Corruption and the Effectiveness of Imported Antiretroviral Drugs in Averting HIV Deaths

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Abstract

This paper looks at the impact of corruption on the effectiveness of antiretroviral drugs in preventing deaths due to HIV and the potential channels that generate this relationship. This is based on a unique panel dataset of countries in sub-Saharan Africa, which combines information on all imported antiretroviral drugs from the World Health Organization's Global Price Reporting Mechanism with measures of corruption and estimates of the HIV prevalence and the number of deaths in each year and in each country. Countries with higher levels of corruption experience a significantly smaller drop in HIV deaths as a result of the same quantity of ARVs imported. This is followed up with a single case-study from Kenya to illustrate one potential mechanism for the observed effect, demonstrating that disproportionately more clinics begin distributing ARVs in areas that are predominantly represented by the new leader's ethnic group.

1 Introduction

Today antiretroviral drugs are widely available in sub-Saharan Africa, with 8 million people receiving treatment in 2011 according to the World Health Organization. Until the last decade, this level of provision was considered inconceivable as the drugs were prohibitively expensive, and this enormous expansion in access has been credited with extending the lives of millions of people across the continent. At the same time, corruption in governments is associated with inefficient distribution of public goods, and this could limit the effectiveness

of imported drugs in saving lives if the drugs do not reach the intended clinics or individual recipients, or if they are distributed with insufficient guidance.

This paper addresses the role of corruption in determining the effectiveness of antiretroviral drugs in reducing HIV mortality in sub-Saharan Africa. This is first done using a cross-country analysis comparing the impact of imported drugs on HIV deaths across countries with different levels of corruption. This is done using an original panel dataset of countries in sub-Saharan Africa from 2000-2007. This dataset combines standard measures of corruption used in economics and political science, information about HIV prevalence and deaths, and records of the quantities of antiretroviral drugs imported into each country. Using year and country fixed effects, this data provides evidence that HIV deaths are reduced less in corrupt countries given the same quantity of medicine, and the effect is even larger if the relevant quantity of drugs is measured in dollars spent.

There are many channels through which corruption could influence the effectiveness of health investments. For example, drugs can be purchased and then diverted either outside the country or within the country. The supply chain can fail if governments with higher levels of corruption are generally less capable of delivering public goods. Additionally, corruption within a government can facilitate targeting of public goods, not based on need, but based on political or other motivations.

Diversion of drugs could happen if drugs purchased by governments are resold. This could be particularly lucrative in sub-Saharan Africa for two reasons. First, in nearly all countries of sub-Saharan Africa, supply is not nearly sufficient to meet demand and so treatment is rationed. This makes resale valuable because some of those excluded are likely to be willing to pay for the treatment. Second, because of international agreements with pharmaceutical companies, ARVs are sold at an enormous discount to governments and NGOs working in many countries in sub-Saharan Africa. This variation in price between different countries creates a substantial opportunity for arbitrage.

Such diversions prevent the drugs from reaching those who need them most, and they

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may take them out of the country entirely. It should be noted that if these drugs are sold to others within the same country, then a change in allocation may not reduce the overall reduction in mortality. However, if they are diverted to those who need them less - perhaps to those for whom the disease has not progressed as far and their risk of opportunistic infection is reduced or to those who have another source and want the security of accumulating a buffer stock - then this will prevent the drugs from having the same national impact on HIV-related mortality.

Studying the impacts of corruption in the context of ARV provision is particularly appropriate for a few different reasons. First, many important outcomes may be only indirectly linked to welfare, whereas the relevant outcome in this study of deaths averted is clearly of direct importance. Second, during this time period there was virtually no domestic production of Antiretroviral Drugs and there is no substitute for these treatments. The next best alternative (good nutrition and treatment and prevention of opportunistic infections through antibiotics) does not have nearly the impact on morbidity and mortality that these drugs do. Therefore, while other studies that look at corruption and goods provision will be unable to measure the entire supply of those goods, this is possible in this case.

Corruption in government could also limit the effectiveness of local supply chains in a number of ways. If promotion within the public sector is not based on performance, there is less incentive for employees to manage transport or work hard at health facilities. Thus the drugs may remain in the country, but sit unused. Similarly, if health facilities are plagued by high absenteeism, drugs may either sit idly or be prescribed with insufficient guidance so that clients are less likely to adhere. Because of its quick rate of mutation HIV is particularly susceptible to the development of drug resistance due to low adherence to the prescribed regimen.[1].

An additional channel through which corruption could influence the impact of imported drugs is through changing allocations within a country. Guaranteeing treatment to those

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[1]It should be noted that adherence to HIV treatment regimens is generally measured to be quite high in developing countries (Mills et al. (2006))

who have low CD4 counts and therefore have the most compromised immune system is the most efficient way to immediately avert deaths using ARVs. However, there is also a benefit to an individual of treatment before the CD4 count is extremely low, and the World Health Organization recently increased the recommended CD4 count threshold of eligibility from 200 to 350. With the higher threshold, demand for the drugs increases and without sufficient supply, other systems of allocation besides targeting those with the lowest CD4 count arise. One notable alternative system of allocation of any health expenditure is political favoritism, including, for example, targeting core supporters or co-ethnics.

Using data from Kenya about ARV provision before and after an election, I test for politically motivated targeting of new ARV clinics in one country with high estimated corruption levels and high HIV rates. This is done using an original dataset containing all health facilities in Kenya that provide antiretroviral drugs, along with the year in which they began distribution and their GPS locations. This information is linked with ethnicity records to look for evidence of targeting of the placement of ARV clinics in the home area of a newly elected political leader. I find that there are disproportionate clinics opened in areas of the leader's ethnic group. This suggests one mechanism through which corruption reduces the impact of health inputs. Namely, in a country with high corruption, the assignment of ARV clinics follows a political criterion rather than a public health criterion. Further, this pattern of allocation appears to reflect additional clinics added to areas that were already served rather than expanding access to districts that were underserved previously.

This paper is organized as follows. Section 2 discusses the relevant literature and explains how this paper contributes to it. Section 3 outlines the data to be used for the main specification and for the analysis of the case study of Kenya. Section 4 presents the empirical strategy and the results of the cross-country analysis and section 5 discusses the methodology and results of the case study. Section 6 concludes.

2 Literature review

Corruption and patronage have long been noticed as an important barrier to effective government provision of services (see for example Mauro (1995) and Bardhan (1997)). Specifically focusing on health, this link between corruption and inefficient provision of services has been used to explain weak observed associations between health spending and health outcomes (Filmer et al. (2000), Rajkumar and Swaroop (2008), and Lewis (2006)).

Some researchers have pointed out that one concern with many studies linking health expenditures to outcomes is an insufficient appreciation for displacement of private spending as a result of public investment (Filmer et al. (2000), Mauro (1995), and Pritchett (1996)). One driver of this issue is that in many cases, researchers have access to information about what is provided through the public sector, but it is difficult to obtain a complete record of private provision of goods. This is a relative strength of this paper, because the measure of the quantity of antiretroviral drugs comes from information about international imports and should therefore represent the entire flow of antiretroviral drugs into each country to be distributed both through the public and private sectors.

To complement the literature demonstrating links between levels of corruption and poor outcomes, there is another strand of literature addressing the potential mechanisms.

