Waves of change: radio announcements and fertility decline

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1 Introduction

Can radio campaigns affect fertility preferences? Recent literature has shown that media and information technologies can influence social capital (Olken, 2009), political outcomes (Wang, 2020), inter-group animosity (Adena et al., 2015), and fertility decisions (La Ferrara et al., 2012), by spreading new social norms. I investigate if a national radio campaign in the late 1960s in Colombia affected fertility levels in the country.

In 1969 Profamilia, one of the largest family planning organisations in the world started a national radio campaign to spread the idea of family planning. In this period, the radio was regarded as the method par excellence for reaching the national population. Early evaluations of the radio campaign show that it accelerated information diffusion about fertility control and had an immediate and positive effect on the number of acceptors (Bailey, 1973; Bailey and Cabrera, 1981). However the effect of this campaign on the rapid fertility decline of Colombia has not been measured.

To evaluate the effects of exposure to radio campaigns, this paper exploits exogenous variation in radio signal strength that results from topographic factors. I use the full count census of 1973 and collected data on the location and dates of establishment of Profamilia's clinics. I gathered information on the content, coverage, and timing of Profamilia radio programmes, and using the Irregular Terrain Model I predict radio signal strength in the country in the 1970s. I employ a difference-in-differences strategy to compare fertility rates in municipalities with strong and weak radio signal strength before and after the start of the radio campaign. The results suggest that the effects of the radio campaign were limited.

2 Fertility decline and Profamilia

Like other Latin American countries, in the 1960s Colombia experienced a rapid fertility transition. Despite important regional disparities in development, the fertility decline in the country was widespread and fertility declined rapidly both in rural and urban areas. What explains such a rapid and widespread decline of fertility?

The literature argues that it was tied to the increase in the knowledge, availability and use of contraceptive methods after the mid-1960s when the Colombian Association for Family Welfare (PROFAMILIA) was founded in Bogota in 1965. Although the use of modern contraceptive methods increased, Miller (2010) estimates that, on urban centres, the effect of Profamilia clinics on fertility was small. But the effects of Profamilia clinics on the fertility of women living in areas outside the city, which were on average more rural and where access to contraception was more limited, are largely unknown.

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In 1969 Profamilia started a radio campaign in 14 of the 19 cities in which they had a clinic. The radio campaign announced the availability of family planning services and the main objective was to promote the clinics and increase the number of acceptors. The announcements were broadcast several times a day between 8 am and 6 pm and were between 15 to 30 seconds long.

The following example of the radio announcements is taken from Bailey (1973):

> ***Announcer 1****: Every child needs special attention. Therefore have only the number of children you can take care of.*
> ***Woman 1****: Talk with your husband and go to Profamilia.*
> ***Woman 2****: [Gives the address of a clinic]*

These announcements introduced the concept of family planning and fertility control, raised awareness of the availability and by being so frequently on the radio, legitimated the concept of family planning. If they were successful in spreading new social norms, they could have prompted the fertility decline in rural areas by increasing the awareness about fertility control, even if rural areas were not intended to be treated. However, as the campaigns did not describe any method of contraception, the impact could have been limited by the restricted access to contraceptive methods in rural areas.

3 Data

To measure the effects of the national radio campaign on fertility I collect data on the location and dates of establishment of Profamilia's clinics and radio programmes and calculate radio signal strength in the country during the 1970s to measure exposure to the radio campaign. Using the full count census of 1973 I calculate several measures of fertility.

To address potential concerns of endogeneity on the treatment, I focus on neighbouring municipalities not further away than 70 kilometres from the city with a Profamilia clinic by 1970. I exclude the cities that had the clinic because as discussed above, it is likely that urban centres differ considerably from their rural neighbours. With this sample of municipalities, I compare places that had access to a Profamilia clinic, but that had different strengths in radio due to the orographic characteristics of the terrain.

