ECONOMETRIC ANALYSIS OF POLITICAL ATTITUDES AND ECONOMIC DEVELOPMENT

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Marie Lechler
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CONTENTS

INTRODUCTION

"*A people inspired by democracy, human rights and economic opportunity will turn their back decisively against extremism.*" (Benazir Bhutto)

Citizens' support of liberal democracy is crucial for the stability of the political system and economic prosperity. This support seems to have deteriorated across the developed world in recent years. Headlines such as "Across the Globe, a Growing Disillusionment with Democracy" (New York Times, September 2015), "Have Millennials Given Up on Democracy?" (The Guardian, March 2016), "Across Europe, Distrust of Mainstream Political Parties is on the Rise (The Guardian, May 2016), or "Is Donald Trump a Threat to Democracy?" (The New York Times, December 2016), shocked liberal minds who have taken a stable democratic order in the western world for granted. A discontent with the current political system also has been manifested in the electoral breakthroughs of populist parties in several European countries, such as PiS in Poland and Fidesz in Hungary, as well as in the election of Donald Trump as US President. These authoritarian parties and politicians threaten the freedom of the press, show little respect for the separation of powers and use populist rhetoric to capitalize on economic and social problems. This kind of political extremism does not only destabilize political institutions but also leads to poorly conceived and unsustainable economic and social policies, which may harm society severely.

Support for democratic institutions may be even more important in developing countries. It has been shown that democracy fuels economic growth, and thus increases living standards (Papaioannou and Siourounis, 2008; Persson and Tabellini, 2009; Acemoglu et al., 2018). Many developing countries have however not yet democratized and often suffer from state capture by individuals, corruption and weak enforcement of property rights. This is a stumbling block not only to economic development but also to peace (Sunde and Cervellati, 2014), the likelihood of economic reforms (Giuliano, Mishra, and Spilimbergo, 2013), educational improvements (Ansell, 2010) and better health outcomes (Kudamatsu, 2012).

There is a large literature highlighting the effect of support for democracy on the

stability of democratic systems. Early work in this field focused on the importance of 'civic culture' (Almond and Verba, 1963) and 'social capital' (Putnam, 1994) for good institutional performance. Both concepts assume that citizens' support of core democratic values and civic engagement are key for the establishment of a stable democratic system. Linz and Stepan (1996) confirm this idea and emphasize that a country can only achieve democratic consolidation if its citizens culturally support its political institutions. Larry Diamond summarizes these findings: "*It is by now a central tenet of empirical democratic theory that stable democracy also requires a belief in the legitimacy of democracy.*" (Diamond, 1999).

This thesis therefore focuses on economic, institutional and demographic determinants of political attitudes, which are key for the stability of institutions and sustainable economic and social policies. Empirically it is difficult to identify the determinants of political attitudes because randomization of potential causes such as education, income or experience with democracy is often not feasible. I therefore apply a variety of econometric techniques including an instrumental variable approach, spatial regression discontinuity design, panel data methods and difference-in-difference estimation to uncover causal factors that shape political attitudes.

In *Chapter one* I examine labour market conditions in Europe and their effect on support for the European Union and voting for eurosceptic parties in European Parliament elections. This study thereby contributes to the debate about determinants of populism in Europe, which is often built on anti-globalization sentiment. It opposes the EU as institution, which symbolizes open markets, free movement of labour and trans-national solidarity and cooperation. I identify the lack of economic perspectives as an important factor contributing to this euroscepticism. To do so, I combine industry-specific employment data for roughly 260 European regions with individual-level Eurobarometer survey data and regional voting results for the past 20 years. I apply panel data and instrumental variable methods. For the latter I construct a Bartik-style instrument, which predicts employment changes on the basis of regional industry specialization and Europe-wide sector specific employment growth rates. I find that decreases in the change of the employment rate lead to lower support for the EU and increased voting for eurosceptic parties. The effect of employment changes on attitudes toward the EU is particularly strong for unemployed and low-skilled workers in regions with a high share of migrants from other European member states, which supports the narrative that 'losers of globalization' tend to be more skeptical toward economic and political integration.

In *Chapter two* Lachlan McNamee and I analyse the effect of historical political institutions and their persistence in Namibia. In line with a body of literature that highlights the importance of forms of colonialism for contemporary political and economic outcomes (Acemoglu, Johnson, and Robinson, 2002; Lange, 2009; Iyer, 2010; Hariri, 2012),

this chapter argues that indirect and direct colonial rule are important factors in shaping contemporary support for democracy. Specifically, we examine indirect and direct colonial rule as causal factors in shaping support for democracy by exploiting a within-country natural experiment. Throughout the colonial era, northern Namibia was indirectly ruled through a system of appointed indigenous elites whereas colonial authorities directly ruled southern Namibia. This variation originally stems from where the progressive extension of direct German control was stopped after a rinderpest epidemic in the 1890s, and thus constitutes plausibly exogenous within-country variation in the form of colonial rule. Using this spatial discontinuity, we find that individuals in indirectly ruled areas are less likely to support democracy and turnout at elections. We explore potential mechanisms and find suggestive evidence that the greater influence of traditional leaders in indirectly ruled areas has socialized individuals to accept non-electoral bases of political authority. Thus, the ongoing parallel existence of undemocratic local governance structures can partially undermine support for democracy even in the context of a functional, largely successful national democratic polity. This has potentially broad implications for democratization processes in other sub-Saharan African countries, where systems of traditional leadership still play an important role in local governance and national democracy is not as consolidated as in Namibia. This chapter is accepted for publication in *Comparative Political Studies* (SAGE Journals).

In *Chapter three* Uwe Sunde and I study the effect of demographic patterns on democratic attitudes across the world. Macro-determinants and retrospective experiences have been shown to affect the support for democracy at the individual level. In this chapter we investigate whether and how future orientation and the individual life horizon, in terms of life expectancy and age, affect individual attitudes toward democracy. Combining information from period life tables with individual survey response data spanning more than 260,000 observations from 93 countries over the period 1994–2014, we find evidence that the expected remaining years of life influence the attitudes toward a democratic political regime. The statistical identification exploits variation in age-specific life expectancy across genders, countries, and time, and decomposes the influence of age from the influence of the expected proximity to death. The evidence shows that support for democracy increases with age, but declines with expected proximity to death. This implies that increasing longevity might help fostering the support for democracy. Increasing age while keeping the remaining years of life fixed as well as increasing remaining years of life for a given age group both contribute to the support for democracy. These results have important implications for policy. Individual democratic attitudes are key for the viability of democratic regimes and these attitudes appear to be weakened by short life horizons. Many developing countries exhibit poor health conditions, high mortality, violent conflicts, and generally gloomy perspectives for individual lives. These conditions

thus constitute a stumbling block to democratic consolidation.

In contrast to the first three chapters, which examined political attitudes, in *Chapter four* Miriam Breckner and I investigate economic development. This chapter illustrates the negative environmental effects of urbanization and industrialization in Egypt and emphasizes the importance of stable institutions that allow for environmental protection and its enforcement. In the course of economic development cities grow rapidly and industries flourish. People are attracted to these hotspots of new opportunities but pollution is a significant downside when political institutions are weak and do not enforce environmental protection. We study the impact of urbanization and industrialization through water pollution on the health of children living along the Nile in Egypt. For our analysis we exploit spatial and temporal variation in factory presence and urbanization, using a newly constructed, finely gridded panel dataset that is based on geo-coded health, factory and population density data. We find that children living in households downstream of urban areas suffer from higher risks of disease than children living upstream. For industrial plants we also find strong negative health effects on children living downstream while children living upstream remain widely unaffected. The negative health effect on the downstream population can be mitigated by access to clean drinking water.

This thesis broadens our knowledge about the formation of political attitudes and economic development. I identify regional employment changes, exposure to autocratic governance systems and life expectancy as important determinants of political attitudes. So far there exist relatively few studies that empirically establish causal links between socio-economic factors and political attitudes. These findings thus contribute to the academic literature in this field and are at the same time highly policy relevant. In addition, I show that economic development (in the form of urbanization and industrialization) has geographically asymmetric health consequences. Pollution is a common phenomenon in developing countries and is often due to weak political institutions. The last chapter of this thesis therefore illustrates the importance of stable political institutions for developing countries.

The four chapters in this thesis are self contained and can be read independently. Each chapter is followed by an Appendix and the combined Bibliography of all four chapters can be found after chapter four.

1

EMPLOYMENT SHOCKS AND ANTI-EU SENTIMENT

1.1 Introduction

Populist parties in many European countries, such as UKIP in the UK, FN in France, PVV in the Netherlands or AfD in Germany have made electoral breakthroughs. Such parties espouse a nationalistic agenda and oppose globalization. This populism is often manifested as Euroscepticism, with populist parties and their supporters seeing the EU as an institutional symbol of globalization. These eurosceptic ideologies can be harmful as support for the EU is key for its legitimacy and effectiveness (Hobolt and Vries, 2016), which in turn fosters political stability and economic prosperity (Schmidt, 2013). It is therefore important to better understand determinants of support for the EU. In the public debate, rising unemployment and the lack of economic perspectives are among the most frequently mentioned reasons for the success of these views.[1] Even the President of the European Central Bank, Mario Draghi, has emphasized the importance of policies which aim at mitigating economic inequality and job insecurity in the EU to prevent the rise of populism.[2]

1. "Brexit is a rejection of globalisation" (Guardian, June 2016). "People who are left behind by structural change and so-called 'losers of globalization' are prone to the rhetoric of the AfD". In German: "vom Strukturwandel Abgehängte und sogenannte 'Globalisierungsverlierer' seien anfällig für die Rhetorik der AfD." (WirtschaftsWoche, February 2018). Angela Merkel in a governmental statement about Brexit: "We have to make Europe more competitive and close the gap between losers and winners of globalization". In German: "[wir müssen uns] gemeinsam dafür einsetzen, Europa wettbewerbsfähiger zu machen und die Kluft zwischen Globalisierungsgewinnern und Globalisierungsverlierern zu verkleinern." (Regierungserklärung Angela Merkel, June 2016).

2. "In unusually political remarks, Mr Draghi called on Brussels to pay more attention to redistribution and address concerns- such as economic inequality and job insecurity- that have played into the

I contribute to this debate by showing that regional labor market conditions affect support for the EU. I document that regions experiencing negative employment changes tend to vote for more eurosceptic parties in European Parliament elections and also show a higher attitudinal euroscepticism. Support for the EU and euroscepticism are defined as two sides of the same coin encompassing attitudes toward the European Union as a regime and its principles. I focus my analysis on attitudinal euroscepticism because it is comparable across countries (as opposed to political parties) and captures the distinct nature of anti-EU attitudes, which is not the case with political parties that campaign on several platforms. In order to quantify attitudinal euroscepticism I analyze Eurobarometer survey data and combine them with regional employment data. The Eurobarometer questions ask about the respondents' image of the EU, the respondents' assessment of the benefits from the EU and the respondents' evaluation of their country's EU membership.

There are huge differences in these attitudes across regions but it is difficult to distinguish economic factors from other factors such as culture, regional institutions or local politics, which are correlated with both labor market conditions and attitudes. I therefore apply panel fixed effect estimation methods, which exploit variation within regions over time, thereby conditioning on region-specific and time-specific unobserved heterogeneity. I also include lagged dependent variables in order to account for feedback effects from past attitudes on employment. Finally, I control for a number of factors that may be correlated with labor market conditions and support for the EU such as education, demography and migration.

Regional employment changes may nevertheless be still endogenous to attitudes due to third factors that are neither region-specific nor time-constant and are not captured by the control variables. To account for that I construct a Bartik-style shift-share instrument (Bartik, 1991) that predicts regional employment changes on the basis of Europe-wide sectoral employment growth and regional industrial specialization.[3] This instrument provides plausibly exogenous variation in regional employment and allows me to identify a causal effect.

In all specifications I find a significantly positive effect of employment changes on support for the EU. This effect is driven by variation in negative employment changes rather than positive ones. In an attempt to identify a potential mechanism, I further analyze interaction effects with education, occupation and migration. The theoretical literature has suggested that nationalist ideology appeals in particular to 'modernization losers' (Golder, 2016; Garry and Tilley, 2009). Hence, those who are threatened

hands of populist anti-European parties across the EU." in "Do more to help globalisation's losers, say champions of liberalism" (Financial Times, September 2016).

3. For applications see also Blanchard and Katz (1992), Katz and Murphy (1992), Bound and Holzer (2000) and Autor et al. (2016).

to lose most from further European integration, such as unskilled people in regions with a lot of low-skilled EU migration, are most likely to be eurosceptic. Consistent with this, I find that both unemployed and low-skilled workers react particularly strongly to employment changes. Moreover, the triple interaction between employment changes, an unskilled worker dummy and EU migration is statistically significant. This finding indicates that unskilled are particularly sensitive to employment changes in regions with high shares of EU migration.

This paper contributes to the literature on several dimensions. First, I exploit variation across 260 European regions over a long time horizon (1996–2014) and am therefore able to control for region and time specific factors that may cause bias. Second, I analyze three different attitudinal dimensions of euroscepticism, which account for its 'multifaceted nature' (Boomgaarden et al., 2011). Other studies have often only focused on one aspect, for example trust in institutions. Moreover, I present results for voting behavior in European Parliament elections using administrative voting data rather than self-reported ones as in other studies (Guiso et al., 2017; Hernández and Kriesi, 2016). Third, I construct a Bartik-style instrument for European regions, which arguably extracts the exogenous component in employment changes. This instrument has not been applied to the European context before. Fourth, I investigate potential mechanisms such as occupation and education as well as their interaction with regional migration.

There is a large literature emphasizing the link between economic insecurity and anti-globalization sentiment (see Anderson (2007) for an overview). A recent strand of literature examines effects of globalization, most notably trade shocks on political polarization and extreme voting. Autor et al. (2016) find that US districts exposed to high import competition tend to remove moderate representatives from office. They conclude that "employment consequences of trade [are] acutely recognizable and therefore politically actionable" (p.45). Similarly, Che et al. (2016) show that US counties exposed to import competition from China experience increases in turnout and are more likely to be represented by a Democrat. Colantone and Stanig (2018) examine the effects of import competition on western Europe and also find that import shocks lead to an increase in support for nationalist parties and a general shift to the right in the electorate. Dippel, Gold, and Heblich (2015) present causal evidence for the effect of trade integration on extreme right voting for Germany. All of these studies apply an instrumental variable strategy exploiting variation in import penetration from China depending on the local industry structure, which is advanced in Autor, Dorn, and Hanson (2013). Guiso et al. (2017), Algan et al. (2017) and Dustmann et al. (2017) provide evidence that economic factors are important determinants of support for right-wing populist parties in Europe.

Right-wing voting is often associated with nationalist ideologies. Therefore another

strand of literature focuses on the effects of economic conditions on attitudes measured in surveys. Hobolt and Vries (2016) provide an extensive overview over the literature about origins of public support for European integration and its consequences. Roth, Otter, and Nowak-Lehmann (2013), Frieden (2016), Dustmann et al. (2017) and Algan et al. (2017) document a decline in trust in European and national institutions as a consequence of the financial crisis. Roth, Otter, and Nowak-Lehmann (2013) show that the economic crisis of 2008–2012 had a particularly pronounced negative effect on trust in the European Commission and European Parliament in the four periphery countries (Spain, Greece, Portugal and Ireland). Dustmann et al. (2017) and Algan et al. (2017) confirm that the economic crisis reduced trust in national and European institutions and was associated with the rise of anti-establishment parties. In terms of labor market conditions Dustmann et al. (2017) find for the EU15 that the unemployment rate has a negative- albeit not significant- effect on support for European integration and a negatively significant effect on trust in the European Parliament and on the vote share of pro-EU parties. Algan et al. (2017) present evidence that underpins these results. Increases in unemployment are associated with voting for non-mainstream parties and a decline in trust in national and European institutions. In order to causally identify this effect they use the share of pre-crisis construction as instrument for employment changes during the economic crisis. The Bartik-style instrument applied in this paper however goes beyond their instrument as it uses both variation across sectors and over time rather than only variation across regions.

All these studies focus on trust in institutions as main attitudinal outcomes. My analysis complements this by focusing on the image of the EU, the perceived benefit from the EU and the evaluation of EU membership in general and thereby disentangles the effect of labor market conditions on mistrust in institutions and euroscepticism. There are a few studies which analyze the effect of economic conditions on this 'attitudinal euroscepticism'.[4] Both Serricchio, Tsakatika, and Quaglia (2013) and Gomez (2015) establish a link between the financial crisis and euroscepticism measured with the Eurobarometer membership question. While Gomez (2015) finds a strong effect of economic variables such as GDP growth, unemployment rate and interest rates on support for the EU in the context of the financial crisis, Serricchio, Tsakatika, and Quaglia (2013) conclude that economic indicators have very limited power in explaining euroscepticism. They instead attribute the effect of the financial crisis to national identity and political institutions. Both approaches however have analytical shortcomings. Their time frame is rather short (2007–2011 in Gomez (2015) and only 2007

4. Other papers have studied macroeconomic and socioeconomic determinants of euroscepticism. The following factors are particularly important in determining euroscepticism: inequality (Kuhn et al., 2016), regional transfers from EU structural funds (Osterloh, 2011), social class (Lucassen and Lubbers, 2012), perceived threat from immigrants (Lucassen and Lubbers, 2012; Lubbers and Scheepers, 2007; De Master and Le Roy, 2000), education (Lubbers and Scheepers, 2010), age (Down and Wilson, 2013).

and 2010 in Serricchio, Tsakatika, and Quaglia (2013)) and the unit of analysis is the country-level. Lubbers and Scheepers (2010) examine the evolution of euroscepticism for the pre-crisis period (1994–2004) and find that changes in economic growth, inflation and unemployment are hardly related to euroscepticism. Their analysis is also conducted on a country level. A regional-level analysis over a long time span examining the effect of labor market conditions on different aspects of 'attitudinal euroscepticism' is still missing from the literature.

The chapter is structured as follows: I first describe the political attitude, voting, and regional employment data (Section 1.2). I then discuss both the fixed effect and the instrumental variable estimation strategies (Section 1.3). The main analysis is conducted in Section 1.4 measuring euroscepticism with survey data. I present results from the panel analysis including effect heterogeneity and also from instrumental variable estimations. Finally, I present results about the relationship between labor market conditions and voting behavior in European Parliament elections in Section 1.5.

1.2 Data

The dataset is a panel containing political attitude, voting and employment information for 265 European NUTS II regions in 25 countries between 1994 and 2014.[5] Data for new member states is available since 2004.[6] European Parliament election data is available for the years 1994 (EU12), 1999 (EU15), 2004 (EU25), 2009 (EU25) and 2014 (EU28).

1.2.1 Political Attitude Data: Eurobarometer

Analyzing attitudes toward the European Union is important because they ultimately affect voting decisions as voting is a form of revealing preferences. While it is hard to disentangle dissatisfaction with EU from other reasons why people vote for right-wing, populist parties (e.g. dissatisfaction with national governments) survey evidence is able to pinpoint the anti-European nature of dissatisfaction. The main part of the analysis in this paper will therefore focus on the determinants of satisfaction with the EU measured with survey responses. It is reassuring that anti-EU voting and attitudinal euroscepticism measured with survey questions are correlated with correlation coefficients around 0.4 (Table A5 in the Appendix).

In order to measure political attitudes I use the Euobarometer survey (European Com-

5. Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finaland, France, Germany, Great Britain, Greece, Hungary, Italy, Ireland, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden.

6. Estonia, Latvia, Lithuania, Poland, Czech Republic, Slovakia, Hungary, Slovenia.

mission, 2017)[7], which asks 1000 representative respondents per EU member country twice a year about their opinion on various EU related topics.[8] The measures for respondents' attitudes toward the EU ask whether the respondent thinks that his/her country has benefited from EU membership, whether his/her country's EU membership is a good or bad thing and whether the EU conjures up a positive or negative image (see exact wording of questions and summary statistics in Appendix Section A.1). Boomgaarden et al. (2011) emphasize that EU attitudes are of 'multifaceted nature' and therefore focusing on one aspect would fall short of a comprehensive characterization of euroscepticism. The membership questions has been widely used in previous literature (Frieden, 2016; Kuhn et al., 2016; Gomez, 2015; Osterloh, 2011; Lubbers and Scheepers, 2010). Lubbers and Scheepers (2005) classified the membership and benefit questions as 'instrumental euroscepticism' reflecting cost/benefit considerations. The image variable is characterized as 'evaluative' dimension of pro-/anti-European sentiment by Fernandez, Eigmüller, and Börner (2016) and is less frequently used in the literature. One reason might be that it was only introduced to the Eurobarometer questionnaire in 2001. The questions are not all asked in each survey round. While the benefit and membership questions are available between 1994 and 2011, the image question was asked between 2001 and 2014. For the years 2001 to 2011 I combine information from all three variables using the first principal component and create a "EU Support Index". In order to use as much variation over time as possible the main specifications are estimated for each outcome variable separately. To make the dependent variables comparable all three are binarized. I also extract data on the evaluation of national institutions (trust in national government and trust in national parliament) from the survey as these constitute important control variables. These variables are also binarized as to make them comparable.

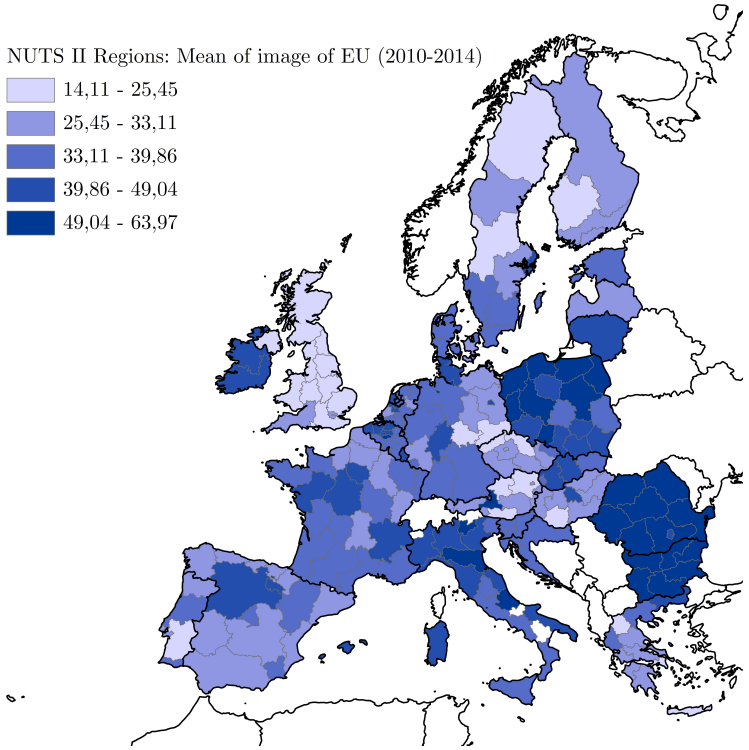
Eurobarometer also contains information about the region of residence (NUTS II[9]) of the respondent so that the data can be linked to other regional data. I aggregate the variables to annual intervals by averaging the values by region over all survey rounds that contain the respective survey question in that year. Finally, I standardize the variables to lie between 0 and 100, so that the values can be interpreted as % of people in a given region in a given year who have a positive image of the EU/ think that their country benefits from EU membership/ believe that their country's EU membership is a good thing. Figure 1.1 displays the distribution of support for the EU as measured by the image variable and averaged over the years 2010-2014 across

7. Eurobarometer thus provides much more frequent data covering a longer time span than the European Social Survey (ESS), which is used in many other studies (Dustmann et al., 2017; Algan et al., 2017). ESS is a bianual survey, which starts in 2002.

8. PSUs are selected from each of the administrative NUTS II regions in every country so that each region is represented in the sample. "PSU selection was systematic with probability proportional to population size, from sampling frames stratified by the degree of urbanization" (Eurobarometer, 2017).

9. For Germany and UK only NUTS I level available from 2004 onwards.

Figure 1.1. Distribution of image of EU across NUTS II regions



European regions. Figure A1 in the Appendix illustrates the evolution of attitudes toward the EU over time. Summary statistics of the regional-level characteristics are provided in the Appendix in Table A1.

The survey also asks about individual characteristics such as age, gender and education, which are important determinants of political attitudes and thus important control variables and possibly interesting interacting factors. I therefore also estimate a model using all individual level observations rather than the region aggregates. Summary statistics of the individual-level variables can be found in the Appendix in Table A2.

1.2.2 Voting Data

The voting data for the years 1994–2009 stem from the European Election Database (EED), which contains voting data on a regional level (NUTS II) for European Parliament Elections for the years 1994, 1996 (Austria and Finland), 1999 (EU15), 2004 (EU25), 2007 (Bulgaria and Romania) and 2009 (EU27). I added missing data based on

national databases.[10] For the 2014 EP election I collected data for all 28 EU member states based on national databases (see Appendix Table A3 for sources). In order to identify pro-EU parties I use results from the Euromanifesto Study, which allocates each party a score on a pro/anti- EU scale based on content analysis of party programs ('$Pro\ EU\ Score$').[11] This pro-/anti-EU score is highly correlated (0.73) with expert evaluations of parties' position toward European integration (Chapel Hill Expert Survey, Bakker et al. (2015)). I then multiply each party's pro-EU score with the vote share that this party gained in region i in election year t. As I cannot allocate scores to each party (Euromanifesto only coded 'relevant' parties) the vote shares do not sum up to 1. I therefore weight the final measure with the inverse of the total vote share of all parties that are coded in region i in year t.

$$Pro\ EU\ Vote\ Score_{it} = \sum_{p} Pro\ EU\ Score_{pt} * Vote\ Share_{pit} * \frac{1}{\sum_{p} Vote\ Share_{pit}}$$

This index ranges from -18 (anti-EU) to 24 (pro-EU) with a mean of 6.7 and is available for 234 regions in the 28 EU countries. For ease of interpretation and to allow comparability with the other outcomes I standardize the variable to lie between 0 and 100. Figure 1.2 shows the distribution of pro-EU voting across Europe. The strongest anti-EU voting behavior was observed in the East Midlands, UK in 2004 (the strongly eurosceptic UKIP received 26% of the votes and the BNP 6.5%). See summary statistics of the Pro EU Vote Score in Appendix Table A4.

1.2.3 Employment Data

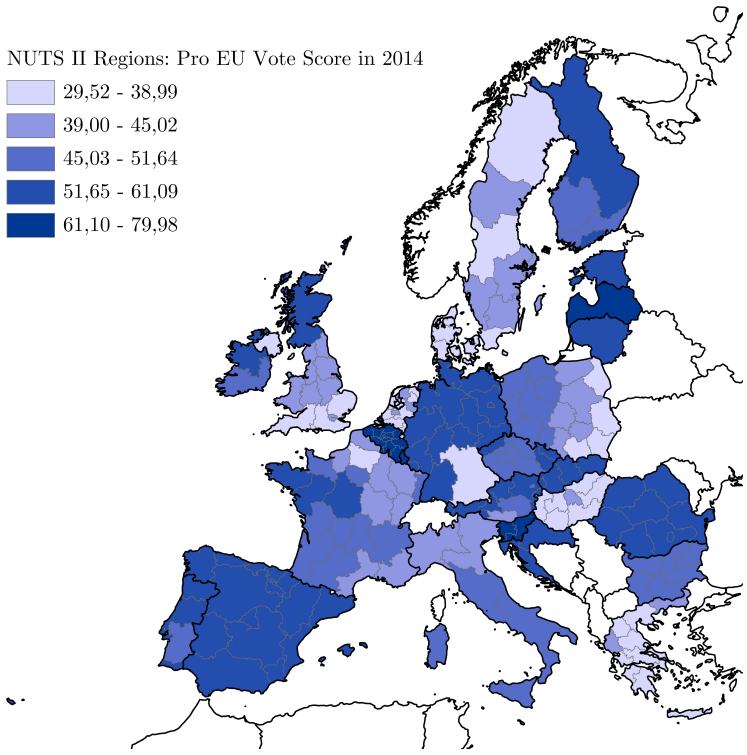
The employment data used in this study comes from Cambridge Econometrics, which combines regional and sectoral data from both Eurostat's REGIO database and AMECO, which is provided by the European Commission's Directorate General Economic and Financial Affairs. The disaggregated data is available for 286 NUTS II regions in 27 EU countries (all EU member states except Malta) and 6 sectors since 1990.[12] The

10. I compiled regional voting data for the following countries: Poland, Portugal, and UK.

11. Euromanifesto evaluates quasi-sentences in party programs. "A classification scheme with invariant general categories is used to cover the total content of election programs by identifying the statements of preference expressed in the programs. [...] Thus, the coding procedure comprises a quantification (how many statements do parties make?) and a classification (what kind of statements do parties make?) of election programs" (Braun et al., 2015, p. 22). The 'Pro EU' variable represents the dimension pro versus contra European integration and is the sum of prointegration codes (16 variables) minus the sum of integration-sceptic codes (19 variables). It ranges from -100 (anti-EU) to 100 (pro-EU).

12. A (agriculture, forestry and fishing), B-E (industry), F (construction), G-J (wholesale, retail, transport, accommodation & food services, information and communication), K-N (financial and business services) and O-U (non-market services).

Figure 1.2. Distribution of pro-EU voting across NUTS II regions in 2014 European Parliament elections



main variable of interest is employment, which "covers all persons engaged in some productive activity (within the production boundary of the national accounts)". As changes in employment may simply reflect changes in the working-age population I adjust this measure by dividing by the active population.[13] The main explanatory variable in this study is the change of the employment rate in region i over the past five years. I expect the change of the employment rate to affect attitudes rather than levels as people are more likely to react to changes, which is confirmed by Algan et al. (2017) findings. The 5-year time horizon was chosen to capture variations that are not only driven by short-term events but represent significant changes in the labor market that people have noticed and can still remember. Moreover it corresponds to the 5-year interval between European Parliament elections. I show that the effects do however not depend on the time horizon.

$$Change\ Employment\ Rate_{it} = \frac{\frac{Employment_{it}}{Active\ Population_{it}} - \frac{Employment_{it-5}}{Active\ Population_{it-5}}}{\frac{Employment_{it-5}}{Active\ Population_{it-5}}} \cdot 100$$

Employment changes for all region-year pairs are close to normally distributed (see Figure A2 in the Appendix) and its mean over the period 1994–2014 is slightly above zero. Both positive and negative outliers (smallest and highest 1%) were excluded from the sample. The largest drop in employment occurred in Greece between 2008 and 2013 (-16%) and the biggest increase occurred in Portugal between 1993 and 1998 (+16%). Figure A3 in the Appendix illustrates the evolution of the change of the employment rate over time for different country sub-samples. Detailed summary statistics can be found in Appendix Table A6.

1.2.4 Additional Data

In addition I use migration data extracted from the EU Labor Force Survey (LFS), which provides information on regional employment, nationality and educational attainment of respondents. For the purposes of my analysis I distinguish between nationals of the reporting country, EU nationals and non-EU nationals. To identify low-skilled respondents I use the 3 step education measure (high, middle and low) based on the Intentional Standard Classification of Education (ISCED). These data is only available since 2006 for EU nationals (which is the most relevant group of migrants) and is therefore most suitably combined with the image outcome so that

13. The active population includes both employed and unemployed people, but not economically inactive, such as students and pensioners. Employment relative to active population can be greater than 1 in regions where many people work in a different region than they live, such as Brussels (BE10) or Luxembourg (LU00).

data for 9 overlapping years is available for analysis. Summary statistics are provided in Table A7 in the Appendix.

Finally, I use data on education (share of population between 15 and 65 with primary, secondary and tertiary education), median age and old-age ratio (above 65 year olds compared to 15-65 year olds) and net migration rate on NUTS II level from Eurostat. These data is available since 2000.

1.3 Empirical Strategy

Figure 1.3 demonstrates that there is a clear positive relationship between changes in regional employment and support for the EU. It is however difficult to identify a causal effect of changes in employment on support for the EU as labor market conditions are not assigned randomly. To the contrary, labor market conditions are related to policies, political and economic institutions and crisis which may all be correlated with support for the EU at the same time. I therefore apply two different estimation strategies to tackle these problems.

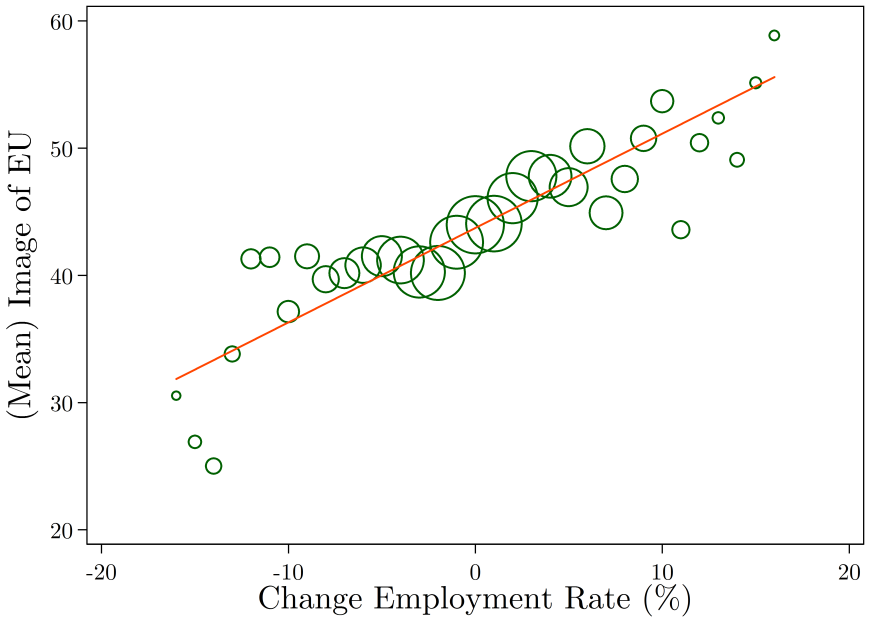
First, I estimate a panel model including time and region fixed effects to account for all region- and time-specific factors. In the primary specification, I estimate the following model:

$$EU\ Support_{it} = \alpha + \beta\ \Delta Employment\ Rate_{i\tau} + \mathbf{X}_{it}^{'}\boldsymbol{\gamma} + \mu_t + \delta_i + u_{it}$$

Here, $EU\ Support_{it}$ denotes the mean attitude toward the EU in region r at time t and pro-EU voting score in region i at time t respectively. $\Delta Employment\ Rate_{i\tau}$ is the change of employment rate between t and t-5 and β is the main coefficient of interest. $\mathbf{X}_{it}$ is a vector of control variables (level of employment rate, national institutions, migration, demography, education), which are successively included. μ_t are year fixed effects and δ_i are region fixed effects. The estimation is conducted by least squares and the error term u_{it} allows for clustering at the regional level. This model accounts for region-specific factors such as institutions, culture or experience with the EU, which are correlated with both labor market outcomes and attitudes toward the EU. The region-specific fixed effects also capture EU funding, which is targeted at less developed regions and hardly varies over time.[14] Moreover, time fixed effects capture year-specific events that affect all European regions as for example the financial crisis. In an additional specification, I also control for country specific

14. The goal of EU transfers is to achieve equalization among European regions and the biggest part of all transfers is spent by the *Structural Funds Programme* (Becker, Egger, and Ehrlich, 2010). There are three funding periods covering the time span of my sample: 1994-1999, 2000-2006 and 2007-2013. Regions defined as "less developed" receive the vast majority of funds. These tend to be the same ones in all funding periods (`http://ec.europa.eu/regional_policy/en/`).

Figure 1.3. Employment changes and image of EU



Change of employment rate (rounded to closest integer) and image of EU (averaged over each bin). Size of bubbles corresponds to number of region-year observations per bin.

linear time trends, which capture country specific changes over time (for example years since a country joined the EU).

In order to rule out reversed causality issues, i.e. past attitudes affecting contemporary labor market conditions (for example through elected politicians) I control for the fifth time lag of the dependent variable. In order to account for potential Nickell bias (Nickell, 1981) I also present specifications using a bias corrected LSDV dynamic panel data estimator (Bruno, 2005).

As robustness check, I test the sensitivity of the results with respect to the definition of the explanatory variable. I use different time horizons for the change of the employment rate, I binarize the explanatory variable to only distinguish between negative and positive changes, I control for absolute employment changes and changes in active population separately and I also control for the level of the employment rate. In addition, I show a robustness check using the EU support index as dependent variable, which comprises all three dimensions of the other dependent variables. To rule out that the effect is driven by third variables such as general disappointment with politicians, education, demographic patterns or migration I control for these factors. They may however be considered 'bad' controls in the Angrist & Pischke sense (Angrist and Pischke, 2008) as they are outcomes of the treatment themselves and are therefore not included in the main specifications.

I also explore potential mechanisms driving this effect. The literature has shown that cost/benefit considerations are important in forming an attitude about the European Union (Frieden, 2016; Foster and Frieden, 2017). I therefore expect people who fear to loose from further integration such as unemployed or low-skilled workers to be more sensitive toward employment changes than others. I analyze whether the effects are driven by positive or negative employment changes by splitting the sample. This helps to understand whether people distinguish between positive and negative labor market outcomes in attributing the changes to the EU. I also compare the labor market effects to migration effects and evaluate the interaction between the two. I then take advantage of the individual level data provided by Eurobarometer, which allows me to identify groups by employment status, age and education and their responsiveness to changes in employment.

