

Mass Media and Public Services

The Effects of Radio Access on Public Education in Benin

Philip Keefer
Stuti Khemani

The World Bank
Development Research Group
Human Development and Public Services Team
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Abstract

Does radio access improve public service provision? And if so, does it do so by increasing government accountability to citizens, or by persuading households to take advantage of publicly-provided services? Prior research has argued that citizens with greater access to mass media receive greater benefits from targeted government welfare programs, but has not addressed these questions for public services such as in education and health. Using unique data from Benin, this paper finds that literacy rates among school children are higher in villages exposed to signals from a larger number of community radio stations. The effect is identified based

on a “natural experiment” in the northern communes of Benin where within-commune variation in village access to radio stations is exogenous to observed and unobserved village characteristics. In contrast to prior research, the authors find that this media effect does not operate through government accountability: government inputs into village schools and household knowledge of government education policies are no different in villages with greater access to community radio. Instead, households with greater access are more likely to make financial investments in the education of their children.

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Philip Keefer
The World Bank

Stuti Khemani
The World Bank

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1. Introduction

Strong evidence links mass media access to greater private benefits from government welfare programs, such as natural disaster relief in India (Besley and Burgess 2002), and welfare payments during the US Great Depression (Strömberg 2004). Research on mass media and public spending is less advanced on two questions. Does media influence extend to outcomes in broad public services, such as the quality of public education, or are its effects limited to government transfers?¹ If media have effects on public service outcomes, do they arise because media facilitate collective action by households to make governments more responsive, or because they influence private household behavior, such as their take-up of government programs? In education, in particular, parental behavior matters for children's participation in schools (De Fraja et al, 2010). Does media programming influence parental effort and investments in children's education? Specific characteristics of the media and education market in Benin allow us to address these questions, some for the first time in the literature.² In particular, we find that greater access to community radio is associated with better learning outcomes in village public schools. Probing the channels for such

¹ A substantial literature examines the effects of media on corruption (Ferraz and Finan, 2008; Besley and Prat, 2006; Brunetti and Weder, 2003; Adsera et al, 2003). Although effects on corruption may impact the quality of public services, this research does not specifically examine this. We review below work in Uganda that examines the effect of concerted information campaigns, as opposed to generalized media access, on corruption in the flow of public funds to schools and on school performance (Reinikka and Svensson, 2005).

² No prior research, to the best of our knowledge, has empirically examined the influence of media on parental investments in children's education.

association, we find significant evidence of media effects on parental investment in their children's education, and no evidence of greater government responsiveness.

The analysis rests on data from a March 2009 survey in Benin of more than 4,000 households and 210 villages, spread across 32 of the 77 communes in Benin, all located in the northern part of the country. In addition, a literacy test was given to 2,100 children in second grade (on average, eight to nine years old) in village schools. The data collection effort yielded unique information on learning among children, school inputs and PTA activities in village public schools, and on household education investments.

Appropriately for the questions we examine here, these villages exhibit substantial variation in access to a type of media that emphasizes public interest programming, community radio. Differences in village access to community radio are important because villages are the relevant jurisdictions within which households are likely to engage in the local action required to improve village public schools (for example, through Parent Teacher Associations). Twenty-one community (private, non-commercial) radio stations serve the communes in the sample. They receive support from donors and government precisely to broadcast public interest or educational programming and to promote local collective action in poor rural areas.

Variation in radio access is exogenous, driven by the nature of media markets in northern Benin. Community broadcasters have limited signal strength, so small geographical differences between villages are sufficient to yield large differences in access. Moreover, while these stations were established to cater primarily to the commune in which they are based, their signals spill over to villages in adjoining communes, leading to substantial variation in access to neighboring commune-based radio across villages within the same commune. Finally, villages within each commune were selected in order to be equidistant from radio broadcast towers so that exogenous

geographic characteristics, rather than the endogenous location of within-commune broadcasters, determine intra-commune variation in village access to within-commune radio stations.

Basic education services in northern Benin are also particularly appropriate to distinguish the accountability effects of media influence, since they are almost exclusively provided by the government. Only 15 villages out of our sample of 210 report having a functional private school; only 1 percent of households report sending their children to a private school. The national government's budgetary support is critical to fitting these village public schools with the inputs needed to deliver quality education. The schools are also required to have Parent Teacher Associations (PTAs) to facilitate local agency in improving the quality of education provided. All of the schools in our sample report having a PTA. In principle, therefore, communities have vehicles through which they can hold government accountable for its funding and management of public schools.

In the years immediately prior to our survey in March 2009, there were large changes in government education policy with increases in public spending on education—specifically, abolishing (previously required) tuition payments, and recruiting more teachers (World Bank, 2009). In this setting, the effects of radio access on collective action to demand more or better public services from government should be evident in more inputs and better quality in schools located in villages with greater radio access. Education also provides a better opportunity than many other government services to identify the private behavioral channels through which media access might affect public good performance. Information conveyed by media can influence the extent to which households take advantage of public schools. In contrast, household private behavior has little effect on many other measures of public service performance, such as whether a village has a paved road.

Based on within-commune variation, the analysis here identifies, for the first time, significant effects of media access on outcomes from the government provision of social services: villages with greater access to community radio exhibit greater functional literacy among children in public schools. We are also able to go further than has been possible in past research and probe the mechanisms through which greater radio access affects outcomes. First, we find no evidence that the mechanism is through government accountability: schools in villages with greater access to community radio exhibit no differences with respect to either these inputs (such as books and teachers) or the efficiency with which inputs are utilized (such as lower teacher absenteeism). Accountability effects should also manifest themselves in the collective action of villagers. However, villages' community radio access is uncorrelated with reports of PTA activity. Furthermore, household knowledge of recent changes in government education policies is no different in villages with greater radio access.

Instead, second, the evidence supports the proposition that media effects on public services operate through changes in parental behavior. The data allow us to address three questions related to parental behavior, none of which previous literature has been able to address, even at the level of correlations. First, does radio access correspond to exposure to more relevant information? The survey of radio programming indicates that community radios broadcast significantly more education programs than other commercial and national public stations. We confirm that villages with greater access to community radio are exposed to substantially larger numbers of programs on education issues. Second, does village access to community radio increase parents' own investments in children's education? It does: households living in villages with greater radio access purchase more books for their children. Third, does listening to community radio by households with greater access to community radio increase these investments? Again, it does: instrumenting for household

listenership of community radio with village access to radio, we find that listening leads households to purchase more books and to pay tuition for children's education.

The analysis here therefore contributes to earlier research in three ways. It documents for the first time, using a unique identification strategy, a causal relationship between access to media and public service outcomes. It presents direct evidence on the accountability channel, rejecting the proposition that media effects on public services, in this case, operate through greater government responsiveness. And, going beyond previous research, it identifies effects of listening to radio programming on parental investments in education.

While we can confirm that these household-level effects are driven by general exposure to greater programming on education issues, we do not have detailed information on programming to probe more specific channels of impact (e.g., whether it operates by convincing parents that education quality is better than they thought it was; by conveying new information about labor market benefits; or simply, by persuading them of the intrinsic value of having better educated children). Donors are significant supporters of education programming; correspondence with donor officials indicates that the sponsored programs contain a mix of all of these. Investigating the effects of specific programming content on household behavior would require an experimental methodology that exposes randomly-selected households to different specific programs, while the research strategy here takes advantage of an existing natural experiment to evaluate the effects of media exposure on its own.

Donor-supported programming is also supposed to provide greater information on changes in government policies and the importance of local action to improve services. Why then, do we find no effects on local accountability? The answer lies in the role of political constraints other than citizens' imperfect information about policies and their effect on "issue framing" in directing the impact of media access on outcomes (Pratt and Strömberg, 2011). Because of these other political

constraints, information on policies is, by itself, unlikely to enable citizens to mobilize for local accountability. Under these circumstances, community radio programming is more likely to frame issues in terms of parental responsibilities towards their children's education rather than in terms of government responsibility.

