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Political Competition and Malaria Control in Mexico and the United States

A dissertation submitted in partial satisfaction of the
requirements for the degree
Doctor of Philosophy

in

Political Science

by

Micah Gell-Redman

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2015

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The dissertation of Micah Gell-Redman is approved, and it is acceptable in quality and form for publication on microfilm and electronically:

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University of California, San Diego

2015

DEDICATION

To Lucía.

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ABSTRACT OF THE DISSERTATION

Political Competition and Malaria Control in Mexico and the United States

by

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Doctor of Philosophy in Political Science

University of California, San Diego, 2015

Professor Wayne A. Cornelius, Co-Chair
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Of the great transformations that have reshaped human society in the modern era, one of the most important is the increase in the average length of time that a newly born human can expect to live. The pattern of increasing longevity raises an important and as-yet unresolved question - did political institutions play any role in the great transformation of the human lifespan? My dissertation aims to contribute to the literature on political institutions and public health by focusing on the efforts to reduce malaria in the

United States and Mexico. Malaria was a major source of disease and premature death in both countries. The central question that occupies the analysis in the subsequent empirical chapters is whether malaria control was shaped by political competition and ethnic or racial diversity. I develop a simple model of disease control in a political system which demonstrates two important facts. First, the impact of political competition on disease control efforts is, theoretically speaking, ambiguous. Competition might increase effort, but might also decrease it. Second, I show that there are two channels through which diversity might impact disease control, one direct, and the other contingent on the level of political competition. The first test of this theory I provide appears in Chapter 3, which focuses on competition, race and malaria in U.S. counties. I find that the effect of race on malaria outcomes is contingent on political disenfranchisement, with more densely black counties suffering from greater levels of malaria only where historical disenfranchisement was low. In Chapter 4, I perform a similar analysis of Mexican municipalities, in which I find that both being located in a competitive state and having a higher level of ethnic diversity lead to worse malaria outcomes, controlling for other factors. Chapter 5 uses another novel data set to explore long term trends in malaria in the Mexican states.

Chapter 1

Introduction

Of the great transformations that have reshaped human society in the modern era, one of the most important is the increase in the average length of time that a newly born human can expect to live. Starting in the countries of the industrial revolution, and ultimately extending to middle- and even some low-income countries today, human longevity has steadily increased over the past two hundred years. Whereas a Londoner born in 1800 could expect to live a mere 36 years, by the mid-twentieth century life expectancy at birth in Great Britain had almost doubled (Fogel 2004, p. 2). Similar improvements have been recorded throughout the developed world, and, on different time scales, in India, China, and many other countries. The pattern of increasing longevity raises an important and as-yet unresolved question - did political institutions play any role in the great transformation of the human lifespan?

To judge by the existing literature on the topic, the answer is no. The initial level of health in a population is determined by the level of income and by geographical and climatological factors (temperature, presence or absence of certain organisms, etc.). The path to improvements in health, in the dominant view, is simply through economic development. As wealth grows, so will health. There is some recognition that inefficient government spending may have a limited impact on health, but the core position is that, after accounting for the role of the environment, we can learn all we need to know about improvements in health by studying economic development.¹ If true, this would be a remarkable fact about the world, and would force a reconsideration of some

¹For a wide-ranging discussion of the role of economic growth in changes to human health, see Deaton (2013)

of the basic premises of modern political science scholarship. If, as is widely contended, democracy leads to improved outcomes on a wide range of social outcomes, we should expect improvements in life expectancy to be tied to advances in democratic institutions. Setting aside any discussion of the empirical challenges inherent in uncovering such a relationship, there are compelling theoretical reasons for investigating whether political competition and contestation have made a significant contribution to the prolonged human life span.

Social scientists have taken up this challenge, and the results of their efforts to date are mixed. The primary research agenda in this area has made use of national-level figures on life expectancy and the level of democracy. While some scholars have found a relationship between democracy and health, these findings have been contested on grounds of incomplete and imperfect data. Beyond any concerns about the quality of national-level data, there are the standard obstacles to inference that confront cross-national studies, especially the substantial, unobserved heterogeneity of the units being studied. Apart from this empirical challenge, there are theoretical reasons why this approach might not be the best way to discover how political institutions impact health. Rather than impacting health continuously over time, it may be that institutions influence health in isolated bursts, for example through large and small-scale interventions intended to improve hygiene or control a particular disease. These two empirical challenges, unit of observation and time scale, lead to the alternative approach that I adopt here.

My approach is also influenced by the existing view that health improvements have been primarily, if not entirely, driven by economic growth. The great transformation in human health has indeed been marked by major increases in income. However, there are other major components in changing human life expectancy that are not perfectly aligned with economic development. The most important of these is the adoption of interventions to reduce disease. The historical record shows that such interventions, large and small in scale, have been at the center of major leaps forward in the reduction of disease. These interventions were carried out by national and local governments, in addition to international organizations, and have been linked to reductions in a broad range of diseases, from water-borne infections to small pox. Such interventions provide a possible window into the politics-health link, because political institutions may impact both the intensity of the interventions and their effectiveness. A particularly interesting case are the campaigns, spanning almost a century and touching all regions of the globe, to eliminate the disease malaria.

According to the most recent estimates, Malaria kills as many as 1,000,000 people around the world each year (Murray et al. 2012), with the majority of these deaths being concentrated in the world's least developed countries.² To make matters worse, global climate change promises to make the burden of malaria, in terms of productivity and human lives, harder to predict and contain (Patz et al. 2005; McMichael, Woodruff

²There is no consensus among scholars as to whether malaria leads to, or is itself caused by economic backwardness. On this point, see Bleakley (2010). As to the question of why malaria has persisted for so long, Packard (2007) suggests that eliminating the disease often requires fundamental changes to aspects of the human economy, specifically the use of land. Whether such changes will be required to eliminate malaria in the countries that continue to suffer from it is a matter of continued debate.

and Hales 2006; Siraj et al. 2014) To solve the global malaria problem, NGOs, multi-lateral development institutions and national governments have committed to a strategy of large-scale deployment of resources and technology until the disease is eradicated.³ Their approach accords well with one strand of conventional wisdom about how malaria control works.

Espoused by many of the most prominent architects of malaria eradication campaigns, the conventional wisdom holds that in order to successfully eliminate malaria, the relevant authorities must exercise absolute control over populations and territory.⁴ Given the history of malaria control, it is not surprising that this view should predominate. The earliest modern campaigns against malaria were headed by U.S. military authorities, and conducted in hostile environments on foreign soil.⁵ The approach that grew out of those early campaigns, and particularly the commitment to military style tactics in their administration, persisted in the work of the Rockefeller Foundation from the sugar fields of northeastern Brazil to the cotton fields of Mississippi. Moreover, some of the techniques of disease control (forcibly impounding water, spraying pesticides in spite of potentially dangerous side effects, etc.) are at odds with an emphasis on individual rights. Even some contemporary campaigners seem to think that absolute authority and

³For a detailed treatment of current malaria control efforts, see <http://www.malariaeliminationgroup.org/publications/atlas-of-malaria-eliminating-countries-2011>

⁴Perhaps the clearest example of this point of view is embodied in the life and work of Fred Soper, a major player in the International Health Division of the Rockefeller Foundation and active in malaria and yellow fever eradication campaigns throughout Latin America. For a detailed account of Soper's point of view, see Stepan (2011).

⁵These include the malaria control campaigns conducted in Cuba and the Philippines during the Spanish American war, which were developed in response to the high level of the disease among U.S. servicemen. Another prominent early example is the malaria campaign that accompanied the construction of the Panama canal, during which many workers suffered from the disease.

control are necessary ingredients for malaria eradication. One prominent malariologist and the founder of the Global Fund to Fight AIDS, TB and Malaria, recently told an audience of academics that in order to eliminate malaria, “a military approach is required.”

6

The conventional wisdom contrasts sharply with one school of social science theories about governance, democracy and the provision of public goods. Social science scholarship tells us that public goods, such as protection from disease and premature death, are most effectively provided when citizens are able to actively exercise individual freedoms, voice their opinions about policies, and choose among their preferred leaders. The empirical evidence on this point, which I consider in Chapter 2, is mixed, but such theories of accountability and public goods provision have been corroborated for a number of important cases. It seems, therefore, that there are two contrasting views of the kinds of political institutions most likely to be associated with successful campaigns against malaria and other tropical diseases.

Understanding the institutional basis of effective disease eradication campaigns is not solely a matter of evaluating public policy. It is intimately connected with two ongoing debates in the political science literature. The first, referenced above, is over the role of institutions in public goods provision. Does the type of public good being provided influence the kind of institutions most conducive to its provision? The second debate is about the role of institutions in shaping prosperity. Inspired by the work of Acemoglu, Johnson and Robinson (2001), a recent wave of research has built the case for institu-

⁶Sir Richard Feachem, giving an invited lecture at the UCSD School of Medicine, February 9, 2012

tions as the source of differences in economic prosperity between nations. An important unresolved question in these studies is what the precise institutional mechanisms are that lead some societies to become more prosperous than others. Disease eradication campaigns sit at precise intersection between geography and institutions, and understanding the campaigns may allow us to better understand the relationship between institutions and prosperity.

Unfortunately, very little research has been undertaken with the aim of explaining the role of political institutions in disease eradication campaigns. There is a rich historical literature on malaria,⁷ as well as accounts of the economic impacts of the disease.⁸ Nonetheless, to my knowledge no scholar has provided a rigorous empirical analysis of how domestic political institutions shaped these major public health initiatives.

Drawing upon extensive archival research, my dissertation aims to contribute to the literature on political institutions and public health by focusing on the efforts to reduce malaria in the United States and Mexico. Malaria was a major source of disease and premature death in both countries. Figures 1.1 and 1.2 provide a general picture of the disease in each of these countries during the twentieth century. In the United States, malaria was practically eliminated from the Northern Mississippi Valley by the end of the nineteenth century. Nevertheless, the disease kept a tenacious grasp on the southern states well into the 1940s.⁹ In Mexico, malaria affected much of the country

⁷In addition to the references given below, see Packard (2007).

⁸Examples include Bleakley (2010), Cutler et al. (2010), Barreca, Fishback and Kantor (2012) and Sachs and Malaney (2002)

⁹See Humphreys (2001, pp.38-40) for a discussion of why the disease persisted in the South.

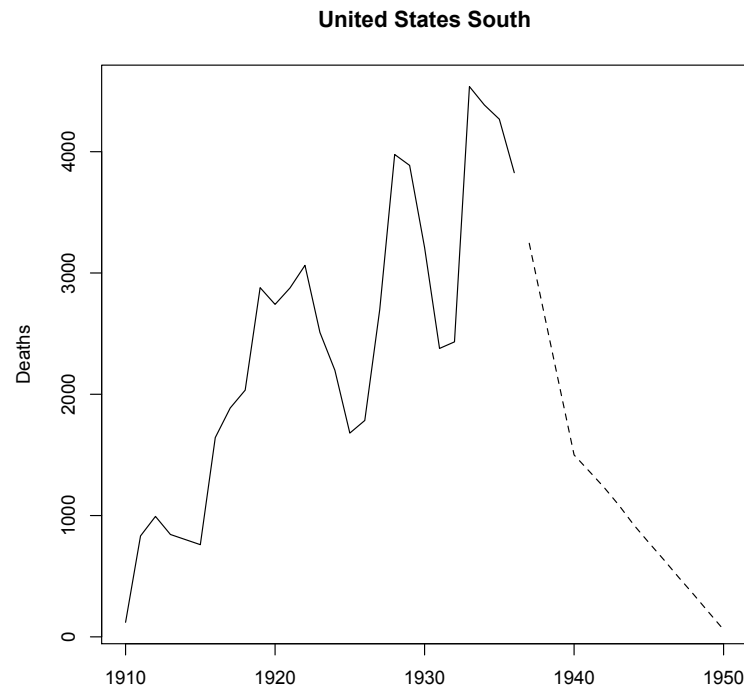


Figure 1.1: Malaria deaths in the Southern states. Data for 1910-1937 from Miller (2008). Data for 1940 from Barreca, Fishback and Kantor (2012). I impute a figure of 10 deaths for the year 1950 to reflect the effective elimination of the disease. Data for remaining years are computed by linear interpolation.

through the 1950s. In both countries, the final elimination of the disease was achieved through spraying of the insecticide DDT to kill malaria-transmitting mosquitoes and their larvae.¹⁰

While these large-scale spraying campaigns were impressive displays of public action, widely adopted by other countries seeking to eradicate malaria, in both cases these campaigns were the final stage in what was a multi-step process of disease control. Starting decades before, and spurred by the same non-state actor (The Rockefeller Foun-

¹⁰I duly note that not all observers are convinced of the necessity of this campaign for the elimination of malaria in the United States (Humphreys 1996). To say the same of the Mexican case would seem to be an overstatement.

ation), both Mexico and the United States saw major efforts to reduce malaria using methods with much smaller scales of application. So-called “demonstration” projects, which showcased the scientifically established best practices of local malaria reduction, were rolled out in the United States as early as 1918, and not long after in Mexico. It is these smaller-scale projects that receive the most attention in the pages that follow.

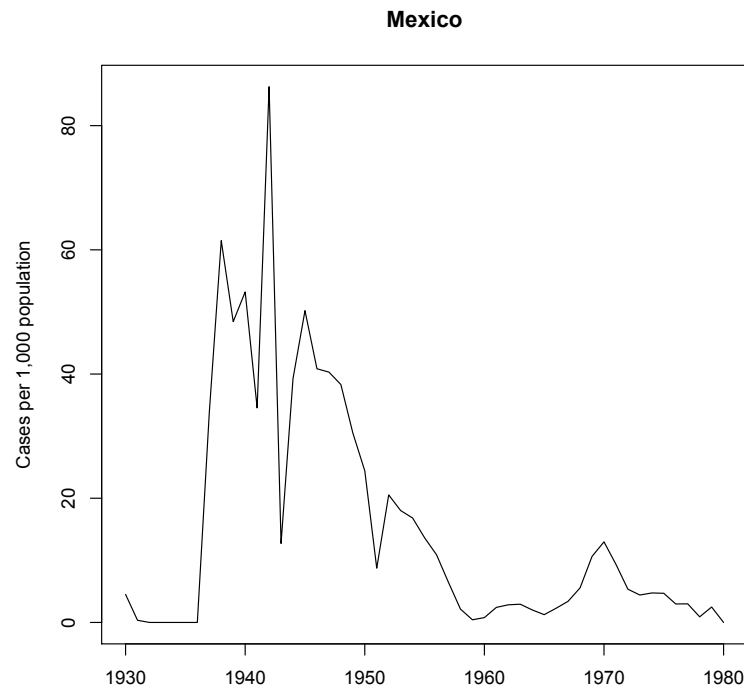


Figure 1.2: Malaria cases per 1,000 population, computed at the national level for Mexico. Data courtesy of Rodolfo Acuña Soto.

The central question that occupies the analysis in the subsequent empirical chapters is whether malaria control was shaped by political competition and ethnic or racial diversity. I choose to focus on these two factors simultaneously because both are identified as potentially important by the existing literature, and also because the two are

closely intertwined in the cases I study.

To those familiar with them, these may seem strange cases in which to seek the effect of competition on disease control. The authorities that undertook malaria control at the local level in these countries were part of political systems marked by limited competition between parties. Both the United States South during the 1930s and Mexico from the 1930s through the 1950s were dominated by a single political party (the Democrats in the case of the U.S., and the PNR-PRM-PRI in Mexico). In each case, the party in question won most elections, and political participation was often restricted, with certain groups facing either overt repression or simply marginalization.

There are two reasons why the cases are highly relevant, both in spite of this feature, and even because of it. First, as I describe below in detail, the existence of a dominant political party does not preclude all competition. This is surely the case in Mexico and the U.S. in the period under study, when various forms of competition existed beneath the veneer of single-party dominance. Furthermore, the limited competition found in these cases is reflective of the types of political institutions either currently or recently in place in many of the countries of the world that face the greatest burden of malaria today.

These cases also have an advantageous position in the history of malaria eradication. For both, data are available at the local level on disease outcomes at the time when new techniques were being established and diffused for the reduction of the disease. The combination of restricted competition and participation, together with the arrival of new

techniques for improving public welfare, raises the following questions. Were counties in the U.S. South or municipalities in Mexico with higher levels of competition more effective in applying the new techniques for malaria reduction than those counties with less electoral competition? Does this effect also hold for the states and territories that comprised Mexico at that time? What role, if any, did race or ethnicity play in determining which places were most effective at reducing the disease?

While Mexico and the pre-war U.S. South are similar in that both had limited electoral competition, they differ markedly in the way that lower levels of government (state and local) interacted with the national-level (federal) policy environment. During the 1950s, the Mexico was developing into a highly centralized system in which the President and the heads of a few federal agencies exercised sweeping authority over national policy in virtually all programmatic areas. In the United States South during the 1920s and 30s, state-level health policy developed unevenly, with early efforts lacking a unifying federal guidance. In my concluding chapter, I consider whether these differences influenced the effects of competition and diversity on disease control.

The remainder of the dissertation is organized as follows. In the next chapter, I review the literature on the politics of health and disease control, and provide a simple theoretical model to guide the empirical sections to follow. In Chapter 3, I test the relationships between competition, race and malaria in U.S. counties. The analysis focuses on the period from 1920 to 1930, with repeated measures of malaria deaths at the county level. To operationalize political competition, I compute a measure of political disen-

franchisement using historical election returns. I find that the effect of race on malaria outcomes is contingent on political disenfranchisement, with more densely black counties suffering from greater levels of malaria only where historical disenfranchisement was low.

In Chapter 4, I perform a similar analysis of Mexican municipalities. Again, the dependent variable in this analysis is the number of malaria deaths occurring in the municipality. These data are based on archival documents kept at Mexico's *Archivo General de la Nación*, which were photographed and digitized. I use a measure of political competition compiled by an earlier scholar of Mexican politics, based primarily on news reports describing whether there was opposition to the candidate approved by the dominant party for the state governorship. I find that both being located in a competitive state and having a higher level of ethnic diversity lead to worse malaria outcomes, controlling for other factors.

Chapter 5 uses another novel data set, built by Mexican medical historian Rodolfo Acuña Soto, to explore long-term trends in malaria in the Mexican states. This analysis uses the same measure of political opposition described above, carried forward through the year 1958. I show that political competition lead to lower levels of malaria, controlling for time trends and unobserved state characteristics. The dissertation concludes with a discussion of the implications of these findings for the broader propositions that competition and diversity matter for disease control outcomes.

Chapter 2

The Political Logic of Disease Control

Why should we expect political institutions to influence health? Public health scholars have identified a panoply of factors that influence human health (Stepan 2011, Introduction). Some of these, most importantly climate and geography, are exogenous to human institutions.¹ There is, however, a group of factors that are potentially linked to human institutions, those belonging to what Fogel has called the social investment in public health. Fogel (2004) documents the tremendous improvement in human life expectancy that followed the industrial revolution. Consider, as an illustrative case, the United States. The sharpest gains in life expectancy in the United States occurred during and immediately following the Great Depression. This, Fogel explains, is because during the 1930s the United States began to enjoy the returns from its social investment in health (37). The main components of this investment were: the extended reach of clinical medicine; improvements in medical education; increased knowledge of biology and chemistry; and expansions in public health infrastructure.

Therefore, a tentative answer to the question posed above is that political institutions influence health because improvements in public health depend on investments in public goods,² and public goods, in turn, are linked to political institutions. The insight that public health improvements follow from investment in public goods suggests a refinement of the question. How do political institutions determine when and where governments deliver health-improving public goods? I explore this problem by focusing

¹While a number of scholars have explored the effect of geographic factors on institutions (see, e.g., Sokoloff and Engerman (2000), Acemoglu, Johnson and Robinson (2001), and Alsan (2015)), few have attempted to study the impact of institutions on disease.

²This is not equivalent to claiming that an additional dollar of health spending leads mechanistically to improved health outcomes, a proposition refuted in Filmer and Pritchett (1999)

on health interventions. By health intervention, I mean the application of a specific technology by multiple actors over a broad range of territory with the specified purpose of reducing disease.

At the core of my theory are the concepts of competition and accountability as mechanisms linking politics to health interventions. Fearon (1999) provides a simple and useful definition of accountability, which I will adopt with slight modification. For two actors A and B, A is accountable to B if the following two conditions hold: A must be charged with acting on behalf of B, and B must have some power to reward or punish A for her performance in this role. Extending the definition to political representation, accountability holds between citizens and government when citizens use some means of intervention (perhaps electoral) to demand some level of performance from politicians, and politicians adjust their behavior in response.

