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DEVOLUTION AND ACCOUNTABILITY EFFECTS IN THE PUBLIC PROVISION OF WATER SERVICES IN INDONESIA

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Abstract

This paper separately evaluates how devolution and accountability, two distinct aspects of the decentralization reforms implemented in Indonesia in the year 2001, influenced the public provision of water services. Using household level data it is found that the devolution of responsibility does not necessarily affect the provision of public services. Our findings show that the quality of publicly provided water decreased only in cities in which devolution was accompanied by a change in accountability. Robustness checks suggest that these results are driven by changes in the accountability framework rather than trends in the health services.

Key words: Indonesia, decentralization, accountability, devolution, water.

JEL Classification: O2, I18, H2, H54.

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EFECTOS DE LA DELEGACIÓN DE RESPONSABILIDAD Y RENDICIÓN DE CUENTAS EN LA PROVISIÓN DE SERVICIOS DE AGUA EN INDONESIA

Resumen

Este estudio evalúa por separado cómo la delegación de responsabilidad y la rendición de cuentas, dos aspectos distintos de las reformas de la descentralización puestas en ejecución en Indonesia en el año 2001, influenciaron la provisión pública de los servicios del agua. Usando datos de encuestas de hogares se encuentra que la delegación de la responsabilidad no afecta necesariamente la provisión de servicios públicos. Nuestros resultados demuestran que la calidad del agua pública solo vario en aquellas ciudades en las cuales la delegación estuvo acompañada por un cambio en el sistema de rendición de cuentas. Ejercicios de robustez sugieren que estos resultados se dan debido al proceso de descentralización y no por cambios en los servicios médicos.

Palabras clave: Indonesia, descentralización, responsabilidad, rendición de cuentas, agua.

Clasificación JEL: O2, I18, H2, H54.

INTRODUCTION

Decentralization reforms have been implemented around the world as a major tool to fight poverty and increase living standards in developing countries (World Bank, 2004). These reforms have been embraced based on the belief that the outcomes obtained under this framework would be superior to those obtained under a centralized system which in numerous countries proved incapable of providing adequate services for its population. This in part explains why from the beginning of the nineties several developing countries have undergone decentralization reforms in infrastructure service deliveries.¹ Decentralization however is a broad term that embodies numerous policy changes and this study is the first one that focuses in two distinctive aspects of these reforms. The first one is related to the government level responsible for the service provision. The second one is related to the accountability framework faced by that government level. Accordingly, the net effect of decentralization reforms will be the product of these two effects: the transfer of responsibility to the local governments which we call "devolution effect" and the change in accountability faced by service providers referred by us as "accountability effect".

The principal argument in favor of decentralization claims that both effects are positive. The devolution of responsibilities is thought to improve outcomes based on the assumption that local governments have better information about local preferences and needs. Given this informational advantage local governments could tailor services provision to better match local demand (Oates, 1972). As for the accountability argument, it is claimed that within a local democracy citizens can better monitor and punish local governments, based on their performance in the provision of these services, than they could monitor higher-level governments. In short, the argument in favor of decentralization claims that local governments are better suited to provide these services and face better accountability mechanisms. However, the literature has also argued that decentralization may be subject to several pitfalls as pointed out by authors such as Bardhan and Mookherjee (2000, 2005, 2006). In terms of the devolution effect newly elected local governments may not be sufficiently prepared to undertake their new responsibilities because of their lack of

¹ For a review of some of these experiences see Bardhan and Mookherjee, 2005.

experience or lower technical competence. Moreover the accountability faced by local governments might in some cases be weaker due to poor local democracy functioning which might result in local capture. Finally, problems of unfunded mandates may also emerge.

These arguments suggest that the net effect of decentralization reforms on public service provision will be context specific and can widely vary according to the experience and political economy characteristics in each country. Henceforward a systematic analysis must be able to control for all the particular features of such reforms. To the best of our knowledge, the empirical literature of impact evaluation has focused on decentralization reforms comprising the several policies changes it entails and do not isolate out the devolution and accountability effects.² The goal of this paper is to investigate for the first time how these two factors, devolution and accountability, separately affected access and quality of water provided by local government enterprises in Indonesia.

The Indonesian decentralization experience in this sector is unique as far as implementation is concerned. First, it was a major reform implemented in a very brief period of time. The decentralization laws, Law 22 and Law 25, were approved in 1999 and by 2001 all local governments became in charge services such as education, health and water provision among others. This creates a break point in time in which water provision went from central to local government control. Although in principle the reforms had no variation across time or space, the existence of several water providers in Indonesia different from the government one allows us to construct a control group in order to evaluate the devolution impact.

The second unique feature of the Indonesian reform is that the new institutional framework defining the local democratic processes creates an exogenous variation across time and space in the country. The decentralization laws established that a new accountability framework was to be introduced at the end of the mandate of all heads of local governments

² Recent empirical evaluations on decentralization reforms include Galiani et al. (2008), Faguet and Sanchez (2008) and Rodriguez (forthcoming). However in none is the distinction between devolution and accountability made.

in power. However, this change occurred gradually throughout the country and by 2003 only 80% of the local governments had changed its head and were working under this new framework. This variation in the timing of implementation was exogenous to the quality of government and arose only because of the existence of previously distinct local governments end of mandate dates. During the New Order period, all the local heads were appointed by the central government through the Minister of Home Affairs for a mandate of 5 years.³ Due to administrative reasons and in order to manage the considerable number of appointments for the local governments, each appointment process was done separately in a different period creating the aforementioned variation on mandate dates.

Using these sources of variation and based on a socioeconomic household survey for the years 1998 and 2003, we evaluate how decentralization affected access and quality of the water provided by local enterprises. Through probit estimation techniques we first find that neither devolution nor accountability changes had a statistically significant impact in the percentage nor the type of population served by the public water enterprises. Second, using the incidence of diarrhea in children under five years of age to proxy water quality, we find that only in those cities in which both devolution and accountability reforms took place the quality of the water changed. Specifically, the probability of a child who resides in these cities to suffer from diarrhea increased by seven percentage points suggesting that the quality of the water in these cities decreased. More importantly, this result shows that the institutional and political framework that surrounds decentralization reforms is critical for the final result achieved.

Our result is consistent with other findings in the literature about the possible negative consequences of decentralization. For instance, in the health sector, Azfar, Livingston and Meagher (2003) find that immunization coverage after decentralization in Uganda was lower than expected. A similar study focusing on health services for Colombia (Munoz and Roa, 1999) also attributes a decrease in immunization coverage to decentralization. In the education sector Galiani et al. (2008) find that while decentralization in Argentina

³ Only in Kabupatens in which the appointed head of local government was from the military forces, the mandate period was of 2 years instead of 5 years.

improved education results in richer provinces, the average test scores in poorer municipalities and less efficiently managed provinces deteriorated since the decentralization reforms took place. For Brazil, Madeira (2007) finds that decentralization reforms in the São Paulo State had negative effects in all performance indicators. For the specific case of Indonesia, studies such as Casson and Obidzinski (2002), Marks (2002) and Matsui (2005), have all shown the negative impact the reforms brought in different areas in the country. As mentioned, there are several theories that could arise in order to explain such results such as local capture, unfunded mandates or simply lack of technical capability of local governments. However, the empirical strategy adopted in this paper does not allow us to identify what is causing such result and future research on the subject is needed.