The next section reviews the literature on the role of media and information in government accountability, public service delivery, and household behavior. Section 3 summarizes how other political constraints in Benin, other than citizens imperfect information, would affect how media frames issues to emphasize parental rather than government responsibility and why media access would therefore be less likely to influence government responsiveness. Section 4 describes the media market in Benin. Section 5 explains the identification strategy. The remaining sections present the empirical results, beginning with the reduced form finding that greater access leads to higher literacy rates, followed by evidence that radio does not encourage collective action to increase government-provided inputs into local schools, but does shift household behavior towards greater private investment in children's education.

2. Literature Review

Prior research has investigated the influence on public service provision of targeted and randomized information campaigns, with some researchers also asking whether that influence is contingent on (endogenous) access to media. A seminal paper, central to the *World Development Report 2004*, finds that a concerted information campaign in Uganda on leakage in the distribution of school grants by district officials led to a dramatic increase in the percent of capitation grants received by schools, to more than 80 percent of entitlement from a pre-campaign low of about 20 percent (Reinikka and Svensson, 2004, 2005). Björkman (2006) examines the effects of the campaign on education quality. Scores on the Primary Leaving Exam were higher after the campaign in districts with greater newspaper penetration: such districts were more exposed to the

information delivered by the information campaigns. The analysis here advances this body of research by examining both the effects of exogenous media access by itself, independent of concerted campaigns, and the mechanisms through which media effects might be transmitted.

Other research on the role of information from sources other than media has focused on intensive grassroots information campaigns, showing mixed effects. In Banerjee et al. (2010), these campaigns alone had no impact on learning in public schools in India, though when combined with efforts to organize volunteers to hold remedial classes outside the public school system, gains in literacy were large. Looking at similar information-only campaigns, Pandey et al. (2009) find reductions in teacher absenteeism, but little impact on learning outcomes. In research by Andrabi et al. (2008), looking at Pakistan, by far the largest effects of increasing information were on the behavior of *private* schools, which faced the risk of parents switching to better-performing schools. In contrast, in Uganda an intensive campaign to mobilize communities to improve public health services, in which project representatives not only provided information, but also actively promoted the organization of villagers, led to large improvements in services provided and in health outcomes (Björkman and Svensson, 2009). The analysis here focuses instead on media access in the absence of concerted and intensive information or mobilization interventions and examines household responses to radio access.

A separate stream of the literature examines redistributive policies: citizens with more media access are more likely to be recipients of targeted benefits from government programs (Besley and Burgess 2002, Strömberg 2004). Scholars offer an accountability explanation for this result: citizens with greater access to media are better able to punish governments for failure to deliver benefits. However, data limitations, particularly the absence of evidence from household surveys, have made it difficult to distinguish this mechanism from others, such as the behavioral channels that we identify in this analysis.

Prat and Strömberg (2005) use household surveys in Sweden undertaken during a period in which commercial television broadcasts reached progressively more areas of the country. New recipients of the broadcasts not only participated more in elections but also had more political and policy knowledge. Data limitations do not allow them to assess effects on public policies, however.³ Snyder and Strömberg (forthcoming) shed light on effects on both knowledge and government effort by exploiting the incomplete correspondence between electoral districts and newspaper markets in the United States. Where the correspondence is low, the incentives of newspapers to report on legislator actions are attenuated, voters know less about their legislators and the legislators appear to work less diligently on behalf of their districts. Districts with low correspondence receive less federal funding, on average. The analysis here contributes to this work by looking at outcomes of public services rather than the distribution of welfare benefits and program funding; at media content; and at both behavioral and accountability channels of media effects.

Keefer and Khemani (2011) examine the effects of community radio access in northern Benin on the household acquisition of government bed nets and find that media access increases the number of bed nets that households report having purchased (as opposed to received for free), just as it increases household investments in education. Two significant differences distinguish that work from this analysis. First, while bed net distribution is a social service, it is more closely related to the monetary transfers that have been previously analyzed in the literature, with a significantly less complex production function than the provision of student learning. Second, the bed net analysis focuses on the effect of media access on the pricing strategies of government officials: while

³ There is a large literature, not directly relevant for our work in Benin, on the influence of political news and campaign advertisements in the US on political behavior—on voting and party affiliation in particular. Della Vigna and Gentzkow (2009) provide a recent review.

previous work on bed net utilization focuses on price and information effects separately, Keefer and Khemani (2011) find that where information increases the demand for bed nets, local officials responsible for distribution are more likely to charge for the nets than to give them away for free.

A large communications literature shows that focused media programming can influence household behavior in public health and family planning, and in women's empowerment, though these studies do not control for the endogeneity of radio access (Arnold and Lambino 2009 provide a review). Other work addresses this endogeneity, but does not examine effects on government programs, as in the analysis here. For example, Chong and La Ferrara (2009) find that expanding access to the broadcasts of soap operas in Brazil led to increased rates of divorce and separation; La Ferrara, et al. (2008) report that it reduced fertility. The potential adverse influence of radio access on household behavior, with tragic consequences, was recently quantified in Yanagizawa's (2009) work on the impact of "hate radio" in the Rwandan genocide.

An aspect of both behavior and accountability is the participation of citizens in collective organizations. Olken (2009) argues that the spread of television in Indonesia may have crowded out participation in groups: greater television viewing leading to lower engagement in social associations and reduced perceptions of trust. However, he finds no effect of television access on local village governance and policies: the number of meetings and corruption in village road projects are unaffected by television viewing. Our analysis is the first that looks both at behavioral effects on access to public services and on participation in collective action. Like much research in this area, Strömberg (2004), Olken (2009), and Yanagizawa (2009) use geologic features that obstruct radio broadcasts as instruments for radio access, arguing that these features (such as remoteness or the suitability of land for economic activity) do not have independent effects on the outcomes of interest. We use a different strategy, exploiting the large number of very local radio stations in north

Benin to argue that variation in radio access across villages within the same commune is accidental, and exogenous to village characteristics.

The analysis here also contributes to better understanding of community radios. These have been a particular focus of donors, but with little evidence on their efficacy. Proponents have argued that community radio is specifically designed to impact local collective action. Community radios are, by definition, licensed as non-commercial radio organized to serve the public interest of the communities in which they are based (Fraser and Restrepo-Estrada, 2002; Buckley, et al. 2008). Furthermore, in the Africa region in particular, community radio networks are used by governments and international donors to convey general public-interest information on the value of health and education to remote, rural and poor areas, such as northern Benin (Buckley et al, 2008). However, the effects of community radio have not been rigorously tested. The estimations below provide such a test and identify positive effects on education.

3. When and how does media access matter? Theory and predictions

Though much of the research reviewed above points to the accountability effects of information and media, there are at least three reasons why media effects on government accountability might be weaker for public goods than for targeted transfers. First, public good failure is less newsworthy than disaster. Reports of natural or economic disasters are more intrinsically interesting to readers and sell more newspapers than do articles on the chronic failures in public good provision, such as dilapidated school buildings and absent teachers (Drèze and Sen, 1990; Eiseensee and Strömberg, 2007; Khemani, 2007). To the extent that public good failure is not reported in the media, media access should have less effect on the provision of public goods. Our analysis is not affected by this caveat because we have, unlike earlier research, direct evidence that a significant share of the programming of the media examined here is dedicated to health and education programming (though we cannot distinguish the share of that programming dedicated to

informing households about the importance of investing in education and the share that informs households about the political and bureaucratic decisions responsible for the quality of education provision).

This relates to a second reason why media access may not have accountability effects. Policies differ according to the ease with which political responsibility for outcomes can be identified. In more complex areas of public policy, where it is more difficult to attribute responsibility for outcomes, citizens are less likely to get the information from media that they need to hold governments responsible for poor outcomes. For these types of public policies, media access alone is unlikely to have strong effects on citizen ability to hold governments accountable.