Secondly, I apply an instrumental variable approach using a sector-specific Bartik (also known as shift-share) instrument (Bartik, 1991). It predicts regional employment changes on the basis of Europe-wide employment growth across industries and exploits the fact that regions differ in their industrial specialization, and that employment rises and falls unevenly across industries over time. The instrument is constructed in the following way:

$$Bartik\ \Delta\ Employment_{it} = \sum_{j} \frac{Employment_{jit-5}}{Active\ Population_{it-5}} * \Delta Employment\ Rate_{j\tau}^{-i}$$

$\frac{Employment_{jit-5}}{Active\ Population_{it-5}}$ denotes the share of total employment in active population in industry j in region i in year t-5. Using the fifth lag ensures that specialization patterns are not themselves the consequence of changes is certain industries. $\Delta Employment\ Rate_{j\tau}^{-i}$ is the change of the employment rate in industry j between t and t-5 for all European regions (excluding region i). The variation thus stems from different sectoral compositions across regions in combination with changes in Europe-wide industry conditions. As employment varies unevenly across industries and over time and regions differ in their industrial specialization, regions are differently exposed to Europe-wide industry shocks. These shocks are assumed to be exogenous to economic and political conditions in region i as they reflect changes in other regions rather than regional circumstances, which could be correlated with support for the EU (for example regional party politics or regional transfers from the EU).

The exclusion restriction underlying this instrumentation strategy thus requires that Europe-wide industry-specific employment growth rates are uncorrelated with regional labor market conditions. It is plausible that no region is large enough to cause Europe-wide changes in an entire industry. The German region North Rhine-Westphalia is the region with the highest employment in a single sector (2.6 Mio employees in sector group G-J[15]) and only accounts for 4% of total employment in that industry in 2014. Shocks to that industry in North Rhine-Westphalia are thus unlikely to cause employment changes in that industry in all of Europe. I also present robustness checks excluding not only the own region but the entire country from the calculation of total employment changes in industry j. That ensures that country specific relations to the EU, which may also be correlated with the national labor market are not introducing a bias.

Moreover, sectoral shares have to be exogenous as well (Goldsmith-Pinkham, Sorkin, and Swift, 2017). A region's sectoral composition may however be driven by some factors, which are correlated with attitudes toward the EU, such as historical events, education and demography. To address these concerns I add region fixed effects and also a set of control variables (education, demography and migration) to the regression. When adding year fixed effects the first-stage results turn insignificant due to high multicollinearity between the Bartik instrument and the fixed effects. Instead

15. Sector group G-J according to NACE Rev. 2 includes wholesale, retail, transport, accommodation and food services, information and communication

of using sectoral shares multiplied by Europe-wide growth rates I therefore only use the first part of the instrument (sectoral shares) as instruments in Section 1.4.4. They are strong instruments even when including time and region fixed effects. This is similar to the instrumentation strategy proposed by Algan et al. (2017).

Another threat to the validity of the instrument may be EU policies specifically targeted at regions with sectoral compositions that particularly suffer from recent changes in economic conditions. These policies may determine support for the EU and sector-specific employment changes in other regions at the same time. The EU does however not have many policy tools available which could affect sector-specific regional employment to a large extent. One of its main tools are funding programs, which are supposed to foster regional convergence (Structural Funds and the Cohesion Fund). If it was the case that the EU targeted certain region-specific industries the coefficient of interest would however be downward biased because the EU would support regions and sectors with negative employment changes, and the interventions would most likely have a positive impact on attitudes.

In addition, the EU could affect employment through regulations such as REACH (regulation addressing the production and use of chemical substances), Capital Requirements Directives, or roaming regulations. These regulations most likely affect employment only with a time lag (due to fixed labor contracts). I therefore present a specification controlling for lagged attitudes to capture these effects.

A recent working paper (Jaeger, Ruist, and Stuhler, 2017) criticizes the use of shift-share instruments in the immigration literature (as for example advanced in Card (2001)). They argue that the exclusion restriction is violated because of high serial correlation of the spatial distribution of immigrants and adjustment processes in response to previous shocks. The instrument thus combines both short-term effects of immigration and responses to previous immigrant shocks, which are endogenous. This criticism does not apply to the setting outlined in this paper because industry-specific employment changes are not highly serially correlated.[16] Moreover, it is implausible that people react to experienced employment changes with a lag, so adjustment processes are unlikely in this setting.

1.4 Main Results: Attitudes toward the EU

Eurosceptic attitudes often manifest in anti-EU voting behavior and can have detrimental effects on the stability of the EU and its growth prospects. In order to disen-

16. Jaeger, Ruist, and Stuhler (2017) computed that the correlation between the predicted immigrant inflow and its lag is 0.96-0.99. In contrast, the correlation between the predicted employment change and its lag is only 0.42. Moreover, the correlation coefficients between changes in industry-specific employment in t and t-5 are between -0.23 (Agriculture) and -0.56 (Industry).

Table 1.1: Effect of employment changes on attitudes toward the EU

	Image			Benefit			Membership		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ Employment (%)	0.6604***	0.4080***	0.1824***	0.5941***	0.3334***	0.3029***	0.3644***	0.1914***	0.1582**
	(0.0861)	(0.0631)	(0.0541)	(0.1026)	(0.0744)	(0.0618)	(0.0987)	(0.0723)	(0.0631)
Year FE		✓	✓		✓	✓		✓	✓
Region FE		✓	✓		✓	✓		✓	✓
Country FE x Year			✓			✓			✓
adj. R^2	0.05	0.63	0.69	0.03	0.63	0.69	0.01	0.60	0.69
N	2,668	2,668	2,668	2,950	2,950	2,950	2,950	2,950	2,950
Cluster	265	265	265	264	264	264	264	264	264
Mean DV	43.86	43.86	43.86	61.01	61.01	61.01	53.92	53.92	53.92

OLS estimations. Image, Benefit and Membership are outcome variables based on Eurobarometer survey questions and are coded to lie between 0 and 100. Change of employment rate is computed over five years. Standard errors (clustered by region) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

tangle the effect on euroscepticism from other characteristics of eurosceptic parties and to ensure comparability across countries the following section provides in-depth analysis of labor market conditions as determinants for eurosceptic *attitudes*.

1.4.1 Panel Analysis

Table 1.1 presents the main results of the panel analysis. Columns (1), (4) and (7) show correlations between employment changes and attitudes toward the EU without any controls. Columns (2), (5) and (8) report my preferred specification including region and year fixed effects and columns (3), (6) and (9) additionally include country specific linear time trends. As I scaled the dependent variables to lie between 0 and 100, a 1 percentage point increase in the change of the employment rate corresponds to a β_1 percentage point impact on the dependent variable. I will interpret all coefficients with respect to a 10 percentage point increase in the 5-year-change of the employment rate, which is roughly analogous to a 2 percentage point increase per year.[17] All coefficients on change of employment rate are statistically significant on the 1% level. A 10 percentage point increase in the change of the employment rate corresponds to an increase of roughly 4 percentage points on the image scale (column (2)), a 3 percentage point increase on the benefit scale (column (5)) and a 2 percentage point increase on the membership scale (column (8)). These effect sizes correspond to 0.1 to 0.3 standard deviations of the dependent variables. Compared to the means of the dependent variables (44 for image, 65 for benefit and 61 for membership) a 10 percentage point increase in employment change raises support for the EU by 5-10% of the sample average of the dependent variables.

In order to account for potential reversed causality problems I include lagged dependent variables to the model. They capture past attitudes and also its policy reactions. The number of observations decreases in these specifications as I loose the first four years in each series due to the five year time lags. The specification with image as dependent variable thus spans the period 2005–2014 and the membership and benefit specifications the time period 1998–2011.[18] The effects on image of EU and perceived benefit are still statistically significant and of roughly the same magnitude as the baseline effects (Table 1.2). The effect on the assessment of the country's EU membership is not statistically significant anymore (p-value of 0.16).

One concern in this setting may be Nickell bias due to a mechanical correlation between the lagged dependent variable and the error term, which vanishes with an increasing number of observations over time (Nickell, 1981). Judson and Owen (1999)

17. The mean negative change is -4.2% and the mean positive change is +4.2%. The standard deviation of change of employment rate is 5.5.

18. The number of regions covered in the Eurobarometer survey decreased in 2004 (higher level of aggregation for German and British regions). Therefore the number of regions covered by the regressions also decreases.

Table 1.2: Effect of employment changes on attitudes toward the EU

	(1) Image	(2) Benefit	(3) Membership
Δ Employment (%)	0.4845***	0.3247***	0.1311
	(0.0914)	(0.1086)	(0.0941)
$Image_{t-5}$	-0.0675		
	(0.0484)		
$Benefit_{t-5}$		0.0658**	
		(0.0320)	
$Membership_{t-5}$			0.0392
			(0.0488)
Region FE	✓	✓	✓
Year FE	✓	✓	✓
adj. R^2	0.62	0.64	0.65
N	1,570	1,742	1,742
Cluster	206	249	249
Mean DV	40.67	62.26	54.65

OLS estimations. Image, Benefit and Membership are outcome variables based on Eurobarometer survey questions and are coded to lie between 0 and 100. Change of employment rate is computed over five years. Standard errors (clustered by region) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

show that the bias of the least square dummy variable (LSDV) estimator for dynamic panel data models is sizable even in panels with 20 time periods. I therefore present robustness checks using a bias-corrected LSDV estimator, which estimates a bootstrap variance-covariance matrix for the corrected estimator (Bruno, 2005) (see Table A8 in the Appendix). Judson and Owen (1999) provide Monte Carlo evidence that the corrected LSDV estimator performs better than traditional GMM estimators. The estimated effects of changes in the employment rate are very similar in the panel fixed effect set-up and the bias corrected fixed effect estimation irrespective of whether the correction is being initialized by the Anderson-Hsiao or Arellano-Bond estimator.

The panel results are robust to a number of checks. First, I investigate the sensitivity of the results to the definition of the main explanatory variable. For this purpose I estimate the effect for different time horizons of employment changes, i.e. employment changes between t and t-1, t-2, t-3 etc. up to t-10. The effect on the image of the EU declines slightly for longer time horizons (the effect of a 1-year change amounts

to 0.42 while the effect of a 10-year change is 0.32) but remains still statistically significant (see Figure A4). I also binarize changes in the employment rate and thus only distinguish between negative and positive changes. The effects on image and benefit are still highly statistically significant and quantitatively similar to the baseline effect. Experiencing positive employment growth rather than negative increases the image of the EU by 3 percentage points and the perceived benefit from the EU by 2 percentage points (see Table A9 in the Appendix). The effect on membership is again not significant (p-value of 0.13) but quantitatively similar to the baseline. Next, I estimate the effect of absolute employment changes and changes in active population separately to show that the effects are indeed driven by employment dynamics rather than population dynamics. The effects of absolute employment changes are still highly significant and of similar size as the baseline. Changes in active population have no significant effect on attitudes (see Table A10 in the Appendix). I then include the level of the employment rate as control variable (see Table A11 in the Appendix). The coefficients decrease slightly in magnitude as compared to the baseline but remain all statistically significant. The effect of the employment rate is positive and for the image and benefit outcomes statistically significant. A 10 percentage point increase in the employment rate corresponds to a 5 percentage point increase on the image scale.

Second, I also estimate the effect of changes in the employment rate on a combined EU support index, which is based on all three outcome variables and also ranges from 0 to 100. It is only available for the period 2001-2011. Here, a 10 percentage point decrease in the change of the employment rate corresponds to a decline by 3 points of the index, which has a sample mean of 57 and a standard deviation of 15 (see Table A12 in the Appendix).

Third, I add a number of control variables in order to substantiate the argument. I control for the evaluation of national institutions (national government and national parliament) to demonstrate that I capture an effect above and beyond attitudes toward politics or politicians in general (see Table A13 in the Appendix).[19] The effect of employment changes on attitudes toward the EU remains significant for the image and benefit outcome- albeit smaller than in the baseline (around half the size). The effect on membership becomes insignificant. I also add trust in EU parliament as an additional outcome to make it comparable to the questions about national institutions. For this outcome, I also find a statistically significant effect even when controlling for trust in national parliament and government. Hence, holding the evaluation of national institutions constant employment changes still affect attitudes toward the EU. That shows that people explicitly attribute changes in the labor market conditions

19. Algan et al. (2017) find that changes in unemployment affect trust toward national and European political institutions.

at least to some degree to the European Union. Interestingly, I find a highly significant and large positive effect of trust in national parliament on attitudes toward EU but an insignificant and small (for membership even negative) effect of trust in national government on attitudes even though trust in national government and trust in national parliament are highly correlated (correlation coefficient of 0.91). Finally, I show that the results are also robust to including education, median age, old-age ratio and migration as control variables (see Table A14 in the Appendix).

Lastly, I explore heterogeneities of the employment effect with respect to country groups. I find that the employment effect is strongest for southern and eastern European countries (see Figure A5). It is mainly driven by Greece, Portugal, Spain and Slovenia, Czech Republic and Hungary (see Figure A6). These countries suffered particularly from the financial crisis, which supports the findings of Frieden (2016), Dustmann et al. (2017) and Algan et al. (2017) who emphasize the negative effect of the Great Recession on trust in European political institutions.

1.4.2 Potential Mechanisms

In this section I investigate potential mechanisms driving the effect of changes in labor market conditions on attitudes. First, I distinguish between positive and negative changes in order to determine whether the effect is driven by regions that experienced a deterioration in labor market conditions or by regions that experienced an improvement. It turns out that negative employment changes have a highly significant and much larger effect on attitudes than the baseline (see Appendix Table A17). A 10 percentage point decrease in the change of the employment rate, raises the image of the EU by 8 percentage points and improves the evaluation of both benefit and membership by 5 points. The effects for the sup-sample of negative employment changes are thus roughly twice the size of the baseline effects. The effect of positive changes is however not statistically different from zero. Fitting a quadratic model confirms the heterogeneous effects for positive and negative changes (see Table A18 in the Appendix). The marginsplot (Figure A7 in the Appendix) shows that the relationship between changes in the employment rate and attitudes toward the EU is strongly negative for negative changes in the employment rate and flattens for values larger than zero (the 95% confidence bands overlap for positive changes in the employment rate). These results indicate that negative changes in employment are associated with the EU while positive changes are not. The estimation also shows that large decreases in the employment rate affect attitudes stronger than small ones. A 15% decline in the employment rate decreases attitudes by around 7 points more than a 10% decline in the employment rate. In turn, a 5% decline in the employment rate decreases attitudes only by 3 points more than no change in the employment rate.

Table 1.3: Effect of employment changes on attitudes toward the EU

	(1) Image	(2) Image	(3) Image	(4) Image
Δ Employment (%)	0.1602**	0.2289***	0.2342***	0.2480***
	(0.0738)	(0.0805)	(0.0724)	(0.0735)
Working age (18-65)	0.9361**			
	(0.4490)			
Working age (18-65) × Δ Employment (%)	0.1446***			
	(0.0534)			
Active Population		1.3948***		
		(0.4215)		
Active Population × Δ Employment (%)		0.0643		
		(0.0518)		
Unemployed			-7.7969***	
			(0.4773)	
Unemployed × Δ Employment (%)			0.1051*	
			(0.0613)	
Low-skilled				-11.3862***
				(0.4236)
Low-skilled × Δ Employment (%)				0.1672**
				(0.0705)
Region FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
adj. R^2	0.06	0.06	0.06	0.07
N	520,233	520,104	520,233	411,137
Cluster	265	265	265	265
Mean DV	44.30	44.30	44.30	43.28

OLS estimations. Image, Benefit and Membership are outcome variables based on Eurobarometer survey questions and are coded to lie between 0 and 100. Change of employment rate is computed over five years. Working age is defined as 18 to 65 years. Active population consists of both employed and unemployed as opposed to students, house persons and retired people. 'Low-skilled' consists of people who left education before the age of 16. Standard errors (clustered by region) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

In order to understand who is particularly affected by these negative changes I analyze individual-level data in a next step. Several studies have documented that people who benefited from European integration (educated and high-skilled citizens) have higher support for EU membership and have higher trust in European institutions (Foster and Frieden, 2017; Frieden, 2016; Algan et al., 2017; Becker, Fetzer, and Novy, 2017).[20] I therefore analyze these characteristics in greater detail.

Table A15 presents estimates of the baseline model including individual level controls (age, gender and education dummies) using all individual-level observations rather than region aggregates. The effects of employment changes are all statistically significant and quantitatively similar to the baseline results.[21] Here the outcome variables are binary (instead of regional averages as in the baseline) and to account for the discrete nature of the dependent variable I also show that the results hold when applying a logit model (see Appendix Table A16). Next, I explore interaction effects between changes in the employment rate and groups in society that may be particularly affected by changes in the labor market. First, I create a dummy for the working age population (18-65) and I find that the effect of changes in the employment rate is particularly strong for this group (Table 1.3, column (1)). Then I analyze heterogeneous effects with respect to the active population (employed or actively seeking employment). The interaction between changes in the employment rate and active population is positive however not statistically significant (Table 1.3, column (2)).[22] The effect of employment changes on attitudes is reinforced if someone is unemployed (Table 1.3, column (3)). Finally I also find that the effect is particularly strong for the low-skilled.[23] While the effect of a change of the employment rate on the image of the EU is around 0.25 for the high-skilled it amounts to 0.42 for the low-skilled (Table 1.3, column (4)). These findings support the hypothesis that the effect of labor market changes on attitudes toward the EU is driven by the so-called 'left-behind'. Both unemployed and unskilled may feel threatened by a deterioration in the labor market conditions and blame the EU.

It is difficult to identify reasons why those with gloomy perspectives on the labor market associate changes in labor market conditions with the EU. One reason may be fear of foreign migration. Becker and Fetzer (2016) show for the UK that increased migration from Eastern Europe (which is relatively low-skilled) increased the vote

20. This line of argument is based on utilitarian explanations for public support of European integration (Hobolt and Vries, 2016).

21. The differences in the size of the coefficients are due to the weighting of observations. While in the baseline each region-year pair receives equal weights, in this specification the unit of observation are individuals.

22. Self-employed, managers, other white collar workers, manual workers and unemployed as opposed to house persons, retired and students.

23. People with up to 15 years of education as opposed to people with 16 or more years of education. Students are excluded.

Table 1.4: Effect of employment changes on attitudes toward the EU: interaction with EU migration

	(1) Image	(2) Image	(3) Image	(4) Image
Δ Employment Rate	0.5835***	0.6020***	0.7288***	0.8255***
	(0.1113)	(0.1218)	(0.1199)	(0.1494)
Share EU migrants	0.8843***	1.2694***		
	(0.3233)	(0.4103)		
Δ Employment Rate × Share EU migrants	0.0087	0.0121		
	(0.0097)	(0.0114)		
Low-skilled × Δ Employment Rate × Share EU migrants		0.0131*		
		(0.0070)		
LS EU/LS Home			0.8692***	0.7210***
			(0.1870)	(0.2573)
Δ Employment Rate × LS EU/LS Home			-0.0027	-0.0040
			(0.0040)	(0.0041)
Low-skilled × Δ Employment Rate × LS EU/LS Home				0.0152*
				(0.0079)
Region FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
adj. R^2	0.05	0.06	0.06	0.07
N	225,099	177,401	184,183	145,343
Cluster	162	162	147	145
Mean DV	41.30	40.75	42.38	41.93

OLS estimations. The image outcome variable is based on a Eurobarometer survey question and is coded to lie between 0 and 100. Change of employment rate is computed over five years. Interaction terms between low-skilled and Δ employment rate and between low-skilled and share EU migrants/share low-skilled EU migrants are included in the estimation model but not reported in the table. Standard errors (clustered by region) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

share for the eurosceptic UK Independence Party. I therefore control for the share of EU migration and examine an interaction effect between changes in employment and migration. I conduct these analysis only for the image outcome as regional data on EU migration is only available since 2006.[24] The series for benefit and membership would be too short. Surprisingly, the effect of EU migration on attitudes toward the EU is significantly positive and the effect is even larger than the employment effect (Table 1.4, column (1)). People living in regions with a high share of EU migrants thus tend to have a better image of the EU. This provides support for the 'contact hypothesis' (Allport, 1954), which states that contact is one of the most effective ways to reduce prejudice. The interaction effect between EU migration and employment changes is insignificant. The effect of employment changes on the image of the EU therefore does not seem to be driven by actual migration. In the previous paragraph I demonstrated that the effect is particularly strong for the low-skilled. This part of society may feel particularly threatened by migration due to an increase in perceived job insecurity and concerns about wage reductions (NAS, 2017; Dustmann, Gabbri, and Preston, 2005; Dustmann, Frattini, and Preston, 2013; Borjas, 2003). The interaction between low-skilled, employment change and share of EU migrants indeed reveals a significant positive effect (Table 1.4, column (2)).[25] The employment effect is thus stronger for low-skilled people in regions with a high share of EU migrants. These findings are in line with Dustmann et al. (2017, p. 14) conclusion from a literature review about immigration and economic adjustment: "Overall, however, it is fair to say that negative effects on native wages, if present, are relatively modest and are restricted to those groups that are in direct competition with immigrants."

In a next step, I focus on low-skilled EU migration as this type of migration may threaten local low-skilled workers most. For this purpose I include the ratio between low-skilled EU migrants to low-skilled local citizens (LS EU/LS Home) to the model. Again, the interaction between this low-skilled migration ratio and employment changes has no effect on attitudes in general (Table 1.4, column (3)). When interacting this term with the low-skilled dummy (Table 1.4, column (4)) the effect becomes statistically significant. This finding demonstrates that low-skilled locals are particularly sensitive to employment changes in the presence of a large share of low-skilled EU migrants.

Finally, I investigate whether the effect of changes in attitudes toward the EU is re-

24. For that reason I also only observe 162 regions rather than 265 as in the previous regressions. Since 2004 Eurobarometer data is available for fewer, more aggregated regions in Germany and the UK.

25. I estimate the fully specified model:
$EU\ Attitude_{rt} = \beta_0 + \beta_1 \Delta Employment\ Rate_{r\tau} + \beta_3 Share\ EU\ Migrants_{rt} + \beta_4 Low\ skilled_{irt} + \beta_5 \Delta Employment\ Rate_{r\tau} * Low\ skilled_{irt} + \beta_6 \Delta Employment\ Rate_{r\tau} * Share\ EU\ Migrants_{rt} + \beta_7 Low\ skilled_{irt} * Share\ EU\ Migrants_{rt} + \beta_8 \Delta Employment\ Rate_{r\tau} * Share\ EU\ Migrants_{rt} * Low\ skilled_{irt} + \mu_t + \delta_r + u_{rt}$

lated to EU policies, i.e. EU migration, or driven by discontent with globalization in general. As a placebo check I therefore estimate the effect of non-EU (low-skilled) migration on attitudes toward the EU. Table A19 shows that there is neither an effect of share of non-EU migrants on image of EU (column (1)), nor interaction effects between the share of non-EU migrants, changes in employment and the low-skilled dummy (column (2)). I also do not find significant effects of the share of low-skilled non-EU migrants and its interaction with employment changes and low-skilled local workers (Table A19, columns (3) and (4)). These findings suggest that the effect of employment changes interacted with a dummy for low-skilled locals and the EU migration rate is unique to EU migration and does not pick up effects of migration or frustration with globalization in general.

1.4.3 Two-Stage Least Squares Analysis

In this section I present results of Two-Stage Least Squares (2SLS) regressions using regional industrial composition multiplied with Europe-wide employment changes in those industries as an instrument. Table 1.5 shows the effect of predicted employment changes based on the the Bartik instrument on actual employment changes.[26] In this model I use variation in shocks to certain industries over time (these shocks are roughly the same for all regions in each year) and variation in the industry composition across regions and over time.

The first column shows the effect of predicted employment on actual employment. A 1 percentage point increase in predicted employment change is associated with a 0.5 percentage point increase in actual employment change. The Kleinbergen-Paap rk Wald F statistic is well above 10 and the instrument is thus highly relevant.[27] In column (2) I add region fixed effects to capture all region-specific factors, which may affect the regional industry composition and total employment changes. I thus rely on variation within regions over time. This yields an F-statistic of 143 and a statistically significant effect of 0.9. Finally, I add socio-demographic controls (education, demography and migration). In this specification a 1 percentage point increase in predicted employment change is associated with a 0.8 percentage point increase in actual employment change and the F-statistic is 58 (column (3)). I will present 2SLS results for all specifications.

The 2SLS results confirm the findings from the panel analysis. There is a statistically significant positive relationship between changes in the employment rate and attitudes toward the EU. The effect sizes are however not comparable as specifications differ (the 2SLS analysis does not include year fixed effects). I will discuss the com-

26. $Bartik\ Employment_{it} = \sum_j \frac{Employment_{jit}}{Active\ Population_{it}} * \Delta Employment\ Rate_{jt}^{-i}$

27. The Kleinbergen-Paap rk Wald F statistic is also well above the Stock-Yogo critical values in all specifications.

Table 1.5: First-stage regression

	(1) Δ Employment	(2) Δ Employment	(3) Δ Employment
Bartik Δ Employment	0.523***	0.892***	0.777***
	(0.0670)	(0.0745)	(0.102)
Region FE		✓	✓
Controls			✓
adj. R^2	0.06	0.23	0.31
N	4,366	4,366	3,095
Cluster	286	286	278
F-Test	60.98	143.44	57.92

OLS estimations for the period 1996-2014 (columns (1) and (2)) and 2000-2014 (column (3). Image, Benefit and Membership are outcome variables based on Eurobarometer survey questions and are coded to lie between 0 and 100. Controls include education (share of population with primary education, share of population with secondary education, share of population with tertiary education), demographic variables (median age and old-age ratio) and migration rate. Standard errors (clustered by region) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 1.6: 2SLS estimations: effect of employment changes on attitudes toward the EU

	Image			Benefit			Membership		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ Employment (%)	1.354***	2.938***	1.979***	-1.630*	1.609***	1.963***	1.232*	1.207***	1.203***
	(0.409)	(0.236)	(0.328)	(0.893)	(0.178)	(0.508)	(0.648)	(0.172)	(0.413)
Region FE		✓	✓		✓	✓		✓	✓
Controls			✓			✓			✓
N	2,618	2,618	2,502	2,925	2,925	2,060	2,925	2,925	2,060
Cluster	265	265	261	264	264	259	264	264	259
1st stage F-Test	48.05	102.10	50.39	21.82	120.39	22.71	21.82	120.39	22.71
Mean DV	43.50	43.50	43.33	60.89	60.89	62.32	53.82	53.82	54.10

2SLS estimations. Image, Benefit and Membership are outcome variables based on Eurobarometer survey questions and are coded to lie between 0 and 100. Change of employment rate is computed over five years. Controls include education (share of population with primary education, share of population with secondary education, share of population with tertiary education), demographic variables (median age and old-age ratio) and migration rate. Kleibergen-Paap rk Wald F statistic reported. Standard errors (clustered by region) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

parison of effect sizes using an alternative instrumentation strategy in Section 1.4.4. In this setting, I find that a 10 percentage point increase in the change of the employment rate is associated with an increase by 14 percentage points on the image scale relative to a mean of around 44 and a standard deviation of 15 (Table 1.6, column (1)). It is puzzling that the effect on benefit from the EU is negatively significant (Table 1.6,column (4)). It however turns positive and becomes statistically significant when including region fixed effects and control variables (Table 1.6, columns (5) and (6)). The effect of changes in the employment rate on the membership outcome are also significantly positive (Table 1.6, columns (7)-(9)).

As robustness check and to account for past attitudes I include the fifth lag of the dependent variables to the 2SLS specifications (see Table A20 in the Appendix). Most coefficients on change of the employment rate are highly statistically significant and even larger than in the baseline 2SLS regressions. A 10 percentage point increase in the change of the employment rate is for example associated with a roughly 30 percentage point increase on the image of the EU scale (column (1)). Column (3) displays the effect of changes of the employment rate on perceived benefit from the EU and this effect is now positive (as opposed to the specification without lagged dependent variable) however not statistically significant (p-value of 0.16). Not surprisingly, the lags of the dependent variable have a positive and quite sizable (coefficients between 0.1 and 0.6) effect on contemporary attitudes.

As an additional robustness check I exclude the own country in the calculation of the Bartik instrument (Table A21 in the Appendix). The results are very similar to the 2SLS baseline. Gaining a bit more credibility for the exclusion restriction comes at the expense of relevance. The F-statistic is only slightly greater than 10 in some specifications (i.e. 10.03 in the specification without any fixed effects for the benefit and membership outcomes). Finally, I also estimate the 2SLS model with individual level observations and individual characteristics as controls. Again, the results also hold in this setting (see Table A22 in the Appendix).

1.4.4 Comparison of Panel and 2SLS Results

The coefficients on the 2SLS regressions in Section 1.4.3 are not comparable with those of the OLS regressions in Section 1.4.1, because of differences in specification. The preferred specification in the panel setup was to use both region and year fixed effects. This specification does not lend itself to a Bartik-type instrument, because the inclusion of year fixed effects absorbs explanatory power from the Bartik instrument and it becomes weak (Kleibergen-Paap rk Wald F statistic for the first stage falls to 4.3).[28] The first-stage however improves drastically when only using the first part of the Bartik instrument, the lagged sectoral shares to predict employment changes

28. The vector inflation factor for the Bartik instrument is around 16.

Table 1.7: Comparison between panel and 2SLS results

	Image		Benefit		Membership	
	(1) Panel	(2) IV	(3) Panel	(4) IV	(5) Panel	(6) IV
Δ Employment (%)	0.2972***	0.5090***	0.2971***	0.4795***	0.1836**	0.2017*
	(0.0657)	(0.1136)	(0.0906)	(0.1410)	(0.0867)	(0.1217)
Year FE	✓	✓	✓	✓	✓	✓
Region FE	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
adj. R^2	0.65	0.65	0.66	0.66	0.66	0.66
N	2,552	2,552	2,083	2,083	2,083	2,083
Cluster	261	261	259	259	259	259
Mean DV	43.71	43.71	62.46	62.46	54.23	54.23
F-Test		42.44		44.26		44.26

Panel and 2SLS estimations including year and region fixed effects. Image, Benefit and Membership are outcome variables based on Eurobarometer survey questions and are coded to lie between 0 and 100. Change of employment rate is computed over five years. Instruments for the change of employment rate are employment share in agriculture, employment share in industry, employment share in construction, employment share in wholesale, employment share in financial services and employment share in non-market services. Kleibergen-Paap rk Wald F statistic reported for 2SLS estimations. Control variables include share of population with primary education (in %), share of population with secondary education (in %), share of population with tertiary education (in %), median age, old age ratio (65 and above compared to 15-65 year olds) and crude rate of net migration plus adjustment. Standard errors (clustered by region) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

(Kleibergen-Paap rk Wald F statistic is 51.4). By using the fifth lag of the sectoral shares as instruments I isolate the component of employment changes stemming from industrial specialization and account for year effects separately (the Bartik instrument combines these two dimensions as Europe-wide industry-specific growth rates are constant for all regions). It seems plausible that the impact of sectoral specialization on support for the EU works mainly through the labour market, especially in the short term. Just as for the Bartik instrument, regional demography, education and migration may nevertheless constitute threats to the validity of the instruments. I therefore include these factors as controls in the panel and 2SLS setting.

Table 1.7 presents the results of the panel and IV models using sectoral shares as instruments. While I find in the panel analysis that a 10 percentage point increase in the change of the employment rate is associated with a 3 percentage point increase on the image scale (column (1)) I estimate an increase by 5 percentage points in the 2SLS setting (column (2)). I also find larger 2SLS coefficients for the benefit and membership outcomes (columns (3)-(6)).

The fact that $\hat{\beta}^{OLS} < \hat{\beta}^{2SLS}$ indicates that the OLS estimates may have been downward biased. This could be the case if for example EU policies were targeted at regions with extremely negative employment changes and thereby mitigated the effect that I estimated in the panel specification. Other omitted factors in the panel analysis may include media reporting or activities of local politicians. It is however reassuring that I find qualitatively a similar pattern- a positive effect of changes in the employment rate on attitudes toward the EU- in both setups.

1.5 Additional Results: Voting

Empowering nationalistic anti-globalization parties may have dramatic consequences for trade policies, immigration policies and international cooperation and thus growth prospects. It is therefore not only important to better understand the determinants of attitudinal euroscepticism but also of eurosceptic voting behavior. This analysis is therefore based on voting behavior in five European Parliament elections (1994, 1999, 2004, 2009, 2014). Throughout all different specifications I find significantly positive effects of changes in the employment rate on pro-EU voting. A 10 percentage point increase in the change of the employment rate raises the pro-EU voting index by roughly 4 points on a scale from 0 to 100 (Table 1.8, column (1)). Greece for example had a rather low pro-EU index in 2014 (37 as compared to a Europe-wide mean of 56). Between 2009 and 2014 it experienced a decline in the employment rate of 13 percentage points. Had the employment rate only decreased by 3 percentage points and holding everything else constant, the pro-EU index would lie around 41 according to the model. A 10 percentage point increase in the change of the employment rate would have thus corresponded to a roughly 10% improvement in Greece's

Table 1.8: Effect of employment changes on pro-EU voting

	(1)	(2)	(3)	(4)	(5)
	Pro EU Voting OLS	Pro EU Voting OLS	Pro EU Voting OLS	Pro EU Voting 2SLS (Bartik)	Pro EU Voting 2SLS (Sectoral Shares)
Δ Employment (%)	0.3813***	0.3802***	0.3552***	2.7035***	0.4699***
	(0.0912)	(0.0978)	(0.0881)	(0.6734)	(0.1602)
Year FE		✓	✓		✓
Region FE		✓	✓	✓	✓
Country FE x Year			✓		
F-Test				11.81	22.72
N	780	780	780	765	780
Cluster	234	234	234	234	234
Mean DV	56.41	56.41	56.41	56.30	56.41

OLS and 2SLS estimations. The pro-EU voting index is based on a party's pro-EU score (assigned by Euromanifesto) and its vote share in the EP elections in 1994, 1999, 2004, 2009 and 2014. It is scaled to lie between 0 and 100. Change of employment rate is computed over five years. Kleibergen-Paap rk Wald F statistic reported. Standard errors (clustered by region) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

pro-EU voting index. When including region and year fixed effects (column (2)) and country specific linear time trends (column (3)) the size of the coefficient remains constant and statistically significant at the 1% level. The coefficient is also highly significant in the 2SLS specification using the Bartik instrument (column (4)). The coefficient should however be interpreted with caution as the first-stage F-statistic is only marginally above 10 (11.8) and the instrument may therefore be weak. When using sectoral shares as instruments the effect is still statistically significant and around 18% larger than the OLS coefficients. A 10 percentage point increase in the change of the employment rate raises the pro-EU voting index by roughly 5 points (column (5)). These results indicate that bad labor market conditions translate into voting for parties campaigning on an anti-EU platform.

I also estimate the effect on turnout as participating in European Parliament elections may be another way to express dismay or approval of the EU (see Guiso et al. (2017)). I do not find any statistically significant effect on turnout in the unconditional model (Table A23, column (1)). When adding region and year fixed effects (column (2)) as well as country specific linear time trends (column (3)) the effects become highly statistically significant (a 10 percentage point increase in the change of the employment rate corresponds to a increase in turnout of roughly 2 percentage points). While the 2SLS estimate using the Bartik instrument is negatively significant the estimate using sectoral shares as instruments is positively significant. These results thus only provide suggestive evidence that the decision to turnout at European Parliament elections is driven by labor market conditions.

1.6 Conclusion

This chapter has shown that regional employment changes affect support for the EU by affecting voting behavior and attitudes. Applying both panel and instrumental variable estimation strategies I find that a decrease in the change of the employment rate is associated with voting for more anti-EU parties and a deterioration of the image of the EU, perceived benefit from the EU and evaluation of the EU membership of one's country. These effects are particularly strong for 'losers of globalization', i.e. unskilled and unemployed people. I also find that the effect of employment changes on the image of the EU is most pronounced for unskilled workers living in regions exposed to high EU migration.

In estimating these effects I take advantage of Eurobarometer survey data which allows linking respondents to their region of residence as well as regional employment data. My analyses are thus based on a novel panel covering roughly 260 European regions over 20 years. In addition, I introduce a Bartik-style instrument, which exploits variation in industry specializations across regions in combination with Europe-wide sector-specific shocks. All different estimation approaches, including fixed effects

models, lagged dependent variables and the IV model, confirm the relationship between labor market conditions and support for the EU. It is however difficult to determine the mechanisms underlying this effect. I provide some suggestive evidence that fear of EU migration may be a concern linking labor market conditions to attitudes toward the EU. Further research is however needed to better understand whether (low-skilled) EU migration is a real threat for low-skilled local workers and whether policies or communication strategies can mitigate this concern.

In times of Brexit and the success of anti-EU parties in many European countries public support for the European endeavor is more important than ever to ensure the stability of the union. Policy makers should therefore emphasize the economic benefits from political and economic integration and aim at redistributing the gains from globalization. More generally, it is important to avoid that regions are left behind and policy makers thus have to tackle inequalities in labor market opportunities. The IMF concluded in its fiscal monitor that "excessive inequality can erode social cohesion, lead to political polarization, and ultimately lower economic growth" (IMF, 2017). The findings of this paper thus do not only have implications for the political future of the EU but also for its growth prospects.

Appendix A.1: Eurobarometer Data

Benefit: Taking everything into consideration, would you say that (OUR COUNTRY) has on balance benefited or not from being a member of the European Union ?

- 0: not benefited
- 1: benefited

Mean	Std. Dev.	Obs.	Period covered	Regions
0.44	0.50	546,291	2001-2014	260

Membership: Generally speaking, do you think that (OUR COUNTRY'S) membership of the European Union is ... ?

- 0: A bad thing
- 0: Neither good nor bad
- 1: A good thing

Mean	Std. Dev.	Obs.	Period covered	Regions
0.65	0.48	533,722	1994-2011	260

Image: In general, does the European Union conjure up for you a very positive, fairly positive, neutral, fairly negative or very negative image?

