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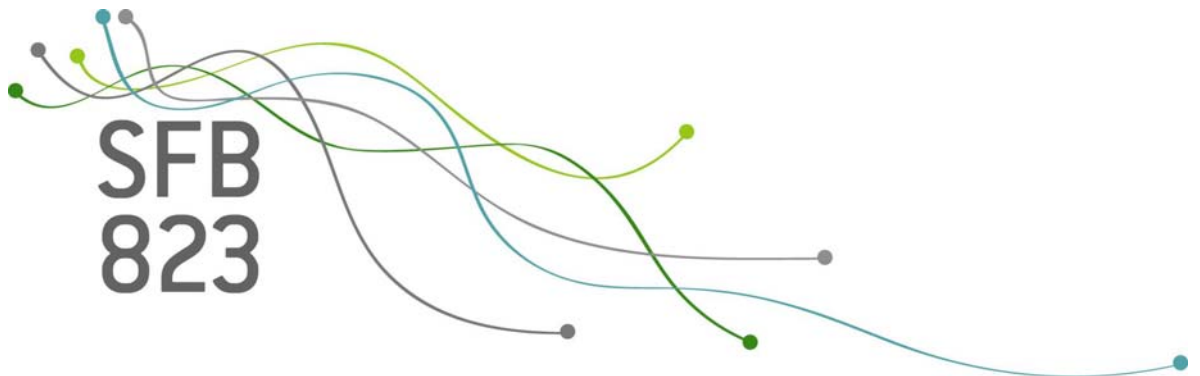
Television and contraceptive use in Indonesia - A weak signal?

Jörg Peters, Christoph Strupat,
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Jörg Peters[1], Christoph Strupat[2], and Colin Vance[3]

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[1]*Jörg Peters, RWI; * [2]*Christoph Strupat, RWI and Ruhr-Graduate School in Economics; * [3]*Colin Vance, RWI and Jacobs University Bremen. – We thank Christoph M. Schmidt and two anonymous referees for helpful comments. - All correspondence to Christoph Strupat, RWI, Hohenzollernstr. 1-3, 45128 Essen, Germany, e-mail: christoph.strupat@rwi-essen.de tel :+49-201-8149-509*

Television and Contraceptive Use – A Weak Signal?

Abstract:

In recent years, rural electrification and access to television have spread throughout the developing world. The values and cultural norms embodied in television programming have potentially profound implications for influencing behaviour, including reproductive decisions. After replicating Westhoff and Koffman's (2011) finding of a positive correlation between television ownership and contraception using pooled Indonesian data, we proceed to estimate a fixed-effects model. The coefficient on television loses its significance while other policy relevant variables retain theirs. We conclude that the growing corpus of cross-sectional evidence on a link between television and contraception should be interpreted cautiously.

1.   Introduction

World population grew by 1 billion in the last 13 years and reached 7 billion in 2011, with particularly strong growth in developing countries (UNITED NATIONS 2011). Because declining birth rates play an important role in facilitating economic welfare,[1] many development interventions target the support of family planning. In addition to improving access to modern contraceptives, these interventions include the expansion of health-care facilities, the establishment of educational programs, and increased access to information on contraceptive options. This last measure, which may be facilitated by television and other technologies, holds particular promise as a cost effective family planning measure owing to the potentially broad reach of modern media across the country-side. Television programming, for example, can provide a window on modern lifestyles and values. The messages conveyed in TV programs may have especially strong resonance in rural areas, where those individuals who would otherwise be interested in controlling fertility are often not aware of the options afforded by modern contraceptives or even of their existence.

As documented in a comprehensive survey by HORNIK AND MCANANY (2008), several empirical studies have emerged that establish a significant correlation between mass media and contraceptive use. Nevertheless, disentangling a causative mechanism out of such correlations is tricky, particularly given that much of the evidence gathered to date is based on cross-sectional data collected at a regional level, making it subject to potential biases from aggregation and omitted variables. Even when individual level data is available, it is difficult to rule out the possibility of biased relationships. The basic problem arises because the incidence of television ownership is unlikely to be randomly distributed across households. To the contrary, it is plausible that many of the same variables that influence television ownership also influence contraceptive use. If these variables are unobserved, then causal effects ascribed to the impact of television on contraception will be spurious.