In Benin, as elsewhere, national legislators, local officials of the education ministry, principals, teachers, parents, and students themselves all share responsibility for student learning. The information citizens need to determine government responsibility for school quality is greater and more nuanced than the information they need to affix responsibility for failures in government transfer programs (or the bed net distribution programs analyzed in Keefer and Khemani 2011). At the same time, since education broadcasts on media are largely funded by donors and government ministries, they are likely to focus most on household benefits from investing in education, and on conveying *de jure* government policies, rather than *de facto* assessments of performance in translating policies into outcomes. Based on the likely information content of education broadcasts, and the way education issues are framed, it is less likely that media access in Benin increases government accountability for the delivery of education services.

Third, even if media broadcast information on public services, attributes of political systems other than citizen information may obstruct the ability of informed citizens to demand better performance from governments. Though the literature on media and information typically abstracts from these other “political market imperfections”, their effects on public good provision can be

substantial (Keefer and Khemani 2005). Societies may be socially polarized or political competition rooted in clientelist promises of privately targeted and immediate benefits even in settings where citizens are well-informed (Khemani 2007; Keefer and Vlaicu 2008). Ferejohn (1986), for example, demonstrated that when politicians cannot make credible pre-electoral commitments to voters, voters cannot act collectively to expel incumbents and political shirking increases. Persson and Tabellini (2000) specifically predict that lack of political credibility suppresses public good provision. Keefer (2007) argues that the relative inability of political competitors in younger democracies to make credible pre-electoral commitments to voters explains why, compared to older democracies, public goods are more scarce in younger democracies and targeted policies and corruption more prevalent. If even informed citizens confront insuperable obstacles to collective action aimed at holding governments accountable, media access would have a smaller effect on public good provision than otherwise.

The political setting in Benin is precisely one in which the capacity of citizens to act collectively to sanction non-performing incumbents is weak. Credible political commitments are, in developed democracies, mediated by political parties. In Benin, these parties are absent. Since competitive elections were first held in 1991, the number of parties has fluctuated between 129 and 27, rising to over 100 prior to the 2007 elections (Economist Intelligence Unit). None of the four parties emerging from the 2007 elections had a programmatic identity – a basis for making credible commitments to groups of citizens. Party fractionalization is high: in 2006 the probability that two randomly selected legislators do not belong to the same party was 80 percent in Benin, compared to 52 percent in Ghana (Beck, et al. 2001). The political setting in Benin may therefore reduce the effects of media access on citizen ability to hold government accountable for service delivery.

However, even if media access does not have a large effect on government accountability, it may still influence the private decisions of citizens if it informs citizens of the value and availability

of government benefits. Here again, though, increased take-up should occur only under specific conditions: radio stations must broadcast the relevant information and households must listen to the broadcasts. Absent a market for information – whether on government accountability or on the existence and benefits of a particular policy – the impact of media on either government accountability or citizen take-up of policy benefits is likely to be negligible. Public interest programming that might convey information about the benefits of schooling or particular health practices may not be the type of programming to which listening audiences flock nor (for that very reason) interesting for radio stations to broadcast. These limitations are not present in northern Benin, as we describe in the following section: survey results indicate that households in northern Benin prefer listening to community radio more than the ubiquitous national public radio.

In short, in countries in which collective political action by citizens confronts many obstacles, we hypothesize that media access alone has a limited effect on political incentives to improve public policies. This means, in contrast to the hypothesis advanced by proponents of community radio, that community radio may not promote local collective action to improve government responsiveness (Buckley, et al. 2008). However, where media broadcast and citizens listen to programs that provide information on the benefits of public policies, media access could have a strong effect on household incentives to take advantage of those policies.

4. Media access in northern Benin

In a literature dominated by a focus on monolithic countries (India, Brazil and Indonesia), and where even Uganda has a population of nearly 30 million, Benin stands out as a small country in Francophone West Africa with a land area of approximately 110,000 square kilometers (slightly smaller than the state of Pennsylvania) and a population of about 8,400,000. However, it has several advantages for the study of media effects. By the standards of the region, it has a relatively long (20 year) history of competitive elections and peaceful turnover of political power, so it is a plausible

setting in which to examine competing hypotheses on whether media effects operate through accountability channels.⁴ It is also known for its vibrant network of local radio media. According to ratings of *Reporters Without Borders* from 2009, the year of our survey, Benin ranks 72nd in the world, out of 175, in terms of freedom of the press, just behind Brazil (number 71), Botswana, Malawi, Tanzania, Liberia and Togo, but substantially ahead of most other African countries.

Benin has 77 communes, ranging in population from under 40,000 to over 700,000. Income per capita is approximately ten times greater in the richest compared to the poorest commune. The 77 communes serve as the electoral districts from which 83 members of the national assembly are elected through a system of party-list proportional representation. It is also the lowest tier of government, with each commune government consisting of a council of directly elected members who elect a mayor from among their ranks.

Given the importance of commune characteristics in the location of radio stations, our sampling strategy focused on 32 northern communes of Benin where we had reason to believe there would be substantial within-commune variation in radio access across villages that is exogenous to village-specific characteristics. A map of our study area is provided in Appendix 1. In the more urbanized and densely settled southern region of the country, most areas have access to multiple national and commercial radio stations resulting in little within-commune variation.⁵

⁴ Although, for the reasons discussed in Section 3, we hypothesize that accountability effects may not be sufficiently strong for public services because young democracies exhibit political market failures that have perhaps been insufficiently appreciated in prior literature on media and accountability.

⁵ Only the northern commune of Parakou is excluded from our study; it is the second largest city of Benin, after the capital region of Cotonou in the south.

During March and April 2009 we collected ownership, licensing, programming and other details on all 68 radio stations operating in Benin; we used direct observations by enumerators and interviews with key informants to assess the availability and quality of public goods in 210 villages across the 32 northern communes; and we implemented a survey of the service access, policy knowledge, and political attitudes of 4200 households residing in these villages, randomly selecting 20 households from each village. Radio access was determined in two ways. Village-level key informants listed which radio stations they were able to receive, and the enumerators used their own transistors to verify and expand on this, if they received additional signals. The codes of the radio listed as accessible to the village were then matched with the radio survey data to examine the nature of programming available to the village. Table 1 summarizes the number and types of radio stations covering this study area.

Table 1: Access to Radio Stations in North Benin

	No. of stations accessible to the region	No. of sampled villages covered (Total=210)	Average Signal Strength	No. of education programs broadcast (over the past 3 mths)
Government-owned Public Radio	3	200	2667 watts	33
Private Non-commercial or Community Radio	21	195	231 watts	50.6
Private Commercial Radio	10	49	476 watts	21
Religious Radio	2	71	.	.

In addition to the ubiquitous national public radio, this region of Benin is primarily covered by a number of local community radio stations. These stations are non-commercial in part by vocation, but in part because the market for commercial advertising is weak or non-existent. As a

consequence, they support themselves by selling airtime to donors and government ministries. These seek to provide information to households that will encourage them to improve their decisions regarding health and education. Of the 21 community radio stations to which our village sample has access, 14 are dependent upon funds from foreign donors, and 3 on non-governmental organizations. All of the community radio stations list the provision of information on health and education as “very important” to their objectives. The average number of education programs reported by station managers is almost double for community radio compared to public radio, and almost three times that of private commercial radio. Hence, access to more numbers of community radio is likely to be associated with exposure to more programming on the value of health and education services.

European donors across several African countries funded community radio to consolidate democratic transitions in these countries and to provide public-interest programming to remote and rural areas that would promote local development initiatives (Gratz, 1999). Donor officials claim that sponsored education programming contains a mix of themes, related to both the value of education and government policies. For example, the USAID Team Leader for Education and Basic Services writes that education messages in radio programming supported by USAID are intended to “reinforce the value of basic education and the important role of teachers.” Some programming, aimed at teachers, emphasizes that “good classroom teaching and professional behavior are appreciated and will be rewarded in the upcoming merit awards program.”⁶ Such programming contains information about teacher policies and the importance of teacher performance, which is relevant for local action to improve village public schools. At the same time, the general message of

⁶ E-mail correspondence with Cynthia Taha, April 14, 2011.

the value of education and policy efforts to increase quality can influence parental assessment of the importance of sending children to school and investing in education.