Absenteeism and mismanagement are commonly addressed channels (Lewis (2006), Vian (2008)). In a system in which government employment and promotions depend on political patronage or bribes, both the selection and the incentives of public sector workers are limited. A large literature discusses the threats to health outcomes from health worker absence including Banerjee and Duflo (2006), Chaudhury et al. (2006), and Banerjee et al. (2008). Specific to antiretroviral drugs, a number of papers have shown the impacts of health-worker absence on long-run impacts of HIV positive individuals, including through transmission from mothers to children (Goldstein et al. (2013)) and HIV testing (Goldstein et al. (2008)).

Health-worker absence will threaten outcomes if the drugs reach the health facilities where they are to be distributed, but another threat comes from breakdowns in the supply chain.

Kangwana et al. (2009) find that malaria medicine is regularly out of stock in health facilities in Kenya because of procurement delays, and Schouten et al. (2011) identify weaknesses in the supply chain of ARVs in Malawi. These could reflect breakdowns in the distribution or centrally.

Interruptions of treatment for HIV from stock-outs or health-worker absence can be extremely costly for the individual and the general population because of the high risk of development of drug-resistance. While this is a threat with the treatment of many infections, HIV is particularly susceptible for three reasons. First, the virus mutates particularly quickly and second, the condition is chronic, so people live for a long time with treatment, presenting a long period of time for the virus to develop drug resistance in each individual. Finally, the development of drug-resistance is particularly devastating for individuals in much of sub-Saharan Africa where third-line and later-line drugs are unavailable so the length of time until drug resistance develops often determines the duration of survival.

An additional channel that exaggerates the role of corruption is the discouragement of public expenditures that comes from a higher effective price of reaching beneficiaries. Besides reducing the impact of government programs, corruption may also increase the cost of provision of goods and services and discourage investment in provision or redistribution (Ferraz et al. (2012), Gupta et al. (2000), Olken and Pande (2012), Olken (2006), Pritchett (1996)). If this is the case, then we would expect that government expenditure decisions would depend on the level of corruption, and indeed Mauro (1998) finds that corrupt politicians induce lower expenditures on education using cross-country variation. On the other hand, there is an alternative strain of literature that argues that corruption may be a more efficient form of taxation that helps an economy overcome initial frictions and grow (see for example Leff (1964) and Huntington and Fukuyama (2006)).

2.1 Clientelism and political patronage

Perceptions of corruption may reflect the presence of clientelism. While these two threats to service provision are not the same, they are undeniably linked. Bandiera et al. (2009) distinguishes between *active waste*, characterized by direct gains paid to public officials and corresponding to traditional forms of explicit corruption, and *passive waste*, in which inefficiencies are not due to public officials gaining but other barriers to efficient procurement, including insufficient information or skill. These authors find a correlation between both types of waste, and find that passive waste explains a much larger fraction of government waste in Italy, which may be evidence that the limits on the efficiency of ARV provision in more corrupt countries may not be evidence of bribes being taken or products being syphoned but other factors that inhibit effective procurement and provision. Many types of clientelism may be categorized as *passive*.

There is growing evidence of political patronage in the form of public goods targeted to co-ethnics of leaders. Some of these studies use data from a large number of countries, including Franck and Rainer (2012) who estimate impacts of co-ethnicity with African leaders on primary-school education and infant mortality, and Hodler and Raschky (2010) using satellite images to measure electrification in countries receiving foreign aid. Other studies find this link at the subnational level in South India (Besley et al. (Forthcoming) and Besley et al. (2004)). Many of these studies have focused linking outcomes in Kenya with the ethnicity of presidents and ministers. Burgess et al. (2011) find impacts on infrastructure development, although they find that the introduction of multiparty democracy limited the cross-ethnic differences. Other studies find different impacts on a range of outcomes (Posner and Kramon (2011) and Kramon and Posner (2012)). Finally, using a similar methodology Kudamatsu (2009) does not find evidence of co-ethnicity with the leader in Guinea reducing infant mortality. Most of these studies estimate the impacts of co-ethnicities on individual outcomes using large surveys of individuals, although Burgess et al. (2011) measures differences in construction of roads directly. The second empirical analysis in this paper will follow Burgess

et al. (2011) and estimate political targeting of health services directly with evidence of placement of new antiretroviral clinics. This type of political targeting, if it is more common in countries with higher levels of corruption could help to explain the link between corruption and inefficient provision of medicine, because targeting based on ethnicity and politics implies not targeting primarily based on need. This will be discussed further below.

2.2   Examples from popular press

Many of the theories outlined in the academic literature find anecdotal support in the popular press in articles from a range of African newspapers. These stories address specific examples of leakages of ARVs and funds to support their provision, and other barriers to effective provision of HIV treatment. For example, a report in Zambia found that an enormous fraction of the money that was provided to the country by the Global Fund could not be accounted for.[2] This money could have been used to build clinics and distribution networks to facilitate the distribution of ARVs, but without it, the ARVs would need to be distributed using fewer resources, possibly causing some drugs to go unused, preventing interventions to increase adherence, or hurting the ability of the government to target those who most needed treatment.

A Ugandan newspaper reported that in many areas of Uganda in 2011, ARV clinics had run out of stocks of drugs.[3] If corruption prevents drugs from being restocked in a timely matter, this can have disastrous impacts on HIV mortality, even if the stocks return. First, a lack of consistent adherence to ARVs allows the virus within an individual to develop immunity to the drugs. When treatment is restarted, it is likely to be less effective at preventing opportunistic infections and keeping the individual alive. HIV is known to mutate rapidly, facilitating the development of drug resistance. Second, if this individual is sexually active, this resistance can be transmitted to others. Both factors will reduce the effectiveness

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[2]"Zambia: Corruption scandal rocks ARV programme," PlusNews, Johannesburg, South Africa, March 14, 2011.

[3]Basudde, Elvis (2011), "Where have all the ARVs gone? World Aids Day Supplement" *The New Vision*, Kampala, Uganda, December 2, 2011.

of future ARVs, because the lack of consistent supply allows the virus to develop drug resistance.

In another article in the same newspaper, alleged corruption prevented a bill to allocate 28.4 billion Ugandan shillings to purchase CD4 count machines. These machines are used to monitor the progress of HIV in an individual and the effectiveness of treatment.[4] With the machines, ARVs could be more efficiently administered. These machines help doctors and clinical officers to determine whether a person has developed drug resistance and ought to be switched to second line treatment, which would improve the effectiveness of the treatment and the likelihood of its prolonging life.

A report from the Ministry of Finance in Swaziland illustrated the scale of money lost due to corruption by showing that it was nearly double the country's yearly budget for social services.[5]

One channel through which corruption could reduce the impact of imported drugs is by preventing targeting based on need in favor of other motives. In order to maximize the benefit of the drugs, they would need to be distributed in such a way that those who can use them have sufficient access that they can begin and successfully adhere to treatment. If corruption allows targeting based on other criteria, this targeting will be weakened, and the drugs may not lead to those most likely to be helped.

In Zimbabwe, PlusNews reports that HIV positive patients are asked to pay providers in order to access drugs which are officially distributed free of charge. [6] With this type of targeting, many who could use the drugs may be denied access in favor of those who either are less likely to be adherent or in less urgent need of the drugs, resulting in higher rates of mortality due to HIV, even with the same quantity of drugs distributed. In order to keep prices high, providers may also restrict access, letting some drugs go unused in order to

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[4] "Corruption feared in sh28b HIV deal" *The New Vision*, Kampala, Uganda, December 4, 2011.

