Online Appendix for

"Can Abortion Mitigate Transitory Shocks? Demographic Consequences under Son Preference"

by Jaehyun Jung

(A) Appendix A: Additional Figures and Tables for Background

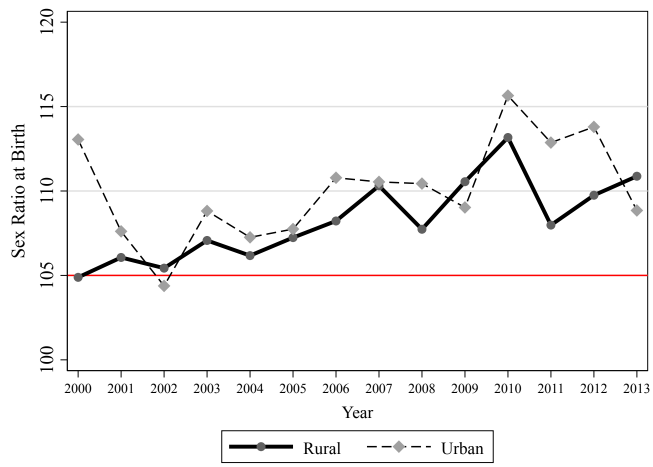
(B) Appendix B: Additional Details on the Effects of Drought on Rice Yield and Household Expenditure

(C) Appendix C: Additional Figures and Tables for Fertility Outcomes

(D) Appendix D: Robustness Checks

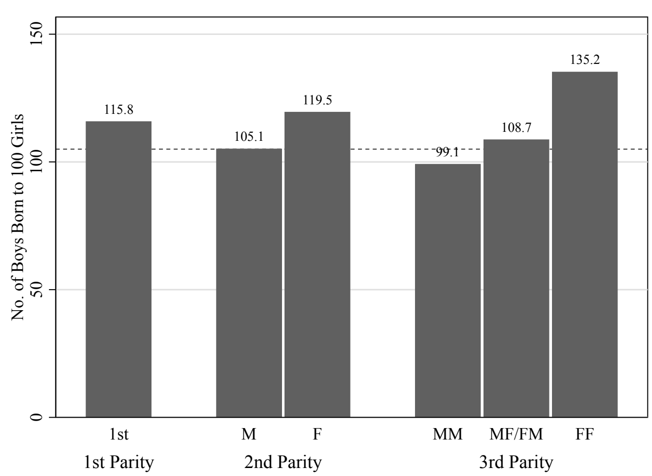
Appendix A. Additional Figures and Tables for Background

Figure A.1: Sex Ratio at Birth in Vietnam



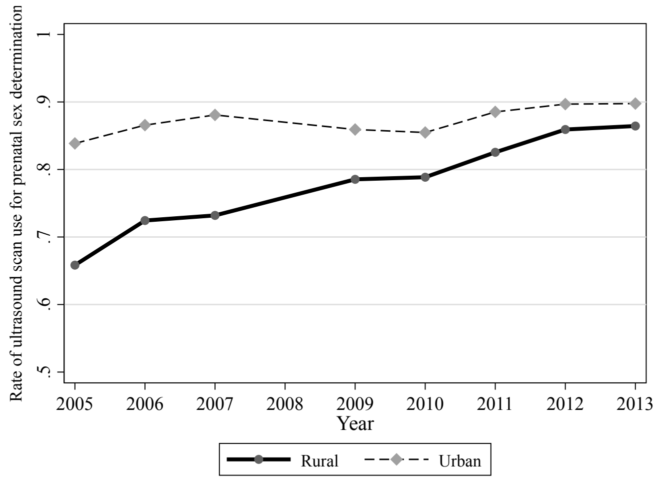
Data: PCS 2000-2008, 2010-2013, Census 2009
Notes: The figure plots the sex ratio at birth, i.e., the number of infant boys (≤ 1 year old) born to one hundred infant girls in each survey year in rural and urban areas, respectively. The red horizontal line denotes the biologically normal sex ratio at birth, approximately 105 male newborns to 100 female newborns.

Figure A.2: Sex Ratio at Birth by Birth Parity



Data: Census 2009
Notes: This figure describes the sex ratio at birth by birth parity depending on the sex of previous births. 'M' of the 2nd parity means the firstborn is son, and 'F' means a daughter. Likewise, for the third parity, 'MM' means the first two births are boys, whereas 'FF' means there is no son in the previous two births.

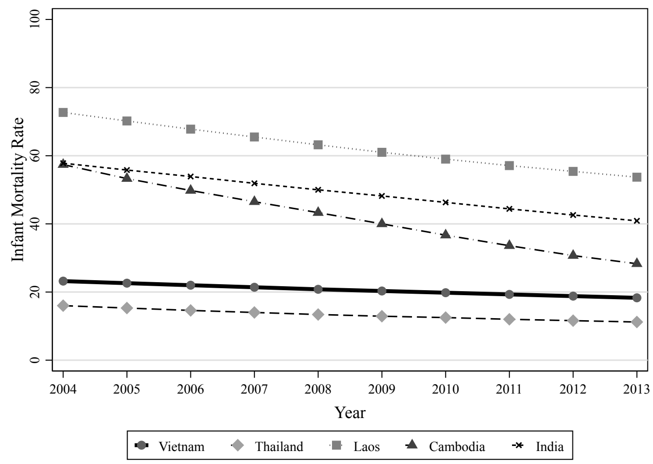
Figure A.3: Rate of Ultrasound Scan Use for Prenatal Sex Determination



Data: PCS 2006, 2007, 2010-2013
Notes: This figure plots the rate of mothers who used ultrasound scans for prenatal sex determination given their childbirth in the survey year. Information about ultrasound scan use is available only in the PCS 2006, 2007, and 2010-2013.

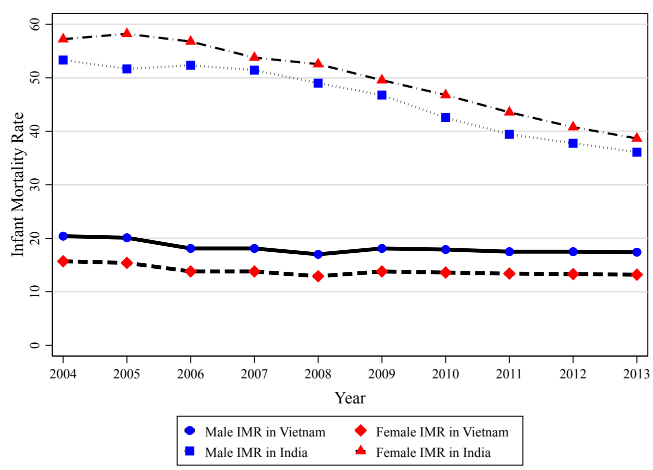
Figure A.4: Infant Mortality Rate

(a) Infant Mortality Rate by Country



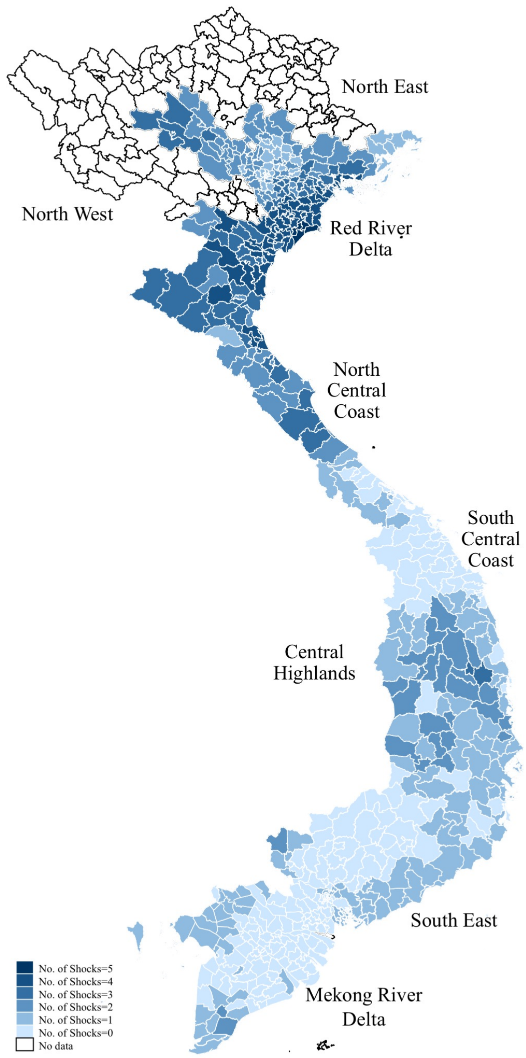
Notes: This figure describes the infant mortality rates of Vietnam and neighboring countries in Southeast Asia using the official statistics from the World Bank.

(b) Infant Mortality Rate by Sex



Notes: This figure describes infant mortality rates (IMRs) by sex using the official statistics from the Vietnam GSO. For the IMR in India, I choose nine states in northwestern India showing strong son preference (Anukriti (2017)). They consist of Rajasthan, Himachal Pradesh, Delhi, Gujarat, Uttar Pradesh, Madhya Pradesh, Maharashtra and Haryana.

Figure A.5: Distribution of Drought Events across Districts in Vietnam



Notes: This map describes the number of drought events experienced by each district in the sample period from 2004-2013. Drought is defined as seasonal rainfall occurring below the 20th percentile of the district-specific dry season rainfall distribution from 1984-2013 from Climate Hazards Group InfraRed Precipitation with Station version 2.0. The districts with ‘No data’ are excluded from the analysis because more than 50 percent of the heads of household are not ethnically Kinh in the 10 provinces. The 10 provinces are Cao Bang, Bac Kan, Ha Giang, Lang Son, Lai Chau, Son La, Dien Bien, Hoa Binh, Lao Cai, and Tuyen Quang.

Appendix B. Additional Details on the Effects of Drought on Rice Yield and Household Expenditure

To confirm that the constructed drought shocks translate into negative economic shocks, I first combine rainfall with yearly rice yields. Then, I demonstrate a more direct effect on household consumption using detailed expenditure surveys.

To explore the effects of adverse rainfall shocks on the economic conditions of rural households, I supplement expenditure information, which is not available in the Population Change and Family Planning Survey (PCS), using the Vietnamese Household Living Standard Survey (VHLSS). This biennial survey has been conducted since 2000, and I use six rounds from 2004 to 2014 to match the sample period of the PCS data. Since the recall period for consumption has changed from yearly to monthly starting in 2010, I use the first three waves to examine the effects on yearly expenditure and the latter three waves to analyze the effects on monthly expenditure and labor participation. I also collect several province-level statistics from the General Statistics Office (GSO) to examine the effects of drought on yearly crop yields and monthly consumer price indices (CPIs).

1. Effects on Yearly Yield and Expenditure

I first assess the effects of drought on yearly yield and expenditure using province-level yield data from the Vietnam GSO during the period 1995-2014 and yearly expenditure data from the three waves of the VHLSS in 2004, 2006 and 2008. The log yield of spring rice and all rice crops, which also include winter and autumn rice yields, are the outcomes for the analyses of the effects on crop outputs. For the analyses of expenditure, I use the log of total yearly expenditure and the logs of yearly expenditure on subcategories such as food items and nonfood items. I aggregate the dry-season rainfall and define drought analogously at the province level rather than at the district level because the province is the unit of analysis for agricultural statistics from the GSO, and the VHLSS has the smaller sample size of households per district in comparison with the PCS.

Figure B.1 presents local linear regression results that describe how crop yields and various expenditure measures are associated with rainfall levels in the dry season. Spring rice and all rice yields are plotted on rainfall percentiles after controlling for province-specific linear time trends and year and province fixed effects in Figure B.1 (a) and Figure B.1 (b). I find positive associations between dry-season rainfall and rice yields, but low rainfall levels in the dry season have unambiguously detrimental impacts on the yield of spring rice, particularly if rainfall is below approximately the 20th percentile. However, this correlation is weakened once rainfall is above the median, providing confidence in employing the 20th percentile cutoff as the drought indicator in the following analyses.

Figure B.1 (c)-(f) provide local linear regression estimates of the four measures of expenditure on the dry-season rainfall percentile after controlling for province, year and survey quarter fixed effects and household-level covariates.[1] Nonfood item expenditure has a strong positive association with rainfall levels (Figure B.1 (e)), but the impacts of poor rainfall on the extent of total expenditure (Figure B.1 (c)) and food expenditure (Figure B.1 (d)) are muted.

