	(0.112)
After 6 quarters	-0.137	0.104	-0.005	-0.006	-0.013
	(0.260)	(0.158)	(0.034)	(0.193)	(0.119)
After 7 quarters	-0.253	0.029	0.039	0.063	0.087
	(0.260)	(0.164)	(0.032)	(0.211)	(0.153)
After 8 quarters	-0.414	0.132	0.045	0.080	0.101
	(0.272)	(0.160)	(0.030)	(0.205)	(0.163)
Region fixed effects (17)	Yes	Yes	Yes	Yes	Yes
Time fixed effects (6)	Yes	Yes	Yes	Yes	Yes
Economic controls	Yes	Yes	Yes	Yes	Yes
Region trend	Linear	Linear	Linear	Linear	Linear
R-squared	0.923	0.794	0.768	0.877	0.914
Observations	102	102	102	102	102

Notes: The estimates presented in all columns are from a seemingly unrelated regression (SUR). Standard errors (reported in parentheses) were clustered by province and allowed to be correlated across equations. Observations were weighted by the population of women aged 15-24 in 2003. Periods included in the sample were Q2 in 2002, 2004, 2005, and 2006 from the Family Planning Surveys (FPS) and Q3 in 2003 and 2008 from the Demographic and Health Surveys (DHS). The R-squared statistic in each column was obtained from separate linear regressions. See Table 1 for the list of economic controls used. The cumulative impact after n quarters sums up the estimates from n quarters behind up to the current quarter.

Asterisks indicate statistical significance: * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 4b. (continued) Impact of quarterly fluctuations in supply of free contraceptives on contraceptive usage of women aged 25-34 years old

	Dep. variable: Contraceptive use rate at time of interview, pooled cross-sections from the DHS and the FPS				
	Not using any method	Using traditional methods	Using sterilization	Using supply methods	
				Public source	Private source
	(1)	(2)	(3)	(4)	(5)
Mean of dep. variable	0.579	0.117	0.046	0.143	0.109
Cumulative impact of change in quarterly contraceptive supply coverage:					
Current quarter	-0.165	0.189	-0.112	0.062	0.010
	(0.347)	(0.203)	(0.128)	(0.200)	(0.205)
After 1 quarter	-0.114	-0.081	-0.024	0.173	0.011
	(0.411)	(0.192)	(0.138)	(0.306)	(0.259)
After 2 quarters	-0.382	-0.070	-0.009	0.293	0.135
	(0.436)	(0.223)	(0.167)	(0.328)	(0.284)
After 3 quarters	-0.544	-0.198	-0.079	0.355	0.397
	(0.609)	(0.299)	(0.218)	(0.429)	(0.375)
After 4 quarters	-0.265	-0.196	-0.005	0.414	0.044
	(0.655)	(0.315)	(0.220)	(0.390)	(0.352)
After 5 quarters	-0.324	-0.300	-0.087	0.656	0.027
	(0.670)	(0.325)	(0.234)	(0.425)	(0.385)
After 6 quarters	-0.522	-0.468	-0.042	0.937*	0.030
	(0.697)	(0.338)	(0.233)	(0.559)	(0.393)
After 7 quarters	-0.210	-0.763**	-0.312	1.213**	0.048
	(0.691)	(0.312)	(0.205)	(0.613)	(0.478)
After 8 quarters	0.227	-0.581*	-0.542**	0.780	0.138
	(0.699)	(0.305)	(0.231)	(0.663)	(0.531)
Region fixed effects (17)	Yes	Yes	Yes	Yes	Yes
Time fixed effects (6)	Yes	Yes	Yes	Yes	Yes
Economic controls	Yes	Yes	Yes	Yes	Yes
Region trend	Linear	Linear	Linear	Linear	Linear
R-squared	0.943	0.846	0.878	0.958	0.912
Observations	102	102	102	102	102

Notes: The estimates presented in all columns are from a seemingly unrelated regression (SUR). Standard errors (reported in parentheses) were clustered by province and allowed to be correlated across equations. Observations were weighted by the population of women aged 25-34 in 2003. Periods included in the sample were Q2 in 2002, 2004, 2005, and 2006 from the Family Planning Surveys (FPS) and Q3 in 2003 and 2008 from the Demographic and Health Surveys (DHS). The R-squared statistic in each column was obtained from separate linear regressions. See Table 1 for the list of economic controls used. The cumulative impact after n quarters sums up the estimates from n quarters behind up to the current quarter.

Asterisks indicate statistical significance: * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 4c. (continued) Impact of quarterly fluctuations in supply of free contraceptives on contraceptive usage of women aged 35-44 years old

	Dep. variable: Contraceptive use rate at time of interview, pooled cross-sections from the DHS and the FPS				
	Not using any method	Using traditional methods	Using sterilization	Using supply methods	
				Public source	Private source
	(1)	(2)	(3)	(4)	(5)
Mean of dep. variable	0.523	0.153	0.136	0.108	0.075
Cumulative impact of change in quarterly contraceptive supply coverage:					
Current quarter	-0.803*	0.962***	-0.618***	0.297**	0.080
	(0.445)	(0.248)	(0.187)	(0.142)	(0.145)
After 1 quarter	-0.722*	0.534	-0.338	0.339**	0.055
	(0.419)	(0.338)	(0.270)	(0.149)	(0.164)
After 2 quarters	-0.783	0.655*	-0.551*	0.456***	0.087
	(0.490)	(0.373)	(0.315)	(0.159)	(0.187)
After 3 quarters	-0.793	0.922**	-0.853**	0.416*	0.138
	(0.709)	(0.388)	(0.352)	(0.249)	(0.242)
After 4 quarters	-0.983	0.924**	-0.710**	0.769***	-0.154
	(0.624)	(0.435)	(0.294)	(0.235)	(0.258)
After 5 quarters	-1.199*	1.015**	-0.733**	0.792***	-0.038
	(0.692)	(0.452)	(0.343)	(0.248)	(0.265)
After 6 quarters	-1.238*	0.929*	-0.732**	0.971***	-0.101
	(0.738)	(0.535)	(0.360)	(0.309)	(0.271)
After 7 quarters	-0.791	0.342	-0.703*	0.944***	0.013
	(0.603)	(0.516)	(0.368)	(0.345)	(0.252)
After 8 quarters	-0.559	0.343	-0.767**	0.866***	-0.126
	(0.631)	(0.544)	(0.366)	(0.334)	(0.228)
Region fixed effects (17)	Yes	Yes	Yes	Yes	Yes
Time fixed effects (6)	Yes	Yes	Yes	Yes	Yes
Economic controls	Yes	Yes	Yes	Yes	Yes
Region trend	Linear	Linear	Linear	Linear	Linear
R-squared	0.938	0.846	0.950	0.950	0.930
Observations	102	102	102	102	102