A good deal of research in the social sciences has focused on competition and contestation as means of improving accountability.³ The basic idea is that, when office-seeking politicians are forced to compete for office, they are more responsive to citizens' preferences, and this greater accountability leads to improved outcomes on various measures of social welfare. This relationship is hypothesized to hold both at the country level and the subnational level, and has indeed been observed in a number of empirical works (examples include Besley and Burgess 2002; Ferraz and Finan 2011). Introducing the threat of competition, either by providing voters with new information or breaking institutional equilibria that prevented effective competition, can improve government

³A classic example is Dreze and Sen (1989). For an overview, see Besley (2006).

performance.

While the theory referenced above is couched in terms of an abstract political system, social scientists have also offered explanations of the mechanisms of accountability in regimes in which competition is, *a priori*, restricted. One important example is selectorate theory (de Mesquita et al. 2003), which posits that as the population to whom rulers are accountable expands, so does the likelihood that rulers will provide public, rather than private goods. In a similar vein, there is the core voter framework described in Cox (2009), applied to the case of contemporary Mexico in Magaloni, Díaz-Cayeros and Estévez (2007), according to which rulers use the relative competitiveness of political units to make strategic decisions about where to provide targeted goods to maximize support. An important corollary of this argument is that institutional limitations on competition can lead to a perverse equilibrium in which, rather improving performance, groups of voters who support the opposition can be punished by incumbents.

A final relevant branch of the social science literature is comprised of scholars arguing that that diversity, ethnic or otherwise, may act as a barrier to the provision of public goods. The basic contours of this argument are developed in Alesina, Baqir and Easterly (1999), which presents the abstract case for diversity as a hindrance to investment in public goods, and provides evidence from local governments in the United States. In this formulation, diversity leads to divergent views over the desired level of investment in public goods, which in turn leads to lower overall investment. A number of scholarly works extend these arguments to other contexts (Miguel and Gugerty 2005;

Habyarimana et al. 2007; Easterly and Levine 1997), although there are also scholars who have presented evidence to the contrary (Trounstine and Rugh 2011; Boustan et al. 2013). I incorporate social science theories on heterogeneity and public goods, while introducing an important caveat that arises from the specific problem of disease control. In contrast to standard models of strategic redistribution, there may be certain health-improving goods which can only be provided to one group if they are also provided to members of other, potentially excluded groups.⁴

More generally, there are a few key features of infectious disease control which could render standard social science models of public goods provision problematic or even invalid. First of all, there is a practical complication that arises from the nature of infectious disease - namely, the potentially large treatment externalities that apply to interventions to reduce infectious disease. Politicians must take into consideration that the decision to treat (or not treat) a particular unit may have impacts on neighboring units. Moreover, effective elimination of disease may require the technical knowledge and expertise of bureaucrats. This is particularly important when bureaucrats and politicians have different aims, or when one has information that the other does not. Finally, strategically placed international or non-state actors may influence the decisions of both politicians and bureaucrats about how to approach disease eradication.

In the empirical analyses that follow, my primary aim is to determine whether there is sufficient evidence to reject this null hypothesis of no relationships between

⁴Precisely such a case is explored masterfully in Troesken (2004), which explains the development of public sanitation in American cities during the early twentieth century.

competition and disease control. I will argue that the evidence provided by the cases of Mexico and the United States South does indeed lead to a rejection of the null hypothesis, and that social science theories of public goods provision should include disease control as one of the arenas in which politicians appear to act strategically. The nature of the relationship between competition and disease control is not as straightforward as the literature leads us to expect, an additional complication to the theory which I explore below.

In what remains of this chapter, I develop a simple theory to explain the effects of competition and diversity on disease control. In the following section, I describe the model. The chapter closes with a review of the literature on politics and health, and discussion of my contribution to it.

2.1 A Simple Model of Disease Control in a Political System

To describe the systematic impact of competition and diversity on disease control, it will be necessary to simplify the complicated circumstances that apply to particular historical instances of disease reduction.⁵ Consider, in the abstract, a system in which a group of rulers are in control of a single political jurisdiction. The jurisdiction is occupied by people belonging to different groups (which could correspond to ethnic groups or social classes), and these people are potentially exposed to an infectious disease. How

⁵Some of this historical detail is re-introduced in the chapters that follow.

will the level of competition and diversity hypothetically impact the way in which the rulers exert effort to control the disease?

Figure 2.1 sketches my answer to this question. To simplify exposition, I will refer directly to the letter labels contained in the figure as “links”. The first links to consider are those at the top of the diagram. These are meant to convey the effect of increasing competition relative to some non-competitive *status quo ante*.⁶ Link A depicts the possibility, described in the references above, that increasing competition will lead to greater pressure on politicians, which will in turn lead to improved performance on the range of observable public policies. Improved performance leads to greater effort exerted to control and reduce infectious disease. It is important to note that this link does not depend on infectious disease being the most important issue of the day, nor on politicians making specific reference to disease control in campaign materials or stump speeches. It is sufficient that disease control be part of the criteria that voters use in evaluating politicians.⁷

It is not the case, however, that the only potential impact of competition is to increase effort towards disease control. There is another possibility, depicted in link B of the diagram. In this scenario, the increase in competition leads to divisions among politicians. These divisions may refer to differences of policy between political parties, rifts

⁶See the beginning of this chapter for the definition of competition used here.

⁷For the two cases under consideration here, there is little empirical evidence that could be used to support or refute this last statement. Modern opinion polling was still coming into being in the United States during the 1930s, and those surveys that did exist had neither the rigor nor the coverage that would be required. Nevertheless, historical studies make it clear that people of different social strata recognized the toll of malaria. And my own archival research uncovered attempts by malaria control officers to determine the public’s view of malaria control, which was generally positive.

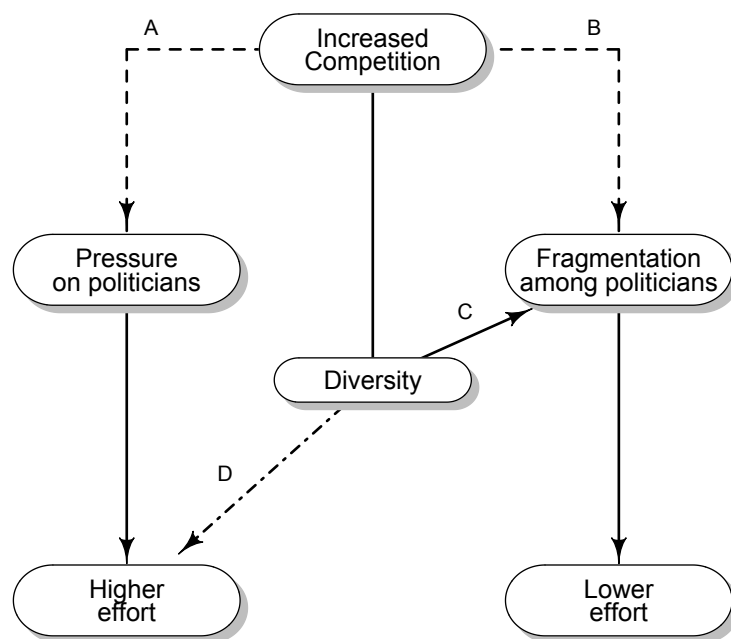


Figure 2.1: The political logic of disease control.

within political parties, or even procedural differences between branches of government. In any case, this increasing fragmentation will tend to make cooperation and coordination more difficult, which in turn will decrease the net level of effort to control disease. This last point about the potential effort-reducing effect of disease control is particularly relevant when applied to the case of a single-party regime. In many such regimes, the centralization of power implies a unity in decision making and policy implementation which can make autocratic rulers more effective at carrying out certain public policies than their democratic counterparts.⁸ Political competition can generate an obstacle to the

⁸For an excellent example of how democratic governance can be disadvantageous for the control of in-

unity of purpose that a dominant party might otherwise achieve.

Links A and B are depicted using dashed lines to graphically indicate what is the main message of this schematic. That is, *the effect of competition on disease control is ambiguously signed by theory*. I now turn to the second portion of the schematic, which illustrates the effects of diversity.

In this stylized presentation, diversity can influence disease control effort directly and indirectly. The direct effect of diversity is illustrated by link C in the diagram. This link shows that relatively more diverse places will tend to suffer from greater fragmentation, both within and outside of the political sphere. As the references above illustrate, this is a well-theorized proposition in the social sciences. However, the effect of diversity on disease control goes beyond its direct effect on fragmentation. It is also essential to consider the interaction between diversity and competition, illustrated by link D in the figure.

To understand the interactive effect between diversity and competition, we must be a bit more specific in our definition of diversity. Consider the case of a society divided into two groups, a more privileged “included” group, and a less privileged “excluded” group. Here, inclusion and exclusion have a specific implication for political competition, which is that politicians will be more responsive to the preferences of the included group than to those of the excluded group. In other words, in a place occupied entirely by members of the excluded group, competition will have relatively little effect on the

fectious disease, see Werner Troesken’s description of smallpox vaccination in the United States (Troesken 2015),

level of effort exerted by politicians. However, as diversity increases, members of the included group become part of this hypothetical constituency, which increases the responsiveness of politicians. It is in this, somewhat limited sense, that diversity interacts with competition to generate greater disease control effort.

To reiterate, the theory outlined above applies to cases in which government is responsible for disease control within a single territory. This case corresponds to the empirical analysis developed in Chapters 3 and 4, in which malaria control is carried out primarily by local and state actors at the county or municipal level. These chapters will consider the effect of competition, as well as diversity and the interactive effect of the two together.

A comprehensive theory of the politics of disease control, however, requires us to also consider a state that is somehow divided into smaller territories. This is required because the decision over how to allocate effort over a set of territories is central to disease control as a political problem. Should all territories receive the same level of effort? Basic epidemiological reasoning tells us that all territories in the area of active transmission should be subject to surveillance and treatment, and that the level of treatment should be based on the burden of disease. But social science theory tells us that the interests of politicians may lead to a different outcome.

I now turn to an extension of this basic model in which the single political jurisdiction is divided into various territories. I model the case of a central authority who, with the help of a bureaucrat possessing expert knowledge, decides how to allocate dis-

ease reduction resources to the provinces under his control.

Consider a state composed of subnational units or provinces. Each province is characterized by two parameters. First, each province faces a high or low level of risk posed by the disease. In other words, some provinces will require a high level of effort in order to reduce disease, while others will require only a low level of effort. Second, provinces differ in the degree to which authority within the province is contested. Provinces that are highly contested are those in which the central authority has not established a monopoly on either the use of violence or the control of political office. For now, I assume that these two parameters are independent.⁹ In the most robust version of the model, provinces also vary in their capacity to successfully implement a program of disease control.

The first actor in the model is a bureaucratic planner. The bureaucrat acts as an agent for two different principals. The first principal is the central authority or president. In the case of Mexico at the height of official party dominance, we might think of the president together with the secretaries of government and the interior. The second principal comprises the group of international actors who, together with the bureaucrat, form an epistemic community—a group of disperse actors who share a common goal and language (see Haas 1989).¹⁰ The bureaucrat-planner is in part beneficent, that is, places intrinsic value on lowering the level of disease. He also wants to not run afoul of politicians, and to cultivate his position among the international actors. The second actor in

⁹The possibility that the two are correlated is both interesting and relatively unexplored.

¹⁰The role of such epistemic communities in international disease control has been well established. For a particularly illustrative example see the account of Japanese smallpox vaccination in Jannetta (2007)

the model is the president. The president, like the bureaucrat, would like for the disease to be eliminated. But he is also aware of the degree of contestation in the provinces. In particular, the president fears failing to provide a level of effort to the contested provinces that is perceived to be sufficient by elites within those provinces.

The order of action is as follows. Taking into consideration the level of disease risk faced by each province, the bureaucrat makes the initial decision about how to allocate resources to reduce disease. He/she carries out the reporting and monitoring necessary to track the campaign's success. The two principals he serves will use markedly different criteria to evaluate his success. The president derives utility from two sources: delivering on the promise of reducing disease, and providing sufficient effort to contested provinces, irrespective of the level of disease within them.¹¹ The international actors will assess whether he has soundly implemented methodologies developed and evaluated through scientific communication (journals, conferences, correspondence). Likewise, these agents will have different mechanisms for rewarding or punishing the bureaucrat's effort. International actors can offer prestige, and positions abroad. The president can offer career advancement within the party (in many regimes, party credentials are indispensable for success in the bureaucracy, and such positions are highly coveted).

The planner can act to eliminate disease, but doing so requires effort. The level of effort required will depend on both the type of disease control mechanisms available

¹¹This sort of political conditioning of disease control is described by Packard (2007), who remarks that Brazil's leader Getulio Vargas insisted that the Yellow Fever and Malaria campaigns cover regions of the country that did have a high burden of disease.

to the planner, and on the intensity with which those techniques are implemented. In the simplest presentation, the mechanisms can be either “large-scale”, by which I refer generally to vector control through insecticide spraying, or “local”, by which I mean reducing mosquito breeding and contact with humans by diverse measures including draining agricultural land, improving home construction, and oiling ponds that harbor *anopheles* larvae. The planner simultaneously determines his level of effort for each subnational unit. The action chosen by the planner can lead to one of four outcomes: persistence, control, reduction, elimination, where each of these outcomes refers to the prevalence of disease in the sub-national unit where the effort was applied, in the period following the application of effort. The possible results of his efforts depend on: the level of effort chosen; the disease environment in a unit; disease environments in nearby units; climactic conditions, set for each period by nature; the disease control technologies available to the planner; and a stochastic noise term.

Rather than developing a formal model, I present this stylization to give a clearer picture of the actors and incentives that shape disease control as a form of distributive politics. The basic implication of this stylization is that the politician will allocate resources to the territories in which the disease burden is greatest, but politically salient territories will also receive a disproportionate share of disease control effort. The question of how different provinces benefit from disease control is the empirical focus of Chapter 5. A secondary implication is that, conditional on any decisions by the president and the bureaucrat, some provinces may deliver a higher level of effort than other oth-

ers. I focus on the factors that determine this differential performance across subnational areas in Chapters 3 and 4.

2.2 Literature Review and the Contribution of this Project

Modern political scholarship has been concerned with the connection between political institutions and social welfare at least since Seymour Martin Lipset posited that economic development would lead to greater demands for democracy (Lipset 1959). In spite of this long-standing interest (for a review of theories linking politics to economic development, see Gourevitch 2008), the basic question remains open. Do political institutions affect human well being? If so, what are the mechanisms that link institutions to improved social welfare? While economic prosperity is an essential component of human well being, other facets may also be related to political institutions. Of these alternative dependent variables, perhaps the most promising is human health.

Social scientists have begun to establish the empirical basis to determine the link between political institutions and human health (a partial review appears in Ross 2006). Studies that use cross-country comparisons generally find that democracy leads to improved health (McGuire 2010; Gerring, Thacker and Alfaroa 2012; Besley and Kudamatsu 2006; Zweifel and Nava 2003) although some have disputed this finding (Ross 2006). This literature has provided extensive, though not uncontested, evidence for an

association between democracy and improved public health outcomes.

Scholars have advanced a number of theoretical explanations for why democracy might lead to improved health. In one account, democratic leaders are more likely to adopt policies favoring the poor than autocracies, and this difference in policy will lead to improved outcomes in areas that matter to the poor and, in turn, to improved public health outcomes (for a discussion of this argument, see Besley and Kudamatsu 2006, p. 315-6). While theoretically compelling, the empirical evidence on this point is ambiguous both for public policy selection in general (Mulligan, Fildes and Martin 2004) and for public health in particular (Ross 2006). In another formulation, democracy provides for channels of communication between citizens and government that allow the former to influence the latter, leading to better public health performance (McGuire 2010; Zweifel and Nava 2003).

Setting aside methodological concerns, these cross-national studies leave the core question unresolved: What is the mechanism that links political institutions to health? Jen Dreze and Amartya Sen contributed a core insight to this debate, by observing that certain social maladies such as famines are much more likely to occur in autocracies than democracies, because the former lack appropriate channels for public action (Dreze and Sen 1989). These channels of public action fit generally under the rubric of accountability, and it is here that we shall seek our mechanism.

Manin, Przeworski and Stokes (1999) define accountability as a governing arrangement in which (a) voters retain only incumbents that act in their best interest and

(b) incumbents choose policies that will improve their likelihood of reelection. Treatments of accountability in the social science literature have focused on the link between voters and politicians (see Fiorina 1981; Ferejohn 1986; Fearon 1999; Besley 2006). The view of accountability emerging from this work is one of a strategic interaction where voters select politicians who they believe will perform well in office, and politicians strive to deliver the goods in order to enjoy the benefits of office. The challenge in moving from theoretical models to empirical application is to determine which institutional arrangements allow for this sort of interaction between citizens and politicians.

Scholars examining variation within countries have considered a number of mechanisms by which political institutions might be linked to improved public health outcomes, including the enfranchisement of excluded groups (Miller 2008), racial politics (Lieberman 2009; Troesken 2004) and electoral democracy (Kudamatsu 2012). Miller (2008) shows that the gradual extension of the franchise to women in the United States was correlated with improvements in child health. Miller's analysis shows that, not only did improvements in child health go hand in hand with women getting the right to vote, but these improvements were correlated with observable changes in the behavior of elected representatives. Taken as a whole, this is the most persuasive argument I am aware of for the role of accountability in improving human health. Nevertheless, as I describe above for the general case, the effect of competition is potentially more complicated. Thus the first contribution of this dissertation is to provide a more complete picture of the theoretical link between competition and health, along with tests of the

theory based on novel evidence.

The second contribution of the dissertation is to focus on one important pathway by which the mechanism of accountability might drive improvements in health: Campaigns to control infectious diseases. This subject has received scant attention from political scientists. On the other hand, scholars of public health and development economists have written a good deal about the causes and consequences of disease control campaigns. Each group of scholars has given some consideration to the role of political institutions, though the two groups have treated the topic in very different ways. To paint the debate in very broad-brush strokes, the public health literature seems to have often ignored the systematic role of political incentives in structuring government action, focusing instead on historical contingencies. On the other hand, the development economics literature has paid more attention to the consequences of disease than to disease as an outcome of political factors.

The public health literature has produced a number of historical accounts of malaria epidemics and anti-malaria campaigns.¹² These accounts have treated governance in one of two ways. In the first, “voluntarist”, view the state is driven to pursue eradication by some force external to the dynamics of political competition. The force may be linked to international conflict, as in the case of the cold war, or to economic development. In either case, the state in this view takes eradication as a given priority, and decisions about how to eradicate are made on either an ad hoc basis or according to

¹²On Egypt, see Gallagher (1990), on Mexico Cueto (2007), on Brazil, Packard (2007, chap. 5) on the rest of Latin America Stepan (2011, chap. 5), and on the United States, Humphreys (2001)

some other generic criteria, such as cost-benefit analysis. An example of this approach can be found in historian Mario Cueto's treatment of Mexico's malaria eradication program (Cueto 2007). In the other view, governments are essentially non-actors. In this view, malaria is overcome either in spite or independently of state action. This view is exemplified by Margaret Humphreys's narrative of malaria eradication in the U.S. South (Humphreys 2001).

It is not surprising that historical scholarship would downplay the role of political institutions in disease control. The public officials who carried out these campaigns espoused a remarkably limited view of the place of governments in large-scale public health interventions. A prominent, comprehensive book on the technical aspects of malaria eradication, written at the height of the international campaign against the disease, dedicates four pages out of 550 to "Responsibilities of Government" (Pampana 1969). Interestingly, the responsibilities enumerated in those four pages include, providing financial and human resources, properly administering the government departments involved, and ensuring cooperation between those departments. Moreover, it stands to reason that politicians themselves would not be eager to assume the responsibilities of implementing a technically rigorous program whose outcome was, at the outset, highly uncertain. Politically speaking, disease control was far from a "safe bet".

Scholars of economic development, on the other hand, have given a more systematic account of political institutions, though they disagree on the precise role that these play. The pathbreaking work of Acemoglu, Johnson and Robinson (2001, 2002)

opened up the line of argument that while the disease environment may have shaped which institutions arose in a given country, it was ultimately the institutions themselves and not any aspect of geography that determined which countries would become most prosperous. By way of historical analysis, Sokoloff and Engerman (2000) make the same case for income differences between countries in the western hemisphere. Nevertheless, the position that institutions are more important than geography or disease in shaping prosperity is not uncontroversial. In the first case, there are those who dispute either the evidence used to make such arguments (Nunn 2008) or the notion that conditions five hundred years in the past can generate valid predictions about differences in economic performance today (Putterman and Weil 2010). More generally, there is the position that geography does matter, and that the institutions-first view ignores the importance of factors such as the disease environment (Sachs and Malaney 2002). Newer work explores the possibility of using geographic and climactic variation to further disaggregate the effects of disease from other factors (see McCord, Conley and Sachs 2014)

More specifically, economic analyses of malaria and its impact at the subnational level comprise the body of research that is substantively most similar to my project. These include historical treatments of the United States (Hong 2007, 2011; Barreca 2010), comparison of the effects of malaria across various cases using micro data (Bleakley 2010), and a similar approach to estimating the impact of malaria in India (Cutler et al. 2010). Others have analyzed which public policies may have been instrumental in reducing malaria (Barreca, Fishback and Kantor 2012, and, in a non-economic approach, Sledge

and Mohler 2013). While these works make important contributions to our understanding of malaria and its impact, they leave mostly untouched the question of how political institutions shaped efforts to control the disease.