In Table B.1, I provide the regression results to examine how the drought indicator I create determines rice yield and expenditure. Columns 1 and 2 show that adverse rainfall shocks in the dry season have negative effects on yields; there is a 2.4 percent reduction in the spring rice yield (column 1, $p < 0.01$), and a 1.3 percent reduction in all rice yields (column 2, $p < 0.05$).[2] Given that annual rice production in Vietnam has shown robust growth at a rate of approximately 4 percent in the 2000s (Jaffee et al., 2016), a rainfall-induced decline in rice yield can have substantive impacts on rural households. Drought is also associated with lower nonfood expenditure by 8.5 percent ($p < 0.01$, column 4). However, the effects on the other expenditure measures are not precisely estimated (columns 3 and 4) mainly because drought also results in price surges of food that constitute approximately half of households' real expenditure (Vu and Glewwe, 2011).[3]

[1]The household-level control covariates include the size of the household, the household head's age, sex, ethnicity and educational attainment and the log of total expenditure.

[2]The reduction in rice production is estimated by similar magnitudes. The point estimates for spring rice and all rice production are -0.055 ($p < 0.05$) and -0.031 ($p < 0.1$), respectively.

[3]These findings are also supported by Figure B.1 (f), which shows a slight increase in the ratio of expenditure on food to total expenditure after low levels of rain, suggesting that rural households allocate relatively more resources to purchasing food after drought.

2. Effect on Monthly Expenditure

To examine how negative aggregate shocks have intertemporal substitution effects on childbearing—e.g., postponing births by abortion—for credit-constrained parents, it is crucial to understand how lower income affects consumption smoothing. Furthermore, describing how consumption is determined by variations in prices after drought is of primary importance because the consumption of a rural household can be more responsive to seasonal prices than to seasonal income (Paxson, 1993; Khandker, 2012). In particular, high-frequency data on consumption are needed because low-cost abortion can permit an immediate substitution between current consumption and childbearing.

I estimate the effects of drought on monthly expenditure using the VHLSSs of 2010, 2012, and 2014, which collect consumption information over the month preceding the date of the interviews. In addition, I examine the effects on province-level prices using the monthly CPIs of 12 provinces provided by the Vietnam GSO from 2005-2014. I estimate the impact of drought using the following equation:

$$(4)\quad Y_{ipt} = \alpha + \sum_{q}^{Q}\sum_{k}^{K}\beta_{qk}Drought_{p,t-k}\times Quarter_{q} + \sum_{q}^{Q}\theta_{q}Quarter_{q} + \sum_{s}^{S}\sum_{l}^{L}\gamma_{sl}R_{s,t+l} + X'_{it}\delta + \tau_{rt} + \mu_{p} + \varepsilon_{ipt}$$

where Y_{ipt} is the log of monthly expenditure of household i in province p in year t.

Since enumerators' visits to rural households were mostly arranged at the end of each quarter, I include indicators for quarters, $Quarter_q$, that equal one if a household was visited in quarter q. To observe the lagged impacts of drought on consumption, I interact the quarter indicators with the lagged drought ($Drought_{p,t-1}$) and with the current drought ($Drought_{p,t}$). While maintaining the same household-level control covariates (X_{it}) and fixed effects used in the estimation of the effects on yearly expenditure, I replace the year fixed effects with region-year fixed effects (τ_{rt}) to control for different market structures and prices across regions. The main coefficient of interest β_{qk} represents the average effect of drought on monthly expenditure surveyed 0-7 quarters away from a drought event, relative to the usual level of monthly expenditure in the unaffected provinces.

I first estimate the effects on price levels using Equation (4) after replacing monthly expenditure with province-month-level CPI as the outcome variable. Figure B.2 (a) plots the coefficients on the interaction terms, β_{qk}'s, with their 95 percent confidence intervals. Statistically significant positive point estimates on the overall CPI ($p < 0.1$) and food CPI ($p < 0.05$) are initially observed in the 3rd quarter (October-December) after drought in the dry season, indicating that drought has lagged effects on local prices.

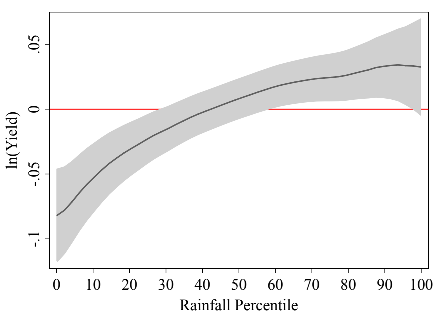
Figure B.2 (b) displays the effects of drought on monthly expenditure in subcategories using Equation (4), suggesting that price surges during the 3rd quarter are associated with lower expenditure on some nonfood daily items in the same quarter. To be specific, while holding the total monthly expenditure constant (columns 1-3 of Table B.2), affected households maintain their consumption of rice and pork (columns 8 and 9 of Table B.2), the two main food categories, by substituting away from consuming some daily nonfood items (the 3rd quarter (Oct-Dec) of Figure B.2 (b)) and toward the consumption of cheaper items, such as maize, cassava and potato (column 11 of Table B.3).

Importantly, I find that the 3rd quarter after drought (October-December), when price hikes and the corresponding adjustment of consumption are conspicuous, is the preharvest season of winter rice, the next rice crop after spring rice for two-cropping regions (Figure 1).[4] Therefore, to examine whether parents want to delay childbearing to smooth consumption after drought, this preharvest season would be the most likely timing for observing the intertemporal substitution effects on childbearing, which is illustrated as an increase in abortion.

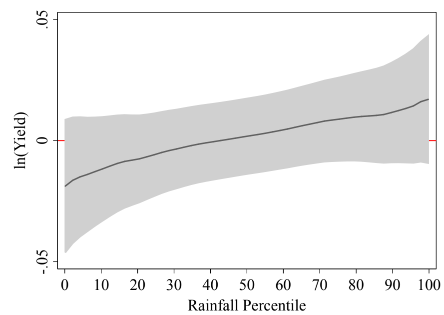
[4] I find that the results discussed thus far are consistent with the findings of Wainwright and Newman (2011): existing risk-coping strategies in rural Vietnam are ineffective in protecting consumption against aggregate shocks. For example, rural Vietnamese households do not have large-scale facilities for storing rice, which limits their capability to smooth consumption using rice as precautionary savings (Vu and Glewwe, 2011; Wainwright and Newman, 2011). The failure of perfect consumption smoothing in the preharvest season is also found in Bangladesh (Khandker, 2012).

Figure B.1: Rainfall Percentiles and Yearly Rice Yields, Expenditures

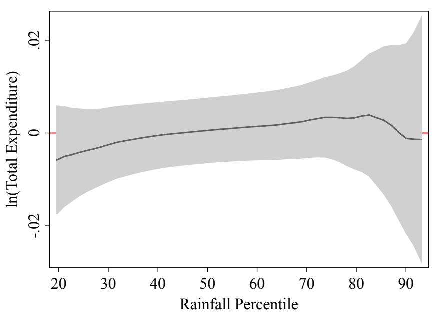
(a) Yield of Spring Rice



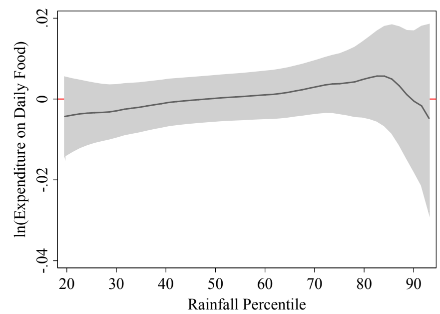
(b) Yields of All Rice Crops



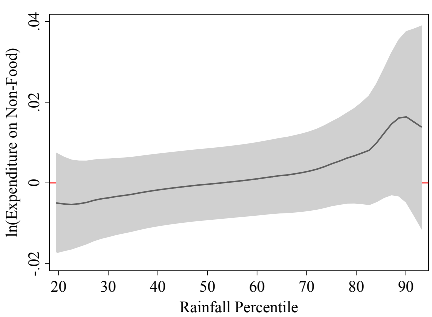
(c) Total Expenditure



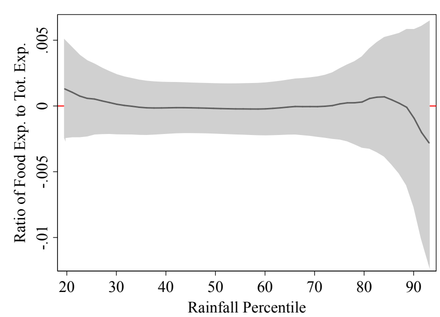
(d) Expenditure on Food



(e) Expenditure on Daily Nonfood



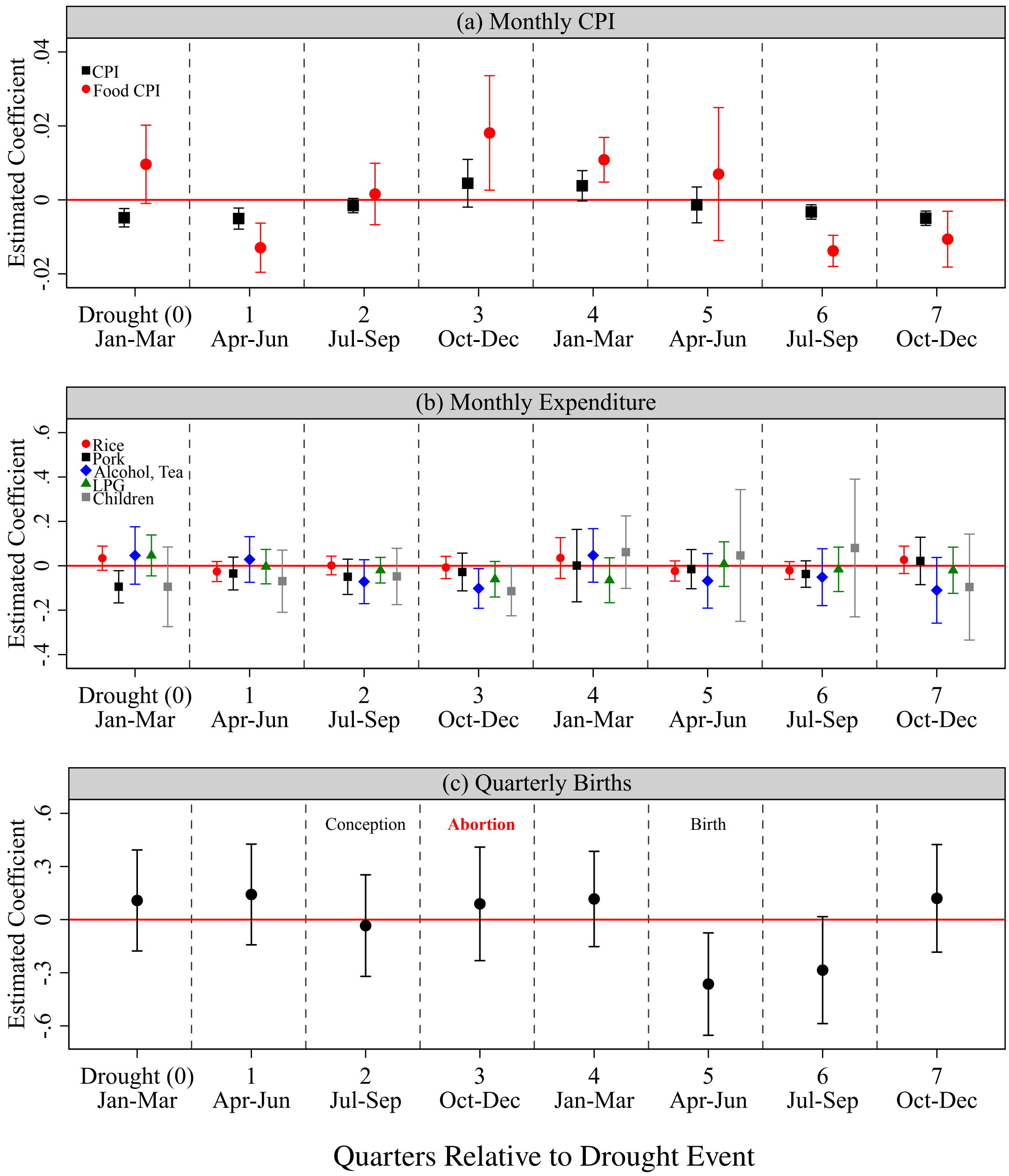
(f) Ratio of Food Exp. to Tot. Exp.