In this paper, we attempt to deal with this difficulty by drawing on household panel data spanning the decade beginning in 1997 to investigate the effect of television ownership on the use of modern contraceptives in rural Indonesia. The launch of nation-wide private television in 1995 coupled with the increased availability of mod-

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[1] Recent comprehensive surveys suggest that population size plays an important role in facilitating economic growth but is not solely responsible for a country's development process. (DAS GUPTA ET AL. 2011, SINDIG 2009). However, some empirical studies have concluded that higher population growth has a negative effect on GDP per capita in the long run (ACEMOGLU AND JOHNSON 2007, LI AND ZHANG 2007, EASTWOOD AND LIPTON 1999).

ern contraceptives creates temporal variability that makes rural Indonesia an ideal setting for examining the television-contraceptives relationship. Although the data does not allow us to directly observe what TV shows are viewed, our research documents relatively limited educational and public service programming along with a high prevalence of soap operas, which are generally thought to strongly influence values associated with fertility (WESTOFF AND KOFFMAN 2011). Millions of women watch Indonesian soap operas (*sinetrons*) and Brazilian *telenovelas* every day, as soon as their households have access to television (AGB NIELSEN 2007, NILAN 2003, WIDODO 2002).[2] Exposure to these programs sensitize viewers to issues ranging from family size to gender equality and the empowerment of women, introducing values that may be positively associated with modern contraceptives. As a large fraction of rural women in Indonesia still do not use modern contraceptives (MCDONALD ET AL. 2009, MIZE AND ROBEY 2006), an important question is the extent to which television increases acceptance of contraceptives.

The ten-year panel is taken from the Indonesian Family Life Survey (IFLS), which covers 3,844 women in their reproductive age (15-49). Our empirical approach proceeds by first estimating pooled logit and linear probability models of the influence of television on contraception. The econometric specification controls for a large suite of individual- and community level socio-economic variables, including the presence of family planning services in the woman's village of residence. Confirming findings found elsewhere in the literature, the pooled analysis identifies a positive and statistically significant effect of both television ownership and the variables capturing family planning services. To explore the robustness of these effects, we subsequently exploit the panel dimension of the data by estimating a fixed-effects model that controls for time-invariant unobserved characteristics. While this model does not find a statistically significant effect of television ownership, the coefficients of the family planning service variables are remarkably robust, both with respect to their magnitude and statistical precision.

The remainder of this paper is organized as follows. Section 2 summarizes television programming in Indonesia, relating this to findings in the literature on the link between information and contraception. Section 3 describes the data and gives details on our empirical model. Section 4 presents the results before section 5 concludes with a summary of the main findings and a research outlook.

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[2] As on average 84% of TV-owning women that live in rural areas watch TV at least once a day and 92% at least once a week, (DHS surveys 1997-2007), we assume that TV ownership is equivalent to regular TV usage.

2. Background on Television in Indonesia

2.1 Television availability and programming

Over the last two decades, access to television has advanced rapidly in the developing world. Since 1980 the number of television sets in Asia increased over six-fold, from 100 million to 650 million (THOMAS 2003). A precondition for this development was the electrification of formerly non-electrified rural areas, which enabled a growing number of rural households to use television (UNDP 2009). In 1997 around 37% of households with an electricity connection reported having access to a TV, a figure that increased to 60% by 2007 (DHS Surveys 1997-2007). As KENNY (2009) documents, even some of the poorest households in rural Indonesia had acquired television sets. PETERS AND SIEVERT (2014), for example, report a massive increase in TV usage after electrification of remote areas in Sulawesi. Almost uniformly respondents state that TV becomes the main source of information as soon as it becomes available.

On the programming side, the deregulation of the television market in the 1990s allowed private channels to broadcast throughout Indonesia over air and via satellite. As a consequence, 10 additional television channels emerged and every household with a TV-antenna was able to receive at least six of these stations over the air (OLKEN 2009). These channels include one all-news station (Metro TV) and nine commercial stations (RCTI, SCTV, Indosiar, ANTV, GLOBALTV, LATIVI, TV7, TransTV, and TPI) offering a range of entertainment programs such as soap operas, movies, and daily national news shows.

According to the literature, public service messages addressing modern contraceptive use can be highly effective in changing the attitudes of women towards reproductive behavior (MISHRA AND RETHERFORD 1997, WESTOFF AND BANKOLE 1997, WESTOFF AND BANKOLE 1999). In Indonesia, such targeted TV programming has been relatively sparse. Between 2000 and 2004 there were only two short TV spots, one from the Safe Motherhood Program funded by the World Bank and the other from the SAHABT media campaign funded by USAID. On average 25% of women living in rural areas were exposed to these spots over the entire duration of their run (DHS Surveys 1997-2007). The spot of the World Bank, which contained interviews and public service announcements about the advantages and availability of modern contraceptives, was broadcast three times a day by two commercial TV stations and lasted about 20 seconds (LULE et al. 2005). The spot of the SAHABT media campaign ran for two minutes and was broadcast two times a week by private TV stations. This spot promoted the quality interaction between clients and providers of modern con-

traceptives and the involvement of husbands in family planning (Annual report STARH program 2003).