In fact, one of the most widely cited works on the micro-economic impact of malaria (Bleakley 2010) makes the tacit assumption that differences between local authorities did not influence the timing or effectiveness of malaria control in the Americas. A third contribution of the dissertation is to refute this assumption. I test whether it is appropriate to treat local units as equivalent, or whether the process of disease control is itself shaped by political competition. The evidence I uncover shows that such variation should not simply be assumed away.

The two specific cases considered here, the United States in the 1920s and Mexico from the 1930s to the 1950s, are both the subject of extensive bodies of scholarship, which I review in Chapters 3 and 4 respectively. Here I provide only a brief overview of my contribution to the understanding of these cases.

The standard account of electoral politics in the U.S. south during the first half of the twentieth century has focused on the means by which the Democratic Party was able to secure almost total dominance in the electoral arena. Along with the Democrats' dominance at the polls went the effective exclusion of most blacks from electoral politics. Scholars of this period have been divided on the sources of black disenfranchisement in the south. In one view, features of the institutional environment were key in establishing which voters were enfranchised and which were not (Kousser 1974, 1999).

In another, these institutional features were less important than “more fundamental political processes,” which were ultimately responsible for the disenfranchisement of blacks (Key 1984). Moreover, the political transition in the South was part of a process by which public policy became progressively less focused on patronage and more concerned with achieving larger programmatic goals (Skowronek 1982). In Chapter 3, I introduce malaria as a policy sphere in which questions about the politics of public administration in the interwar U.S. South can be re-evaluated.

The canonical account of Mexican politics in this period is one of a single, dominant political party, the PRM-PRI, at the center of a system of corporatist interest groups whose support for the regime led to a strong, centralized authority (Brandenburg 1964). This single party dominance was coupled with a powerful federal bureaucracy recruited through clientelist ties that exercised sweeping influence over public policy (Centeno 1997, chapter 3).¹³ The picture of static dominance that emerges from this account masks what more recent scholarship on Mexican politics has made clear: Although institutional channels of accountability were uneven and imperfect, political authority in Mexico was contingent on the support of actors other than the president and party leadership. Elections themselves, though surely plagued by fraud, served as important mechanisms for revealing support for the regime (Magaloni 2006) and were linked to expectations about the provision of public goods at the local level (Díaz-Cayeros, Magaloni and Weingast 2003). I argue that measures of electoral competition in Mexico from this period are

¹³For an excellent description of how Mexico’s “classic pyramid of patronage” operated in the period of ruling party dominance, see Grindle (2012, pp.169-172)

valuable tools for assessing the variation that lies beneath the monolithic image of Mexico as a fully centralized entity.

I now turn to a series of empirical explorations of the theoretical arguments developed above. My main aim is to provide multiple tests of the core hypothesis that competition impacts disease control. Demonstrating this relationship in multiple contexts will provide the rationale for developing methods and seeking new data to better understand the mechanism that drives this relationship.

Chapter 3

Competition, Diversity, and the Decline of Malaria in the United States

The southern United States was deeply affected by malaria for centuries (Humphreys 2001). Until the 1910s, malaria was a persistent cause of illness and premature death in the former slaveholding states. Spurred primarily by a non-state actor (The Rockefeller Foundation), local-level efforts to reduce the disease began around 1918. These early demonstration projects leveraged knowledge that had not been widely adopted before, and that became increasingly widespread during the 1920s.

The United States South in this era was remarkable not only for the presence of malaria. It was also marked by a political system in which one party (the Democrats) dominated most elections, and participation was restricted almost exclusively to whites. This combination of restricted competition with the arrival of new techniques for improving public welfare, raises the following questions: Were southern counties with higher levels of electoral competition more effective at applying the new techniques for malaria reduction than those counties with less electoral competition? What role, if any, did race play in determining which counties were most effective at reducing the disease?

In this chapter, I combine vital records data on malaria deaths in Southern counties with census data and election returns to test the hypothesis that competition leads to improved disease reduction. Surprisingly, I find that political disenfranchisement, which I measure using election returns dating back to the reconstruction era, caused more effective disease control. This effect is dependent on the racial make up of the county. By contrast, contemporary levels of electoral competition do not predict lower levels of disease or more effective disease control.

The chapter proceeds as follows. In the next section, I describe the prevalence and impact of malaria in the United States South from around 1915 - 1930, along with the measures to control the disease. Section 3.2 summarizes the state of political competition in the single-party south during the same period. Section 3.3 describes the data and research design, and Section 3.4 presents the empirical results of the chapter. The final section discusses the results and concludes.

3.1 Malaria in the United States, c. 1920 - c. 1930

Malaria was endemic to various regions of the United States for much of the nineteenth century, with periodic epidemics reported from the Ohio River Valley to Texas and through the Deep South. While the disease was widespread, its effects on public health and economic prosperity were most pronounced in the South. Until the 1930s, malaria was an important cause of mortality in the states of Mississippi, Alabama, Georgia, South Carolina, Arkansas, Louisiana, and Florida (Humphreys 2001, p. 96). In the 1910s the Rockefeller Foundation began to pilot malaria control operations in several southern states. Though the Rockefeller foundation maintained a leading, and in some cases dominant, role, these efforts were joined by fledgling state- and county-level public health authorities, and expanded both in their geographic extent and in the methods used. Over a two-decade period, Rockefeller and the states presided over a major decline in malaria prevalence.

Until the end of the nineteenth century, little was known about the etiology of

vector-borne disease. Prevailing beliefs about transmission focused on noxious “airs” or fumes that were thought to affect the body directly. By the 1890s, advances in the germ-theory of medicine allowed scientists to understand how malaria was transmitted, and what sort of measures might lead to its reduction. By the time demonstration projects to reduce malaria were underway in the U.S. South, a cohort of scientists had dedicated a great deal of effort in the lab to outlining specific interventions. This training and knowledge production gave rise to an “epistemic community” of public health researchers, which had as its focal points Johns Hopkins University and the International Health Board of the Rockefeller Foundation (henceforth, IHB).

The interventions proposed to reduce malaria during the demonstration projects can be divided into two types, vector control and therapeutic. Vector control interventions include a variety of construction, engineering and land management efforts, designed primarily to reduce the breeding habitat available to the *Anopheles* mosquitoes that transmit malaria, and secondarily to reduce contact between mosquitoes and humans. One of the most well known interventions to reduce malaria in the United States was the adoption of screened porches and other construction techniques that made mosquito bites less common. While it is indeed the case that public health officers were aware that the houses of the rural poor living in malarious areas of the South were poorly built, construction improvements were emphasized less than other forms of vector control. The primary tools adopted in the southern counties were the drainage of swamp and agricultural land to reduce the availability of breeding sites and the application of oils and other

insecticides to standing water to impede mosquito breeding. Therapeutic methods of disease reduction relied primarily on the use of quinine, a chemical known to reduce the symptoms of malaria, which was also believed to make individuals carrying the malaria parasite less likely to transfer it back to a mosquito host.

By the year 1920, demonstration projects had begun in a limited number of counties in each of the southern states with persistent malaria (see Table 3.1).¹ The bulk of these demonstration projects were carried out first in more urban counties, where the problem of malaria was less intense. The rationale for choosing urban counties as the first locations for demonstration projects appears to be one of convenience, in that the IHB staff and officers believed they were more likely to succeed in reducing malaria in urban counties.²

Table 3.1: Malaria Demonstration Projects by State, circa 1920.

Alabama	8
Arkansas	7
Florida	7
Georgia	3
Louisiana	6
Mississippi	6
North Carolina	14
South Carolina	11
Tennessee	7
Texas	24
Virginia	10
Source: Rockefeller Archive Center	

Here I highlight three points about malaria control activities in the U.S. South.³

¹Source for table: RF Record Group 5 Series 3 200 Box 5 Folder 46

²While internal correspondence makes it clear that Rockefeller officers believed their early efforts would be more successful in urban counties, the reasons for this belief are not transparent.

³My account is based on archival documents held at the Rockefeller Archive Center and the United

The first point is that, as of 1920, the malaria control efforts being made had as their focus a handful of counties that were not “hotspots” of the disease. In other words, there was not a robust program of malaria control in place in any of the southern states before the year 1920. As the decade of the 1920s wore on, malaria control became more widespread in the southern states. This was primarily due to the expansion of county health efforts promoted by the IHB, which now looked beyond a handful of urban counties in an effort to foster self-sufficiency in the area of public health. In this sense, southern U.S. counties were much like the regions of developing countries where the IHB carried out its programs.

A second important theme is that the actors involved in malaria control were deeply concerned with how the campaigns would be funded. Money for the urban demonstration projects came initially from the IHB. However, as was the case for the IHB’s more general efforts to support local health delivery, emphasis was placed from the outset on identifying local sources of funding to ensure the projects’ long-term success. In some cases, specific municipal authorities showed themselves to be either reticent or outright hostile to the idea of subsidizing malaria control work. In other settings, local populations and authorities appeared to be enthusiastic contributors to the work. Ultimately, officials encountered a wide range of levels of local support, with some going so far as to conduct small surveys in towns where demonstration projects were ongoing to assess the value attributed by the public to their efforts. In one case, the State Health Officer of Georgia recorded specific statements made by members of the public regard-

States National Archives at College Park Maryland, as well as secondary sources.

ing malaria control, along with pertinent details about each respondents' economic and social position.

The final theme to highlight is race. Race was an important element of every public policy initiative adopted in the United States South in the interwar years. Nevertheless, it is remarkable to note how race seemingly entered into all aspects of the campaigns, even the most practical administrative details. Flyers were drafted so as to be directed to the different races and to make clear to the public that campaign efforts would target the two races separately. Not only were statistics on the number of malaria cases and deaths reported separately by race, so were statistics on the number of individuals and dwellings inspected or treated. Moreover, informational materials distributed to the public were designed in such a way that the targeted individuals would know that racial segregation was built into the campaign.

Of course, the IHB and state and county health personnel had varying success in their efforts to adopt public health campaigns in the southern counties. These efforts were met with a wide range of responses, from enthusiasm to hostility, as southerners of different social and economic backgrounds balanced their desires for improved health with competing opinions about racial hierarchy, as well as the role of government in society.⁴ In any case, efforts to control malaria and other diseases gradually expanded until a broad range of counties had been covered.

These smaller-scale interventions culminated in the much more well known DDT-spraying campaign that took place shortly after World War II, and that was widely touted

⁴On this last point, see Frederickson (2001).

as the moment when malaria was permanently eliminated from the United States. While the large-scale spraying campaign was an impressive demonstration of the capacity of the state, my focus here is on the local level control measures employed in the preceding decades. There are two reasons for this. First, it has been persuasively argued that, in spite of the fanfare accompanying it, the spraying campaign was not the primary or even the proximate cause of the decline of malaria in the United States (Humphreys 1996). For the moment, it seems the specific causes of malaria's decline in the United States will remain an open question,⁵ and more empirical traction can be had by focusing on the decades prior to the spraying campaign. The second reason to focus on the earlier period is that the pre-campaign disease control activities were undertaken primarily by state and county health authorities, with support from the Rockefeller Foundation. For this reason, subnational variation in contestation can plausibly have influenced these efforts.

3.2 Competition and Race in the One-Party South

It is well known that electoral politics in the U.S. South, from the post-reconstruction period through the civil rights era, was dominated by the Democratic Party (see, among others Key 1984; Kousser 1974; Gibson 2013; Frederickson 2001). While the Democrats were surely a hegemonic party in the south during the 1920s and 30s, they were not uncontested. Even Key, in his classic study of the "one-party South", describes a system

⁵While Humphreys (1998) contends that many of the malaria control efforts carried out in the 1930s were of limited use, Sledge and Mohler (2013) conclude, based on evidence from the state of Alabama, that drainage projects led to a decline in malaria.

in which competition regularly occurs in two important ways (Key 1984). He describes the persistent presence and threat of Republican politicians willing and able to appeal to black voters, as well as to poor whites. Moreover, even where competition *between* parties was limited, competition *within* the Democratic Party occurred regularly, with primary elections often featuring competitions between what Key described as factions within the party.

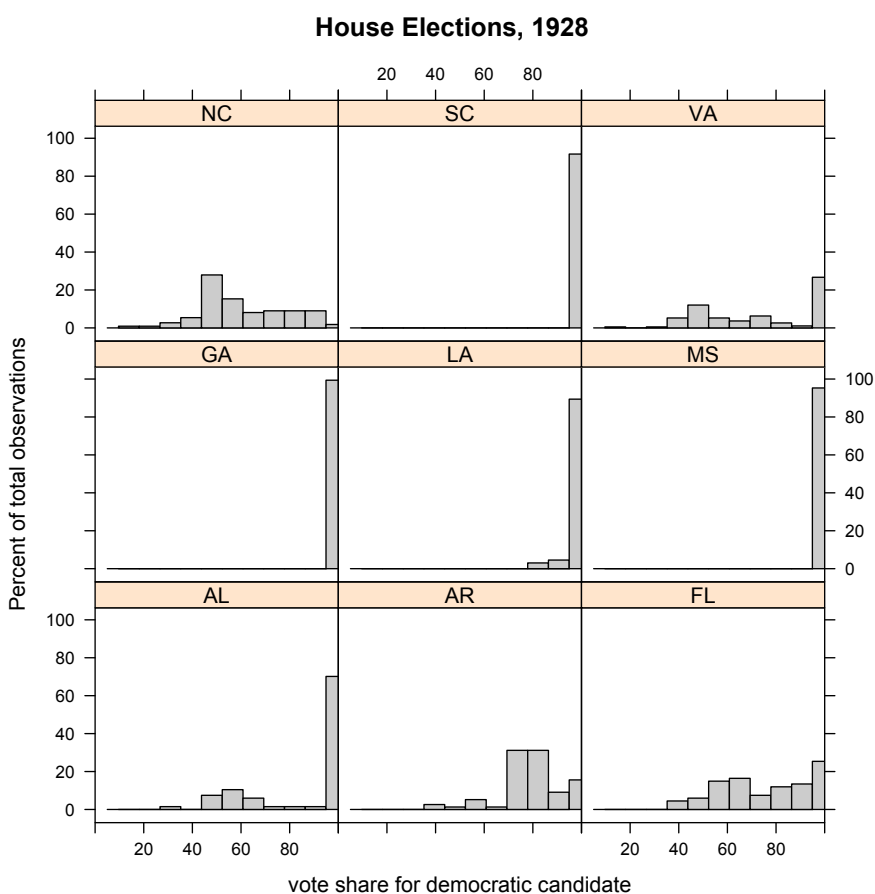


Figure 3.1: Competition in Presidential elections, U.S. South 1920.

Figure 3.1 plots the distribution of vote shares for the Democratic Party in congressional election of 1928. The figure suggests two conclusions. First, in many counties

throughout the U.S. South, congressional elections were indeed “lopsided”, in the sense that the vote share for Democratic candidates rarely dipped below 50 percent. Second, this dominance was not universal, in the sense that there is variation in the level of competition both within and between states, although the level of within-state competition is extremely low in Georgia, South Carolina, and Mississippi.

Nevertheless, while the level of competition may be greater than the phrase “one-party South” would lead one to expect, this does not imply that elections were unpredictable in the sense that they would lead an average representative to be concerned about the prospect of defeat by a candidate from another party.⁶ As Figure 3.2 demonstrates, by around 1910 the level of support for Democratic candidates in house elections was changing very little over time within counties. The figure plots the distribution of the differences in the vote share for the Democratic candidate in House elections with the average result of the three previous elections.⁷

Taken together, these data suggest that, in the period leading up to 1920, there is little reason to expect that election results could have acted as a “shock to the system” in many southern counties. Instead, congressional and presidential elections both appear to be relatively stable contests over time, with a greater degree of competition than expected in some states, and a very low level of competition in others.

If elections were relatively stable and uncompetitive, can we expect that polit-

⁶This is the type of competition that we might expect to impact the behavior of the archetypal Mayhewian representative.

⁷The box plots show data aggregated to the county level. Averages are calculated using mid-term results to reduce the between-election heterogeneity introduced by election type. Similar results obtain using averages calculated over presidential elections. The year 1922 is used because data for Georgia House elections are missing for the years 1900 through 1920.

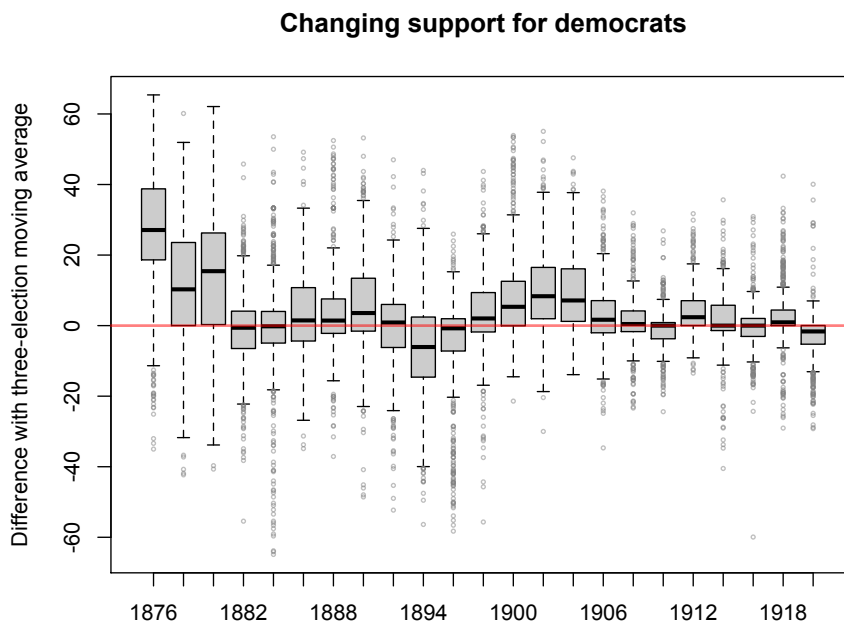


Figure 3.2: Each box plot shows the distribution of differences in the vote share for the Democratic candidate in House elections with the average result of the previous three elections. All observations are at the county level.

ical competition would have led to improvements in disease control? Answering this question requires a brief discussion of the party system in the U.S. South and its historical antecedents.⁸ In the period of Reconstruction, which followed the Civil War, the federal government imposed various modifications to the political process in the former slaveholding states. The net effect of these was to dramatically increase the participation of blacks in politics, both as voters and as office holders. This period of political participation for blacks was short-lived, as whites sought out the means to effectively disenfranchise them. Disenfranchisement occurred through a number of channels. The

⁸This account draws primarily from Kousser (1974) and Gibson (2013). A recent survey is also provided in Acharya, Blackwell and Sen (2014)

relative position of blacks and whites in the labor market provided the former with ample opportunity for coercion.⁹ Organized groups of whites carried out campaigns of violent intimidation. And finally, as Kousser (1974) describes in detail, whites used a variety of institutional measures including literacy requirements, poll taxes, and the secret ballot to effectively restrict black suffrage. These methods of suffrage restriction were applied broadly across the former slaveholding states.¹⁰

The widespread diffusion of suffrage restriction in the south leaves us with an empirical conundrum. Election results post-disenfranchisement do not reflect the underlying level of competition in a county, given standard assumptions about electoral rules and citizen participation. Rather, they measure the equilibrium level of competition given revised expectations about which groups of citizens will be able to vote.¹¹

As a means of circumventing this measurement problem, I propose comparing the pre-disenfranchisement electoral results with post-disenfranchisement results. The difference between the two is a proxy for the degree of disenfranchisement that occurred within each county. Figure 3.3 shows the distribution of this measure for the nine southern states.

As opposed to the contemporary election results, which are generally static within counties over time, this historical measure provides dynamic information about electoral competitiveness. While that is an advantage, this measure does not entirely escape

⁹On the long-lasting legacy of such coercion, see Crosby (2005, chap. 1)

¹⁰Election-related violence occurred as early as the 1870s, while some institutional means of disenfranchisement were not enacted until the turn of the century or shortly thereafter.

¹¹For a discussion of the role that such expectations play in structuring election outcomes and single party dominance, see Cox (1997, chap. 4 and chap. 13).