The remainder of the paper is organized as follows. Section two comprises a brief description of the country's institutional background, focusing on the water sector. Moreover we depict the main changes imposed by the reforms, clearly defining the devolution and accountability channels that are studied. Section three describes and justifies the empirical methodology chosen and section four embodies a detail description of the data used. Section five reports the results found under the methodology adopted as well as some robustness checks. Finally section six concludes.

INSTITUTIONAL FRAMEWORK

In spite of the broad scope of the Indonesian decentralization reform we focus our analysis on two aspects of the reform: (i) the transfer of resources and responsibility of service provision from central to local governments (devolution) and, (ii) the change in the accountability mechanism faced by the government level in charge of the public service provision (accountability). The implementation of the decentralization reforms in Indonesian and its implications in the water sector provides us with a unique opportunity to evaluate the separate effects that devolution and accountability may bring. In this section we briefly explain the main characteristics of the reforms and the sector which will allow us to empirically evaluate our question of interest.

Decentralization reforms in Indonesia

Beginning in 1998, Indonesia went from being one of the most centralized countries in the world under Suharto's regime to one of the most decentralized ones under a newly born democracy. Since the original constitution of 1945, the Republic of Indonesia is administratively divided in three government levels: center, province and local governments. Currently, there are 30 provinces and 416 local governments, commonly known as Kabupatens, existent in the country.⁴ At the local level the government is composed by the legislative body (DPRD) and by the executive body, the head of local government. Decentralization reforms did not change these administrative divisions or the local government structure. The same administrative tiers, center-province-local government, were kept but their functions and the hierarchy between them changed, giving more autonomy to local governments. Furthermore, at the local level there was also a change in the functions assigned to legislative and executive bodies.

The passing of Laws 22 and 25 in 1999 created the legislative background for Indonesia's decentralization reforms. These laws embody a comprehensive program of local autonomy that devolved to local governments the discretion to manage its affairs, by transferring responsibilities such as public service provision along with civil servants and the governmental apparatus as well as resources from the central government. According to these laws, sectors such as health, education, public works and infrastructure (e.g. roads, water and sewerage) became obligatory responsibilities of local governments. These laws also introduced a fiscal reform which meant a transition from a system of earmarked grants to a general allocation grant, called DAU. The DAU was a formula based central government grant transferred to all local governments and whose entire allocation is left to the local government discretion. In its origin, the formula was based on the fiscal gap principle, which is the difference between fiscal need and fiscal capacity. According to this principle the grant received by local governments should increase with fiscal need

⁴ It should be noted however, that the decentralization reform in Indonesia has triggered the formation of new local government so this number of Kabupatens has been growing substantially since the reform took place. (Country Reports on Local Government System: Indonesia.)

indicators, such as poverty rate, population and land area and decrease with fiscal capacity ones, such as local governments revenues. Given that the final amount transferred depended on such objective indicators no space for political bargaining in this matter was available.

In addition, the local political framework in the country also changed with the decentralization reforms. Previously, under the centralized regime the head of the local government (Bupati) was appointed and therefore held accountable to the central government through the Ministry of Home Affairs (MoHA). During the New Order the manner in which the MoHA was able to manage all these appointments was to spread them out randomly in time, so that the ministry would not have to deal with the appointment process of all Kabupatens at the same time. All the heads of local governments were appointed for a five-year term but the appointment date was different for each Kabupaten. Under this framework, local heads were simply agents who sought to implement the policies set by the center at the local level, reflecting the highly centralized system that was in place previous to the reform. Under this regime then, there was no scope for local accountability to be in place.

Law 22/1999 changed such framework by clearly defining the functions of the head of local government and the local legislature (DPRD); making the head of the local government in charge of local administration and responsible for policy implementation while the DPRD was made responsible for setting policy, monitoring and punishing the head of local government. Moreover, in order to introduce democratic incentives, locally elected members of DPRD became in charge of electing the head of the local government and gained the power to dismiss him. It should be noted however that even though the 1999 general elections installed a new DPRD under this framework in all Kabupatens, not all the heads of governments were replaced. This was due to the fact that not all the heads who were in power in 1999 had fulfilled their five year term and the Law established that only those who had done so could be dismissed and changed by another head elected under the new system. The centrally nominated local heads that remained in power were allowed to finish their terms and only when they did so they were replaced by a person elected by the DPRD.

The effect of this reform can be significant if the heads of the local government elected by the DPRD react in a different manner than the ones nominated by the center. Such difference in behavior could stem from several reasons. For instance, heads elected by the DPRD, because of its oversight, might act in order to satisfy all the policies suggested by the legislative body; while centrally nominated ones might disagree with them especially if they contrast with the center's policy priorities. Another plausible scenario is that heads appointed by DPRD have a collusive behavior with the latter and act opportunistically. In an environment like Indonesia, in which local democracy at the beginning of the century was still incipient and the population might not have had much information about local affairs the head may have no incentive to comply with the demands of their constituents and act to benefit its own main interest. On the other hand, centrally nominated heads could have been forced to comply with the center's strategy in order to remain in power.

Irrespective on how the incentives for local heads changed, the fact that they were allowed to finish their terms and that they were appointed in different points in time implied that the actual change in the accountability framework varied across Kabupatens and time in such a manner that was exogenous to the quality of governance. We will use this characteristic as one of the identification strategies in the empirical exercises.

The water sector in Indonesia

There exist several sectors in which the separate effect of devolution and accountability changes in Indonesia can be examined. However we focus our attention in this country's peculiar water sector. The water sector in Indonesia is unique insofar as the variety of providers that coexist in the market. There are five different types of providers operating in the market: i) the public sector through the Water Utilities Enterprises (PDAMs); ii) the formal private sector who through concessions, BOT or service contracts take over the management of the city PDAMs as in the case of Jakarta; iii) the informal private sector that comprise all the unregulated service providers and at the moment are the largest group of providers; iv) the community organizations that with NGOs help and national or donor funds are created; and lastly v) the households themselves who choose to have a well in their house or to depend on other natural sources such as rivers or springs to obtain their water. Moreover, the importance of nongovernmental water providers is important in the

country. Specifically, more than 50% of the Indonesian households report to have as source of drinking water the wells, springs or rivers and hence do not rely on the PDAMs to obtain this valuable resource.

The PDAMs were established under Law 5/1962 as a semi-autonomous regional enterprise at the Kabupaten or Regency Level. Under this law, PDAMs are entirely owned by the local government (Kabupaten/Kota), they are responsible for tariff setting and under specified conditions part of the enterprise's profits can be used by the local governments for its own regional purposes.⁵ Due to the close relationship between local governments and these enterprises, it is expected that changes in the responsibilities and in the accountability framework of the former should have an impact on the behavior of the latter.