Data: Province-level rice yields from 1995-2014 from the GSO; Yearly household expenditure from the VHLSS 2004, 2006, 2008

Notes: Figures provide the point estimates (line) and the corresponding 95 percent confidence intervals (shaded area) from local linear regressions of the log of yield (Quintal/Ha) and the log of rural households' yearly expenditure ('000 VND) on the percentiles of the dry season rainfall in a given year, relative to the long-run rainfall distribution in a province. The regressions for crop yields include the logs of other season-year rainfalls, province-level linear time trends, and year and province fixed effects. The regressions for expenditure include household-level characteristics, survey-quarter fixed effects, year and province fixed effects. All rice crops refer to spring, autumn and winter rice crops. Daily nonfood items include petroleum, cooking fuels, detergent, etc.

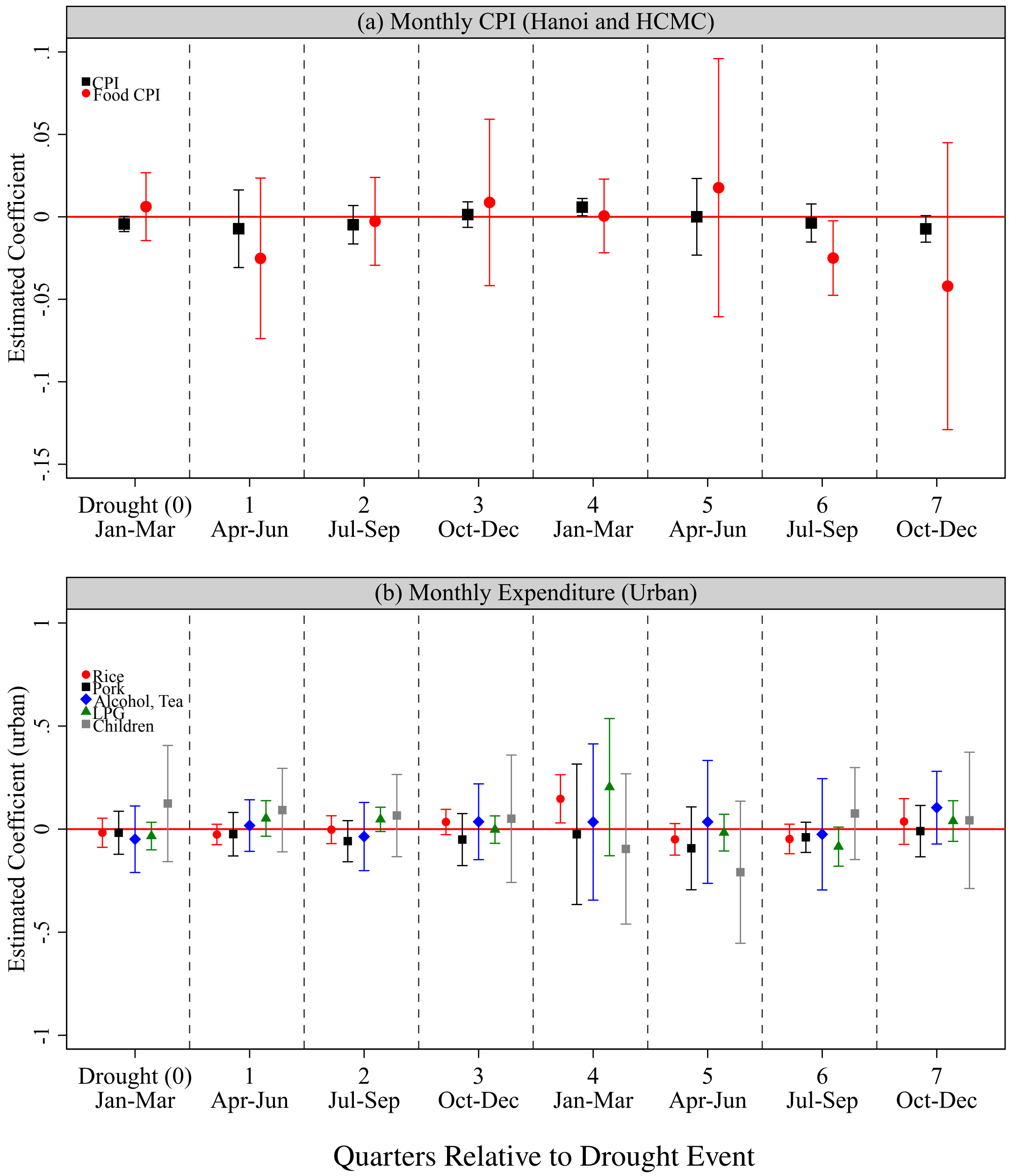
Figure B.2: Effects of Drought on Monthly CPI, Expenditure and Birth



Data: Province-level monthly CPI from the GSO; Monthly expenditure from the VHLSS 2010, 2012, 2014; Births from the PCS 2004-2008, 2010-2013

Notes: Figures plot the coefficients on the interaction terms between quarters and drought in t and $t-1$ from the regressions estimating the effect on the province-level monthly CPIs (Panel (a)), the log of monthly expenditures (Panel (b)) and the district-quarter level number of births (Panel (c)). Colored bars represent the 95% confidence intervals of the estimated coefficients. The 'Conception' and 'Abortion' in Panel (c) denote the timing of conception and abortion of the birth cohort in the 5th quarter after drought.

Figure B.3: Effects of Drought on Monthly CPI, Expenditure for the Urban Sample



Data: Province-level monthly CPI from the GSO; Monthly expenditure from the VHLSS 2010, 2012, 2014; Births from the PCS 2004-2008, 2010-2013

Notes: Figures plot the coefficients on the interaction terms between quarters and drought in t and $t-1$ from the regressions estimating the effect on the province-level monthly CPIs (Panel (a)) and the log of monthly expenditures (Panel (b)) for the urban sample. Colored bars represent the 95% confidence intervals of the estimated coefficients.

Table B.1: Effects of Drought on Yearly Rice Yields and Expenditures

	Dependent variables					
	Spring Rice (1)	All Rice Crops (2)	Total Expenditure (3)	Expenditure on Food (4)	Expenditure on Nonfood (5)	Ratio (Food/Total) (6)
Drought	-0.024***	-0.013**	0.005	0.007	-0.085***	0.002
	(0.008)	(0.006)	(0.018)	(0.021)	(0.028)	(0.006)
Observations	1,045	1,055	18,128	18,128	18,128	18,128
R-squared	0.804	0.901	0.530	0.609	0.530	0.119
Mean of Dep. Var.	3.923	3.783	9.878	9.078	7.564	0.471
Controls						
Province and year FE	Yes	Yes	Yes	Yes	Yes	Yes
Rainfall in other season-year	Yes	Yes	Yes	Yes	Yes	Yes
Province-specific linear time trend	Yes	Yes				
Household characteristics			Yes	Yes	Yes	Yes
Survey quarter FE			Yes	Yes	Yes	Yes

Data: Agricultural statistics from the GSO; VHLSS 2004, 2006, 2008

Notes: Columns (1) and (2) present the results from a regression of the log of annual crop yields (Quintal/Ha) on rainfall shocks. The unit of observation for crop yield is a province-year from 1995-2014. Columns (3)-(6) present the results from a regression of the log of expenditure (in '000 VND) on rainfall shocks. The unit of observation is a household. The sample excludes the 10 poorest provinces to be consistent with the analyses using the PCS. Household characteristic controls include sex, age, ethnicity (Kinh or not) and years of schooling of the household head, household size and the dummy for multigenerational households. Robust standard errors, which are reported in parentheses, are clustered at the province level.

Table B.2: Effect of Drought on Monthly Household Expenditures

	Dependent variables								
	ln(Exp. in '000VND)			**1**(Expenditure>0)				ln(Quantity in kg)	
	Total	Excl. gift	Excl. gift & self	Rice	Pork	Gas	Child	Rice	Pork
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Q1 (Jan-Mar)×Drought(t)	-0.017	-0.017	-0.035	0.000	-0.006	-0.047	0.019	0.074***	-0.062*
	(0.029)	(0.030)	(0.036)	(0.005)	(0.011)	(0.029)	(0.018)	(0.026)	(0.037)
Q2 (Apr-Jun)×Drought(t)	0.021	0.023	0.022	0.005	0.009	-0.006	0.017	-0.001	-0.017
	(0.020)	(0.020)	(0.024)	(0.004)	(0.008)	(0.021)	(0.017)	(0.017)	(0.036)
Q3 (Jul-Sep)× Drought(t)	0.031	0.033	0.028	0.006	0.017	-0.028	-0.013	0.013	-0.046
	(0.021)	(0.020)	(0.025)	(0.004)	(0.011)	(0.021)	(0.018)	(0.022)	(0.039)
Q4 (Oct-Dec)× Drought(t)	0.014	0.020	0.015	0.002	-0.014	-0.036*	0.021	0.029	-0.054
	(0.022)	(0.022)	(0.027)	(0.006)	(0.011)	(0.019)	(0.017)	(0.022)	(0.037)
Q1 (Jan-Mar)× Drought($t-1$)	0.017	0.020	0.071	0.002	0.002	-0.028	0.001	0.053	0.012
	(0.036)	(0.035)	(0.054)	(0.017)	(0.017)	(0.054)	(0.055)	(0.046)	(0.077)
Q2 (Apr-Jun)× Drought($t-1$)	-0.029	-0.028	-0.057	0.011*	0.003	-0.054*	-0.013	0.017	0.007
	(0.041)	(0.042)	(0.051)	(0.006)	(0.010)	(0.028)	(0.026)	(0.019)	(0.042)
Q3 (Jul-Sep)× Drought($t-1$)	-0.011	-0.008	-0.016	0.009	0.024**	-0.009	-0.028	-0.009	-0.007
	(0.033)	(0.033)	(0.044)	(0.008)	(0.011)	(0.030)	(0.025)	(0.021)	(0.027)
Q4 (Oct-Dec)× Drought($t-1$)	0.023	0.030	0.017	0.011	-0.000	-0.004	-0.064***	-0.003	-0.056
	(0.030)	(0.029)	(0.049)	(0.007)	(0.011)	(0.031)	(0.022)	(0.021)	(0.050)
Observations	17,448	17,433	17,432	17,448	17,448	17,448	17,448	17,297	16,665
R-squared	0.536	0.531	0.499	0.016	0.063	0.287	0.217	0.591	0.350
Mean of Dep. Var.	7.860	7.834	7.654	0.991	0.948	0.590	0.367	3.545	1.058
Controls									
Province and year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region × Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rainfall in other season-year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ln(Total Expenditure)				Yes	Yes	Yes	Yes	Yes	Yes

Data: VHLSS 2010, 2012, 2014

Notes: This table presents the coefficients on the interaction terms between quarters and drought in t and $t-1$ from the regressions estimating the effect on the log of total expenditure (columns (1)-(3)), the indicator for the consumption of each good (columns (4)-(7)), and the log of consumed quantity (columns (8)-(9)). Column (2) excludes the consumption of gifts from total expenditure, and column (3) further excludes the consumption of self-generated goods. Robust standard errors are shown in parentheses clustered at the province level.