- 0: Very negative
- 0: Fairly negative
- 0: Neutral
- 1: Very positive
- 1: Fairly positive

Mean	Std. Dev.	Obs.	Period covered	Regions
0.55	0.49	567,567	1994-2011	260

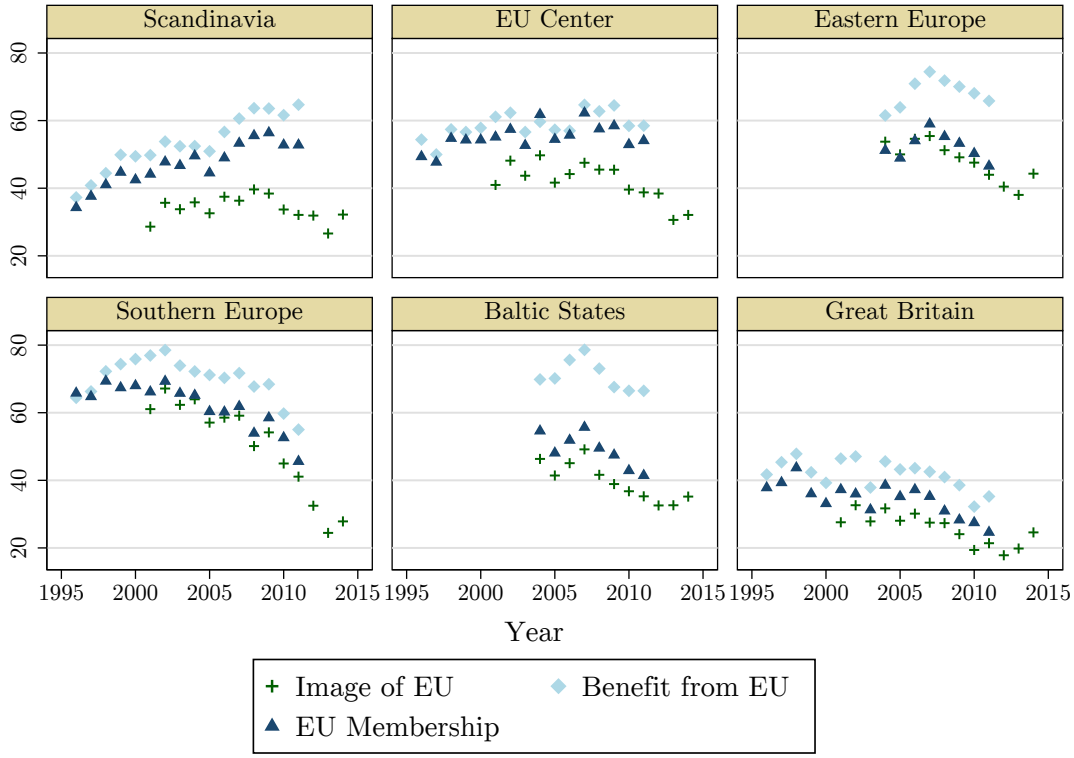
Table A1: Summary statistics: Eurobarometer data (aggregated to regional level)

	Mean	SD	Min	Max	Obs
Image	43.60	15.40	0	93	2,827
Benefit	60.94	17.03	0	100	3,091
Membership	53.93	16.07	0	100	3,091
EU Support Index	56.90	14.82	0	100	2,151
Trust national government	36.36	17.02	0	100	3,014
Trust national parliament	38.99	19.53	0	100	3,014
Trust EU Parliament	60.53	17.32	0	100	3,014

Table A2: Summary statistics: Eurobarometer data (individual-level data)

	Mean	SD	Min	Max	Obs
Age	46.85	18.24	15	99	805,578
Gender	1.54	0.50	1	2	832,290
Education	2.19	0.89	1	4	749,618
Unemployed	0.07	0.26	0	1	833,226
Low-skilled	0.26	0.44	0	1	689,023

Figure A1. Evolution of image of EU, benefit from EU and evaluation of EU membership over time



Scandinavia: Denmark, Finland and Sweden. EU Center: Austria, Belgium, Germany, France, Luxembourg and Netherlands. Eastern Europe: Bulgaria, Czech Rep., Croatia, Poland, Romania, Slovakia, Slovenia. Southern Europe: Greece, Spain, Italy and Portugal, Baltic States: Estonia, Latvia and Lithuania.

Appendix A.2: Voting Data

Table A3: Sources: European Parliament Election results 2014

Austria	http://euwahl2014.bmi.gv.at
Belgium	http://polling2014.belgium.be
Bulgaria	http://results.cik.bg/ep2014
Croatia	http://www.izbori.hr
Cyprus	http://www.europarl.europa.eu/elections2014-results
Czech Republic	http://www.volby.cz
Denmark	http://dst.dk/valg
Estonia	http://ep2014.vvk.ee/voting-results-en.html
Finland	http://stat.fi/tup/tilastotietokannat/index_en.html
France	http://www.interieur.gouv.fr/Elections/Les-resultats/Europeennes
Germany	http://www.bundeswahlleiter.de/europawahlen/2014.html
Greece	http://www.ypes.gr/en/Elections/
Hungary	http://www.valasztas.hu/hu/ep2014/
Ireland	http://electionsireland.org/results/europe/index.cfm
Italy	http://elezionistorico.interno.it/
Latvia	http://www.europarl.europa.eu/elections2014-results
Lithuania	http://www.europarl.europa.eu/elections2014-results
Luxembourg	http://www.europarl.europa.eu/elections2014-results
Netherlands	http://www.nlverkiezingen.com/EP2014P.html
Poland	http://pe2014.pkw.gov.pl/pl/
Portugal	http://www.eleicoes.mai.gov.pt
Romania	http://www.roaep.ro/bec_europ2014
Slovakia	http://volby.statistics.sk/ep/ep2014/
Slovenia	http://www.dvk-rs.si/index.php/si/volitve/evropski-parlament
Sweden	http://www.val.se/val/ep2014/slutresultat/E/rike/index.html
Spain	http://www.infoelectoral.mir.es/infoelectoral/min/
United Kingdom	http://www.bbc.com/news/politics/eu-regions/E15000004

Table A4: Summary statistics: voting in European Parliament elections

	Mean	SD	Min	Max	Obs
Pro EU Voting	56.68	14.58	0	100	819
Turnout	46.67	17.70	0	94	740

Table A5: Correlation between different aspects of euroscepticism

	Pro EU Score (EED)	Membership	Benefit	Image
Pro EU Score (EED)	1.00			
Membership	0.44	1.00		
Benefit	0.34	0.83	1.00	
Image	0.40	0.77	0.74	1.00

Appendix A.3: Employment Data

Figure A2. Histogram of change of employment rate

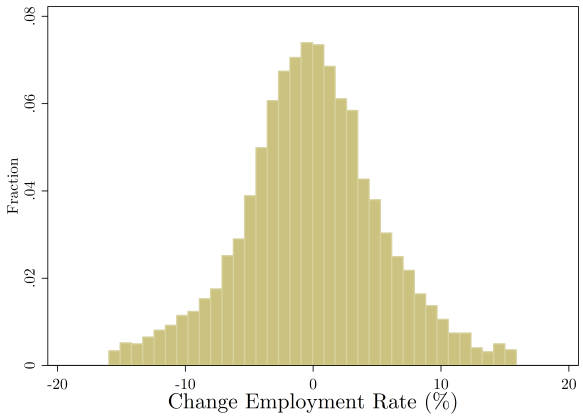
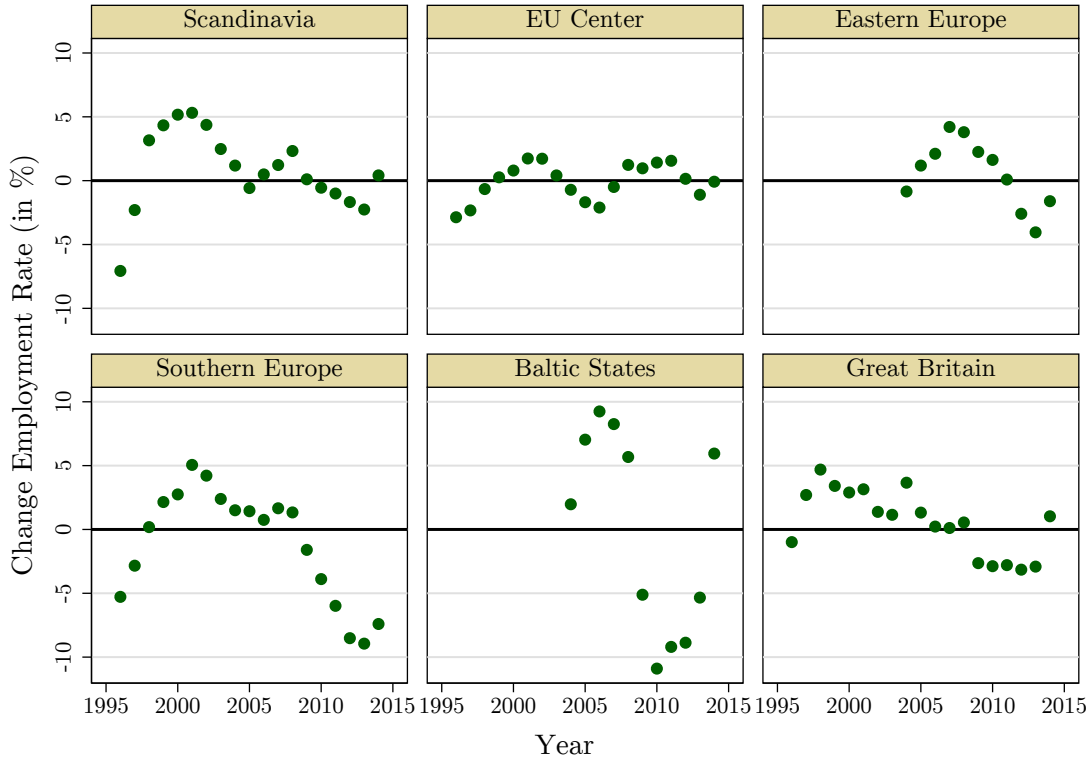


Table A6: Summary statistics of change in employment rate

Mean	Std. Dev.	Obs.	Period covered	Regions
0.015	0.08	6,955	1980-2014	285

Figure A3. Evolution of change in employment rate over time



Scandinavia: Denmark, Finland and Sweden. EU Center: Austria, Belgium, Germany, France, Luxembourg and Netherlands. Eastern Europe: Bulgaria, Czech Rep., Croatia, Poland, Romania, Slovakia, Slovenia. Southern Europe: Greece, Spain, Italy and Portugal, Baltic States: Estonia, Latvia and Lithuania.

Table A7: Summary Statistics: employment and migration data

	Mean	SD	Min	Max	Obs
Δ Employment (%)	-0.13	5.47	-16	16	4,450
Share EU migrants	3.41	6.07	0	73	1,326
Low-skilled EU/Low-skilled Home	3.84	6.30	0	67	1,146

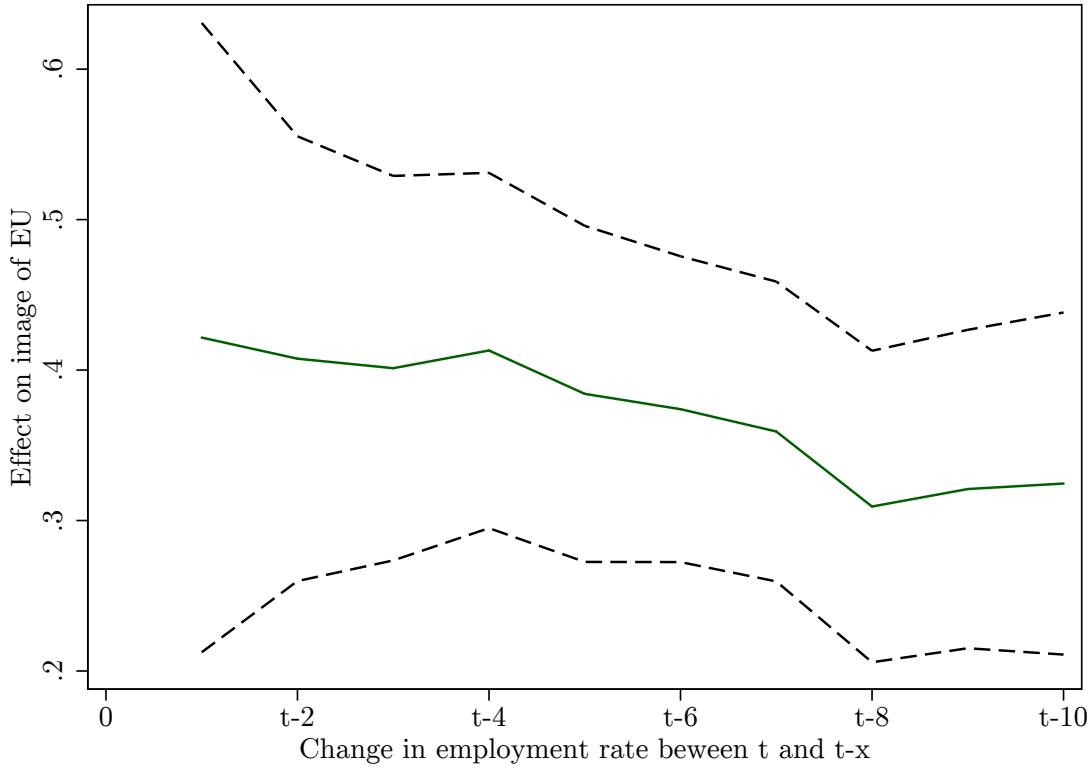
Appendix A.4: Robustness Checks

Table A8: Bias corrected fixed effect estimator

	Image			Benefit			Membership		
	(1) FE	(2) CFE-AH	(3) CFE-AB	(4) FE	(5) CFE-AH	(6) CFE-AB	(7) FE	(8) CFE-AH	(9) CFE-AB
Δ Employment (%)	0.3171***	0.3049***	0.2940***	0.2135***	0.1951***	0.1919***	0.1222**	0.1102*	0.1117*
	(0.0580)	(0.0303)	(0.0304)	(0.0650)	(0.0578)	(0.0571)	(0.0601)	(0.0575)	(0.0571)
$\text{Image}_{\text{t-5}}$	0.2306***	0.3283***	0.3318***						
	(0.0356)	(0.0231)	(0.0218)						
$\text{Benefit}_{\text{t-5}}$				0.3172***	0.4207***	0.4168***			
				(0.0360)	(0.0125)	(0.0121)			
$\text{Membership}_{\text{t-5}}$							0.3066***	0.4071***	0.4060***
							(0.0371)	(0.0137)	(0.0137)
Region FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
N	2,429	2,429	2,429	2,706	2,706	2,706	2,706	2,706	2,706
Mean DV	43.73	43.73	43.73	46.31	45.41	45.41	46.31	45.41	45.41

Bias corrected LSDV dynamic panel data estimator. Columns (1), (4) and (7) present results using a fixed effect estimator. In columns (2), (5) and (8) bias correction is initialized by Anderson-Hsiao estimator and in columns (3), (6) and (9) by Arellano and Bond estimator. Image, Benefit and Membership are outcome variables based on Eurobarometer survey questions and are coded to lie between 0 and 100. Change in employment rate is computed over five years. Bootstrapped standard errors. *** p<0.01, ** p<0.05, * p<0.1.

Figure A4. Emplyoment change over various years



Coefficients from baseline OLS regression (including region and year FE) and 95% confidence bands for different time horizon of explanatory variable.

Table A9: Effect of binary employment changes on attitudes toward the EU

	(1) Image	(2) Benefit	(3) Membership
Δ Employment (Binary)	2.9088***	2.1608***	1.0779
	(0.6285)	(0.7053)	(0.7046)
Year FE	✓	✓	✓
Region FE	✓	✓	✓
adj. R^2	0.63	0.62	0.60
N	2,668	2,950	2,950
Cluster	265	264	264
Mean DV	43.86	61.01	53.92

OLS estimations. Image, Benefit and Membership are outcome variables based on Eurobarometer survey questions and are coded to lie between 0 and 100. Change in employment rate is binary (1 if positive over past 5 years, 0 if negative over past five years). Standard errors (clustered by region) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A10: Effect of employment changes on attitudes toward the EU

	(1) Image	(2) Benefit	(3) Membership
Δ Absolute Employment (%)	0.4487***	0.4256***	0.2211***
	(0.0611)	(0.0579)	(0.0601)
Change Active Population (%)	-2.8778	12.0728	-4.0525
	(7.2219)	(9.8012)	(9.4951)
Year FE	✓	✓	✓
Region FE	✓	✓	✓
adj. R^2	0.63	0.64	0.60
N	2,715	2,980	2,980
Cluster	265	264	264
Mean DV	43.73	61.04	53.91

OLS estimations. Image, Benefit and Membership are outcome variables based on Eurobarometer survey questions and are coded to lie between 0 and 100. Absolute change in employment is computed over five years. Additional control variable is change in active population over the same time. Standard errors (clustered by region) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A11: Effect of employment changes on attitudes toward the EU

	(1) Image	(2) Benefit	(3) Membership
Δ Employment (%)	0.1701**	0.2161**	0.1615*
	(0.0788)	(0.1027)	(0.0923)
Employment Rate (%)	0.5543***	0.3053*	0.0778
	(0.1180)	(0.1816)	(0.1523)
Year FE	✓	✓	✓
Region FE	✓	✓	✓
adj. R^2	0.64	0.63	0.60
N	2,668	2,950	2,950
Cluster	265	264	264
Mean DV	43.86	61.01	53.92

OLS estimations. Image, Benefit and Membership are outcome variables based on Eurobarometer survey questions and are coded to lie between 0 and 100. Change in employment rate is computed over five years. Level of employment rate is added as additional control. Standard errors (clustered by region) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A12: Effect of employment changes on attitudes toward the EU

	(1) EU Support Index	(2) EU Support Index	(3) EU Support Index
Δ Employment (%)	0.3102***	0.2422***	0.4098***
	(0.0768)	(0.0682)	(0.1140)
EU Support Index$_{t-5}$			-0.0482
			(0.0661)
Year FE	✓	✓	✓
Region FE	✓	✓	✓
Country FE x Year		✓	
adj. R^2	0.63	0.67	0.68
N	2,030	2,030	936
Cluster	263	263	190
Mean DV	46.45	46.45	44.33

OLS estimations. Change in employment rate is computed over five years. EU Support index is first principal component of image, benefit and membership variables and scaled to lie between 0 and 100. Column (3) includes fifth lag of EU support index as control variable. Standard errors (clustered by region) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A13: Effect of employment changes on attitudes toward the EU

	(1) Image	(2) Benefit	(3) Membership	(4) Trust EU Parliament
Δ Employment (%)	0.1686***	0.2010**	0.0731	0.1722***
	(0.0491)	(0.0783)	(0.0725)	(0.0542)
Trust in national government	0.0083	0.0024	-0.0471	-0.0564
	(0.0419)	(0.0445)	(0.0442)	(0.0412)
Trust in national parliament	0.3828***	0.3429***	0.3535***	0.5824***
	(0.0412)	(0.0443)	(0.0422)	(0.0424)
Year FE	✓	✓	✓	✓
Region FE	✓	✓	✓	✓
adj. R^2	0.72	0.69	0.69	0.73
N	2,668	2,213	2,213	2,851
Cluster	265	263	263	265
Mean DV	43.86	62.67	54.44	54.44

OLS estimations. Image, Benefit and Membership are outcome variables based on Eurobarometer survey questions and are coded to lie between 0 and 100. Change in employment rate is computed over five years. Additional controls include trust in national government and trust in national parliament. Standard errors (clustered by region) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A14: Effect of employment changes on attitudes toward the EU including control variables

	Image			Benefit			Membership		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ Employment (%)	0.3346***	0.3520***	0.2972***	0.3168***	0.3561***	0.2971***	0.1642**	0.2082**	0.1836**
	(0.0617)	(0.0627)	(0.0657)	(0.0864)	(0.0870)	(0.0906)	(0.0798)	(0.0820)	(0.0867)
Year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Region FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Education Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓
Demographic Controls		✓	✓		✓	✓		✓	✓
Migration Control			✓			✓			✓
adj. R^2	0.64	0.65	0.65	0.65	0.65	0.66	0.65	0.65	0.66
N	2,588	2,588	2,552	2,118	2,118	2,083	2,118	2,118	2,083
Cluster	261	261	261	259	259	259	259	259	259
Mean DV	43.91	43.91	43.71	46.59	46.59	46.35	46.59	46.59	46.35

OLS estimations. Image, Benefit and Membership are outcome variables based on Eurobarometer survey questions and are coded to lie between 0 and 100. Change in employment rate is computed over five years. Education controls include primary education (in%), secondary education (in%) and tertiary education (in%). Demographic controls include median age and old age ratio (65 and above compared to 15-65 year olds). Migration is crude rate of net migration plus adjustment. Standard errors (clustered by region) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A15: Effect of employment changes on attitudes toward the EU: individual-level observations

	Image			Benefit			Membership		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ Employment (%)	0.2636***	0.2831***	0.1662***	0.3425***	0.3612***	0.2816***	0.2141**	0.2151**	0.1204**
	(0.0734)	(0.0717)	(0.0551)	(0.0893)	(0.0864)	(0.0588)	(0.0842)	(0.0858)	(0.0546)
Year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Region FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ind. Controls		✓	✓		✓	✓		✓	✓
Country FE x Year			✓			✓			✓
adj. R^2	0.06	0.08	0.09	0.10	0.13	0.13	0.07	0.10	0.11
N	520,233	422,610	422,610	513,015	450,974	450,974	544,846	476,720	476,720
Cluster	265	265	265	264	264	264	264	264	264
Mean DV	45.34	45.79	45.79	61.25	61.09	61.09	54.91	54.96	54.96

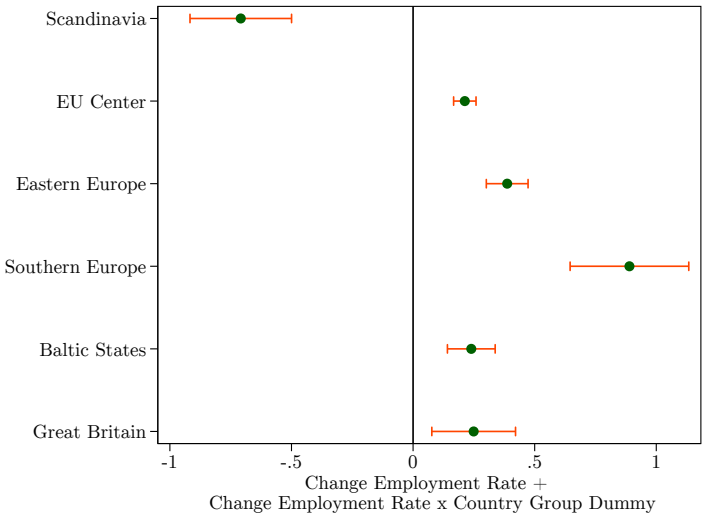
OLS estimations. Image, Benefit and Membership are outcome variables based on Eurobarometer survey questions and are coded to lie between 0 and 100. Change in employment rate is computed over five years. Individual level control variables include age, gender and education. Estimation sample based on individual level observations. Standard errors (clustered by region) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A16: Effect of employment changes on attitudes toward the EU: logit estimations

	(1) Image	(2) Benefit	(3) Membership
Δ Employment (%)	0.0108***	0.0179***	0.0094**
	(0.0031)	(0.0045)	(0.0038)
Year FE	✓	✓	✓
Region FE	✓	✓	✓
Pseudo R^2	0.04	0.08	0.05
N	520,233	513,015	544,846
Cluster	265	264	264
Mean DV	44.30	65.36	55.49

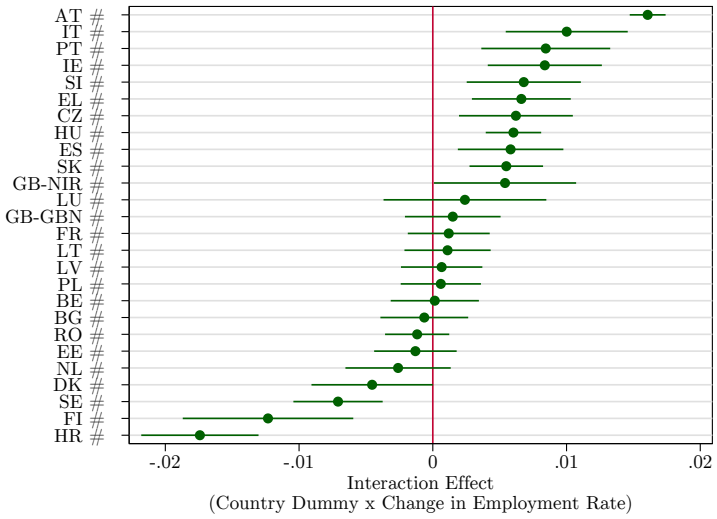
Logit estimations. Image, Benefit and Membership are outcome variables based on Eurobarometer survey questions and are coded to lie between 0 and 100. Change in employment rate is computed over five years. Standard errors (clustered by region) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Figure A5. Country-group-specific effect heterogeneity



Interaction coefficients from fixed effect regressions of change in employment rate on image outcome including country group and year fixed effects and interactions between country dummies and change in employment rate. Figure shows base effect of change employment rate plus interaction effect. Base category is EU Center. Image outcome variable is based on Eurobarometer survey questions, and is aggregated by region and year and coded to lie between 0 and 100.

Figure A6. Country-specific effect heterogeneity



Interaction coefficients from fixed effect regressions of change in employment rate on image outcome including country and year fixed effects and interactions between country dummies and change in employment rate. Base category is Germany. Image outcome variable is based on Eurobarometer survey questions, and is aggregated by region and year and coded to lie between 0 and 100.

Table A17: Effect of employment changes on attitudes toward the EU

	Image		Benefit		Membership	
	(1) Change<0	(2) Change>0	(3) Change<0	(4) Change>0	(5) Change<0	(6) Change>0
Δ Employment (%)	0.8481***	-0.1730	0.5011***	0.0616	0.5138***	0.0521
	(0.1500)	(0.1245)	(0.1869)	(0.1163)	(0.1731)	(0.1095)
Year FE	✓	✓	✓	✓	✓	✓
Region FE	✓	✓	✓	✓	✓	✓
adj. R^2	0.62	0.70	0.58	0.69	0.62	0.64
N	1,320	1,348	1,380	1,570	1,380	1,570
Cluster	233	244	235	241	235	241
Mean DV	40.72	46.94	58.07	63.60	52.13	55.49

OLS estimations. Image, Benefit and Membership are outcome variables based on Eurobarometer survey questions and are coded to lie between 0 and 100. Change in employment rate is computed over five years. Estimations for sub-samples. Columns (1), (3) and (5) focus on regions that experienced a negative change in the employment rate over past five years and columns (2), (4) and (6) focus on regions that experienced a positive change in the employment rate over past 5 years. Standard errors (clustered by region) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A18: Effect of employment changes on attitudes toward the EU: quadratic model

	(1) Image	(2) Benefit	(3) Membership
Δ Employment (%)	0.3944***	0.3619***	0.2106***
	(0.0607)	(0.0748)	(0.0716)
Δ Employment (%) ^{2}	-0.0416***	-0.0205***	-0.0138**
	(0.0067)	(0.0069)	(0.0062)
Year FE	✓	✓	✓
Region FE	✓	✓	✓
adj. R^2	0.64	0.63	0.61
N	2,668	2,950	2,950
Cluster	265	264	264
Mean DV	43.86	46.45	61.01

OLS estimations. Image, Benefit and Membership are outcome variables based on Eurobarometer survey questions and are coded to lie between 0 and 100. Change in employment (in %) rate is computed over five years. Standard errors (clustered by region) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Figure A7. Marginsplot: quadratic model

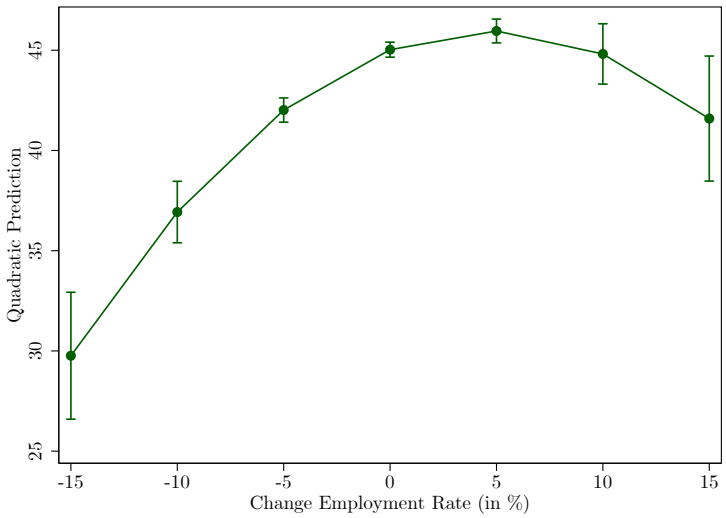


Table A19: Effect of employment changes on attitudes toward the EU: interaction with non-EU migration

	(1) Image	(2) Image	(3) Image	(4) Image
Δ Employment Rate	0.2278	0.2837**	0.3359	0.3811
	(0.1543)	(0.1322)	(0.2176)	(0.2324)
Share Non-EU migrants	14.2916	18.9964		
	(11.9242)	(12.3160)		
Δ Employment Rate ×	0.2761	0.1133		
Share Non-EU migrants	(1.1828)	(1.2014)		
Low-skilled × Δ Employment Rate ×		-1.2013		
Share Non-EU migrants		(1.8053)		
LS Non-EU/LS Home			20.6648	9.6420
			(17.4045)	(16.6549)
Δ Employment Rate ×			-0.0949	-0.3016
LS Non-EU/LS Home			(1.8771)	(2.0650)
Low-skilled × Δ Employment Rate ×				-1.1352
LS Non-EU/LS Home				(1.7791)
Region FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
adj. R^2	0.05	0.06	0.05	0.06
N	278,413	218,374	244,857	193,280
Cluster	166	166	162	162
Mean DV	40.74	39.88	40.36	39.65

OLS estimations. The image outcome variable is based on a Eurobarometer survey question and is coded to lie between 0 and 100. Change in employment rate is computed over five years. Standard errors (clustered by region) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A20: 2SLS estimations: effect of employment changes on attitudes toward the EU

	Image		Benefit		Membership	
	(1)	(2)	(3)	(4)	(5)	(6)
Δ Employment (%)	2.764***	3.548***	1.206	2.243***	4.244**	1.822***
	(0.412)	(0.341)	(0.864)	(0.447)	(1.681)	(0.397)
$Image_{t-5}$	0.535***	-0.0632				
	(0.0477)	(0.0631)				
$Benefit_{t-5}$			0.576***	0.181***		
			(0.0328)	(0.0529)		
$Membership_{t-5}$					0.569***	0.102*
					(0.0691)	(0.0555)
Region FE		✓		✓		✓
N	1,556	1,556	1,732	1,732	1,732	1,732
Cluster	206	206	249	249	249	249
1st stage F-Test	59.24	77.18	7.07	31.76	7.91	33.05
Mean DV	40.56	40.56	62.16	62.16	54.54	54.54

2SLS estimations. Image, Benefit and Membership are outcome variables based on Eurobarometer survey questions and are coded to lie between 0 and 100. Change in employment rate is computed over five years. Kleibergen-Paap rk Wald F statistic reported. Standard errors (clustered by region) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A21: 2SLS estimations: effect of employment changes on attitudes toward the EU. Own country excluded in calculation of Bartik instrument.

	Image		Benefit		Membership	
	(1)	(2)	(3)	(4)	(5)	(6)
Δ Employment (%)	1.430**	3.520***	-3.292*	1.970***	1.402	1.559***
	(0.566)	(0.385)	(1.698)	(0.296)	(0.966)	(0.283)
Region FE		✓		✓		✓
N	2,615	2,615	2,922	2,922	2,922	2,922
Cluster	265	265	263	263	263	263
1st stage F-Test	27.52	57.31	10.03	71.29	10.03	71.29
Mean DV	43.51	43.51	60.89	60.89	53.81	53.81

2SLS estimations. Kleibergen-Paap rk Wald F statistic reported. Standard errors (clustered by region) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A22: 2SLS estimations with individual-level data: effect of employment changes on attitudes toward the EU

	Image		Benefit		Membership	
	(1)	(2)	(3)	(4)	(5)	(6)
Δ Employment (%)	1.252***	2.211***	-0.930	0.998***	2.089**	0.647***
	(0.475)	(0.254)	(1.169)	(0.173)	(0.973)	(0.182)
Ind. Controls		✓		✓		✓
Region FE		✓		✓		✓
N	509,039	412,906	506,912	445,337	538,327	470,730
Cluster	265	265	264	264	264	264
1st stage F-Test	26.37	103.70	9.79	67.33	7.63	69.72
Mean DV	44.98	45.43	61.15	60.99	54.84	54.88

2SLS estimations using individual-level data. Image, Benefit and Membership are outcome variables based on Eurobarometer survey questions and are coded to lie between 0 and 100. Change in employment rate is computed over five years. Individual controls include age, gender and education dummies. Kleibergen-Paap rk Wald F statistic reported. Standard errors (clustered by region) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A23: Effects of employment changes on turnout

	(1) Turnout OLS	(2) Turnout OLS	(3) Turnout OLS	(4) Turnout 2SLS (Bartik)	(5) Turnout 2SLS (Sectoral Shares)
Δ Employment (%)	-0.1346	0.1916**	0.2058***	-2.9302***	0.6091***
	(0.1495)	(0.0786)	(0.0707)	(1.1042)	(0.1164)
Year FE		✓	✓		✓
Region FE		✓	✓	✓	✓
Country FE x Year			✓		
N	704	704	704	691	704
F-Test				7.36	15.68
Cluster	225	225	225	225	225
Mean DV	46.85	46.85	46.85	46.54	46.85

OLS and 2SLS estimations. Turnout (in %) at European Parliament elections in 1994, 1999, 2004, 2009 and 2014. Change in employment rate is computed over five years. Kleibergen-Paap rk Wald F statistic reported. Standard errors (clustered by region) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

2

INDIRECT COLONIAL RULE UNDERMINES SUPPORT FOR DEMOCRACY: EVIDENCE FROM A NATURAL EXPERIMENT IN NAMIBIA

2.1 Introduction

"The authority of the chief thus fused in a single person all moments of power: judicial, legislative, executive, and administrative" (Mahmood Mamdani, Citizen and Subject: Contemporary Africa and the Legacy of Late Colonialism, p.23)

What factors shape individual and community attitudes toward democracy? There is substantial cross-national and within-country variance in individual support for democratic institutions. This component of the political or 'civic' culture of a society has long been shown to play a important role in affecting both the sustainability and success of democratic institutions (Almond and Verba, 1963; Putnam, 1994; Inglehart and Welzel, 2005). Yet, beyond a number of recent findings that show that support for democracy is endogenous to exposure to national democratic institutions (Persson and Tabellini, 2009; Fuchs-Schündeln and Schündeln, 2015; De Aquino, 2015) we have relatively little quantitative evidence for other factors behind variation in individual support for democratic institutions. In line with a body of literature that highlights the importance of forms of colonialism for contemporary political and economic outcomes (Acemoglu, Johnson, and Robinson, 2002; Lange, 2009; Iyer, 2010; Hariri, 2012), this study argues that indirect and direct colonial rule are important factors in shaping contemporary support for democracy.

The difficulty in demonstrating the effects of direct and indirect colonialism on contemporary democratic attitudes is, of course, that colonial strategies were not as-

signed randomly. For example, because indirect colonialism tended to be conducted in pre-colonial states that were more centralized (Gerring et al., 2011; Hariri, 2012), we usually cannot rule out that pre-state centralization also affects political culture through channels beyond the form of colonial rule (Michalopoulos and Papaioannou, 2013; 2015). To address this endogeneity issue, this paper introduces a novel empirical design that exploits a within-ethnic group natural experimental setting in the sub-Saharan country of Namibia. In Namibia, as in sub-Saharan Africa as a whole, colonial authorities instituted systems of direct rule in those areas settled by white Europeans whereas in those areas where indigenous population was not dispossessed colonial authorities ruled through a indirect system of local 'tribal' elites (Miescher, 2012). Unlike elsewhere in sub-Saharan Africa, however, Europeans did not settle and directly rule only the most agriculturally fertile areas of Namibia (Werner and Odendaal, 2010) but rather settled in the more arid southern areas of Namibia which were hardest hit by an 1897 rinderpest epidemic. In order to protect German herds from future epidemics, a veterinary cordon fence was introduced at the spatial extent of direct German control in 1897 that divided northern and southern Namibia. In the face of stringent financial constraints, the German colonists then never completely expanded their settlement territory to the northern areas of the country (Eckl, 2007) but rather ruled indirectly through a system of appointed traditional authorities.

Hence, whilst indirectly ruled areas of Namibia were governed through a system of appointed traditional authorities, traditional authorities were given no formal political role in the directly ruled central and southern areas of Namibia. After Namibian independence in 1990, these regional differences in the influence of traditional leaders still persist; traditional leaders play an extremely important formal role in land allocation and customary law enforcement in northern Namibia whilst playing a largely symbolic role in central and southern Namibia (Keulder, 2000).

Given that this colonial-era dividing line, progressively formalized throughout the 20th century, was drawn with little reference to existing indigenous territorial boundaries, Namibia provides an ideal setting to examine the effect of direct and indirect colonial rule on contemporary democratic attitudes. We can identify the effect of forms of colonial rule on individual support for democracy using the spatial discontinuity that exploits the exogenous border between formerly indirectly and directly ruled areas of Namibia with a spatial regression discontinuity design (RDD). Our results suggest that that individuals in indirectly ruled areas are less likely to support democracy as a system of governance, and less likely to participate in voting.

By analyzing individual-level survey data, we are able to provide evidence for the potential mechanisms through which indirect and direct colonial rule affect contemporary political attitudes. We find that people living in formerly indirectly ruled areas tend to contact traditional leaders more and respect authority to a greater extent.