[5] "SWAZILAND: Corruption exceeds social services budget," IRIN, Mbabane, Swaziland, October 12, 2011.

[6] ZIMBABWE: HIV patients forced to pay up or go without," PlusNews, Harare, Zimbabwe, October 5, 2010.

maximize profits, again resulting in increased mortality.

3 Data

3.1 Cross-country impacts of corruption and ARVs

The data in this paper comes from many sources. For the first section of the paper, all data is collapsed to a single observation per year in each country in sub-Saharan Africa. The sample is restricted to one region of the world in order to avoid some - but not all - of the standard concerns with cross-country analysis, and to focus on the region that is the hardest hit by the HIV epidemic.

The first datasource is used to measure the quantity of drugs entering each country. This information comes from the WHO Global Price Reporting Mechanism. This is an online database of all international purchases of drugs associated with HIV/AIDS, malaria, and tuberculosis going into developing and middle income countries. For each purchase, the database reports the date of purchase, the country and company of manufacture, the country of the purchaser, and the price and quantity of each type of drug. This contains records for approximately 30,000 purchases of antiretroviral drugs across three categories - antiretroviral drugs, HIV Diagnostics, and HIV prevention. The same drugs with the same dosages are listed in each category and combining all three reduces threats from misclassification at the international level of how drugs will be used at the local level.[7] The records includes purchases on the part of governments, NGOs, and researchers.[8]

The analysis uses two measures of the quantity of drugs entering each country in each year. The first measure uses standard doses to calculate the quantity of drugs in terms

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[7]For example, antiretroviral drugs purchased as HIV prevention may be used for Prevention of Mother to Child Transmission, and as HIV positive babies typically are overcome by the disease quickly, this should also show up in preventing future deaths.

[8]Agreements between drug companies and developing countries set maximum prices that are low if drugs are purchased by governments or NGOs, but the prices are higher for the private sector. Partly because of this, the private sector does not import large quantities of ARVs in these countries, but it minimally participates in distribution of drugs once they are in the country.

of person-years. Because some drugs are used in combination with others, this measure is imperfect and may be higher in countries that use fewer combination pills. The second measure is the quantity of money spent on all imported ARVs. This is simply the sum of the costs of all purchases.

HIV statistics come from the UNAIDS/WHO 2008 Report on the Global AIDS Epidemic, which for each country in each year reports an estimate of the prevalence, the number of people living with HIV, and the number of deaths due to HIV. While this information may be flawed, there is no better source of information about the prevalence in all countries.

Governance indicators for Control of Corruption, Government Efficacy, and Rule of Law are taken from Kaufmann et al. (2010).[9] In each year, each country is given a score for each of these indexes. In order to not rely on small differences, the analysis uses binary measures of each of these representing an indicator for a score above the mean in sub-Saharan Africa. GNI per capita is taken from the World Bank's Human Development Indicators.

3.2   Case study

The second section of the analysis uses more detailed data on ARV distribution, combined with population data from MeasureDHS. The information about ethnic backgrounds of populations comes from the 2008/2009 Measure DHS data, in which respondents are asked to report their own ethnicity. The GPS data used to link the two is from the Kenya Open Data Initiative.[10]

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[9]There are many other options of corruption measures, and this measure was chosen because it is both widely used and covers a large number of African countries, which is not the case of many of the more recent measures of actual (rather than perceived) corruption. Other authors have found that the different measures are quite highly correlated, and that the choice of measures rarely changes the outcomes of a study (Svensson (2005), Olken (2009)).

[10](opendata.go.ke)

4 Empirical Strategy and Results

4.1 Cross-country impacts of corruption and ARVs

This paper will follow previous analysis of cross-country panel-data, including country and year fixed effects and estimating the coefficient on the interaction of corruption and quantities of imported drugs. To ensure some reliability of the data, I will first estimate the following equation to verify that the quantity of drugs is associated with a reduction in deaths due to HIV:

$$deaths_{jt} = \alpha_j + \gamma_t + \beta_1 * ARVs_{jt} + \beta_2 * prev_{jt} + \beta_3 * PLWH_{jt} + e_j$$

where $deaths_j t$ is the number of deaths in year t in country j due to HIV as reported by the WHO, and $ARVs_{jt}$ is the total quantity of drugs imported in that year according to the WHO Global Price Reporting Mechanism. In the first set of specifications, this is included measured in doses (person-years), and in the second set of estimates, the quantity is reported in dollars spent. Controls are included for the prevalence of HIV (α_j)and the number of people living with HIV ($PLWH_{jt}$) as well as country and year fixed effects (α_j and γ_t). The coefficient β_1 shows the association between ARVs entering a country and deaths due to HIV reported in that year.

As reported in columns 1 and 4 of Table 1, this is large and negative and statistically significant at all standard levels. Column 1 reports the estimates using the number of person days of drugs as the quantity of ARVs and Column 4 presents the same with the cost of all imported drugs as the measure of quantity. In both cases, the coefficient is negative and significant.

To investigate the role of corruption in changing this effect, I focus on the interaction between the quantity of ARVs and the level of corruption. To do this, I estimate the following

equation:

$$deaths_{jt} = \alpha_t + \gamma_j + \beta_1 * ARVs_{jt} + \beta_2 * corruption_{jt}$$
$$+ \beta_3 * ARVs * corruption_{jt} + \Sigma b_i * X_{ij} + e_j$$

where: $ARVs_{jt}$ is the person*years purchased by country j in year t. $Corruption_{jt}$ is an indicator for being below the mean (in Africa) on the Kaufmann et al. (2010) Control of Corruption Index. To ease interpretation, the quantity of ARVs are demeaned so that the mean is zero. This way the coefficients on the un-interacted terms are meaningful and can be interpreted as the impact at the mean.

If corruption does limit the reduction in deaths generated by purchased drugs, then β_3 should be positive (reflecting a dampened reduction in deaths).

The estimated parameters from this equation are reported in columns 1 and 4 of Table 1. In this table, the coefficients on quantities of ARVs are still large and negative and significant, showing that in less corrupt countries, ARVs reduce deaths due to HIV. The coefficient on the interaction term in column 2 is positive, but not significant. A positive coefficient reflects that the impact of ARVs in corrupt countries is lower, but the fact that it is not significant means that this is inconclusive. In column 4, using spending as the measure of quantity, the interaction term is positive and significant, and large enough to nearly wipe out the impact of ARVs on deaths averted. This suggests that corruption does mitigate the impact of imported ARVs.

Perhaps the variable for corruption is picking up other measures of good governance that have an effect through different channels on the impacts of ARVs on deaths. Columns 3 and 6 of Table 1 show the same estimates including the country's GDP and the interaction between that and the quantity of ARVs. With this included, the coefficient on the interaction between ARV quantity and corruption is of a similar magnitude, but significant using both

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measures of quantity.

Interestingly, the positive coefficients on the interaction between ARV quantity and GDP imply that wealthier countries may see fewer deaths averted as a result of the same quantity of ARVs. One possible explanation is that richer countries have met more of the demand within their countries and the marginal (and average) return is lower as those with less advanced infection are treated. Although not estimated in this paper, these countries may be treating those who would not have died immediately otherwise, but the effects on mortality may show up after a few years.