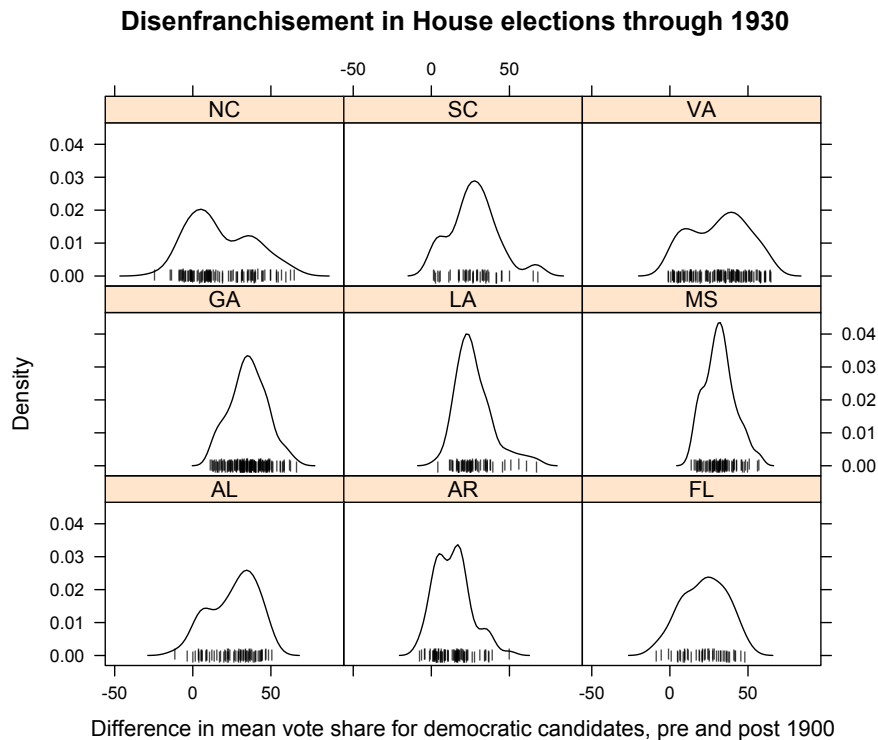


Figure 3.3: Disenfranchisement in Southern Counties. Disenfranchisement is measured as the difference between the mean level of support for Democratic candidates in House elections in the periods 1870-1900 and 1902 - 1930.

another challenge to measuring the effect of competition in the one-party south —the overwhelming role of race in shaping elections. Indeed, there is a substantial correlation between race and disenfranchisement (the within-state correlations ranges from 0.14 to 0.83). Nevertheless, there is also significant overlap between the two variables, the degree of which is visualized in Figure 3.4.

To summarize, competition in the U.S. South during the 1920s was more widespread than the label “single-party South” might lead one to believe. Nevertheless, the overall level of competition is low enough that historical measures may be required to capture the competition that had been suppressed during the period of disenfranchisement. The

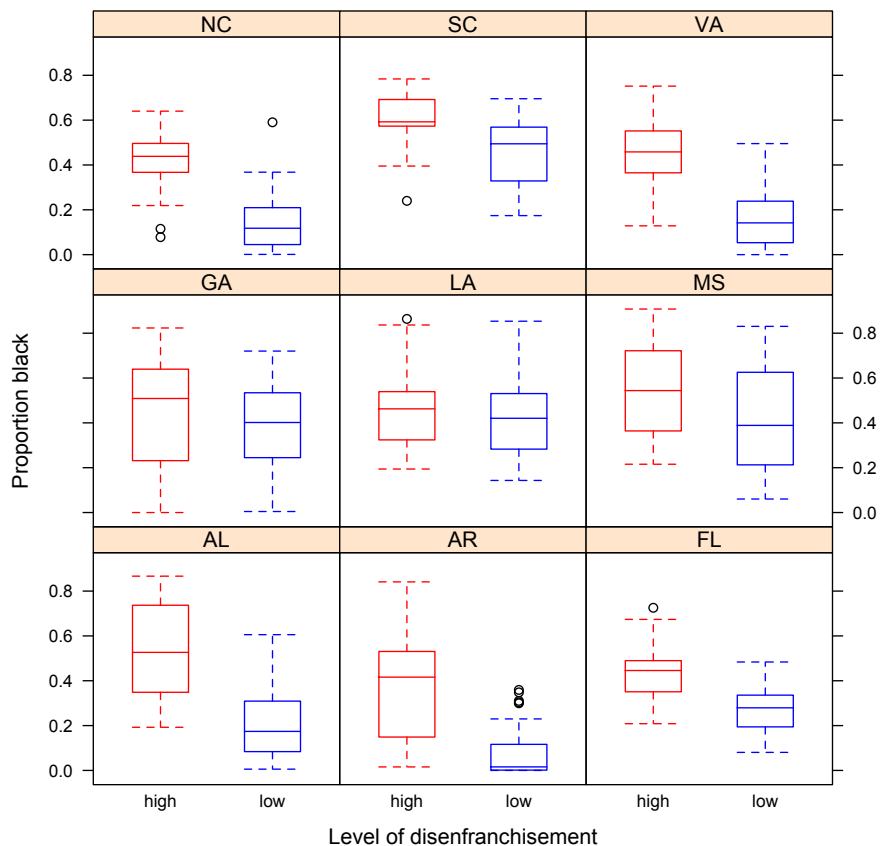


Figure 3.4: Proportion of black residents in U.S. counties, conditional on level of disenfranchisement. Red box plots give the distribution of race in counties with a level of disenfranchisement higher than the state median. Blue box plots give the distribution of race in counties with lower than median disenfranchisement.

historical measure derived for this analysis succeeds at increasing the variation in competition, but it also introduces the complication of being highly correlated with race. I provide further discussion of these points in the discussion section of this chapter, and in the description of the empirical strategy, to which I now turn.

3.3 Research Design and Data

At the core of this chapter's empirical strategy is the assertion that malaria prevalence in U.S. counties in 1920 is exogenous to the ability or willingness of public health personnel to control the disease. This claim about the timing of available interventions is described and justified above. By estimating the relationship between political competition and the prevalence of malaria in 1920, I am thus calculating the baseline relationship between competition and disease in the absence of any specific interventions available to local-level actors.

Starting around 1920, interventions that could be implemented at the local level became widely available. It is therefore plausible that, from about 1920 onward, malaria could have been reduced thanks to the actions of county administrators, a prominent NGO (i.e, the Rockefeller Foundation, whose role is described above), and other local actors. Using the change in malaria levels between 1920 to 1930, I can estimate the effect of electoral competition on malaria reduction. I do this by estimating an unobserved effects model with a lagged dependent variable, where the estimating equation has the following form:¹²

$$Y_{1930,j} = \beta_1 * Y_{1920,j} + \beta_2 * POL_j + \beta_3 * RACE_j + \beta_4 * \mathbf{X}_j + c_s + u_j$$

In the main specification, the outcome variable is the count of deaths per 100,000 pop-

¹²For a discussion of assumptions of the model and properties of the estimator, see Wooldridge (2002, chap. 10, esp. pp. 255-6).

ulation for the year 1930 in county j . Y_{1920} is the lagged dependent variable, giving the 1920 death count for county j . The variable POL is one of a number of measures of electoral contestation, including the measure of disenfranchisement described above. The variable $RACE$ measures the proportion of black residents in each county, and \mathbf{X}_j is a vector of other county-level characteristics, all measured in 1920. Finally, c_s is a random variable that captures an unobserved effect at the state level, and u_j is an error term. In alternative specifications the contestation measure is treated as categorical, and interaction effects are also estimated.

It is important to note that the measures of political competition used in this analysis apply to offices (president, congress) other than the offices charged with taking direct action on disease control (county officials and bureaucrats, and, to a lesser extent, state governors and the state health agencies). The main justification for this is that these are the only measures available consistently for all counties in the selected states over a large number of elections. The measures used can be thought of as both a proxy for local elections, and as an indication of the degree of social division within each county.

Data on malaria mortality were compiled from a variety of sources, following the references provided in Barreca, Fishback and Kantor (2012). The conventions adopted here mirror those used in Barreca, Fishback and Kantor (2012) with one exception. For some of the states, data on malaria deaths in 1920 is available only through a compilation of vital records undertaken by Kenneth F. Maxcy, officer of the United States Public Health Service. These statistics, published in Maxcy (1923), do not include records for

counties with fewer than 1 death per 10,000 inhabitants. Rather than treat those counties as containing missing data, I impute a random value between 1 and 10 deaths per 100,000 inhabitants.

Information on county characteristics for the decennial years is drawn from Haines (2010). Election results come from two sources. Clubb, Flanigan and Zingale (2006) provide county-level results for presidential and House elections for the period covered. Data from Heard and Strong (1950)¹³ are used for the gubernatorial primary results.

3.4 Results

3.4.1 Baseline

As a first step to understanding the relationship between competition and malaria, Table 3.2 shows the results of three separate regressions in which the dependent variable is the number of malaria deaths recorded in a county in or around 1920, as described above. As the table indicates, none of the available measures of competition are predictive of lower levels of malaria at the county level. By contrast, in all of the reported specifications the proportion of black inhabitants in a county is a significant positive predictor of malaria levels.

In specification one, column (1) of the table, the measure of political competition included is the proportion of the vote in presidential elections that goes to Democrats. This is intended to directly test the hypothesis that support for the opposition (the Repub-

¹³Now available through the Inter-university Consortium for Political and Social Research.

icans) will affect disease outcomes. Specification two tests the hypothesis that competition occurs *within* political parties rather than *between* parties. To that end, the measure of political competition used comes from gubernatorial primary elections, which were restricted to Democratic Party candidates. The specific measure used is the expected number of parties in the primary, which is given by $\frac{1}{\sum p_i^2}$, where the p_i are the vote shares of candidates competing in the primary. Finally, specification three, uses an estimate of the proportion of the voting age population who turned out to vote as a measure of competition.¹⁴ All three specifications also control for sociodemographic measures that are predictive of malaria: the (logged) population of the county, the proportion of homes owned by their occupants, the number of farms per capita, the proportion of total acreage dedicated to farming, the total value of crops per capita, and the proportion of adults unable to read.¹⁵

To summarize this first finding, there is no indication that more competitive counties had a lower incidence of disease in the period before micro-level interventions were both available and actively prescribed. Instead, the cross-sectional evidence demonstrates that, while competition is not a strong predictor of the incidence of disease, the proportion of blacks living in a county is a strong and significant predictor. This effect is robust to the inclusion of measures that proxy for county-level wealth, as well as state-level fixed effects. Overall, the controls and fixed effects in the model explain a substantial proportion of the variation in malaria deaths across U.S. counties ($R^2 \sim 0.4$).

¹⁴The turnout measure is taken directly from Clubb, Flanigan and Zingale (2006).

¹⁵These are the same controls included in Barreca, Fishback and Kantor (2012).

Table 3.2: Baseline Relationship Between Competition and Disease

	Malaria deaths, 1920		
	(1)	(2)	(3)
Prop. Democrat, pres. elects	0.005 (0.067)		
ENP, gub. elect.s		-1.289 (1.682)	
Turnout, pres. elect.s			-0.087 (0.107)
Proportion black	21.161*** (6.774)	21.558*** (5.734)	18.536*** (6.709)
Log of total population	-0.673 (1.353)	-0.651 (1.339)	-0.647 (1.342)
Proportion home owners	-36.569*** (9.114)	-36.345*** (8.947)	-36.401*** (8.952)
Farms per capita	156.591*** (26.922)	154.337*** (27.125)	162.227*** (27.586)
Proportion of acres in farms	-19.819*** (4.690)	-19.461*** (4.688)	-19.845*** (4.672)
Crop value per capita	-0.011 (0.010)	-0.010 (0.010)	-0.013 (0.010)
Proportion illiterate	22.097 (15.973)	20.835 (15.225)	21.423 (15.191)
N	761	761	760
R ²	0.423	0.424	0.424
Adjusted R ²	0.410	0.411	0.411

*p < .1; **p < .05; ***p < .01

3.4.2 Core Results

Having established that, as of 1920, more competitive southern counties did not suffer from different levels of malaria than their less-competitive counterparts, I now use a repeated measures model to estimate of the effect of competition on disease levels. Before proceeding, one important caveat should be considered.

The nature of political competition in the U.S. South during the first half of the

twentieth century, described above, suggests that competition may be so effectively repressed as to make accurate measurement difficult, if not impossible. In particular, the static nature of competition over time, and the low and declining level of participation mean that few contemporaneous elections could have acted as shocks to the political system in southern counties. In order to find a better approximation of such a shock, it is necessary to look to the history of party competition in the South. To do this, I employ the historical measure of disenfranchisement described above.

Table 3.3: Core Estimates

	Malaria deaths, 1930		
	(1)	(2)	(3)
Malaria Deaths, 1920	0.420*** (0.027)	0.393*** (0.029)	0.360*** (0.030)
Disenfranchisement	-8.402*** (2.765)	-7.308** (2.861)	-6.586** (2.774)
Proportion black	-9.341* (4.807)	-7.351 (5.914)	4.767 (5.837)
Historical support for Dem.s	0.279*** (0.056)	0.269*** (0.062)	0.074 (0.076)
Prop. black*Disenfranchisement	37.302*** (6.646)	33.875*** (6.866)	19.988*** (6.580)
Controls	<i>NO</i>	<i>YES</i>	<i>YES</i>
State fixed effects	<i>NO</i>	<i>NO</i>	<i>YES</i>
N	713	713	713
R ²	0.397	0.407	0.501
Adjusted R ²	0.393	0.398	0.488

*p < .1; **p < .05; ***p < .01

Table 3.3 presents results of a lagged dependent variable model. The dependent variable is the number of malaria deaths per 100,000 population at the county level, measured in or near 1930. The model controls for the number of malaria deaths in 1920,

and also contains the same controls included in the model described in Table 3.2. State-level fixed effects are included as indicated. These results can be interpreted as the effect of disenfranchisement and race on malaria reduction.

The main independent variable in this model is the historical measure of disenfranchisement specified as a binary variable. Counties with values of disenfranchisement greater than or equal to the median take a value of 1, while counties with values less than the median take a value of 0. All of the specifications reported in Table 3.3 include an interaction term, which multiplies the binary measure of disenfranchisement by a continuous measure of the proportion of blacks in each county. Because this interaction term is present, the coefficient on disenfranchisement refers to the 23 counties in which there were 0 black residents. The estimated coefficient indicates that greater disenfranchisement leads to lower levels of malaria in this small subsample of counties.

The most convenient way to interpret the remaining coefficients is to visualize the conditional effect of race for the two values of the disenfranchisement variable. This visualization appears in figure 3.5. When comparing high- and low-disenfranchisement counties, race played a distinctly different role. The red line depicts counties with greater than the median level of historical disenfranchisement. In these counties, having a greater proportion of black inhabitants leads to weaker disease control, as measured by the difference between the 1920 and 1930 death rates. On the other hand, in counties with a lower than median level of historical disenfranchisement, having a greater proportion black leads to more effective disease control, as measured by greater improvements in

the malaria death rate.

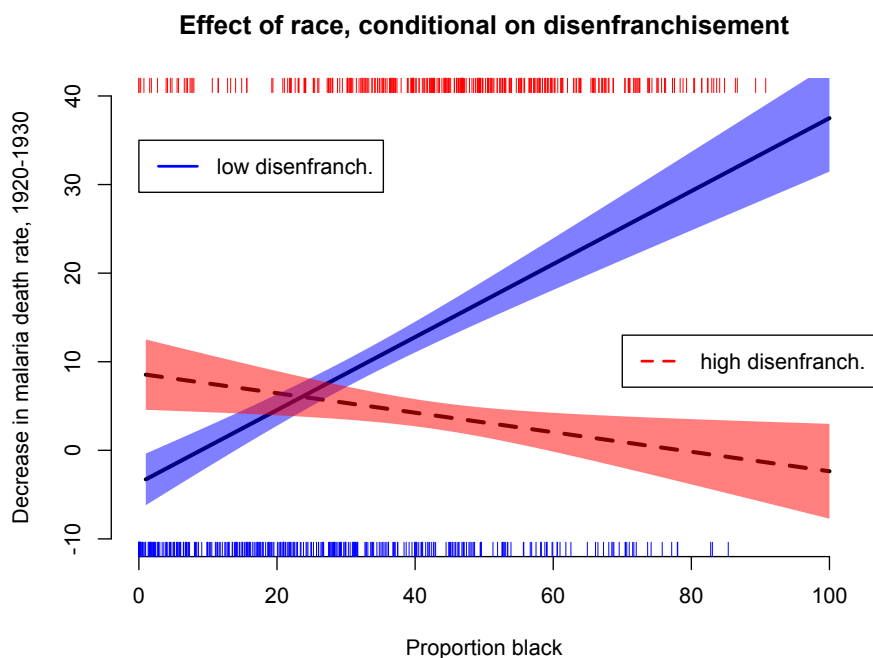


Figure 3.5: Effect of race, conditional on level disenfranchisement

3.5 Discussion

What can the historical case of the United States South teach us about the impact of competition and diversity on malaria control? The first finding of this chapter is that, before the diffusion of local methods of malaria control, political competition was not a significant predictor of disease levels. In other words, it is not the case that malaria “hotspots” were concentrated in places that lacked competitiveness.

In the second set of results, I control for the level of malaria in this earlier period, and predict the malaria death rate in a later period, after local methods of malaria con-

trol had been widely diffused the Rockefeller Foundation and the United States Public Health Service. These estimates also employ a historical measure of disenfranchisement, in order to overcome the difficulty of measuring contemporaneous political competition, which had been suppressed. These results show that, in counties with low levels of disenfranchisement, having a greater proportion of black inhabitants led to larger improvements in controlling malaria.

How should this finding be interpreted in light of the theory developed in the preceding chapter? Recall that in that framework I posit two channels through which diversity affects disease control. The first is a direct effect, whereby diversity leads to greater fragmentation, and thus to lower effort to control disease. In the second channel, diversity modifies the impact of competition depending on the relative composition of groups within a place. As places move from having a higher proportion of inhabitants who belong in an “excluded” group to having a greater proportion belonging to the “included” group, I posit that competition will be increasingly likely to yield greater disease control effort. The findings presented in this chapter are mixed in terms of their implications for this theory. On the one hand, they demonstrate that the effect of race is contingent on competitiveness. On the other, if anything it appears that outcomes worsen as counties move from being more densely black to being more mixed, the opposite of what the theory predicts.

There are two methodological concerns that require more careful consideration. First, it might be the case that malaria is influencing the levels of both competition and

diversity. In fact, there is good reason to believe that the second of these statements is true. The greatest concentrations of blacks are in the so-called “cotton belt”, which was a hotbed of both slavery and disease. There is no obvious theoretical reason to believe that malaria would influence competitiveness, but it is certainly possible. One method for evaluating this threat would be to extend the time series of disease outcomes into the past, by including available data on malaria deaths in Alabama and Mississippi during the 1910s. Because methods for local disease control were not widely available during that period, we should expect to see little effect of competition between the first two cross sections, and a greater effect between the second two.

Another important feature of this analysis is that I am unable to directly measure disease control effort. To this point, archival searches have not led to any data sets with sufficient coverage to allow for direct measurement of disease control, even in a single state for a single cross section. Because of this data limitation, I am forced to use the outcome (malaria deaths) as a proxy for effort. The preferred remedy for this will be to continue archival research until data are found to measure effort directly at least for some subset of counties and years.

I now turn to analysis of malaria deaths in Mexico during the 1930s. With a few important methodological differences I will replicate much of the approach of the current chapter. The findings, as we shall see, differ in ways both important and illuminating.

Chapter 4

Local Control of Malaria in Mexico

The previous chapter considered the role of political competition and ethnic diversity in shaping malaria control efforts. I concluded that these two factors interact in shaping the effectiveness of U.S. counties in reducing malaria. In the present chapter, I consider the influence of these same two factors on the distribution of malaria in Mexico in the 1930s.

As in the previous chapter, the main theoretical question is whether, in a context of single-party dominance, political competition leads to lower levels of disease at the local level, and whether this effect is contingent upon the ethnic composition of the locality. While in the preceding analysis diversity was measured using race, for the Mexican case I must rely on indigenous language use, the best available measure of ethnic diversity in Mexican municipalities during the period in question. To measure political competition, I use the results of previous archival work reported in Anderson (1971), which classifies state elections as contested or uncontested. I discuss each of these measures, and their associated challenges, below.

In shifting the analysis to 1930s Mexico, I introduce a distinct political context, and a debate phrased in markedly different terms concerning the nature and importance of political competition. The United States South in the period of single-party dominance displayed elements of political control and limited competition that have rightly been characterized as subnational authoritarianism (Gibson 2013). Nevertheless, the dominance of the Democratic Party in the southern states was restricted by the real and constant influence of outside actors from both parties.¹

¹On this point, see Gibson (chap. 3 2013) and for historical antecedents, Kousser (chap. 1 and refer-

As I describe below, Mexico in the 1920s and 30s was marked by factional disputes, some of which continued to be violent. Poor, agrarian, buffeted by civil conflict and disease, Mexico was decades away from the political consolidation and economic growth that would lead it to be viewed as the most stable authoritarian regimes in Latin America, if not the world. The Mexico depicted in this chapter was governed by the first incarnation of the party that would later be known as the PRI.² It was a country that still struggled with regional integration, and had yet to fully establish a durable federal pact (chap. 2 Díaz-Cayeros 2006).