Contrasting with the relatively limited reach of public services messages, Indonesian soap operas (*sinetrons)* and imported Brazilian *telenovelas* have dominated prime day-time and early evening programming. *Sinetrons* and *telenovelas* had the highest audience shares among all broadcasted entertainment programs (AGB NIELSEN 2007), reaching about 66% of TV-viewers nationwide (HABSARI 2008). Soap operas have become especially popular among women, as a large majority of them watch television every day.[3] They often report scheduling all daily household chores, community meetings and social events around the timetables of *sinetrons* and *telenovelas* (WIDODO 2002) and state that these programs became an integral part of their social life and private leisure (HOBART 1999, NILAN 2003). Survey evidence from rural Sulawesi and Sumatra confirms that soap operas are the main type of show viewed by women (BENSCH et al. 2011, PETERS AND SIEVERT 2014).

Over 40 percent of these *sinetrons* were produced in Jakarta, but they often copied the imported *telenovelas* from Latin America. NILAN (2003) shows that several key elements demonstrate the generic similarity of these shows both in storyline and character line-up, including a young and desperate women living in a small family in an urban environment, a wealthy and neglectful husband, another man who threatens the marriage, and children over whom an ownership struggle rages. While *sinetrons* and *telenovelas* in Indonesia do not explicitly address the use of modern contraceptives, they provide information about controversial ideas such as divorce, abortion, and female emancipation. Altogether, *sinetrons* and *telenovelas* in Indonesian TV reinforce the image of a specific type of woman and her family: One who lives in a small, wealthy and urban family and who is able to decide and act independently of her husband and relatives.

2.2 The role of information

Given the popularity of the *sinetrons* and *telenovelas* along with the limited use of public service messages to promote contraception, the question emerges as to the overall effect of television on family planning. By all accounts, Indonesia has already seen an impressive increase in contraception use, rising from 17.2% in 1976 to 52.4% in 2003 (Hull 2007) since the launch of the Indonesian Family Planning Program in 1970. This program was started by the New Order regime of President Suharto in

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[3] On average 84% of women living in rural areas and 88% of women from urban areas watch TV at least once a day, if they own a television set. (DHS surveys 1997-2007).

1970 and was implemented by the National Family Planning Coordinating Board (BKKBN), with branch offices in each of the country's 33 provinces (McDonald et al. 2009). Cornerstones of the program were community health meetings in villages and community family planning facilities run by BKKBN counsellors that distribute contraceptives in the communities. Moreover, the program employed a broad variety of family planning instruments to encourage the use of contraceptives, including the distribution of local field workers, trained midwives, and mobile clinics (Hull and Hull 1997). According to the program strategy ("Panca Karya"), couples with wives 20 to 30 years of age should have no more than two children and couples with wives ages 30 years or over, or who have had two or more children should stop having children (DHS report 1991). In fact, the program seems to have been successful with this strategy (Hull 2007).

Notwithstanding these successes, there is some evidence that contraception uptake rates have been stagnating in recent years. According to surveys conducted by the DHS, 45.5 percent of women did not use any modern contraceptives in 1997, a figure that dropped only marginally to 43 percent by 2007 (DHS Surveys 1997-2007). As suggested by MCDONALD et al. (2009) and MIZE AND ROBEY (2006), one of the main reasons for the low rate of uptake is the lack of information on modern contraceptives, especially in rural areas. While the daily exposure to television, in particular to *sinetrons* and *telenovelas*, portray smaller families and greater female autonomy, the extent to which this type of information changes the reproductive behaviour of rural women in Indonesia remains unclear.

Much of the empirical evidence gathered to date indicates that access to information is crucial for the adoption of new technologies in developing countries. External information about an available new technology like modern contraceptives can initiate a transition from traditional behaviour to the use of the new technologies. Owing to uncertainty about the technology's efficacy and the fear of potential side-effects, many studies explain the transition as a gradual process involving social learning (UDRY AND CONELY 2010, MUNSHI AND MYAUX 2006, BANDIERA AND RASUL 2006) or individual learning (MUNSHI 2004, BESLEY AND CASE 1994) about the advantages and disadvantages of the technology. A second strand of the literature stresses the importance of education in the transition process. More educated individuals are more likely to adopt new technologies, as they have better access to and are more receptive of relevant information (SKINNER AND STAIGER 2005, FOSTER AND ROSENZWEIG 1996).