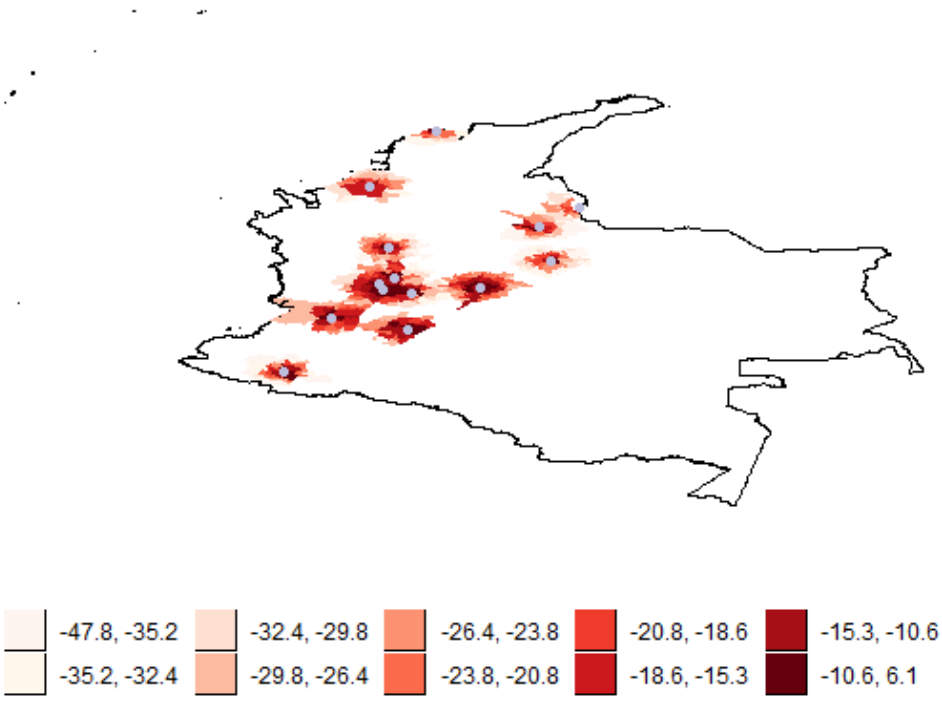
3.1 Exposure to radio campaign

Using data from Miller (2010) I compile the location and dates of establishment of Profamilia clinics from 1965 to 1970. From Bailey (1973); Stycos and Avery (1975) I collected the cities where the radio campaign started in 1969.

Although by the 1960s radio was very popular across the country the information on how many people listened to the radio or to the radio announcements is not available. To overcome this, I exploit continuous variation in signal strength and proxy radio exposure in each municipality by an indicator of its signal quality. Using the first National directory of broadcasting stations of 1976, I collect information on radio stations in all cities that had radio campaigns. As I don't have information on the exact radio stations used by Profamilia I compile data by city on transmitters' location, frequency, and power from one of the more long-established radio stations in the country, *Radio Reloj*, which was present in all cities where the spots were broadcast.

I use the Irregular Terrain Model (ITM) developed by Hufford (2002) to exploit exogenous variation in radio signal strength that results from topographic factors.[1] For each municipality-radio station pair the ITM calculates the predicted signal power a receiver would get including the effects of topography and distance to the transmitter.[2] The predicted signal strength of Profamilia transmitters are shown in Fig. 1.[3]

Figure 1: Location and signal strength of Profamilia transmitters



Notes: Predicted signal strength in each neighbouring municipality that is less than 70 km away from the transmitter of *Radio Reloj* and it is measured in decibel-milliwatts (dBm). The grey dots are the transmitter location. Sources: Authors' calculations based on Miller (2010); Bailey (1973); Stycos and Avery (1975) and the National directory of broadcasting (1976).