Perhaps one of the clearest channels through which changes in the provision of this public service could have changed after the reforms is through the financial channel. Before Law 22 most of the investment in the water sector was financed through central government grants or concessionary loans. For instance, between 1994 and 1998 about 91% of the PDAMs funding came from the central government.⁶ However, since the year 2001 all special investment grants were replaced by the DAU and Kabupatens must now decide how much to invest in each sector according to its own judgment. If they regard water and sanitation sector to be functioning in good standard or as the responsibility of the own households or NGOs it may be the case that the sector could end up being under-prioritized and under-funded. On the other hand, if the local government prioritizes water then devolution and accountability might have a positive effect on the sector by increasing the resources devoted to it.

⁵ Several laws and regulations that try to make the service more efficient have been passed. Examples include Regulation 2/1998 (MoHA) which gives guidelines for the establishment of drinking water tariffs by PDAMs; or Regulation 7/1998 (MoHA) that tries to reduce the bureaucracy in the enterprises by preventing the head of the local government to be part of the PDAM's supervisory board and limiting the number of bureaucrats on it.

⁶ Stone and Webster Consultants. Regulatory Framework for Water Supply and Wastewater Enterprises. Final Interim Report.

EMPIRICAL EVALUATION STRATEGY

In theory, the argument that devolution of responsibilities to local governments will improve public service provision is based on the idea that local governments might have better information concerning local needs, tastes and cost structure than the central government has and henceforward could provide these services to better match their respective demand. Nonetheless, these positive aspects of devolution and accountability could be hindered if the resources handed to the local governments are insufficient to cope with all its new obligations, phenomenon known as unfunded mandates.

Similarly, the principal argument leading to the conclusion that the accountability effect is positive is based on the idea that fostering democratic institutions at the local level will give the correct incentives for the executive and legislative branches of the local government to provide public services according to local demand. However, numerous flaws in the democratic process could lead to a negative accountability effect. In particular, if there is a cost for citizens to obtain information about the political process and if these costs are negatively correlated to income, then the introduction of democratic institutions at the local levels won't necessarily lead to better outcomes. In fact, the empirical literature has emphasized that local governments are particularly more prone to local capture with the existence of higher levels of inequality and illiteracy.

The objective of this paper is to quantify both the devolution and the accountability effects that took place in the water sector in Indonesia after the decentralization reforms. To do so we use a rich household survey that provides the necessary evidence to test whether the access and the quality of the water provided by the local governments' enterprises varied.

Given that public service devolution affected all the PDAMs in the country after the 1999 reforms there exists no variation in time or in space of the policy. Hence, any inference carried from a before-after comparison may pick up the effect of some other shock or treatment that are not taken into account and erroneously lead to the conclusion that any observed results in the access or quality of the publicly provided water are being caused by the reforms. In order to overcome such problems, a group that controls for both observable and unobservable effects that may be taking place at the Kabupaten level is needed.

Indonesia's peculiar water sector provides such control group. Specifically, comparing the evolution of access and quality of the water for households that receive and drink water from PDAM with those who rely on other sources constitutes a natural experiment that can evaluate the effect that devolution had in the public provision of water. If the reforms influenced the behavior of both local governments and the PDAMs, it is expected that only the quantity and quality of water provided by these enterprises could have changed while that from rivers or wells should have remained constant.⁷

The form in which the decentralization process was implemented in Indonesia provides a second interesting source of variation both in time and in space in order to evaluate the effect that accountability has on the provision of water services. Due to the exogenous motives previously explained, the head of local governments in some of the Kabupatens changed at different points in time while in others it did not. To test how differences in accountability affect both the access and the quality of the water provided by PDAMs after the devolution process took place two additional control and treatment groups are used. The second treatment group is composed by all households who drink water from PDAMs and who live in Kabupatens where the head of local government was elected by the DPRD. Analogously, the second control group is composed by those households who drink water from PDAMs but who live in Kabupatens where the government head was not elected and where the centrally nominated bureaucrat remained in power.

Based on these treatment and control groups, changes in access are evaluated through two different channels. The first one analyze whether the percentage of the total population served by the local water enterprises (PDAMs) changed after the reforms took place. Even if the total percentage of population served by these companies remained constant, the second strategy determines whether the average characteristics of the households served changed. That is, it evaluates if the water companies are now serving a different type of households. Both changes are quantified through a difference in difference approach where

⁷ It is possible that local governments after devolution embark in environmental projects to restore or improve the quality of the water from natural resources. However, in the Indonesian case this has not been their primary objectives and hence if any such changes have occurred their magnitude would be of second order.

the dependent variable must provide information regarding the access to PDAM service by the different households captured in the survey. The simplest empirical specification used in the paper is given by equation (1) below:

$$PDAM_{j,z,t} = \alpha_1 + \alpha_2 * y03_{j,z} + \alpha_3 * T_{j,z,t} + \alpha_4 * y03_{j,z} * T_{j,z,t} + \alpha_5 * X_{j,z,t} + \lambda_j + \xi_{j,z,t} \quad (1)$$

where $PDAM_{j,z}$ is a dummy variable equal to one if the source of drinking water from household j in Kabupaten z in year t is the PDAM; the variable $y03_{j,z}$ is a period dummy equal to one if the observation of the household is from the year 2003. $T_{j,z,t}$ will capture the tenure that the head of the local government elected by the DPRD in the Kabupaten z has at time t . For instance, if the head of the local government was elected in the year 2000 by the DPRD, $T_{j,z,t}$ will be equal to three for all households from this Kabupaten in the year 2003. If the Bupati from Kabupaten z is still the one nominated by the center then $T_{j,z,t}$ will be equal to zero for all the households who reside in it for both years. The vector $X_{j,z,t}$ captures basic characteristics of household j that resides in Kabupaten z in time t such as age and education of the household head and household consumption expenditure among others. To capture any difference between Kabupatens that are constant in time a dummy for each of them is included and is represented by λ_j . Finally, $\xi_{j,z,t}$ will be an unobserved error that is homoskedastic and uncorrelated across time with the other explanatory variables across all periods.

The coefficients of interest in this regression are two. First, α_2 will capture the aggregate effect that devolution brought to the access of tap water provided by PDAMs in the country. Second, the coefficient α_4 will provide evidence on the effect that accountability changes brought to the access of water services of households in Kabupaten z . To further test whether the characteristics of the households served changed we include in specification (1) interactions of devolution and accountability measures with both household expenditure and household head's level of education.