Community radio stations have low signal strength and any one station is accessible to only a few villages in our sample. Yet, because of the large number of community broadcasters, at least one community signal is accessible to 93 percent of our sampled villages. In contrast, while private commercial radio has greater signal strength, these are established in the southern communes of Benin, outside our study area; only a few villages in our sample (23 percent) are able to access their signals. Government-owned public radio has several relay transmitters allowing it to cover most of the villages in our sample (95 percent) with uniform programming. We were not able to gather reliable data on the nature of programming on religious radio, but our household data suggests that almost no one listens to it.

Most households that listen to radio report listening either to the national public radio or to a local community radio, or both. Of the 3828 households that listen to some radio, 64 percent report listening to at least one community radio station and 45 percent report listening to national public radio.⁷ Only 13 households report listening to religious radio and only 176 to private commercial radio.⁸ These listening preferences reflect what broadcast media experts have contended: poor households in rural Africa prefer to listen to local radio stations because their

⁷ “Listenership” data was gathered by simply asking households to name the station they listen to and then having our investigating team post-code the response for type of radio. We did not directly prompt the household to categorize what *type* of radio they like listening to.

⁸ Even among these 176 that report listening to some private commercial radio, only 67 report listening *only* to commercial radio; the rest listen as well to at least one other public or community radio station.

programming conforms better to their tastes and linguistic preferences than do broadcasts from radios headquartered outside of their region (Buckley et al, 2008).

Much of the literature on media access must concern itself with the multiple sources of information that households have. In Benin, radio is essentially the only media to which most citizens have access. According to the nationally representative Afrobarometer (2005) survey of Benin, 25 percent of households own televisions. In our sample of 4200 households from northern Benin, only eight percent own a television, but 84 percent own radios. Newspapers are underdeveloped in Benin; the largest has a circulation of 7,000. They have little or no penetration in the areas surveyed here, although interviews with radio station staff indicate that radio news reports about Benin are often prepared based on reports from newspapers in the capital city, Cotonou.

5. Identification—the “natural experiment” in north Benin

The central challenge in identifying media effects is the possibility that unobserved factors influence both media access and outcomes of interest, such as the provision of education services. The fragmentation of the radio market in Benin present circumstances akin to a natural experiment, giving us a different strategy to control for the endogenous placement of radio stations than in the received literature.

Previous research has relied on geological features that obstruct broadcasts from one or a few large stations as the source of identification of media impact (Strömberg, 2004; Olken, 2009; and Yanagizawa, 2009). Most debate centers on the exclusion assumption that these features have no direct effect on outcomes of interest. To the extent that topographical differences between communities with more and less access are significant, the exclusion assumption is more controversial. For example, geological obstacles that leave communities with less radio access might also render them significantly more isolated in all respects compared to communities with more radio access. The effects of radio access are then entangled with those of remoteness. Issues of

external validity are also more pronounced, since the effects of media access on remote jurisdictions may not be the same as in more general populations.

The idiosyncrasies of the radio market in Benin allow us to rely on small geological features to identify radio effects; it is implausible that these features influence education outcomes except through their effects on radio access. Radio markets in northern Benin consist of many small radio stations with limited signal strength, each carrying similar programming that is likely to influence education decisions. Villages that are close to each other and not separated by any remarkable topographical features can nevertheless exhibit significant differences in access because short distances and small changes in elevation are enough to degrade the signal received by some of them.

As Table 1 illustrates, although 93 percent of the sampled villages can access signals from at least one local community radio, variation in the number of community radios to which they have access is large, ranging from zero to seven stations. The average number is 2.4; the standard deviation is 1.5. Exposure to a greater number of signals is expected to be correlated with greater exposure to programming on the value of education, as discussed in the previous section and as will be confirmed in the following section on empirical results. In contrast, villages are homogeneous in their access to the relays of the national public radio station: all but 20 villages in the sample receive strong signals from one or more relays.

One might nevertheless be concerned that the location of small radio stations is related to unobserved characteristics of the villages that receive them. This is allayed by the histories of individual radio stations, our purposive selection of the village sample, and controls for commune fixed effects. As discussed in the previous section, most of the small community radio stations were established through the support of donors and governments, who cared about reaching remote and rural areas but were otherwise indifferent on criteria for selecting radio locations.

By themselves, these selection criteria are ideal for our purposes. However, donors needed local partners to establish the stations and idiosyncratic conditions within communes affected which communes yielded such partners. Ahokossi (2009) argues that potential radio entrants in Benin took the commune as the relevant market and took commune-specific characteristics into account in deciding whether they would locate. Commune-specific characteristics, related to economic conditions and political struggles within a commune, therefore ultimately affected where radios were established

For example, in a detailed case study of one of these community radios, Radio Tanguieta located in Tanguieta commune in Atacora department, Gratz (1999) reports on the political contestation over the locally-elected committee to oversee the radio and manage its funds. Control of the community radio rested in the hands of local politicians and Gratz indicates concerns about embezzlement and over-spending on salaries of numerous presenters representing different ethnic groups. Community radio projects are subject, then, to the same political risks of local elite capture and clientelist and ethnic politics as community-based projects in other sectors.

Since the unobserved characteristics of communes that affect these projects could plausibly affect education outcomes, we do not exploit inter-commune differences in community radio access to identify radio effects on education outcomes. Instead, all estimates control for commune fixed effects and identify the influence of community radio on education outcomes based solely on intra-commune variation in radio access.

Even within a commune, however, villages with access to more within-commune community radio broadcasters may have unobserved economic and cultural characteristics that promote better education outcomes. We constructed our sample of villages to be able to address such concerns. The 210 villages in the study were selected from maps showing the location of villages, radio towers, and major road networks. We restricted the sample frame to villages that were

approximately equidistant to (equally remote from) radio towers and roads inside the commune.⁹

Complementing the fragmentation of the Benin radio market, such a sampling frame yields variation in radio access driven by station location and transmission conditions that are exogenous to the sampled villages.

Most of the variation in access to radio signals is explained by differences in access to out-of-commune radio stations. The average household has access to .63 private within-commune community radio stations, with a standard deviation of .51. It has access to 1.78 out-of-commune stations, with a standard deviation of 1.45. Exposure to signals from neighboring communes is particularly likely to be exogenous, since the location decisions of out-of-commune community broadcasters are unrelated to the characteristics of villages in neighboring communes.

Examination of observable village characteristics reinforces the conclusion that within-commune variation in radio access is exogenous to village characteristics. If observable characteristics do not differ systematically across villages with more and less access to community radio, it is unlikely that radio access would be associated with unobservable characteristics that have independent effects on education. The village survey includes data on village distance from urban centers and distance to a train or bus stop; smaller and more remote villages could both be likely to have fewer accessible radio signals and lower investments in education. Larger villages might also

⁹ Unfortunately, no data was available on the precise GPS locations of stations and villages to directly control for this in our analysis. The best we could do was rely on pictorial maps provided by our local consultants to “eyeball” neighboring villages that were located equally distant from radio towers. However, as we discuss below, we are able to verify that our sampled villages exhibit no correlation between radio access and observable characteristics of location that could independently impact education outcomes.

have more access to radio signals and to government education services: the most recent census in Benin, from 2002, has information on village population for nearly all of the villages in the sample.

Poorer villages might have unobserved characteristics that affect both radio access and education outcomes. Though there is no census or statistically representative data of incomes and economic conditions at the village-level in Benin, the surveys offer several proxies for village incomes. Most are based on village averages of responses to the household survey: the percentage of households that report their income as belonging to the lowest of the income brackets; the percentages of sampled households that report owning a mobile phone and a television; the percentage of households surveyed with brick walls; and the percentage with houses with more than five rooms. With 20 observations per village, these averages are not precise enough to reject small income differences across villages, but they are sufficient to test whether larger income differences separate villages with more and less radio access. From the village surveys, it is also possible to compare villages according to the number of private schools serving the village.