Table **??** further investigates whether the variable for corruption is a proxy for other types of governance. This table adds a number of measures of government quality alone and interacted with ARV quantities. These variables are binary measures constructed in the same way as the measure of corruption coding above average values as 1 and below average as 0.

The first column uses person days of treatment as the quantity and the second uses the price. In column 1, the coefficient on the interaction term of ARVs and Corrupt is still positive and significant, although Good Rule of Law and Effective Governance also have significant relationships when interacted with ARVs. In the second column, only the interaction with corruption is significant.

Are corrupt countries different in other ways? Table 5 shows which countries fall in which categories. Table 6 compares the countries that are more or less corrupt on a variety of measures. As seen in Table 6, more corrupt countries have lower HIV prevalence rates. They also spend more on ARVs, but for a lower quantity. One possibility is that more corrupt countries are buying more expensive drugs that may be less likely to be first or second line treatments, and therefore more valuable since third line and beyond treatments are rarely widely available.[11] Tables 7 and 8 show the breakdown of types of antiretroviral

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[11]ARV treatment becomes ineffective for an individual once the HIV in their system develops resistance to the treatment they are given. Once this happens, a person is given a different treatment, referred to as the second line. In developed countries, this process can repeat many times with those who live with HIV for many years progressing to third, fourth, etc. line treatments.

drugs purchased by more and less corrupt countries. This is measured as the percentage of all drugs purchased in each category these quantities by the specific type of drug.

Based on these comparisons, the quantity of ARVs imported is clearly not exogenous and it is possible that the association shown in this cross-country analysis is not causal. The inclusion of country and year fixed effects deals with many potential threats to endogeneity, but it cannot handle all of them.

5   Case study in Kenya

Then looking at the mechanisms through which corruption could change effectiveness of imported HIV treatment is a pertinent next step. At the same time, identifying specific mechanisms provides additional support that the relationship is causal.

The fact that controlling for the role of government efficacy does not eliminate the effect is suggestive that the channel through which corruption has an influence is not in simply making government programs less efficient generally with poor incentives for performance or high absenteeism. Instead, this suggests other channels through which drugs are diverted or allocated inefficiently.

One channel through which corruption could reduce the impact of imported drugs is by preventing targeting based on need in favor of other motives. In order to maximize the benefit of the drugs, they would need to be distributed in such a way that those who can use them have sufficient access that they can begin and successfully adhere to treatment. If corruption allows targeting based on other criteria, adequate targeting will be weakened, and the drugs may not reach those most likely to be helped. In this section, I test whether one type of targeting exists in Kenya, a country consistently listed as in the top half of corrupt countries in sub-Saharan Africa.

In particular, I look for evidence of selective placement of ARV clinics in Luo areas after Raila Odinga became Prime Minister in 2008. Previous research has demonstrated that the

match between the ethnicity of leaders and constituents is a strong predictor of the provision of public goods (Burgess et al. (2011), Kramon and Posner, 2012). In 2008, after a fiercely contested election for president, followed by allegations of electoral fraud and eventually by violence, the opposition leader, Raila Odinga, became prime minister. Jablonski (2012) looks at government spending in areas populated by Odinga's core supporters after the same election and finds a disproportionate increase in expenditures. This paper uses a similar method, focusing exclusively on ARV clinics.

If there is targeting based on shared ethnicity, then we would expect to see a relative increase in ARV clinics in Luo areas after the election. To test this, I construct a dataset in which each observation represents one division in one year.[12] For each year between 2004 and 2010 and each of the 225 divisions covered in the 2003 or 2008/2009 DHS survey, this dataset contains the number of clinics which disburse antiretroviral drugs and an estimate of the proportion of the population that self-defines as Luo.

This data is used to look for evidence that Luo areas disproportionately introduced ARVs into clinics after the election, by regressing the number of clinics on the proportion of the population that is Luo, an indicator variable for whether the observation is after the election, and the interaction of the two. I also include controls for the local HIV prevalence at both the district and division levels and year and division fixed effects. The coefficient of interest is the coefficient on the interaction term. Formally, the equation to estimate is:

$$NumClinics_{jdt} = \alpha_t + \gamma_{jd} + \beta_1 * PercentLuo_{jdt} + \beta_2 * PercentLuo_{jd} * Post_t$$
$$+ \beta_3 Post_t * HIVrate_{jd} + \beta_4 Post_t * HIVrate_d + \epsilon_{jdt}$$

where $NumClinics_{jdt}$ is the number of health facilities distributing ARVs in division j of district d in year t. $Post_t$ is a binary variable that is 1 if the observation is from 2008 or

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[12]Kenya has provinces subdivided into districts, further subdivided into divisions.

later and 0 if it is earlier. If there exists ethnically-based targeting, one would expect that β_2 would be positive and significant.

Columns 1 and 2 of Table 9 shows the estimates of the parameters from the equation above. The coefficient of interest is the coefficient on the interaction between being a year after the election and the percent of the population that is Luo. These are reported in the first row. The first column includes the basic specification without any controls. The second column HIV rates interacted with $Post_t$, the indicator for 2008 and later. In each specification, the coefficient on the interaction term is large, positive and significant. This provides evidence that Luo areas saw a disproportionate increase in the number of HIV clinics after the 2007 election.

To better understand the relationship, I replace the outcome with a binary indicator for whether the division has any ARV clinics, estimating the following equation:

$$I\_Clinic_{jdt} = \alpha_t + \gamma_j d + \beta_1 * PercentLuo_{jdt} + \beta_2 * Post_t$$
$$+\beta_3 * PercentLuo * Post_{jdt} + \beta_4 * HIVrate_{jd} + \beta_5 * HIVrate_d + \epsilon_{jdt}$$

where $I_C linic_{jdt}$ is an binary variable which takes on a value of 1 in divisions with an ARV-distributing facility in a given year and 0 otherwise.

Columns 3 and 4 of Table 9 shows the estimates from this equation. Unlike in the previous table, the coefficients on these interaction terms are consistently insignificant. The estimates are imprecise enough that it is not possible to conclusively rule out some impact on this margin, but the difference between the two tables is suggestive of an increase in intensity rather than an expansion to new areas.

The lack of impact on the extensive margin demonstrated in the last columns of 9 is suggestive of a reduction in welfare as a result of this misallocation. Arbitrary distribution of scarce resources may not reduce welfare, but this suggests an increase in distribution without a corresponding increase in access. The degree to which this is true depends on

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the degree to which the previously existing ARV-distributing facilities were able to meet the local demand.

The response of targeting to the ethnic composition is not likely to be linear as specified above. The analysis from Table 9 is repeated, replacing the dependent variable *percent_luo* with an indicator for whether the majority of the population is Luo.[13] The results, reported in Tables 10, are qualitatively unchanged.

One explanation for the estimated result is that before the election, Luo areas may have been disproportionately underserved and the increase was bringing them to where they would have been otherwise. Limiting the analysis to the years before the election, Table 11 does not provide evidence that Luo areas were previously underserved.