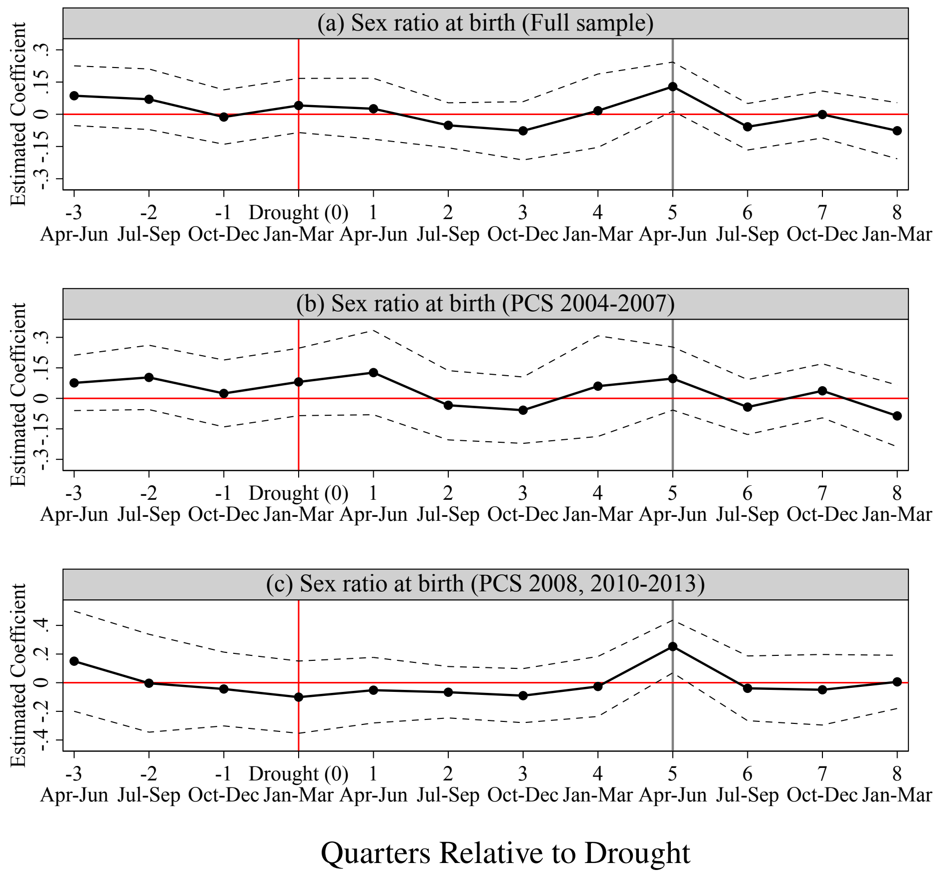
Table B.3: Effect of Drought on Monthly Household Expenditures on Food Items

	Dependent vars. (ln(Expenditure in '000 VND))											
	FAFH	Rice	Pork	Veget., Fruit	Other Meat	Seafood	Dairy	Alcohol Tea	Other Starch	Tobacco	Staple	ETC
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Q1 (Jan-Mar)×Drought(t)	0.027	0.036	-0.091**	-0.056	0.014	-0.114**	-0.101*	0.047	0.087	0.100*	0.056	-0.065**
	(0.065)	(0.027)	(0.036)	(0.037)	(0.054)	(0.048)	(0.057)	(0.063)	(0.054)	(0.053)	(0.065)	(0.031)
Q2 (Apr-Jun)×Drought(t)	-0.054	-0.023	-0.039	0.056	0.011	0.002	0.073	0.048	0.061	-0.016	0.032	0.078**
	(0.060)	(0.022)	(0.036)	(0.044)	(0.042)	(0.047)	(0.050)	(0.051)	(0.044)	(0.064)	(0.056)	(0.032)
Q3 (Jul-Sep)×Drought(t)	0.068	0.007	-0.046	-0.019	0.066	-0.049	0.065	-0.045	0.058	-0.002	0.046	0.031
	(0.068)	(0.022)	(0.038)	(0.039)	(0.045)	(0.049)	(0.056)	(0.051)	(0.046)	(0.055)	(0.058)	(0.035)
Q4 (Oct-Dec)×Drought(t)	-0.008	-0.005	-0.035	-0.012	0.012	-0.028	0.057	-0.100**	0.078	0.052	0.099*	0.000
	(0.065)	(0.027)	(0.041)	(0.042)	(0.039)	(0.046)	(0.063)	(0.043)	(0.047)	(0.065)	(0.057)	(0.036)
Q1 (Jan-Mar)×Drought($t-1$)	-0.116	0.035	0.002	0.123**	-0.077	-0.103*	-0.200	0.052	-0.152	0.080	0.355*	0.062
	(0.103)	(0.048)	(0.083)	(0.047)	(0.079)	(0.059)	(0.155)	(0.059)	(0.096)	(0.086)	(0.211)	(0.050)
Q2 (Apr-Jun)×Drought($t-1$)	-0.110	-0.024	-0.025	-0.013	0.017	-0.066	-0.022	-0.047	0.118	-0.149*	0.005	-0.068
	(0.078)	(0.023)	(0.045)	(0.056)	(0.077)	(0.043)	(0.063)	(0.058)	(0.080)	(0.082)	(0.099)	(0.056)
Q3 (Jul-Sep)×Drought($t-1$)	-0.070	-0.024	-0.038	-0.032	-0.106**	-0.035	0.042	-0.030	0.054	0.019	-0.087	0.024
	(0.052)	(0.021)	(0.028)	(0.043)	(0.046)	(0.060)	(0.068)	(0.063)	(0.066)	(0.074)	(0.064)	(0.045)
Q4 (Oct-Dec)×Drought($t-1$)	0.106	0.017	0.005	-0.018	-0.007	0.009	0.080	-0.107	0.026	-0.005	-0.051	0.008
	(0.074)	(0.030)	(0.056)	(0.046)	(0.067)	(0.063)	(0.072)	(0.073)	(0.038)	(0.099)	(0.062)	(0.048)
Observations	12,643	17,297	16,665	17,384	13,437	16,827	15,547	14,239	15,373	8,987	6,526	17,422
R-squared	0.317	0.570	0.392	0.378	0.311	0.434	0.274	0.212	0.214	0.380	0.176	0.419
Mean of Dep. Var.	5.721	5.867	5.303	5.205	5.265	5.209	4.242	4.182	4.062	4.407	3.140	5.194
Controls												
Province and year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region × Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rainfall in other season-year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ln(Total Expenditure)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Data: VHLSS 2010, 2012, 2014
Notes: This table presents the coefficients on the interaction terms between quarters and drought in t and $t-1$ from the regressions estimating the effect on the log of monthly household expenditure on each food category. The regression columns are sorted by the share of expenditure on the item to the total expenditure from the largest to the smallest. FAFH denotes the food away from home. Robust standard errors are shown in parentheses clustered at the province level.

Appendix C. Additional Figure and Tables for Fertility Outcomes and Alternative Channels

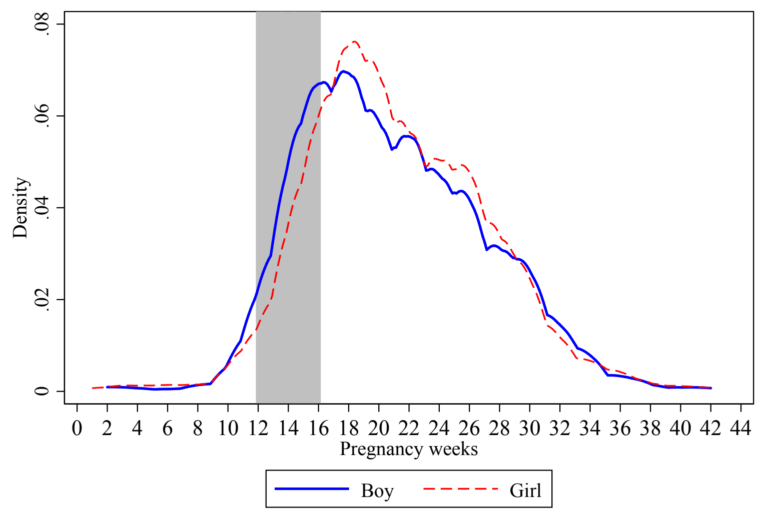
Figure C.1: Effects of Drought on the Sex Ratio at Birth



Data: PCS 2004-2008, 2010-2013
Notes: Panel (a) plots the coefficients on the indicators for n quarters away from the drought occurring at $n = 0$ in the regression estimating the effect on the log of province-quarter level sex ratio at birth using the full PCS sample. Panel (b) and (c) plot the coefficients by repeating the same regression of Panel (a) using the first four and the latter five rounds of the PCS, respectively. The sex ratio at birth is defined by the number of infant boys ($\leq$ 1 year old) born to one hundred infant girls in each survey year. The dashed black lines refer to the 95 percent confidence intervals. The gray vertical line denotes the quarter when drought has significant effects on births, as shown in Figure 2 (c).

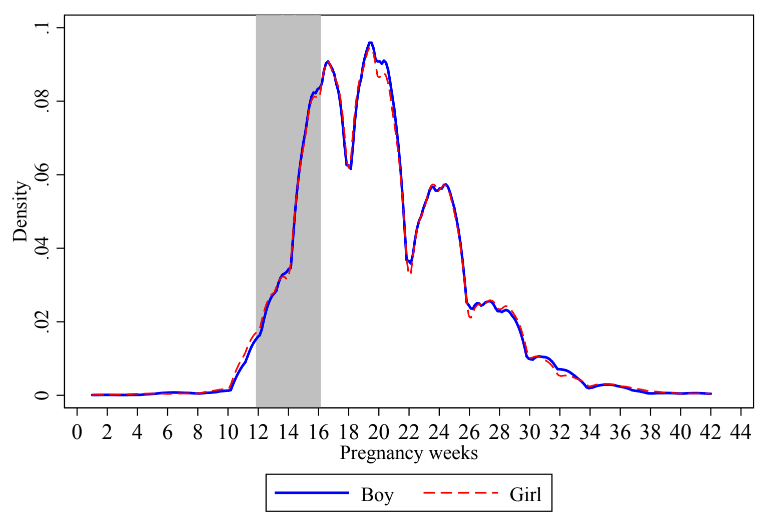
Figure C.2: Distribution of the Pregnancy Weeks of Fetal Sex Determination

(a) By the sex of newborns born to affected mothers



p-value of two-sample Kolmogorov–Smirnov test: .112

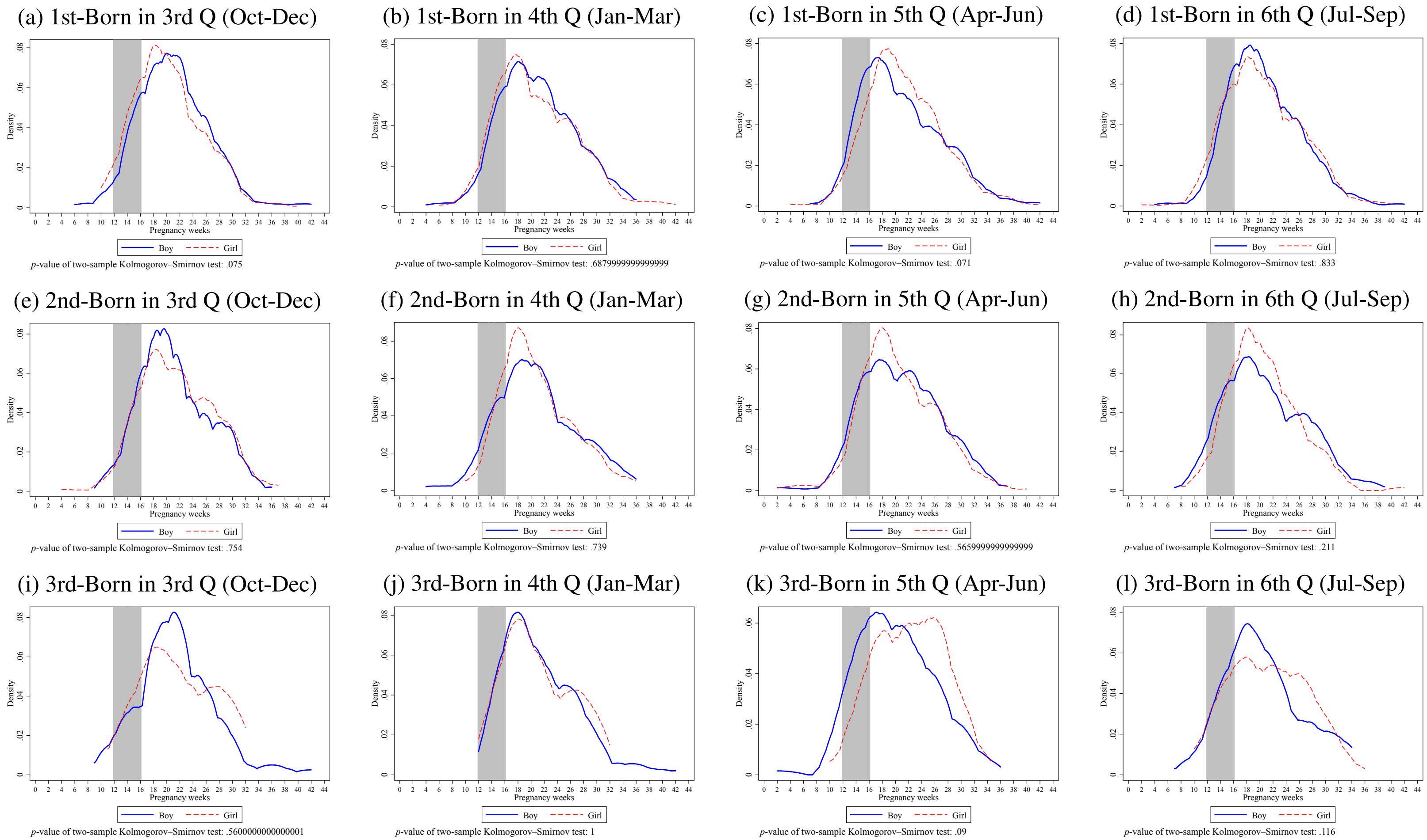
(b) By the sex of newborns born to unaffected mothers