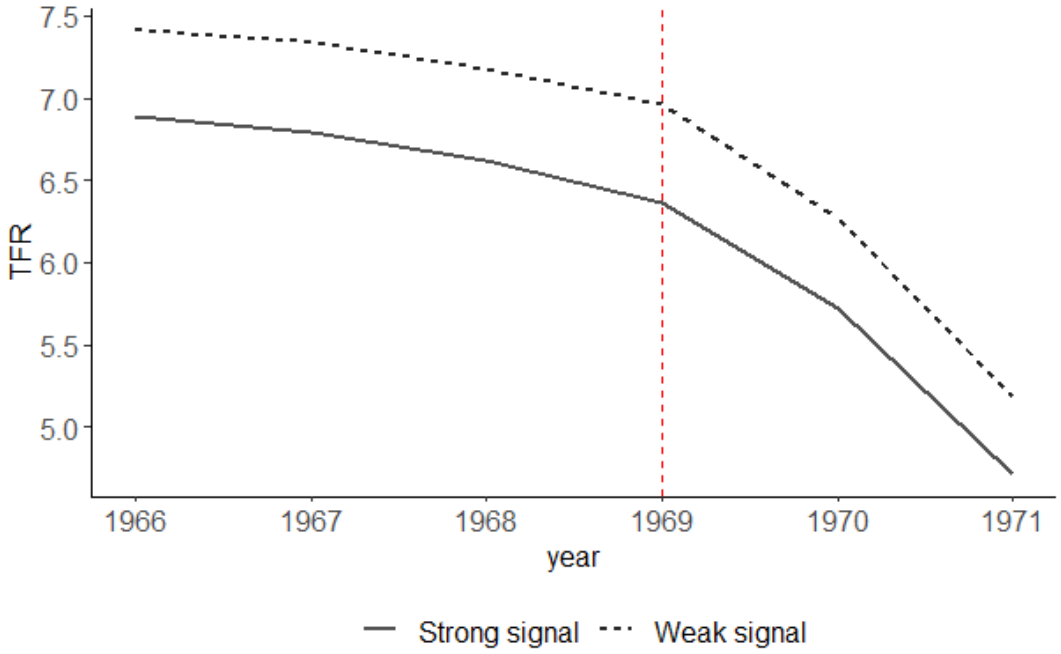
3.2 Fertility measures

I use individual-level data from the full count census of 1973 to observe the short term effects on fertility. The first outcome of interest is the Total Fertility Rate (TFR) which I compute at the municipal level for 1966 to 1971. Additionally, I compute Age-Specific Fertility Rates for the same period and at the municipal level to observe potential heterogeneous effects by age.

Fig. 2 shows the Total Fertility Rate for 1966 to 1971 divided by places with a signal strength above the median signal strength of the sample and places with a signal strength below the median. Municipalities with signal strength above the mean had on average lower fertility in comparison to the municipalities with weaker signal strength. Noticeable, fertility declines faster after 1969 in both groups but the trends seem to suggest that fertility changes faster in places with weak signal strength. Table 3 presents the summary statistics for these municipalities.

[1]I would like to thank the generosity of Benjamin Olken who kindly shared with me the ITM software.
[2]Following Olken (2009); Wang (2020) I use the centroid of each municipality as the receiver location.
[3]Fig. 3 shows the predicted signal strength of Profamilia transmitters to the whole country.

Figure 2: Total Fertility Rate, 1966-1971



Note: Total Fertility Rate (TFR) for municipalities that are less than 70 kms. away from the transmitter. Calculations based on women between 15 and 64 years old and children between 0 and 7 years old. The dotted line shows the TFR for municipalities with a predicted signal strength below the median signal strength of the sample. Sources: Authors' calculations based on 1973 full Census data.

4 Empirical strategy

The baseline of my empirical strategy is to measure the effects of exposure to Profamilia's radio campaign on fertility during the onset of the fertility transition. To identify this effect I employ the difference-in-differences (DD) setup indicated in equation Eq. (1).

$$Y_{m,t} = \alpha_m + \theta_t + \beta \text{strong signal}_m \times post1970_t + \epsilon_{m,t} \tag{1}$$

Where $Y_{m,t}$ is some measure of fertility in municipality m in year t. For example, $Y_{m,t}$ is the Total Fertility Rate or the Age-Specific Fertility Rate for different ages. The main coefficient of interest is the interaction term between the post-treatment indicator ($post1970_t$) and treatment status strong signal$_m$, where treated-status means that the signal strength of the municipality is above the median signal strength in the case of a binary treatment.[4] The estimation includes time and municipality fixed effects. The standard errors are robust, clustered at the municipality level to account for the possibility of serial correlation in the error term.