6 Conclusion

This paper identifies two interesting patterns. First, using a cross-country panel from sub-Saharan Africa, it shows that corruption is associated with a reduction in efficiency of imported antiretroviral drugs. The lack of reduction in mortality from the same expenditure on treatment in relatively more corrupt countries points to a very dangerous consequence of corruption. This contributes to a literature on the national impacts of corruption on various outcomes and adds a new outcome with important consequences. Second, using data from within Kenya, I find evidence of political targeting of HIV treatment, again suggestive of a reduction in efficiency of important health expenditures. This speaks to a separate literature on political favoritism and targeting of public goods.

This raises the question of how corruption is maintained. Why are corrupt politicians not voted out of office? Chong et al. (2012) and Banerjee et al. (2012) both find strong evidence that voters punish corrupt politicians, even those of the same ethnicity. Still, targeting resources to constituents may not qualify as corruption and thus it could be an effective

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[13]The divisions with Luo majorities are in Homa Bay(Kendul Bay, Lake Victoria, Mbita, Ndhiwa, Oyugis, and Rangwe), Kisumu (Lower Nyakach, Muhoroni, Nyando, Upper Nyakach, and Winam), Migori (Migori and Nyatike), and Siaya(Bondo, Boro, Rarieda, Ugunja, Ukwala, and Yala)

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strategy to increase electoral support. In addition, while corruption may be punished, Ferraz and Finan (2008) find that non-zero levels of corruption may be tolerated. There are other studies that find evidence of various factors that reduce the level of or the impacts of corruption. For example Reinikka and Svensson (2005) find evidence that an increase in public awareness of leakage of public funds in Uganda reduced capture and improved outcomes, demonstrating that these issues may not be intractable. Similarly Burgess et al. (2011) find that multiparty democracy reduced the degree of ethnic targeting of public expenditures in Kenya. On the other hand, deeply entrenched corruption may be difficult to truly address. Banerjee et al. (2008) reports the results of a large-scale government monitoring and incentives program aimed at improving health worker attendance. While the initial results showed improvements, the long-term gains were lost as health facilities learned ways around the rules, and Fisman and Miguel (2007) find that corruption norms follow diplomats, predicting their behavior even outside their home countries.

This paper presents evidence of large costs of corruption in reducing the efficiency of health services that are able to save lives. This is combined with suggestive evidence of one mechanism which may contribute to this relationship. Future work is needed to expand the analysis of mechanisms through which corruption limits the effectiveness of health spending in producing outcomes, and to identify more ways in which these barriers to efficiency can be mitigated to save lives.

References

Bandiera, Oriana, Andrea Prat, and Tommaso Valletti, "Active and Passive Waste in Government Spending: Evidence from a Policy Experiment," *The American Economic Review*, 2009, *99* (4), 1278–1308.

Banerjee, Abhijit and Esther Duflo, "Addressing absence," *The journal of economic perspectives: a journal of the American Economic Association*, 2006, *20* (1), 117.

_ , **Donald P Green, Jeffery McManus, and Rohini Pande**, "Are Poor Voters Indifferent to Whether Elected Leaders are Criminal or Corrupt? A Vignette Experiment in Rural India," 2012.

Banerjee, Abhijit V, Esther Duflo, and Rachel Glennerster, "Putting a Band-Aid on a corpse: Incentives for nurses in the Indian public health care system," *Journal of the European Economic Association*, 2008, *6* (2-3), 487–500.

Bardhan, Pranab, "Corruption and development: a review of issues," *Journal of Economic Literature*, 1997, *35* (3), 1320–1346.

Besley, Timothy, Rohini Pande, and Vijayendra Rao, "Just Rewards? Local Politics and Public Resource Allocation in South India," *World Bank Economic Review*, Forthcoming.

_ , _ , **Lupin Rahman, and Vijayendra Rao**, "The politics of public good provision: Evidence from Indian local governments," *Journal of the European Economic Association*, 2004, *2* (2-3), 416–426.

Burgess, Robin, Remi Jedwab, Edward Miguel, Ameet Morjaria, and Gerard Padro i Miquel, "Ethnic favoritism," *Unpublished ms*, 2011.

Chaudhury, Nazmul, Jeffrey Hammer, Michael Kremer, Karthik Muralidharan, and F Halsey Rogers, "Missing in action: teacher and health worker absence in developing countries," *The Journal of Economic Perspectives*, 2006, *20* (1), 91–116.

Chong, Alberto, Ana De La O, Dean S Karlan, and Léonard Wantchékon, "Looking Beyond the Incumbent: The Effects of Exposing Corruption on Electoral Outcomes," Technical Report, CEPR Discussion Papers 2012.

Ferraz, Claudio and Frederico Finan, "Exposing Corrupt Politicians: The effects of Brazil's publicly released audits on electoral outcomes," *The Quarterly Journal of Economics*, 2008, *123* (2), 703–745.

_ , _ , **and Diana B Moreira**, "Corrupting learning: Evidence from missing federal education funds in Brazil," *Journal of Public Economics*, 2012.

Filmer, Deon, Jeffrey S Hammer, and Lant H Pritchett, "Weak links in the chain: a diagnosis of health policy in poor countries," *The World Bank Research Observer*, 2000, *15* (2), 199–224.

Fisman, Raymond and Edward Miguel, "Corruption, norms, and legal enforcement: Evidence from diplomatic parking tickets," *Journal of Political Economy*, 2007, *115* (6), 1020–1048.

Franck, Raphaël and Ilia Rainer, "Does the Leaders Ethnicity Matter? Ethnic Favoritism, Education and Health in Sub-Saharan Africa," 2012.

Goldstein, Markus, Joshua Graff Zivin, James Habyarimana, Cristian Pop-Eleches, and Harsha Thirumurthy, "The Effect of Absenteeism and Clinic Protocol on Health Outcomes: The Case of Mother-to-Child Transmission of HIV in Kenya," *American Economic Journal: Applied Economics*, 2013, *5*, 58–85.

_ , Joshua Graff Zivin, James Habyarimana, Cristian Pop-Eleches, and Harsha Thirumurthyk, "Health worker absence, HIV testing and behavioral change: Evidence from western Kenya," *Unpublished Working Paper, Department of Economics, Columbia University*, 2008.

Gupta, Sanjeev, Hamid Reza Davoodi, and Erwin Tiongson, *Corruption and the provision of health care and education services*, International Monetary Fund, 2000.

Hodler, Roland and Paul A Raschky, *Foreign Aid and Enlightened Leaders*, Studienzentrum Gerzensee, 2010.

Huntington, Samuel P and Francis Fukuyama, *Political order in changing societies*, Yale University Press, 2006.

Jablonski, Ryan, "How Aid Targets Votes: The Impact of Electoral Incentives on Foreign Aid Distribution," in "APSA 2011 Annual Meeting Paper" 2012.

Kangwana, Beth B, Julius Njogu, Beatrice Wasunna, Sarah V Kedenge, Dorothy N Memusi, Catherine A Goodman, Dejan Zurovac, and Robert W Snow, "Malaria drug shortages in Kenya: a major failure to provide access to effective treatment," *The American journal of tropical medicine and hygiene*, 2009, *80* (5), 737.

Kaufmann, Daniel, Aart Kraay, and Massimo Mastruzzi, "The worldwide governance indicators: methodology and analytical issues," *World Bank policy research working paper*, 2010, (5430).

Kramon, Eric and Daniel N Posner, "Ethnic Favoritism in Primary Education in Kenya," *Unpublished manuscript*, 2012.

Kudamatsu, Masayuki, "Ethnic favoritism: Micro evidence from Guinea," *Available at SSRN 1440303*, 2009.