This suggests that traditional leaders still play an important role in the local governance in indirectly ruled areas and we theorize that this is an important mechanism through which the form of colonial rule likely affects contemporary democratic attitudes. In this way, our findings advance a long-standing debate over whether there is a trade-off between the consolidation of 'traditional' and 'modern' institutions in sub-Saharan Africa (Mamdani, 1996; Englebert, 2000; Williams, 2004; 2010; Logan, 2008; 2009; Baldwin, 2015) by suggesting that the institutional legitimacy held by traditional leaders in indirectly ruled areas has socialized individuals to accept non-electoral systems of governance.

2.2 Theory

How might the form of colonial rule affect contemporary political attitudes? We follow Lange (2009) by defining indirect rule as "domination via collaborative relations between a dominant colonial center and several regionally based indigenous institutions" (p.28) and direct rule as a "system of colonial domination in which both local and central institutions are well integrated and governed by the same authority and organizational principles" (ibid.). In sub-Saharan Africa, the existence of collaborative relations between traditional leaders[1] and colonial bureaucrats is a key factor distinguishing directly and indirectly ruled colonies. Directly ruled colonies were administered by imperial bureaucrats who enforced written laws whereas indirectly ruled colonies were administered through local 'chiefs' who were given the authority to informally enforce customary or 'traditional' law (Lange, 2004; Acemoglu, Reed, and Robinson, 2014).[2]

There are striking cross-national correlations linking different forms of colonial rule with contemporary levels of democracy. Countries with stronger pre-colonial states tended to experience indirect colonial rule and states that experienced indirect rule in turn tend to be less democratic today (Lange, 2009; Hariri, 2012; Gerring et al., 2011). Hariri (2012) influentially argued that indirectly ruled countries are less democratic today because indirect colonial rule reinforced traditional bonds of political authority and did not facilitate the transplantation of participatory democratic institutions from Europe.

The institutional legacies of indirect colonial rule have largely persisted to the current day at a local level in sub-Saharan Africa, even as countries such as Namibia or Sierra

1. We do not mean to imply an endorsement of claims to traditional notions of legitimacy when using the term traditional leader. Rather, we follow Baldwin (2015) by defining traditional leaders with reference to contemporary customs i.e. as 'rulers' who have power by virtue of their association with the customary mode of governing a place-based community" (p.21).

2. See Michalopoulos and Papaioannou (2015) for a overview of the literature about the role of traditional leaders in Africa.

Leone have democratized at a national level. Barring a radical post-colonial upheaval in local governance of the kind that occurred in Tanzania (Miguel, 2004), traditional leaders still today enjoy unparalleled political, social and economic authority in local governance in indirectly ruled areas of sub-Saharan Africa (Düsing, 2002; Baldwin, 2014; Acemoglu, Reed, and Robinson, 2014). As highlighted by many African scholars and political leaders (e.g. Mboya 1956; Luthuli 1962; Ntsebeza 2005), the institution of traditional leadership is incongruous with procedural democratic notions of rule of law, the primacy of individual over group rights, and the electoral accountability of authority; indeed, Mahmood Mamdani goes so far as to call traditional leadership a system of 'decentralized despotism' (Mamdani, 1996).

The existence of an undemocratic[3] parallel governance system at the local level has important implications for the development of different kinds of political culture in directly and indirectly ruled areas of sub-Saharan Africa. The inclusiveness of colonial rule - broadly defined as the extent to which a broad range of political actors are involved in policy formulation and implementation - is a key mechanism linking the form of colonial rule to contemporary political and economic outcomes (Lange 2009). The differential inclusiveness of colonial governance systems across direct and indirectly ruled areas shapes both the 'supply' and 'demand' of post-colonial democracy. Emphasizing the institutional supply-side, Lange (2009) argues that less inclusive colonial institutions in indirectly ruled areas ultimately fostered the development of autocracy because low inclusiveness impeded the ability of the post-colonial state to manage competing social demands and incentivized the use of coercion as a means of regulating social relations.[4]

We build on this argument by demonstrating that the legacy of less inclusive colonial-era institutions may also be felt in a lower general 'demand' for procedural democracy. The appointment of political leaders through elections is not necessarily the most effective or legitimate means of allocating political office. Rather, in sub-Saharan Africa, traditional leaders are actually the most widely supported and trusted political actors in society and appear to have an independent, non-electoral base of political legitimacy (Logan, 2008).[5] Traditional leaders don't appear to rely on coercion to sustain their rule; rather, traditional leaders have proven deft at managing compet-

3. In using the term 'undemocratic' to describe traditional leadership we are only referring to its lack of procedural democracy and make no claim about the substantive democratic qualities of traditional leaders, which may exceed those of elected political leaders (Baldwin, 2015).

4. Lange (2009) provides persuasive evidence for this structural or 'supply-side' mechanism by comparing how different levels of institutional inclusiveness during the colonial transition in Guyana and Mauritius ultimately set these two states on different political trajectories as politics in post-independence Guyana retained a confrontational, zero-sum and autocratic character.

5. Logan (2008) explores a number of reasons for this legitimacy including the greater symbolic resonance, responsiveness, proximity to and overall effectiveness of traditional leaders at performing governance functions in their communities compared to elected officials.

ing constituencies as informal social ties have kept such leaders highly accountable and close to their communities (Baldwin, 2015). Given the legitimacy and support possessed by traditional leaders, often exceeding those of elected leaders, it may be that a key legacy of indirect rule has also been to socialize individuals to *demand* less formally inclusive systems of government relative to individuals living under democratic local institutions.

Indeed, in a more general sense, political attitudes are endogenous to exposure to forms of governance. Individuals who live under democracies are more likely to become socialized to accept democratic notions of electoral legitimacy whereas individuals who live under autocracies are more likely to become socialized to accept non-democratic bases for legitimacy - hence, support for electoral democracy has been shown to increase the longer that individuals live under a democratic government (Fuchs-Schündeln and Schündeln, 2015; De Aquino, 2015). Given the legitimacy possessed by traditional leaders, we expect that ongoing exposure to the institution of traditional leadership in indirectly ruled areas of sub-Saharan Africa has socialized individuals to accept non-democratic systems of government even as national political leaders are increasingly democratically elected. We also expect that, because the institution of traditional leadership is a hierarchical form of governance, individuals in indirectly ruled areas have been socialized to be less willing to question authority in general. Finally, given that voting is the essential participatory exercise in a democracy and civic norms of participation have been shown to be crucial in motivating individuals to sustain the cost of voting in Southern Africa (e.g. De Kadt 2017; Roberts, Struwig, and Gordon 2014), we expect weaker civic norms of electoral participation to be reflected in lower turnout in indirectly ruled areas.

In articulating and testing whether the institutional legacies of indirect colonial rule undermine democratic consolidation, we consciously enter into a long-standing and rich debate in the literature on sub-Saharan African politics. A number of authors have previously and compellingly argued that the ongoing political influence of traditional authorities in the post-colony presents a significant block to democratic consolidation (Mamdani, 1996; Englebert, 2000; Ntsebeza, 2005). Mamdani (1996) and Englebert (2000) were both particularly influential in arguing that African states and democratic leaders have been engaged in a struggle with local traditional leaders over power and political legitimacy in the post-colonial context.

On the other hand, a number of other authors have since argued that there is no necessary trade-off between traditional leadership and democratic consolidation because good governance is key to the legitimation of both elected and unelected officials in Africa alike (Bratton, Mattes, and Gyimah-Boadi, 2005). As local political actors may be kept accountable and good governance achieved through both electoral and non-electoral means (Baldwin, 2015), there may be no necessary trade-off between sup-

port for traditional leadership and elected leadership (Williams, 2004; 2010). Rather, insofar as good governance requires co-operation between traditional authorities and elected officials, it may be that legitimacy is a a rising tide that lifts all boats (Logan, 2013).[6] We help adjudicate between these competing perspectives by exploiting exogenous variation in the form of colonial rule - something that is essential to conduct causal inference given that the institutional influence of traditional leadership across different ethnic groups is far from assigned randomly.

Specifically, and following on from the above theoretical framework, we will test the following two key hypotheses:

H1: Individuals in indirectly ruled areas are less likely to support democracy as a system of government

H2: Individuals in indirectly ruled areas are less likely to turnout at elections

Our theoretical framework moreover predicts that this relationship is likely being driven by greater contact to traditional leaders and greater respect for authorities in indirectly ruled areas. Thus, whilst we primarily focus on support for democracy as our outcome of interest, we will also test the following secondary hypotheses:

H3: Individuals in indirectly ruled areas are more likely to contact traditional authorities

H4: Individuals in indirectly ruled areas are less likely to support questioning authority

2.3 Historical Background

Namibia, or South-West Africa as it was formerly known, was colonized progressively by Germany over the second half of the nineteenth century in the so-called 'Scramble for Africa'. Immediately prior to colonization, the dominant ethnic groups in Namibia were the Ovambo (Ambo), Herero, Nama, Bushmen (Kung), Heikum (San) and Damara (Bergdama) (see Figure B1 in the Appendix). The Ovambo and Herero are both Bantu-speaking groups who had migrated to Namibia during the great Bantu Migration over the 14th and 17th centuries, displacing and establishing predominance over the Khoisan-speaking San, Damara and Nama. All of these groups had qualitatively similar political structures as measured by traditional form of succession of the local headman (patrilineal heirs) and none had individual property rights. However, the means of subsistence differed. While the Ovambos depended on agricultural farming, Herero and Nama depended on animal husbandry and Bushmen and Damara

6. Such an argument has recently received support from Logan (2008), 2013 who has used cross-national individual survey data to illustrate that greater trust and support for traditional authorities does not negatively correlate with support for core democratic tenets.

on gathering and hunting.[7] Given that political authority among all groups in pre-colonial Namibia was hereditary and patriarchal, we therefore refer to pre-colonial society as undemocratic.[8]

When Namibia became a German protectorate in 1884, German settlement initially focused on the less densely populated southern and central coastal regions of Namibia which they reached first and where land could be more easily acquired (Zimmerer, 2001). German colonial authorities then gradually expanded their territorial remit from the coast by playing off warring local factions and remunerating a number of indigenous elites for lost landholdings (German Colonial Office, 1919; Ofcansky, 1981). The Germans had planned on conquering the wealthier northern part of the protectorate but in 1897, a critical event occurred that was to shape the spatial incidence of direct and indirect rule: a rinderpest epidemic killed 95 percent of the cattle herds in central and southern Namibia. The epidemic particularly devastated cattle-dependent indigenous communities in central and southern Namibia because, unlike agricultural communities in fertile northern Namibia, the arid nature of the land prevented agriculture from being used as a feasible food-source substitute (Eckl, 2007; Miescher, 2012; Gewald, 2003). The rinderpest epidemic thereby provided a key opportunity for German colonists to acquire large tracts of land in central and southern Namibia relatively cheaply with lessened collective resistance from weakened indigenous communities.

However, the epidemic also presented a dilemma to colonizers - there was little prospect of quickly extending direct German rule to the relatively unaffected northern areas of South-West Africa, yet continuing to allow free animal movement across South-West Africa would potentially expose European herds to future devastating epidemics (Phoofolo, 1993). Shortly after the epidemic in 1897, therefore, the German colonial government set up a veterinary cordon fence at the boundaries of where its control extended in order to protect southern and central cattle herds from future potentially rinderpest-infected animals from the north (Directorate of Veterinary Services, 1996).

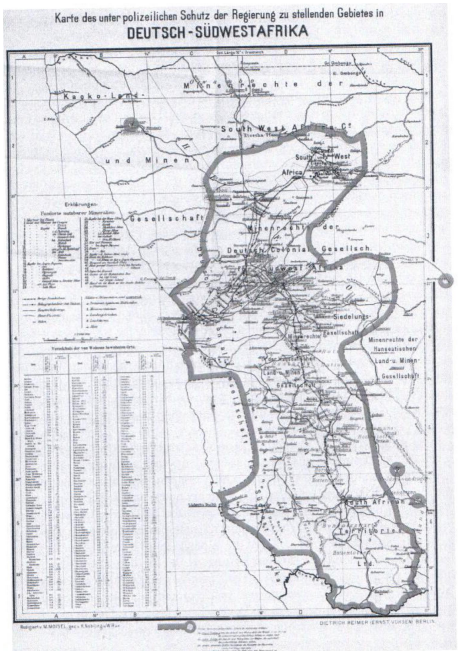
Irked by the rising cost of colonization in South-West Africa, in December 1905 the Reichstag in Berlin passed a resolution stating that police protection in the colony "should be restricted to the smallest possible area focusing on those regions where our economic interests tend to coalesce".[9] The veterinary cordon fence in effect then

7. Information on local headmen taken from v72, data on property rights from variables v74 and v75 and information on economic structures from variables v1-v5 in (Murdock, 1967). Given that we will only compare support for democracy amongst individuals from the same ethnic group, the ethnic-group specific pre-colonial differences reported in Murdock (1967) are not confounders for our empirical design.

8. Taking care to again note that we refer to democracy in a procedural rather than substantive sense.

9. Resolution des Deutschen Reichstags vom 15. December 1905.

Figure 2.1. The first map defining the Police Zone, issued in 1907



became a Police Zone boundary (see Figure 2.1 - the first map issued by colonial authorities defining the Police Zone) and formed the dividing line between 'white' and 'black' Namibia – the area directly settled and directly ruled by German authorities, and the area indirectly ruled through a system of indigenous elites.[10] Trade and the permanent movement of people between these two parts of South-West Africa was restricted by the German authorities and European settlers consolidated control over the Police Zone.

The timing of the rinderpest shock in 1897 thus created a number of counterfactuals that we rely on for our identification strategy. As Miescher (2012) summarizes, "the geographical location of the border reflected the limits of colonial power at the moment of its inception" (p.41). Cooperation on the part of the indigenous population was essential to maintain the integrity of the cordon and prevent cross-border cattle flows, and as such only those areas where the Germans exerted political control in 1897 were incorporated. No attempt was made to include the areas outside German

10. "The activities of the administration were concentrated in the southern and central regions of the protectorate, the so-called Police Zone". In the German original: "Die Taetigkeit der Verwaltung beschraenkte sich auf das Zentrum und den Sueden des Schutzgebietes, die sogenannte 'Polizeizone', waehrend der noerdliche Teil von der deutschen Verwaltung vorlaufig ausgenommen war." (Zimmerer, 2001, p. 114).

authority within the fenced territory; as Governor Friedrich von Lindequist optimistically put it, the areas in the far north would "temporarily need to remain outside the cordon" (v. Lindequist, letter to Reichskanzler 1897 quoted in Miescher 2012 p.25).

The timing of the epidemic thus meant that areas such as Grootfontein where the Germans had triumphantly marched to in 1895 were included within the cordon fence. However, settlements such as Sesfontein in Kaoko were not included within the cordon fence because the chief of Sesfontein, Jan Uixamab, refused to allow the cordon to divide his grazing lands (v. Lindequist to Reichskanzler February 20, 1897, Miescher 2012 p. 25). In late 1897 a coalition of Herero chiefs led by Uixamab then rose up in a last ditch effort to expel the Germans from Kaoko, but were defeated in March 1898 (Rizzo, 2009). By 1901 German troops were permanently stationed in Sesfontein (Deutsche Kolonialzeitung, 1901).

The timing of the epidemic in 1897 is thus of critical significance - given the 1907 Police Zone boundary eventually followed the cordon fence, settlements in northern Namibia such as Grootfontein, Outjo and Fransfontein where the Germans had consolidated control in the years leading up to the epidemic were incorporated into the German Police Zone whereas other nearby settlements where the Germans only established control after 1897 such as Sesfontein were not. If the rinderpest epidemic had occurred in 1895 or 1902 different boundaries defining the extent of the Police Zone would have been drawn. Hence, whilst the fact that the Germans initially colonized central and southern Namibia rather than northern Namibia may be endogenous to factors such as strength of pre-colonial state institutions that may affect contemporary political attitudes, the fact that the border defining the limits of direct German control was drawn around areas of northern Namibia such as Grootfontein rather than Sesfontein was, we argue, driven by the idiosyncratic timing of the rinderpest epidemic in 1897. Thus, we argue for the identifying condition that the geographic extent of direct colonial rule in a small area of northern Namibia can be considered exogenous to pre-colonial factors likely to affect contemporary political attitudes.[11]

After the South Africans took control of South-West Africa during World War I, the Police Zone boundary took on new forms and functions. Appendix Section B.2 provides more disaggregated detail on the small changes made to the Police Line between 1907 and 1964. Initially fearing that the remaining German soldiers could ally with indigenous forces in the northern areas beyond the Red Line, the South Africans issued a new Martial Law Regulation in October 1916 restricting all Europeans to the

11. Indeed, the fact that European settlement never expanded further north meant that the most potentially lucrative areas of Namibia never experienced direct rule - as the 1964 Odendaal commission put it, "Okavangoland and Eastern Caprivi are undoubtedly the areas with the highest agricultural potential in South West Africa" (Odendaal 1964 p.291) yet both areas experienced no European settlement.

area within the Police Zone as mapped by the Germans (Waters 1918; Administrator of South West Africa 1916). After World War I, movement between the two zones continued to be restricted due to the desire of authorities to prevent the spread of veterinary diseases (Moser, 2007).

The spatial division of South West Africa was further formalized by colonial authorities after the Odendaal Commission of 1964, which created a number of racially demarcated 'Homelands' in northern Namibia to be administered by officially recognized chiefs. Provided they complied with the colonial administration, appointed traditional leaders were afforded substantial political authority over subject populations (Keulder, 2000). The consequent construction of a visible physical border between the two parts of the country meant that the internal border became more tightly controlled than ever (Odendaal, 1964). While the north was ruled by traditional authorities and customary pastoral and agricultural practices continued, the indigenous population in the south was employed by the German and later South African colonizers through a system of contract labor on white-owned farms and factories (Moorsom, 1977).[12] Figure B3 in the Appendix Section B.3 documents the progressive extension of European farmland over the first half of the twentieth century and, as such, the progressive destruction of traditional modes of governance and subsistence in southern Namibia.

Over the period of South African administration, South West Africa was treated as an effective 'fifth province' of South Africa (Jansen, 1995). As such, after the introduction of apartheid in South Africa in the late 1940s, the rule of law and electoral suffrage only extended to the white population. White South West Africans participated in South African elections, lived in strictly segregated neighborhoods, and monopolized land and political office in directly ruled areas (Werner, 2007; Wolputte, 2007). Hence, whilst indigenous populations in southern Namibia certainly had greater contact with the colonial state including European farmers, police and district officials, it would not be accurate to say that indigenous persons had greater access to the colonial state in southern South West Africa. Under both German and South African administration, the colonial state remained closed to all but white South West Africans in directly ruled areas (Aitken, 2007; Melber, 2015).

The South West African People's Organization (SWAPO), a liberation party established in 1960 on a platform to end apartheid and secure Namibian independence, quickly emerged as the leading challenger to South African rule (Melber, 2015). Following an military stalemate between South African-led and Cuban-led forces in

12. In order to supply growing farm labor needs in southern Namibia, a great number of temporary laborers were also brought from north of the Red Line on a temporary permit system; such workers were required to return to their racial 'homeland' after one or two years working in the south (Melber, 1996).

the Angolan Civil War, the withdrawal of Cuban troops from Angola was linked to Namibian independence in peace talks in New York in 1988 (Herbstein and Evenson, 1989). The first fully free and fair UN-monitored elections in Namibia were then held in 1989 and Namibia transitioned to independence (Udogu, 2011).

Since independence in 1990, Namibia has remained a successful, multi-party democracy and it has been governed continuously at the national level by SWAPO. Namibia has been consistently rated as 'Free' by Freedom House, has maintained a Polity score above 6 in all of its post-independence periods and is generally regarded as one of sub-Saharan Africa's success stories (Radelet, 2010). Consistent with the development of democracy in other directly ruled colonies (Lange, 2009), therefore, democracy in Namibia was consolidated via early post-independence reforms that expanded racial suffrage and that institutionalized elections as the means of resolving social conflict at all levels of government.

Also reflecting the experience of other colonies, a within-country "reversal of fortune" (Acemoglu, Johnson, and Robinson, 2002) occurred in Namibia whereby extractive[13] colonial institutions were set up in the relatively densely populated areas of northern Namibia, which were the poorest in the country at the time of independence in 1990 (Namibian Statistics Agency, 2011). The Namibia government under SWAPO invested heavily in the northern regions after independence in order to support the convergence of living standards in the two parts of the country, and differences in poverty rates have gradually declined.

Electoral institutions across the country have been homogenized but the local institutional influence of traditional leaders in the north persists to the present day. Namibians living in the former Police Zone have only experienced a democratic governance system since independence at all levels of government. The existence of elected regional and local governments is enshrined in the Namibian Constitution.[14] In an explicit rejection of the ethnic spatial organization of Namibia during the colonial era, local and regional councils are mandated to cross former ethnic homelands.[15] Whilst Namibia is highly centralized fiscally, local elected councilors nevertheless exercise important oversight over the provision of local education, housing, and utilities.[16]

13. Colonial institutions in directly ruled Namibia cannot be considered 'inclusive' from the perspective of the indigenous population, but nevertheless inclusive institutions as defined by Acemoglu, Johnson, and Robinson (2002) such as an independent judiciary, universal schooling and individual property rights were instituted in directly ruled areas of Namibia that underpinned economic development.

14. Chapter 12 Article 102(1) states 'For purposes of regional and local government, Namibia shall be divided into regional and local units, which shall consist of such region and Local Authorities as may be determined and defined by Act of Parliament' and 102(3) states that 'Every organ of regional and local government shall have a Council as the principal governing body, freely elected'.

15. Article 102(2), Chapter 12 of Namibian Constitution.

16. M. Amutse, Regional Councillor Oshikuku Constituency, personal communication September

On the other hand, in formerly indirectly ruled areas, traditional authorities have proven successful in carving out a sphere of non-electoral political influence (Düsing, 2002). The legacy of strong, decentralized traditional leadership in northern Namibia posed a challenge to the capacity of the newly independent Namibian state which was largely unable to penetrate society in northern Namibia without the cooperation of traditional authorities.[17] The administration of communal land proved a locus of conflict given that the new constitution vested all communal land in the state[18] but communal land administration was formerly the sole prerogative of traditional authorities (Devereux, 1996). In a compromise move in 2002, SWAPO instituted a system of Land Boards to regulate communal land resources in northern Namibia staffed by both traditional leader and elected representatives.[19] Similarly, to formalize the role of traditional authorities, a system of traditional leader registration has been progressively rolled out since the 1990s whereby traditional leaders have been newly able to apply for recognition by the central government (Friedman, 2006).[20] SWAPO has tried to insulate the electoral system and, arguably, its own power from challenge by traditional leaders by restricting recognized traditional leaders from running for elected office.[21]

As such, governance in formerly indirectly ruled areas of Namibia since 1990 has been largely characterized by the increasing institutionalization of co-governance between elected officials and hereditary traditional leaders.[22] In directly ruled southern

2015. M. Mutonga, Director of National Planning Commission of Namibia, personal communication August 2015.

17. As one well-respected traditional leader put it to us when asked about the regional council, "if they want to put up road or a clinic, then they have to come to me first". (P. Kauluma, personal communication September 2015). The necessity of traditional leader cooperation was corroborated by the Deputy Director Rural Services in Ohangwena Region who, when asked about the possibility of ever implementing an entirely top-down project, said "Of course the headman would not let you do that". (N. Ndaitwa, personal communication, September 2015). See more generally Keulder (2000).

18. "Land, water and natural resources…shall belong to the State if they are not otherwise lawfully owned" Article 124, Constitution of Namibia.

19. The Communal Land Reform Act (2002), the implications of which were analyzed by Werner (2003).

20. Recognition provides a number of benefits to leaders including receipt of an official salary, eligibility for a position on the Council of Traditional Leaders which advises the government and the right to sit on constituency and regional development committees where development projects in Namibia are planned. (E. H. Weyulu, Senior Traditional Leader Oukwayenama, personal communication August 2015, G. Kamseb, Chief Regional Officer of Kunene Region Council, personal communication August 2015, K. Sinvula Deputy Director of Planning Kunene Regional Council, personal communication August 2015).

21. Düsing 2002, N. J. P. Muharukua, Kunene Regional Councillor for DTA, personal communication August 2015 and M. Tjimuine, Kunene Regional director for DTA, personal communication August 2015.

22. The effectiveness of traditional leaders as 'development brokers' (Baldwin, 2015) is appreciated even by government officials whom one might think would find their competing authority bothersome - as one regional official who works closely with traditional leaders in implementing development

Namibia, on the other hand, traditional leaders play only a minor role.

2.4 Data and Empirical Strategy

We identify the effect of indirect colonial rule on democratic attitudes and behavior by using the location of the Police Zone boundary in Namibia and applying a spatial regression discontinuity design analogous to Dell (2010). The northern border between directly and indirectly ruled territories delimited by the German Police Zone followed the spatial extent of direct German control at the end of the rinderpest epidemic of 1897 (Directorate of Veterinary Services 1996, Miescher 2012). We argue that the border zone where the progressive extension of direct German rule was frozen can be considered plausibly exogenous to pre-colonial political attitudes.[23] To further establish the exogeneity of the border, we will demonstrate that there is no discontinuous jump in pre-treatment geographic characteristics along the Police Zone boundary used in our analysis including elevation, grass-cover, rainfall and livestock density.

We use the original map published by the Odendaal Commission in 1964 as digitized by Mendelsohn (2002) to identify regions directly controlled by the colonizers and those that were governed by traditional authorities during colonial times. To minimize potential endogeneity, we only focus on the northern part of the former Police Zone boundary focused around Etosha National Park as this part still largely represented the original boundary drawn in 1907 by the Germans when the Odendaal Commission of 1964 formalized the border. Other parts of the border experienced significant changes over time. The Appendix Section B.2 provides more historical detail on these changes made to the Police Line between 1907 and 1964 to represent the lack of major changes to the northern border.

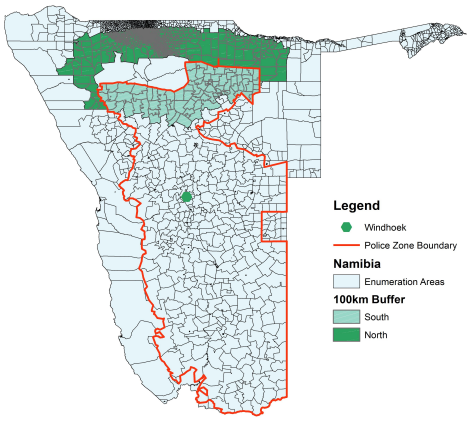
We then created a 100km buffer zone around the plausibly exogenous boundary between these two zones (see Figure 2.2) and only focus on observations within this buffer to ensure comparability.[24] We chose a 100km buffer because individuals living in this zone live in similar geographic, political and cultural environments. There is a tradeoff between comparing individuals living in very similar environments (as close to each other as possible) and still having enough observations for our analysis. Based on power calculations we then decided to use a 100km buffer, which provides us with enough observations to identify our effects of interests. While the 100km is our preferred buffer size we also include estimations using observations from the

projects put it, "in general they are commendable. They are doing a good job". N. Ndaitwa, personal communication, September 2015.

23. In summary, "the Police Zone border was determined in Berlin, its location resulted from geographical considerations, previous colonial experiences in boundary-drawing, and arbitrary decisions disconnected from actual on-site conditions" (Miescher, 2012, p.47).

24. We excluded those EAs inside Etosha National Park from the buffer area.

Figure 2.2. Enumeration Areas and buffer zone



entire country and observations from a 50km buffer zone as robustness checks.

The outcome variables of interest used in this paper stem from the Afrobarometer survey. Between 1999 and 2008, four survey rounds (1999, 2003, 2005, 2008) were conducted, which covered questions about attitudes toward politics, the economy and civil society. Afrobarometer uses random sampling methods, which are conducted with probability proportionate to population size (i.e. more densely populated areas have a higher probability of being sampled). Thus, "the sample design is a clustered, stratified, multi-stage, area probability sample" (Afrobarometer.org).

The relevant question about "demand for democracy" (Bratton, 2004; De Aquino, 2015), our main outcome variable, asks about support for democracy.[25] The main behavioral outcome that we focus on is voter turnout. We measure individual turnout using a question asking whether the individual voted in the most recent national election.[26] Finally, to test our hypothesis that different attitudes toward authority and

25. "Which of these three statements is closest to your own opinion?
Statement 1: Democracy is preferable to any other kind of government.
Statement 2: In some circumstances, a non-democratic government can be preferable.
Statement 3: For someone like me, it does not matter what kind of government we have."

26. We rely on self-reported data because official turnout data is not available at the EA level. This level of disaggregation is necessary in order to clearly identify whether people live in the directly or indirectly ruled areas.

contact with traditional leaders are important mechanisms for the development of different attitudes toward democracy, we analyze responses to (i) a question about the frequency of contact with traditional leaders and (ii) a question which asked whether authorities should be respected or whether one should be allowed to question authority in general (see exact wording of the questions in Appendix Section B.4).

The geographical location of the surveyed individuals is identified by enumeration area.[27] The Namibian Statistics Agency divided Namibia into 4080 enumeration areas for the 2001 census (see Figure 2.2), each comprises between 80 and 100 households. Therefore, there are more enumeration areas in more densely populated regions. The number of enumeration areas within the 100km buffer zone is 1247. Out of these 1247 enumeration areas, the Afrobarometer survey covered between 42 and 47 in in each round. This constitutes a random sample of all enumeration areas in the buffer zone. There are more enumeration areas in the northern part of the buffer as this part is more densely populated than the southern part. We observe eight individuals per enumeration area in each survey round. This gives us a maximum number of 1426 observations for the 100km buffer. This number of observations however differs between specifications as not each question is asked in every survey round and we eliminated observations where the responded answered "don't know".

Pre-colonial political structures and attitudes were ethnic-group specific. The Police Zone border cuts through the pre-colonial territories of five different ethnic groups (Ovambo, Kavango, Nama/Damara, Herero and Caprivi, see Figure B1 in the Appendix). The Murdock (1967) data suggests that pre-colonial modes of subsistence differed between these communities, which may in turn have affected the political structures and thereby political attitudes. We therefore include ethnic fixed effects in all specifications so as only to compare individuals from the same ethnic group and thereby ensure that pre-treatment attitudes did not differ between the direct and indirectly ruled areas. We use self-reported ethno-linguistic data from Afrobarometer and all ethnic groups are represented in both parts of the buffer.

Survey round fixed effects are included in order to account for the different timing of the Afrobarometer survey rounds. The border also cuts through seven (out of fourteen) administrative regions[28] so that we can compare individuals who face the same regional institutions with each other by including region fixed effects. This is important in order to account for differential institutional performance, which is an important predictor of support for democracy (Bratton, Mattes, and Gyimah-Boadi, 2005). Whilst Namibia is highly centralized politically, elected regional councillors

27. Details for how to apply for the restricted geographic data used in this project are available at http://www.afrobarometer.org/data/data-use-policy.

28. The border cuts through Kavango, Kunene, Ohangwena, Omusati, Oshana, Oshikoto, Otjozondjupa.

nevertheless play an important role in lobbying for and allocating central funds.

There are no significant differences in terms of income, education, gender and age between individuals in the northern and southern part of the buffer zone (see discussion in Section 2.6.1).[29] We nevertheless add individual-level controls to some specifications as they are also important determinants of political attitudes (Bratton, Mattes, and Gyimah-Boadi, 2005) and help us to identify the effects more precisely. We measure individual income through a lived poverty index based on Mattes, Bratton, and Davids (2003) by taking the principal component of responses to questions about access to food, water, healthcare, fuel and cash income. We also constructed measures of education (highest level attained), age (in years) and gender (binary) using responses from Afrobarometer (see exact wording of the questions in the Appendix Section B.4). For summary statistics see Table B1 in the Appendix.

In our preferred specification we include distance to Windhoek as a control variable because it is likely to capture variation in observables and unobservables that affect political attitudes such as trade or information penetration. It thus ensures that we are not only picking up a linear trend in terms of proximity to the capital.

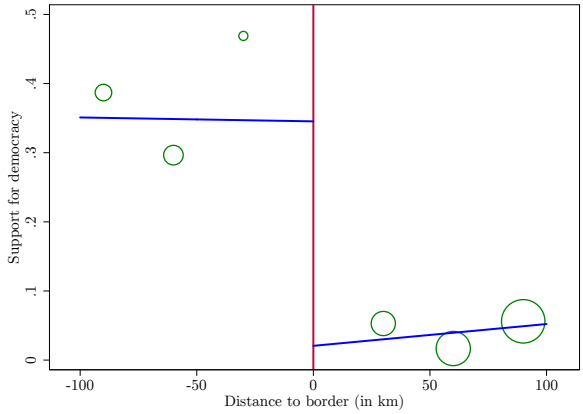
For robustness and to help rule out alternative mechanisms we also include specifications with the following controls: subjective evaluation of the performance of local government councilors, livestock suitability and a urban/rural dummy. Bratton, Mattes, and Gyimah-Boadi (2005) found that the most important predictor of support for democracy in sub-Saharan Africa is the performance of the government. We therefore control for the performance of local governance councils measured with the respective Afrobarometer question (see Appendix Section B.4) to ensure that our estimated effects are not driven by differences in institutional quality at the local level. We include livestock suitability[30] as further proxy for economic well-being in each of the predominantly rural communities, which rely on cattle rearing as an important source of income (Mendelsohn, 2002). Moreover, it helps to eliminate concerns about pre-colonial differences in pastoral and agricultural suitability, which may in turn have affected the political processes of different communities within the same ethnic group.

We are aware that some of these control variables may be "bad controls" and thereby lead to post-treatment control bias (Angrist and Pischke, 2008). The perceived performance of local government officials, urbanization as well as income are potential

29. As these variables are post-treatment characteristics and may be affected by the treatment itself we consider them as potential mechanisms rather than as suitable balancing variables.

30. Livestock suitability is measured as "maximum biomass of livestock that can be supported on a long-term, sustainable basis by the available grazing" in kg/hectare (Mendelsohn, 2002 p. 150). We assume that these geographic conditions are constant over time and therefore use a ten-year average (1995-2005) of the variable.

Figure 2.3. Regression discontinuity plot



A local linear regression discontinuity plot representing how support for democracy differs according to distance from the Red Line border, obtained from a multivariate regression model with a vector of binary indicator variables identifying respondent ethnicity, survey round and region. Circle size corresponds to the number of respondents in each bin.

outcomes of our treatment. We therefore also present specifications without these controls.

Our baseline specification includes ethnicity and survey round fixed effects because these are both crucial requirements for our identification strategy. These specifications are spatial regression discontinuity designs, as discussed in Dell (2010), with distance to Windhoek as running variable because distance to the capital is the politically and economically most relevant geographic dimension in our context. In addition, we present specifications which control flexibly for geographic location.[31]

The baseline RDD estimation equation is thus:

$$Y_{idres} = \beta_0 + \beta_1 Indirectrule_d + \mathbf{X}'_{ides}\boldsymbol{\gamma} + \eta_e + \mu_s + \psi_r + \epsilon_{idres}$$

Y expresses demand for democracy of individual i, living in enumeration area d in region r, belonging to the ethnic group e, being surveyed in round s. *Indirectrule* is a dummy variable indicating whether the individual lives in an enumeration area which belonged to the indirectly or the directly ruled part of Namibia. **X** is a set of

31. Second order polynomials of distance distance to Windhoek and to the Police Zone boundary as well as local linear polynomial in longitude and latitude.

Table 2.1: Indirect rule and geographic characteristics

	(1) Savanna	(2) Grasscover	(3) Average Rainfall	(4) Elevation	(5) Carrying Capacity	(6) Livestock Density
Indirect colonial rule	0.131	12.27	0.523	4.853	-0.377	15.00
	(0.121)	(11.45)	(1.694)	(20.36)	(0.307)	(11.03)
Distance Windhoek	-0.0343	-5.417	0.115	3.145	0.0106	26.01***
	(0.0330)	(7.095)	(0.847)	(11.14)	(0.179)	(8.301)
Observations	1,418	1,410	1,418	1,418	1,418	1,418
R^2	0.105	0.302	0.786	0.369	0.803	0.539
Region FE	✓	✓	✓	✓	✓	✓
Mean of DV	0.99	54.97	41.17	10.58	4.21	75.21

Results from OLS regressions including regional fixed effects and an urban/rural dummy. The sample consists of observations from the 100km buffer zone. Standard errors (clustered by Enumeration Area) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

control variables, which includes individual-level characteristics such as age, gender and dummies for income and education.[32] It also include distance to Windhoek as running variable. η_e are ethnicity fixed effects, μ_s are survey-round fixed effects and ψ_r are region fixed effects.

We identify the effect of indirect colonial rule on democratic attitudes by OLS estimation and also show specifications using (ordered) probit estimations because our outcome variables are discrete.

As discussed above, the identifying assumption for this RD identification strategy is that all other unobservable factors are continuously related to distance to the northern Red Line border. This assumption implies a testable implication that observable pre-treatment covariates will have a continuous distribution across the northern Red Line. Ideally, we could show that pre-1897 political and economic characteristics do not change discontinously at the Police Zone boundary. However no such data exists. We can demonstrate that the border cuts through pre-colonial political territories (see Figure B1). Moreover, as geographic variables are commonly seen as important determinants of pre-colonial development, we collected data on a number of geographic variables to substantiate the continuity of 'pre-treatment' variables across the northern Red Line. We compiled EA-level data on elevation, grass cover, savannah cover, carrying capacity and livestock density from Mendelsohn (2002).

Table 2.1 demonstrates that these geographic covariates do not differ discontinuously at the northern Red Line border.[33] This test of continuity of observed covariates is evidence in favor of the identifying assumption of continuity of unobservables and therefore that the regression discontinuity design is a valid one (Lee and Lemieux, 2010).

2.5 Results

Living in the formerly indirectly ruled part of Namibia decreases the probability that people think that a democratic government is preferable to any other type of government. Figure 2.3 demonstrates the discontinuous drop in support for democracy at the Police Zone border.[34] The plot confirms that attitudes toward democracy discretely change at the internal border dividing formerly directly and indirectly ruled areas of Namibia.