As in the United States South, it is true for the Mexican case that basic democratic theory leads us to expect that competition should lead to better performance in controlling disease. It is also the case for Mexico that the effect of competition should be expected to depend on ethnic diversity. While Mexico did not experience precisely the same type of racial stratification as the pre-World War II U.S. South, it was nevertheless a highly divided society, with indigenous populations experiencing extreme social deprivation and often relegated to the margins of political power.

In this chapter, I argue against two likely expectations of casual observers of Mexican politics. First, I argue that state and local actors played an important role in controlling disease during the 1930s. While Mexico in the twentieth century is usually characterized as a highly centralized system, this description does not apply cleanly to the period following the Mexican Revolution, during which national authority was effec-

ences 1974)

²See Garrido (chap. 2 1991) for a discussion of the ruling party during this period

tively splintered.³ Second, I argue that the political environment in which state governors functioned was much more decentralized and competitive than might be expected.

To preview the main results of the chapter, I find a strong, positive association between diversity and the level of disease. In other words, municipalities with a higher proportion of indigenous inhabitants had higher levels of malaria, controlling for other factors. Being located in a competitive state is also associated with higher levels of disease, a result which stands in contrast to the findings I will present in Chapter 5. I discuss the difference between these two results in the concluding chapter of the dissertation.

The finding that municipalities in more competitive states have worse disease outcomes demands further elaboration. My explanation, described below, hinges on the political context of 1930s Mexico. Specifically, I argue that competitive states in 1930s Mexico were those in which the problems of political fragmentation and conflict which characterized post-revolutionary Mexico were most severe. Thus, rather than spurring improved performance, competition led to decreased coordination and lower provision of public goods at the local level.

The chapter proceeds as follows. In the next section, I describe the nature of political competition at the state and local level in Mexico during the period in question. Section 4.2 describes the problem of malaria control in Mexico. Section 4.3 discusses the data and research design, section 4.4 presents the results, and section offers discussion and concluding remarks.

³Nor does this description apply cleanly to much of the post-1990 period of political liberalization (Cornelius 1999, see).

4.1 Contestation and competition in post-revolutionary

Mexico

In this section, I describe the nature of political competition and contestation in the period ranging from the end of the Mexican revolution, 1917, until the mid 1930s. My purpose here is not to give a comprehensive description of post-revolutionary Mexico, but rather to highlight two core points about Mexico's political system during this period. First, subnational actors during this period had significant independence from the leadership of the central government. In other words, they were not merely puppets of the regime. Second, subnational governments were subject to varying degrees of political competition, rather than being uniform in this regard. The question of how to measure this variation will be treated in the data section, below.

Following a period of repressive dictatorship in which the same leader, Porfirio Díaz, effectively ruled the country for four decades, Mexico experienced a nearly ten-year period of civil conflict. When the Mexican Revolution ended in 1917, the country's population and its political institution had been decimated. There followed a period of roughly 20 years in which political power was hotly, sometimes violently, contested. By the mid-1930s, during the presidency of Lázaro Cárdenas, the main features that would define the Mexican political system for the next 70 years had been established. Most important among these was a single, hegemonic political party which acted as the focal point for social groups —peasants, organized labor, urban small businesses —organized

into corporatist sectors. This political party eventually came to be called the PRI, and is widely viewed as one of the main sources of political stability which distinguished Mexico from most of the Central and Latin American republics during the twentieth century.

While hegemonic stability came to be the defining characteristic of the Mexican political system, this was far from the case during the period immediately following the Revolution. Perhaps the most concise way to describe the political system of post-revolutionary Mexico would be “fragmented”. This fragmentation can be seen in various aspects of the system, particularly in the means by which political power was cultivated and exercised. This feature is nicely summarized in the following description of the period 1917-1940: “The rules of the game were unambiguous: get close to a powerful person by whatever means, stick to him for as long as possible, and be ready to abandon him if he starts to lose his strength”(Smith 1979, p.245). Included among this list of powerful people were the state governors, whose influence in this period was greater than it would later come to be, as the dominant party progressively centralized power.⁴

The importance of state governors has as its historical root the power of regional and local leaders who exercised significant influence from the time of Mexico’s War of Independence. In particular, the fall of long-standing dictator Porfirio Diaz was precipitated in part by the former’s inability to accommodate competing local interests.⁵ The

⁴A description of this process, which I treat in a subsequent chapter, appears in Scott (1959).

⁵“La destrucción dramática y rápida de la dictadura . . . se debió en gran parte a la incapacidad del régimen de transformar sus estructuras para acomodar a nuevos actores políticos y al estallido de viejos rencores de las oligarquías locales (Meyer 1986, p.29)

active contestation of national authority by regional and local leaders, and, by extension, some state governors, continued until Lázaro Cárdenas succeeded in his major centralizing project of establishing the *Partido de la Revolución Mexicana* (PRM) as the focal point of political contestation and accommodation (Meyer 1986, p.32).

While the preceding makes clear that struggles for power were an important element of politics in post-revolutionary Mexico, this leaves open the question of whether that competition was played out in the electoral arena. In fact, for students of Mexican politics, any emphasis on electoral politics as an indication of political competition may seem odd. As Paul Gillingham put it, scholars have generally dismissed elections in modern Mexico as being “epiphenomenal to the real business of recruiting elites, reproducing power, and constituting a political system”(Gillingham 2012, p.53). But this view of Mexican elections as entirely ceremonial is unsatisfying for at least two reasons. First, it ignores the important purposes that the elections served for the regime, even when the outcome was predetermined.⁶ Most important among these for our purposes is that elections acted as a demonstration of the authority and unity of the dominant party. Where any level of unexpected competition appeared, it indicated discord within the party, or pressure from those who found themselves unable to gain access to the party structure.⁷

The second reason why it is premature to dismiss Mexican elections as epiphenomenal is that state and local elections were more competitive and unpredictable than national elections, especially presidential elections. In one scholar’s interpretation, these

⁶For a discussion of these purposes, see (Magaloni 2006).

⁷This sort of competition occurred repeatedly in presidential contests through 1952. See Gillingham (2012, p.53) for a brief summary.

state and local elections “permitted the contestation and participation that are the principal elements of Robert Dahl’s definition of polyarchy”(Gillingham 2012, p.65). It is not my purpose here to dwell on such conceptual distinctions, but merely to point out that the historical record supports a view of state and local elections as substantially more competitive than the hegemonic image of the consolidated PRI might suggest.

One might respond that, in a system that concentrated so much power in the hands of the president (Garrido 1989), competition at the local level could have little impact on the functioning of government. This however, is an error of both logic and history. Mexico’s centralized system emerged as a compromise between competing regional and local interests, and was not impervious to dissent from below (see Díaz-Cayeros 2006, Chap.2). National interests dominated because they won and maintained the allegiance of state and local interests, not by default. Furthermore, national authorities were not always as dominant as they later came to be; their dominance emerged gradually over the course of the post-revolutionary period.

It is certainly the case that political contestation was a central feature of Mexico’s political system during the years between the end of the revolution and the political consolidation that accelerated during the mid-1930s and continued unabated for four decades. Molinar Horcasitas provides a good general description of this difference, labeling the post-revolutionary system a “diarchy,” as opposed to the unified presidentialism of the later period.⁸ In making this general description of contestation more pre-

⁸“... desde 1917 hasta 1935 existió una ‘diarquía’, consistente en que junto al supremo Poder Ejecutivo ... casi siempre coexistió, en competencia más o menos abierta, un caudillo o un jefe máximo ... con poder suficiente para enfrentar con perspectivas de éxito al presidente”(Molinar-Horcasitas 1991, p.17).

cise, Molinar Horcasitas points directly to state and local leaders, whose regional power formed “an important part of the general equilibrium of forces in the system, affecting, and being affected by, the balance of powers in the capital”(Molinar-Horcasitas 1991, p.20, translation mine).

In contrast to the dominant narrative of Mexican politics emphasizing the centralization of the PRI regime, a strong federalist character permeated the republic from the time of the liberal constitution of 1857. As one scholar described it, the Mexican Revolution of 1910-1917 sought in part to re-establish the sovereignty of the states, by emphasizing the importance of the popular vote (Hernández-Chávez 1996, p.277). This federalist current continued during the post-revolutionary period, as “the politics of compromise aimed to reconcile the broader public interest with the autonomy of the regions”(Hernández-Chávez 1996, p.279, translation mine).

We have established that regional diversity characterized the political system of post-revolutionary Mexico. While this lends credence to the argument that state governors were meaningful policy actors, because the regions they represented had interests different from those of the center, there is another concern that needs to be addressed. It has been widely argued that, from the moment of their nomination onward, governors were so tightly controlled by the president that they could not be credibly viewed as independent actors. While it is certainly true that Mexican governors during the period of ruling party hegemony were not independent by democratic standards, this does not imply that they were either indistinguishable from the president or ineffectual.⁹

⁹For a general discussion of the role of the governors in Mexico since the revolution, see Díaz-Cayeros

Indeed, there is evidence that state governors had substantially more leeway than might be expected in a hegemonic centralized system. This is true both in terms of their political ideology and the public policies adopted within the states. Regarding ideology, as Díaz-Cayeros demonstrates using data spanning the years from the Maximato to the Salinas administration, Mexican governors did not always align ideologically with the presidents who nominated them (Díaz-Cayeros 2006, Chap.4). The main conclusion of this research is that presidents were constrained in their choice of governors by the preferences of other regional actors. So it is not the case the governors were merely political mirror images of the president.

In terms of public policy, during post-revolutionary period, a number of states formed so-called “laboratories of innovation,” in which policies were adopted that differed markedly from those of the center (Benjamin 1990). This policy innovation was especially pronounced in the areas of agrarian reform and labor politics, where the relative strength of factional players varied significantly across states. In states such as Yucatán, San Luis Potosí, and Tabasco, a strong socialist streak developed, in which mobilization amongst peasants and workers aimed at more aggressive redistribution than the national norm.

To summarize: Mexico during the post-revolutionary period was a complicated and diverse place. Political actors at the local and state level, rather than merely puppets of a consolidated regime, exercised some independence in the realm of policy, and

(2006); Anderson (1971). During his effort to centralize power, Lázaro Cárdenas wrestled with recalcitrant state-level strongmen, most notably General Saturnino Cedillo, ex-governor of the state of San Luis Potosí (Cornelius 1973, pp. 424 *et passim*)

responded to subnational, rather than exclusively national interests.

4.2 Malaria in Mexico, ca. 1930

By the 1930s, malaria had been a serious public health problem in Mexico for centuries. As late as 1947, malaria was still the third most important cause of death in the entire country, behind only diarrhea and pneumonia (Gonzales 1979, Figure 2, p.24). This high death rate is remarkable in part because the type of malaria parasite that was dominant in Mexico, *plasmodium vivax*, is not as deadly as the other principal variety, *plasmodium falciparum*. In addition to these premature deaths, it was also widely held the malaria exacted large economic costs in the form of decreased productivity.¹⁰

Figure 4.1 summarizes the most comprehensive data currently available on the level of malaria in Mexico during the twentieth century. The figure plots the monthly count of malaria cases reported by all of the Mexican states, divided by the national population and multiplied by 10,000 to preserve scale. More nuanced analysis of these data appear in Chapter 5, but for present purposes it is sufficient to note two points about this figure. First, the incidence of malaria during the 1930s and 40s was substantial, and preceded the dramatic decline that would occur in the 1950s. In other words, the time period considered in the present analysis was one of ongoing malaria prevalence. Second, case data for the early 1930s are missing from archival records. The data presented in this chapter use a different measure, malaria deaths, and they occupy what is currently a gap

¹⁰As an example of this attitude, see Appendix, Figure 4.8.

in our epidemiological knowledge of malaria in Mexico.

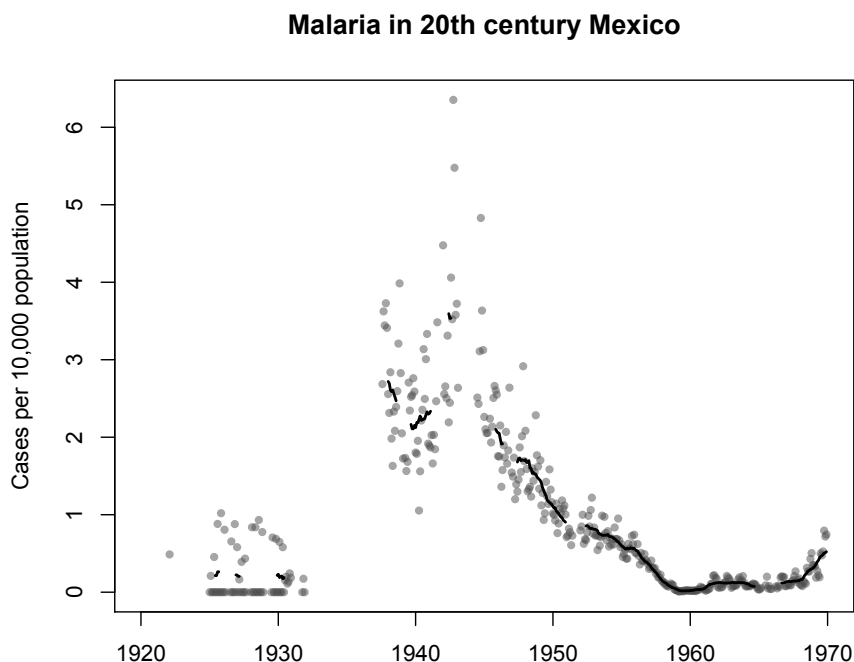


Figure 4.1: The level of malaria in Mexico during the twentieth century. The points show the monthly count of cases in all Mexican states divided by the national population, computed yearly. The line shows a two-sided, twelve month moving average of the same data. These data were compiled by Rodolfo Acuña Soto, using records from the Mexican Department of Health and Assistance (*Departamento de Salubridad y Asistencia*)

More generally, infectious disease was an important issue in both the international and domestic politics of Mexico. In the international realm, infectious disease intersected at key moments with Mexico's larger economic and political aims. A key example of this is the alarm raised by Mexico's trading partners at the turn of the twentieth century when it was discovered that the port of Veracruz was a potential hotspot in a global yellow fever epidemic (Ramos 1990; Birn and Ramos 1999). My own archival work revealed continued interest by the United States Government in Mexican rates of

yellow fever and malaria, presumably as part of more general concerns about international contagion.

Moving into the 1950s, malaria eradication became an element of cold war politics played out between the United States and Mexico. Around the world, many millions of dollars were invested in global eradication of the disease, with Latin America as a primary focal point for these efforts (Stepan 2011). The multilateral institutions that coordinated these eradication campaigns, especially the Pan-American Sanitary Bureau, were points of contact between representatives of the U.S. government, their primary donors, and national governments in the region. As Cueto (2007) describes in a book-length treatment of the topic, disease eradication dove-tailed with the United States' Cold War aims of cultivating allies in the region and preventing the Soviet Union from using aid to establish its own alliances in the region. In Mexico, the campaign to eradicate malaria was designed jointly with diplomatic and technical personell from the U.S. Government.

But infectious disease was not only an international issue. During late nineteenth and early twentieth centuries, the dictatorship of Porfirio Díaz showed itself to be particularly adept in controlling epidemics. In particular, the regime was quite thorough in dealing with typhoid epidemics that touched Mexico city, making use of so-called sanitary police, and imposing what one author labeled a "sanitary dictatorship" (Ross 2005).

It was not until after the 1910 Revolution that authorities turned their attention specifically to malaria. They did so at first under the guidance of the Rockefeller Foun-

dation (henceforth, RF), whose role in international health during this period is described in the previous chapter.¹¹ The RF's approach to disease control in Mexico closely paralleled its approach in the United States, in that the basic aims were to establish local capacity to carry out scientifically supported solutions to major infectious diseases, including hookworm, yellow fever, and malaria.¹²

In the case of malaria, the solutions proposed by the RF to reduce the disease were nearly identical to those adopted in the United States: control of mosquito habitat through engineering and direct application of various insecticides, improvements to dwellings, and therapy for the infected using quinine. As is for the United States South, the precise efficacy of these measures is unknown for the Mexican case. The main difference between Mexico and the United States in the early treatment of malaria is the geographic scope of activity by the RF. In the 1920s and 30s, the RF actively observed and promoted malaria control activities in only a few locations.

It is in part because the RF played a less active role in malaria reduction in Mexico than in the United States that we can focus more clearly on the part played by local authorities in the Mexican case. Both the Mexican Constitution of 1917 and a sanitary code adopted in 1926 place explicit responsibility on state and local authorities in the reduction of infectious diseases. While the incipient centralization of the post-revolutionary period tended to give greater power to the national government and to national bodies such as the Department of Public Health, local and state bodies were not entirely

¹¹For an overview, see Farley (2003).

¹²Birn (2006) provides an excellent analysis of the relationship between the RF and Mexican public health authorities

eclipsed.¹³

At least in the view of the central health authorities, local actors were capable of implementing the suite of policies that RF science had established as the main tools for reducing malaria. In 1933, the Mexican Department of Health sent hundreds of letters to municipal mayors throughout the country, urging them to adopt these policies in order to reduce malaria. The letters, reproduced in the appendix, were addressed using the name of the municipality, and contained specific information on the number of malaria deaths recorded in that municipality during a prior month. The letters included an informational pamphlet detailing the preferred methods of malaria reduction, and conveyed explicit instructions to the municipal president to endeavor to reduce malaria deaths.

That Mexico's Department of Health had such detailed information about malaria deaths is itself somewhat remarkable. As explained above, Mexico during the 1930s was still consolidating national authority in the aftermath of the 1910 Revolution. This lack of consolidation was particularly acute at the local level, where the national authorities were still struggling to ensure that elections were conducted on schedule and according to uniform regulations. For reasons that are not apparent, the Department of Health at this time embarked on a major data collection effort focused on malaria. This effort generated monthly death records for all of the Mexican localities in which at least one malaria death occurred. An example of these death records is reproduced in the appendix.¹⁴

¹³Birn (2006) discusses the tension between autonomy and limited capacity that characterized the interchange between local and national authorities during this period.

¹⁴To my knowledge, this dissertation is the first scholarly work to use these death records, or the correspondence based on them.

It is important to note that the period considered in the present analysis precedes by decades the discovery of DDT and its large-scale application for malaria vector control. In part because of this, and in part because of the incomplete centralization of the health bureaucracy, no national-level malaria reduction campaigns occurred during the 1930s. As discussed in Chapter 5, these efforts would come in the 1950s, when both administrative and technological advances made such an approach feasible.

4.3 Data and Research Design

4.3.1 Measuring malaria

The primary new source of data for this chapter are death records that were recorded by the Mexican Department of Public Health, the precursor to the Mexican Ministry of Health.¹⁵ These data were collected by photographing documents held at the Mexican National Archive (*Archivo General de la Nación*). The deaths were reported by month during the years 1933 and 1934. Each document lists the localities (the lowest level of political geography in the Mexican system, corresponding to a town or village) in which at least one fatality was attributed to malaria in the corresponding period. The documents were photographed and the photographs digitized by Creekside Digital.¹⁶

Figure 4.2 maps the data described above. Each municipality is shaded by the

¹⁵The precise institutional designation is Oficina de Enfermedades Tropicales de la Sección de Bioestadística del Departamento de Salubridad Pública, which was an executive agency of the Mexican federal government.