Notes: The estimates presented in all columns are from a seemingly unrelated regression (SUR). Standard errors (reported in parentheses) were clustered by province and allowed to be correlated across equations. Observations were weighted by the population of women aged 35-44 in 2003. Periods included in the sample were Q2 in 2002, 2004, 2005, and 2006 from the Family Planning Surveys (FPS) and Q3 in 2003 and 2008 from the Demographic and Health Surveys (DHS). The R-squared statistic in each column was obtained from separate linear regressions. See Table 1 for the list of economic controls used. The cumulative impact after n quarters sums up the estimates from n quarters behind up to the current quarter.

Asterisks indicate statistical significance: * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 5. Characteristics of women affected by quarterly fluctuations in supply of free contraceptives

	Dep. variable: Quarterly probability of conception for pregnancies that ended in live birth, sample of non-moving women since 2000 in the 2008 DHS						
		Residence location		Wealth status		Education	
	All	Rural	Urban	Poorest quintile	Not the poorest quintile	Did not attend high school	Attended high school or more
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mean of dep. variable	0.034	0.039	0.029	0.058	0.029	0.046	0.031
Cumulative impact of change in quarterly contraceptive supply coverage:							
Current quarter	-0.038*	-0.037*	-0.042	-0.095**	-0.027	-0.055**	-0.034
	(0.021)	(0.021)	(0.029)	(0.039)	(0.023)	(0.027)	(0.023)
After 1 quarter	-0.065**	-0.057*	-0.079**	-0.141**	-0.048*	-0.102**	-0.054*
	(0.026)	(0.029)	(0.035)	(0.055)	(0.026)	(0.040)	(0.028)
After 2 quarters	-0.072**	-0.070*	-0.075*	-0.241***	-0.035	-0.145***	-0.050
	(0.032)	(0.037)	(0.042)	(0.062)	(0.033)	(0.050)	(0.034)
After 3 quarters	-0.075*	-0.071	-0.083	-0.344***	-0.014	-0.185***	-0.040
	(0.040)	(0.044)	(0.051)	(0.077)	(0.037)	(0.061)	(0.041)
After 4 quarters	-0.091*	-0.101*	-0.073	-0.401***	-0.020	-0.224***	-0.049
	(0.050)	(0.054)	(0.062)	(0.089)	(0.045)	(0.072)	(0.048)
After 5 quarters	-0.084	-0.101*	-0.051	-0.378***	-0.017	-0.238***	-0.033
	(0.053)	(0.057)	(0.068)	(0.099)	(0.048)	(0.076)	(0.050)
After 6 quarters	-0.088	-0.105	-0.054	-0.422***	-0.011	-0.289***	-0.021
	(0.063)	(0.066)	(0.080)	(0.103)	(0.059)	(0.084)	(0.060)
After 7 quarters	-0.066	-0.085	-0.024	-0.443***	0.023	-0.309***	0.016
	(0.067)	(0.072)	(0.085)	(0.094)	(0.064)	(0.088)	(0.064)
After 8 quarters	-0.075	-0.101	-0.019	-0.533***	0.032	-0.335***	0.013
	(0.074)	(0.080)	(0.088)	(0.097)	(0.072)	(0.090)	(0.071)
Woman fixed effects	6882	3775	3107	1448	5434	1719	5163
Time fixed effects (24)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Economic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Retail prices	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province × qtr. fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province trend	Quadratic	Quadratic	Quadratic	Quadratic	Quadratic	Quadratic	Quadratic
Woman-level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.171	0.171	0.171	0.172	0.172	0.172	0.172
Observations	116758	63008	53750	23704	93054	28610	88148

Notes: The estimates presented in columns 2 and 3, 4 and 5, and 6 and 7 each come from the same least squares regression, where the effect of the contraceptive supply coverage was differentiated by indicated subgroup. Standard errors (reported in parentheses) were clustered by province. Sampling weights in the Demographic and Health Survey (DHS) were used to weight observations. The sample period was from 2002:Q1 to 2007:Q4. Sample women were only included when they were 15-41 years old to keep the average age constant during the sample period. The dependent variable is defined when a woman is fecund, so that observations when a sample woman is pregnant, concluding pregnancy, or sterilized were excluded. Woman-level controls used were indicator variables for single-year age, marital or cohabitation status, and parity (the number of previous births). See Table 1 for the list of economic controls used. Retail prices denote deflated average quarterly prices of 62 food commodities at the provincial level. The cumulative impact after n quarters sums up the estimates from n quarters behind up to the current quarter.
Asterisks indicate statistical significance: * $p<0.10$, ** $p<0.05$, *** $p<0.01$.