Finally, village linguistic characteristics could be associated both with their inclusion into specific radio markets and independently with cultural practices that influence education. Based on the household survey, it is possible to compare villages according to, first, the probability that any two of these households would speak the same language at home; and, second, an indicator variable for whether the most common language among the sample of 20 households in a village is different from the most common language among all the households surveyed in the commune in which that village resides.

Table 2 reports results from a multivariate regression that yields no statistically significant association between any of these variables and either the number of community radio stations or the share of community stations as a fraction of all stations to which a village has access. No measures of income, wealth, remoteness or linguistic diversity are significant. In the first column,

the variable closest to significance is the distance of a village from the nearest urban center.

However, its effects are small: a one standard deviation increase in distance (18.7 kilometers) is associated with access to approximately 0.11 fewer radio stations.

Table 2: Correlates of village access to community radio*(Commune fixed effects, robust p-values in parentheses)*

	Number of Community Radios	Share of Community Radios
Village population (1,000s)	-.014 (0.78)	.002 (0.77)
Distance of village to nearest urban center	-0.00609 (0.14)	-0.000312 (0.65)
Distance of village to nearest bus or train stop	-0.00410 (0.30)	-0.000156 (0.75)
Number of functional private schools	-0.227 (0.28)	-0.0133 (0.72)
Fraction of surveyed households with income < 30,000 CFA Francs	-0.383 (0.23)	-0.0825 (0.20)
Fraction of surveyed households with a mobile phone	0.346 (0.47)	0.109 (0.33)
Most common language in village and commune is the same	0.301 (0.24)	0.0249 (0.48)
Probability that main language in any two households in the village is the same	-0.558 (0.27)	0.0608 (0.35)
Mean number of houses in village with brick walls	0.298 (0.46)	0.159 (0.11)
Mean number of houses in village with more than 5 rooms	-0.355 (0.52)	-0.0584 (0.54)
Fraction of surveyed households with a television	1.118 (0.41)	-0.274 (0.17)
Observations	200	200
R^2	0.78	0.69

In villages with a larger share of community radios, brick walls are almost significantly more common. Again, the magnitude of the effect is small: a one standard deviation in the fraction of households with brick walls (19 percent) is associated with only a three percent greater share of community radios. These variables are also not jointly significant in this specification. Furthermore,

village-level variation in community radio access is largely explained by commune fixed-effects alone, rather than the inclusion of these additional variables; the R^2 for the fixed effects specification, without any additional controls, is 0.73.

Table 3: Bivariate correlates of village access to community radio
(*Bivariate regressions; commune fixed effects; robust p-values in parentheses*)

	Coefficients from bivariate regression (<i>p-value</i>)
Village population (1,000s)	.05 (.29)
Paved road	.33 (.26)
Potable water source	-.01 (.74)
Village chief has some primary or secondary education	.23 (.15)
Distance of village to nearest urban center	-.01 (.09)
75% of villages \leq 32 km from nearest urban center	-.001 (.91)
Distance of village to nearest bus or train stop	-.01 (.25)
Fraction of surveyed households with income < 30,000 CFA Francs	-.57 (.10)
75% of villages where this fraction is < .53	-.81 (.30)
Fraction of surveyed households in dwelling with	
brick walls	.58 (.25)
cement floors	-.11 (.81)
more than 5 rooms	-.18 (.78)
Most common language in village and commune is the same	.25 (.31)
Probability that main language in any two households in the village is the same	-.31 (.57)

Table 3 provides bivariate correlations between radio access and each of the variables included in the regression of Table 2. In nearly all cases, observable village characteristics are not significantly correlated with community radio access. However, in this bivariate setting there appears to be some correlation between village radio access and distance to an urban center, though the

coefficient is not large: a one standard deviation increase in distance (18.7 kilometers) is associated with access to .19 fewer stations (less than .20 of a standard deviation). If one looks only at the 75 percent of villages that are no more than 32 kilometers from the nearest urban center, however, there is no significant association between radio access and distance. The results reported below are robust to looking only at this smaller sample of villages.

The fraction of households reporting incomes of less than 30,000 CFA Francs is also marginally correlated with community radio access. A one standard deviation increase in this fraction (.21) is associated with access to .12 fewer community radio stations, less than 10 percent of the standard deviation of community radio access. This association is not significant in the 75 percent of villages where fewer than 53 percent of villages report low incomes. Again, results below are robust to looking only at this subsample.

In sum, the fragmentation of the Benin radio market and a sampling procedure that exploits variation in access to out-of-commune community radio stations allow us to include more homogeneous villages than has been possible in previous research and to identify variation in radio access with less significant geographic features. Unobserved differences between commune villages that can access community radio broadcasts, particularly from outside of the commune, and those that cannot, are likely to be insignificant compared to the differences between villages that can access centrally-broadcast media and those that cannot.

6. Village-level variation in radio access and education outcomes

The essential “outcome” measure in education is whether students are learning, or acquiring specific competencies. To build such a measure, we applied a new type of literacy test developed by Pratham, a large civic society organization in India (ASER). The test assesses whether students can read words, sentences and simple paragraphs in French. It is easy and reliable to administer and measures a basic outcome a well functioning school should be able to deliver. It has recently been

used successfully in East Africa to measure basic reading competencies among young school-age children (UWEZO). The test was applied to ten children in the second grade in each village, 2100 children in all. The average age of the tested children was 8.75 years.¹⁰

Measured literacy rates vary widely among the 210 village public schools. Nineteen percent of all tested children, across all villages, could read simple sentences and paragraphs in French. In the median village, only 10 percent of tested children could read at this level. In 67 villages, or 32 percent of the sample, none of the tested children was able to read at this level while in 12 percent of the sample, 26 villages, more than half the children could.

The central hypothesis in this paper is that a key public service in villages in northern Benin – the quality of education in the village public school – is influenced by village access to community radio. To test the hypothesis, we estimate

$$(1) \textit{Child literacy}_{jk} = \beta_0 + \beta_1 \textit{number of community radios}_{jk} + \mathbf{X}_{jk} \mathbf{B} + \mu_k + \epsilon_{jk}$$

where j indexes the 210 villages and k the 32 communes, μ_k is a commune fixed effect, and \mathbf{X} is a vector of village controls. The key coefficient is β_1 which, because of exogenous variation within communes in the number of community radios to which villages have access, is identified through the inclusion of commune fixed effects. The dependent variable is the proportion of children tested in the village public school who could read sentences and paragraphs.

All of the variables in Table 2 are controls in \mathbf{X} . In addition, \mathbf{X} includes the availability of other public goods (literacy centers, health centers, the availability of a secondary school) and whether the village is one of the few with a functioning private school. The effects of access to community radios depend on the village's access to other types of radio, as well. A highly popular

¹⁰ We did not administer the literacy test in our household survey because we did not have a reliable sample frame to select those households that had young school-age children.

commercial radio might attenuate village interest in community radio, for example. The control variables therefore also include the number of religious, public and commercial radio stations to which villages have access.

Table 4 reports the results of estimating equation (1) with different sets of controls. Since the effects of access to community radio might operate through other right hand-side variables, such as the presence of other public goods that might increase demand for education, the first column shows the simple bivariate correlation between access to radios and child literacy. Villages within communes with access to a larger number of community radio stations have a higher share of children that are literate (each additional community radio station increases the share of literate children by 3.6 percentage points). The second column includes all of the controls except for the number of other types of radios to which villages have access. The estimated effect of additional community radio stations rises to five percentage points. The third column adds controls for other radio stations and the estimated effect rises further, to 5.4 percent. A one standard deviation increase in community radio access (by 1.5 stations) increases literacy by 8 percentage points, or .40 of a standard deviation.