¹⁶<http://creeksidedigital.com/>

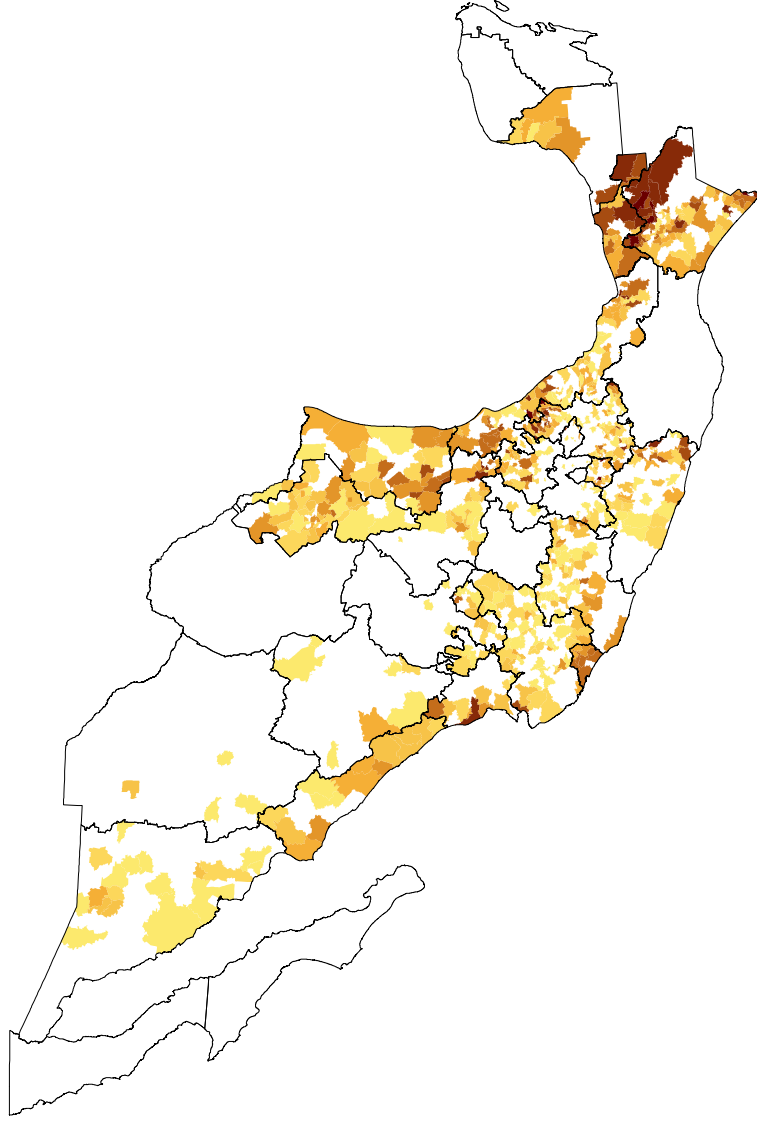


Figure 4.2: Geographic distribution of malaria deaths in Mexican municipalities, 1933-34. Municipalities with outlines drawn experienced at least one malaria fatality during the period. Darker colors represent more deaths. Data on Oaxaca are omitted because no file containing the correct boundaries for Oaxaca's districts (the unit of political geography in use in the state in 1930) is publicly available.

total number of malaria deaths occurring within that municipality during 1933 and 1934. Data for the state of Oaxaca are omitted.¹⁷ The map shows that the geographic distribution of malaria in Mexico was bi-coastal, that the central mountainous region was mostly free of the disease, and that most states had at least some of their population at risk.

As noted in the previous chapter, deaths are not necessarily the ideal dependent variable for the type of analysis presented here. Because the malaria parasite that dominated in Mexico (*plasmodium vivax*) kills only a small proportion of those infected, a more direct measure of disease control would be malaria cases. For the period in question, however, there are no case data that provide even partial coverage at the municipal level. In fact, to my knowledge, the data presented here are the only comprehensive, local-level data set on malaria prevalence for Mexico during the period when the disease constituted a major public health threat.

4.3.2 Measuring competition and diversity

The main independent variables in the analysis are political competition and ethnic diversity, each treated here in turn. As the description above makes clear, measuring political competition in post-revolutionary Mexico is not a straightforward task. Election returns are available for only a handful of contests, almost entirely for the presidency. And those election results that do exist are of limited use, because it was often the case that, by the time formal candidates for office had been chosen, the final outcome of the election had been practically decided. This does not mean, however, that the system

¹⁷This is due to the Oaxaca data being reported at the district, rather than municipal level.

Table 4.1: Competition in the Mexican states, ca. 1940

Competitive States	Coahuila, Guerrero, Morelos, Guanaguato, Nuevo León, Aguascalientes, Chiapas, Oaxaca, Tamaulipas, Nayarit
Non - Competitive States	México, Yucatán, Jalisco, Campeche, Colima, Sonora, Chihuahua, Durango, Puebla, Sinaloa, Veracruz, Tlaxcala, Tabasco

Source: Anderson (1971)

was devoid of competition, but rather that measures of competition must be sought from sources other than election returns.

One potential alternative source of data on political competition are the many historical studies of the period, which use varying approaches to make (or allow for) qualitative assessments of the level of competition within Mexico. The first point to note about such sources is that, geographically, they focus on either regions of the country, or on the 29 Mexican States, the federal district, and the territories of the Yucatan peninsula. In other words, no such measurement is available at the municipal level. These state-level measures appear in a variety of sources, including Brandenburg (1956, p. 340) who provides a map of states with strongest organized political opposition in the early 1950s, and Benjamin (1990, p. 74) who gives a list of the states led by “reformist” governors during the 1930s.

Of these alternative measures, the one most useful for present purposes was developed in Anderson (1971), who details the methods of selecting state governors start-

ing as early as the mid 1930s. Anderson's analysis demonstrates that the occupants of these politically important positions were chosen through an often conflict-ridden process of conciliation between the representatives of various social sectors, along with the national executive. While this process was designed to reduce the risk of violent conflict over the choice of governor, it did not eliminate all opposition entirely. In fact, by consulting newspaper reports and other archival records, Anderson was able to provide an election-by-election evaluation of whether the dominant-party gubernatorial candidates faced opposition, starting in 1941.¹⁸ Table 4.1 shows the designation of states as competitive or non-competitive according to Anderson's measure.

Two facets of this measure demand further discussion. First, Anderson's categorization of elections as competitive and non-competitive applied to elections beginning in 1941. This is seven years after the malaria deaths that form the dependent variable of my analysis were collected. The justification for using this measure is to be found in the description of the nomination process that accompanied these elections. If nominations were contested by interest groups, opposition to the ruling party's candidate reflected divergence between those groups. While some component of that divergence may have reflected disagreement over a specific candidate, it is more likely that opposition emerged in places where there were more deeply ingrained sources of contention between social sectors. For this reason it is plausible to assume that competition in 1941 is a reliable measure of competition seven years earlier.

¹⁸The details for each election are provided in Anderson (1971), and summary results are provided in 1941-1946 in Anderson (1971, Table 2-2, p. 78).

The second point to consider about the Anderson measure has to do with the unit of observation. A key challenge in understanding the impact of competition on disease control in Mexico is that the theoretically relevant unit of analysis for the first concept is the state, while the relevant unit of analysis for the second concept is the municipality. State governors were more politically relevant actors, but municipal authorities had the motive and means to be concerned with the local mechanisms for reducing malaria. The analysis reported below takes the municipality as the unit of observation to preserve a direct theoretical link to disease control.

This raises the question of whether competition at the state level would have impacted actions carried out at the municipal level. The historical record is not robust enough to answer this question definitively. Nevertheless, it is plausible that the dynamics of state elections would have been felt by municipal presidents and others in municipal government. As described above, state-level elections were primarily concerned with competition and negotiation between the societal sectors whose support comprised the power base of the ruling party. These same sectoral organizations were active in a very wide array of municipalities, and the organizational actors at the municipal level would likely have been subject to the same pressures as their counterparts in the state capitals.

I now turn to the second measure of theoretical interest, ethnic diversity. The measurement of ethnicity in Mexico, and its relationship to poverty, has been the subject of extensive controversy.¹⁹ In spite of its imperfections, language use, in particular the speaking of an indigenous language, has been widely recognized as the best available

¹⁹See, e.g., the discussion of James Wilkie's work in Skidmore and Smith (1970).

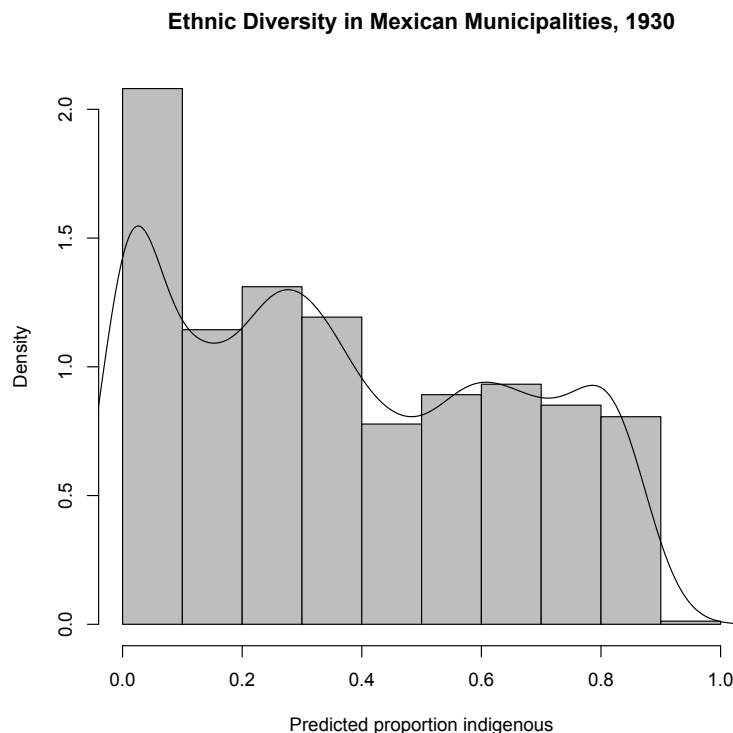


Figure 4.3: Distribution of ethnic diversity in Mexican municipalities, circa 1930. Imputed using contemporary data at the municipal level and historical data at the state level to estimate the proportion of the population over 5 years old in each municipality who speak at least one indigenous language, in addition to Spanish.

measurement of ethnic diversity with universal coverage. The 1940 census reports data on the use of indigenous language among the population over 5 years old at the municipal level for the year 1930.²⁰ This figure suffers from potential measurement error, resulting from the difficulty of administering a multi-lingual survey. Any attenuation bias that could result from measurement error is of particular concern, and so I adopt an alternative measure of language use that is less prone to such error.

This alternative measure takes as its starting point data from the 2010 decennial

²⁰It is unclear why these figures are reported in the 1940, rather than the 1930 census.

census on the number of inhabitants over the age of five who speak at least one indigenous language in addition to Spanish. These municipal-level data were collected at a time when the capacity of the Mexican statistical agencies to collect accurate information at fine levels of geography is widely recognized. The contemporary municipal-level data are combined with the same figure calculated at the state level going as far back as 1890. The historical data are used to fix a maximum value for indigenous language use in each municipality. The figure is then assumed to decay logistically at intervals of ten years between 1890 and 2010. The interpolated value for the year 1930 is used in the analysis below, and summarized in Figure 4.3.²¹

4.3.3 Other measures

Other measures used in the analysis that are taken from the Mexican Census. Mexico has conducted decennial censuses going back to the late nineteenth century, summaries of which are available on the website of the national statistical agency (INEGI). Two of these measures were coded from the electronic copies of the 1960 census summary documents. The literate proportion of the population reports the proportion of the population six years and older capable of reading and writing.²² The economically active population reports the proportion of the population eight years and older who work for money, produce goods of commercial value, are seeking work, or are expecting to start

²¹Thanks to Alberto Díaz Cayeros for preparing these data.

²²Specifically, the census codes as literate anyone above the age of six capable of reading and understanding a paragraph of text, and writing a brief exposition about daily life.

work.²³ Although the 1960 census documents are used, the figure reported corresponds to data collected during the 1930 census.²⁴

Finally, the measure of proportion rural is constructed using data from the Mexican historical archive of localities (*Archivo Histórico de Localidades*).²⁵ This data set provides historical population levels by locality, the unit of political geography below the municipality. Following the Mexican government's official definition, localities were coded as either urban (population $\geq 2,500$) or rural (population $< 2,500$). The proportion rural figure reports $\frac{\sum r_i}{pop}$ where R is the set of all rural localities, r_i is the population of locality i , and pop is the total population of the municipality.²⁶

4.3.4 Research Design

Briefly, the aim of the analysis presented below is to estimate the association between competition and malaria deaths in the period covered by the data set described above (roughly 1932-1934). An obvious question that arises is whether higher levels of malaria deaths might lead to lower levels of competition, leading to endogeneity bias. While the current version of the analysis does not allow me to protect against this bias, subsequent research has identified another set of archival documents containing counts of malaria deaths at the municipal level during the early 1940s. With this second cross

²³These variable definitions are reproduced in the front matter of the 1960 census summary documents corresponding to each Mexican state.

²⁴This is because the statistical agency reproduced the 1930 data in the 1960 census. In addition possibly being more accurate, the data from the 1960 census documents are more convenient to transcribe.

²⁵<http://www.inegi.org.mx/geo/contenidos/geoestadistica/introduccion.aspx>. This data was processed by Ayal Margalit.

²⁶Note that this approach differs slightly from the coding employed by the Mexican statistical agency (INEGI). That agency codes the the county seat as urban, regardless of its size.

section in hand, future versions of this work will be better able to address threats of endogeneity and omitted variable bias. A second important modification for future analyses will be to adequately model the geographical dependency of malaria deaths.

The estimating equation is generally of the form:

$$Y = \alpha + \beta_1 * POL + \beta_2 * RACE + \gamma * \mathbf{X} + e \quad (4.1)$$

Where *POL* is an indicator of political competition, uniform within states, *RACE* is one of the measures of ethnic diversity described above, and \mathbf{X} is a vector of municipal level indicators.

4.4 Results

The discovery and collection of local-level malaria data from the 1930s allows us to determine the systematic effect of political and social factors on human health during an era of consolidation in both the political realm, and in the technologies available for disease reduction. The first core finding of this chapter is that political competition is associated with higher levels of malaria. This relationship is visible in the raw data, as Figure 4.4 shows; the analysis presented below will demonstrate that the relationship is robust, and thus demands further examination. The second main finding of the chapter is that ethnic diversity is also positively associated with malaria deaths, and this association is not contingent on the level of political competition.

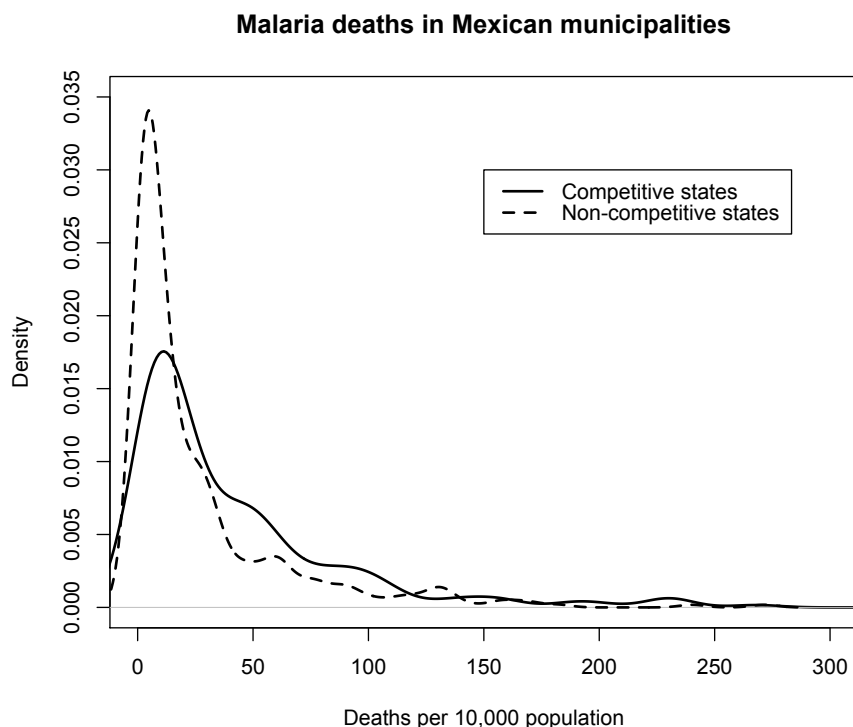


Figure 4.4: Density plots of the level of malaria deaths by competitive vs. non-competitive state.

In Table 4.2, I present two different empirical specifications to predict the level of malaria deaths in Mexican municipalities. The main independent variables in both specifications are the measures of political competition and ethnic diversity described above. However, I show two different approaches to measuring the effect of ethnicity, with markedly different results. In both specifications the dependent variable is the count of malaria deaths divided by the municipal population, multiplied by 10,000. Because the measure of competition being used is uniform within states, the standard errors reported for all specifications are clustered at the state level.²⁷

²⁷Clustered standard errors were generated using code created by Ian Gow.

In the first specification, reported in column 1 of the table, I control for socio-economic characteristics that are predictive of malaria. Here, ethnic diversity is measured simply by the proportion of inhabitants speaking at least one indigenous language in addition to Spanish, imputed using contemporary and historical data according to the procedure described above. All specifications also include two categorical measures of geography. The first takes the value 1 if a municipality is located below the median value of latitude for the entire country and 0 otherwise. The second geographic variable takes the value of 1 if the municipality is closer to the coast than the median value for the county, and 0 otherwise. The estimates on my main independent variables are robust to including these geographical measures as continuous rather than categorical variables. Political competition and ethnic diversity are significant predictors of the variation that remains after accounting for other variables.

In the second specification, I consider an alternative approach to measuring ethnicity. Using the data on the proportion of inhabitants who speak at least one indigenous language in addition to Spanish, I compute a diversity index. This index is equivalent to the widely used index of ethno-linguistic fractionalization, and is computed by $\frac{1}{p_{eth}^2 + (1-p_{eth}^2)}$.²⁸ Considering this transformation of the raw proportion, call it $f(x)$, one notes that $f(0.5 - \delta) = f(0.5 + \delta)$, for $0 < \delta < 0.5$. For this reason, I also include an indicator variable that takes the value of 1 if the municipality is majority indigenous, and 0 otherwise. The results using this alternative measure indicates that malaria deaths are concentrated in the most densely indigenous municipalities. It is important to note that

²⁸For a discussion of this measure, see Easterly and Levine (1997)

Table 4.2: Competition and malaria in Mexican municipalities.

	Malaria deaths per 10,000 pop., 1933-34	
	(1)	(2)
Prop. illiterate	5.271 (17.243)	11.813 (15.572)
Prop. econ. inactive	6.719 (72.967)	4.620 (64.952)
Prop. rural	13.675*** (5.283)	13.100*** (4.764)
Prop. indigenous	68.139*** (14.301)	
Fragmentation		13.453 (9.113)
Majority Indigenous		25.968*** (8.344)
Southern latitude	-4.689 (7.284)	1.205 (9.129)
Close to coast	16.186*** (5.987)	16.970*** (6.332)
Competitive state	17.100** (7.844)	15.936** (8.018)
Constant	-15.561 (57.418)	-28.135 (53.255)
N	568	568
R ²	0.165	0.164
Adjusted R ²	0.154	0.152
Residual Std. Error	45.671 (df = 560)	45.741 (df = 559)
F Statistic	15.759*** (df = 7; 560)	13.658*** (df = 8; 559)

*p < .1; **p < .05; ***p < .01

the coefficient on competitiveness remains similar in magnitude and significance in this specification.

Following the analysis presented in the preceding chapter, I also estimated a model (results not shown) including the interaction between competition and diversity. The measure of ethnicity used is the simple proportion of indigenous people, as in specification 1. While in the analysis of U.S counties, I found that competition acts as a mediator of the effect of race, with more densely black counties being associated with higher malaria only in the more competitive states. For Mexican municipalities, ethnic diversity leads to increasing levels of malaria in both competitive and non-competitive states. The interaction effect is visualized in Figure 4.5

In the following section, I discuss the results presented here with reference to the results of the previous chapter, and to my theoretical argument. The basic conclusion is that Mexico provides an example of the second possible pathway by which competition can influence disease control - through increasing fragmentation and decreasing the provision of public goods.

4.5 Discussion

Mexico was still emerging from the period of revolutionary violence when the Department of Public Health first turned its attention to the problem of malaria. At the time, the 1930s, the Mexican state was not nearly as stable, nor as centralized as it would come to be in the next few decades. Moreover, the available methods to reduce

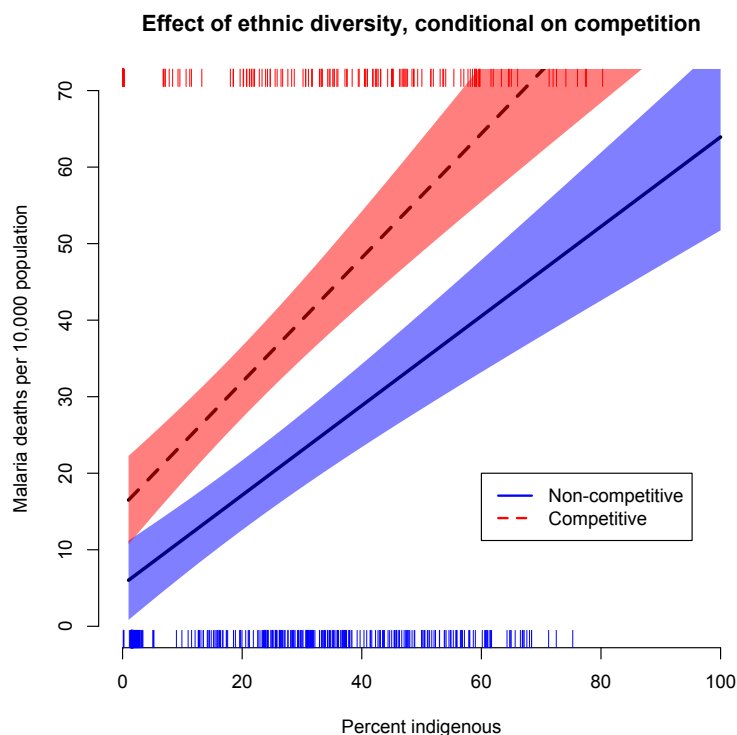


Figure 4.5: The effect of ethnic diversity contingent on political competition. Solid lines give predicted values of malaria deaths over the range of values of ethnic diversity. Predictions are based on the model reported in table 4.2, column 3.

malaria were far less powerful than they would soon become. Nevertheless, the archival evidence makes it clear that there was a nation-wide effort to monitor and reduce malaria during this period, and that the focal points of this effort were municipal presidents.