Leff, Nathaniel H, "Economic development through bureaucratic corruption," *American Behavioral Scientist*, 1964, *8* (3), 8–14.

Lewis, Maureen, "Governance and corruption in public health care systems," *Center for Global Development Working Paper*, 2006, (78).

Mauro, Paolo, "Corruption and growth," *The quarterly journal of economics*, 1995, *110* (3), 681–712.

_ , "Corruption and the composition of government expenditure," *Journal of Public economics*, 1998, *69* (2), 263–279.

Mills, Edward J, Jean B Nachega, Iain Buchan, James Orbinski, Amir Attaran, Sonal Singh, Beth Rachlis, Ping Wu, Curtis Cooper, Lehana Thabane et al., "Adherence to antiretroviral therapy in sub-Saharan Africa and North America," *JAMA: the journal of the American Medical Association*, 2006, *296* (6), 679–690.

Olken, Benjamin A, "Corruption and the costs of redistribution: Micro evidence from Indonesia," *Journal of Public Economics*, 2006, *90* (4), 853–870.

_ , "Corruption perceptions vs. corruption reality," *Journal of Public Economics*, 2009, *93* (7), 950–964.

_ **and Rohini Pande**, "Corruption in Developing Countries," *Annual Review of Economics*, 2012, *4* (1), 479–509.

Posner, Daniel and Eric Kramon, "Who benefits from distributive politics? How the outcome one studies affects the answer one gets," 2011.

Pritchett, Lant, "Mind your p's and q's: the cost of public investment is not the value of public capital," *World Bank policy research working paper*, 1996, (1660).

Rajkumar, Andrew Sunil and Vinaya Swaroop, "Public spending and outcomes: Does governance matter?," *Journal of development economics*, 2008, *86* (1), 96–111.

Reinikka, Ritva and Jakob Svensson, "Fighting corruption to improve schooling: Evidence from a newspaper campaign in Uganda," *Journal of the European Economic Association*, 2005, *3* (2-3), 259–267.

Schouten, Erik J, Andreas Jahn, Anne Ben-Smith, Simon D Makombe, Anthony D Harries, Francis Aboagye-Nyame, and Frank Chimbwandira, "Antiretroviral drug supply challenges in the era of scaling up ART in Malawi," *Journal of the International AIDS Society*, 2011, *14* (Suppl 1), S4.
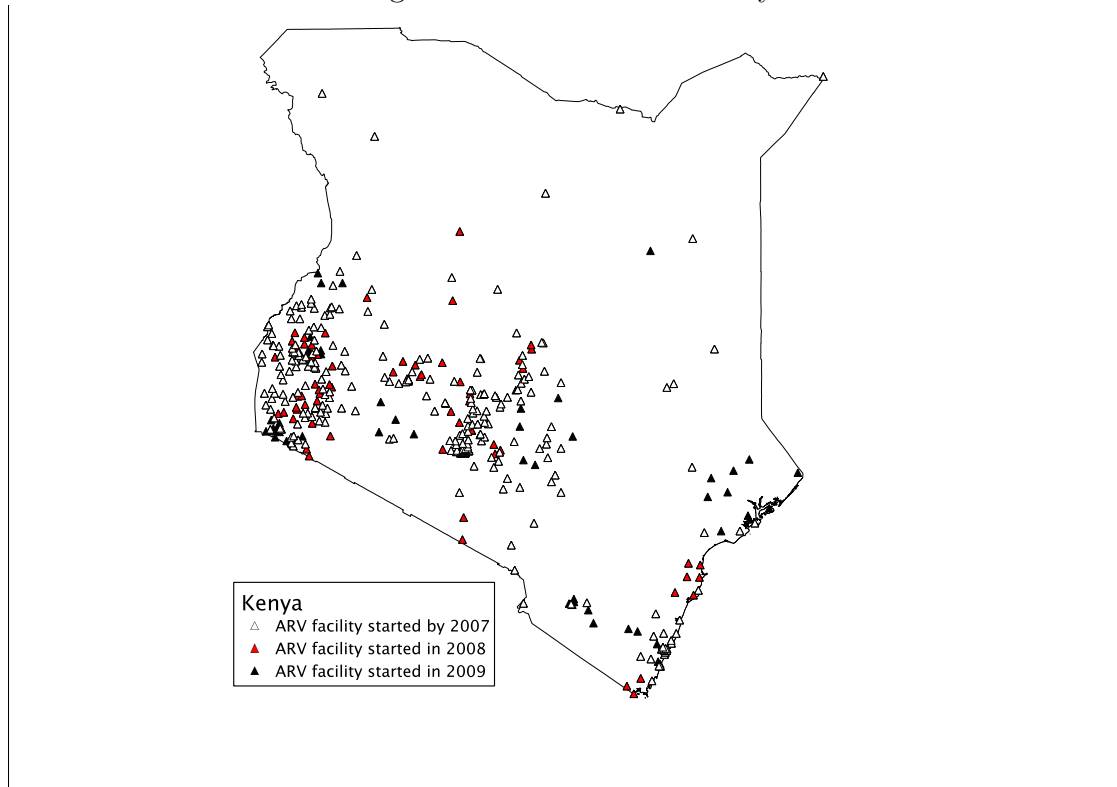
Svensson, Jakob, "Eight questions about corruption," *The Journal of Economic Perspectives*, 2005, *19* (3), 19–42.

Vian, Taryn, "Review of corruption in the health sector: theory, methods and interventions," *Health Policy and Planning*, 2008, *23* (2), 83–94.

7 Figures

Figure 1: ARV clinics in Kenya

8 Tables

Table 1: Impact of corruption on effectiveness of ARVs (Corruption fixed over time)

VARIABLES	(1) deaths	(2) deaths	(3) deaths	(4) deaths	(5) deaths	(6) deaths
ARVs (person years)	-0.0308	-0.162***	-0.162***			
	(0.0433)	(0.0318)	(0.0346)			
ARVs*Corrupt		0.149***	0.149***			
		(0.0506)	(0.0534)			
ARVs*High GDP			0.00613			
			(0.0548)			
Spending on ARVs (1000s)				-0.139	-0.495***	-0.478***
				(0.182)	(0.166)	(0.168)
Spending*Corrupt					0.445*	0.426*
					(0.253)	(0.252)
Spending*High GDP						-0.175
						(0.505)
HIV prevalence (t-1)	12,965***	10,917***	11,014***	12,797***	11,381***	11,225***
	(2,327)	(2,514)	(2,541)	(2,467)	(2,509)	(2,379)
PLWH (t-1)	-0.000238	0.0175	0.0165	-0.00197	0.00894	0.0123
	(0.0278)	(0.0235)	(0.0257)	(0.0272)	(0.0253)	(0.0230)
Observations	161	161	157	161	161	157
R-squared	0.997	0.998	0.998	0.997	0.998	0.998

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All estimates include both country and year FEs,
and all SEs are clustered at the country level.