As a strong correlation between TV exposure and contraceptive use has been established for many developing countries (WESTOFF AND KOFFMAN 2011), access to TV

may be an important source of information for encouraging the use of modern contraceptives, even when the programming content is for entertainment rather than education. In Brazil, for example, CHONG, DURYEA AND LA FERRARA (2012) find that role models of liberated women and family planning in soap operas induce adaption in reproductive behaviour in regions in which the TV channels are expanded. JENSEN AND OSTER (2009) estimate a fixed-effects model, using a TV cable roll-out in rural India as a treatment and find negative impacts on fertility and women's acceptance of domestic violence. However, they make no claim that the change in fertility is the result of a change in contraceptive usage. PETERS AND VANCE (2011) explore the role of electrification on fertility, distinguishing between direct and indirect channels through which access to electricity affects birthrates. The direct channel reduces the frequency of intercourse due to better lighting and alternatives to sex, while the indirect channel operates via the modernization of rural areas that is fostered by exposure to TV and radio programming. Their finding of a negative association between rural electrification and fertility for rural households in Côte d'Ivoire supports evidence gathered in an earlier study by IEG (2008), which also uncovers a negative correlation between electrification and fertility based on a cross-country sample.

3. Data and empirical approach

3.1. Data description

We use panel data from three waves of the Indonesian Family Life Survey (IFLS), which contains socio-economic variables measured at the individual, household and community levels, including information on the use of contraceptives. For the first wave, 7,224 households across 13 Indonesian provinces were interviewed in 1993 (IFLS1). In 1997, the first follow-up, IFLS2, was carried out, which re-interviewed 94.5% of the households from the 1993 survey. The third wave was conducted in 2000 and included the entire sample of IFLS1 respondents. The fourth and last round in 2007, IFLS4, includes 93% of all households that were interviewed for IFLS1.

Since the first wave does not contain information on our treatment variable, TV ownership, we use the last three waves, thereby covering the time from 1997 to 2007. We limit the data set to women of reproductive age, between 15 and 49 years, who live in rural areas. This results in a sample of 3,844 women living in 2,426 households, for a total of 6,961 observations.

Table 1 displays the descriptive statistics of the variables used in the econometric model, distinguished by television use. Two potential indicators for contraceptive use are presented: First, an indicator for whether the woman is currently using modern contraceptives and, second, an indicator for whether the woman has ever used modern contraceptives. Among the women living in households without a TV, 47% currently use contraceptives, compared to 57% of women in TV owning households. The respective share of women who have ever used contraception distinguished by television ownership are 61% and 76%.

Several other differences are notable. Sixty-eight percent of women without television and 58% of women with a television attended primary school. Moreover, per capita expenditures of the household, which serves as proxy for income (Deaton 1997), are nearly 133,000 Rupiah less among households without a television. Other variables such as marital status, age, and the number of family planning counselors do not differ significantly between the two groups.

Table 1: Descriptive statistics

	Total	Use TV	No TV	p-value (Diff. in means)
	mean	mean	mean	
Household- level variables:				
Number of children live in HH	1.84	1.76	2.11	0.00
Primary School Head (Male) (0/1)	0.63	0.61	0.64	0.10
Secondary School Head (Male) (0/1)	0.22	0.29	0.13	0.00
Expenditures per capita (in Rupiah)	293,188	352,055	219,419	0.00
Individual- level variables:				
Current contraceptive use (0/1)	0.52	0.57	0.47	0.00
Ever contraceptive use (0/1)	0.67	0.76	0.61	0.00
Marital status (0/1)	0.91	0.95	0.91	0.12
Age	34.41	35.01	33.66	0.15
Working Status Woman (0/1)	0.58	0.61	0.53	0.00
Primary School (0/1)	0.61	0.58	0.68	0.00
Secondary School (0/1)	0.25	0.33	0.15	0.00
Village- level variables:				
Midwife (0/1)	0.81	0.83	0.78	0.01
Number of Family planning counselors	2.29	2.38	2.19	0.38
Community health meeting (0/1)	0.86	0.90	0.80	0.00
Community woman meeting (0/1)	0.54	0.61	0.46	0.00
Number of observations:	6,961	3,872	3,089	

As we will exploit the time dimension of our dataset in our identification strategy (see next section), we assess the temporal variability in the key variables of interest. Among the women in the sample, 27% start using a television set during the period of observation, either by 2000 or 2007. Forty percent use a TV over the entire observation period, while 33 percent never acquire a TV. Further evidence for the temporal variability in the data is displayed in Figure 1, which shows the share of contraceptive users from the group of women that acquired a TV either in 2000 or 2007. The figure additionally presents the share of contraceptive users from the group of women that never possessed a TV. Two features are evident from this depiction. First, households that acquired a TV either in 2000 or 2007 exhibit a uniformly higher share of contraceptive usage relative to those that never acquired a TV set. Second, while there is also some temporal variation, no discernible pattern is evident with respect to the change in contraceptive usage among both groups.