The results above tell us a number of things about how this effort unfolded, using a single snapshot of malaria mortality taken between 1933 and 1934. We know that, controlling for other factors including geography, municipalities in politically competitive states suffered higher levels of malaria deaths. Two aspects of this finding demand elaboration. First it is necessary to consider whether competition may be acting as a proxy for another factor. Second, if it is competition and not some other factor that leads

to higher malaria death rates, this relationship must be reconciled with the results of the previous chapter, and more generally, with the theory developed in this dissertation.

Of course, in a single cross-sectional analysis using observational data, it is impossible to definitively discard the possibility that some other factor, correlated with both competition and malaria deaths, is driving the result. That being said, there are good reasons to believe that competition did play a core role in shaping the pattern of malaria deaths. The measure of competition used in this analysis indicates those states in which one or more of the social sectors were not able to reach an equilibrium negotiation point with others involved in selecting the candidate for state governor. In these cases, the spurned sector voiced opposition to the ruling party's chosen candidate. The states in which this sort of coordination failure occurred are likely those in which public officials may have been less efficient at coordinating implementation of the recommended package of interventions to reduce malaria in this period (those referenced above and in Figure 4.6).

In fact, this relationship is precisely the one hypothesized in the second arm of the diagram presented in Chapter 2, above. Rather than spurring improved performance, competition can lead to decreased coordination, and thus less efficient provision of public goods. This is particularly relevant in a context of limited overall political competition, such as a single-party-dominant regime. Where a dominant party controls government, any form of fragmentation may detract from the ability of the authorities to coerce and otherwise shape effective public action to control disease.

The topic of fragmentation is doubly relevant, as our second independent variable is a direct measure of fragmentation linked to ethnicity. Theoretically, the role of ethnicity in the Mexican case differs from the case of the United States South, where ethnicity was the primary axis of political contestation, and often the cause of open, even violent conflict. In Mexico, ethnic diversity is less central to the historical narrative, but that does not imply it is of lesser importance for understanding the systematic determinants of human welfare. As the analysis here shows, ethnicity is highly predictive of malaria levels, even after controlling for economic and geographic factors.

Nevertheless, the role of ethnicity, and its interaction with competition, are different from what was encountered in the previous chapter. Specifically, my analysis of the U.S. case showed that competition acted as an important mediator of the effect of race, with increases in the proportion black leading to higher malaria death rates only in counties with low disenfranchisement (that is, the competitive counties). That this contingent relationship is not present in the Mexican case simply reinforces the notion that ethnicity can more easily be decoupled from competition in Mexican municipalities than in U.S. counties.

The general implications of these findings is that, in order to properly understand the impact of competition upon disease control, we must consider both of the possible pathways that govern that theoretical relationship. In one of these, increased competition induces government officials to perform better, and thus to provide more effective disease control. In the other, however, competition leads to greater fragmentation among

government actors, reducing their ability to coordinate and to provide public goods.

4.6 Appendix: Archival materials

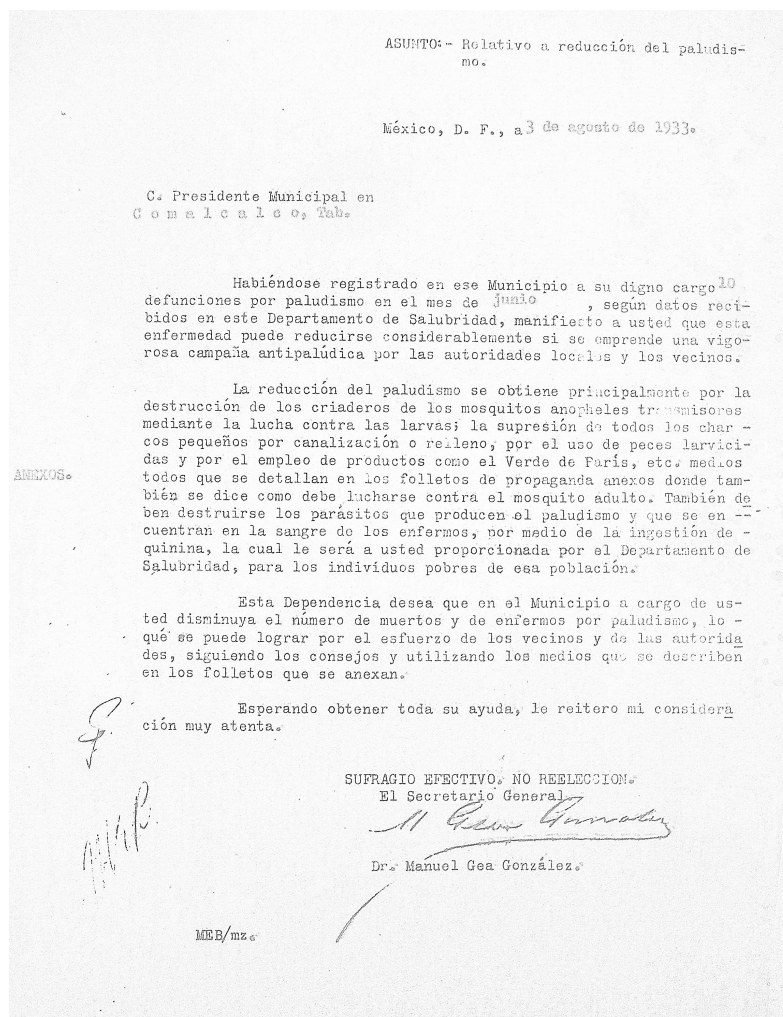


Figure 4.6: Sample of letters to municipal presidents describing methods to reduce malaria, held at the Mexican National Archives. Each letter was addressed by the name of the municipality, rather than by the name of the municipal president. Dashes represent portions of the letter filled in using data collected by the Mexican Department of Health.

Figure 4.6 shows an example of the letters directed to municipal presidents by the Mexican Department of Health. The text is reproduced in its entirety below. Rather than

being addressed to the municipal president by name, the letters were addressed using the name of the municipality. Each letter contained specific figures on the number of malaria deaths occurring in the municipality, which were based on data collected by the Department of Health.

Habiéndose registrado en ese municipio a su digno cargo - defunciones por paludismo en el mes de - , según datos recibidos en este Departamento de Salubridad, manifiesto a usted que esta enfermedad puede reducirse considerablemente si se emprende una vigorosa campaña antipalúdica por las autoridades locales y los vecinos.

La reducción del paludismo se obtiene principalmente por la destrucción de los criaderos de los mosquitos anopheles transmisores mediante la lucha contra las larvas; la supresión de todos los charcos pequeños por canalización o relleno, por el uso de peces larvicidas y por el empleo de productos como el Verde de París, etc. medios todos que se detallan en los folletos de propaganda anexos donde también se dice como debe lucharse contra el mosquito adulto. También denem destruirse los parásitos que producen el paludismo y que se encuentran en la sangre de los enfermos, por medio de la inyección de quinina, la cual le será a usted proporcionada por el Departamento de Salubridad, par los individuos pobres de esa población.

Esta Dependencia desea que en el Municipio a cargo de usted disminuya el número de muertos y de enfermos por paludismo, lo que se puede lograr por el esfuerzo de los vecinos y de las autoridades, siguiendo los consejos y utilizando los medios que se describen en los folletos que se anexan.

Esperando obtener toda su ayuda, le reitero mi consideración muy atenta.

Figure 4.7 shows an example of the records of malaria deaths collected by the Mexican Department of Health. The records were gathered monthly, as indicated by the date stamps. Each line shows the number of deaths registered in an individual locality, the lowest unit of Mexican political geography.

610-3113/1

6001.

OFICINA DE REGISTRO NOTARIAL

Anexo A de las defunciones por FALCIDIA registradas en la República durante el mes de SEPTIEMBRE ppdo., con su proporción al C. Jefe de la Oficina de Enfermedades Tropicales.

LOCALIDADES.	MUNICIPIOS.	ESTADOS.	INDICACIONES.
Calvillo.	Calvillo.	Agu.	1
Eda. de Sta. Teresa.	Castafios.	Coab.	1
Francisco I. Madero.	Francisco I. Madero.	"	2
Villa de Alvarez.	Villa de Alvarez.	Col.	3
Tecoman.	Tecoman.	"	4
Coquimtlán.	Coquimtlán.	"	7
Mansanillo.	Mansanillo.	"	1
Comalá.	Comalá.	"	1
Acapetahu.	Acapetahu.	Chi.	2
La Libertad.	La Libertad.	"	1
Herriozabal.	Herriozabal.	"	1
Mocintla.	Mocintla.	"	1
Terán.	Terán.	"	1
Mapastepec.	Mapastepec.	"	1
Buquiatán.	Buquiatán.	"	1
Mixtla.	Mixtla.	"	2
Motocintla.	Motocintla.	"	4
Arriaga.	Arriaga.	"	3
Presidios.	Presidios.	Dgo.	1
Canatlán.	Canatlán.	"	1
Durango.	Durango.	"	2
Dolores Hidalgo.	Dolores Hidalgo.	Oto.	1
Jaral del Progreso.	Jaral del Progreso.	"	3
Ciudad Manuel Moblado.	Ciudad Manuel Moblado.	"	1
Jerécuaro.	Jerécuaro.	"	1
Valle de Santiago.	Valle de Santiago.	"	10
Irapuato.	Irapuato.	"	2
Tarandacua.	Tarandacua.	"	2
Sa. Rosa Durango.	Valle de Santiago.	"	1
Petresillos.	Pénjamo.	"	1
S. Miguel Coahuila.	Sela.	"	2
Cortazar.	Cortazar.	"	2
Victoria de Cortazar.	Jaral del Progreso.	"	3
Victoria.	Victoria.	"	2
Atargua.	Atargua.	"	2
Jalpa de Cánovas.	Purísima del Rincón.	"	2
Silao.	Silao.	"	2
Villagrán.	Villagrán.	"	2
Jacontla el Grande.	Dolores Hidalgo.	"	2
Chilpancingo.	Chilpancingo.	Gro.	2
Tesco.	Tesco.	"	2
Chilapa.	Chilapa.	"	2
Tlape.	Tlape.	"	2
S. Jerónimo de Juárez.	Atenas de Alvarez.	"	2
Salinaltepec.	Salinaltepec.	"	2
Motatitlán.	Motatitlán.	Dgo.	2
Piñaflores.	Piñaflores.	"	2
Ixmiquilpan.	Ixmiquilpan.	"	2
Calnali.	Calnali.	"	2

A. H. G. H. G.
32 de Julio 1910

Figure 4.7: Sample image of the malaria death records held at the Mexican national archives.



Figure 4.8: Draft of an image for a propaganda piece in support of Mexican malaria eradication campaign. The text reads: *The sick man does not produce. The economy of the country falls behind*

Chapter 5

To Elimination and Back: Malaria in Mexico over the 20th Century

The previous chapters focused on the dynamics that shape disease at the local level. The evidence suggests that we should reject the null hypothesis that competition does not impact disease control. In the present chapter, I explore this theoretical relationship further. The country to be analyzed will be Mexico, and the level of analysis will be the state, rather than municipality. My approach will be more descriptive than analytic, though I will provide one set of statistical results to support the argument that, in the case of the Mexican states, competition led to improved disease control.

Even prior to independence, the territory of Mexico was divided into administrative and political units which often obeyed either geographic boundaries, or divisions among indigenous peoples. These boundaries persisted through independence, increased during the nineteenth century, and remained intact through the revolution of 1910-1917. By the 1930s, the composition of states was nearly the same as it is today, with the exception of some further divisions and administrative changes at the periphery.¹ As indicated in the previous chapter, the Mexican states were an important focal point of political action, and state leaders played key roles in the conflicts that shaped the political system during the period of ascendancy by the PRI.

In the pages that follow, I take the states as my primary focus, and make use of a new data set that is well suited to this purpose. These data report the monthly level of malaria cases in each of the Mexican states beginning in the 1930s, and continuing through the 1980s.² Figure 5.1 depicts each of the state-level time series contained in

¹Specifically, the states of Baja California North and South, the State of Quintana Roo, and the Yucatan peninsula more generally, all gained official status later in the twentieth century.

²These data were collected by Rodolfo Acuña Soto at the Mexican National Autonomous University,

this data set.

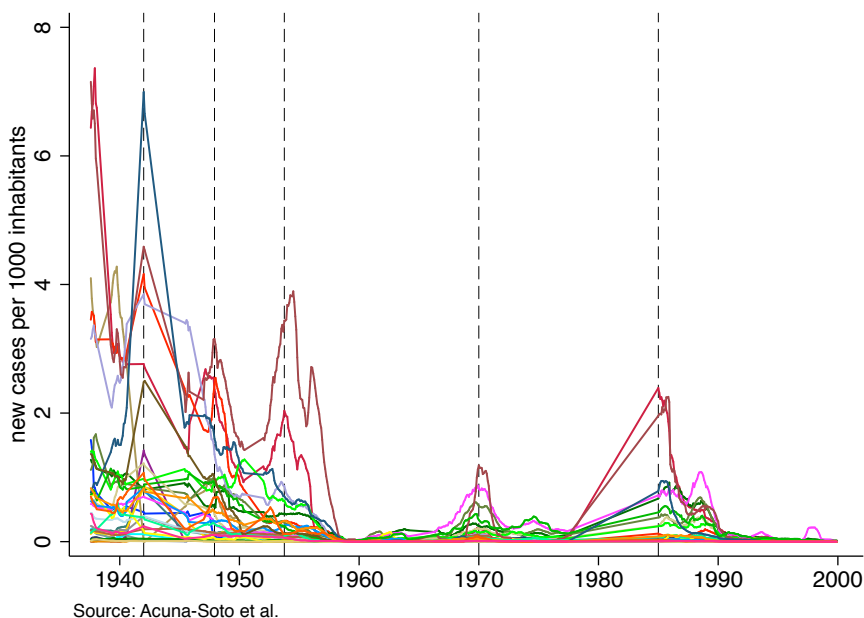


Figure 5.1: Malaria epidemics in Mexican states. Y axis reports the number of cases per 1,000 inhabitants separately for each of the Mexican states. Dashed vertical lines correspond with periods of sharply increased incidence.

Figure 5.1 provides a number of basic insights into malaria and its decline in the Mexican states. First note the overall shape of the time series. Prior to the mid-1930s, no case data are available. The mid-1930s and 1940s are a time of high malaria incidence, The 1950s show the beginning of a decline in the disease, followed by a the near elimination of the disease in the 1960s. This period corresponds to the malaria eradication campaign. In the 1970s, and again in the 1980s, a smaller group of states were struck by major outbreaks of the disease. These different levels of incidence correspond roughly to three periods: pre-eradication campaign, eradication campaign, and post-eradication campaign. Each of these periods will be treated separately below.

based on bulletins published by the Mexican Secretary of Health.

The figure demonstrates one additional fact about the disease that merits consideration —malaria is subject to climatic factors that are exogenous to political institutions. These climatic factors appear in the figure in the form of periodic peaks in the level of disease that occur before the eradication campaign. The peaks are separated by roughly five years, and correspond to global cycles in the levels of precipitation and temperature. I discuss this feature in greater detail in the section on the pre-campaign era below.

The remainder of the chapter is organized as follows. In the next section, I examine the period prior to malaria eradication. Here I provide another empirical test of the main hypothesis of this dissertation, that competition impacts disease control. In the following section, I give a brief description of the malaria eradication campaign. The final section of the chapter describes the malaria outbreaks that occurred in Mexico in the years following the eradication campaign.

5.1 Competition and malaria before eradication

As the preceding chapter demonstrated, malaria had already become a focal point for Mexican health authorities by the 1930s. In fact, malaria control had been a priority dating back to the 1920s, when the Rockefeller Foundation began a major collaborative effort with the Mexican government to control a number of disease, including hookworm, yellow fever, and malaria.³

As it had in the United States, the Rockefeller Foundation (henceforth RF) en-

³The interaction between the Rockefeller Foundation is described in detail in Birn (2006), whose account forms the basis of my own description.

deavored to transmit knowledge to federal and local authorities in Mexico about the most effective methods of malaria control currently available. Also in keeping with the approach it followed in the United States, the RF established a handfull of locations in which it carried out a number of demonstration projects designed to establish the feasibility of these methods, to collect data on their application, and to act as a training ground for local officials. Paramount among the aims of the RF was the establishment and diffusion of local expertise. In other words, the RF endeavored to make the knowledge and skills needed for malaria control widely available among Mexican health officials at not only the federal, but also the subnational level.⁴

These efforts went hand in hand with a gradual decline in malaria over the two decades prior to the campaign.⁵ In the decades of the 1940s and 1950s, we have another opportunity to test the hypothesis that political competition impacts disease control. This case has a number of advantages over those considered in the preceding chapters. First, the measure of malaria is cases rather than deaths. Cases are a more direct measure of a disease that only occasionally results in death. Second, the case data reported here are available monthly over the entire time series, rather than only at the beginning and end. In addition to increasing the amount of overall variation in the dependent variable, this also increases the signal to noise ratio by allowing the measure to be averaged over a twelve month cycles.

In spite of these advantages, the remains a core obstacle to drawing reliable in-

⁴Program documents and internal correspondence of RF officials make this aim clear.

⁵This observation is not meant to deny that other factors, including urbanization, surely had a role in reducing malaria.

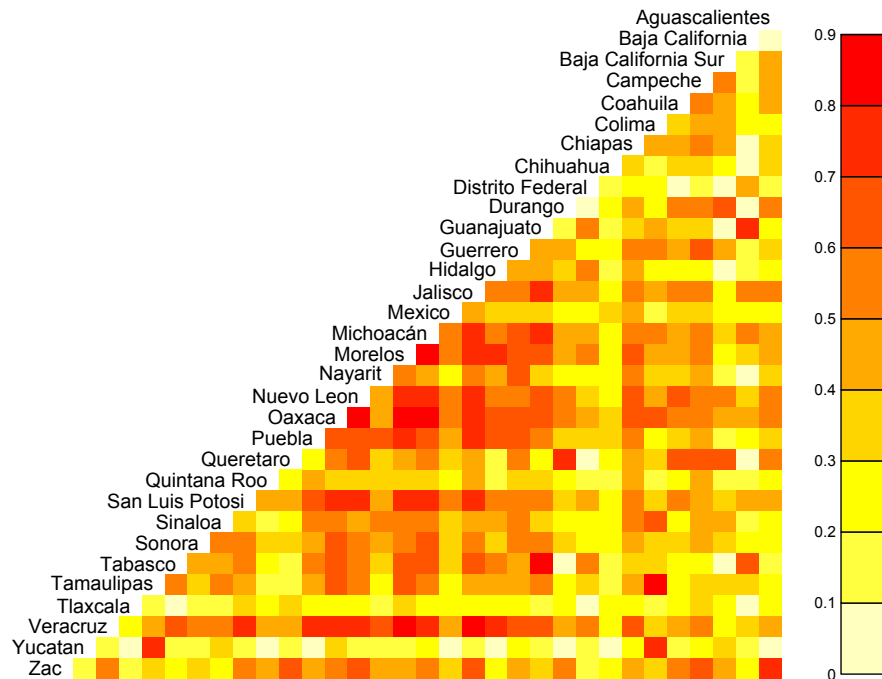


Figure 5.2: Pairwise Correlation in number of cases per month for Mexican States, 1932-1960.

ference about the relationships between competition and malaria. I refer to the existence of strong spatial correlation between observations. Figure 5.2 shows a heatmap of the Pearson correlation statistics for each pair of Mexican states. As the figure indicates, correlation levels of 0.7 or greater are common. In order to deal with this clear non-independence of observations, the analysis below includes a direct measure of the malaria ecology of each state.⁶

I now turn to a closer analysis of competition and disease in Mexico during the period 1940-1950. I begin with a brief discussion of political competition during this period, followed by presentation and discussion of regression results.