Few of the control variables are significant after controlling for commune fixed effects. Villages that are closer to the nearest urban center exhibit higher rates of child literacy. A one standard deviation increase in distance to the nearest urban center reduces the share of literate children by approximately three percentage points. Villages with more educated chiefs (those with secondary education) exhibit *less* literacy than villages with no or only pre-school education. In 85 percent of the villages, the main language spoken by sampled households is the same as the main language spoken by all the households surveyed in the commune. In these villages, the share of literate children is approximately eight percentage points greater. The number of non-community radios to which villages have access has no effect on literacy.

Table 4: Community radio and French literacy among second graders

	Bi- variate	Base controls	Base plus other radio types	Base, villages less than 32 km. from nearest urban center	Base, fewer than 53% of village HHs report incomes \leq 30K	Base, in vs. out stations	Base, robust regression
Community radio received by village (# stations)	0.0361 (0.05)	0.0497 (0.02)	0.0541 (0.02)	0.06 (0.03)	0.047 (0.08)		0.0260 (0.09)
Within-commune community stations received by village						0.150 (0.05)	
Out-of-commune community stations received by village						0.0478 (0.02)	
Literacy Center Dummy		-0.0648 (0.12)	-0.0614 (0.13)	-0.05 (0.26)	-0.053 (0.19)	-0.0672 (0.11)	-0.0310 (0.36)
Village chief has secondary education		-0.0773 (0.14)	-0.0813 (0.11)	-0.08 (0.31)	-0.09 (0.13)	-0.0881 (0.11)	-0.0175 (0.62)
Distance of village to nearest urban center		0.00153 (0.10)	0.00157 (0.09)	0.002 (0.37)	0.003 (0.02)	0.00171 (0.06)	0.00143 (0.05)
Most common language in village and commune is the same		0.0947 (0.07)	0.0843 (0.12)	0.10 (0.16)	0.07 (0.26)	0.0887 (0.08)	0.0832 (0.04)
Private commercial stations received by village			0.0147 (0.67)				
Religious radio stations received by village			-0.0553 (0.35)				
Public radio stations received by village			0.0642 (0.25)				
Observations	210	199	199	152	151	199	199
R ²	0.30	0.40	0.42	0.44	0.44	0.41	0.43

Note: All specifications include commune fixed effects, and have standard errors clustered by commune; p -values are reported in parentheses. Other control variables (none significant), not reported: village population; whether village has a paved road; dummy for presence of secondary school; number of functional private schools; health or maternity center dummy; number of potable water sources built in 2007 or 2008; whether village chief has primary schooling; distance of village to nearest bus or train stop; fraction of households in village sample with income less than 30,000 CFA Francs; mean number of houses in village sample with brick walls; mean number of homes in village sample with cement floors; mean number of houses in village sample with more than five rooms; fraction of households in village sample with a mobile phone; probability that main language in any two households in the village is the same.

The fourth and fifth columns of Table 4 provide further support for the argument that unobserved village characteristics do not drive the results in the first three columns. Column four reports estimates on a subsample that excludes the 25 percent of villages (47) located further than 32 kilometers from an urban center. Results are unchanged; the effects of community radio increase, such that additional stations increase the share of literate children by six percentage points. Column 5 excludes the 25 percent of the sample villages in which more than 53 percent of households reported income of less than 30,000 CFA Francs. Effects of community radio access are unchanged.

The sixth column separately examines the effects of within-commune variation in village access to within- and out-of-commune community radio stations. The coefficient for out-of-commune stations is similar to the aggregate coefficient in the earlier estimates: one additional out-of-commune community radio station is associated with a 4.8 percentage point increase in the literacy share. The coefficient for within-commune stations is larger, suggesting that own-commune stations are likely to have a larger influence on household behaviors and education outcomes. The seventh column applies an atheoretical robustness test, using robust regressions to arbitrarily reduce the weight given to influential observations. The weight given to those observations is the Stata default ($tune = 7$). The effects of community radio remain significant, though the coefficient value drops to .026.

7. Channels of influence of village radio access on education outcomes

The data allow us to test, for the first time, the mechanisms through which radio access exerts effects on public policy – in this case, literacy. One basic issue in examining mechanisms is whether community radio access is actually associated with increased village exposure to education-related information. Like other studies, this analysis measures media access with the number of radio station signals that households can receive. However, in contrast to previous work, the data

permit us to verify that this measure is associated with exposure to more relevant information. Table 5 shows that villages with greater access to community radio are also exposed to more education and health programming.¹¹ The coefficient on the total number of radio stations indicates the average health and education programming that is associated with an extra radio station. From the first and second columns, each additional radio station is associated with approximately 19 additional education programs and three additional health programs. Additional community radios are associated with 20 education programs, in addition to the 19, and 126 health programs.

The third and fourth columns disaggregate radio types, distinguishing the contribution of community, public, commercial and religious radio stations to health and education programming. Community radios make, by far, the largest contribution to such programming. Religious stations are more likely to broadcast education programming, a mix of both secular and sectarian shows; they are significantly less likely to broadcast health programs. Public and commercial radios, with less need to raise funds by selling air-time to donors or government ministries, contribute relatively little education and health programming. The final two columns distinguish the health and education offerings of community radios broadcasting from inside and outside the village's commune. Villages that receive (exogenously) more out-of-commune community radio stations are also exposed to significantly more health and education programming.

¹¹ The dependent variable here is the number of education programs that the radio manager reports as being broadcast over the last 3 months prior to the survey.

Table 5: Community Radio Effects on Village Exposure to Education and Health Programs
(Commune fixed effects, robust p-values in parentheses)

	Number of Programs:					
	Education	Health	Education	Health	Education	Health
Community radio received by village (# stations)	20.52 (0.04)	126.3 (0.01)	38.61 (0.00)	129.4 (0.01)		
Within-commune community radio received by village (# stations)					35.86 (0.15)	87.30 (0.00)
Out-of-commune community radio received by village (# stations)					19.96 (0.04)	127.7 (0.01)
All radio received by village (# stations)	19.28 (0.00)	2.768 (0.88)			19.26 (0.00)	2.821 (0.88)
Public radio received by village (# stations)			0.522 (0.97)	-50.11 (0.33)		
Commercial radio received by village (# stations)			6.438 (0.39)	25.25 (0.33)		
Religious radio received by village (# stations)			67.08 (0.01)	-43.35 (0.49)		
Observations	210	210	210	210	210	210
R ²	0.90	0.80	0.91	0.81	0.91	0.80

Note: Standard errors clustered at commune level. Each column regresses the number of education or health programs received by a village, as determined by information supplied by the radios that broadcast to the village, on the number of different types of radio stations received by the village. The regressions control for commune fixed effects and therefore capture only intra-communal variation in village access to education and health programming.

The second issue in discussing mechanisms of radio effects is whether this information influences literacy outcomes through accountability or behavioral channels. If through accountability, then villages with greater access should see greater government provision of those inputs that matter for child literacy and more evidence of collective action. For every village school, enumerators collected information on the following: the average pupil-teacher ratio across classrooms, the number of available textbooks reported per enrolled pupil, the share of teachers that

are absent on the day of the visit, the number of classrooms, and the share of classrooms where the survey team could see teaching activity. In addition, the household survey asks respondents to give their assessment of how active the Parent-Teacher Association is. Although all schools report having a PTA, households vary significantly in the degree to which they report PTA activities aimed at improving schools. Since community action to secure greater school inputs would likely occur through the PTA, this is a plausible proxy for collective action.