Figure 1: TV ownership and contraceptive usage
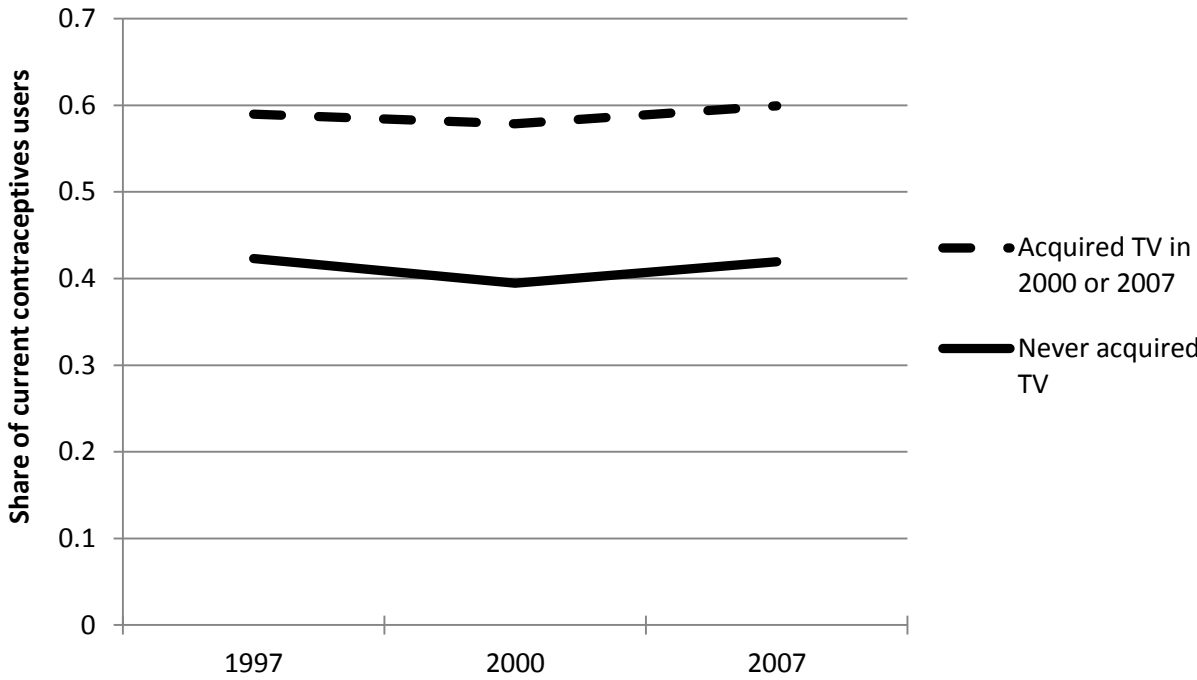
3.3. Identification strategy

The main interest in our impact analysis is to examine whether women on average change their contraceptive use resulting from the ownership of a television. To determine the causal impact requires comparing the contraceptive use of women after having acquired a television to the counterfactual situation of the same women had they not acquired a TV, a clearly impossible task. We instead approximate this counterfactual situation by relying on the inclusion of a control group that fulfils certain requirements to make the underlying identification assumption hold. Specifically, the control group should mimic the behaviour of TV-owning women in the absence of a television. Thus, the principal identification assumption of this cross-sectional comparison is that women with a TV would use contraceptives with the same probability of women without a TV under the hypothetical circumstance that the TV-owners have no TV. This assumption is easily violated. If, for example, households with a higher income own a television and are more able to afford contraceptives than poor households, we may falsely attribute the higher level of contraceptive usage to the ownership of a television rather than to income.

In order to deal with this selection bias in identifying the impact of television on contraceptive use, we begin with the following regression model:

$$C_{it} = \alpha + \delta T_{it} + \boldsymbol{\beta}' \mathbf{x}_{it} + \boldsymbol{\theta}' \mathbf{z}_t + e_{it}. \tag{1}$$

The decision of whether to use contraception is a discrete choice, denoted here by the outcome variable C_{it}, which takes the value 1 if woman i uses modern contraceptives at time t and 0 if she does not.[4] T_{it} is the indicator for television ownership, $\mathbf{x}_{it}$ is a vector of control variables such as per capita expenditures, $\mathbf{z}_t$ is a vector of year dummy variables, and e_{it} a stochastic error term. The coefficients α, δ, β, and θ are a set of parameters and parameter vectors to be estimated, with robust standard errors obtained by clustering on the household. The coefficient of interest is δ, which represents the effect of television ownership on the likelihood of using contraception.