⁶These data were gathered and prepared by Gordon C. McCord.

5.1.1 Political competition, 1940s-1950s

Here I highlight two important facts about the Mexican political system relevant to understanding the connection between political competition and disease control. The first is that, in spite of its reputation as a highly centralized system, Mexico during the 1940s and 50s enjoyed a robust legacy of federalism in which state actors played important roles. Second, much as it was during the 1930s, competition continued to be an important, if suppressed part of Mexican politics. I consider these two points in turn.

In contrast to the dominant narrative of Mexican politics emphasizing the centralization of the PRI regime, a strong federalist character permeated the republic from the time of the liberal constitution of 1857. As one scholar described it, the Mexican Revolution of 1910-1917 sought in part to re-establish the sovereignty of the states, by emphasizing the importance of the popular vote (Hernández-Chávez 1996, p.277). This federalist current continued during the post-revolutionary period, as “the politics of compromise aimed to reconcile the broader public interest with the autonomy of the regions”(Hernández-Chávez 1996, p.279, translation mine).

We have established that regional diversity characterized the political system of post-revolutionary Mexico. While this lends credence to the argument that state governors were meaningful policy actors, because the regions they represented had interests different from those of the center, there is another concern that needs to be addressed. It has been widely argued that, from the moment of their nomination onward, governors were so tightly controlled by the president that they could not be credibly viewed as

independent actors. While it is certainly true that Mexican governors during the period of ruling party hegemony were not independent by democratic standards, this does not imply that they were either indistinguishable from the president or ineffectual.⁷

Indeed, there is evidence that state governors had substantially more leeway than might be expected in a hegemonic centralized system. Díaz-Cayeros demonstrates, using data spanning the years from the presidency of Plutarco Elias Calles to the Salinas administration of 1988-1994, that Mexican governors did not always align ideologically with the presidents who nominated them (Díaz-Cayeros 2006, Chap.4). The main conclusion of this research is that presidents were constrained in their choice of governors by the preferences of other regional actors. So it is not the case the governors were merely political mirror images of the president.

The nature of political competition in Mexico changed in the years following the early 1930s, the period covered in the previous chapter. What had once been a highly conflicted and violent system was gradually becoming among the most stable in all of Latin America.⁸ The general picture that has emerged of Mexico in this period is that of a highly centralized polity in which the President exercised an authority so absolute that the system came to be called “presidentialist”. In contrast with this established view, however, a number of authors have portrayed aspects of the Mexican system in which contestation, and to some extent competition, continued to be important.⁹

⁷For a general discussion of the role of the governors in Mexico since the revolution, see Díaz-Cayeros (2006); Anderson (1971). During his effort to centralize power, Lazaro Cardenas wrestled with recalcitrant state-level strongmen, most notably General Saturnino Cedillo, ex-governor of the state of San Luis Potosí (Cornelius 1973, pp. 424 *et passim*)

⁸For a regional perspective, see (Collier and Collier 2002).

⁹For a general view of the period see Smith (1990). For a discussion of the role of governors in Mexican

The measure of political competition described in the previous chapter is particularly useful for describing competition in the period prior to the malaria eradication campaign. The data on opposition to the PRI candidate in gubernatorial elections are available from 1941-1958, which coincides with the available case data up until the onset of the eradication campaign. Table 5.3 in the appendix to this chapter enumerates the elections in which such opposition existed.

The table demonstrates that there was substantial variation among states and over time in the level of opposition to dominant party candidates. This variation is key in determining the impact of competitive elections on disease control. I now present a test of this relationship.

5.1.2 The effect of competition on malaria

Table 5.1 shows the results of a time series regression in which the dependent variable is the number of malaria cases per 1,000 population at the state level. The malaria deaths variable is coded as a yearly average. The main independent variable in the analysis is the measure of opposition to the dominant party candidate in state elections described above. For the competition measure, the years between observations take the value of the last, non-missing observation in the time series. A lagged value of the competition measure is also included. To control for the unobserved heterogeneity between states in the climatic features that shape malaria risk, the model includes a measure of malaria ecology, calculated for each state and year. State fixed effects are

politics see (Díaz-Cayeros 2006, Chap. 4).

included to control for any time-invariant unobserved factors at the state level that could influence malaria, such as the relative level of development and urbanization. Year fixed effects are included to control for spurious correlation between the overall trends in the levels of malaria and competition.

	Cases per 1,000 pop.
Competitive election	-1.116 (1.73)
Competitive election, lagged	-0.638 (0.95)
Malaria ecology	2.684 (2.22)*
R^2	0.90
N	317

* $p < 0.05$; ** $p < 0.01$

Table 5.1: Time series analysis of malaria in the Mexican states. The dependent variable is the number of cases per 1,000 population recorder in each state, coded as a yearly average.

The table shows that, controlling for unobserved effects at the state and year level and the level of malaria risk, competitive elections led to decreases in the level of malaria. This is the clearest support for the hypothesis corresponding to link A of Figure 2.1 in the Theory chapter. Namely, that political competition leads improved effort in disease control. The reader will note that this result seems to contrast sharply with those presented in the preceding chapter. I consider the contrast between the two sets of results in the conclusion to the dissertation.

The main concern to be kept in mind when interpreting this evidence are that we are unable to directly observe disease control effort, and so we must use the outcome

of disease prevalence as a proxy for the effort. It is also worth bearing in mind that the regression evidence does not demonstrate that the theoretical mechanism I have proposed, pressure on politicians to perform better, is the one that led to this effect. With these caveats in mind, we find evidence in support of the core hypothesis linking political institutions to disease outcomes, a main objective of this project.

5.2 Malaria eradication in Mexico

The campaign to eradicate malaria in Mexico, which began in the mid-1950s and peaked in intensity in the early 1960s, was directed almost entirely by Mexican national authorities, in partnership with the nascent Pan American Health Organization. To give some indication of its scope, over the five most intensive years of the campaign roughly 27 million small-scale operations were carried out to control malaria vectors. These operations took place in 21 different Mexican states, from Chihuahua in the north to Chiapas in the south (Cueto 2007, p. 97 and Table 3.1).

Mexico's malaria eradication campaign was carried out over a roughly three-year period. Campaign administrators broke this period into six month blocks, and, accordingly, spraying activities were planned to occur in semi-annual cycles. Spraying activities were divided into administrative zones or "sectors" that had been designed by the directors of the campaigns.¹⁰ The activities of the campaign consisted primarily of

¹⁰There is an unfortunate imprecision in the vocabulary used by those who recorded the activities of the campaign. The terms "zone" and "sector" are sometimes used interchangeably. But at other times, they refer to a geographical hierarchy, wherein the zones are divided into sectors, which formed the lowest level of geography for which campaign activity was reported. Here I use the term sector to refer to the level of

surveillance (using laboratory methods to seek active cases of malaria), monitoring the mosquito population, and spraying of households with chemicals (primarily DDT) to kill infected mosquitoes.

I now present a second novel data set generated through my archival research. This data set records the amount of effort expended by the national campaign to reduce disease. The measure of effort is derived from data held in the Historical Archive of the Secretary of Health and Social Assistance (AHSSA). These records provide detailed information on the malaria spraying campaign carried out between 1957 and 1960. Table 5.2 provides descriptive statistics on the activities carried out during the campaign. The figures in the table are generated based on the eight semi-annual campaign cycles that took place from 1957-1960.

The first column of the table gives the label used to name each of the campaign sectors. These sectors and their labels changed only slightly during the first three years of the campaign, although in the following years more significant changes make the collection of time series data challenging. The second column reports the number of houses sprayed with DDT in each zone. As for all other figures in the table, this is an average of the numbers reported for the eight semi-annual campaign cycles that occurred between 1957 and 1960. The third column shows the standard deviation of the number of houses sprayed, which indicates that there was substantial variation in the intensity of spraying from cycle to cycle. The final two columns correspond to the disease surveillance activities that were carried out in parallel with the insecticide spraying. Column four shows

campaign geography that corresponds most closely to state boundaries.

Sector	Houses Sprayed (mean)	Sprayed (sd)	Samples (mean)	Positive (mean)
I	126286	21767	25796	86.83
II	120646	55444	14667	53.46
III	311596	83932	20596	72.71
IV	149118	19814	12443	117.30
V	222109	34679	17035	133.85
VI	173030	60394	10648	51.14
VII	210808	34311	23507	51.42
VIII	161648	62271	14476	186.28
IX	191401	46653	13683	69.71
X	233017	71646	22542	278.57
XI	283179	45662	21935	90.00
XII	91429	72334	12211	78.14
XIII	160719	21601	17847	54.42
XIV	54192	11370	12018	30.71

Source: AHHSA¹¹

Table 5.2: The campaign to eradicate malaria in Mexico. Table shows descriptive statistics calculated from numerical summaries of the malaria eradication activities carried out by the Mexican government from 1957 through 1960. Activities were divided into six month periods, and reported for geographic sectors, administrative units created for the campaign. Figures rounded to the nearest integer.

the number of blood and spleen samples that were collected for laboratory testing, and column five shows the total number of these samples that tested positive for malaria.¹²

What can we make of this effort? While it is clear that malaria rates were already declining when the eradication campaign began in 1957, there does not seem much room for doubt that the spraying campaign was successful at interrupting the long-term cycle of malaria epidemics in Mexico. The case data reported by the Secretary of Health indicate that during the years of the campaign, the country experienced fewer than 1 case of malaria per 1,000 inhabitants.

¹²Statistics are reported separately for positive cases of *vivax*, *falciparum*, and *malariae* parasites. However, *vivax* parasites comprise the overwhelming majority of positive cases.

While the campaign seems to have succeeded in reducing malaria, reduction does not imply elimination, and the gap between the two has often been difficult to bridge.¹³ Official statistics show that blood samples continued to test positive for malaria throughout the campaign, with 1,000 positive samples reported in 1960.

Ultimately, the low levels of disease that continued to be observed during the campaign proved to be an indication that a dangerous level of malaria parasites persisted in the population. This became obvious when, in 1970, the first of multiple post-campaign outbreaks occurred. Outbreaks of malaria following a sustained eradication campaign and a period of very low incidence are a recurring theme in the history of malaria, and have led some to dismiss the total eradication of the disease as an impossibility. Such outbreaks also demonstrate that one of the requisite features of a political system that aims to eliminate malaria is the capacity for finely detailed and persistent surveillance - the ability to follow the disease “down to the last case”. This capacity was clearly absent in the Mexican case.¹⁴

5.3 An unwelcome return: malaria post-eradication

The initial decline produced by the eradication campaign was followed by a number of outbreaks. The two most important periods of resurgence occurred at the beginning of the 1970s (as depicted in Figure 5.3) and then again in the early 1980s. Confined

¹³On this point, see the treatment of the Venezuelan malaria eradication campaign in Stepan (2011).

¹⁴This is not to imply that state capacity entirely determines the success of malaria eradication in individual countries. There is also the matter of malaria ecology, which determines the level of effort required to successfully eliminate the disease.

mostly to the underdeveloped southern states, these outbreaks flummoxed public health authorities who had set their sites on eradicating the disease, only to see it reemerge.¹⁵

What caused these outbreaks? From the remaining internal records of the bureaucrats charged with malaria eradication, this was partly due to declining resources dedicated to malaria control by the federal government. After the dramatic impact of the DDT spraying campaign, it appears that the government's focus drifted away from malaria to other public health priorities. That notwithstanding, it is worth remarking that no outbreaks were reported during this same period in the states of Morelos and Veracruz, in spite of these states having had malaria trends that were very highly correlated with those in, for example, Oaxaca.

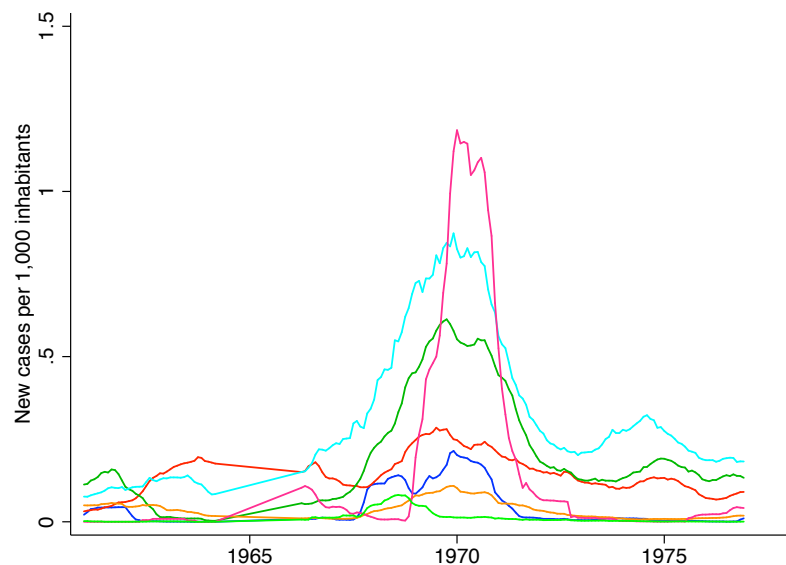


Figure 5.3: Malaria outbreaks in the southern states of Campeche, Chiapas, Guerrero, Oaxaca, Quintana Roo, Tabasco, and Puebla

¹⁵This section is based on my own review of archival documents in the Archivo Histórico de Salubridad y Asistencia in Mexico City.

In the case of the outbreaks that occurred in the 1980s, there is another factor that drew the attention of bureaucrats as a potential cause —migration from Central America. Displaced primarily by civil conflicts that were ongoing in El Salvador, Nicaragua and Guatemala, a significant number of migrants did indeed pass through Mexico's Southern border into Mexico during this period, many in transit to the United States. Data from the long form of the U.S. Census show that the number of Central American migrants living in the United States more than doubled from 1980 - 1990.¹⁶

A more revealing explanation of these outbreaks is that to avoid them would have required a far greater effort than politicians would have been willing to commit to. This derives from the view, expressed by many malaria experts at the time and since, that eradication was an impossible goal to achieve, one whose pursuit could even be counter-productive.¹⁷ Whether eradication is in fact impossible is a topic of ongoing debate, but of greater importance to the current discussion is the inherent institutional difficulties in reducing the incidence of malaria to zero. By all accounts, doing so requires a state with the capacity to carry out intensive surveillance, and to extend resources into the farthest reaches of its territory. This so-called state capacity represents another theoretical link between malaria and political institutions that demands further exploration.

¹⁶These data are available through the Census Bureau at the American Fact Finder website, and are also presented on the website of the Migration Policy Institute. Information previously gathered by the long form is now collected through the American Communities Survey.

¹⁷This is the ultimate conclusion of one of the most important scientific chroniclers of malaria eradication in Mexico (see de Castro P. 1988, p.14).

5.4 Appendix: Table of competitive elections

Table 5.3 reports the data collected in Anderson (1971) on the presence of opposition to the candidate chosen by the ruling party in gubernatorial elections from 1941-1958.

Table 5.3: Competitive state elections, 1941-1958

Year	State
1941	Coahuila
1941	Guerrero
1942	Morelos
1943	Guanajuato
1943	Nuevo leon
1944	Aguascalientes
1944	Chiapas
1944	Guerrero
1944	Oaxaca
1944	Tamaulipas
1945	Nayarit
1946	Morelos
1948	Chiapas
1949	Sonora
1949	Nuevo leon
1950	Chihuahua
1950	Durango
1951	Yucatan
1951	Coahuila
1952	Chiapas
1952	Jalisco
1953	Baja california
1955	Sonora
1956	Michoacan
1956	Sinaloa
1956	Tamaulipas
1956	Chihuahua
1956	Veracruz
1957	Coahuila
1958	Chiapas

Source: Anderson (1971)

Chapter 6

Conclusion

In the preceding chapters I have taken up the question of whether political competition and diversity impacted the reduction of malaria in Mexico and the United States South. I now consider the answers provided in the those chapters, and the implications of this study for future research.

As demonstrated in Chapter 2, the theoretical expectations for the impact of competition on disease control are ambiguous. It could be that competition induces better performance, which leads to increased effort and more effective disease control. On the other hand, competition can cause fragmentation among politicians, and this increased fragmentation could lead to lower disease control effort. Similarly, diversity can have both positive (indirect) and negative (direct) impacts on disease control. For this reason, what is at stake in the empirical analysis presented in Chapters 3-5 is the null hypothesis that competition and diversity have no effect on disease control.

To test this hypothesis, I have marshaled evidence from a number of different sources. Most importantly, I draw from my own archival research to produce new data sets on malaria prevalence in Mexico. I supplement these with data generously provided by collaborators, as well as existing secondary data sources. The result is a set of three distinct empirical approaches designed to test variations on the null hypothesis described above.

How does this hypothesis fare? In Chapter 3, I show that the case of the United States South demonstrates a joint effect of competition and diversity on disease control. Because this chapter uses a repeated measures design, it provides relatively strong

evidence with which to reject the null hypothesis that political competition and diversity do not impact disease control. The main drawback of this analysis is that it cannot disentangle the effect of competition from the effect of diversity.

By contrast, the empirical analysis in Chapter 4 suggests that both race and competition each exerted an independent influence on the prevalence of malaria in Mexican municipalities. This cross-sectional analysis is based on a new data set of malaria deaths in Mexico during the 1930s, constructed from archival documents. The main result of the chapter is that municipalities in states that experienced political competition had higher levels of malaria. Controlling for competition and other factors, including geographic variables, a greater level of ethnic diversity also predicts greater malaria prevalence.

While both of the approaches described above focus on local (county or municipal) aspects of disease control, Chapter 5 shifts the level of analysis up to the state, focusing on malaria prevalence in the Mexican states from around 1935 to 1980. This chapter is partly descriptive, providing an account of malaria's trajectory in Mexico from the early twentieth century, through the large-scale DDT spraying campaign of 1958-1961, and culminating with the outbreaks of disease that followed this campaign in the 1970s and 80s. The chapter also contains time series analysis of the effect of political competition on malaria prevalence, which shows that political competition caused malaria to decrease.

The results described above are uniform in rejecting the null hypothesis of no effect of competition (or diversity) on disease control. Indeed, this is among the first

bodies of evidence to establish a systematic link between characteristics of a political regime and the control of malaria. While the null hypothesis is uniformly rejected, the empirical results are not otherwise uniform. Perhaps the most important difference is that between Chapter 4, which shows that Mexican municipalities in competitive states had higher malaria prevalence, and Chapter 5, which shows that political competition caused lower malaria rates in the Mexican states.

Before reconciling these two results, it should be noted that they do not necessarily contradict each other. The municipal-level analysis in Chapter 4 is for a single cross section, while the state-level analysis in Chapter 5 is conducted on a 20-year time series. Nevertheless, it behooves us to consider whether there is some difference between municipalities and states that would lead to the contrast between these two findings.

By appealing to the theory developed in Chapter 2, we can sketch a simple answer. That chapter posits that, where political competition leads to fragmentation, it can cause disease control to be less robust than it would be in a similar area without competition. During the post-revolutionary period, when territorial authority was still being consolidated, Mexican municipalities were highly vulnerable to fragmentation. Local strongmen battled to maintain control over groups of peasants and workers, while the central authorities struggled to impose uniform party rule. It seems that municipalities in competitive states were indeed likely to experience fragmentation as a result of that competition.

The same theoretical model predicts that competition will lead to improved disease control where it induces better government performance. Authority at the state level during the 1940s was much better established than municipal authority during the 1930s. It seems plausible that, rather than leading to fragmentation, competition within the states could have led to more effective performance by public officials. In other words, the contrast between these two findings seems a natural consequence of my theoretical expectations.

The discussion of these specific findings points to a larger aspect of the project. Because I focus on historical cases for which data are scant and imperfect, it is difficult, if not impossible, to provide direct evidence on the specific mechanisms that link competition with disease control. For now, those mechanisms must remain in the province of theory. Thus, perhaps the most important implication of this project for future research is that the stage is now set to seek new sources of evidence on the specific actors responsible for disease control, and on the incentives faced by those actors.

Perhaps equally important, information about the incentives facing those responsible for disease control should be paired with direct evidence on the effort exerted to control disease. On this point, the limitations of historical data loom large, as data on local-level expenditures during the early part of the twentieth century are incomplete and irregular for both Mexico and the United States South. It may be that, for both understanding incentives and observing effort, qualitative evidence provides the greatest insight, and allows for the construction of a more complete and convincing model of the

political logic of malaria control.

As such a model is developed, its most pressing application will be to contemporary cases of malaria control, especially in regimes with limited political competition. In the absence of major medical innovation, malaria will continue to be a disease whose treatment involves cheap, low-technology interventions applied at the individual and community level. In this sense, measures to control the disease today are subject to many of the same factors that shaped disease control in the cases I have examined here. The main aim of future research in this area should be to extract from these historical cases the clearest possible understanding of how political actors' strategic decisions impact the prospects for taming this deadly disease.

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