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Table 2: Impact of corruption on effectiveness of ARVs (Continuous corruption and gdp)

VARIABLES	(1) deaths	(2) deaths	(3) deaths	(4) deaths	(5) deaths	(6) deaths
ARVs (person years)	-0.0308	-0.185**	-0.251**			
	(0.0433)	(0.0720)	(0.109)			
ARVs*Corruption		0.166**	0.214**			
		(0.0741)	(0.0884)			
ARVs*GDP			2.92e-05			
			(2.68e-05)			
Spending on ARVs (1000s)				-0.139	-0.855**	-1.112***
				(0.182)	(0.322)	(0.387)
Spending*Corruption					0.777**	0.951**
					(0.370)	(0.362)
Spending*GDP						0.000133
						(0.000117)
HIV prevalence (t-1)	12,965***	11,196***	11,662***	12,797***	11,773***	12,421***
	(2,327)	(2,208)	(2,404)	(2,467)	(2,624)	(3,046)
PLWH (t-1)	-0.000238	0.0249	0.0138	-0.00197	0.0190	0.00787
	(0.0278)	(0.0230)	(0.0220)	(0.0272)	(0.0200)	(0.0182)
Observations	161	161	158	161	161	158
R-squared	0.997	0.998	0.998	0.997	0.998	0.998

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All estimates include both country and year FEs,
and all SEs are clustered at the country level.

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Table 3: Impact of corruption on effectiveness of ARVs (PRS measure of corruption)

VARIABLES	(1) deaths	(2) deaths	(3) deaths	(4) deaths	(5) deaths	(6) deaths
ARVs (person years)	-0.0347	-0.0659***	-0.0717***			
	(0.0243)	(0.0167)	(0.0195)			
ARVs*High GDP			0.0543			
			(0.0374)			
Spending on ARVs (1000s)				-0.125	-0.336***	-0.347***
				(0.106)	(0.0864)	(0.0929)
Spending*High GDP						0.150
						(0.155)
ARVs*Corrupt(PRS)		0.0666*	0.0749*			
		(0.0385)	(0.0421)			
Corrupt(PRS)		-2,248	-2,408		-2,460	-2,398
		(2,805)	(2,699)		(2,836)	(2,754)
HIV prevalence (t-1)	14,630***	14,701***	15,027***	14,393***	15,225***	15,438***
	(1,471)	(1,225)	(1,577)	(1,725)	(1,401)	(1,500)
PLWH (t-1)	0.000188	-0.000372	-0.00781	-0.000940	-0.00661	-0.0102
	(0.0150)	(0.0109)	(0.0162)	(0.0169)	(0.00937)	(0.0112)
Spending*Corrupt(PRS)					0.321**	0.338**
					(0.119)	(0.126)
Observations	147	147	143	147	147	143
R-squared	0.997	0.997	0.997	0.997	0.997	0.997

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

All estimates include both country and year FEs,

and all SEs are clustered at the country level.

Table 4: Impact of corruption and other government indicators on effectiveness of ARVs

VARIABLES	(1) deaths	(2) deaths
ARVs (person years)	0.0587	
	(0.0607)	
Spending on ARVs (1000s)		-0.0494
		(0.173)
pd_yc_i_corrup	-0.0209	
	(0.0661)	
cost_yc_i_corrup		0.221
		(0.165)
ARVs*High GDP	-0.0467	
	(0.0622)	
Spending*High GDP		-0.139
		(0.461)
ARVs*Good Rule of Law	-0.00122	
	(0.0602)	
Spending*Good Rule of Law		0.178
		(0.146)
ARVs*Effective Governance	-0.109***	
	(0.0266)	
Spending*Effective Governance		-0.498***
		(0.0980)
Corrupt	729.5	905.8
	(1,665)	(1,950)
High GDP	0	0
	(0)	(0)
Good Rule of Law	496.5	4.893
	(2,428)	(2,322)
Effective Governance	-2,160	-1,203
	(1,592)	(1,711)
HIV prevalence (t-1)	13,262***	12,700***
	(2,591)	(3,127)
PLWH (t-1)	-0.0108	-0.00404
	(0.0138)	(0.0166)
Observations	157	157
R-squared	0.998	0.998

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All estimates include both country and year FEs,
and all SEs are clustered at the country level

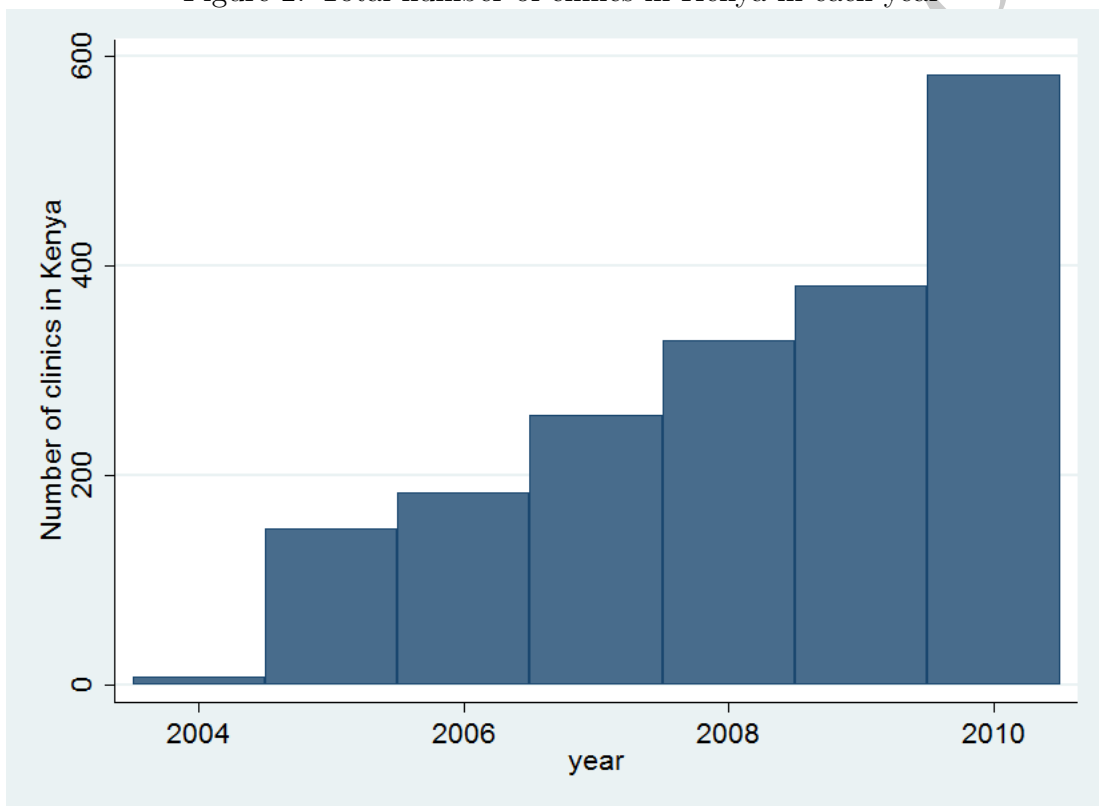Figure 2: Total number of clinics in Kenya in each year