Whether we can interpret this effect as causal depends critically on our ability to control for the range of confounding factors that determine contraception and that are correlated with television ownership. Household income was already mentioned as one such factor, which is proxied in the vector $\mathbf{x}_{it}$ with a control for the per capita

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[4] This definition follows the standard approach in the literature, which focuses on current use of contraception. As a robustness check, we also explored models whose dependent variable is 1 if the woman ever used contraceptives and zero otherwise. This distinction was found to have no bearing on the key results from the analysis. The results are available from the authors upon request.

expenditure of the household. Other controls presented in Table 1 are also included in the vector.

However, we still cannot exclude the possibility that some variables are not observable, in which case the estimate δ will be prone to a selection bias and a causal interpretation unwarranted. Consider the example of women's attitudes towards modernization. Because of individual character traits some women might be more inclined to get a television. At the same time, this generally unobservable characteristic likely affects contraceptive use, as having a small family corresponds more to a modern lifestyle. To overcome this selection problem we exploit the panel dimension of our dataset and augment Equation 1 with a time-invariant and person-specific fixed effect (ϕ_i):

$$C_{it} = \alpha + \delta T_{it} + \boldsymbol{\beta}' \mathbf{x}_{it} + \boldsymbol{\theta}' \mathbf{z}_t + \phi_i + e_{it} \ . \tag{2}$$

The term ϕ_i considers individual-specific characteristics such as personal attitudes that affect the outcome variable but do not change over time. As this term will induce the above mentioned selection bias, we have to eliminate it from our model by transforming our data as follows. First, we calculate individual averages for every woman:

$$\bar{C}_{it} = \delta \bar{T}_i + \boldsymbol{\beta}' \bar{\mathbf{x}}_i + \bar{z} + \phi_i + \bar{e}_i \ . \tag{3}$$

Second, we subtract these averages from Equation 2, which gives:

$$C_{it} - \bar{C}_{it} = \delta'(T_{it} - \bar{T}_i) + \boldsymbol{\beta}'(\mathbf{x}_{it} - \bar{\mathbf{x}}_i) + \boldsymbol{\theta}'(\mathbf{z}_t - \bar{z}) + \left(\phi_i - \phi_i\right) + (e_{it} - \bar{e}_i) \ . \tag{4}$$

In doing so, we eliminate the time-invariant and person-specific fixed effect from our model by calculating deviations from means. The related identification assumption is that in estimating δ, no time-varying unobservable factors are correlated with changes in television ownership. This common-time-trend assumption will be violated if, for example, unobservable changes in social norms might affect only women that have not acquired a TV set.

A final methodological consideration concerns the binary nature of our outcome variable. This would conventionally suggest estimation of the coefficients using a probit or logit model, an approach followed here as a point of departure when we pool the data. Binary choice models, however, can be problematic when applied using the fixed-effects transformation because they often suffer from a substantial loss of observations. In particular, observations for which the dependent variable remains the same over two consecutive time periods are excluded from the estimation. To avoid

this loss of information, we instead apply the fixed-effects transformation to our data by using the linear probability model (LPM). While the LPM generates consistent and unbiased estimates, the drawback of the model is that it treats the dependent variable as continuous, with the consequence that the predicted values from the model may fall outside the 0-1 range. It is thus prudent to assess the extent to which this problem afflicts the estimates, an issue taken up below.

4.   Results and Treatment heterogeneity

4.1 Results

Table 2 presents estimation results from three models. The first two columns contain the coefficient estimates and associated marginal effects from a pooled logit model, the third column contains the coefficients from a pooled linear probability model (LPM), while the last column contains the coefficients of the linear probability model including fixed-effects (LPM-FE). Turning first to the two pooled models, we begin by noting that the marginal effects of the logit and the coefficients of the LPM are virtually the same, providing some assurance that the distinction between a linear and non-linear modelling approach has little bearing on the interpretation. Further assurance is provided by the fact that the differences in the predicted probabilities between the two models are negligible, with those of the LPM falling consistently within the 0-1 range.

Both the logit and LPM suggest a statistically significant and positive effect of the television dummy. Specifically, the logit model indicates that the presence of a television in the household is associated with a nearly 0.07 higher probability of using contraception.[5] The corresponding odds ratio, calculated as e^{β}, is 1.36, suggesting that women with a television have a 36% higher odds of using contraception than women without a television. This estimate is similar in magnitude to the 1.49 odds ratio obtained by WESTOFF, KOFFMAN, AND MOREAU (2011), who use cross-sectional household data drawn from Indonesia in 2007 among women who report watching TV daily. If we remove the controls for community meetings, midwives and the number of family planning counselors, which were not considered in the work of Westoff and colleagues, we obtain an even closer odds ratio of 1.45 (not presented).