To test changes in the quality of water provided by PDAMs information on children's health is used. The link between safe water and health outcomes is a widely recognized fact. The World Health Organization estimates that each year there are 1.6 million diarrhea deaths related to unsafe water, sanitation, and hygiene. Among the population, children

under five years of age constitute the most susceptible group to suffer from gastrointestinal diseases caused by poor quality of water due to their weaker body defenses and their lack of knowledge on how to avoid risks. Not surprisingly, the common methodology in policy analysis on this issue uses a difference in difference estimate to compare diarrhea incidence in children from an area affected by a policy change with the incidence of children from an area that was not affected. A clear example of this methodology can be found in Galiani et al. (2005) where they estimate that privatization reforms of water companies in the early nineties in Argentina reduced child's mortality rates between 5% and 7%.

Based on a household optimization problem where utility is a function of children's health outcomes, it can be shown that a demand for children health (H) will emerge. This demand will be a function of child (C), household (Y) and community (Z) characteristics as well as on the type of drinking water used by the household (w), that is $H=h(C, Y, Z, w)$.⁸ For the Indonesian case, an estimating equation that can be used in order to evaluate the effect that devolution and accountability respectively had in the quality of the water provided by the state owned water enterprises will be given by:

$$H_{i,j,z,t} = \gamma_1 + \gamma_2 * y03_{i,j,z} + \gamma_3 * PDAM_{i,j,z,t} + \gamma_4 * T_{i,j,z,t} + \gamma_5 * DEV_{i,j,z} + \gamma_6 * LD_{i,j,z} + \gamma_7 * X_j + \lambda_j + \zeta_{i,j,z,t} \quad (2)$$

where $H_{i,j,z}$ is a dummy variable equal to one if child i in household j , Kabupaten z in year t suffered from diarrhea in the two weeks prior to the survey. The variable $y03_{i,j,z}$ is a period dummy equal to one if the observation of the child's health is from the year 2003 and will capture aggregate factors that affect in the same way the diarrhea incidence of all the children in the sample over time. It is also reasonable to assume that there exist differences between the treatment and control groups even before the decentralization process occurred. Hence, two additional variables are included. First, to capture possible differences between households we include $PDAM_{i,j,z}$ which is a dummy variable equal to one if the source of drinking water of child i who lives in household j and Kabupaten z is tap water and zero otherwise. Second, $T_{i,j,z,t}$ will capture general differences among Kabupatens where the local head was elected by the DPRD and those where it was still that

⁸ For a literature review on the subject please refer to Strauss and Thomas (1995).

nominated by the center. Finally, $\zeta_{i,j,z,t}$ will be an unobserved error that is homoskedastic and uncorrelated across time with the other explanatory variables across all periods.

The average effect that devolution brought to the quality of the water provided by the PDAMs will be captured by the coefficient ς where DEV is the interaction between the $PDAM_{i,j,z,t}$ dummy and the year 2003 dummy. The effect of changes in local democracy will be captured by the coefficient ς where LD is the interaction between $PDAM_{i,j,z}$, $y03_{i,j,z}$ and $T_{i,j,z}$. As mentioned before, devolution and accountability changes could have different effects on the behavior of the various actors in the water sector. For instance, the lack of money and the negative financial position of the water local enterprises may induce all local governments to reduce costs by lowering the quality of the treatment made to the water. However, this effect could be smaller in Kabupaten where the head of local government was elected by DPRD if the politicians feel that their constituents consider water quality of PDAMs an important factor that could influence their re-election possibilities.

DATA

In order to test the effect that the devolution and accountability changes had on the access and quality of the water delivered by the public enterprises in Indonesia information from the SUSENAS household survey is used. This is a yearly socioeconomic survey carried out by the Indonesian government in conjunction with the RAND Institute. Since the year 1993 it covers a nationally representative number of households in the country containing on average approximately two hundred thousand households per round. The survey provides detailed information of all members in the household such as their age, sex, education, health and labor status; as well as on characteristics of the house they live in, its location, type of infrastructure it has and the property status among others.

This paper uses information from the 1998 and 2003 survey rounds. This choice rests on the fact that while the former year captures the situation in the water sector just before the reforms started to take place, the latter one provides information from four years after the reforms were implemented allowing sufficient time for any change to be observed. Given the fact that PDAM service is mostly intended to serve the urban population and only 10%

of the rural population is served by them, for the remaining of the paper only information for households residing in urban areas will be used. It is also worth mentioning that Jakarta and the Aceh region were also excluded from the study. Jakarta was excluded due to the fact that the water utility company of the city is not under the local government supervision since it was given in concession to an international company. Aceh was excluded from the study because violent conflicts present in the region did not allow the complete collection of data at the time of the surveys. Finally, given that the empirical strategy analyses children under five years of age reside, only information from households where children of this age range reside is used. This restricted sample contains a total of 29,705 and 36,069 households in 1998 and 2003.

In order to construct the first treatment and control group information on the type of water drank by these household is needed. Even though there is no specific question in the SUSENAS survey that directly determines whether households rely on PDAM service to obtain their drinking water, a combination of information from three different questions can be used to infer the primary source of drinking water that each household has. The first question asks households about their drinking water source. Table 1 shows that even though a considerable number of households obtain their drinking water from the tap; almost sixty percent of them rely on wells or other natural sources such as springs or rivers to obtain it. The second question used provides information on how households obtain this water, specifically it asks them whether they buy it or not.⁹ The percentage of households that bought their drinking water in the year 1998 and 2003 respectively were 42% and 45% and are observable in Table 2. Finally, the third question used asks households whether their drinking water facility is private, shared, public or none. The responses to this last question are displayed in Table 3.

⁹ It should be noted that this question changed slightly from one year to the other. In the 1998 survey, the households had two possible answers for this question: buy or not buy. In the year 2003 the possibilities of answers increased to three: subscribe, not subscribe or do not buy. Since it is impossible to obtain information of which households from the 1998 survey had a subscription to water services, in order to have comparable groups in the two years the subscribers and non subscribers in the year 2003 were collapsed in only one group.

Following the definition set by the Indonesia's Central Planning Agency (Bappenas), a household that answers that their source of drinking water is the tap, that it buys it and that it has a private drinking water facility is considered to obtain its drinking water from the PDAMs. Based on this we obtain our first treatment and control group. Specifically, the control group will be composed by children between zero and five years of age who's principal source of drinking water are PDAMs. The treatment group will be all other children who rely on other sources to obtain their drinking water. Specifically, the percentage of PDAM users in each year is 23% and 26% respectively.

The second treatment and control groups are constructed based on the political information of the Kabupatens. As previously explained, in some Kabupatens the head of the local governments was elected by their respective DPRDs while in others the same bureaucrat nominated by the center remained in power. The timing of the election was different in each Kabupaten and varied depending on the number of years that each Bupati nominated during the centralized era had been in power. Only after their five year period on the job had elapsed was it possible for the DPRD to elect a new head of the local government. These electoral rules in Indonesia implied that in the year 2003 only 62% of the Kabupatens were able to elect their head of local government which created a political variation in time and in space across the country.