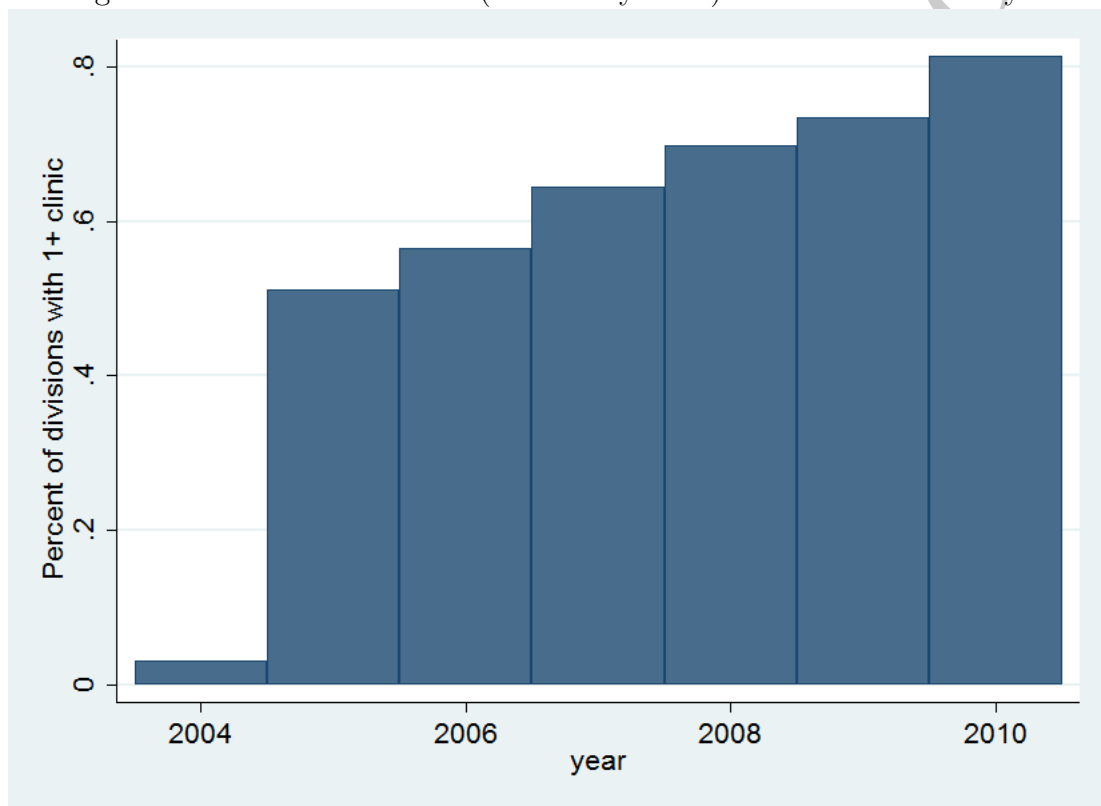Figure 3: Percent of divisions (covered by DHS) with clinics in each year

Table 5: Countries by corruption status

	Never Corrupt	Sometimes Corrupt	Always Corrupt
Never Rich	Burkina Faso	Benin	Burundi
	Eritrea	Comoros	Cameroon
	Ghana	Djibouti	Central African Republic
	Lesotho	Ethiopia	Chad
	Madagascar	Gambia	Cote d'Ivoire
	Mali	Guinea	Guinea-Bissau
	Mauritania	Liberia	Kenya
	Mozambique	Malawi	Niger
		Rwanda	Nigeria
		Togo	Sierra Leone
		Zambia	Sudan
			Uganda
Sometimes Rich	Senegal	Sao Tome and Principe	Angola
			Zimbabwe
Always Rich	Botswana	Gabon	Republic of the Congo
	Cape Verde	Tanzania	Democratic Republic of the Congo
	Namibia	Equatorial Guinea	
	Seychelles	Somalia	
	South Africa		
	Swaziland		

Table 6: Comparison of more and less corrupt countries

Variable	Less Corrupt	More Corrupt
HIV prevalence	7.102	3.816
	(8.253)	(3.607)
PLWH	584929.13	506132.11
	(1196059.3)	(768017.77)
ARVs (person years)	18720.661	23879.56
	(35918.306)	(61875.849)
Money for ARVs (1000s)	4782.879	5635.222
	(8885.153)	(12423.863)

Table 7: Drugs purchased by country, by dose

Variable	Less Corrupt	More Corrupt
Abacavir (ABC)	1.03	1.28
Combination	18.24	23.09
Didanosine (ddI)	1.68	1.5
Efavirenz (EFV)	14.86	19.53
Indinavir (IDV)	.68	.56
Lamivudine (3TC)	20.01	13.48
Nelfinavir (NFV)	.55	.41
Nevirapine (NVP)	22.18	22.08
Ritonavir (RTV)	.53	.48
Saquinavir (SQV)	.09	.06
Stavudine (d4T)	15.09	13.32
Tenofovir (TDF)	0	0
Zidovudine (ZDV)	5.07	4.21

Table 8: Drugs purchased by country, by money spent

Variable	Less Corrupt	More Corrupt
Abacavir (ABC)	2.31	2.42
Combination	48.79	53.1
Didanosine (ddI)	1.84	1.29
Efavirenz (EFV)	18.91	21.74
Indinavir (IDV)	1.57	1.08
Lamivudine (3TC)	5.26	3.99
Nelfinavir (NFV)	2.67	1.85
Nevirapine (NVP)	10.69	8.26
Ritonavir (RTV)	.22	.29
Saquinavir (SQV)	.47	.32
Stavudine (d4T)	2.45	1.96
Tenofovir (TDF)	1.4	.96
Zidovudine (ZDV)	3.42	2.75

Table 9: Targeting of introduction of ARVs in health facilities in Kenya

VARIABLES	(1) Num. ARV clinics	(2) Num. ARV clinics	(3) Any ARV clinics	(4) Any ARV clinics
Post*PercLuo	2.079***	1.753**	0.0442	-0.0681
	(0.528)	(0.874)	(0.0760)	(0.161)
Post*HIVdivision		1.553		-0.132
		(2.565)		(0.306)
Post*HIVdistrict		0.727		0.774
		(4.841)		(0.685)
Observations	1,568	1,260	1,568	1,260
R-squared	0.721	0.724	0.747	0.748
Clusters	224	180	224	180

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Standard errors clustered at the division level. All estimates include division and year FEs.

Table 10: Targeting of introduction of ARVs in health facilities in Kenya

VARIABLES	(1) Num. ARV clinics	(2) Num. ARV clinics	(3) Any ARV clinics	(4) Any ARV clinics
post_luo_majority	1.906***	1.631**	0.0540	-0.0388
	(0.463)	(0.714)	(0.0705)	(0.131)
Post*HIVdivision		1.635		-0.144
		(2.588)		(0.296)
Post*HIVdistrict		0.792		0.684
		(4.496)		(0.638)
Observations	1,568	1,260	1,568	1,260
R-squared	0.721	0.725	0.747	0.748
Clusters	224	180	224	180

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Standard errors clustered at the division level. All estimates include division and year FEs.

Table 11: Previously underserved?

VARIABLES	(1) Num. ARV Clinics	(2) Any ARV clinics	(3) Num. ARV clinics	(4) Any ARV clinics
luo_majority	0.237	-0.0392		
	(0.380)	(0.163)		
HIVdivision	0.130	-0.0992	0.0423	-0.125
	(0.858)	(0.383)	(0.829)	(0.374)
HIVdistrict	2.501	1.148	1.847	0.914
	(1.630)	(0.849)	(1.617)	(0.896)
PercLuo			0.448	0.0288
			(0.404)	(0.193)
Observations	720	720	720	720
R-squared	0.212	0.266	0.215	0.266

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Standard errors clustered at the division level.

All estimates include division and year FEs.