p-value of two-sample Kolmogorov–Smirnov test: .999

Data: PCS 2006, 2007, 2010-2013
Notes: Figures plot the kernel density estimation on the distributions of the weeks of fetal sex determination using ultrasound, conditional on childbirth in April-June. The gray vertical bands denote the pregnancy weeks when sex-selective abortion can be performed; the 12th week is the earliest possible week when the fetal sex can be determined by ultrasound, and the 16th week is the latest possible week when abortion can be performed from DHS 2002 (Committee for Population, Family and Children [Vietnam] and ORC Macro, 2003). Panel (a) plots the pregnancy weeks of fetal sex determination of affected mothers by the sex of a newborn, whereas Panel (b) plots those of unaffected mothers, conditional on giving birth to a child in the 5th quarter after drought (April-June) when the effect of drought on birth is significant as shown in Figure 2 (c).

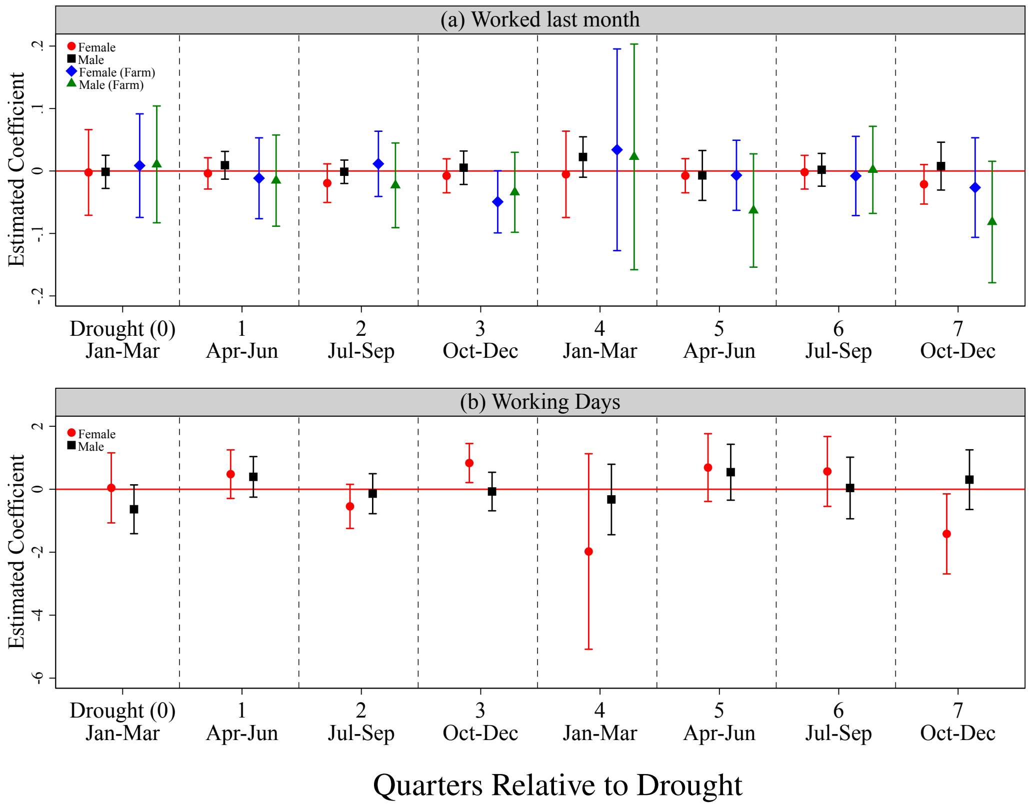
Figure C.3: Distribution of the Weeks of Sex Determination by the Sex of Newborns and by the Birth Order



Data: PCS 2004-2008, 2010-2013

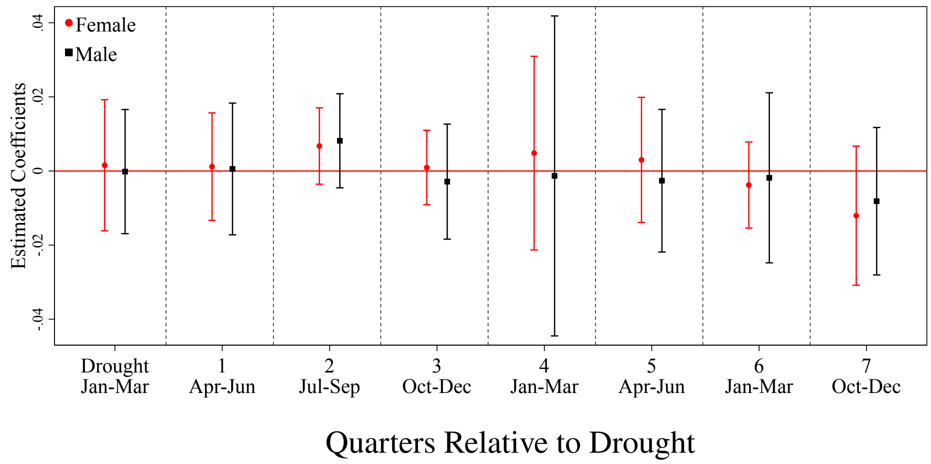
Notes: Figures plot the kernel density estimation on the distributions of the weeks of fetal sex determination of affected mothers using ultrasound, conditional on the childbirth of each parity from the 3rd (Panel (a), (e), (i)) to the 6th quarter (Panel (d), (h), (l)) after drought. It is from the 3rd to the 6th quarter after drought when the aborted fetuses in the PCS (t) would have been born otherwise. The gray vertical bands denote the pregnancy weeks when sex-selective abortion can be performed; the 12th week is the earliest possible week when the fetal sex can be determined by ultrasound, and the 16th week is the latest possible week when abortion can be performed from DHS 2002 (Committee for Population, Family and Children [Vietnam] and ORC Macro, 2003). It is the 5th quarter after drought (April-June) when the effect of drought on birth is significant, as shown in Figure 2 (c).

Figure C.4: Effects of Drought on Labor Market Participation



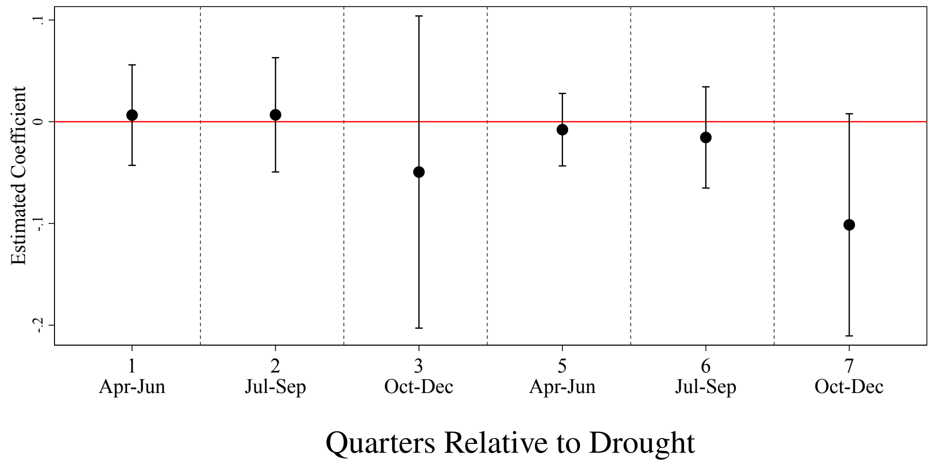
Data: VHLSS 2010, 2012, 2014
Notes: Figures plot the coefficients on the interaction terms between quarters and drought in t and $t-1$ from the regressions estimating the effect on whether a married woman or man worked last month (Panel (a)) and the working days conditional on her or his labor market participation last month (Panel (b)). Colored bars represent the 95% confidence intervals of the estimated coefficients. Each regression includes quarter fixed effects (FEs), province FEs, region×year FEs, the logs of other season-year rainfalls and household-level controls such as the sex, age, ethnicity (Kinh or not) and years of schooling of the household head, the household size and the dummy for multigenerational household. Robust standard errors are clustered at the province level.

Figure C.5: Effect of Drought on Recent Migration



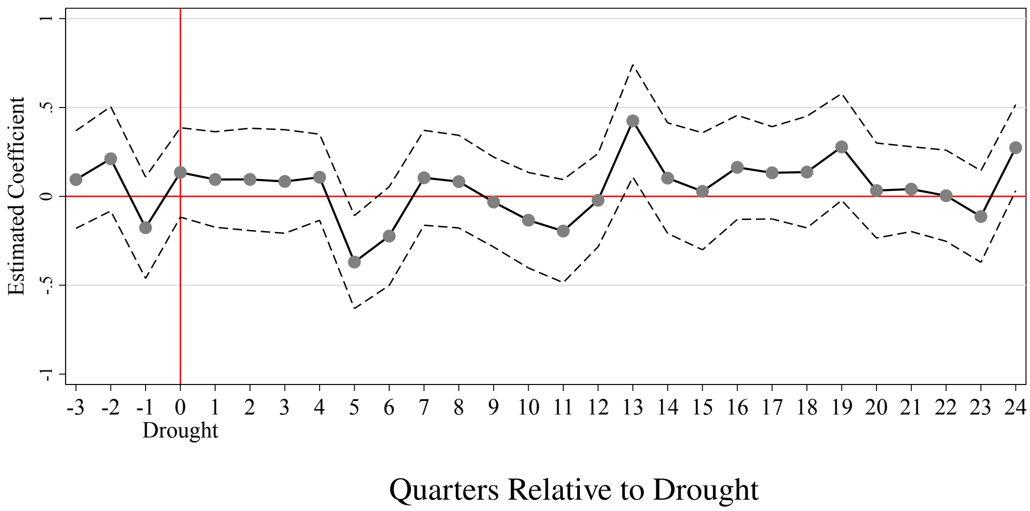
Data: VHLSS 2010, 2012, 2014
Notes: This figure plots the coefficients on the interaction terms between quarters and drought in t and $t-1$ from the regression estimating the effect on recent migration of a rural household. The indicator for the recent migration becomes one if a married woman or man had been away from home for less than 6 months at the time of the survey. Black bars represent the 95% confidence intervals of the estimated coefficients. The regression includes quarter fixed effects (FEs), province FEs, region×year FEs, the logs of other season-year rainfalls and household-level controls such as the sex, age, ethnicity (Kinh or not) and years of schooling of the household head, the household size and the dummy for multigenerational household. Robust standard errors are clustered at the province level.

Figure C.6: Effect of Drought on Recent Illness



Data: VHLSS 2004, 2006, 2008
Notes: This figure plots the coefficients on the interaction terms between quarters and drought in t and $t-1$ from the regression estimating the effect on recent illness of any rural household member. The indicator for the recent illness becomes one if any household members suffered from any illness or injuries for the past 4 weeks from the date of the survey. The regression includes quarter fixed effects (FEs), province FEs, region$\times$year FEs, logs of other season-year rainfalls and household-level controls such as the sex, age, ethnicity (Kinh or not) and years of schooling of the household head, household size and the dummy for multigenerational households. Robust standard errors are clustered at the province level. There are no point estimates in the quarter with drought, nor are there in the 4th quarter after drought due to no observations of households having been surveyed in that quarter.