To see if these inputs were significantly higher in villages with greater access to community radio, we estimate the following,

$$(2) \text{ Quantity of education inputs}_{jk} = \beta_0 + \beta_1 \text{ community radio access}_{jk} + \mathbf{X}_{jk} \mathbf{B} + \mu_k + \epsilon_{jk},$$

where the control variables are the same as in the base specification (column 2) of Table 3. Table 6 displays the main results of the estimation. Community radio access has no effect on any inputs. Tangible inputs into education (teachers, classrooms and books) are no different across villages with less or more access. Government oversight of the deployment of those resources, measured by teacher absenteeism, is also no different. Access seems to have no effect on collective action: perceived levels of PTA activity are unrelated to access to community radio. The PTA result does not change when using an estimate of PTA activity based only on the perceptions of households with children in school. In addition, there is no correlation between village radio access and the proportion of households reporting specific PTA participation in the recruitment of new teachers, monitoring of teacher presence in the classroom, conflict resolution, school supervision, or the collection of contributions.¹² These results stand in contrast to earlier research on transfer programs, where access to media did affect government behavior.

¹² These results are not reported here in the interest of brevity, but are available upon request.

Table 6: Radio Access and Education Inputs

	Student- teacher ratio	Textbook -pupil ratio	Absent/Total teachers	Classroom number	Proportion of active classrooms with teachers	Level of PTA activity
Community radio stations received by village (#)	-1.656 (0.23)	-0.505 (0.39)	-0.00856 (0.55)	-0.0978 (0.52)	-0.133 (0.58)	1.444 (0.39)
Village population (thousands)	1.81 (0.02)	-.046 (0.69)	-.012 (0.07)	.041 (0.75)	.113 (0.45)	.902 (0.48)
Observations	196	196	199	195	198	199
R ²	0.59	0.32	0.43	0.37	0.47	0.51

Note: Commune-clustered p -values in parentheses. Regressions control for commune fixed effects. Control variables are the same as in the base specification (column 2) of Table 3. With isolated exceptions, none are significant. Only village population and community radio stations are reported here.

In fact, in Table 6, no determinants of school inputs seem to matter, consistent with the government's claim to allocate resources on a strict per capita basis, or with the possibility that allocation is purely random. The only correlate that is significant in even two of the specifications is village population. Both significant results, however, are intuitive: larger villages with larger student populations have higher student-teacher ratios (classroom size is approximately two pupils larger). On the other hand, they are also more attractive to teachers: teacher absenteeism is somewhat lower in larger villages.

A further test of the accountability channel is to ask whether households with greater access to community radio have greater knowledge of government policies relevant to literacy. Prior research emphasizes the impact of media on government responsiveness through its effects on citizen knowledge (e.g., Besley and Burgess 2002; Strömberg 2004), but data limitations have prevented researchers from examining whether this is indeed the case.¹³ The Benin household

¹³ Snyder and Stromberg (forthcoming) is an exception; they estimate effect of newspaper access on

survey contains detailed questions that probe respondent knowledge of important national policy changes that are relevant to citizen efforts to hold governments accountable: a massive program to hire new teachers; large increases in budgetary outlays to education; and more stringent requirements for students to pass the primary school leaving examination. Consistent with the lack of impact of community radio on government inputs into village schools, reported in Table 6, access to community radio is not associated with greater knowledge of these policies, under any specification.¹⁴

One explanation for lack of accountability effects might be that the variation in radio access is driven by access to out of commune radio stations which may not carry information relevant for local, commune-level, accountability. To check an immediate implication of such an explanation, we examined whether within-commune radio had a different correlation with school inputs, teacher presence, PTA activity, and policy knowledge, than did out-of-commune radio. We find no difference.

Even if the effects of media access do not operate through the accountability channel, they still may influence household behavior. Households exposed to more programming on the importance of educating their children might invest more time and money in the education of their children. In countries such as Pakistan, tests of this channel are complicated by the proliferation of private education options. Public schools are the only educational option for most households in our sample. Only 2 villages in the sample report having no functional public school, and 44 percent have more than 1 public school. Private schools exist in only 7 percent of the sampled villages, and

voter knowledge about their legislators.

¹⁴ These results—of lack of effect on household policy knowledge—are available upon request.

only 1.6 percent of household respondents report enrolling any of their school-age children in private schools.

The household survey reports two financial investments that households make in education. The focus here is on a variable constructed from the household roster: the number of children in the household attending school for whom the household purchases books. Approximately 42 percent of households with children in school report buying books. The reporting is likely to be accurate, since the number of children for which households buy books is significantly negatively correlated with the number of children in schools where government-supplied books are available; the majority of children are in schools where books are not available.

The household roster also records the number of children for whom the household paid matriculation fees for a child in school. However, two factors weaken the likely effects of radio access on these payments. First, education programming may increase household demand for better educational outcomes for their children (increasing the likelihood of payments), but in the case of the USAID programming described earlier, may also increase household confidence in the quality of schools and reduce the value they place on private payments to teachers. Second, in contrast to the book-buying information, responses to this question appear to exhibit substantial measurement error. The survey asks, “Do parents in your area continue to pay fees to schools?” Of the respondents who indicate that they have paid fees for their children, though, 63 percent report that parents in their area are *not* paying fees. In addition, income and wealth variables that are associated with book-buying are not associated with fee payment.

Table 7 reports the effects of radio access on households’ education investments. The base regression is:

$$(3) \text{ Household educ investment}_{ijk} = \beta_0 + \beta_1 \text{community radio access}_{jk} + \mathbf{X}_{ijk} \mathbf{B} + \mu_k + \epsilon_{ijk}$$

where the units of observation are household i in village j and commune k . The number of school-aged children for whom the household buys books and the number of children for whom the household reports paying fees are the dependent variables. The control variables include commune fixed effects; the number of children in the household; the number of adults, including adults over 60; a number of ethnic and religion dummies; a variety of measures of household income (quality of housing construction, cash income levels reported by the household and ownership of mobile phones or a television); the marital status of the household head (including single or polygamous), the gender and age of both the respondent and household head, and the number of textbooks in the village primary school. We assume that standard errors are independent at the commune level, not at the village level, and report robust standard errors, clustered at the village level. Results are actually stronger when standard errors are clustered at the commune level.

The previous arguments for the exogeneity of village access to community radio stations extends to households. First, households with children in school and more radio access are essentially indistinguishable from those with less radio access. With few exceptions, controlling for commune fixed effects, access to community radios is not significantly associated with any observable attributes (most ethnicities and religions, income and wealth variables, etc.). One exception is that Peulh households exhibit significantly greater access, but the magnitude of the relationship is small. The age of the head of household also differed significantly across households with more and less radio access, but again the effect is small: a one standard deviation increase in the age of the head of the household (14 years) is associated with a reduction in the number of radio stations by .05. Female-headed and Dendi households also had less access to community radio, though these effects are not quite significant ($p=.12$ and $.15$, respectively), and are also small. Results are robust to excluding Peulh and Dendi respondents, the oldest 25 percent of household heads, and female-headed households (results not reported).

Second, household mobility is low; there is little risk that households with more interest in education move into areas where community radio is more prevalent. Third, and most importantly, the main endogeneity concern is not that motivated families move to jurisdictions with better radio programs about education. It is rather that they move to jurisdictions with better schools. However, the results in Table 6 indicate that there are no measurable differences in school inputs in villages with greater and less access to community radio, including differences that are known to have a significant impact on student learning, such as student-teacher ratios and teacher absenteeism.

The first column in Table 7 shows the results of the regression of community radio access on the number of children in school for which a household buys books. This is really the share of children for which it buys books, since the regression controls for the number of children. One additional community radio increases the number of children for which the household buys books by .08; though the effect is not large, it is statistically significant and supportive of the behavioral channel of community radio influence. Column 2 reports results that restrict the sample to households that are indistinguishable on all observables, focusing only on households with respondents and household heads younger than 50, non-Peulh and non-Dendi households, and households headed by males. Though this sample is much smaller than in Column 1, the results are nearly indistinguishable.