Table 4 presents detailed information on the distribution of the population used in this paper that reside in the different Kabupatens depending on the specific year in which the Bupatis were elected by their DPRDs. As can be observed, for the 1998 survey almost 40% of the households lived in Kabupatens were by 2002 the Bupati would still be the one nominated by the central government. The year in which most of the Bupatis changed was in year 2001 (35%) while the next year fewer Bupatis were elected by the DPRDs (4%). A very similar distribution of households according to this change in local government is obtained for the 2003 survey.

This information is complemented by children and households' socioeconomic characteristics. The mean and standard deviation of the controls used in the paper are depicted in Table 5.

IMPACT ESTIMATES

In order to evaluate whether devolution and accountability changes introduced by the decentralization reforms in Indonesia influenced the access and quality of the water provided by PDAMs in the present section we carry out the probit estimations suggested in the empirical strategy section.

Changes in the access to PDAM services

According to the definition of PDAM access given by the Bappenas office, Graph 1 depicts the evolution of the percentage of households that relied on the public water enterprises for the provision of drinking water during the period 1996-2003. The sample is divided according to the type of Kabupaten in which they live depending on whether or not the head of the local government had changed. As can be observed, on average the access to PDAM drinking water throughout the period is higher in Kabupatens where the head of local the government was elected by DPRD than in those where it was not. The graph also shows that after the decentralization reforms took place, there is a tendency to decrease the households' access to such service.

However, this simple graph does not give us information on whether or not devolution and accountability affected the provision of public water in Indonesia and a more rigorous exercises needs to be carried out. As mentioned before, there are two channels through which devolution and accountability could have affected the access to public water services in Indonesia: changes in the total percentage of the population served or/and changes in the characteristics of such population. To test this we carry out specification (1) and its results are depicted in Table 6.

As shown in Table 6 household's characteristics do influence the probability of relying on PDAMs as the source of drinking water. In general, it appears that households from a higher socioeconomic level have access to this service given that the level of household per capita expenditure, the level of education of the head and its age all have a positive effect in explaining the usage of this service. The same can be told by the quality of the house they reside. Having a

private toilet facility and a septic tank increases the probability of being served by the PDAMs.¹⁰

More importantly, Model 1 in the same Table provides evidence that suggests that the probability that a given household drinks water from PDAM has not significantly changed after the decentralization reforms were undertaken. The coefficient on the year dummy is not significant at any reasonable level implying that the access to such services did not change on the four years after the decentralization reforms devolved to the local governments the provision of such services. Given that the coefficient associated with the tenure of local government is not significant either it implies that the probability of access is not different between Kabupatens that changed and did not change local governments once its fixed characteristics are controlled for. Finally, changes in the local democracy functioning and hence in the accountability framework have not significantly affected the access to this service either given that the interaction between the year dummy and the tenure of the head of local government is not significant.

Finally Table 6 also shows that there was no change in the access to this service according to the households' per capita expenditure or education either. Models II and III include the interaction of these two characteristics with the year dummy and the tenure of local government respectively. Finally, Model IV incorporates booth interactions simultaneously. As can be observed, in no specifications are the interactions significant suggesting that the average household served by the government water enterprises remained constant along the five years studied also.

Results from Table 5 are expected given the fact that changes in the level of access of a service such as water provision requires significant investments of resources and time devoted to the renovation and expansion of the necessary infrastructure that can probably only be observed in the long run. This result actually favors the evaluation of changes in the quality of the water provided by PDAMs carried in the next subsection given that no major change in their customers occurred after the reforms were undertaken. This of course

¹⁰ Robust Standard errors, corrected by cluster at the Kabupaten/year level are reported in all tables. Although not reported clusters at the province level were also carried out. The results obtained are very similar to the ones described in this paper and are available by request.

implies that the probability and average characteristics of control and treatment groups across the two years remained constant and our empirical strategy is a valid one.

Changes in the quality of water provided by the PDAMs

As explained in the previous section the second channel through which decentralization reforms may have influenced the PDAMs is through changes in the quality of the water provided by them. In this paper we proxy this quality by the incidence of diarrhea of children under five years of age. Graph 2 depicts its evolution according to the source of drinking water and the political characteristics of the Kabupaten in which the households reside. As expected, it can be observed that on average children who drink water from PDAM have lower diarrhea incidence than children who drink water from other sources such as wells, rivers or springs. One explanation for this result could be the fact that while PDAM water can be subject to some type of treatment, water from wells and rivers are not. More importantly, it has been previously established that several wells are located close to septic tanks which significantly reduces the quality of its water and increase the likelihood of digestive diseases (Brodjonegoro, 2003).

Comparing the diarrhea incidence of children that drink water from PDAM but reside in different types of Kabupatens it can be observed that before decentralization the incidence in both types of Kabupatens was very similar and moved in the same direction almost every year. However in the year 2000 this pattern changed and while the incidence of children in Kabupatens where the head of local government was elected by DPRD increased, the incidence in the other Kabupatens decreased. During the same period of time the incidence of children that drank water from other sources also increased in both types of Kabupatens.

Again, the information on this graphs needs to be complemented by more rigorous econometric exercises. In order to estimate the effect that both devolution and accountability had in the quality of the water provided by the public enterprises in Indonesia a triple difference approach is undertaken. Specifically we carry out equation (2) under a probit model. The coefficients obtained are reported in Table 7 where control variables are gradually added to the first simple regression in order to obtain unbiased and consistent estimates and increase their efficiency.

The first model in the table provides the average impact that both devolution and accountability had in the quality of the water having only the Kabupaten fixed effects as control variables. The first three variables from Model I correspond to dummies that respectively capture if a child under five drinks water from PDAM, was interviewed in the year 2003 and the tenure that the elected head of the local government where he resides has as of year 2003. As expected, given the information shown in Graph 2, the coefficient on drinking water from the public water enterprises is negative and highly significant. This implies that independent of the year of the survey the probability of a child suffering from diarrhea given that he or she drank the water provided by the PDAMs was significantly lower than those who drank water from other sources. Model I also provides evidence that there is no significant difference in the incidence of children's diarrhea between the two years studied, that is, the average incidence of this illness remained constant across the two years. Similarly, there is no difference in incidence between children that reside in Kabupaten where the head of local government was elected by the DPRD and those where it was still nominated by Ministry of Home Affairs after controlling for fixed effects at the municipality level.