Figure C.7: Effect of Drought on Births in the Medium Term



Data: PCS 2004-2008, 2010-2013

Notes: This figure plots the coefficients on the interaction terms between quarters and drought from t to $t-6$ from the regression estimating the effect on the number of quarter-district-level births. Each point estimate refers to the effect on births in n quarters away from the drought occurring at $n=0$. The dashed lines refer to the 95 percent confidence intervals. The regression includes the same controls in Equation (2), district FEs, province$\times$quarter FEs, quarter$\times$year FEs, and district-level linear time trends. Robust standard errors are clustered at the district level.

Table C.1: Effect of Drought on Abortion for Women in Urban and 10 Northern Provinces

	Dependent variable: Abortion=1							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Urban Sample								
Drought	0.0016*	0.0014	0.0014	0.0014	0.0014	0.0013	0.0012	0.0008
	(0.0009)	(0.0009)	(0.0009)	(0.0009)	(0.0009)	(0.0009)	(0.0009)	(0.0010)
Observations	840,836	840,836	839,551	839,551	839,551	839,551	834,191	490,732
R-squared	0.008	0.008	0.009	0.009	0.009	0.012	0.013	0.014
Mean of Dep. Var.	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069
Panel B. 10 Northern Provinces								
Drought	-0.0008	-0.0012	-0.0012	-0.0009	-0.0009	-0.0009	-0.0009	0.0007
	(0.0017)	(0.0018)	(0.0018)	(0.0019)	(0.0019)	(0.0019)	(0.0019)	(0.0021)
Observations	169,410	169,410	169,196	169,196	169,196	169,196	167,805	93,159
R-squared	0.014	0.015	0.016	0.020	0.021	0.021	0.021	0.019
Mean of Dep. Var.	0.0129	0.0129	0.0129	0.0129	0.0129	0.0129	0.0129	0.0129
Controls								
District and year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rainfall in other season-year		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mother characteristics			Yes	Yes	Yes	Yes	Yes	Yes
Birth parity FE				Yes	Yes	Yes	Yes	Yes
Gender composition FE					Yes	Yes	Yes	Yes
District-specific linear time trend						Yes	Yes	Yes
Fertility characteristics							Yes	Yes
Spouse characteristics								Yes

Data: PCS 2004-2008, 2010-2013

Notes: This table reports the results of regressions for the urban and 10 northern-province samples. In the 10 provinces, more than 50 percent of the heads of household are not ethnically Kinh. The 10 provinces are Cao Bang, Bac Kan, Ha Giang, Lang Son, Lai Chau, Son La, Dien Bien, Hoa Binh, Lao Cai, and Tuyen Quang, and the locations are mapped in Figure A.5. The dependent variable is the indicator for the experience of abortion in the survey year. Fertility characteristic controls consist of the mother's age at her first birth and birth spacing, measured as the months between the most recent childbirth and the starting month of the survey period. Spouse characteristics include the age of the mother's spouse, age squared and educational attainment. The mean of the dependent variable is the mean abortion rate of mothers living in the districts that were not inflicted with drought. Robust standard errors are shown in parentheses and clustered at the district level.

Table C.2: Effect of Drought on Abortion

	Dependent variable: Abortion=1							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Drought in the dry season (t)								
Drought	0.0002	0.0001	0.0001	0.0001	0.0001	-0.0002	-0.0003	-0.0012
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0008)	(0.0008)	(0.0011)
Observations	811,092	811,092	810,144	810,144	810,144	810,144	802,589	441,789
R-squared	0.008	0.008	0.009	0.009	0.009	0.012	0.012	0.013
Mean of Dep. Var.	0.0066	0.0066	0.0066	0.0066	0.0066	0.0066	0.0066	0.0066
Panel B. Drought in the dry season ($t-2$)								
Drought	0.0009	0.0009	0.0009	0.0010	0.0010	0.0010	0.0010	0.0008
	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0009)
Observations	811,092	811,092	810,144	810,144	810,144	810,144	802,589	441,789
R-squared	0.008	0.008	0.009	0.009	0.009	0.012	0.012	0.013
Mean of Dep. Var.	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069	0.0069
Controls								
District and year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rainfall in other season-year		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mother characteristics			Yes	Yes	Yes	Yes	Yes	Yes
Birth parity FE				Yes	Yes	Yes	Yes	Yes
Gender composition FE					Yes	Yes	Yes	Yes
District-specific linear time trend						Yes	Yes	Yes
Fertility characteristics							Yes	Yes
Spouse characteristics								Yes

Data: PCS 2004-2008, 2010-2013
Notes: The dependent variable is the indicator for the experience of abortion during the survey year. Fertility characteristic controls consists of the mother's age at her first birth and the birth spacing, measured as months between the most recent childbirth and the starting month of the survey period. Spouse characteristics include the mother's spouse's age, age squared and educational attainment. The mean of the dependent variable is the mean abortion rate of mothers living in those districts that were not inflicted with drought. Robust standard errors are shown in parentheses clustered at the district level.

Table C.3: Effect of Drought on Abortion Using Distributed Lagged Model

	Dependent variable: Abortion=1						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Low rainfall in the dry season (t)	0.0008	0.0008	0.0008	0.0008	0.0006	0.0006	0.0006
	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0012)
Low rainfall in the dry season ($t-1$)	0.0022***	0.0023***	0.0023***	0.0023***	0.0021***	0.0021***	0.0030**
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0008)	(0.0008)	(0.0012)
Low rainfall in the dry season ($t-2$)	0.0013**	0.0013**	0.0013**	0.0013**	0.0013*	0.0013*	0.0016
	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0007)	(0.0007)	(0.0011)
Low rainfall in the wet season (t)	-0.0006	-0.0006	-0.0006	-0.0006	-0.0008	-0.0007	0.0007
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0008)	(0.0008)	(0.0013)
Low rainfall in the wet season ($t-1$)	-0.0007	-0.0006	-0.0007	-0.0007	-0.0009	-0.0009	-0.0007
	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0014)
Low rainfall in the wet season ($t-2$)	-0.0004	-0.0004	-0.0004	-0.0004	-0.0002	-0.0002	-0.0000
	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0011)
Observations	811,092	810,144	810,144	810,144	810,144	802,589	441,789
R-squared	0.008	0.009	0.009	0.009	0.012	0.012	0.013
Mean of Dep. Var.				0.0066			
Controls							
District and year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mother characteristics		Yes	Yes	Yes	Yes	Yes	Yes
District-specific linear time trend			Yes	Yes	Yes	Yes	Yes
Birth parity FE				Yes	Yes	Yes	Yes
Gender composition FE					Yes	Yes	Yes
Fertility characteristics						Yes	Yes
Spouse characteristics							Yes

Data: PCS 2004-2008, 2010-2013

Notes: Low rainfall shocks refer to the realization of rainfall in the wet season (April-November) or in the dry season (December-March) below the 20th percentile of the historical distribution of district-specific seasonal rainfall from 1984-2013. The dependent variable is the indicator for the experience of abortion during the survey year. Fertility characteristic controls consist of the mother's age at her first birth and the birth spacing, measured as months between the most recent childbirth and the starting month of the survey period. Spouse characteristics include the age of the mother's spouse, age squared and educational attainment. The mean of the dependent variable is the mean abortion rate of mothers living in the districts that were not inflicted with drought. Robust standard errors are shown in parentheses clustered at the district level.

Table C.4: Effect of Drought on Childbirth

	Dependent variable: Giving Birth=1			
	Birth in Apr-Jun (1)	Birth in Jul-Sep (2)	Birth in Oct-Dec (3)	Birth in Jan-Mar (4)
Panel A. Drought in the dry season (t)				
Drought (t)	0.0003	0.0008	-0.0014*	0.0004
	(0.0008)	(0.0008)	(0.0008)	(0.0007)
Observations	810,144	810,144	810,144	810,144
R-squared	0.035	0.040	0.042	0.035
Mean of Dep. Var.	0.0258	0.0281	0.0202	0.0323
Panel B. Drought in the dry season $(t-1)$				
Drought $(t-1)$	0.0005	0.0001	0.0002	0.0002
	(0.0007)	(0.0007)	(0.0007)	(0.0006)
Observations	810,144	810,144	810,144	810,144
R-squared	0.035	0.040	0.042	0.035
Mean of Dep. Var.	0.0258	0.0281	0.0201	0.0321
Panel C. Drought in the dry season $(t-2)$				
Drought $(t-2)$	-0.0023***	-0.0012*	0.0010	0.0009
	(0.0006)	(0.0007)	(0.0006)	(0.0006)
Observations	810,144	810,144	810,144	810,144
R-squared	0.035	0.040	0.042	0.035
Mean of Dep. Var.	0.0258	0.0283	0.0200	0.0318
Controls				
District and year FE	Yes	Yes	Yes	Yes
Rainfall in other season-year	Yes	Yes	Yes	Yes
Mother characteristics	Yes	Yes	Yes	Yes
Birth parity FE	Yes	Yes	Yes	Yes
Gender composition FE	Yes	Yes	Yes	Yes
District-specific linear time trend	Yes	Yes	Yes	Yes

Data: PCS 2004-2008, 2010-2013
Notes: This table shows OLS regressions for the effects of drought on the likelihood of giving birth. The outcome is the indicator for giving birth in a given quarter in the survey year. Robust standard errors are shown in parentheses clustered at the district level.

Table C.5: Effects of Droughts on a Child's Sex

	Dependent variable: Newborn is a boy=1			
	Born in Apr-Jun	Born in Jul-Sep	Born in Oct-Dec	Born in Jan-Mar
	(1)	(2)	(3)	(4)
Panel A. Drought in the dry season (t)				
Drought	0.0068	0.0143	-0.0071	0.0261
	(0.0182)	(0.0199)	(0.0148)	(0.0181)
Observations	20,683	22,791	23,212	19,005
R-squared	0.009	0.007	0.009	0.010
Mean of Dep. Var.	0.5244	0.5143	0.5267	0.5262
Panel B. Drought in the dry season ($t-1$)				
Drought	0.0006	-0.0271	-0.0156	0.0137
	(0.0153)	(0.0170)	(0.0135)	(0.0197)
Observations	20,683	22,791	23,212	19,005
R-squared	0.009	0.007	0.009	0.010
Mean of Dep. Var.	0.5232	0.5190	0.5267	0.5250
Panel C. Drought in the dry season ($t-2$)				
Drought	0.0234*	-0.0046	0.0058	-0.0134
	(0.0134)	(0.0152)	(0.0128)	(0.0157)
Observations	20,683	22,791	23,212	19,005
R-squared	0.009	0.007	0.008	0.010
Mean of Dep. Var.	0.5219	0.5179	0.5272	0.5264
Controls				
District and year FE	Yes	Yes	Yes	Yes
Rainfall in other season-year	Yes	Yes	Yes	Yes
Mother characteristics	Yes	Yes	Yes	Yes
District-specific linear time trend	Yes	Yes	Yes	Yes
Birth parity FE	Yes	Yes	Yes	Yes
Gender composition FE	Yes	Yes	Yes	Yes

Data: PCS 2004-2008, 2010-2013
Notes: This table provides the effects of droughts on the likelihood that a newborn is a boy. The outcome is the indicator for a newborn being a boy conditional on being born in each quarter of the survey year. Robust standard errors are shown in parentheses clustered at the district level.