32. $\mathbf{X}_{idres} = \sum_{n=0}^{4} income^{i}_{idres} + \sum_{m=0}^{8} education^{i}_{idres} + age_{idres} + gender_{idres}$

33. We use contemporary data assuming that geographic conditions are roughly constant over time.

34. Negative values correspond to EAs located inside the Police Zone (south) and positive values correspond to EAs outside the Police Zone (north). The smallest bin only contains 24 observations and we are therefore not able to credibly graphically represent the effects for smaller bin sizes. The size of the circles corresponds to the number of observations per bin.

Table 2.2: Effect of indirect rule on support for democracy and voting

	(1) Support democracy OLS	(2) Support democracy OLS	(3) Support democracy O Probit	(4) Voting OLS	(5) Voting OLS	(6) Voting Probit
Indirect colonial rule	-0.262***	-0.203*	-0.309*	-0.211***	-0.162*	-0.549*
	(0.0950)	(0.119)	(0.179)	(0.0483)	(0.0880)	(0.310)
Distance Windhoek		-0.0346	-0.0399		-0.0373	-0.0904
		(0.0752)	(0.113)		(0.0565)	(0.212)
Observations	1,347	1,322	1,322	734	718	716
R^2	0.029	0.051		0.059	0.291	
Ethnicity FE	✓	✓	✓	✓	✓	✓
Survey round FE	✓	✓	✓	✓	✓	✓
Region FE	✓	✓	✓	✓	✓	✓
Individual-level controls		✓	✓		✓	✓
# clusters	165	165	165	91	91	91
Mean of DV	2.399	2.399	2.399	0.722	0.721	0.721

Results from OLS and (ordered) probit regressions. Individual-level control variables are age, gender, education dummies and poverty index dummies. The sample consists of observations from the 100km buffer zone. Standard errors (clustered by Enumeration Area) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Columns (1) and (4) in Table 2.2 present raw comparisons of political attitudes and behavior between indirectly and directly ruled areas. These specifications include only ethnicity, region and survey round fixed effects, which are minimally required to draw causal inference in our context. Columns (2) and (5) present our preferred RDD specification including also individual level controls[35] and distance to Windhoek as running variable. Columns (3) and (6) show that the effects are also statistically significant when applying a (ordered) probit model because the dependent variables are discrete.

The magnitude of the effect on democratic attitudes is in the range of a fourth of a standard deviation of the dependent variable (i.e. living in the formerly indirectly ruled areas decreases support for democracy by 0.2 on a scale from 1 to 3). The coefficient decreases slightly when adding distance to Windhoek and individual level controls.

Moreover, people in the indirectly ruled part of the buffer report that they vote significantly less (15-20 percentage points) than people living in the directly ruled part. This corresponds to around a third of the standard deviation of the dependent variable. This indicates that weaker democratic attitudes are associated with less reported voting - the essential political act in a democracy - and thus that indirect colonial rule indeed presents a block to democratic consolidation both in an attitudinal and behavioral sense. These results provide confirmatory evidence for **H1** and **H2**: people living in formerly indirectly ruled areas indeed support democracy less as a system of government and turnout less at elections.

Table 2.3 presents evidence on potential mechanisms linking indirect colonial rule and contemporary political attitudes as outlined in the theory section. We theorized that contact to traditional authorities is an important mechanism for persistence in the effects of indirect colonial rule on contemporary democratic consolidation in sub-Saharan Africa. Our results (Table 2.3, columns (1)-(3)) confirm **H3** as contact to traditional leaders increases by around 0.4 points (on a scale of 0-3) if an individual lives in an indirectly ruled area of Namibia rather than in a directly ruled area. We also theorized that living under a hierarchical local governance system in indirectly ruled areas has socialized individuals into having greater respect for authority. The results in columns (4), (5) and (6) provide suggestive evidence in favor of **H4** as the evidence indicates that people in the north do tend to respect authorities more.[36] We discuss further empirical evidence against other potential causal mechanisms in

35. The coefficients on the individual-level control variables are reported in the Appendix in Table B3. Figure B4 in Appendix Section B.7.2 represents the regression discontinuity plot when adding individual-level controls.

36. This effect goes beyond the effect on contact with traditional leaders as we hold contact with traditional leaders constant across specifications (4), (5) and (6).

Table 2.3: Effect of indirect rule on contact with traditional leaders and respect for authority

	(1) Contact TL OLS	(2) Contact TL OLS	(3) Contact TL O Probit	(4) Respect authority OLS	(5) Respect authority OLS	(6) Respect authority O Probit
Indirect colonial rule	0.388**	0.417*	0.734*	0.269**	0.268*	0.322*
	(0.170)	(0.244)	(0.405)	(0.115)	(0.161)	(0.186)
Distance Windhoek		-0.0240	-0.0360		-0.00524	-0.0169
		(0.141)	(0.212)		(0.0967)	(0.109)
Observations	1,413	1,387	1,387	1,361	1,335	1,335
R^2	0.150	0.185		0.133	0.148	
Ethnicity FE	✓	✓	✓	✓	✓	✓
Survey round FE	✓	✓	✓	✓	✓	✓
Region FE	✓	✓	✓	✓	✓	✓
Individual-level controls		✓	✓		✓	✓
# clusters	165	165	165	165	165	165
Mean of DV	0.696	0.702	0.702	2.431	2.432	2.432

Results from OLS and (ordered) probit regressions. Individual-level control variables are age, gender, education dummies and poverty index dummies. Columns (4)-(6) additionally include contact with traditional leaders as control variable. The sample consists of observations from the 100km buffer zone. Standard errors (clustered by Enumeration Area) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Section 2.6.

2.5.1 Alternative RD polynomials

This section shows that the effect of indirect colonial rule on contemporary political attitudes holds when controlling for the geographic location of the individuals in a flexible manner. We first control for a local linear polynomial in longitude and latitude as suggested by Gelman and Imbens (2014), which allows us to take the multidimensionality of the discontinuity into account (Dell, 2010). We also present specifications with a one-dimensional running variable (distance to Windhoek as in the baseline and distance to the Police Zone boundary).[37] In order to control for these one-dimensional measures more flexibly we include second order polynomials.

Table 2.4 shows that the negative effect of indirect colonial rule on support for democracy and turnout is largely robust across different spatial regression discontinuity specifications. The positive effect of indirect colonial rule on contact to traditional leaders and respect for authorities is similarly robust across different spatial regression discontinuity specifications (see Table B4). Hence, the evidence is largely supportive of hypotheses **H1**, **H2**, **H3** and **H4**.

2.5.2 Robustness checks

To test the robustness of our results to the inclusion of more controls, we also included performance of the government, livestock suitability and an urban/rural dummy as control variables because these factors may bias the estimated coefficients (see Tables 2.5 and 2.6). The size of the effect of indirect colonial rule on support for democracy is -0.29 when adding all controls at the same time (column (5)). That corresponds to around a third of a standard deviation of the dependent variable. It is however larger than the baseline effect (column (1)), which may be caused by bad controls, which are outcomes of the treatment themselves. Nevertheless, the results confirm that there is still a significant negative effect of indirect rule on support for democracy even when taking potential confounders into account. The effect of indirect rule on voting also remains statistically significant negative throughout all but one specifications (Table 2.6). The effect size is also substantially larger when compared to the baseline and should similarly be interpreted with caution.

The results for support for democracy also hold when not only focusing on observations in the 100km buffer zone but using a sample from the entire country and also when using a 50km buffer zone (see Appendix Tables B5 and B6). The results for voting are not robust to changing the buffer size. The sample size reduces to 390 when restricting the sample to the 50km buffer and therefore there is likely not enough vari-

37. In these specifications we also add regional fixed effects to better account for the exact geographic location of the individuals.

Table 2.4: Different specifications of RD polynomial

	(1) Support democracy	(2) Support democracy	(3) Support democracy	(4) Voting	(5) Voting	(6) Voting
Indirect colonial rule	-0.208*	-0.246*	-0.259***	-0.192**	-0.127	-0.216***
	(0.111)	(0.127)	(0.0956)	(0.0952)	(0.0815)	(0.0496)
Observations	1,347	1,347	1,347	734	734	734
R^2	0.022	0.029	0.029	0.052	0.063	0.060
Lat/Lon	✓			✓		
Dist. Windhoek quadr		✓			✓	
Dist. Boundary quadr			✓			✓
Ethnicity FE	✓	✓	✓	✓	✓	✓
Survey round FE	✓	✓	✓	✓	✓	✓
Region FE		✓	✓		✓	✓
# clusters	165	165	165	91	91	91
Mean of DV	2.399	2.399	2.399	0.722	0.722	0.722

Results from OLS regressions. Columns (1), and (4) include a local linear polynomials in longitude and latitude. Columns (2), and (5) include a quadratic polynomial in distance to Windhoek. Columns (3), and (6) include a quadratic polynomial in distance to the boundary. The sample consists of observations from the 100km buffer zone. Standard errors (clustered by Enumeration Area) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 2.5: Effect of indirect rule on support for democracy

	(1) Support democracy	(2) Support democracy	(3) Support democracy	(4) Support democracy	(5) Support democracy
Indirect colonial rule	-0.203*	-0.310**	-0.234**	-0.215*	-0.294**
	(0.119)	(0.121)	(0.118)	(0.121)	(0.128)
Distance Windhoek	-0.0346	-0.00746	-0.0302	-0.0326	-0.00593
	(0.0752)	(0.0787)	(0.0767)	(0.0767)	(0.0788)
Performance government		0.00192			-0.00661
		(0.0289)			(0.0284)
Carrying Capacity			-0.0103		-0.0357
			(0.0357)		(0.0422)
Urban				-0.0205	-0.0491
				(0.0713)	(0.0874)
Observations	1,322	1,291	1,347	1,347	1,266
R^2	0.051	0.028	0.029	0.029	0.052
Ethnicity FE	✓	✓	✓	✓	✓
Survey round FE	✓	✓	✓	✓	✓
Region FE	✓	✓	✓	✓	✓
Individual-level controls	✓				✓
# clusters	165	165	165	165	165
Mean of DV	2.399	2.398	2.399	2.399	2.397

Results from OLS regressions. Individual-level control variables are age, gender, education dummies and poverty index dummies. The sample consists of observations from the 100km buffer zone. Standard errors (clustered by Enumeration Area) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 2.6: Effect of indirect colonial rule on voting

	(1) Voting	(2) Voting	(3) Voting	(4) Voting	(5) Voting
Indirect colonial rule	-0.162*	-0.201**	-0.148	-0.169*	-0.217**
	(0.0880)	(0.0808)	(0.0903)	(0.0916)	(0.100)
Distance to Windhoek (decimal degrees)	-0.0373	-0.00726	-0.0384	-0.0333	-0.00465
	(0.0565)	(0.0519)	(0.0575)	(0.0572)	(0.0566)
Performance government		0.0324			0.0207
		(0.0251)			(0.0231)
Carrying Capacity			0.0105		0.00227
			(0.0231)		(0.0325)
Urban				0.00622	0.0304
				(0.0455)	(0.0604)
Observations	718	698	734	734	682
R^2	0.291	0.059	0.060	0.060	0.291
Ethnicity FE	✓	✓	✓	✓	✓
Survey round FE	✓	✓	✓	✓	✓
Region FE	✓	✓	✓	✓	✓
Individual-level controls	✓				✓
# clusters	91	91	91	91	91
Mean of DV	0.721	0.723	0.722	0.722	0.723

Results from OLS regressions. Individual-level control variables are age, gender, education dummies and poverty index dummies. The sample consists of observations from the 100km buffer zone. Standard errors (clustered by Enumeration Area) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

ation left to estimate the effect on voting precisely given that we include a number of fixed effects and control variables.

In addition we created placebo buffers by shifting the location of the former Police Zone boundary one degree latitude north and south respectively. When running these regressions we do not find any significant effects on support for democracy or voting (Tables B7 and B8), which confirms that our results are unique to this historical meaningful Police Zone boundary. As an additional robustness check we clustered the standard errors on a constituency level, which reduces the number of clusters from 165 to 44 (see Appendix Table B9). The main results still hold.

2.6 Discussion of other Potential Mechanisms

It is difficult to move from cleanly identifying the effect of compound 'treatments' such as indirect colonial rule to pinpointing the precise causal mechanisms at work. Many institutional, social and economic factors differed between indirectly and directly ruled areas of Namibia during the colonial-era. In order to substantiate the institution of traditional leadership as a likely causal mechanism connecting colonial-era governance structures and post-colonial political attitudes, we have shown that greater contact to traditional leaders and greater respect for authority is still persistent in indirectly ruled areas of Namibia.

In this section, we demonstrate that other potentially important causal mechanisms - including economic development, education, political socialization, sorting, contemporary institutional quality - do not differ across formerly indirect and directly ruled areas of northern Namibia. Thus, this section demonstrates that there is an absence of evidence in favor of other potentially important causal mechanisms connecting the form of colonial rule and contemporary democratic attitudes in northern Namibia.

2.6.1 Individual Characteristics

Income, education, age and gender are important individual characteristics that determine political attitudes. None of these factors differs significantly between indirectly and directly ruled areas (see Table 2.7), suggesting that there is an absence of evidence that demography is an important causal mechanism linking the form of colonial rule and contemporary political attitudes.[38]

38. The difference in support for democracy has remained persistent despite efforts on the part of the Namibian government to raise the incomes of Namibians north of the Red Line after independence. Moreover, education levels do not differ significantly likely because missionaries founded schools long before the first colonizers reached Namibia. Even during colonial times, missionaries were as active at providing education for indigenous Namibians in the south as in the north.

Table 2.7: Balancing table for the buffer zone: individual characteristics

	(1) Poverty index	(2) Education	(3) Gender	(4) Age
Indirect colonial rule	-0.226	-0.139	0.0392	3.441
	(0.310)	(0.394)	(0.0444)	(2.690)
Distance Windhoek	0.0110	-0.0457	-0.00166	-0.479
	(0.168)	(0.215)	(0.0217)	(1.632)
Observations	1,404	1,406	1,418	1,418
Ethnicity FE	✓	✓	✓	✓
Survey round FE	✓	✓	✓	✓
Region FE	✓	✓	✓	✓
Mean of DV	2.55	3.81	0.50	35.80

Results from OLS regressions controlling for distance to Windhoek and an urban/rural dummy. The sample consists of observations from the 100km buffer zone. Standard errors (clustered by Enumeration Area) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

2.6.2 Economic Conditions

Table 2.8 provides further evidence that economic conditions do not differ significantly today across direct and indirectly ruled areas of our buffer zone. Whether measuring economic development through night time lights, infrastructure development or homelessness, levels of economic development do also not differ significantly between indirectly and directly ruled areas of our buffer zone.[39] There is thus an absence of evidence that contemporary differences in terms of political attitudes are driven by different levels of economic development. In any case, as we have demonstrated in our main results, controlling flexibly for respondent poverty, education, age and gender does not alter the robust relationship between the form of colonial rule and contemporary political attitudes and in fact tends to strengthen the magnitude of the estimated effects.

39. Satellite data on night lights come from The National Oceanic and Atmospheric Administration (NOAA) and are averaged over the period 2001-2008. We use composites, which are "made using all the available archived DMSP-OLS smooth resolution data for calendar years". The infrastructure index is calculated by taking the first principal component of a series of Afrobarometer questions about the existence of a paved road, a sewage system, electricity grid and water systems in the enumeration area and data on EA-level homelessness stem from the 2001 census published by the Namibia Statistics Agency.

Table 2.8: Balancing table for the buffer zone: EA characteristics

	(1) Night lights	(2) Bad infrastructure	(3) Homeless
Indirect colonial rule	-2.034	0.217	-28.83
	(2.045)	(0.176)	(25.49)
Distance to Windhoek	3.468**	-0.0725	8.652
	(1.528)	(0.102)	(7.179)
Observations	1,418	1,418	1,418
Region FE	✓	✓	✓
Mean of DV	6.98	0.36	4.15

Results from OLS regressions controlling for distance to Windhoek and an urban/rural dummy. The sample consists of observations from the 100km buffer zone. Standard errors (clustered by Enumeration Area) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

2.6.3 Political Socialization

Political socialization over one's lifetime is of course an important determinant of future political attitudes and different colonial experiences in the north and south may have led to different attitudes toward democracy. Importantly, however, the indigenous population of Namibia across the direct and indirectly ruled araas of Namibia had the same (absence of) experience with electoral democracy during the colonial era. In South West Africa, the 'rule of law' and electoral democracy only applied to the white population. Different lengths of participation in democracy thus does not represent a confounder between the north and the south.

It could be on the other hand that the introduction of democracy was seen as a greater 'liberation' in the south relative to the north. For example, it may have been that differences in levels of repression during the liberation struggle of the 70s and 80s may have led to a greater demand for democracy in the south. To test this argument, we see whether the effect of indirect colonial rule differs for individuals who experienced liberation and those who did not. Table B10 in the Appendix demonstrates that there is no interaction effect between age and living in the formerly indirectly ruled areas. That means that the effect of living in the north on democratic attitudes does not differ between young and old people. These results also hold when using a binary age measure[40] (see Table B10 in Appendix). Given the *persistent* effects of indirect rule on contemporary political attitudes of both young and old Namibians, there is an absence of evidence that our effects are being driven by historical factors such as

40. Dividing the sample into those younger than the 25^{th} age percentile (24 years) and those older than that. The younger people experienced the most part of their political socialization after 1990.

memories of the liberation struggle.

2.6.4 Sorting

During German and South African rule, permanent migration between the two parts of the country was prohibited and thus colonial-era sorting is not a confounder. We cannot entirely rule out the effect of selective sorting after independence in 1990, however we believe this is unlikely to act as an important confounder. In northern areas of Namibia, land is communally held and community ties are consequently extremely close. Moreover, migration statistics from the Namibian Statistics Agency suggest that permanent migration from the north, where it has occurred, has been economic in nature as the young have moved to the larger cities of the south such as Windhoek or Walvis Bay far south of our study area to look for jobs. To control for the factors that might affect individual propensity to migrate, we control for age and education in our specifications - neither of which changes the results. Hence, though it cannot be completely ruled out, it is unlikely that selective sorting explains our results (Moorsom, 1977; Melber, 1996).

2.6.5 Contemporary Institutions

Other than the greater importance of traditional leaders in northern Namibia, contemporary institutions do not differ between the northern and southern areas in our sample. In order to ensure that our effects are not different by differing performance of local government officials as theorized by Williams (2010) and Logan (2013), we have previously included controls for the individuals' evaluation of the performance of local government councils. Moreover, Namibia is extremely centralized politically because, after independence, the Namibian government made a great effort to homogenize governance between the two parts of the country (Werner and Odendaal, 2010; Melber, 2015; Düsing, 2002; Keulder, 2000). Finally, we can use Afrobarometer data to show that people living north and south of the border do not systematically evaluate the effectiveness of government institutions differently in a way that would bias towards our results (see Table 2.9).

Individuals on both sides of the former Red Line border think that governmental officials are similarly receptive. The coefficient on fear of unjust arrest, which is an indicator for despotism of officials, also does not differ significantly. Trust in courts does not differ between the two parts. Trust in police is even significantly higher in the north, which would bias against finding an negative effect of indirect colonial rule on support for democracy. Finally, support for the ruling party SWAPO is also higher in previously indirectly ruled areas than in directly ruled areas. That suggests that lower support for democracy in the north is not driven by frustration at the outcome

Table 2.9: Balancing table

	(1) Direct rule	(2) Indirect rule	(3) Difference
Government officials listen	1.22	1.26	-0.048
	(1.06)	(1.08)	(0.11)
Trust in police	1.78	1.91	-0.13*
	(0.85)	(0.88)	(0.070)
Trust in courts	1.83	1.91	-0.085
	(0.92)	(0.95)	(0.067)
Fear of unjust arrest	3.93	3.83	0.097
	(0.73)	(0.93)	(0.091)
Swapo Support	0.35	0.53	-0.18***
	(0.48)	(0.50)	(0.034)
Observations	254	1,164	1,418

of the electoral process.[41]

Moreover, we include fixed effects for the seven regions that the settlement boundary cuts through in our baseline specification. This ensures that we only compare individuals living close to each other on the same part of the boundary, who are governed by the same contemporary national and regional institutions.

2.7 External Validity

Whilst we have chosen to focus on Namibia in order to try to cleanly identify the effect of colonial rule on contemporary support for democracy, it is natural to question whether results stemming from a single country are generalizable. Theoretically, we believe that the 'demand-side' mechanisms outlined in this paper are generalizable because contemporary contact with traditional leaders is actually more frequent elsewhere in sub-Saharan Africa than in Namibia and it has been suggested that the legitimacy of traditional leaders has undermined the consolidation of democracy elsewhere on the continent (Mamdani, 1996; Englebert, 2000; Ntsebeza, 2005).[42]

41. The greater support for SWAPO may in part reflect the institutional capacity of traditional leaders to mobilize support for the ruling party in indirectly ruled areas, as in contemporary South Africa (De Kadt and Larreguy, forthcoming)

42. Indeed, as Lange (2009) points out in the context of post-colonial Sierra Leone, "the system of rule through chiefs was hardly questioned because it was accepted and viewed by both officials and the public as appropriate. Indeed, even the Sierra Leoneans who rebelled against the chiefly misrule in the mid-1950s asked for new chiefs, not a new system of rule" (p. 197)

Moreover, we show in Appendix Section B.8 that there is empirical evidence that the relationship between indirect colonial rule, contact to traditional leaders and lower support for democracy is generalizable across the continent. Pooling Afrobarometer responses from across countries and controlling for ethnicity, standard demographic characteristics and level of development, indirect colonial rule is negatively associated with individual support for democracy, turnout[43], and positively associated with contact to traditional leaders. Although these results cannot be interpreted as causal, they are nonetheless suggestive that the documented within-country effects of indirect colonial rule in Namibia are generalizable to the rest of the continent.

2.8 Conclusion

The results presented in this study show that indirect colonial rule has persistent effects on contemporary political attitudes and behavior. We identified the effect of indirect rule by exploiting a unique natural experiment in Namibia. Due to the effects of a 1897 rinderpest epidemic, Namibia was divided into a southern region directly settled and ruled by colonial authorities and a northern region that was indirectly ruled through a system of appointed indigenous tribal elites, leading to exogenous variation in the form of colonial rule amongst members of the same ethnic group. Applying a spatial RDD, we found that individuals in indirectly ruled areas of Namibia are less likely to support democracy as a form of governance and participate in voting at elections.

Our evidence suggests that the mechanisms underlying this relationship are not demographic factors such as education or income but rather are institutional - specifically, the legacy of colonial governance institutions (Lange 2009). Despite the low procedural inclusiveness of hereditary systems of traditional leadership in indirectly ruled areas of sub-Saharan Africa, traditional leaders are nonetheless usually seen as far more effective and trustworthy than elected leaders (Logan, 2008; Baldwin, 2015). We therefore theorize that the institution of traditional leadership in sub-Saharan Africa has acted as an parallel legitimate governance system that has socialized individuals in indirectly ruled areas to accept non-electoral systems of government. This paper thereby contributes to a long-running debate in comparative politics (Mamdani, 1996; Englebert, 2000; Williams, 2010; Logan, 2013) - our results suggest that the hereditary system of traditional leadership institutionalized by indirect colonial rule may indeed present a stumbling block to contemporary democratic consolidation in sub-Saharan Africa.

Our findings have potentially broad implications for our understanding of processes of democratization in the post-colonial context. Indirectly ruled countries are on av-

43. This result is not statistically significant though the coefficient is in the theorized direction.

erage relatively autocratic today (Hariri, 2012; Lange, 2009). Our evidence suggests that a causal mechanism underlying this important aggregate cross-national relationship is potentially cultural - Namibians in indirectly ruled areas are less likely to believe that democracy is the only legitimate form of government or participate in the electoral process. The relatively autocratic nature of indirectly ruled areas of the world today may, therefore, not only be due to a lack of 'supply' of democracy from post-independence elites who successfully captured less inclusive political systems. Rather, it may also be due to weaker general 'demand' for electoral democracy as a system of government in indirectly ruled areas.

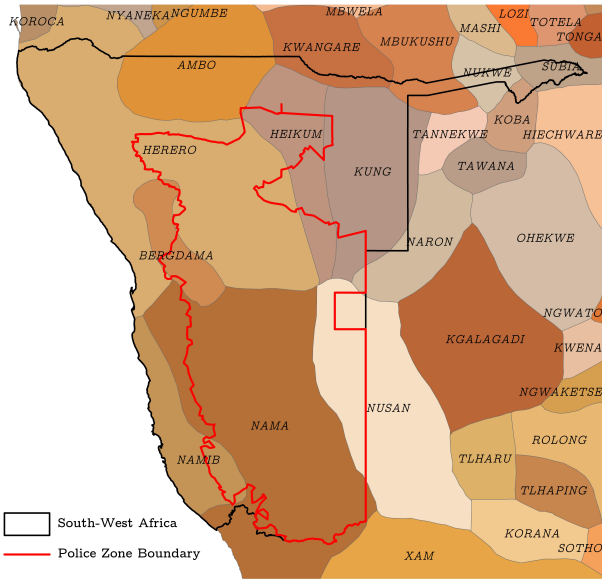
Whilst our evidence suggests that indirect colonial rule plays an important role in shaping individual attitudes toward democracy, we do not wish to imply a monocausal explanation for variance in contemporary political culture in sub-Saharan Africa. Colonization is not destiny - the legacy of indirect colonial rule, whilst important, can only explain part of the variance in Namibia's contemporary political culture. Rather, we want to highlight the fact that the ongoing parallel existence of undemocratic local governance structures can partially undermine support for democracy even in the context of a functional, largely successful national democratic polity. This has potentially broad implications for democratization processes in other indirectly ruled sub-Saharan African countries, where systems of traditional leadership still play an important role in local governance and national democracy is not as consolidated as in Namibia.

Moreover, the fact that the institutional legacies of indirect rule may weaken support for core democratic tenets in sub-Saharan Africa does not invalidate the extremely important and valuable governing roles that traditional authorities currently play in their communities. Indeed, we have argued that it is likely in part because non-electoral mechanisms such as strong social ties have proven so effective in keeping traditional leaders accountable and responsive to the needs of their communities and thus more effective than elected officials (Baldwin, 2015) that support for electoral democracy as a system of government is weakened in areas with influential traditional leaders. Despite the presence of a trade-off between influential local traditional institutions and democratic consolidation, therefore, the policy mechanisms for improving overall quality of governance in sub-Saharan Africa in the future remain more unclear and is a currently fruitful area of research.[44] Ultimately, we hope that our findings documented in this paper encourage further research about the competing legitimacy of different institutional configurations and the historical legacies that continue to shape political culture in both sub-Saharan Africa and the wider world.

44. As Baldwin and Mvukiyehe (2015) show, introducing elections for traditional authorities may actually have counter-productive effects on community collective action.

Appendix B.1: Ethnic Groups Prior to Colonization

Figure B1. Ethnic groups prior to colonization (Murdock, 1967)



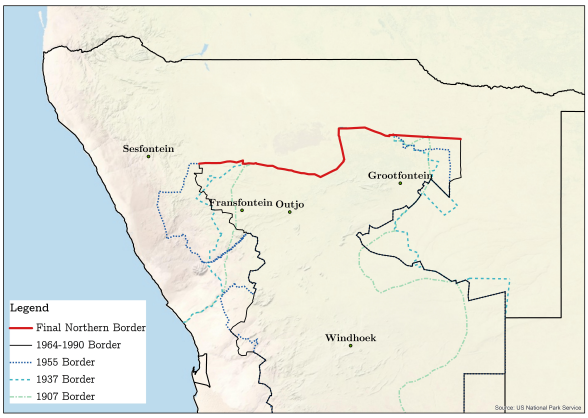
Appendix B.2: Red Line Changes Over Time

In this section we provide greater detail on the changes made to the location of the Red Line between 1897-1990. The first map of the Police Zone was made in 1907 by the colonial department in Berlin, in response to a decree issued by the German Reichstag in 1905 to restrict police protection in South West Africa (Department of Veterinary Services 1996). In northern Namibia, the 1907 boundary defining the Police Zone followed the veterinary cordon fence established ten years earlier (Miescher 2012). Reserves outside the Police Zone were restricted from European settlement (Waters, 1918).[45]

Between 1907 and 1937, the area covered by the boundary of the Police Zone partially expanded west and east. The exact location of the Red Line in the west and east, unlike the areas in the north bordering the Native and Game Reserves which were defined in 1907, was not documented in writing until 1928 despite appearing on maps (Prohibited Areas Proclamation, 1928). Throughout the 1920s, farmers thus had some leeway to incorporate new farms immediately outside the eastern and western boundary of the Police Zone by having such lands formally surveyed. Moreover, the

45. The boundary of legal European settlement remained unchanged as of the 1911 farm map (*Besitzstandkarte*)

Figure B2. Red line changes over time



Changes in boundaries defining area of legal European settlement between 1907-1990. Sources: Karte des unter polizeilichen Schutzder Regierung zu stellenden Gebietes in Duetsch-Sudwest Afrika 1907; Verodnung betreffend Bildung von Wildreservaten in dem sudwesafrikanischen Schutzgebiet 22 March 1907, South West Africa - Suidwes Afrika 1937, Suidwes Afrika - South West Africa 1955, Suidwes Afrika - South West Africa 1966. National Archives of Namibia, Waters (1918) and Mendelsohn (2002)

Red Line was extended by authorities to the international border with Bechuanaland and to the Atlantic coast in 1926 (see South West Africa - Suidwes Afrika 1926). This was apparently done by authorities in Windhoek in order to better convince South African authorities that the Red Line represented an impermeable veterinary boundary, necessary to allow the ongoing export of cattle from South West Africa (Miescher 2012 p. 96).

Three months after the end of World War II, South African authorities established a commission to enquire into policy changes needed to secure the 'social security' of European persons in South West Africa (Botha, 2000). Among a number of topics investigated by the Lardner-Burke commission was the possibility of surveying and leasing new farmers for settlers. In order to meet the goal of "a farm for every settler", the commission ultimately recommended a dramatic expansion of the Police Zone in order to accommodate an extra 1,127 farms (Government of South West Africa, 1946). This expansion was, however, opposed by the colonial veterinary service who feared extending European farms further north proximate to potentially diseased cattle (Botha, 2000). To accommodate these competing demands, the authorities in 1947 partially adopted the recommendations of the commission - extending the Police Zone west of Fransfontein and moving the Police Zone in the northeast along the 19th degree of latitude to the 19th degree longitude (Government Notice No. 375, 1947). The north-eastern border was shifted slightly again along a further

parallel northeast in 1961 to create more farms (Government Notice No. 222, 1961). In a sense, the recommendations of the Lardner-Burke commission provide further evidence for the exogeneity of the Police Zone boundary. The commission (unsuccessfully) recommended a significant expansion of farms in the area north of the Police Zone, thus indicating that such areas in our indirectly ruled buffer zone would have been suitable for European settlement had the original veterinary cordon fence been located further north.

The final major change to the Red Line was due to the Odendaal Commission of 1964. The commission was a political response to the rise of apartheid and African nationalism (Melber, 2015). In order to legitimate ongoing segregation between Europeans and Africans, the Commission recommended the creation of a number of African homelands which would be ruled on a 'traditional' basis (Odendaal, 1964). The proportion of land allocated to African reserves almost doubled and correspondingly the area where Europeans were legally allowed to settle actually shrunk significantly (Republic of South Africa, 1964). For example, in the west of Fransfontein, in order to create the new Damara homeland the commission recommended the official purchase of hundreds of European farms to be allocated to the Damara (Odendaal, 1964). The northern border between European and African areas remained, however, unchanged.[46] After the Odendaal commission of 1964, no further changes were made to the area delimiting European settlement. The Red Line was eventually dissolved following Namibian independence in 1990.

Thus, the changes to the boundaries of European settlement between the establishment of the veterinary cordon fence and the final boundary formalized in 1964 as represented in figure B2 can be summarized as follows: there was a gradual increase and then significant reduction in the land allocated to European settlers in the western and eastern portions of the Red Line; the bulk of the northern boundary remained unchanged; some expansion of the Red Line beyond the original cordon fence did occur in the north-east and north-west so the exogeneity of the final border is not perfect. However these changes were small and were largely to bring the border in alignment with degrees longitude and latitude, which is quite arbitrary. Thus, whilst as in all historically oriented work it is difficult to rule out all other competing explanations, the historical record is nonetheless quite suggestive that the northern location of the Red Line border was exogenous to pre-colonial confounders.

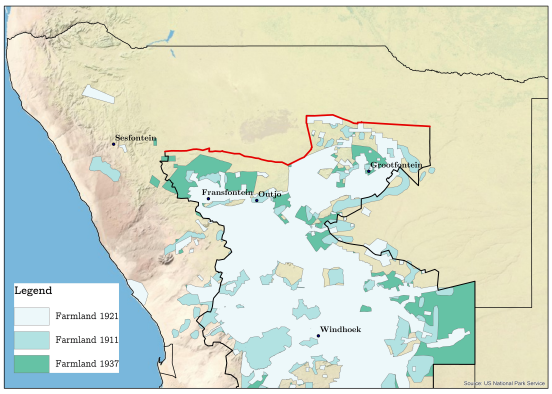
Appendix B.3: Extension of European Farmland 1911-1964

This figure demonstrates the progressive extension of European farmland in South West Africa. In the early 1900s, European settlement was primarily focused in central

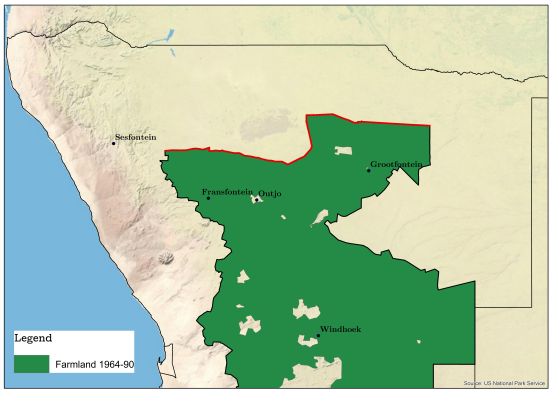
46. For example, see the 1966 farm map as digitized in figure B2

and southern Namibia around Windhoek. Over the course of the first half of the twentieth century, Europeans settlers gradually 'filled out' most of the Police Zone. In north-eastern and north-western Namibia, the Red Line contracted in parts after the Odendaal Commission of 1964 (see figure B2) which meant that some European farms were allocated to traditional authorities.

Figure B3. Extension of European farmland 1911-1964



(a) Farmland 1911-1964



(b) Farmland 1964-1990

Sources: Besitzstandkarte 1911, South West Africa - Suidwes Afrika 1921, South West Africa - Suidwes Afrika 1937, Suidwes Afrika - South West Africa 1966. National Archives of Namibia, Mendelsohn (2002).

Appendix B.4: Afrobarometer Survey Questions

Afrobarometer survey questions uesed in this paper (Afrobarometer, 1999, 2003, 2005, 2008).

Outcome variables

- **Support for democracy**: Which of these three statements is closest to your own opinion?
  Statement 1: Democracy is preferable to any other kind of government.
  Statement 2: In some circumstances, a non-democratic government can be preferable.
  Statement 3: For someone like me, it does not matter what kind of government we have.
  1= Statement 2: Non-democratic preferable, 2=Statement 3: For someone like me, it does not matter what kind of government we have, 3=Statement 1: Democracy preferable

- **Voting**: With regard to the most recent national elections, which statement is true for you?
  0= You decided not to vote
  1= You voted in the elections
  We dropped observations from respondents who reported that they could not find the polling station, were prevented from voting, did not have time to vote or not vote for some other reason. This constitutes less than 3% of the sample.

- **Contact traditional leader**: During the past year, how often have you contacted any of the following persons about some important problem or to give them your views: A traditional ruler?
  0=Never, 1=Only once, 2=A few times, 3=Often

- **Respect for authority**: Let's talk for a moment about the kind of society we would like to have in this country. Which of the following statements is closest to your view? Choose Statement 1 or Statement 2.
  Statement 1: Citizens should be more active in questioning the actions of leaders.
  Statement 2: In our country, citizens should show more respect for authority.
  1=Agree very strongly with Statement 1, 2=Agree with Statement 1, 3=Agree with Statement 2, 4=Agree very strongly with Statement 2

Control variables

- **Poverty Index**: Over the past year, how often, if ever, have you or your family gone without:

  - Enough food to eat?
  - Enough clean water for home use?
  - Medicines or medical treatment?
  - Enough fuel to cook your food?
  - A cash income?[47]

  0=Never, 1=Just once or twice, 2=Several times, 3=Many times, 4=Always
  In order to construct the poverty index we predict the first principal component of these five variables and then generate 5 different poverty groups based on this component (with group 1 being the poorest and group 5 being the richest, i.e. never without any of these five necessities).

- **Education**: What is the highest level of education you have completed?
  0=No formal schooling, 1=Informal schooling, 2=Some primary schooling, 3=Primary school completed, 4=Some secondary school/ High school, 5=Secondary school completed/High school, 6=Post-secondary qualifications, other than university, 7=Some university, 8=University completed, 9=Post-graduate
- **Respondent's gender**:
  0=Male, 1=Female
- **Performance of local government councilor**: Do you approve or disapprove of the way the following people have performed their jobs over the past twelve months, or haven't you heard enough about them to say: Your Elected Local Government Councillor?
  1=Strongly Disapprove, 2=Disapprove, 3=Approve, 4=Strongly Approve

47. Other studies also include a question about lack of electricity. This question is however not included in Afrobarometer rounds 3-5 for Namibia.

Appendix B.5: Summary Statistics

Table B1 and Table B2 summarize the main variables of interests for the buffer zone. The number of observations in Table B1 differs as some variables are not available in all four survey rounds.