A recent paper by Callaway et al. (2021) suggests that using a binary treatment when the treatment is continuous can bias the results due to treatment effect heterogeneity and that the bias could be ambiguous. To deal with this issue and following Lindo et al. (2020), I allow the treatment to vary in dosages to see if there were nonlinearities in treatment effects. In this case, the estimation

[4]Although the campaign started in 1969, it is only after around 9 months that we expect to see an effect, given that fertility takes time to respond to this type of policies.

of the effect of signal strength on fertility rate corresponds to the Eq. (2):

$$Y_{m,t} = \alpha_m + \theta_t + \beta \text{signal}_m \times post1970_t + \epsilon_{m,t} \tag{2}$$

Where $Y_{m,t}$ is some measure of fertility in municipality m in year t and $signal_m$ is a set of signal strength ranges. The estimation includes time and municipality fixed effects and the standard errors are robust and clustered at the municipality level.

5 Results

Table 1 reports the result for the estimated effects of radio signal strength on fertility following Eq. (1). Column 1 reports the raw correlation between Total Fertility Rates and getting a stronger signal, which is negative. As Fig. 2 shows, municipalities with stronger signal strength had fewer children over the period. In Column 2 to Column 4, I present only the results from the effect in the municipalities after the campaign started. The results show that there is no effect on the Total Fertility Rate or on age-specific fertility rates.

Table 2 confirms that there is no effect of the radio campaign on fertility rates even when accounting for differences in the intensity of the radio signal. The first column corroborates that there is a negative relationship between the intensity of signal strength and fertility rates, but this relationship is only significant when the signal strength is higher than -20.8 dBm. Once we look at the average post-treatment difference we observe that relative to getting a signal strength below -32.4 dBm, having a stronger signal does not affect the total fertility rate or age-specific fertility rates.

Table 1: Estimated effects of radio signal strength on fertility - binary treatment

	TFR	TFR	ASFR 15-19	ASFR 30-34
Strong signal	-0.53^{***}			
	(0.08)			
Strong signalxPost-1970		0.04	0.01^{**}	0.00
		(0.05)	(0.00)	(0.01)
(Intercept)	6.72^{***}			
	(0.06)			
Municipality fe	N	Y	Y	Y
Year fe	N	Y	Y	Y
Adj. R^2	0.04	0.84	0.17	0.25
Num. obs.	3,078	3,078	13,924	15,170
N Clusters	513	513	513	513

Notes: Estimates are based on a OLS model evaluating expected fertility rates in municipalities living less than 70 kms away from cities that had a Profamilia clinic by 1970. Strong signal_m equals 1 if the signal strength of the municipality is above the median signal strength. Standard errors in parentheses are clustered at the municipality level, and $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$ indicate statistical significance.

Table 2: Estimated effects of radio signal strength on fertility - continuos treatment

	TFR	TFR	ASFR 15-19	ASFR 30-34
$[-32.4, -26.4)$ dBm	-0.03	-0.07	-0.03	-0.02
	(0.14)	(0.08)	(0.01)	(0.02)
$[-26.4, -20.8)$ dBm	-0.11	-0.13	-0.03	-0.03
	(0.13)	(0.07)	(0.01)	(0.02)
$[-20.8, -15.3)$ dBm	-0.34^{**}	0.01	-0.04^{*}	-0.04
	(0.13)	(0.07)	(0.01)	(0.01)
$[-15.3, 6.1)$ dBm	-0.95^{***}	0.01	-0.03	-0.03
	(0.13)	(0.07)	(0.01)	(0.01)
(Intercept)	6.75^{***}			
	(0.10)			
Municipality fe	N	Y	Y	Y
Year fe	N	Y	Y	Y
Adj. R^2	0.06	0.76	0.16	0.24
Num. obs.	3,078	3,078	13,924	15,170
N Clusters	513	513	513	513

Notes: Estimates are based on a OLS model evaluating expected fertility rates in municipalities living less than 70 kms away from cities that had a Profamilia clinic by 1970. The excluded category is signal strength between -47.8 dBm and -32.4 dBm. The coefficients in Column 2-4 are interacted with the $Post-1970$ variable. Standard errors in parentheses are clustered at the municipality level, and $^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$ indicate statistical significance.