The fourth variable corresponds to the interaction between drinking water from the PDAM and the dummy for the year 2003. Since the devolution of responsibilities was given to all Kabupaten in the country, this coefficient estimates the impact that this aspect of the reforms had in the quality of drinking water provided by the PDAM. As can be observed, the coefficient is not significant implying that there was no significant effect of devolution on the quality of the water provided by PDAMs compared to that obtained from natural resources after the decentralization reforms were implemented. However, the coefficient of the interaction between drinking water from the PDAM and the tenure that a newly elected head of local government has is positive and significant. This suggests that for the Indonesian case, the quality of the water provided by the PDAM in Kabupaten where the head of local government was chosen by DPRD decreased in comparison to those in which the local government did not change. Children who drink the water provided by the state-owned enterprises after Law 22/1999 passed and reside in Kabupaten faced with the new accountability framework are 1% more likely to suffer from diarrhea. Given that on

average 2.22% of these children suffer from this gastrointestinal disease the latter result implies that the diarrhea likelihood increased by more than 40%.¹¹

This negative result in the quality of the PDAM water is not a surprising one given the fact that "national newspapers keep publishing how infrastructures are deteriorating all over Indonesia and how the local governments pay little attention to the quality improvement of public service delivery." (Brodjonegoro, 2004) Furthermore, an examination of the fiscal data available suggests that the level of resources invested in this sector by the local governments has decreased since 1999. For instance, while the average spending in the "Housing and Settlement" sector, which is in charge of the healthy water supply and processing program, in the two years previous to the reforms was around 8% of total development spending in the two years after them it decreased to 7%.

Models II through IV in Table 7 include additional controls such as children and household's characteristics in order to reduce any potential bias that may exist due to omitted variables. The most important characteristics of the child that should be taken into account are their age and gender. It is recognized that older children will have a more developed immunological system and are more resistant to infectious diseases; hence the older they are, the lower their probability of suffering diarrhea. The evidence also suggests that boys have a higher probability of suffering from this disease.

One important household characteristic that should be taken into account is the level of income of the household. It is normally believed that wealthier households can provide the child with a nutritious diet and a cleaner and safer environment that help improve their health outcomes. Household monthly per capita expenditure was used as a proxy for income and the results can be seen in Model III of Table 7. However, for the Indonesian case it can be observed that the level of income of the household although significant, has a positive impact in the likelihood of a child to suffer from diarrhea. Other researches in health economics have found that self reported measures of health could be correlated with some individual characteristics, such as income. Some of these studies find that richer

¹¹ An F-test for this model shows that devolution and accountability are jointly significant since the likelihood ratio test allow us to reject the null hypothesis (i.e, LR value was 12.95).

households report more about health problems than poorer ones. Hence it is possible that our positive coefficient on household expenditure is picking this effect, given that we use self reported data on diarrhea outcome. Numerous studies in the health literature have tried to assess the importance that parent's education have in their child's health outcome. It is believed that parents, specially the mother, are the most important health workers in the household and their education may have both knowledge and income effects that need to be accounted for. Due to the structure of the SUSENAS questionnaire, it is not possible to identify with certainty which member of the household is the father and mother of the child. We therefore opt to control for the education of the head of the household and assume that they are a good proxy of the parent's education. Even though we acknowledge the fact that this variable is not a perfect proxy, it has a significant effect in reducing the probability of a child under five years old to experience diarrhea. Interestingly, we also find out that children that live in households where the head of the household is older are less prone to have gastrointestinal problems.

Model IV reports the results controlling for other household's place of residence characteristics that may affect children's health outcomes. They include the type of toilet facility households have and their final disposal method. It is found that children who live in households where the toilet facility is private and the final disposal is made in a septic tank as opposed to a pond, a hole or a river have lower probability of having diarrhea.

It should be noted that throughout all the models the basic results are maintained. On average, the devolution of responsibilities of public service provision to local governments did not alter the quality of water provided by the local enterprises. However, the tenure of the head of the local governments that were elected by their respective DPRD appears to have a negative effect in the quality of the water publicly provided.

This paper does not study the mechanisms through which this result emerges and leaves this topic for future research. However, plausible channels can be discussed. For instance, Bardhan and Mookherjee (2000, 2005, 2006), have drawn attention to the political economy trade-offs that can arise under this setting, such as the low ability of local governments, unfunded mandates and local capture. Under these ideas we discuss three different alternative explanations for the results found. The first possible explanation is

lower technical capacity of local governments. Specifically, the lack of experience from the newly elected government could be driving these results. It is a known fact that central government officials are better trained and have more experience running government affairs. It is natural that this first cohort of local governments have an inferior performance due to the learning process involved in administering local affairs and the negative effect could be driven by this channel. It does not appear to be a problem of unfunded mandates given that if this was the case we should have seen the same result in all Kabupatens irrespective of whether or not they changed their local government.

A second explanation could be that of local capture. It could be the case that under the new political and administrative framework incentive for collusion between DPRD and the head of local government emerged. If this was true, given that the body supposed to monitor local affairs is the DPRD bad governance might go unpunished. In theory this behavior would not hold because of democratic pressures on DPRD members will make it deviate from such pervasive behavior. However, if there is a malfunctioning of local democracy or any problems of local accountability this conduct could hold. One of the main problems of accountability diagnosed with the 1999 elections, but that changed for the 2004 elections, emerged from the system of closed party list. In this system, voters vote for a party and seats on legislative body are proportionally assigned to the parties according the amount of votes each party had. Consequently, the voters have no ex-ante information on the identity of its legislators creating a distant link between them. Monitoring a group of representative makes the task much more costly and impersonal for the people. Moreover, under this arrangement legislators could have incentives to get involved in central parties politics instead of learning about local needs and demands given that central party executives will assign their seats. Hence, it could have been the case that from the 1999 election and the decentralization reforms emerged a system of local representation in which the control and the links of the voters over its representative were very weak.

Finally, the last possible explanation for the results found is that households in Indonesia are unwilling to use the service provided by PDAMs due to its bad service history and hence the newly elected local governments are just complying with the desire of its constituents and investing monetary and time resources in other sectors of the economy.

That is, the decrease in the quality of publicly provided water goes in hand with what constituents desire. Bali's history of publicly provided water gives anecdotal evidence on this last argument. In the early eighties Bali became a wide known sophisticated resort site. Given the amount of influx of people from developed countries infrastructure investments were made necessary in order to stimulate this island main activity, tourism. Investments in the water sector were significant, both in infrastructure and in water treatment, which allowed the island to have potable publicly provided water. Nonetheless, since population was still used to boiling water and relying on wells to obtain their drinking water, there was a low demand for the PDAM potable water. After a while, this low demand induced the PDAM to stop using the resources to provide high quality piped water and by 2004 the island was again without this valuable service.

Robustness checks

In order to check the validity of the results previously explained two additional experiments were carried out. The same regressions of Table 7 were run using as dependent variable alternative health outcomes, namely cough, asthma and accidents. The reason for this choice of health outcomes is twofold. First, the incidence of asthma or accidents in the population is not related with the quality of water and hence it could first give us evidence of whether the results found are spurious or not. Second, it could be the case that devolution and accountability somehow improved health awareness or health services in the Kabupaten inducing households to use more their services or report more illness. It is hard to imagine how asthma or accidents can be influenced by governments given that the former mainly depends on genetic or environmental conditions hard to change in the short run, while the latter depends on the care the household gives to their children under five years of age. Therefore the rationale for these exercises is to rule out that other sources might be driving the results found.