Table B1: Summary statistics for buffer zone: individual characteristics

	Mean	SD	Min	Max	Obs
Support for democracy	2.40	0.83	1	3	1352
Voted in last election	0.72	0.45	0	1	742
Contact traditional leader	0.69	1.01	0	3	1421
Trust traditional leaders	1.91	0.91	0	3	1029
Respect authority	2.43	1.01	1	4	1369
Performance government	2.88	0.79	1	4	1360
Gender	0.49	0.50	0	1	1426
Age	35.74	14.79	18	92	1426
Education	3.81	1.85	0	8	1414
Poverty group	2.55	1.31	1	5	1412

Table B2: Summary statistics for buffer zone: EA characteristics

	Mean	SD	Min	Max	Obs
Indirect colonial rule	0.83	0.38	0	1	165
Distance to border (in km)	66.24	23.63	5	99	166
Distance to Windhoek (in decimal degrees)	4.49	0.70	2	5	166
Distance to Windhoek (in km)	499	75	287	591	166
Carrying Capacity	4.19	1.04	2	6	166
Urban	0.83	0.38	0	1	166
Night lights	6.46	13.12	0	52	166
Infrastructure Index	0.64	0.47	0	1	166
Homeless people	4.40	22.18	0	212	166

Appendix B.6: Overview Individual-Level Control Variables

Table B3: Indirect rule and support for democracy

	(1) Support democracy	(2) Voting
Indirect colonial rule	-0.203*	-0.162*
	(0.119)	(0.0880)
Distance Windhoek	-0.0346	-0.0373
	(0.0752)	(0.0565)
Education=0	-0.312*	-0.525***
	(0.165)	(0.0938)
Education=1	-0.426**	-0.329***
	(0.201)	(0.103)
Education=2	-0.203	-0.188**
	(0.139)	(0.0809)
Education=3	-0.306**	-0.174*
	(0.140)	(0.0937)
Education=4	-0.130	-0.0901
	(0.134)	(0.0781)
Education=5	-0.125	-0.109
	(0.136)	(0.0800)
Education=6	0.0426	-0.0396
	(0.158)	(0.0938)
Education=7	-0.115	-0.00128
	(0.182)	(0.104)
Poverty group=1	-0.0832	0.123**
	(0.0761)	(0.0469)
Poverty group=2	-0.163*	0.157***
	(0.0852)	(0.0546)
Poverty group=3	-0.0968	0.152***
	(0.0706)	(0.0459)
Poverty group=4	-0.271***	0.0510
	(0.0976)	(0.0576)
Age	0.00105	0.0154***
	(0.00193)	(0.000927)
Gender	0.0728*	-0.0156
	(0.0416)	(0.0342)
Observations	1,322	718
R^2	0.051	0.291
Ethnicity FE	✓	✓
Survey round FE	✓	✓
Region FE	✓	✓
# clusters	165	91
Mean of DV	2.399	0.721

Results from OLS regressions. The sample consists of observations from the 100km buffer zone. Reference group for edducation is group 8 (highest level of education) and group 5 (richest group) for poverty group. Standard errors (clustered by Enumeration Area) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Appendix B.7: Robustness Checks

B.7.1 RDD Specification

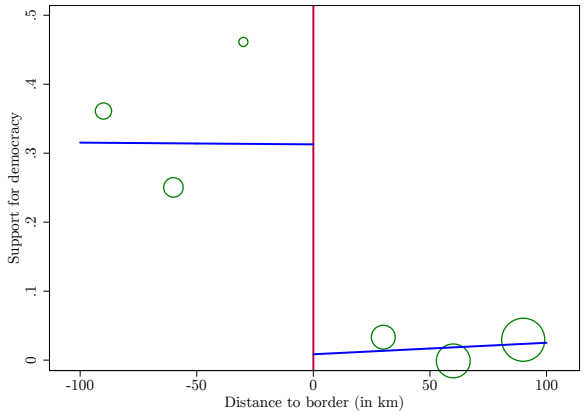
Table B4: Indirect rule and support for democracy: alternative RDD specifications

	(1) Contact TL	(2) Contact TL	(3) Contact TL	(4) Respect authority	(5) Respect authority	(6) Respect authority
Indirect colonial rule	0.229	0.529*	0.411**	0.302*	0.247	0.241**
	(0.220)	(0.282)	(0.169)	(0.155)	(0.186)	(0.115)
Observations	1,413	1,413	1,413	1,361	1,361	1,361
R^2	0.145	0.152	0.153	0.126	0.131	0.133
Lat/Lon	✓			✓		
Dist. Windhoek quadr		✓			✓	
Dist. Boundary quadr			✓			✓
Ethnicity FE	✓	✓	✓	✓	✓	✓
Survey round FE		✓	✓	✓	✓	✓
Region FE		✓	✓		✓	✓
# clusters	165	165	165	165	165	165
Mean of DV	0.696	0.696	0.696	2.431	2.431	2.431

Results from OLS regressions. Individual-level control variables are age, gender, education dummies and poverty index dummies. The sample consists of observations from the 100km buffer zone.. Standard errors (clustered by Enumeration Area) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

B.7.2 Regression Discontinuity Plot with Individual Controls

Figure B4. Regression discontinuity plot



A local linear regression discontinuity plot of difference in support for democracy from the Red Line border obtained from a multivariate regression model with a vector of binary indicator variables identifying respondent ethnicity, survey round, individual controls and region. Bin size corresponds to the number of respondents

B.7.3 Different Buffer Sizes

The results are robust to using observations for the entire country and for a 50km buffer rather than only focusing on the buffer zone. When decreasing the size of the buffer the number of observations is too small using voting as an outcome and therefore the effect cannot be precisely estimated.

Table B5: Indirect rule and support for democracy: different buffer sizes

	(1) Entire Country	(2) Entire Country	(3) 50km Buffer	(4) 50km Buffer
Indirect colonial rule	-0.0941***	-0.100**	-0.161*	-0.182**
	(0.0328)	(0.0501)	(0.0881)	(0.0848)
Distance Windhoek		-0.0232		-0.0346
		(0.0250)		(0.0900)
Observations	4,656	4,565	620	606
R^2	0.008	0.037	0.044	0.092
Ethnicity FE	✓	✓	✓	✓
Survey round FE	✓	✓	✓	✓
Region FE		✓		✓
Individual-level controls		✓		✓
# clusters	571	571	77	77
Mean of DV	2.424	2.420	2.382	2.381

Results from OLS regressions. Individual-level control variables are age, education, gender dummies and poverty index dummies. The sample consists observations for the entire country and a 50km buffer respectively. Standard errors (clustered by Enumeration Area) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table B6: Indirect rule and voting: different buffer sizes

	(1) Entire Country	(2) Entire Country	(3) 50km Buffer	(4) 50km Buffer
Indirect colonial rule	0.0200	-0.0473	-0.0963	-0.0694
	(0.0240)	(0.0422)	(0.0638)	(0.0636)
Distance Windhoek		0.00479		-0.142**
		(0.0178)		(0.0552)
Observations	2,711	2,664	392	386
R^2	0.036	0.185	0.066	0.246
Ethnicity FE	✓	✓	✓	✓
Survey round FE	✓	✓	✓	✓
Region FE		✓		✓
Individual-level controls		✓		✓
# clusters	335	335	48	48
Mean of DV	0.733	0.733	0.747	0.749

Results from OLS regressions. Individual-level control variables are age, gender, education dummies and poverty index dummies. The sample consists observations for the entire country and a 50km buffer respectively. Standard errors (clustered by Enumeration Area) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

B.7.4 Placebo Buffer

We created placebo buffers by shifting the location of the former Police Zone boundary one degree latitude north and south respectively. We do not find any significant effects on support for democracy or voting, which confirms that our results are unique to this historical meaningful Police Zone boundary.

Table B7: Indirect rule and support for democracy: placebo buffers

	(1) Support for democracy	(2) Support for democracy	(3) Support for democracy	(4) Support for democracy
Placebo indirect (south)	0.0532	-0.160		
	(0.119)	(0.168)		
Placebo indirect (north)			-0.105	-0.0276
			(0.0840)	(0.0993)
Distance Windhoek		0.198		-0.0535
		(0.128)		(0.123)
Observations	324	318	927	914
R^2	0.067	0.169	0.028	0.084
Ethnicity FE	✓	✓	✓	✓
Survey round FE	✓	✓	✓	✓
Region FE		✓		✓
Individual-level controls		✓		✓
# clusters	42	42	114	114
Mean of DV	2.349	2.358	2.383	2.380

Results from OLS regressions. Individual-level control variables are age, gender, education dummies and poverty index dummies. The sample consists of oberservations from the placebo buffer zone. Standard errors (clustered by Enumeration Area) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table B8: Indirect rule and voting: placebo buffers

	(1) Voting	(2) Voting	(3) Voting	(4) Voting
Placebo indirect (south)	-0.00805	-0.140		
	(0.0800)	(0.0945)		
Placebo indirect (north)			0.0278	0.116*
			(0.0591)	(0.0645)
Distance Windhoek		0.0225		-0.0271
		(0.106)		(0.0608)
Observations	186	184	546	539
R^2	0.078	0.341	0.073	0.286
Ethnicity FE	✓	✓	✓	✓
Survey round FE	✓	✓	✓	✓
Region FE		✓		✓
Individual-level controls		✓		✓
# clusters	23	23	68	68
Mean of DV	0.720	0.717	0.722	0.722

Results from OLS regressions. Individual-level control variables are age, gender, education dummies and poverty index dummies. The sample consists of oberservations from the placebo buffer zone. Standard errors (clustered by Enumeration Area) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

B.7.5 Different Clustering

Table B9: Indirect rule and support for democracy and voting: clustering SE on a constituency level

	(1) Support for democracy	(2) Support for democracy	(3) Voting	(4) Voting
Indirect colonial rule	-0.178**	-0.203*	-0.122*	-0.162*
	(0.0768)	(0.112)	(0.0615)	(0.0895)
Distance Windhoek		-0.0346		-0.0373
		(0.0719)		(0.0497)
Observations	1,347	1,322	734	718
R^2	0.019	0.051	0.049	0.291
Ethnicity FE	✓	✓	✓	✓
Survey round FE	✓	✓	✓	✓
Region FE		✓		✓
Individual-level controls		✓		✓
# clusters	44	44	38	38

Results from OLS regressions. Individual-level control variables are age, gender education dummies and poverty index dummies. The sample consists of observations from the 100km buffer zone. Standard errors (clustered by Constituency) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

B.7.6 Interaction Effects

Finally, we analyzed interactions between indirect rule and age using both the reported age and a binary age measure (Table B10). The binary measure divides the sample in people older and younger than 24, who are the so-called 'born free' generation. Neither of the estimations yields statistically significant effects of the interaction. This demonstrates that the effect of indirect colonial rule on political attitudes does not depend on age.

Table B10: Interaction between indirect colonial rule and age

	(1) Support for democracy	(2) Support for democracy	(3) Voting	(4) Voting
Indirect colonial rule	-0.109	-0.109	-0.325*	-0.229*
	(0.187)	(0.144)	(0.169)	(0.120)
Distance to Windhoek	-0.0390	-0.0285	-0.0382	-0.0270
	(0.0780)	(0.0755)	(0.0559)	(0.0529)
Indirect rule x Age	-0.00282		0.00494	
	(0.00461)		(0.00366)	
Age	0.00307		0.0110***	
	(0.00438)		(0.00345)	
Indirect rule x Old dummy		-0.142		0.163
		(0.134)		(0.108)
Old dummy		0.198*		0.415***
		(0.116)		(0.0963)
Observations	1,317	1,322	718	718
R^2	0.048	0.054	0.294	0.365
Ethnicity FE	✓	✓	✓	✓
Survey round FE	✓	✓	✓	✓
Region FE	✓	✓	✓	✓
Individual-level controls	✓	✓	✓	✓
# clusters	165	165	91	91

Results from OLS regressions including interaction terms between colonial rule and age. Individual-level control variables are age, gender, education dummies and poverty index dummies. The sample consists observations for the buffer zone only. Standard errors (clustered by Enumeration Area) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Appendix B.8: External Validity

In this subsection we examine how the variation in political attitudes by form of colonial rule is reflected at the cross-national level. Whilst these results cannot be considered causal, they are nonetheless suggestive that there is some external validity for our better identified natural experimental evidence. We use the cross-national Afrobarometer Round 4 dataset compiled by Robinson (2014) because Robinson standardized ethnic group names across different countries. This means that, by taking ethnic group fixed effects, we are able to mimic our analysis in Namibia by only examining within-ethnic group variation in support for democracy.

Our independent variable of interest, indirect colonial rule, is a country-level variable that varies from 0 to 1. This variable captures the proportion of a country's colonial court cases that were decided on a 'customary' basis rather than a formal court of law, thus giving a measure of the 'indirectness' of colonial rule (Lange, 2004). Because this measure is only available for British colonies, Hariri (2012) interpolated it for other countries in sub-Saharan Africa and it is his interpolated measure that we use.

We are interested in the effect of indirect colonial rule on contemporary political attitudes and behaviour net of the confounding variables of democratic and economic development. We thus control for an individual's experience with democracy after the third wave (Polity IV score average from 1991-2005) and economic development (log GDP per capita). Because treatment is assigned at the country-level, we cluster our standard errors at the country-level. Otherwise the specification remains the same as in our specifications in Namibia - we include age, gender, education dummies, poverty index dummies and ethnic fixed effects.

Even when only examining within ethnic-group variation, individuals in countries that were ruled more indirectly are less likely to support democracy and more likely to contact traditional leaders.[48] Whilst they are also less likely to turnout at elections, the difference is not statistically significant. These results should be interpreted with caution given that this is a non-random sample of countries in sub-Saharan Africa (biased towards more democratic countries) and the basis of assignment to treatment is unknown. Nevertheless, they show that there is suggestive evidence that the relationship between the form of colonial rule and contemporary political culture is not just limited to in Namibia but rather holds more generally in sub-Saharan Africa.

48. This data does not have responses to "respect for authority" as in our Namibian subset

Table B11: Effect of indirect rule on support for democracy and contact with traditional leaders across Africa

	(1) Support democracy OLS	(2) Support democracy O Probit	(3) Turnout OLS	(4) Turnout O Probit	(5) Contact TL OLS	(6) Contact TL O Probit
Indirect colonial rule	-1.599***	-3.403**	-0.170	-0.504	0.653*	1.222*
	(0.312)	(1.348)	(0.151)	(0.559)	(0.357)	(0.643)
Mean Polity IV	-0.0878***	-0.195**	-0.00934	-0.0275	-0.000436	-0.00727
	(0.0232)	(0.0901)	(0.00548)	(0.0214)	(0.0225)	(0.0384)
Log GDP p.c.	0.0407	0.0161	-0.0336	-0.136*	0.0297	0.0205
	(0.0652)	(0.109)	(0.0219)	(0.0812)	(0.0415)	(0.100)
Observations	16,461	16,461	18,530	18,530	18,597	18,597
R^2	0.070		0.142		0.180	
Ethnicity FE	✓	✓	✓	✓	✓	✓
Individual-level controls	✓	✓	✓	✓	✓	✓
# clusters	15	15	15	15	15	15
Mean of DV	2.612	2.612	0.753	0.753	0.508	0.508

Individual-level control variables are age, gender, education dummies and poverty index dummies. Data on indirect rule at the country-level is taken from Lange (2004). Estimations based on Afrobarometer round 4 (all countries included). Standard errors (clustered by country) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

3

INDIVIDUAL LIFE HORIZON INFLUENCES ATTITUDES TOWARD DEMOCRACY

3.1 Introduction

The emergence and stability of political regimes crucially depends on the support for these regimes in the population. A strong preference for democracy in the population can destabilize autocracies and lead to democratization, whereas a lack of support for democracy may lead to a breakdown of democracy (Linz and Stepan, 1996). Surprisingly little is known about the determinants of individual preferences for democracy. Traditionally, the literature has focused on macro-determinants that foster democratic attitudes and that include, in particular, economic development, education, and inequality (Lipset, 1959; 1960; Almond and Verba, 1963; Persson and Tabellini, 2009). Recent work has shifted attention to the analysis of survey data to explore individual support for democracy and its determinants. The results of this literature indicate that support for democracy is higher in democracies (Inglehart, 2003; Inglehart and Welzel, 2003), and affected by perceived government effectiveness (Magalhaes, 2014).

An increasing body of evidence suggests that preferences in various domains, including political preferences, are influenced by the societal context as well as individual life experiences (Fehr and Hoff, 2011) and modernization in general (Inglehart and Welzel, 2010). Retrospective experiences, such as macroeconomic shocks or the social and institutional context during childhood and adolescence have been shown to influence preferences for redistribution later in life.[1] For political preferences, recent

1. See, for instance, Alesina and Fuchs-Schündeln (2007) or Luttmer and Singhal (2011). Related evidence for risk tolerance has been reported by Malmendier and Nagel (2011) or Dohmen et al. (2012).

evidence has shown that also the individual support for democracy is influenced by the individual experience with democracy, in terms of the length of time an individual spent under a democratic regime (Fuchs-Schündeln and Schündeln, 2015).[2]

While this body of evidence suggests that political preferences are to some extent endogenous with respect to the overall environment and to events or experiences in the past, little is known about how the individual life horizon and future orientation affect political preferences. Do young individuals have a systematically different predisposition toward democracy than older ones? Is the remaining life expectancy relevant for the attitudes toward the political regime? And can the influence of age effects be separated from the role of the expected length of the remaining life?

From a theoretical point of view, retrospective experiences should matter less for regime preferences than the beliefs or expectations about the personal benefits from alternative political regimes in the future. The regime preferences of forward-looking individuals should thus be influenced by the future benefits or costs expected from a particular regime as well as by the time horizon over which they are expected to accrue, as suggested by the literature on the determinants of democracy (Acemoglu and Robinson, 2006, e.g.). A prominent example of this argument has been made in the context of former colonies, where the quality of the institutions set up by the colonizers has been found to be crucially related to their life expectancy (Acemoglu, Johnson, and Robinson, 2001; 2003). Greater life expectancy implies a greater incentive to set up inclusive institutions that allow for political participation, secure private property and provide checks against power abuse by the state or the government, i.e., democratic regimes, in particular if the implementation of such institutions is costly and time intensive. Building on the idea of a youth bulge, according to which the presence of a large share of young adults within the population provides a favorable environment for civil conflict Urdal (2006), Cincotta and Doces (2012), and Weber (2013) provide evidence that the age composition of the population affects the likelihood of the establishment of liberal democracies or the likelihood of dictatorships, respectively. Likewise, a considerable body of evidence in social psychology has established a link between individuals' awareness of mortality or threats to their life, and authoritarian attitudes (Sales, 1973; Doty, Peterson, and Winter, 1991; Echebarria-Echabe and Fernandez-Guede, 2006). The nexus between salience of mortality and political attitudes has been confirmed in numerous studies (see Burke, Kosloff, and Landau (2013) for a recent meta analysis). Recent work by Foa and Mounk (Foa and Mounk, 2016a; 2016b) on the decreasing support for democracy in Western countries, particularly among the young, has sparked an intense debate about "democratic deconsolidation".[3] However, a study that provides systematic evidence regarding the

2. Recent work by Roth and Wohlfart (2017) uses a similar approach to explore the effect of experienced inequality on the preferences for redistribution.

3. See the Online Exchange on "Democratic Deconsolidation" on the website of the *Journal of Democ-*

influence of age and the remaining life expectancy on the preferences for democratic political regimes is still missing.

This study reports results from an empirical study that explores the effect of the expected length of the remaining life faced by individuals of different ages on individual attitudes toward democracy. The identification strategy is based on individual-level observations for political regime preferences for a panel of countries and on variation in the remaining years of life across age-gender-country-period cells. Building on work in demography by Sanderson and Sherbov (Sanderson and Sherbov, 2005; 2013), this approach distinguishes between chronological age and a forward-looking definition of age reflected by remaining life expectancy. This allows controlling for other individual-level factors that might influence individual preferences for the political regime, as well as potential confounds at the country level such as economic and institutional factors, health infrastructure, or life expectancy. The evidence shows that support for democracy increases with age, but declines with expected proximity to death. Increasing age while keeping the remaining years of life fixed as well as increasing remaining years of life for a given age group both contribute to the support for democracy.

3.2 Data and Methodology

3.2.1 Data

The analysis is based on individual-level survey data collected as part of the World Value Surveys. The World Value Surveys are nationally representative surveys that are conducted repeatedly in almost 100 countries, using a common questionnaire that contains consistent and comparable sets of questions on various topics. The relevant questions for this study relate to the individual assessment of democracy as a form of governing a country (see Appendix Section C.1.1 for details regarding text and coding). In addition to the subjective assessment of democracy as form of governance, we use alternative questions regarding the subjective importance associated with living in a country that is governed democratically, with having a parliament and elections rather than a strong leader, and an assessment of democracy as best form of government, as well as indices that combine these questions. The same questions have been used previously in research on democratic attitudes (Fuchs-Schündeln and Schündeln, 2015; Inglehart and Welzel, 2003). Summary statistics of all outcome variables are provided in Appendix Table C1.

These data are combined with information about the years until the expected death of an individual of a given age and gender living in a particular country at a given point in time. Data about the remaining years of life of an individual is taken from period

racy.

life tables assembled by the United Nations (United Nations, 2015), which contain the respective information for each country for age brackets of five years for both genders and is available for different periods. Table C2 in the Appendix contains summary statistics. Variation in remaining years of life is plausibly exogenous to individual preferences for a political regime and is thus suited for addressing the research question.

The empirical analysis is conducted using a sample with survey information from the World Value Survey rounds 3-6 (1994-1998, 1999-2004, 2005-2009 and 2010-2014) for an unbalanced panel of 93 countries for which information is available for the relevant questions regarding individual attitudes toward democracy. The pooled sample for the main specification consists of 267,426 individual observations. Figure 3.1(a) captures the average attitude toward a democratic political system across countries, based on individual responses for the most recent survey wave of the World Values Survey available in each country. Figure 3.1(b) displays the corresponding life expectancy at age 40 for all countries contained in the estimation sample for the year in which the most recent survey wave was elicited.

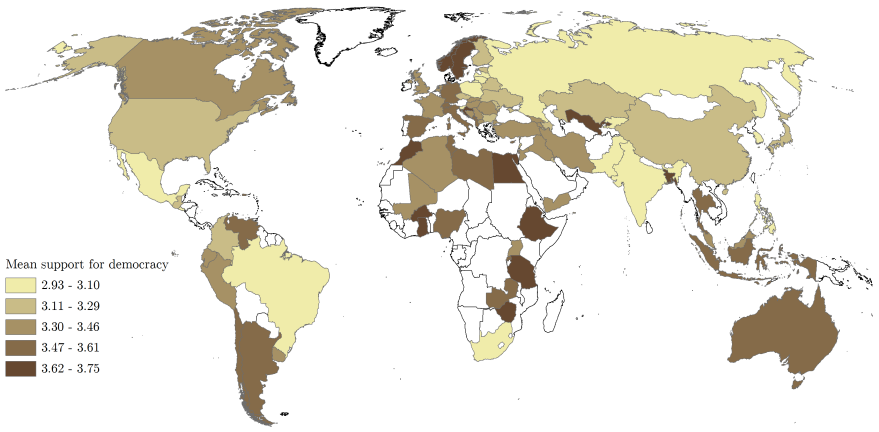
3.2.2 Methodology

To identify the effect of age and remaining years of life, the empirical strategy exploits variation in the remaining years of life that an individual of a given age and gender faces in the respective country at the respective point in time, therefore relying on variation across age-gender-groups in a country across time. Concretely, the estimation framework is based on a panel data set for age-gender-country-period cells and is given by

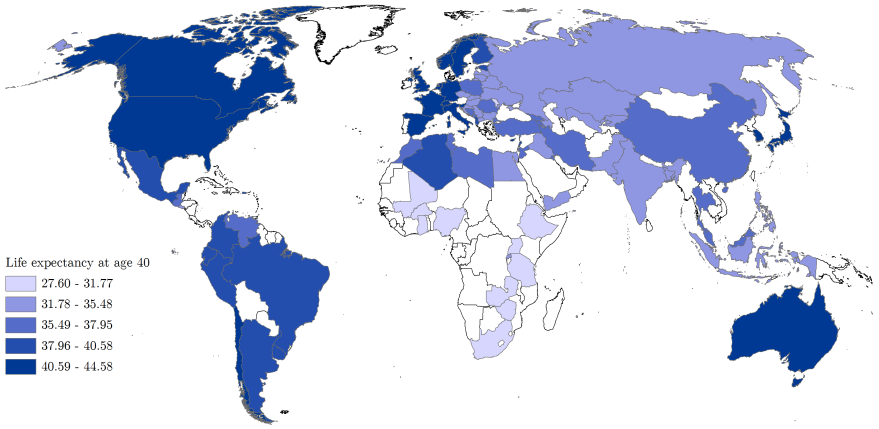
$$
\begin{aligned}
Attitude\ toward\ Democracy_{iagct} = \\
&\alpha + \sum_{\tau=1}^{T} \beta_\tau \mathcal{I}\left(\tau = Remaining\ Years_{iagct}\right) \\
&+ \sum_{a=15}^{97} \delta_a \mathcal{I}\left(a = Age_{iagct}\right) + \gamma X_{iagct} + \delta \mathcal{I}_{a,g,c,t} \\
&+ \varepsilon_{iagct}
\end{aligned}
$$

where $Attitude\ toward\ Democracy_{iagct}$ measures the survey response regarding attitudes toward democracy by an individual i with age $a \in [15, 97]$ and gender $g \in \{male, female\}$ in country c at time (survey year) t. $Remaining\ Years_{iagct}$ measures the remaining years of life that this individual respondent can expect to live according to the most recent (period) life tables for this country. Age_{iagct} is

Figure 3.1. World maps of individual democratic attitudes and individual life expectancy



(a) Individual attitudes toward democracy



(b) Remaining years of life

Panel (a): World map of attitude toward democracy. Country averages for the estimation sample of individual responses for the most recent survey wave available in each country. Authors' calculations are based on microdata from World Values Survey. Panel (b): World map of life expectancy in terms of remaining years of life at age 40. Country averages for the estimation sample of countries of the respondents to the World Values Survey contained in the estimation sample, for the year in which the most recent survey wave was elicited. Authors' calculations are based on period life tables. White color indicates excluded country (both panels).

the age of the respondent. By estimating a distinct coefficient for each year of remaining life expectancy (the vector of β-coefficients) and for each age (the vector of δ-coefficients), this empirical specification provides flexible semi-parametric estimates of the respective patterns of the effects of remaining years of life and of age on attitudes toward democracy. The vector X_{iagct} contains individual information about socio-demographic characteristics, such as number of children, marital status, income, and education level. Finally, $\mathcal{I}_{a,g,c,t}$ denotes a vector of binary indicator variables that account for systematically different democratic attitudes by gender, country and period cells. Richer specifications also include interactions, allowing for period-specific country effects and gender-specific age effects. The baseline estimation is conducted by least squares, the error term ε_{iagct} allows for clustering at the country-age-gender-period level.

The identifying assumption underlying this estimation approach is that there are no unobserved factors at the age-gender-country-year level that are correlated systematically with individual remaining years of life, or age. Covariates at the age, gender, country and period level also account for factors that might affect democratic attitudes. To account for country or period-specific factors that might affect the attitudes toward democracy, the specification of the empirical model includes country and period effects, which capture factors such as the quality of democratic institutions, political and civil liberties, ruling parties, the overall health status and life expectancy at birth of the population. The same is true for country-specific historical events that influence the attitudes toward democracy. Age effects account for age-specific patterns that are correlated with health and political attitudes.[4] Gender effects or in some specifications age-specific gender effects account for differences between women and men that might be linked to culture or development. To account for country-specific time trends in political attitudes and health we include country-period effects in some specifications.

With this estimation framework, the identification of the effects of remaining life years and age on attitudes toward democracy is based on within-country variation in remaining years of life across age-gender cells and over time. The use of information from life tables corresponds to quasi-experimental variation in the sense of an intention to treat approach, since individual life styles or factors directly related to the quality of or attitudes toward political institutions are not correlated with remaining years by construction and thus do not affect the estimates. In particular, endogeneity stemming from a third factor that is related to both the subjective life expectancy

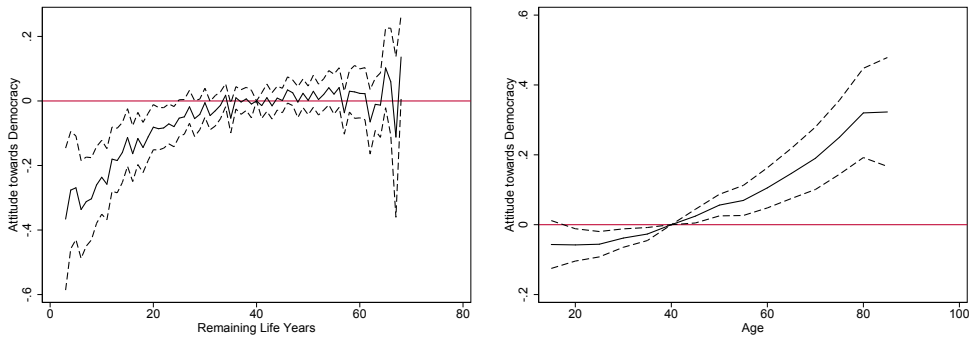
4. Without additional assumptions, this estimation approach does not allow for a decomposition of age and cohort effects due to collinearity. However, the estimates for the effects of remaining years of life and age obtained with this panel identification approach cannot be driven by cohort effects, provided that political attitudes are persistent along cohort lines, an assumption that appears to be in line with existing evidence (Sears and Funk, 1999).

and the preference for democracy, as for instance with victims of political violence in autocracies who expect to only live a short period of time as consequence of ensuing health damages, or with individuals planning to conduct a suicide attack, is ruled out by this approach. Notably, such endogeneity concerns prevent the use of subjective health assessments or individual assessments of remaining years of life in terms of subjective life expectancy for the purpose of this study. In focusing on objective life table information, our analysis also differs from the literature that focuses on the role of mortality salience, e.g., in the context of terror attacks, for political attitudes, see, e.g., Burke, Kosloff, and Landau (2013).

3.3 Results

The estimation results reveal a significant gradient in the attitudes toward democracy with remaining life expectancy. Figure 3.2(a) visualizes the effect relative to the base category of individuals with 40 remaining life years. The effect is non-linear and monotonically increasing in remaining life years. Holding age fixed, individuals that are closer to their expected end of life value democracy less than individuals that can still expect to live for 25 years or more. This effect is distinct from the age effect according to which individuals value democracy more at older ages (Figure 3.2(b)). Relative to the base category of 40-year olds, age is associated with more positive attitudes toward democracy, with older individuals having significantly more positive attitudes toward democracy. The age profile is approximately linear except for the tails. The coefficients of remaining life years and general age-patterns (shown in Figure 3.2) are estimated jointly within the same estimation framework. This implies that these coefficients correspond to variation in attitudes toward democracy in response to the respective category, holding all other covariates fixed. Figure C1 in the Appendix displays the respective cell frequencies, suggesting that the empirical pattern is not driven by outliers.

Figure 3.2. Effect of remaining years of life and age on subjective assessment of democracy



(a) Effect of remaining years of life

(b) Effect of age

Coefficient estimates obtained from a multivariate regression model (3.1) with controls for age and a vector of binary indicator variables that identify gender, country and period cells. Dotted lines represent +/− 1.96 standard deviation bands around the respective coefficient estimate (95% confidence interval).

The results are reproduced in parametric multivariate regression settings with a quadratic specification of the effect of remaining years of life, see Table 3.1, column (1). Restricting the estimation sample to individuals age 60 and younger to reduce potential collinearity between age and remaining years delivers almost identical point estimates (Table 3.1, column (2)). In order to rule out that individual socioeconomic background conditions such as family status, education and income, trust, or cohort-specific factors such as individual experience with a democratic system (Fuchs-Schündeln and Schündeln, 2015) that are related to age or life expectancy affect the results, we also conduct estimations based on an extended specification, with similar findings, see Table 3.1, column (3). The results of this analysis reproduce earlier findings that individual experience with democracy shapes the preferences for democracy.

The results reported in Table 3.1, imply that an increase of twenty remaining life years while holding everything else fixed is associated with attitudes toward democracy that are more favorable by about a third of a standard deviation of the world sample. This appears to be a significant effect, especially in light of the discrepancies in life expectancy across the world.

Table 3.1: Effect of remaining years of life on democratic attitudes: parametric estimates

	(1)	(2)	(3)
Sample	Full	Under 60	Full
Remaining Life Years	0.0137***	0.0154***	0.0145***
	(0.0033)	(0.0035)	(0.0038)
Remaining Life Years^2	-0.000137***	-0.000134***	-0.000140***
	(0.0000)	(0.0000)	(0.0000)
Democratic Capital			0.00412***
			(0.0012)
Country FE	✓	✓	✓
Age FE	✓	✓	✓
Gender FE	✓	✓	✓
Survey round FE	✓	✓	✓
Children			✓
Marital Status			✓
Trust			✓
Education Dummies			✓
Income Dummies			✓
R^2	0.080	0.080	0.096
N	267,426	230,502	198,026
Cluster	2,909	1,966	2,455

Least Squares estimates. Columns (1) and (3) are based on the full sample, column (2) is based on the sample of respondents aged ≤ 60 years. Standard errors (clustered by country-age group-gender-survey round) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

3.4 Additional Findings

The results are robust with respect to alternative specifications of the estimation equation. Columns (1) and (2) in Table C3 in the Appendix replicate the main findings, column (3) shows that the baseline results are robust to applying an ordered logit model because the dependent variable is ordinal, and columns (5) and (6) show that the results are robust to different combinations of control variables (family status, education and income, trust, experience with a democratic system). Figure C2 shows that the life expectancy and age patterns are very similar across these alternative specifications. Next, we add age-gender and country-period fixed effects (Table C4 and Figure C3) to demonstrate that the results are not driven by age-specific gender characteristics or country-specific time trends. Moreover, restricting attention to cross-country variation (see Figures C4 and C5 in the Appendix) does not affect the findings, suggesting that the identification approach is unlikely to be driven by time-varying third factors. The results regarding the influence of remaining years of life and age on democratic preferences also extend to alternative measures of democratic preferences that have been used previously in the literature (see Table C5 and Figures C6-C9 in the Appendix).

One challenge for identification in this context is the systematic correlation between age and remaining years of life (see Table C6 and Figure C10). This correlation is highest for the cells with high ages and low remaining life years. To investigate the sensitivity of the results with respect to potential empirical multicollinearity, we conduct several tests. Estimates of variance inflation factors for the estimates for remaining years of life obtained on the full sample do not reveal evidence for excessive multicollinearity (see Figure C11).[5] Alternatively, we analyzed restricted samples of individuals of age 60 years and younger (see Figures C12 and C13), or 40 years and younger (see Figures C14 C15). This reduced the correlation between age and remaining years of life. The sample of individuals under 60 years of age uses information for 230,502 observations from 93 countries for the World Value Survey rounds 3-6 (1994-1998, 1999-2004, 2005-2009 and 2010-2014). The correlation between age and remaining years of life is -0.876 in the sample restricted to ages $\leq$ 60. The correlation is -0.687 in the sample restricted to ages $\leq$ 40. The estimation results based on this restricted sample reveal similar patterns. Finally, even extreme multicollinearity between regressors does not violate the assumptions for unbiasedness of the coefficient estimates.

5. VIFs exceed 6, except for values of remaining years of life between 10 and 15, where they rise almost up to 8; variance inflation factors for age are below 5 throughout.

3.5 Conclusion

This study has presented novel evidence that support for democracy increases with age, but declines with expected proximity to death. This indicates that longevity plays a crucial role for the support for democracy. More experience in life in general, as reflected by a greater individual age while holding other factors fixed, is associated with more favorable attitudes toward democracy as political system. A greater individual life expectancy, as reflected by the expected remaining years of life, also implies a more favorable attitude toward democracy. These results hold above and beyond controlling for the usual macro-determinants and retrospective experiences, such as individual exposure to democratic institutions, that have been shown to affect support for democracy in the existing literature.

The results have implications for policy. Individual democratic attitudes are key for the viability of democratic regimes and these attitudes appear to be weakened by short life horizons. Many developing countries exhibit non-democratic or weak institutions, deficient health infrastructure and poor health conditions, high mortality, violent conflicts, and generally gloomy perspectives for individual lives. These conditions thus constitute a stumbling block to democratization. Increasing the life expectancy for any given age group under these conditions can be expected to contribute to the support for democracy in a country. At the same time, this would imply an increase in age for a given remaining years of life, with similar consequences for democratic attitudes.

Conversely, the results point at potentially detrimental consequences of declining life expectancy for the support for democracy. In developing countries, falling life expectancy as consequence of epidemics or conflicts is predicted to undermine popular support for democracy. Our study also raises a note of caution for developed countries in which life expectancy has been stalling recently (Xu et al., 2016). In light of considerable heterogeneity in the projections of life expectancy across developed and developing countries (Kontis et al., 2017) the findings suggest the possibility of heterogeneous prospects for the popular support for democracy across the world. The results also provide a new aspect to ongoing discussions about the stability of democracy in aging societies, which has largely focused on policies (Lee and Mason, 2011; Goldstone, Kaufmann, and Duffy Toft, 2012), but less on the public support for the political system at large. By highlighting the potential effects of health improvements on support for democracy our results provide a novel perspective on the potential outcomes of health interventions and improved health infrastructure.