Table C.6: Effects of Drought on Infant Mortality

	Dependent variable					
	Newborn died=1					**ln(IMR)**
	Born in Apr-Mar	Born in Apr-Jun	Born in Jul-Sep	Born in Oct-Nov	Born in Dec-Mar	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Drought in the dry season ***(t)***						
Drought	-0.0010	0.0032	0.0005	-0.0047	-0.0026	-0.0057
	(0.0014)	(0.0030)	(0.0029)	(0.0032)	(0.0029)	(0.0144)
Observations	85,691	20,683	22,791	23,212	19,005	477
R-squared	0.008	0.014	0.013	0.014	0.017	0.789
Mean of Dep. Var.	0.0081	0.0083	0.0081	0.0084	0.0077	2.7273
Panel B. Drought in the dry season ***($t-1$)***						
Drought	-0.0001	-0.0043	0.0018	0.0044	-0.0047*	-0.0045
	(0.0014)	(0.0026)	(0.0029)	(0.0028)	(0.0024)	(0.0201)
Observations	85,691	20,683	22,791	23,212	19,005	477
R-squared	0.008	0.014	0.013	0.014	0.017	0.789
Mean of Dep. Var.	0.0082	0.0082	0.0090	0.0079	0.0081	2.7245
Panel C. Drought in the dry season ***($t-2$)***						
Drought	-0.0006	-0.0024	-0.0025	0.0002	0.0026	-0.0066
	(0.0013)	(0.0023)	(0.0026)	(0.0032)	(0.0023)	(0.0161)
Observations	85,691	20,683	22,791	23,212	19,005	477
R-squared	0.008	0.014	0.013	0.014	0.017	0.788
Mean of Dep. Var.	0.0082	0.0082	0.0084	0.0082	0.0086	2.7309
Controls						
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Region×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Rainfall in other season-year	Yes	Yes	Yes	Yes	Yes	Yes
Mother characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Birth parity FE	Yes	Yes	Yes	Yes	Yes	Yes
Gender composition FE	Yes	Yes	Yes	Yes	Yes	Yes
Province-specific linear time trend	Yes	Yes	Yes	Yes	Yes	Yes

Data: PCS 2004-2008, 2010-2013; Province-level IMR from the GSO
Notes: This table presents the results from regressions estimating the effect of drought on infant mortality. Columns (1)-(5) report the effect on the likelihood that a newborn died in the survey year (column (1)) and in a given quarter in the survey year (columns (2)-(5)) from the PCS. Column (6) presents the effect on the log of province-level infant mortality rates from the GSO. Robust standard errors are shown in parentheses clustered at the province level.

Table C.7: Effects of Drought on Conception and Contraceptive Use

	By Parity							
	Conception		Use any contraceptives		Use modern contraceptives		No contraception to have a child	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Drought in the dry season (t)								
Drought (t)	-0.0005	-0.0003	-0.0046	-0.0046	-0.0030	-0.0094	0.0021	-0.0013
	(0.0018)	(0.0024)	(0.0029)	(0.0045)	(0.0040)	(0.0063)	(0.0023)	(0.0028)
Observations	810,144	441,789	808,809	441,222	808,809	441,222	808,809	441,222
R-squared	0.148	0.105	0.326	0.224	0.233	0.158	0.237	0.188
Mean of Dep. Variable	0.107	0.072	0.769	0.842	0.666	0.736	0.117	0.071
Panel B. Drought in the dry season ($t-1$)								
Drought ($t-1$)	0.0012	0.0012	0.0011	0.0030	0.0070**	0.0037	0.0005	0.0001
	(0.0015)	(0.0019)	(0.0024)	(0.0031)	(0.0033)	(0.0046)	(0.0019)	(0.0022)
Observations	810,144	441,789	808,809	441,222	808,809	441,222	808,809	441,222
R-Squared	0.148	0.105	0.326	0.224	0.233	0.158	0.237	0.188
Mean of Dep. Variable	0.107	0.072	0.768	0.842	0.665	0.736	0.117	0.071
Panel C. Drought in the dry season ($t-2$)								
Drought ($t-2$)	0.0008	0.0022	-0.0003	-0.0031	0.0068**	0.0073	0.0033	0.0017
	(0.0014)	(0.0018)	(0.0026)	(0.0033)	(0.0035)	(0.0046)	(0.0020)	(0.0023)
Observations	810,144	441,789	808,809	441,222	808,809	441,222	808,809	441,222
R-Squared	0.148	0.105	0.326	0.224	0.233	0.158	0.237	0.188
Mean of Dep. Variable	0.107	0.072	0.770	0.842	0.668	0.736	0.115	0.071
Controls								
District and year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rainfall in other season-year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mother characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Birth parity FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Gender composition FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District-specific linear time trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fertility characteristics		Yes		Yes		Yes		Yes
Spouse characteristics		Yes		Yes		Yes		Yes

Data: PCS 2004-2008, 2010-2013

Notes: This table provides the current and lagged effects of drought on the conception and various measures of contraceptive use. "Conception" is defined as an abortion occurring in the survey year and the corresponding conception cohort to this abortion, that is, the births between September and March in the PCS and the current pregnancy (see Figure 1). Any contraceptives include traditional methods such as periodic abstinence or withdrawal, and modern contraceptives describe IUDs, birth-control pills, injections, condoms, diaphragms, foam or sterilization. Columns 2, 4, 6 and 8 use the restricted sample that contains spousal characteristics. Robust standard errors are shown in parentheses clustered at the district level.

Table C.8: Heterogeneous Effects of Drought on Conception

	Full Sample		By Parity							
			1st		2nd		3rd		4th	
Dependent Vars.	Mean/(SD) (1)	Diff. (2)	Mean/(SD) (3)	Diff. (4)	Mean/(SD) (5)	Diff. (6)	Mean/(SD) (7)	Diff. (8)	Mean/(SD) (9)	Diff. (10)
Panel A. Mother's characteristics										
Age (Year)	26.181	-0.104	22.689	-0.335	26.722	-0.611	31.716	0.268	34.347	0.428
	(5.632)		(3.803)		(4.249)		(4.914)		(5.110)	
Being the household head	0.039	-0.008	0.018	-0.009	0.056	-0.009**	0.052	-0.008	0.055	0.003
	(0.193)		(0.133)		(0.229)		(0.222)		(0.228)	
Educ. Attain.: Primary or none	0.284	-0.199	0.210	-0.197	0.303	-0.201	0.376	-0.217	0.487	-0.211
	(0.451)		(0.408)		(0.460)		(0.484)		(0.500)	
Educ. Attain.: Lower secondary	0.493	0.166	0.480	0.143	0.506	0.182	0.513	0.184	0.455	0.195
	(0.500)		(0.500)		(0.500)		(0.500)		(0.498)	
Educ. Attain.: Higher secondary or above	0.223	0.033	0.310	0.053	0.191	0.019	0.111	0.032	0.058	0.016
	(0.416)		(0.463)		(0.393)		(0.314)		(0.233)	
Age at the first birth (Year)	22.035	-0.289	-	-	22.243	-0.365	21.719	-0.147	21.626	0.116
	(3.190)		-		(3.320)		(2.932)		(2.955)	
Number of children ever born	0.887	0.016	-	-	-	-	-	-	-	-
	(0.902)		-		-		-		-	
Having the first child	0.434	-0.012	-	-	-	-	-	-	-	-
	(0.496)		-		-		-		-	
Have at least one son	0.576	0.006	-	-	0.530	0.016	0.649	-0.013	0.657	-0.081
	(0.494)		-		(0.499)		(0.477)		(0.475)	
Panel B. Spouse's characteristics										
Age (Year)	31.843	0.196	27.589	0.020	30.537	-0.456	35.013	0.420	37.186	0.656
	(6.018)		(5.761)		(4.859)		(5.342)		(5.188)	
Educ. Attain.: Primary or none	0.311	-0.154	0.237	-0.151	0.296	-0.155	0.348	-0.166	0.432	-0.193
	(0.463)		(0.426)		(0.457)		(0.477)		(0.496)	
Educ. Attain.: Lower secondary	0.493	0.150	0.470	0.126	0.491	0.152	0.515	0.151	0.484	0.178
	(0.500)		(0.499)		(0.500)		(0.500)		(0.500)	
Educ. Attain.: Higher secondary or above	0.196	0.004	0.292	0.025	0.213	0.002**	0.137	0.016	0.084	0.015
	(0.397)		(0.455)		(0.410)		(0.344)		(0.278)	
Observations	14,373	94,995	6,241	42,239	5,024	34,227	2,396	14,298	712	4,231

Data: PCS 2004-2008, 2010-2013

Notes: This table tests for difference in observable characteristics between affected and unaffected mothers who had an abortion, gave birth or were pregnant at the time of the survey. The statistics of affected mothers are presented in columns (1), (3), (5), (7) and (9). The number of observations in every first column for the full sample and for each parity refers to the number of affected mothers, whereas the number of unaffected mothers is presented in every second column. After regressing each dependent variable on the indicator of drought, the statistical significance of the coefficient is marked on the difference in the means between the two samples of mothers.

Appendix D. Robustness Checks

D.1 Alternative Empirical Specifications

The main result on abortion remains intact to more flexible specifications. To test for nonlinearities, I replace the indicator for drought in Equation (1) with multiple binned indicators that become one if rainfall falls within each 10th percentile interval of the historical distribution and zero otherwise while making the 5th indicator the omitted category.[5] Panel (f) of Figure D.3 plots the coefficients on each dummy that is constructed using the dry-season rainfall in $t-1$. I find that the lowest level of dry-season rainfall in $t-1$, i.e., the 1st decile, leads to the highest rate of abortion compared to the effect of rainfall in the 5th decile. The point estimates for the other decile indicators are close to zero.

In addition, I further show that the main results are robust to replacing the rainfall estimates from Climate Hazards Group InfraRed Precipitation with Station (CHIRPS) data with the modified distributions that result from fitting the historical rainfall realizations to a district-specific gamma distribution, as suggested by Burke et al. (2015) and Corno et al. (2017). Figure D.1 shows consistent results with Panel (f) of Figure D.3 using the historical rainfall realizations in the main analysis.

Finally, to further examine the relationship between rainfall and abortion, it is important to estimate the marginal effects of rainfall levels on the likelihood of abortion. Using restricted cubic splines with three knots, I present the estimated marginal effects of an additional unit increase in the dry-season rainfall percentile on the probability of abortion. Figure D.2 shows that rainfall levels below the 20th percentile have consistent and significant effects on abortion, lending credence to my definition of drought in the main analysis as that occurring below the 20th percentile in the main analysis.

D.2 Other Seasonal Rainfall

I examine whether the drought shock I construct using the dry-season rainfall in $t-1$ is the most crucial shock to determine economic conditions and fertility outcomes in the main analyses. Table D.1 shows that drought, as defined using either the wet-season rainfall in t (Panel A) or the calendar-year rainfall in t (Panel B), does not have statistically significant effects on rice yields or on yearly household expenditure measures. Next, Figure D.3 shows the coefficients resulting from repeating the estimation in Figure D.3 Panel (f) using all of the combinations of other

[5] $Y_{idt} = \alpha + \sum_{k \in K} \beta_k \widetilde{R}^k_{d,t} + \sum_s^S \sum_l^L \gamma_{sl} R_{s,t-l} + X'_{it}\delta + \tau_t + \mu_d + \theta_d * t + \varepsilon_{idt}$ where $\widetilde{R}^k_{d,t}$ are the dummies for every 10th percentile.

season-year-rainfall distributions. I find that the drought shocks defined by rainfall levels in the preceding dry season have the largest impacts on abortion (Figure D.3 Panel (f)), whereas the effects of the other drought shocks are imprecisely estimated in general. Finally, I examine whether consecutive rainfall shocks would amplify or mitigate the effect of drought in the dry season in $t-1$ by augmenting Equation (1) with the indicators for positive (8th and 9th deciles) or negative shocks (1st and 2nd deciles) of the wet-season rainfall in t and $t-1$. Table D.2 shows that the effect of drought in the dry season in $t-1$ remains robust and that the interaction terms are not statistically significant.

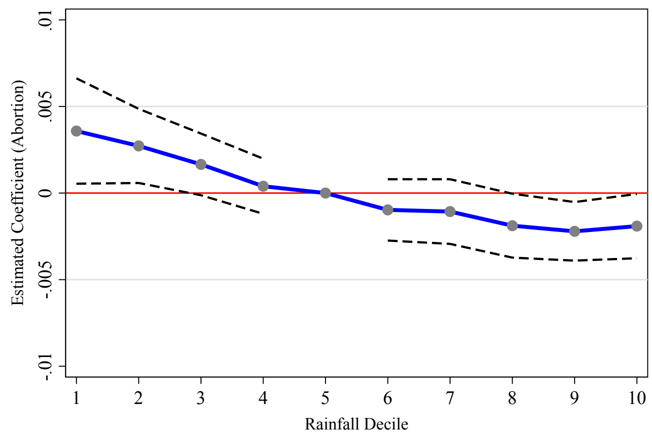
D.3 Measurement Error

I calculate the average effect on yearly births by summing up the four point estimates from the 3rd to the 6th quarters after drought (or, equivalently, from October to September) and compare it to the point estimate for yearly abortion. This exercise checks the measurement error in the reporting of abortion because mothers might be reluctant to provide their true experience of abortion if those abortions were particularly sex-selective. The average effect of drought on the yearly birthrate is -0.0023, which is almost identical to the point estimate on yearly abortion in Table 3, implying that the underreporting of abortion should be less of a concern.