Table 8 displays the results for asthma, accidents and cough regression. In all regressions none of the estimated coefficients of interest are significant. This result implies that, at least for these outcomes, there are no systematic changes in the probability of having cough, asthma or accidents before and after the decentralization reforms were implemented given the source of drinking water that each child has. More importantly, these last results

provide evidence in favor of the hypothesis that effectively the quality of the water provided by the PDAMs decreased after the decentralization reforms took place.

CONCLUSIONS

Even though several empirical studies have tried to evaluate the effect of decentralization reforms around the world, to the best of our knowledge this paper is the first attempt that seeks to disentangle the separate effect that devolution and changes in local democracy introduced by such reforms may have in the provision of public services in a country. The characteristics of the reforms implemented in the late nineties in Indonesia united with its peculiar water sector allows for such an exercise to be carried out.

In 1999 Indonesia launched one of the most comprehensive decentralization programs up to date comprising fiscal, political and administrative reforms. In less than two years around two thirds of the civil servant force of 3.9 million was reallocated from the central to local governments, all local governments became responsible for the provision of public services and their participation on public spending almost doubled. Furthermore, in some of these Kabupatens the political arrangements, specifically the relationship between the head of local government and the legislative body, also changed. Using a rich socioeconomic household survey and concentrating in the public provision of water services, this paper finds that the final effect of decentralization reforms crucially depends on the political institutions in place. Even though no significant change in the access of the population to this publicly provided service was found, suggesting that the average characteristics of the pool of PDAM users remained constant along the period, an interesting change in the quality of the water provided was revealed. Using the incidence of gastrointestinal diseases on children under five years as a proxy for water quality, we find that the devolution of responsibility and resources had no impact on the water quality provided by the local enterprises. However, in those Kabupatens where an accountability change also took place a significant increase in the incidence of diarrhea suggests that the combination of devolution and accountability reforms worsened the quality of PDAM's water provision.

In terms of policy debate it is clear that the effects of decentralization crucially depend on the political and administrative framework in place. For the Indonesian case we find that it

is the combination of both political and administrative reforms the key to obtain a change in behavior. Future research should try to identify what are the specific channels through which both devolution and accountability acts and how they can improve public service provision.

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TABLES

Table 1

Source of Drinking Water (in percentages)

	Year	
	1998	2003
Bottled Water	1.21	2.57
Tap Water	41.6	37.69
Pump	13.46	14.77
Protected well	29.22	30
Unprotected well	8.44	7.01
Protected spring	1.81	2.58
Unprotected spring	0.66	0.89
River	1.16	0.92
Rain Water	2.13	3.09
Others	0.33	0.48
Number of Children under five	30,452	36,068

Source: SUSENAS 1998, 2003

Table 2
Obtaining Drinking Water Method (in percentages)

	Year	
	1998	2003
Purchase	41.5	44.59
Not purchase	58.5	55.41
Number of Children under five	30,452	36,068

Source: SUSENAS 1998, 2003

Table 3
Property status of the Drinking Water Facility (in percentages)

	Year	
	1998	2003
Private	60.71	61.98
Public	22.5	20.78
Shared	11.04	6.16
None	5.75	11.09
Number of Children under five	30,452	36,068

Source: SUSENAS 1998, 2003

Table 4

Location of Children According to change in the Kabupatens' local government (in percentages)

	Year	
	1998	2003
Percentage of children that live in Kab. where		
<i>Head of Local Government did not change</i>	41.1	37.77
<i>Head of Local Government was elected in 1999</i>	8.05	7.46
<i>Head of Local Government was elected in 2000</i>	10.58	9.87
<i>Head of Local Government was elected in 2001</i>	35.93	40.17
<i>Head of Local Government was elected in 2002</i>	4.34	4.74
Number of Children under five	30,452	36,068

Source: SUSENAS 1998, 2003

Table 5

Descriptive Statistics Control Variables

	Mean	Standard Deviation	Minimum	Maximum
Childs' Age	2.59	1.67	0.00	5.00
† Male	0.52	-	0.00	1.00
Household per capita expenditure	160987.90	157577.40	13400.67	21300000.00
Head of Household Education	3.44	1.90	0.00	9.00
Head of Household Age	38.44	10.67	12.00	98.00
† Head of Household Male		-	0.00	1.00
Number of Children in Household	1.19	0.64	0.00	6.00
† Private Toilet Facility	0.70	-	0.00	1.00
† Septic Tank	0.60	-	0.00	1.00

Source: SUSENAS 1998, 2003

Table 6
Dependent binary variable: PDAM Access

	Probit Regressions			
	Model I	Model II	Model III	Model IV
† Devolution (Year 2003)	-0.044 [0.060]	-0.053 [0.074]	-0.046 [0.061]	-0.046 [0.074]
Tenure of Elected Head of Local Government (TEHLG)	-0.373** [0.080]	-0.375** [0.079]	-0.372** [0.079]	-0.372** [0.079]
Accountability (y03*TEHLG)	-0.009 [0.019]	-0.002 [0.027]	0.012 [0.018]	0.012 [0.029]
Accountability*Household per capita Expenditure		0.000 [0.000]		0.000 [0.000]
Accountability*Head of Household Education			-6.00E-03 [0.005]	-6.00E-03 [0.004]
Household per capita expenditure	0.000** [0.000]	0.000** [0.000]	0.000** [0.000]	0.000* [0.000]
Head of Household Education	0.106** [0.008]	0.105** [0.008]	0.113** [0.009]	0.113** [0.009]
Head of Household Age	0.009** [0.001]	0.009** [0.001]	0.009** [0.001]	0.009** [0.001]
† Head of Household Male	0.195** [0.028]	0.195** [0.029]	0.193** [0.029]	0.193** [0.029]
Number of children in Household	0.009 [0.020]	0.009 [0.020]	0.010 [0.020]	0.010 [0.020]
† Private Toilet Facility	0.915** [0.048]	0.915** [0.048]	0.915** [0.049]	0.915** [0.049]
† Septic Tank	0.215** [0.078]	0.215** [0.078]	0.215** [0.078]	0.215** [0.078]
Log Likelihood Ratio	-24474	-24474	-24470	-24470
Pseudo R2	0.246	0.246	0.246	0.246
Number of Observations	65,191	65,191	65,191	65,191

All specifications include Kabupaten fixed effects.

† Denotes dummy variables.

Robust Standard errors corrected by cluster at kabupaten/year level are in parenthesis

(+), (*) and (**) Denotes significance level at 10%, 5% and 1% respectively.