Future work is needed to address the link between political attitudes and institutions as well as the link between life expectancy and future orientation to corroborate the policy relevance of our results. In this respect, our study addresses two important

points that deserve more attention. First, while the importance of individual attitudes toward democracy for the political system has been emphasized previously (Fuchs-Schündeln and Schündeln, 2015), more evidence is needed to establish the link between individual support for democracy and the emergence and stability of democratic institutions. Second, while remaining years of life is likely to be a critical determinant of future orientation by affecting the life horizon of an individual, direct evidence for this link is scarce. Some recent work on time preferences suggests that life expectancy indeed affects individual future orientation in terms of patience and time preference (Falk et al., 2015). More work is needed to establish this link at the individual level and to uncover the causal pathways by which age and remaining life expectancy affect attitudes toward democracy.

Appendix C.1: Data Sources and Sample Preparation

C.1.1 World Value Survey

The primary data source for the empirical analysis is survey information from the World Value Survey (WVS) available at `www.worldvaluessurvey.org`. The variables of main interest regarding preferences for democracy are contained in survey rounds 3-6 (1994-1998, 1999-2004, 2005-2009 and 2010-2014). The analysis is conducted using an unbalanced panel of all 93 countries for which information is available for the relevant questions regarding individual attitudes toward democracy. This panel data set comprises 267,426 individual responses. The relevant WVS questions read:

E117: "I'm going to describe various types of political systems and ask what you think about each as a way of governing this country. For each one, would you say it is a very good, fairly good, fairly bad or very bad way of governing this country? Having a democratic political system"

- 1: Very good
- 2: Fairly good
- 3: Bad
- 4: Very bad

To facilitate the interpretation, the responses to this question have been recoded by reversing the scale as 5-*i*, so that in the empirical analysis the responses are:

Attitude toward Democracy: Having a democratic political system

- 1: Very bad
- 2: Bad
- 3: Fairly good
- 4: Very good

The analysis is focused on question E117 because it it available for most survey rounds. In the robustness analysis, the following alternative questions have been used:

E114: "I'm going to describe various types of political systems and ask what you think about each as a way of governing this country. For each one, would you say it is a very good, fairly good, fairly bad or very bad way of governing this country? Having a strong leader who does not have to bother with parliament and elections"

- 1: Very good

- 2: Fairly good
- 3: Bad
- 4: Very bad

E123: "I'm going to read off some things that people sometimes say about a democratic political system. Could you please tell me if you agree strongly, agree, disagree or disagree strongly, after I read each one of them?
Democracy may have problems but it's better than any other form of government" (reversed scale)

- 0: Strongly disagree
- 1: Disagree
- 2: Agree
- 3: Strongly agree

E235: "How important is it for you to live in a country that is governed democratically? On this scale where 1 means it is "not at all important" and 10 means "absolutely important" what position would you choose?"

- 1: Not at all important
- ...
- 10: Absolutely important

IW-Index: Inglehart and Welzel index created based on questions E114, E116, E117 and E123. It ranges from -6 (pro-autocracy) to +6 (pro-democracy).

Table C1: Summary Statistics: Outcome Variables

	Mean	Std. Dev.	Min	Max	N
E117	3.35	0.74	1	4	267,426
E114	2.76	1.03	1	4	253,469
E123	2.24	0.74	0	3	99,833
E235	8.45	2.02	1	10	144,461
IW-Index	2.72	2.24	-6	6	89,748

C.1.2 UN Life Tables

Expected remaining years of life is constructed using life expectancy at exact age x (years), $e(x)$, from UN Life Tables provided by the United Nations, Department of

Economic and Social Affairs, Population Division (2015). *World Population Prospects: The 2015 Revision.* The variable is defined as "average number of remaining years of life expected by a hypothetical cohort of males/females alive at age x who would be subject during the remaining of their lives to the mortality rates of a given period." The variable is available at the country level in 5-year intervals and for 5-year age brackets, separately by gender. The data were matched to the corresponding WVS waves [6] for 5-year age brackets, which we match to the age reported in the WVS. We could not match data for the following countries, which are covered in the WVS: Andorra, Taiwan (both not available in UN Life Tables) and Serbia and Montenegro (covered as individual countries in UN Life Tables).

C.1.3 Countries Included and Summary Statistics

The sample for our baseline regression comprises all 93 countries contained in the WVS. Countries that could not be matched with the UN Life Tables were eliminated from the sample. This applies to the following countries: Andorra, Taiwan (both not available in UN Life Tables) and Serbia and Montenegro (covered as individual countries in UN Life Tables). As robustness checks we conducted the same analysis with different dependent variables. For these regressions the composition of the sample depends on the availability of data for the dependent variable (see Table C1). Further robustness analysis has been conducted for a sample of cross-sectional data from WVS round 6 (2010-2014) for 58 countries.[7]

Table C2: Summary statistics: explanatory variables (used in baseline specification)

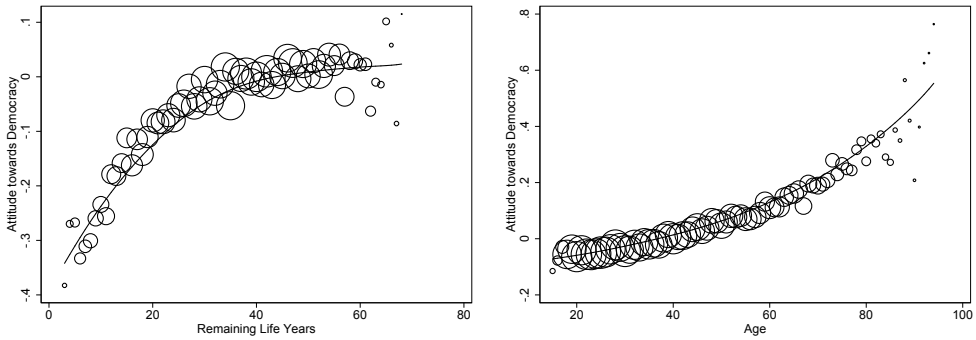
	Mean	Std. Dev.	Min	Max	N
Remaining years of life	35.91	13.73	2	68	267,426
Age	40.68	16.06	15	97	267,426
Gender	0.49	0.50	0	1	267,426
Children	0.72	0.45	0	1	267,426
Most people can be trusted	0.26	0.44	0	1	256,534
Education	4.78	2.22	1	8	250,941
Income Steps	4.69	2.31	1	10	246,655
Democratic capital by age (PolityIV)	12.76	11.04	0	37	242,125

6. Wave 3: 1995-2000, Wave 4: 2000-2005, Wave 5: 2005-2010, Wave 6: 2010-2015.

7. Argentina, Armenia Australia, Azerbaijan, Bahrain, Belarus, Brazil, Chile, China, Colombia, Cyprus, Ecuador, Egypt, Estonia, Georgia, Germany, Ghana, Hong Kong, India, Iraq, Japan, Jordan, Kazakhstan, Kuwait, Kyrgyzstan, Lebanon, Libya, Malaysia, Mexico, Morocco, Netherlands, New Zealand, Nigeria, Pakistan, Palestine, Peru, Philippines, Poland, Romania, Russia, Rwanda, Singapore, Slovenia, South Africa, South Korea, Spain, Sweden, Thailand, Trinidad and Tobago, Tunisia, Turkey, Ukraine, United States, Uruguay, Uzbekistan, Yemen, Zimbabwe.

Appendix C.2: Cell Frequencies

Figure C1. Determinants of subjective attitude toward democracy

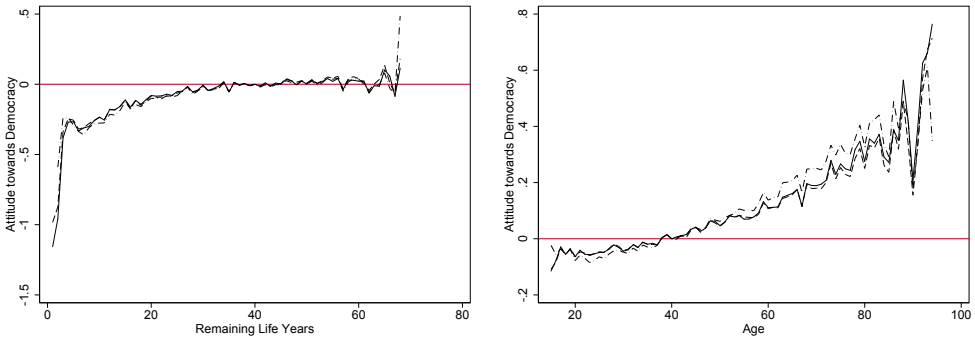


(a) Effect of remaining years

(b) Effect of age

Appendix C.3: Alternative Specifications

Figure C2. Comparison of sepcifications



(a) Effect of remaining years

(b) Effect of age

Main specification (solid line), main specification with democratic capital as control (dashed line), main specification with democratic capital, children, marital status, trust, education dummies and income dummies as controls (dotted line).

Table C3: Effect of remaining years of life on democratic attitudes: parametric estimates

	(1) Full	(2) Age<60	(3) O Logit	(4) Full	(5) Full
Remaining Years	0.0137***	0.0154***	0.0376***	0.0129***	0.0145***
	(0.0033)	(0.0035)	(0.0088)	(0.0035)	(0.0038)
Remaining Years^2	-0.000137***	-0.000134***	-0.000368***	-0.000119***	-0.000140***
	(0.0000)	(0.0000)	(0.0001)	(0.0000)	(0.0000)
Democratic Capital				0.00448***	0.00412***
				(0.0011)	(0.0012)
Country FE	✓	✓	✓	✓	✓
Age FE	✓	✓	✓	✓	✓
Gender FE	✓	✓	✓	✓	✓
Survey round FE	✓	✓	✓	✓	✓
Children					✓
Marital Status					✓
Trust					✓
Education					✓
Income					✓
R^2	0.08	0.08		0.08	0.10
N	267,426	230,502	267,426	242,125	198,026
Cluster	2,909	1,966	2,909	2,613	2,455

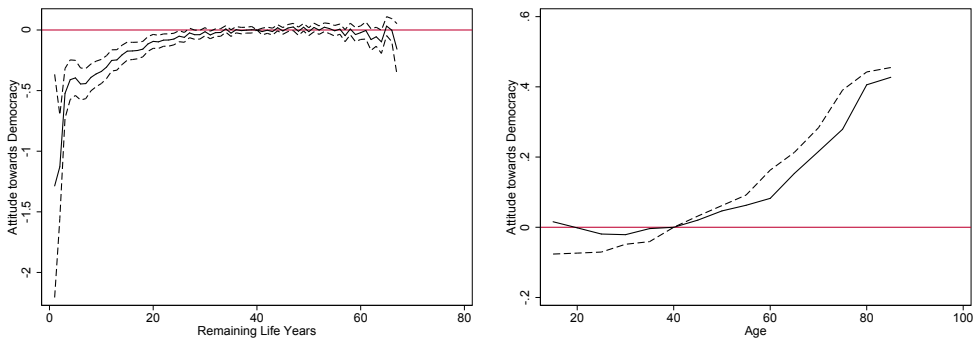
Standard errors (clustered by Country-Agegroup-Gender-Survey Round groups) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table C4: Effect of remaining years of life on democratic attitudes: More flexible specifications

	(1)	(2)	(3)
Remaining Years	0.00767***	0.0247***	0.0187***
	(0.0022)	(0.0036)	(0.0025)
Remaining Years^2	-0.0000940***	-0.000260***	-0.000213***
	(0.0000)	(0.0000)	(0.0000)
Country FE	✓	✓	✓
Age group FE	✓	✓	✓
Gender FE	✓	✓	✓
Survey round FE	✓	✓	✓
Survey round x Country FE	✓		✓
Age group x Gender FE		✓	✓
R^2	0.09	0.08	0.09
N	267,426	267,426	267,426
Cluster	2,909	2,909	2,909

Standard errors (clustered by Country-Agegroup-Gender-Survey Round groups) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Figure C3. Extended specification including interactions of fixed effects

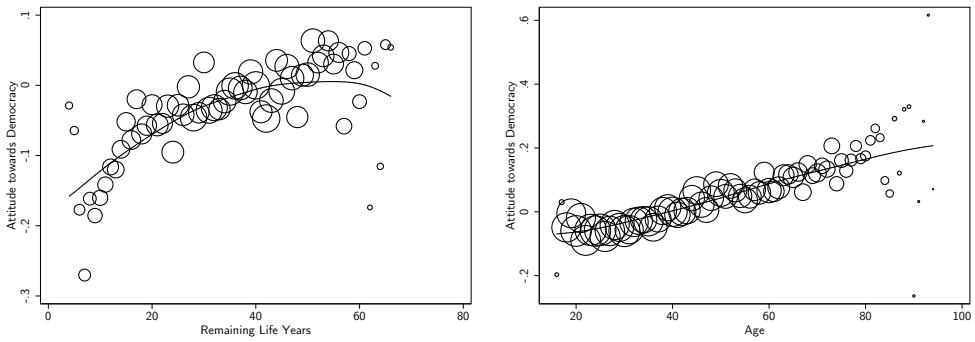


(a) Effect of Remaining Years

(b) Effect of Age for Men (dashed) and Women (solid)

Appendix C.4: Cross-Sectional Results

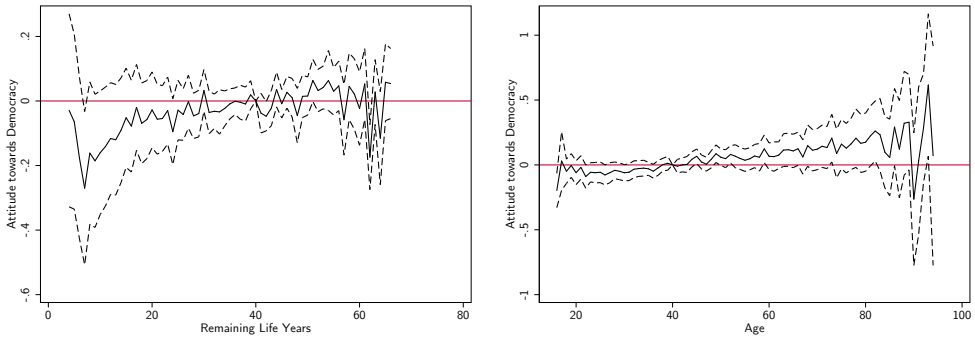
Figure C4. Cross-sectional analysis



(a) Effect of remaining years

(b) Effect of age

Figure C5. Cross-sectional analysis



(a) Effect of remaining years

(b) Effect of age

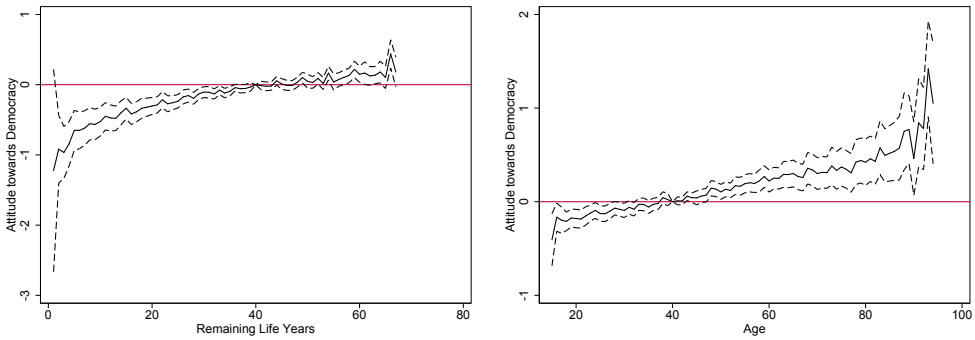
Appendix C.5: Other Outcomes

Table C5: Effect of remaining years of life on democratic attitudes: alternative measures of democratic attitudes

	(1) E117	(2) E114	(3) E123	(4) E235	(5) IW Index
Remaining Years	0.0185***	0.0223***	0.0228***	0.0177**	0.0229***
	(0.0044)	(0.0050)	(0.0066)	(0.0059)	(0.0053)
Remaining Years^2	-0.000185***	-0.000140***	-0.000194*	-0.000245***	-0.000187***
	(0.0000)	(0.0000)	(0.0001)	(0.0000)	(0.0001)
Country FE	✓	✓	✓	✓	✓
Age FE	✓	✓	✓	✓	✓
Gender FE	✓	✓	✓	✓	✓
Survey round FE	✓	✓	✓	✓	✓
R^2	0.08	0.14	0.10	0.08	0.20
N	267,426	253,469	99,833	144,461	89,748
Cluster	2,909	2,903	1,181	1,610	1,160

Dependent variables are standardized (mean 0 and standard deviation 1) to facilitate comparison of coefficients. Standard errors (clustered by Country-Agegroup-Gender-Survey Round groups) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

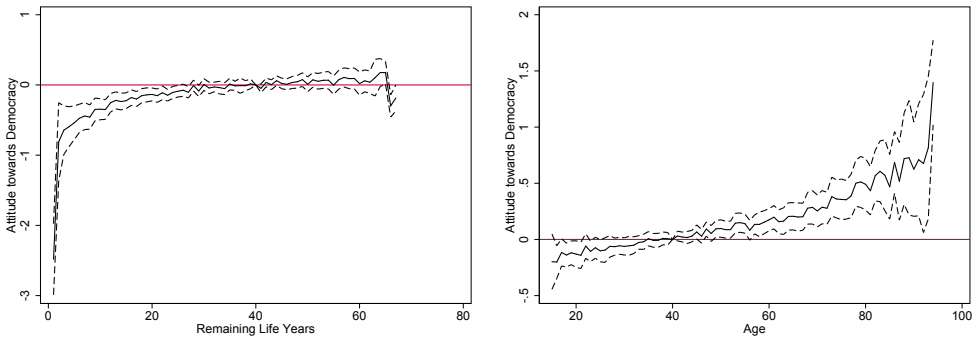
Figure C6. Outcome variable: E114 (Strong leader)



(a) Effect of remaining years

(b) Effect of age

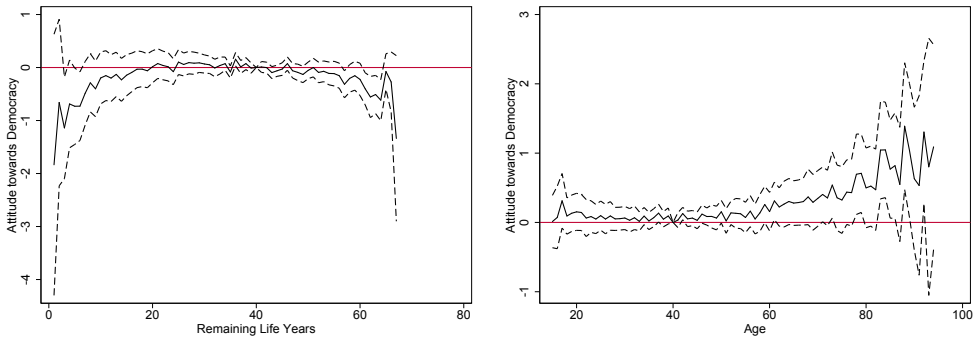
Figure C7. Outcome variable: E123 (Democracy may have its problems but is better than other forms of government)



(a) Effect of remaining Years

(b) Effect of age

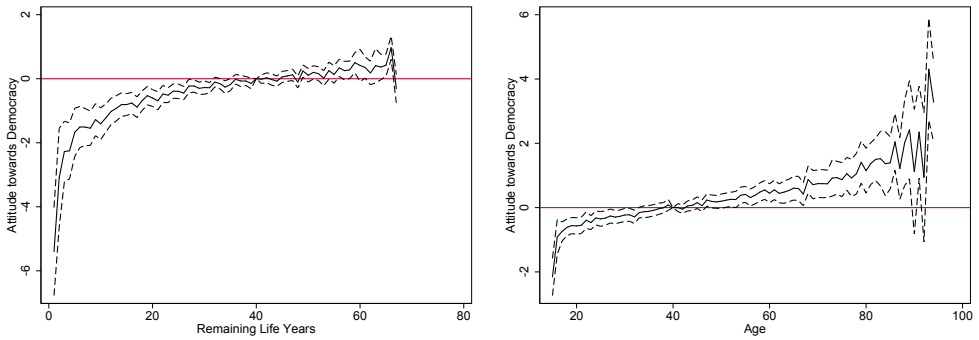
Figure C8. Outcome variable: E235 (Importance of democracy)



(a) Effect of remaining years

(b) Effect of age

Figure C9. Outcome variable: IW Index



(a) Effect of remaining years

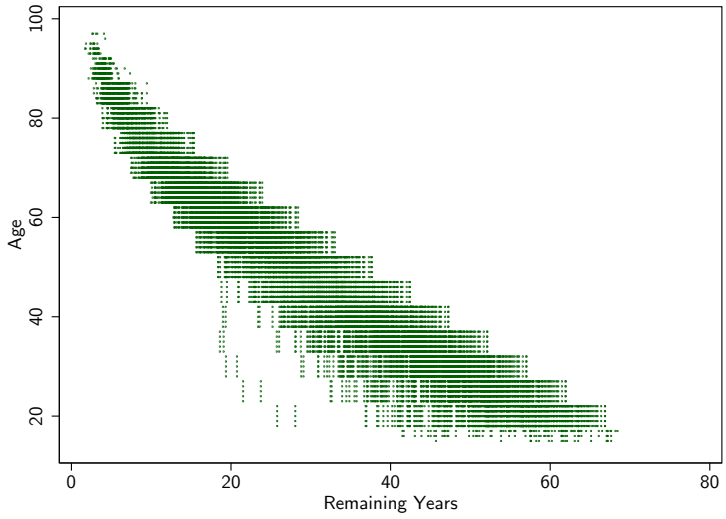
(b) Effect of age

Appendix C.6: Correlation between age and remaining years of life

Table C6: Correlation between age and remaining years of life

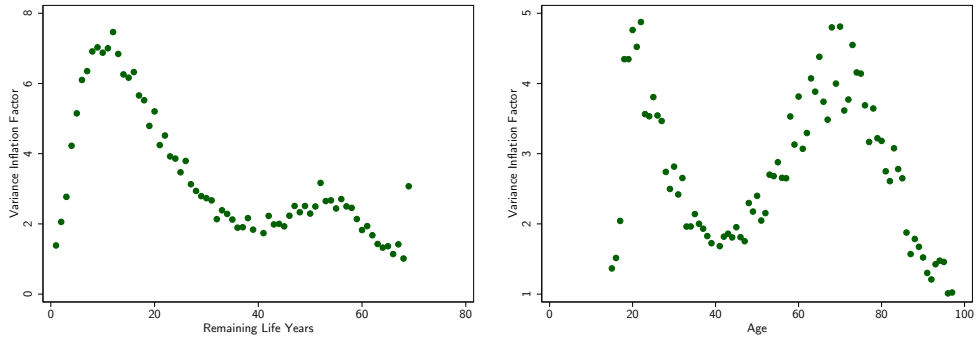
	(1) Age	(2) Age<60	(3) Age<40
Remaining years of life	-0.925	-0.876	-0.687

Figure C10. Correlation between age and remaining years of Life



C.6.1 Variance Inflation Factors

Figure C11. VIFs: full sample

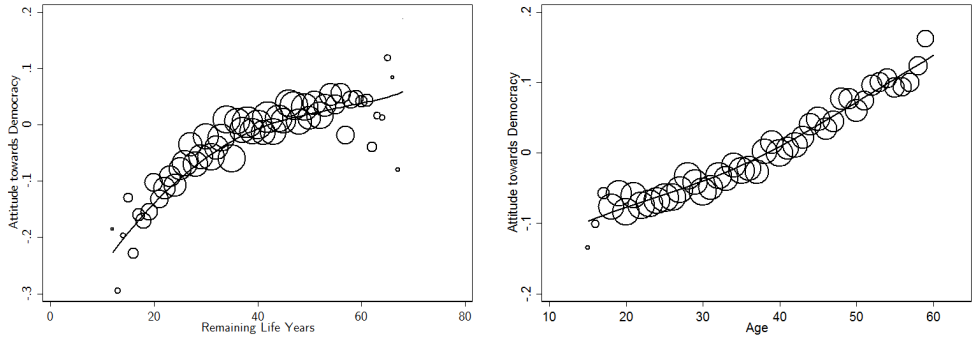


(a) VIFs for remaining years

(b) VIFs for age

C.6.2 Estimations for Subsamples

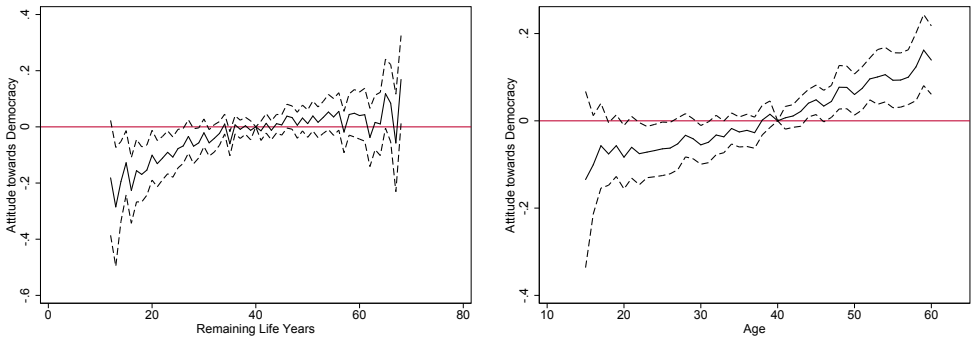
Figure C12. Subsample: under 60 years old



(a) Effect of remaining years

(b) Effect of age

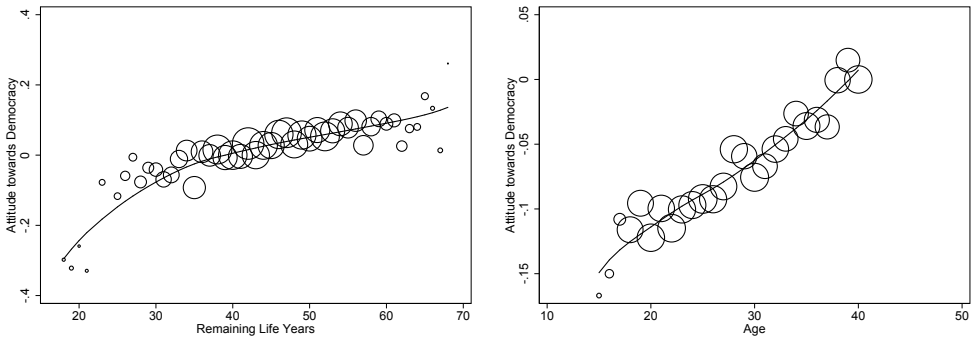
Figure C13. Subsample: under 60 years old



(a) Effect of remaining years

(b) Effect of age

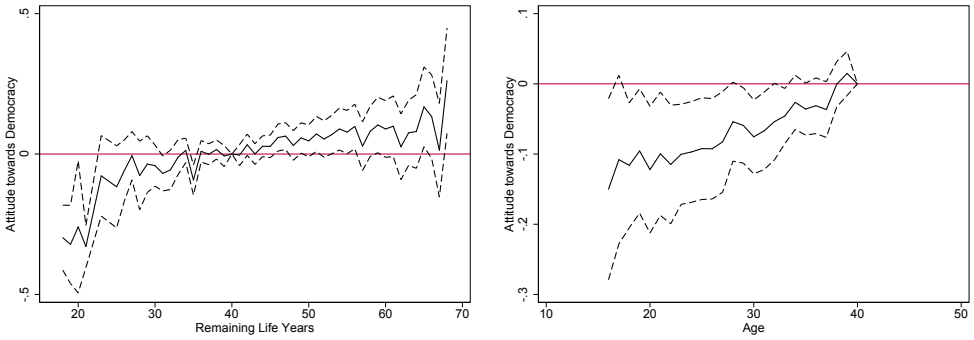
Figure C14. Subsample: under 40 years old



(a) Effect of remaining years

(b) Effect of Age

Figure C15. Subsample: under 40 years old



(a) Effect of remaining years

(b) Effect of age

4

HEALTH ON THE NILE: THE CURSE OF LIVING DOWNSTREAM

4.1 Introduction

Urbanization and industrialization characterize economic development worldwide. Standards of living seem to be higher in urban and industrial areas, which promise job opportunities, better infrastructure and public good provision. Therefore many people are attracted to these areas. But one important downside of urbanization and industrialization is pollution. This is particularly problematic in developing countries as the institutional framework is usually weak and environmental regulation is not enforced. Industrial wastewater and sewage containing toxic substances are often discharged into rivers. Hence, water pollution is a particular concern associated with high population density and industrial activity. The WWF calls it "one of the most serious ecological threats we face today" (WWF, 2017) and the WHO estimated that more than 360,000 children under 5 years die due to diarrhea, as a result of poor access to clean water, sanitation, and hygiene (WHO, 2017c).

Water pollutants are spread by moving water, and so the flow of rivers through cities and past industrial plants determines which households are affected by polluted water. We use this quasi-experimental variation in exposure to pollutants and examine the effect of pollution on children's health. We construct a novel panel dataset based on geocoded DHS survey data between 1992 and 2014, geocoded factory locations and finely gridded population density in Egypt. We aggregate this data for 75 segments along the Nile. We then estimate the effect of population density and the existence of a factory on the health of children living up- or downstream of the pollutant. Further, we use information on the opening year of factories. We are thus able to exploit temporal and spatial variation in water pollution and to hold region and time specific

factors constant.

We find a negative effect of urbanization (measured by population density) and factory presence on health for the downstream population whereas we do not find a negative health effect on the upstream population. This differential health effect is most likely caused by water pollution and suggests that factories and agglomerations emit pollutants into the Nile, which worsen health outcomes. The effect does not seem to be driven by sorting as we do not find differential wealth effects. Further results show that the negative health impact of urban and industrial areas can be mitigated by access to clean drinking water. Moreover, we find that in the case of urbanization the negative health effect is localized and vanishes with increased distance between the pollutants and the population. In contrast, we find evidence that cumulative industrial pollution over several upstream grids still has detrimental health effects. This is due to the different nature of pollutants. While industrial pollution is to a large extent persistent due to its chemical composition, pollution caused by agglomerations degrades more rapidly.

With this study we contribute to a large body of literature, which links water pollution to poor health outcomes in developing countries. First, we add methodologically to the existing literature. Based on our unique dataset we exploit both spatial and temporal variation in pollution and are therefore able to deal with potential endogeneity issues, as for instance systematic differences between upstream and downstream location and time-specific shocks. Second, we directly examine the health effects of the two most important pollutants, urban areas and industrial plants. Third, our study adds a highly relevant case, namely the Nile in Egypt, to the body of literature. Moreover, while most other studies linking water pollution to poor health outcomes only focus on specific cases we provide an extensive analysis of the effects along the entire course of the Nile river in Egypt.

There are a few papers that are methodologically related to our approach analyzing differential effects on the population depending on the relative location to the pollutant. Duflo and Pande (2007) compare agricultural productivity and vulnerability to rainfall shocks in Indian districts downstream of a dam with other districts. They thereby assume that people living downstream of a dam tend to benefit while those living in the vicinity or upstream do not. Garg et al. (2016) show for Indonesia that human bathing in upstream villages increases diarrheal incidence, while bathing of downstream villages has no effect. Romero and Saavedra (2016) examine health effects of mines in Columbia and find that while mothers living in the vicinity of a mine are positively affected, mothers living downstream from a mine are negatively affected.

Methodologically less related but relevant in the context of water pollution is a study by Brainerd and Menon (2014), who show that water quality has an effect on infant

and child health in India, exploiting seasonal and geographic variation in the use of fertilizers. Greenstone and Hana (2014) also focus on India and study the impact of environmental regulations on infant mortality. They find however no significant effect of water regulations. Ebenstein (2012) uses variation in water pollution across river basins in China and shows that lower water quality is associated with a higher digestive cancer death rate. Galiani, Gertler, and Schargrodsky (2005) find that water privatization in Argentina decreases child mortality using variation in ownership of water provision across time and space. Another strand of literature deals with the effects of water pollution on other outcomes such as labor productivity. A recent study by Zhang and Xu (2016) finds for example a positive effect of a water treatment program in China on education. Zivin and Neidell (2013) provide an overview over quasi-experimental evidence on the negative effects of pollution on individual well-being in general and Currie et al. (2014) provide an overview over the literature about early-childhood exposure to pollution and health and human capital outcomes later in life. This literature predominantly finds significantly negative effects of water pollution on health and human capital. While our study confirms this relationship for the case of Egypt it goes beyond the existing literature by studying two of the most hazardous pollutants, agglomerations and industrial plants.

Egypt provides an ideal setting to study health effects of water pollution. The Nile river is the country's only major river and around 90% of Egyptians live in the Nile valley and are thus directly or indirectly affected by polluted water. The Nile is the 'life artery' of Egypt and constitutes the most important freshwater resource for almost all water demands. The Nile water can thus reach human organisms through fishing, irrigation, the groundwater (which is for instance used for washing) and even as drinking water. The Nile's water quality has been deteriorating over several decades due to the disposal of industrial effluents and human sewage (Wahaab and Badawy, 2004; El-Ayouti and Abou-Ali, 2013; Ali et al., 2014; Abdel-Satar, Ali, and Goher, 2017). Abdel-Satar, Ali, and Goher (2017) document spatial differences in the measured water quality of the Nile, which reflect "combinations of natural and human activities". In our study we focus on industrial activities and urbanization, which generate industrial wastewater and human sewage that are often disposed into the Nile. Water pollution is a serious concern as around 40% of the Egyptian population does not have access to 'safely managed'[1] sanitation (WashWatch, 2017), which fosters the transmission of diarrhoeal diseases. These diseases are particularly dangerous for children, who are extremely sensitive to dehydration and the related loss of electrolytes (WHO, 2017a). According to UNICEF, diarrhea is the second leading cause of death among under 5 year old children in Egypt (3,500 to 4,000 under 5 year old children die of diarrhea every year (UNICEF, 2017)). Egypt thus constitutes a com-

1. 'Safely managed' sanitation refers to improved sanitation facilities that are not shared with other households and where excreta are safely disposed of in site or transported and treated off site.

pelling case to study the hazardous effects of water pollution on children's health.

4.2 Health Impact of Industrial and Urban Water Pollution

Water pollutants can be broadly classified into biodegradable and non-biodegradable pollutants. Biodegradable pollutants consist of organic matter that is broken down into simple organic molecules by natural agents like water, oxygen and microorganisms. These molecules eventually return into the environment.[2] However, the speed rate of the degradation process differs strongly by material (e.g. paper towels naturally take approximately 1-2 weeks whereas a plastic bottle takes 100 years to biodegrade). At the extreme, non-biodegradable substances are entirely resistant to natural degradation processes - they are environmentally persistent and bioaccumulate.

So called Persistent Organic Pollutants (POPs) constitute a great environmental concern. These materials are widely resistant to natural degradation processes and are particularly toxic to living organisms (Schwarzenbach et al., 2010).[3] POPs are used in agriculture, manufacturing and industrial processes (e.g. fertilizers) but can also emerge unintentionally as by-products of industrial production (e.g. dioxins in textile production) (Krizanec and Le Marechal, 2006).

Urban sewage mainly consists of "raw sewage" containing excrement and debris (e.g. sanitary towels or plastic). However, in developing and emerging economies the organic part of urban sewage like bacteria, parasites as well as viruses constitute the major health concern (Schwarzenbach et al., 2010). Diseases caused by the respective bacteria and viruses can involve gastro-enteritis, diarrhea, typhoid, cholera, but also respiratory diseases like the Acute Severe Respiratory Syndrome (SARS) involving heavy cough as major symptom (Feachem et al., 1983). An important cause of waterborne illness is the Escherichia coli bacterium that is commonly found in intestines of humans and animals. Five groups of pathogenic excreted viruses are particularly important: adenoviruses, enteroviruses (including poliovirus), hepatitis A virus, reoviruses and diarrhea causing viruses (especially rota virus).

In contrast, the dominant pollutants in industrial sewage are non-degradable pollutants such as POPs. They constitute around 95% of industrial effluents in Egypt (Dahshan et al., 2016) and have hazardous effects on human health (WHO, 2017b). The most toxic are so called dioxins and dioxin-like compounds (Krizanec and Le

2. The level of organic pollution is measured by the biochemical oxygen demand (BOD). Two counteracting effects determine the BOD: The organic pollution load and natural cleaning.

3. The POP 'Dirty Dozen' are aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, toxaphene, polychlorinated biphenyls (PCBs), dioxins and furans. POPs have been subject of two international environmental treaties, the Stockholm Convention on Persistent Organic Pollutants (2004) and the Aarhus Protocol (1998).

Marechal, 2006).[4] Dioxins are considered to have detrimental effects on the immune system making people more vulnerable to acute infections. Further, they can damage the gastrointestinal tract, organs and the reproductive system. In industrialized countries the use of many of these substances in production processes is forbidden and particular technologies are in place to destroy material containing POPs. Developing and emerging economies however often lack regulations and funds to pursue consequent environmental strategies to combat POPs. Industrial waste water may also contain harmful components of inorganic pollutants including heavy metals like lead, cadmium, mercury and arsenic. The related health effects are however expected to unfold after long-term exposure and often only emerge later in life. Given our research design we are not able to detect these effects.

4.3 Data

Our analysis is based on a panel data set of 78 river segments and 7 time periods between 1992 and 2014. The spatial dimension of the dataset is based on equally spaced 10x10 square kilometer grids along the course of the Nile. We include grids, whose center is located within a radius of 30km from the river line. This captures the entire Nile valley and thereby the vast majority of Egypt's population as only few people live in the desert regions beyond the Nile valley. In addition we create a subsample, which only includes grids that intersect with the Nile. In Egypt the Nile runs relatively straight from its southern border with Sudan northwards into the Mediterranean Sea. Accordingly, we group grids by latitude. Employing this strategy, we obtain 78 horizontal river segments (see Figure 1). We exclude the Nile delta, as the river disperses into multiple arms so that the population may be affected by polluted water from several sources and a clear assignment is not possible anymore. The temporal dimension of the dataset is determined by the availability of DHS survey waves for Egypt. All, factory-, population density and household DHS data contain geographic coordinates. We use geospatial software to aggregate all data for each segment.[5]

To assess health outcomes of children we use data from the Demographic and Health Survey. The survey is conducted by USAID and collects detailed health and demographic data for a wide range of developing countries. For Egypt there are seven survey rounds available that contain geographic coordinates of the surveyed households for the years 1992, 1995, 2000, 2003, 2005, 2008 and 2014.[6] We employ data from

4. The main groups of dioxins are polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs). Polychlorinated biphenyl (PCB) are also chlorinated hydrocarbons with a similar structure as dioxin (Umweltbundesamt, 2018).