D.4 Spatial and Serial Correlation

I investigate whether the estimates of standard errors are biased due to the spatial correlation of drought indicators. I attempt to correct for the spatial correlation by clustering the standard errors at the province level rather than at the district level. I also show the p-values from clustering on both district and year to further account for serial correlation in rainfall realizations over time within districts. In Table D.3, I still find that the main estimates are statistically significant at the 95 percent significance level, although alternative clustering slightly reduces the significance.

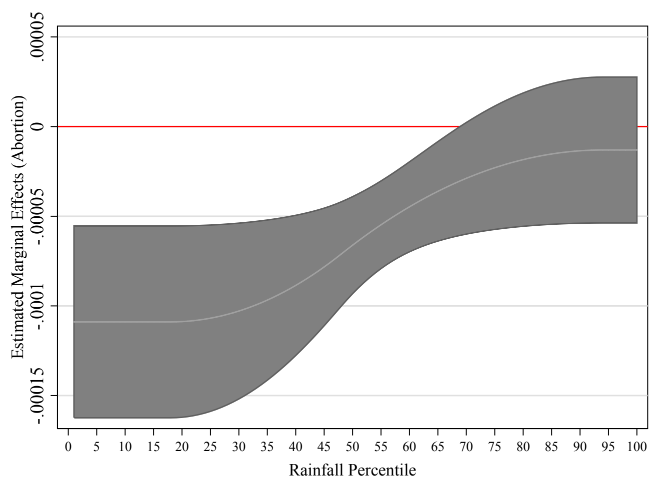
Figure D.1: Effects of Rainfall Decile on Abortion



Mean at the 5th Decile: .0088

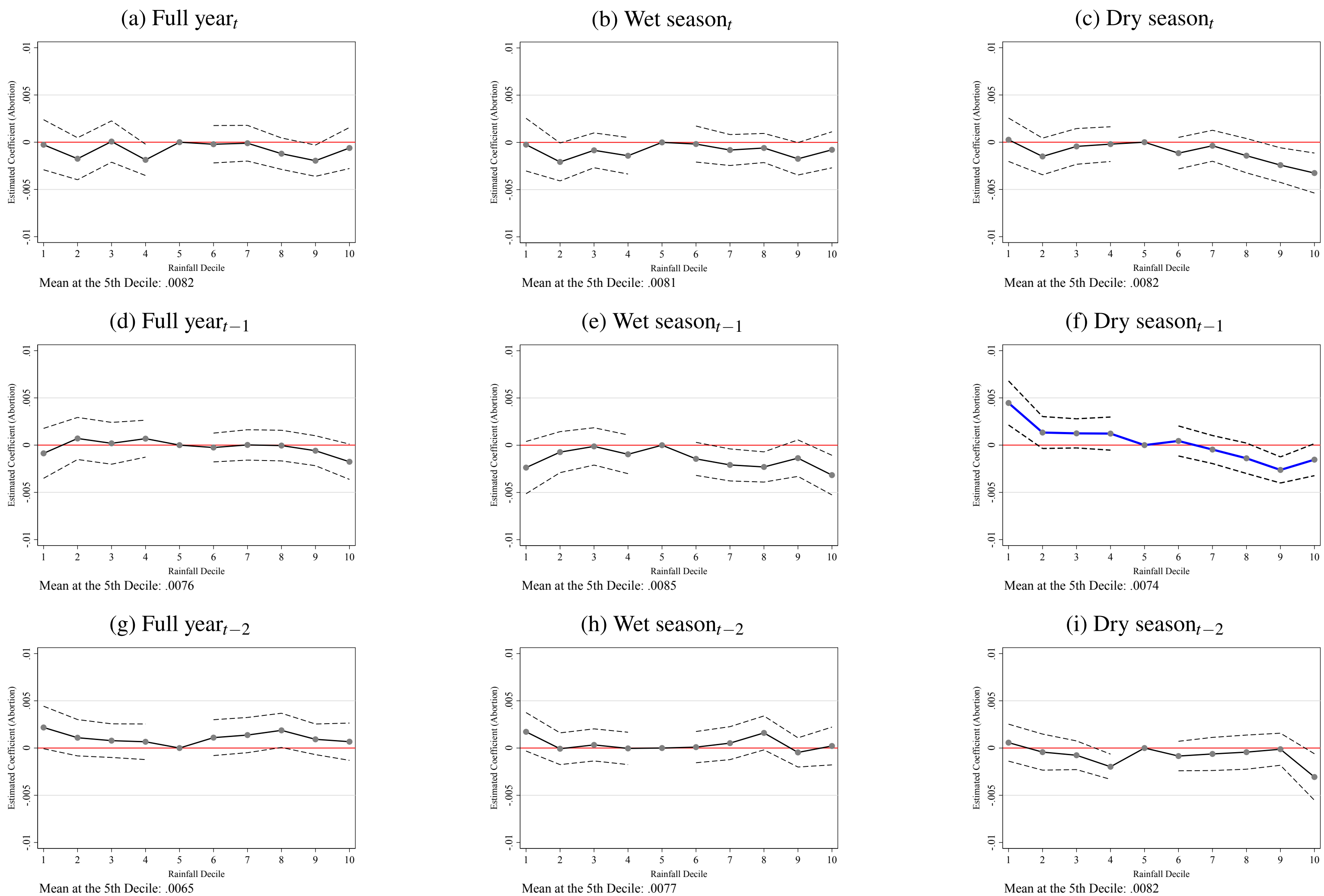
Data: PCS 2004-2008, 2010-2013
Notes: The figure plots coefficients and 95% confidence intervals from a regression of abortion on the dummies for each 10th percentile (decile) of the gamma distribution fitted by the district-specific dry season rainfalls in 1984-2013. The omitted category is the 5th decile.

Figure D.2: Marginal Effects of Rainfall Percentiles on Abortion



Data: PCS 2004-2008, 2010-2013
Notes: The figure plots marginal effects of rainfall percentile on the indicator for abortion along with its 95% confidence intervals. The marginal effects are estimated using a restricted cubic spline with the knots at 18, 48 and 98, which are chosen by Harrell's procedure.

Figure D.3: Effects of Other Season-Year Rainfalls on Abortion



Data: PCS 2004-2008, 2010-2013

Notes: The figures plot coefficients and 95% confidence intervals from regressions of abortion on the dummies for each 10th percentile interval (decile) of the district-specific rainfalls of the full year (Dec-Nov), dry season (Dec-Mar) and wet season (Apr-Nov) from 1984-2013. The omitted category is the 5th decile. Panel (f) plots the coefficients on each dummy (connected with blue solid lines) that is constructed using the dry season rainfall in $t-1$, the drought shocks used in the main analyses.

Table D.1: Effects of Alternative Rainfall Shocks on Yearly Rice Yields and Expenditure

	Dependent variables					
	Spring Rice (1)	All Rice (2)	Total Expenditure (3)	Expenditure on Food (4)	Expenditure on Nonfood (5)	Ratio (Food/Total) (6)
Panel A. Low rainfall shocks in the wet season						
Low rainfall	0.005	0.001	-0.018	-0.018	0.024	-0.000
	(0.007)	(0.006)	(0.016)	(0.015)	(0.021)	(0.003)
Observations	1,045	1,055	18,128	18,128	18,128	18,128
R-squared	0.8010	.900	0.531	0.610	0.530	0.119
Mean of Dep. Var.	3.922	3.788	9.861	9.060	7.505	0.471
Panel B. Low rainfall shocks in the calendar year						
Low rainfall	0.005	0.003	-0.018	-0.013	0.016	0.002
	(0.006)	(0.006)	(0.015)	(0.014)	(0.021)	(0.003)
Observations	1,045	1,055	18,128	18,128	18,128	18,128
R-squared	0.800	0.898	0.530	0.609	0.529	0.119
Mean of Dep. Var.	3.921	3.787	9.874	9.070	7.516	0.469
Controls						
Province and year FE	Yes	Yes	Yes	Yes	Yes	Yes
Rainfall in other season-year	Yes	Yes	Yes	Yes	Yes	Yes
Province-specific linear time trend	Yes	Yes				
Household Characteristics			Yes	Yes	Yes	Yes
Survey Quarter FE			Yes	Yes	Yes	Yes

Data: Agricultural statistics from the Vietnam GSO and the VHLSS 2004, 2006, 2008

Notes: This table presents the results from regressions of the log of annual crop yields (Quintal/Ha) and the log of expenditure (in '000 VND) on low rainfall shocks in the wet season (Panel A) and in the calendar year (Panel B), respectively. Low rainfall shocks refer to the realization of rainfall in the wet season (April-November) or in the calendar year (January-December) below the 20th percentile of historical distribution of district-specific rainfall in 1984-2013. The sample excludes the 10 poorest provinces to be consistent with the analyses using the PCS. Household characteristic controls include sex, age, ethnicity (Kinh or not) and years of schooling of the household head, household size and the dummy for multigenerational households. Robust standard errors, which are reported in parentheses, are clustered at the province level.

Table D.2: Effects of Multiple Rainfall Shocks on Abortion

	Dependent variable: Abortion=1			
	(1)	(2)	(3)	(4)
Drought$_{(t-1)}$	0.0021**	0.0022***	0.0015*	0.0022***
	(0.0009)	(0.0008)	(0.0008)	(0.0008)
Drought$_{(t-1)}$ ×Low rainfall in the wet season $(t-1)$	-0.0001			
	(0.0012)			
Drought$_{(t-1)}$ ×High rainfall in the wet season $(t-1)$		-0.0008		
		(0.0015)		
Drought$_{(t-1)}$ ×Low rainfall in the wet season (t)			0.0031	
			(0.0022)	
Drought$_{(t-1)}$ ×High rainfall in the wet season (t)				-0.0009
				(0.0018)
Mean of Dep. Var.	0.0066	0.0066	0.0066	0.0066
Controls				
District and year FE	Yes	Yes	Yes	Yes
Rainfall in other season-year	Yes	Yes	Yes	Yes
Mother characteristics	Yes	Yes	Yes	Yes
Birth parity FE	Yes	Yes	Yes	Yes
Gender composition FE	Yes	Yes	Yes	Yes
District-specific linear time trend	Yes	Yes	Yes	Yes

Data: PCS 2004-2008, 2010-2013
Notes: This table presents the results from regressions of the indicator for abortion on various interaction terms between drought in the dry season and a high or low level of wet-season rainfall. Levels of 'low' and 'high' level rainfall in the wet season refer to the realization of rainfall in the wet season (April-November) below the 20th percentile or in the 8th or 9th decile of historical distribution of district-season-level rainfall in 1984-2013. Robust standard errors, which are reported in parentheses, are clustered at the district level.

Table D.3: Robustness for Alternative Clustering of Standard Errors

	Dependent variable: Abortion=1							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Drought (coefficient)	0.0020	0.0021	0.0022	0.0020	0.0021	0.0020	0.0021	0.0023
p-value (clustered by district)	0.003	0.001	0.001	0.004	0.004	0.004	0.003	0.024
No. of Clusters (district)	502							
p-value (clustered by province)	0.018	0.007	0.006	0.017	0.017	0.017	0.015	0.056
No. of Clusters (province)	51							
p-value (two-way by district & year)	0.041	0.015	0.014	0.042	0.042	0.042	0.037	0.101
Controls								
District and year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rainfall in other season-year		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mother characteristics			Yes	Yes	Yes	Yes	Yes	Yes
District-specific linear time trend				Yes	Yes	Yes	Yes	Yes
Birth parity FE					Yes	Yes	Yes	Yes
Gender composition FE						Yes	Yes	Yes
Fertility characteristics							Yes	Yes
Spouse characteristics								Yes

Data: PCS 2004-2008, 2010-2013
Notes: This table shows *p*-values from alternative clustering for the regressions reported in Table 3. The first *p*-values in the 2nd row are derived from the standard errors clustered by district. The second series of *p*-values in the 3rd row are derived from the standard errors clustered by province. The last series of *p*-values in the 4th row are derived from the two-way clustering of district and year.

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