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[5] The marginal effect of dummy variables is calculated by subtracting the value of the logit function when the dummy is set to one from the value when it is set to zero:

$$\frac{\Delta Y}{\Delta X_k} = \frac{\exp(\beta' x)}{1 + \exp(\beta' x)}\big|_{x_k=1} - \frac{\exp(\beta' x)}{1 + \exp(\beta' x)}\big|_{x_k=0}.$$

Several other variables are also statistically significant, all of which have signs that are consistent with intuition. Higher numbers of children in the household, which would increase the likelihood that the target household size is reached, increases the likelihood of using contraception. Being married also increases the probability of using birth control by 0.19 probability points. One explanation for this result is that marital status serves as proxy for frequency of intercourse, because premarital sexual activities are less likely in rural Indonesia (HULL AND MOSLEY 2008). Education is another positive correlate of using modern contraceptives; women who attended a primary school have a 0.08 higher probability of using modern contraceptives than women who never attended a school. Age has a non-linear effect, increasing the likelihood of using contraception at a decreasing rate. Specifically, the likelihood to use contraceptives rises until age 35 and falls thereafter, a finding consistent with the expectation that younger women are more likely to become pregnant due to higher sexual activity and hence more likely to use contraceptives to space or avoid births. Another explanation is the declining fecundity with age that makes the use of contraceptives less important for older women.

Finally, the community-level variables, which measure the impact of health and social-support organizations in the community of residence, all have positive impacts on contraception. For example, the presence of a midwife in the community increases the probability of contraception by 0.02, while the effect of each additional family planning counsellor is to increase the probability by 0.004.

The final column presents estimates of the LPM with fixed-effects to control for unobserved heterogeneity. While many of the explanatory variables, including the midwife dummy and the control for the number of family planning counsellors, retain their statistical significance, the most notable discrepancy is the drop in magnitude of the coefficient on television. Based on this estimate and its standard error, we can no longer reject the null hypothesis that the effect of television on the probability of contraceptive use is significantly different from zero. We thus conclude that notwithstanding the statistically significant correlation between television and contraception in the pooled models, the reduced magnitude and insignificance of the television dummy in the fixed-effects model suggests that a causal interpretation is not warranted. In other words, the significant effects obtained in the pooled model seem to be driven by unobservable household characteristics correlated with television use.

Table 2: Regression of modern contraceptive use

	Logit		LPM	LPM-FE
	Coefficient	Marg. effect	Coefficient	Coefficient
Household- level variables				
Television	0.309	0.071	0.071	0.010
	(0.000)	(0.000)	(0.000)	(0.660)
Number of children live in HH	0.108	0.025	0.025	0.049
	(0.000)	(0.000)	(0.000)	(0.000)
Primary School HH- Head	0.165	0.037	0.035	-0.065
	(0.071)	(0.071)	(0.094)	(0.192)
Secondary School HH- Head	0.267	0.061	0.059	-0.018
	(0.015)	(0.015)	(0.019)	(0.802)
Log per capita expenditure (Rupiah)	-0.004	-0.001	-0.001	-0.020
	(0.924)	(0.939)	(0.941)	(0.165)
Individual- level variables				
Primary School	0.375	0.085	0.083	0.052
	(0.000)	(0.000)	(0.000)	(0.450)
Secondary School	0.181	0.041	0.039	0.134
	(0.000)	(0.145)	(0.160)	(0.149)
Age	0.248	0.057	0.057	0.077
	(0.000)	(0.000)	(0.000)	(0.000)
Age2	-0.004	-0.001	-0.0012	-0.001
	(0.000)	(0.000)	(0.000)	(0.000)
Married	0.857	0.194	0.181	0.118
	(0.000)	(0.000)	(0.000)	(0.041)
Working status	0.074	0.017	0.017	0.011
	(0.000)	(0.202)	(0.208)	(0.520)
Community- level variables				
Community health meeting	0.356	0.082	0.079	0.020
	(0.000)	(0.000)	(0.000)	(0.359)
Community women meeting	0.208	0.048	0.048	0.013
	(0.000)	(0.000)	(0.000)	(0.441)
Midwife	0.119	0.028	0.027	0.037
	(0.091)	(0.088)	(0.091)	(0.090)
Number of family planning counselors	0.019	0.004	0.004	0.004
	(0.008)	(0.000)	(0.006)	(0.015)
Number of observations	6,961		6,961	6,961
adj. R-sq			0.080	0.061

p-values are in parentheses.