5. Following, we use the terms segment and grid interchangeably, referring to the 78 horizontal segments along the Nile.

6. In order to ensure respondent confidentiality, the longitude/latitude information are randomly dis-

the survey's 'Individual Recode' asking women about their own and their children's health. Accordingly, for data on children's health we use questions asking whether any child had diarrhea (H11), fever (H22) or cough (H31) during the two-week period before the survey. We construct binary variables (0 indicating that no child had the respective illness and 1 indicating that at least one child suffered from the illness) and combine them to a one-dimensional health index by taking the average of the three measures.[7]

We also construct a wealth index for each of these households (DHS only provides a wealth index from 2003 onwards). The DHS index is based on households' ownership of selected assets. We follow the same methodology and take the first principal component of the following survey items, which are covered in all surveys since 1992: type of toilet facility (dummy variables), possession of radio, TV, refrigerator, bicycle and electricity and type of floor material (dummy variables). Our newly constructed index highly correlates with the index provided by DHS for rounds 2003-2014 (correlation coefficient: 0.8). For ease of interpretation we normalize the measure to scale the range in [0, 1].

In addition we examine sub-samples with respect to the source of drinking water. The indicator variable turns 1 if drinking water is piped into dwelling and remains 0 if public taps, the Nile, wells and springs are the household's source of drinking water.

We thus obtain information on children's health and household characteristics for 2500 households in 1992 and up to 4400 households in 2014 along the Nile river grid, which amounts to 23,700 households in total. These households are grouped into 3200 clusters , which are georeferenced (the points in Figure 4.1 represent the clusters).[8] Finally, we aggregate the health data to the river segment level, which leaves us with data on children's health for 78 segments at 7 points in time. We observe on average 22 DHS clusters per year and river segment.[9]

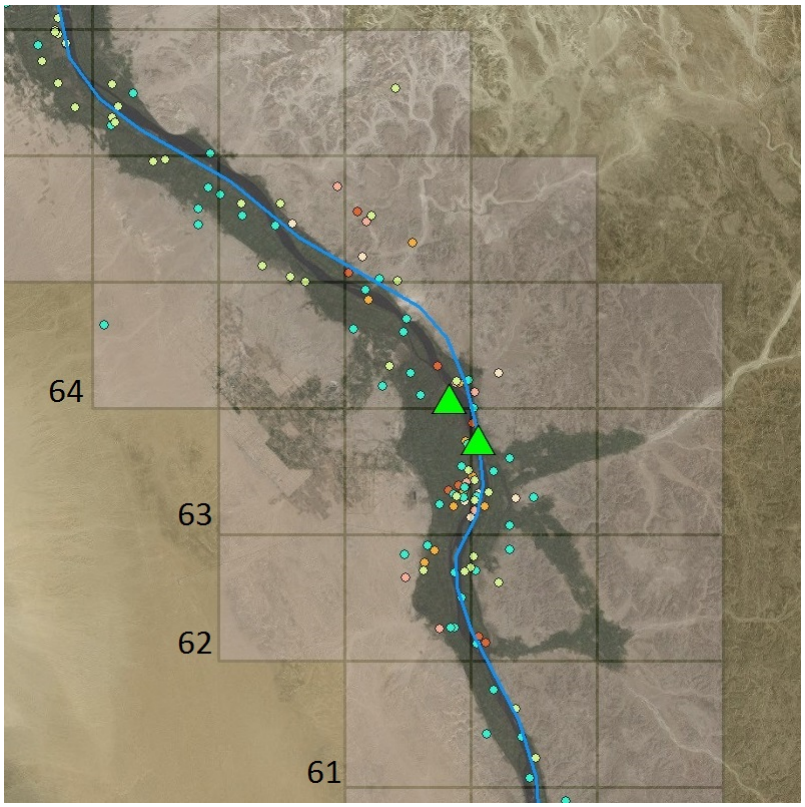
placed. "Urban clusters contain a minimum of 0 and a maximum of 2 kilometers of error. Rural clusters contain a minimum of 0 and a maximum of 5 kilometers of positional error with a further 1% of the rural clusters displaced a minimum of 0 and a maximum of 10 kilometers" (http://dhsprogram.com/What-We-Do/GPS-Data-Collection.cfm). Given that our segments span around 40 x 10 kilometers there should only be few cases in which a DHS cluster is mistakenly allocated to the previous or subsequent segment. In these cases we only introduce random noise and measurement error, which would bias our results towards zero.

7. We also construct an alternative health index based on the first principal component. The correlation is 0.999 and we therefore use the former index, which is easier to interpret.

8. 242 clusters in 1992, 433 clusters in 1995, 395 clusters in 2000, 391 clusters in 2003, 614 clusters in 2005, 530 clusters in 2008 and 724 clusters in 2014.

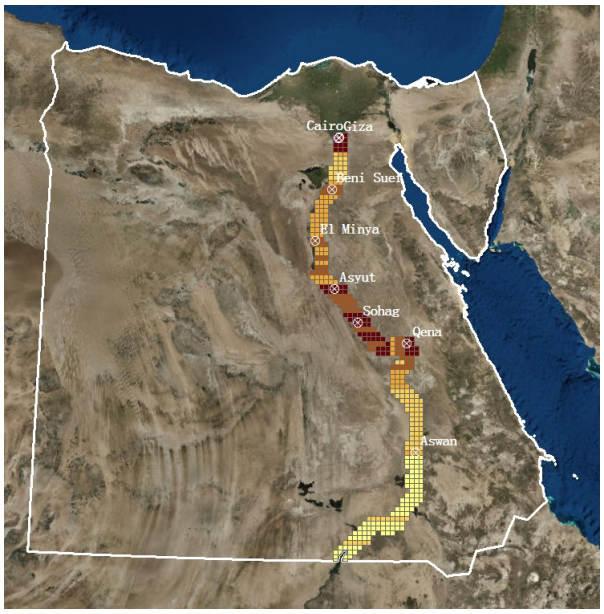
9. The median number of grids per year and river segment is 9.

Figure 4.1. Nile river grid and DHS cluster



In our main specification we use population density data as a continuous measure for the level of urbanization in each grid. Data on population density on a 2.5 arc-minutes grid is obtained from the Gridded Population of the World Database (v3) provided by the Socioeconomic Data and Applications Center (SEDAC). The data provides estimates of population density based on counts consistent with national censuses and population registers in 5 year intervals. To match the years to our DHS waves, we take the value closest to the respective DHS year. We then also aggregate them to the river segment level. As the population is concentrated around the Nile and the fringes of the Nile valley are sparsely inhabited, the highest rather than average population density in each segment is the relevant measure to determine the extent of pollution. In an additional specification we use cities as binary measure for urbanization. Cities are defined by the "World Cities Database" and we focus on Egyptian cities with at least one million inhabitants along the Nile (ordered by total population: Cairo/Giza, Asyut, Aswan, Minya, Beni Suef, Quena, Sohag).

Figure 4.2. Nile river grid



Finally, we use data on plant establishment to measure industrialization. Data on industrial plants comes from the "Plants Database" of Industrial Info Resources, a provider of global market intelligence. The database tracks the 368 most important industrial facilities in Egypt.[10] The data provides geographic coordinates as well as

10. Plants are considered 'important' if they qualify for industry-specific criteria, e.g. mines with capacity of 250.000 tons per anum and greater.

opening and closing dates, which enables us to conduct comparisons of health outcomes across both, space and time. To the best of our knowledge this is the first time this data is used for scientific purposes in the context of analyzing health effects of industrialization. We select all 65 plants, which are located within our grid. The industry types represented in our sample involve power plants, chemical processing, metals and minerals, and pulp, paper and wood production. The Nile provides approximately 65 percent of the industrial needs for fresh water used in the production process and receives approximately 57 percent of industrial effluents. It has been shown that industries in our sample produce toxic wastewater with detrimental effects on human health (Megahed et al., 2015; Balabanič et al., 2017). An indicator variable denotes whether there existed a plant in a river segment at a certain point in time. Summary statistics on all variables of interest are provided in Table 4.1.

Figure 4.3. Factories along the Nile in Egypt

4.4 Urbanization

4.4.1 Empirical Framework

To estimate the effect of urbanization on children's health we exploit variation in population density across space. Although we use our panel dataset spanning seven time periods, the variation in population density mainly stems from spatial differences whereas there is relatively little idiosyncratic variation in population density over time. We estimate the effect of population density upstream of grid i on the

Table 4.1: Summary statistics

	Mean	SD	Min	Max	Obs
Health Index	0.72	0.12	0	1	459
Wealth Index	0.67	0.14	0	1	459
Population Density (in 10K per sqkm)	0.25	0.45	0	4	539
Factory (binary)	0.23	0.42	0	1	539
Cumulative Popualtion Density (weighted)	0.06	0.05	0	0	539
Cumulative Factory Presence (weighted)	0.06	0.06	0	1	539
Population share with access to piped water	0.73	0.24	0	1	459
Distance along Nile (from south to north)	481.03	286.03	0	921	539

health index in grid i. To control for neighboring population density with potential spill-over effects we also control for population density downstream of the respective grid. At the same time this serves as an important placebo check. According to our assumption that water pollution affects upstream and downstream population differentially we do not expect strong health effects for population living upstream of the pollutant. Population density in the same grid is an important control variable as it is correlated with population density in the previous and following grids and may affect health in grid i. We thus estimate the following model in order to identify the effect of upstream population density on health:

$$Health_{it} = \alpha + \beta Pop\ Density^{U}_{it} + \delta Pop\ Density^{D}_{it} + \sigma_r + \sigma_t + \epsilon_{it} \tag{4.1}$$

$Health_{it}$ denotes the health index in grid i at time t, $Pop\ Density^{U}_{it}$ is the population density in the grid directly upstream of grid i at time t and β therefore constitutes the coefficient of interest. $Pop\ Density^{D}_{it}$ is the population density downstream of grid i at time t. By including $Pop\ Density^{D}_{it}$ we are able to take advantage of the quasi-experimental setting that only upstream pollution affects health in grid i while downstream pollution should have no negative effect. Further, we use DHS wave fixed effects, σ_t, to capture common time trends in urbanization and health. We also include 10 region fixed effects, σ_r, to compare households within the same subnational administrative unit, which are exposed to the same institutional, economic, and cultural environment. In additional specifications we include distance along the Nile and population density in grid i as control variables. Distance along the Nile is measured from the southern border of Egypt and constitutes an important control variable that captures linear trends along the Nile such as downstream increases in cumulative pollution or factors related to the distance from Cairo. Finally, we also show that our results are robust to including region-year fixed effects to control for

all region-specific changes over time such as changes in health legislation or enforcement of regulations. This specification uses the variation in population density as pollutant most efficiently as it captures the localized effects. Section 4.6 presents results for a cumulative measure of population density.

The correlation between population density in two contiguous grids is however rather high (0.72) and therefore multicollinearity may be an issue when estimating OLS. The coefficients would not be biased but standard errors tend to be very high in the presence of multicollinearity. Estimates of variance inflation factors for the estimates for $Pop\ Density_{it}^{D}$ and $Pop\ Density_{it}^{U}$ are however below 5 and thus do not reveal evidence for excessive multicollinearity. In the baseline specification we cluster standard errors at the grid level. To more precisely account for both, cross-Sectional spatial correlation and location-specific serial correlation we conduct robustness checks using Conley standard errors with a spatial HAC correction (Conley, 1999; 2008).[11] Spatial autocorrelation is assumed to linearly decrease with distance up to a cutoff of 100 km and we account for serial correlation across all seven time periods.

Our main identifying assumption is that upstream population density is uncorrelated with unobserved factors that are correlated with health and that affect the down- and upstream population differentially. We use data on upstream polluting behavior rather than data on local pollution levels and are therefore not relying on correlating local pollution with local health outcomes - in fact we even control for local population density and thereby capture all factors associated with both local level of urbanization and local health.

The inclusion of downstream population density as a placebo check rules out all concerns related to urbanization effects besides water pollution (such as working conditions in cities, health care provision, air pollution, risk of contagion). If water pollution is a relevant channel downstream population density should not affect health. A remaining concern threatening our identifying assumption is sorting. Particularly, poorer people may sort into more polluted areas and accordingly settle downstream of high population densities. To address this concern we estimate the effect of both, upstream and downstream population density on wealth in order to check for systematic differences.

4.4.2 Results

We find that upstream population density has a significantly negative effect on health. An increase in population density by 10,000 inhabitants per sqkm, which corresponds to 2 standard deviations, decreases the health index by roughly 5 percentage points, which corresponds to half a standard deviation of the health index (see Table 4.2).

11. We rely on STATA code by Fetzer (2014).

Table 4.2: Effects of urbanization on health

	(1) Health	(2) Health	(3) Health
Upstream Pop Density	-0.0428***	-0.0455***	-0.0506***
	(0.0130)	(0.0116)	(0.0124)
Downstream Pop Density	0.0260	0.0272*	0.0296
	(0.0174)	(0.0154)	(0.0180)
Year FE	✓	✓	✓
Region FE	✓	✓	✓
Controls		✓	✓
Year x Region FE			✓
N	450	450	450
Cluster	74	74	74
Mean DV	0.72	0.72	0.72

Health is the share of households in each grid where no child suffered from diarrhea, fever or cough in the past 14 days. It lies between 0 and 1. Upstream Pop Density is population density in the grid upstream of grid i. Downstream Pop Density is population density in the grid downstream of grid i. Controls include distance along Nile and population density in grid i. Standard errors (clustered by grids) in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

This increase corresponds to one additional disease in every 6th household.[12] The effect remains statistically significant when including distance along the Nile and population density in grid i as control variables (column (2)) and also when adding year-specific region fixed effects (column (3)). These results are also robust to using Conley spatial HAC standard errors, which account for both, spatial- and temporal correlation of the standard errors (see Table D1). The negative effect of downstream population density on health is significantly different from the (positive) effect of upstream population density (p-value of 0.00). Hence, the negative health effects are unique to the downstream population. This indicates that population density affects health through water pollution as it is tied to the direction of the river flow.

In order to further substantiate water pollution as a driver of the observed negative

12. The health index is an average over the number of diseases (diarrhea, cough and fever) per household, which is then averaged across all households in the grid. Accordingly, if the health index increases from 0 to 1 all three diseases will occur in all households within the grid. If the health index increases by 1/3 there will be on average one additional disease in every household. As the health index increases by 0.05, there will be on average 1/6 additional disease in every household or in other words: one more disease in every 6th household.

Table 4.3: Effect heterogeneity: role of piped water

	Health	
	(1) Piped Water<0.75	(2) Piped Water>0.75
Upstream Pop Density	-0.0796***	-0.0416**
	(0.0155)	(0.0159)
Year FE	✓	✓
Region FE	✓	✓
Controls	✓	✓
N	177	270
Cluster	58	73
Mean DV	0.71	0.73

Health is the share of households in each grid where no child suffered from diarrhea, fever or cough in the past 14 days. It lies between 0 and 1. Upstream Pop Density is population density in the grid upstream of grid i. Controls include distance along Nile and population density. The sample is split according to the fraction of households with access to piped water. Standard errors (clustered by grids) in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

health effects on the downstream population, we take into account the households' source of drinking water. For this analysis we calculate the fraction of households within a grid that have access to piped water and split the sample at the mean of this variable (75%). We find that the effect of upstream population density is almost twice as large in grids where drinking water of less than 75% of households comes from clean sources (these households use public taps, the Nile, wells and springs) as opposed to grids where more than 75% of households have access to clean water (Table 4.3). The negative health effect is considerably mitigated by the access to clean drinking water. This again points to water being the crucial link between pollutants and diseases.

4.4.3 Robustness

To address sorting as a potential concern we analyze whether there are differential effects of urbanization on wealth given the relative location of the household to the pollutant. In fact we replicate our analysis from the previous section using wealth as outcome. We find that both, downstream and upstream population density have positive, albeit not statistically significant effects on wealth (see Table 4.4). The upstream and downstream coefficients in Table 4.4, do not differ significantly from each other (p-value of 0.84). This shows that there is no heterogeneity in wealth outcomes de-

Table 4.4: Effects of urbanization on wealth

	(1) Wealth	(2) Wealth	(3) Wealth
Upstream Pop Density	0.0295	0.0346*	0.0255
	(0.0449)	(0.0178)	(0.0206)
Downstream Pop Density	0.0468	0.0256	0.0350
	(0.0444)	(0.0242)	(0.0280)
Year FE	✓	✓	✓
Region FE	✓	✓	✓
Controls		✓	✓
Year x Region FE			✓
N	450	450	450
Cluster	74	74	74
Mean DV	0.72	0.72	0.72

Wealth is a wealth index, which lies between 0 and 1 and is averaged over all households living in grid i. It is based on households' ownership of selected assets. Upstream Pop Density is population density in the grid upstream of grid i. Downstream Pop Density is population density in the grid downstream of grid i. Controls include distance along Nile and population density in grid i. Standard errors (clustered by grids) in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

pending on the geographic location of households indicating that sorting between up- and downstream locations based on wealth is unlikely. Hence, more polluted water downstream of agglomerations does not prevent wealthy people from living there (unlike air pollution caused by industrial activity in 19th century Britain (Heblich, Trew, and Zylberberg, 2016).
We also include wealth as control variable in an additional specification (Table D2 in Appendix) because it may be an omitted variable in the main specification. The results are robust to the inclusion of this additional control variable. This however introduces bad control bias (Angrist and Pischke, 2008) as wealth itself is an outcome of the treatment.

As additional robustness check we estimate the same model using only grids that intersect with the Nile river rather than grids within a 30km radius.[13] We expect the effect to be stronger for people living extremely close to the river as opposed to people who live on the fringe of the Nile valley, close to the desert. The disadvantage of

13. The number of river segments (grids grouped by latitude) is still similar. The sample size only reduces by 26 segment-year cells due to missing DHS observations).

using this subsample is however that we observe fewer DHS clusters in each segment (though the most affected ones).[14] Table D3 in the Appendix shows that the negative effect of population density on downstream health is indeed stronger than for the main sample (the effect size is 30% - 40% larger). In contrast, the effect on the health of the upstream population is significantly positive in all specifications estimated for this subsample. These findings stress the asymmetric health effects of population density.

Finally, we focus on large and densely populated cities as the most severe cases of concentrated pollution. To do so, we restrict our sample to grids surrounding large cities, excluding all other observations. We thus only compare grids located downstream of a city to grids located upstream of the same city rather than comparing all grids in the region.. The downside of this approach is the limited number of observations given that there are only 6 major cities along the Nile.[15]

We estimate the following model:

$$Health_{it} = \alpha + \beta City_i^U + \sigma_c + \sigma_t + \mathbf{X}_{it} + \epsilon_{it} \tag{4.2}$$

where $Health_{it}$ denotes health in grid i at time t. $City_{it}^U$ indicates whether the grid is "treated", this indicator variable turns 1 if the city is located upstream of grid i and zero if the city is located downstream of gird i. σ_c denotes city cluster fixed effects. Each of these clusters contains three grids: the grid where the city is located, the upstream (control) and the downstream (treatment) grid. The city cluster fixed effects thus ensure that we only compare grids around the same city. σ_t denotes time fixed effects and X_{it} is a vector of control variables for grid i, including distance along the Nile and population density.

We find that children living downstream of a city are significantly sicker than children living upstream of the same city. Specifically, their health index is 4 percentage points lower, which corresponds to 0.4 standard deviations of the health index for this sample. This provides further evidence for asymmetric health effects of agglomerations. Children living downstream of these pollutants exhibit significantly worse health outcomes than children living upstream.

14. We here observe on average 16 DHS cluster per segment-year cell as opposed to 20 in the main sample.

15. We exclude Cairo from the regression because we cannot specify a unique downstream grid. The city is located at the end of the river stream and spreads across the Nile Delta, which we have excluded from the analysis.

Table 4.5: Case study: effect of cities on health

	(1) Health
City Upstream	-0.0413* (0.0182)
Year FE	✓
City FE	✓
Controls	✓
N	112
SE	6 City Cluster

The sample is restricted to grids that are located directly upstream or downstream of a city. Health is the share of households in each grid where no child suffered from diarrhea, fever or cough in the past 14 days. It lies between 0 and 1. City Upstream is a binary variable, which indicates whether a city is located upstream of grid i (=1) or whether a city is located downstream of grid (=0). Controls include distance along Nile and population density. Standard errors (clustered by grids) in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

4.5 Industrialization

4.5.1 Empirical Framework

In this section we analyze the impact of water pollution caused by industrial plant openings close to the Nile on children's health. Information on the opening date of industrial plants allows us to exploit temporal variation in addition to spatial variation to estimate the health effect of industrial water pollution. Applying a difference-in-difference strategy we compare health changes of children living downstream of a factory with health changes of children in unaffected grids.[16] We estimate the following model:

$$Health_{it} = \alpha + \beta Factory_{it}^{U} + \sigma_i + \sigma_t + \epsilon_{it} \tag{4.3}$$

$Health_{it}$ denotes health in grid i at time t. $Factory_{it}^{U}$ indicates whether a factory is located in the upstream grid at time t and thus constitutes a binary treatment variable. σ_i are grid fixed effects, which account for grid specific factors, as for instance potential systematic differences between northern and southern areas.[17] σ_t denotes time fixed effects, which account for health trends over time. ϵ_{it} is the error term and standard errors are clustered on a grid level.

In an additional specification we include population density as a control variable in order to account for changes in population density caused by the opening of a factory, which at the same time may influence health.[18] We also apply a placebo check by estimating the effect of a downstream factory on health.

Since we control for all grid-specific and time-specific factors the only threat to identification would be an event that occurred simultaneously with the factory opening and affects downstream and upstream health differentially. As this seems rather unlikely, we are confident that water pollution caused by the factory contributes to poor health outcomes.

4.5.2 Results

We find that a factory located upstream affects children's health negatively. The effect is however only marginally significant (see Table 4.6, columns (1) and (2)). The effect appears to be quantitatively sizable - the opening of an upstream factory decreases

16. The variation in this set-up stems from 31 factories (out of the 65), which opened between 1992 and 2014.

17. Here we can exploit temporal variation within the grid and are therefore able to include gird fixed effects as opposed to our specification in Section 4.4.1.

18. It becomes obsolete to control for distance along the Nile as this variable is time-invariant and is captured by grid FE.

Table 4.6: Effects of industrialization on health

	(1) Health	(2) Health
Upstream Factory	-0.0763*	-0.0751*
	(0.0429)	(0.0421)
Downstream Factory	0.00857	0.0113
	(0.0430)	(0.0423)
Year FE	✓	✓
Grid FE	✓	✓
Pop Density		✓
N	450	450
Cluster	74	74
Mean DV	0.72	0.72

Health is the share of households in each grid where no child suffered from diarrhea, fever or cough in the past 14 days. It lies between 0 and 1. Upstream Factory indicates whether a factory is located in the grid upstream of grid i. Downstream Factory indicates whether a factory is located in the grid downstream of grid i. Standard errors (clustered by grids) in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Control for population density is included.

the health index by roughly 8 percentage points, which corresponds to roughly 0.7 standard deviations of the dependent variable. In other words, the factory opening leads to an additional child disease in every 4th household. Contrary, we find that a downstream factory has no effect on health. These results are also robust to using Conley spatial HAC standard errors, which account for both spatial and temporal correlation of the standard errors (see Table D4).

In order to further examine water pollution as driver of the negative health effects we again split the sample into grids with less than 75% of households with access to piped water and grids where more than 75% of households have access to piped water. We find that the effect of an upstream factory is highly significant and twice as large for the group with less than 75% of households with access to piped water and turns insignificant for grids where more than 75% of households use piped water as drinking water. This demonstrates that children who have contact with industrial wastewater are more likely to fall sick than children who have access to clean drinking water.

Table 4.7: Effect heterogeneity: role of piped water

	Health	
	(1) Piped Water<0.75	(2) Piped Water>0.75
Upstream Factory	-0.101***	-0.0450
	(0.0257)	(0.0574)
Year FE	✓	✓
Grid FE	✓	✓
N	177	277
Cluster	58	74
Mean DV	0.71	0.73

Health is the share of households in each grid where no child suffered from diarrhea, fever or cough in the past 14 days. It lies between 0 and 1. Upstream Factory indicates whether a factory is located in the grid upstream of grid i. Controls include distance along Nile and population density. The sample is split according to the fraction of households with access to piped water within each grid. Controls include distance along Nile and population density. Standard errors (clustered by grids) in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

4.5.3 Robustness

To tackle the potential concern of sorting due to polluting factories we examine the effects on wealth. Table 4.8 shows that there are no statistically significant effects of factories (both upstream and downstream) on wealth. The coefficients on upstream and downstream factories are also not statistically different from each other (p-value: 0.49), which suggests that there is no sorting based on wealth around factories.

One might argue that control grids may in fact be "treated" by a factory two or three grid further upstream. Even though this would only bias our coefficients towards zero we address this issue twofold. First, to account for accumulating pollution we construct a cumulative measure (see Section 4.6). Second, we construct factory clusters to better distinguish between treated and control grids. We therefore generate a new sample where geographically close factory grids are defined as factory clusters. We define grids that are located downstream of the entire factory cluster as treated grids and grids, which are located upstream of the cluster as control grids. In 2014, we for example observe six factory clusters consisting of 3 to 16 individual grids (as opposed to 22 individual factory-grids). Instead of grid fixed effects we include factory cluster fixed effects and thereby directly compare children living upstream to

Table 4.8: Effects of industrialization on wealth

	(1) Wealth	(2) Wealth
Upstream Factory	-0.0374	-0.0399
	(0.0279)	(0.0263)
Downstream Factory	-0.0119	-0.0171
	(0.0160)	(0.0150)
Year FE	✓	✓
Grid FE	✓	✓
Pop Density		✓
N	450	450
Cluster	74	74
Mean DV	0.72	0.72

Wealth is a wealth index, which lies between 0 and 1 and is averaged over all households living in grid i. It is based on households' ownership of selected assets. Upstream Factory indicates whether a factory is located in the grid upstream of grid i. Downstream Factory indicates whether a factory is located in the grid downstream of grid i. Control for population density is included. Standard errors (clustered by grids) in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 4.9: Case study: effect of factory clusters on health

	(1) Health
Factory Upstream	-0.0926* (0.0552)
Year FE	✓
Factory Cluster	✓
Controls	✓
N	80
Mean DV	0.73

Sample consists only of grids, which are directly located upstream or downstream of an industry cluster (consecutive grids that are characterized as industrial area). Health is the share of households in each grid where no child suffered from diarrhea, fever or cough in the past 14 days. It lies between 0 and 1. Factory Upstream indicates whether a factory cluster is located upstream of grid i (=1) or whether the factory cluster is located downstream of grid i (=0). Controls include population density and distance along Nile. Standard errors (in parentheses) are bootstrapped, *** p<0.01, ** p<0.05, * p<0.1.

children living downstream of the same factory cluster.[19] Due to the small number of observations we bootstrap the standard errors.

We again find that children living downstream of a factory are significantly sicker than children living upstream. Specifically, their health index is around 9 percentage points lower, which corresponds to roughly 0.8 standard deviations of the dependent variable (Table 4.9, column (1)). This provides further evidence for adverse health effects of the presence of industrial plants.

19. For each factory cluster we observe health in two grids (upstream and downstream) over 8 years. As these clusters change over time (due to factory openings and closings) we only observe 5 of these clusters over the entire sample period

4.6 Cumulative Pollution

Finally, we shift the focus from localized pollution to cumulative pollution along the Nile. Here we analyze the aggregate effects of population density and factory presence over all grids located upstream. To do so, we weight population density and factory presence respectively by the inverse of the distance to grid i. This weighting accounts for cumulative pollution as people living downstream are not only exposed to pollution from the previous grid but also to water pollution originating in grids further upstream.

$$Weighted\ Population\ Density_i = \sum_{j=1}^{78} \frac{1}{Distance_{ij}} * Population\ Density_j * I(j < i)$$

The mean of the weighted population density is 0.06 and the standard deviation 0.05. We applied the same formula to calculate the weighted factory presence, which has a mean of 0.07 and a standard deviation of 0.06. We assume linear degradation of pollutants in this setting. In an alternative specification we weight by the inverse of the quadratic distance, which gives closer grids a higher weight as compared to linear weighting. We include this measure as regressors in specification 4.1 (see Section 4.4.1).

We do not find an effect of the cumulative population density measure on health, irrespective of the weighting function (Table 4.10, columns (1) and (2)). While we detect negative health effects of population density in the adjacent upstream grid (Section 4.4.2) we do not identify a statistically significant effect of cumulative population density. This finding suggests that the negative health effect of population density is localized. The effects of the cumulative factory measure are in turn highly statistically significant (Table 4.10, columns (3) and (4)). If a factory opens 10km upstream (increase of weighted factory measure by 0.1) the health index decreases by 0.02 points which corresponds roughly to 0.2 standard deviations of the health index. The results reflect a key difference between the two types of pollution in terms of degradability. While organic pollutants in urban waste are subject to natural cleaning and dilution, large fractions of industrial pollution are not. In line with this pattern we observe that the effects of urbanization decline more rapidly with distance to the pollutant than the effect of industrial pollution on human health.[20] Finally, we also include both sources of pollution in the specification at the same time and find that the effect of cumulative factory presence remains statistically significant negative while the effect of cumulative population density remains insignificant.

20. Depending on industry type the scale of biodegradability can vary, e.g. slaughter houses contain higher extend of biodegradable components whereas chemical plants or pulp and paper mills contain higher content of persistent organic pollutants.

Table 4.10: Distance weighted treatments

	(1) Health	(2) Health	(3) Health	(4) Health	(5) Health	(6) Health
Pop Dens (weighted by distance)	-0.190				-0.0994	
	(0.153)				(0.149)	
Pop Dens (weighted by distance^2)		-1.542				-0.904
		(2.160)				(2.412)
Factory Presence (weighted by distance)			-0.231***		-0.222***	
			(0.0712)		(0.0714)	
Factory Presence (weighted by distance^2)				-0.804**		-0.745***
				(0.309)		(0.267)
Year FE	✓	✓	✓	✓	✓	✓
Region FE	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
R^2	0.29	0.29	0.29	0.29	0.29	0.29
N	459	459	459	459	459	459
Cluster	76	76	76	76	76	76
Mean DV	0.72	0.72	0.72	0.72	0.72	0.72

Health is the share of households in each grid where no child suffered from diarrhea, fever or cough in the past 14 days. It lies between 0 and 1. The weights on population density and factory presence are constructed as the inverse of the linear distance and quadratic distance respectively. Pop Dens (weighted by distance or distance^2) and Factory Presence (weighted by distance or distance^2) constitute cumulative measures of pollution, which are based on all grids that are located upstream of grid i. Control for distance along Nile is included. Standard errors (clustered by grids) in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

4.7 Conclusion

Using a newly constructed, geo-coded dataset for Egypt we find detrimental effects of urban and industrial water pollution on health. Our research design exploits the direction of the river flow as natural experiment, where population density and industrial plant location constitute the sources of urban and industrial pollution.

We find a strong negative impact on the health of children who live downstream of an agglomeration. Children living upstream are not negatively affected. This heterogeneity of health outcomes suggests that urbanization affects health through water pollution. The opening date of industrial plants allows us to employ a difference-in-difference strategy to analyze the health effect of industrialization. Here we also find a significantly negative effect on the health of children living downstream of a factory while children living upstream are again not affected.

The health effects of urbanization and industrialization are strongest for grids where a significant proportion of households uses untreated water as source of drinking water. This finding substantiates the argument that the water transmits diseases caused by the pollutants. Finally we show that the cumulative effect of factories along the course of the Nile is significant whereas we do not find a cumulative effect of population density. This finding reflects the difference between these two different sources of pollution in terms of degradability. While organic pollutants in urban waste dilute, large fractions of the industrial pollutants are persistent. The health effects of water pollution caused by urbanization are therefore expected to decline more rapidly with distance to the pollutant than the effect of water pollution caused by factories.

The findings of this study have important implications for policy in developing countries. In order to improve health outcomes it is important to put environmental regulations in place and to enforce them. This is particularly important for countries that are industrializing rapidly and are positioned on the polluting trajectory of the Environmental Kuznet Curve[21]. Weak political and legal institutions are however a stumbling block to regulation. It is thus important to fight corruption, promote law enforcement and increase awareness for sustainable growth. In addition the international community has to support developing countries in these efforts as they often do not have the resources and technologies needed for environmental protection.

In Egypt, various authorities are in charge of water management and quality control, which leads to ambiguous responsibilities.[22] Water quality thus has to become a priority for the Egyptian government and it has to assign responsibilities clearly.

21. It illustrates that over the course of development pollution first increases and then decreases again.

22. "The absence of a single administrative body in charge of water management and quality improvement from the High Dam to the riverbed, and up to the point where it [water] is delivered to people's homes, is the reason behind water pollution in Egypt." (Kareem Khaled, 2015).

Moreover, adverse health effects of urbanization have to be taken into account for city planning in developing countries. The direction of the river flow determines who is affected most by water pollution and thereby leaves people living downstream worse off. As long as there is no environmental protection in place governments have to work on improved sanitation in these areas. Institutional changes are thus key to reduce the detrimental health effects of industrialization and urbanization in emerging economies.

Appendix D.1: Appendix

Table D1: Effect of urbanization on health using Conley spatial HAC standard errors

	(1) Health	(2) Health	(3) Health
Upstream Pop Density	-0.0428	-0.0455*	-0.0457*
	(0.0275)	(0.0275)	(0.0275)
Downstream Pop Density	0.0260	0.0272	0.0274
	(0.0275)	(0.0274)	(0.0276)
Year FE	✓	✓	✓
Region FE	✓	✓	✓
Controls		✓	✓
Region x Year FE			✓
N	450	450	450

Health is the share of households in each grid where no child suffered from diarrhea, fever or cough in the past 14 days. It lies between 0 and 1. Upstream Pop Density is population density in the grid upstream of grid i. Downstream Pop Density is population density in the grid downstream of grid i. Controls include distance along Nile and population density. Conley spatial HAC standard errors estimated, *** p<0.01, ** p<0.05, * p<0.1.

Table D2: Including wealth as control

	(1) Health	(2) Health	(3) Health
Upstream Pop Density	-0.0412***	-0.0437***	-0.0499***
	(0.0118)	(0.0116)	(0.0122)
Downstream Pop Density	0.0286*	0.0285*	0.0307*
	(0.0160)	(0.0149)	(0.0179)
Year FE	✓	✓	✓
Region FE	✓	✓	✓
Controls		✓	✓
Year x Region FE			✓
N	450	450	450
Cluster	74	74	74
Mean DV	0.72	0.72	0.72

Health is the share of households in each grid where no child suffered from diarrhea, fever or cough in the past 14 days. It lies between 0 and 1. Upstream Pop Density is population density in the grid upstream of grid i. Downstream Pop Density is population density in the grid downstream of grid i. All specifications include wealth in grid i as control. Other controls include distance along Nile and population density. Standard errors (clustered by grids) in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table D3: Subsample: only includes grids which intersect with Nile

	(1) Health	(2) Health	(3) Health
Upstream Pop Density	-0.0599***	-0.0571***	-0.0649***
	(0.0121)	(0.0129)	(0.0126)
Downstream Pop Density	0.0384**	0.0387***	0.0412***
	(0.0156)	(0.0133)	(0.0147)
Year FE	✓	✓	✓
Region FE	✓	✓	✓
Controls		✓	✓
Year x Region FE			✓
N	424	424	424
Cluster	71	71	71
Mean DV	0.72	0.72	0.72

Data for segments along the Nile is only based on grids that intersect with NIle river (information from grids that are located close to the desert is excluded). Health is the share of households in each grid where no child suffered from diarrhea, fever or cough in the past 14 days. It lies between 0 and 1. Upstream Pop Density is population density in the grid upstream of grid i. Downstream Pop Density is population density in the grid downstream of grid i. Controls include distance along Nile and population density. Standard errors (clustered by grids) in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table D4: Effect of industrialization on health using Conley spatial HAC standard errors

	(1) Health	(2) Health
Upstream Factory	-0.0763*	-0.0751*
	(0.0410)	(0.0405)
Downstream Factory	0.00857	0.0113
	(0.0517)	(0.0510)
Year FE	✓	✓
Grid FE	✓	✓
Pop Density		✓
N	450	450

Health is the share of households in each grid where no child suffered from diarrhea, fever or cough in the past 14 days. It lies between 0 and 1. Upstream Factory indicates whether a factory is located in the grid upstream of grid i. Downstream Factory indicates whether a factory is located in the grid downstream of grid i. Population density in grid i is included as control variable in column (2). Conley spatial HAC standard errors estimated, *** p<0.01, ** p<0.05, * p<0.1.

Table D5: Including wealth as control

	(1) Health	(2) Health
Upstream Factory	-0.0759*	-0.0752*
	(0.0410)	(0.0425)
Downstream Factory		0.0112
		(0.0424)
Year FE	✓	✓
Grid FE	✓	✓
Pop Density	✓	✓
N	457	450
Cluster	75	74
Mean DV	0.72	0.72

Health is the share of households in each grid where no child suffered from diarrhea, fever or cough in the past 14 days. It lies between 0 and 1. Upstream Factory indicates whether a factory is located in the grid upstream of grid i. Downstream Factory indicates whether a factory is located in the grid downstream of grid i. All specifications include wealth and population density in grid i as controls. Standard errors (clustered by grids) in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

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