Table 7: Effect of Listening to Community Radio on Household Education Investments

	Dependent variable: Book purchase			DV: Tuition	
	OLS-Base	OLS-Exclude Peulh, Dendi, HHs w/older or female heads, older respondents	IV for HH listening: Radio access	OLS-Base	IV for HH listening: Radio access
Community radio stations received by village (#)	0.08 (0.04)	0.09 (0.04)		0.03 (0.24)	
Household listens to at least one community radio station (IVs: radio access)			1.84 (0.04)		.84 (0.09)
Private commercial stations received by village	-0.10 (0.09)	-0.11 (0.08)		-0.06 (0.13)	
Elementary Education – Respondent	0.11 (0.14)	0.13 (0.14)	0.14 (0.09)	.02 (0.59)	0.04 (0.40)
Secondary Education – Respondent	0.30 (0.01)	0.29 (0.02)	0.42 (0.00)	0.10 (0.10)	0.15 (0.02)
Higher Education – Respondent	0.32 (0.21)	0.41 (0.21)	0.78 (0.01)	0.09 (0.61)	0.31 (0.24)
Number of children listed	0.11 (0.09)	0.07 (0.38)	0.17 (0.04)	.12 (0.04)	0.15 (0.03)
Income is between 27.5K and 44K	0.14 (0.01)	0.14 (0.04)	0.12 (0.09)	.001 (.97)	-0.006 (0.87)
Income is over 44K	0.30 (0.00)	0.38 (0.00)	0.23 (0.02)	0.08 (0.10)	0.05 (0.34)
Wall - Brick/Semi-rigid	-0.13 (0.08)	-0.22 (0.01)	-0.05 (0.60)	-0.01 (0.77)	0.02 (0.75)
Owens a TV	0.39 (0.00)	0.50 (0.00)	0.42 (0.01)	-0.10 (0.11)	-0.09 (0.14)
Owens a mobile	0.18 (0.01)	0.12 (0.20)	0.14 (0.09)	0.14 (0.01)	0.12 (0.03)
Observations	2,165	1,276	2,165	2,165	2,165
R ²	0.27	0.29		0.10	
Hansen's J-statistic (<i>p</i> -value), F-statistic			.92, 10.2		.68, 5.12
First stage results (Same for both IV regressions; robust <i>p</i>-values in parentheses)					
Community radio stations received by village (#)				.03 (.02)	
Commercial stations				-.06 (.003)	
Religious stations				.06 (.08)	
Public stations				.03 (.30)	
F-statistic on excluded instruments				3.3	

Note: "Household listens to community radio" instrumented with access to community stations, commercial stations, religious stations, public stations. Robust *p*-values, clustered at the village level, reported in parentheses. All specifications include controls for commune fixed effects. Other controls (all are either never or rarely significant) are not reported: access to public or religious radio stations; age and gender of household respondent and of household head; eight different ethnic dummy variables; whether respondent is Islamic or Catholic; number of adults in household and number of household members older than 60; whether head of household is polygamous; whether respondent is single; whether household has cement floors; or more than five rooms, and number of textbooks in the primary school.

Since the household survey contains information on which radio stations households listen to, it is possible to ask directly whether listening to stations that broadcast education programming influences household investment decisions. This is yet another link in the causal chain from radio access to education outcomes. Of households with children in school, 67 percent listen to community radio. Though this ratio is almost precisely the same (66 percent) for households that do not have children in school, it is nevertheless possible that the decision to listen to community radio is potentially endogenous to unobserved household characteristics that influence education investment. To address this possibility, radio access can be used as an instrument for listening behavior, assuming that radio access is exogenous to households and influences education investments only through its effect on household listening behavior.

The third column in Table 7 therefore asks whether households that report listening to at least one community radio station, using access to community, private commercial, public and religious radio stations as instruments for station preference. All types of stations are used as instruments since the decision to listen to any one type of station is dependent on the availability of other kinds. As the lower rows of Table 7 demonstrate, station access has a significant effect on whether households listen to community radio; the *F*-statistic associated with the instruments implies that the probability that the instruments do not add explanatory power to the first-stage regression is less than two percent. Evidence from the Hansen's *J*-statistic (with a *p*-value of .92) is also supportive of the exclusion restriction: the effect of access variables on book-buying is only through household listening behavior. Using these instruments to control for the endogeneity of listening behavior, then, the estimated effects of listening to community radio are large: households that listen to community radio purchase of books for 1.8 additional children.

The fourth and fifth columns of Table 7 display the results for fee payments reported by parents. The fourth column shows the OLS estimates of the effect of living in a village with greater

radio access on school fee payments. Households pay fees for a larger share of children in villages with greater radio access. Because of noisy responses to this question, the effect is not significant. However, when household listenership is instrumented with radio access, the effects on fee payments are large and significant: households that listen to community radio pay informal school fees for one additional child.

The results in this section are notable in demonstrating for the first time the channels through which media access operate. First, we document that a particular kind of media access, community radio, is strongly associated with greater village exposure to information about education and health. Second, access to this information does not increase government accountability: it is associated neither with greater government inputs into local schools nor with greater knowledge about government policies that affect those inputs. Third, though, media does increase household investments in education. Moreover, after isolating the exogenous component of household listening behavior explained by radio access, households that listen more to community radio also invest more in their children's education.

8. Conclusion

The analysis here contributes to the fast-growing literature on the role of media and information in influencing household behaviors and government accountability. We use unique data from Benin to shed light on several issues that, because of data limitations, were beyond the reach of earlier research. First, the results demonstrate for the first time a substantial effect of media access on education performance: the literacy scores of eight and nine year-olds are significantly higher in villages with greater access to community radio.

Second, the data permit the channels through which media access matters to be separately investigated. Prior research has not been able to document whether media actually broadcast relevant information. The data allow us to verify that one type of radio, community radio,

broadcasts a significant quantity of education-related information, both absolutely and relative to other broadcasters. However, access to community radio does not influence education outcomes through greater collective demand for better government performance. Government inputs into village schools, and household knowledge of government policies related to education, are all unrelated to village access to community radio. Instead, greater access to community radio leads to significantly more private investment by households in the education of their children. Among households with children, those that listen to more community radio because of their access to a larger number of community radio stations are more likely to buy books and to make informal or private tuition payments to schools.

Community radio has unique attributes that enable it to provide information that influences household decision making with regard to education. On the one hand, these broadcasters, unlike the national radio station, are established to cater to the local audience. On the other hand, the scarcity of commercial advertising means that these radio stations have to sell their broadcasting time to ministries and donors interested in disseminating public interest programming, particularly on education and health. Because they play programming that people like, people are more likely to hear this public interest programming. Because stations cannot turn to commercial advertisers for financial support, they are more likely to broadcast this type of programming.

The effects of community radio that we document have three important policy implications. First, media interventions intended to promote better service delivery by improving government responsiveness should take into account the broader conditions in political markets and whether they promote political incentives to provide quality public services. Lack of policy information *per se* may not be the main impediment to citizen collective action needed to hold governments accountable.

Second, radio markets such as Benin's, dependent on donor and government purchases of programming slots, may be particularly inhospitable to accountability-based programming. Stations that depend on government programming (or on programming by donors who are in turn concerned about relations with government) are less likely to broadcast programs that question government performance in education or other areas. The data from Benin are unique in identifying the extent of education programming in radio broadcasts, but are insufficient to establish the programming balance between government education performance and the desirability of household investments in education. This remains an important topic for future research.

Third, even in the absence of an accountability channel, media interventions can have an effect on service delivery outcomes through their influence on household incentives to optimize their use of public services. However, the particular type of programming that can have these effects may not emerge everywhere. It is the product of media markets in which media providers want to broadcast the information and households want to listen to it. The radio market in northern Benin provides such a setting, but other markets may not.

In particular, a market in which commercial radio, dependent on traditional commercial advertising, is more firmly entrenched, may be less hospitable to extensive public interest programming. Airtime is more expensive, raising the cost of information interventions. Stations may regard informative programming as harmful to a franchise that depends on pure entertainment programming to attract advertisers. In contrast, commercial stations may regard "accountability" programming, which may have "sensational" news characteristics, as more attractive. The degree to which this may enable commercial radio to deliver accountability effects, through their greater independence from government and ability to package accountability programming in entertaining ways, remains another important topic for future research.

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Appendix 1: Map of study area in North Benin