6 Conclusions

While radio seems to be successful in influencing social capital, political outcomes and empowering minorities, this paper shows that it had a limited effect on fertility rates.

This paper exploits exogenous variation in radio signal strength that results from topographic factors and uses a difference and difference setup to measure the effect of a radio campaign on fertility rates in municipalities that were not further away than 70 kilometres from a city with a family clinic. The limited effects of the radio campaigns in this population could be due to restricted access to modern contraceptive methods in rural areas. How fertility declined so fast in rural areas in Colombia is still an open question.

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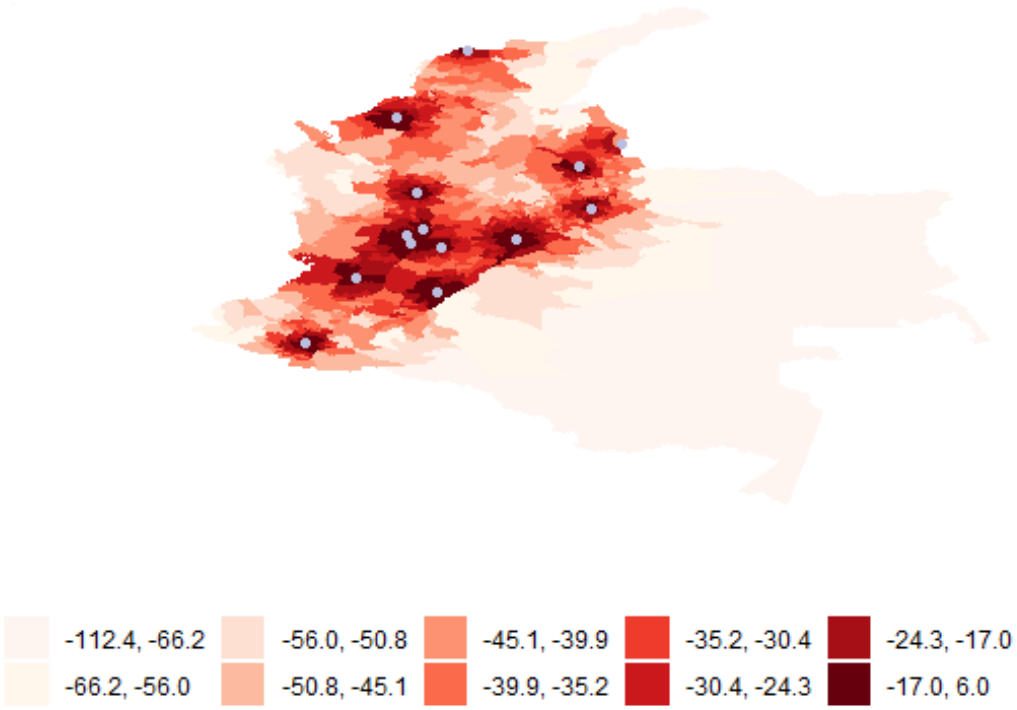
Appendices

Table 3: Summary statistics by signal strength

	Strong signal	**Weak signal**
Total Fertility Rate in 1968	6.64	7.17
	(1.08)	(1.23)
Crude Birth Rate in 1970-1973	568	618
Population in 1973	15,539	11,555
Urbanization rate	38%	31%
Distance to Profamilia city (kms.)	31.12	54.11
Sex ratio	1.04	1.03
Number of municipalities	248	265

Notes: Summary statistics for neighbouring municipalities of cities with a Profamilia clinic by 1970. Strong signal strength means that the municipality received a signal strength that is above the median. Source: Authors' calculations based on 1973 full Census data.

Figure 3: Location and signal strength of Profamilia transmitters



Notes: Predicted signal strength for each municipality for the radio station *Radio Reloj* and it is measured in decibel-milliwatts (dBm). The grey dots are the transmitter location. Sources: Authors' calculations based onMiller (2010); Bailey (1973); Stycos and Avery (1975) and the National directory of broadcasting (1976).