4.2 Treatment Heterogeneity

Women's choice of contraceptive use is widely acknowledged to be determined by socioeconomic status, attitudes, and cultural background. In order to examine whether these factors mediate the impact of television on contraception, we explore models with interaction effects between the television dummy and variables that capture the women's socio-economic situation. We use woman's age, number of living children and marital status in order to approximate changes in fecundity and her cultural background. Furthermore, we calculate interaction terms between the television dummy and a dummy that indicates if health care practitioners or family planning counsellors that distribute contraceptives are present in the community. It is conceivable, for example, that television programming encourages women to raise reproductive issues with such individuals, which would strengthen the impact of these influences. However, none of the interaction terms were found to be statistically significant (results are available upon request), which supports the conclusions that the impact of television is not mediated by demand and supply factors that influence women's choice of contraceptive use.

5. Conclusion

This paper investigates the effect of television ownership on the usage of modern contraceptives in rural Indonesia. A large fraction of women, roughly 44%, still do not use modern contraceptives, which has been argued to be due to a lack of information and/or social norms on fertility regulation that discourage acceptance of modern contraceptives. In addition to midwives and family planning counsellors, found here to be statistically significant correlates in all of the estimated models, rural electrification and the subsequent spread of television in Indonesia may serve to close this information gap and help to overcome social norms on fertility regulation. According to qualitative studies and national audience figures, soap operas (*sinetrons*) and Brazilian *telenovelas* enjoy high viewership, especially among women. While *sinetrons* and *telenovelas* in Indonesia do not explicitly address the use of contraceptives, they still provide information about controversial family issues that are associated with family planning. The literature on the adoption of new technologies indicates that these new information technologies can change the attitudes towards reproductive behaviour, and therefore might increase the use of modern contraceptives.

Nevertheless, our findings suggest that the strong association between television and contraceptive use established by the empirical literature may, in the Indonesian context, be just that, an association – and not a causal influence. Based on the model estimations with pooled data, our results are in line (even in terms of magnitude) with the findings of the related literature, showing a statistically significant correlation between television and modern contraceptive use: Women with a television in the household have a 0.07 higher probability of contraceptive use. Controlling for unobserved heterogeneity with a fixed-effects model, however, substantially reduces the estimated coefficient and renders it statistically insignificant. The discrepancy across the pooled and panel estimates thus substantiates the concerns raised by some authors (e.g. Hornik and McAnany 2008; Westoff and Koffman 2011) concerning the difficulties in disentangling cause and effect of media impacts. In fact, our results suggest that the effect of television on contraceptive usage found in the literature and in our pooled model is driven by other household features that are correlated with television ownership. One might for example think of a woman's modernity or certain openness towards new technologies in a broader sense that strongly determine her propensity to use contraceptives. At the same time, these women are more inclined to obtain a television or are more likely to live in households that do so. Given the unobservability of this feature and its effect on television ownership, cross-sectional models may wrongly attribute higher contraceptive usage rates observed among more modern women to television ownership.

It might nevertheless be premature to conclude that there is no role of television in disseminating contraceptives. The indicator we are using – television ownership – might be too blunt to register an effect. In this regard, the use of a television ownership dummy does not allow us to measure either the intensity of television viewing or its content. Thus, it may be that better measurement of these features would enable more precise estimates.[6] Another explanation may relate to the content of Indone-

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[6] The intensity of television viewing might also bias the fixed-effects estimate of the television dummy in our analysis. For instance, changes in the frequency of exposure to a television might be highly correlated with changes in TV ownership and modern contraceptive usage, thus, inducing an omitted variable bias. In order to assess whether our coefficient of interest is possibly biased, we use exposure data for the same sample of women from DHS surveys that cover the time period of our analysis (1997 – 2007). We found that temporal variation of exposure to television seems to be very small and conclude that the applied fixed-effect transformation to the IFLS data captures the time-invariant effect of exposure to television. Thus, we expect that our estimates are not prone to omitted variable bias from this source.

sian television programming, including the lack of public service messages. As *sinetrons* and *telenovelas* do not explicitly address the use of modern contraceptives, their content – and the content of other programming – may not be sufficiently persuasive to overcome prevailing norms related to reproductive behaviour. A promising avenue for future research would therefore to elicit more detailed data on which type of broadcasts is watched and by whom. Future research using cross-national data could also probe more deeply into the role of cultural background and how this mediates the impact of information. Nonetheless, the policy implication of our analysis is that more direct campaigns focussing on contraceptives' availability and awareness are more effective than counting on indirect modernization approaches.

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