Sources: Susenas 1998 and 2003

Table 7
Dependent binary variable: Diarrhea Incidence in Children under Five years of Age

	Probit Regressions			
	Model I	Model II	Model III	Model IV
† PDAM Access	-0.209** [0.049]	-0.215** [0.046]	-0.182** [0.062]	-0.146* [0.063]
† Year 2003	0.044 [0.056]	0.050 [0.058]	0.044 [0.062]	0.047 [0.061]
Tenure of Elected Head of Local Government (TEHLG)	-0.150** [0.027]	-0.131** [0.023]	-0.134** [0.023]	-0.130** [0.020]
Devolution (y03*PDAM)	-0.103 [0.096]	-0.091 [0.091]	-0.104 [0.090]	-0.108 [0.094]
Tenure*Year2003	-(0.004) [0.022]	-(0.002) [0.021]	-(0.001) [0.023]	-(0.001) [0.023]
Local Democracy (y03*PDAM*TEHLG)	0.078+ [0.044]	0.077+ [0.043]	0.077+ [0.045]	0.077+ [0.045]
Age		-0.121** [0.007]	-0.125** [0.009]	-0.125** [0.009]
† Male		0.071** [0.020]	0.074** [0.021]	0.074** [0.021]
Household per capita expenditure			0.000+ [0.000]	0.000* [0.000]
Head of Household Education			-0.017 [0.014]	-0.006 [0.015]
Head of Household Age			-0.003 [0.002]	-0.002 [0.002]
† Head of Household Male			0.007 [0.051]	0.010 [0.051]
Number of children in Household			-0.032 [0.026]	-0.032 [0.026]
† Private Toilet Facility				-0.111** [0.030]
† Septic Tank				-0.057 [0.040]
Log Likelihood Ratio	-8340	-8150	-7997	-7981
Pseudo R2	0.045	0.066	0.067	0.069
Number of Observations	64,755	64,755	63,829	63,829

Ho: Devolution=Local Democracy=0: F=12.95

All specifications include Kabupaten fixed effects.

† Denotes dummy variables.

Robust Standard errors corrected by cluster at kabupaten/year level are in parenthesis

(+), (*) and (**) Denotes significance level at 10%, 5% and 1% respectively.

Sources: Susenas 1998 and 2003

Table 8

Dependent binary variable: Accident and Asthma Incidence in Children under Five years of Age

	Probit Regressions		
	Cough	Accident	Asthma
† PDAM Access	-0.009 [0.046]	0.192 [0.192]	0.098 [0.106]
† Year 2003	0.026 [0.029]	0.175 [0.309]	-0.074+ [0.045]
Tenure of Elected Head of Local Government (TEHLG)	-0.067 [0.050]	0.060 [0.037]	0.205 [0.195]
Devolution (y03*PDAM)	-0.053 [0.085]	-0.078 [0.429]	-0.216 [0.149]
Tenure*Year2003	(0.018) [0.012]	-(0.096) [0.099]	(0.005) [0.020]
Accountability (y03*PDAM*TEHLG)	0.004 [0.022]	0.008 [0.083]	0.018 [0.047]
Age	-0.017** [0.005]	0.035 [0.037]	0.033* [0.013]
† Male	0.010 [0.025]	-0.213+ [0.112]	-0.022 [0.048]
Household per capita expenditure	0.000* [0.000]	0.00E+00 [0.000]	0.000** [0.000]
Head of Household Education	0.000 [0.003]	-0.015 [0.017]	-0.003 [0.016]
Head of Household Age	-0.005** [0.001]	-0.006 [0.005]	0.005 [0.003]
† Head of Household Male	0.121** [0.039]	0.310 [0.234]	-0.080 [0.138]
Number of children in Household	0.033* [0.015]	-0.104 [0.069]	0.020 [0.036]
† Private Toilet Facility	-0.020 [0.015]	-0.043 [0.179]	0.002 [0.070]
† Septic Tank	-0.051 [0.034]	0.219+ [0.130]	-0.139** [0.049]
Log Likelihood Ratio	-31464	-269	-1361
Pseudo R2	0.030	0.085	0.048
Number of Observations	65,541	17,630	44,475

All specifications include Kabupaten fixed effects.

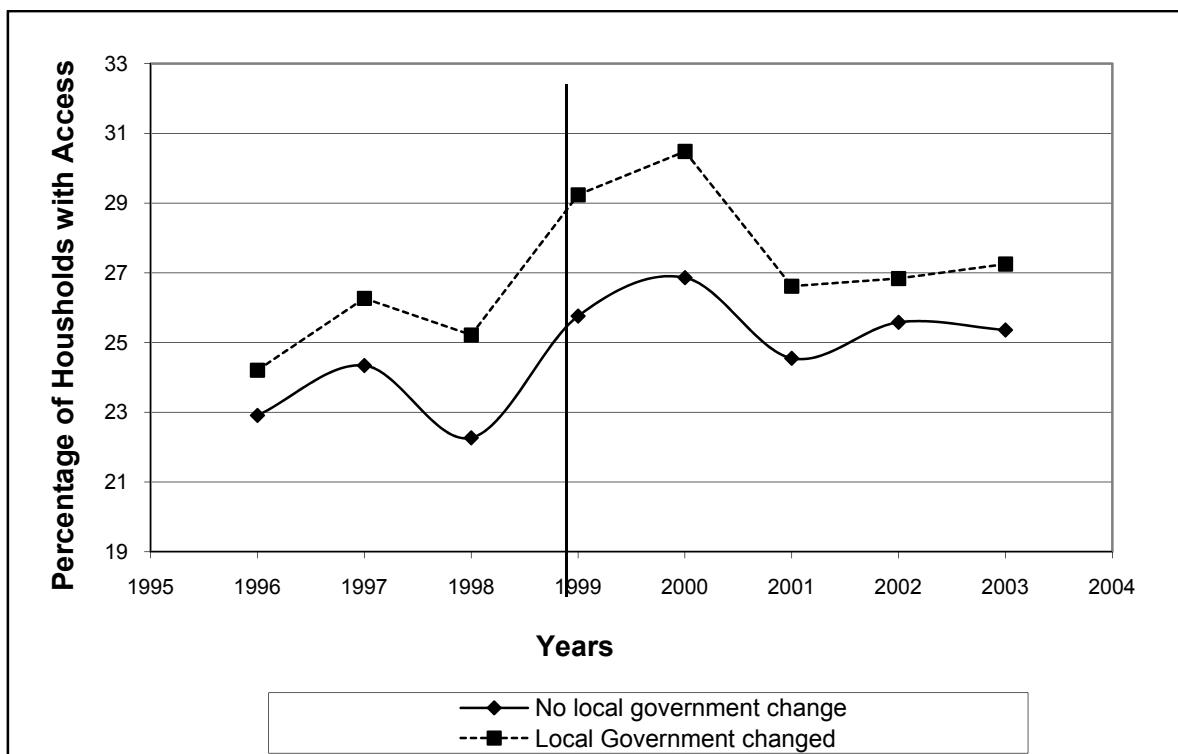
† Denotes dummy variables.

Robust Standard errors corrected by cluster at kabupaten/year level are in parenthesis

(+), (*) and (**) Denotes significance level at 10%, 5% and 1% respectively.

GRAPHS

Graph 1: Evolution of Households' PDAM Access



Graph 2: Evolution of Diarrhea Incidence of Children Under Five Years of Age

