Essays on Inequality and Persuasion

by

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Finally, I would like to acknowledge the generous financial support I have received for my doctoral studies from the Department of Economics at Warwick.
Declaration

I submit this thesis to the University of Warwick in accordance with the requirements of the degree of Doctor of Philosophy in Economics. I declare that it has not been submitted for a degree at another university. Chapters 1 is co-authored with Apurav Yash Bhatiya (University of Warwick). I came up with the research idea, the identification strategy, conducted analysis on survey data and wrote all the versions of the text. Chapter 2 is co-authored with Amit Chaudhary (University of Warwick). I came up with the research idea, the identification strategy, helped equally in data collection and analysis and wrote all (except the first version) of the text. Chapter 3 is co-authored with Raghav Malhotra (University of Warwick). I contributed equally in all the stages of development and writing of this chapter.

December 2021
Abstract

In my thesis, I study questions related to the issues of economic inequality and political persuasion. I apply insights from behavioural sciences and general equilibrium to study these phenomena. In my first chapter, we (co-author and I) understand what makes people respond to political persuasion. We apply salience theory (studied extensively in behavioural sciences) to understand voting behaviour. In my second chapter, we explore the role of identity and pride in contributing to group-level inequality. It also highlights one of the reasons why religious groups might resist modern welfare-enhancing interventions. Finally, my third chapter tries to contribute to the theory of economic policy by expanding the set of instruments that can help our society to deal with economic inequality. We study the effectiveness of our policy instrument and compare it to other traditional policy instruments in a general equilibrium framework.

The three chapters are summarised below.

Chapter 1: Leaders often send political messages to try to influence citizens and voters. But, what makes their messages more or less salient? One possibility is that the salience of political messages increases if voters are exposed to events related to the messages. We study this question using the 2019 national election in India, where Prime Minister Modi’s speeches focused on his aggressive response to deadly attacks on soldiers. Using a difference-in-differences identification strategy, we find that the vote share of the PM’s incumbent party increased by 4.6 percentage points in the home constituencies of dead soldiers. Text analysis of Modi’s speeches reveals that only deaths referenced by him affect public opinion, but deaths not referenced by him do not. Our paper is one of the first to study how event exposure interacts with political messages to affect voting behaviour.

Chapter 2: Religious groups sometimes resist modern welfare-enhancing interventions, adversely affecting the group’s human capital levels. In this context, we study whether the two largest religious groups in India (Hindus and Muslims) resisted western education because they shared religious identity with the rulers deposed by British colonizers. We find that Muslim literacy in an Indian district under the British is lower where the deposed ruler was a Muslim, while Hindu literacy is lower where the deposed ruler was a Hindu. To deal with possible omitted variable bias, we instrument the religion of the deposed ruler with distance from the birthplace of Shivaji, a Hindu king who rebelled against the Muslim empire. We find other results consistent with the hypothesis espoused by some historians that when...
foreign occupiers dislodged Islamic rulers, Muslims showed resistance to the inventions/institutions introduced by the occupiers. Our paper is the first to document a similar effect among Hindus in India empirically.

Chapter 3: Inequality and skewed distribution of ‘essential’ goods remain problems even in the 21st-century world. We consider a general equilibrium framework where some goods are considered essential, whereas some are not. Essential goods are relevant for distributional concerns, up to a certain level of consumption. We then compare the effects of four policies on social welfare: subsidies, direct transfers, quantity rationing, and a fourth policy that we introduce and call Market Segmentation (MS). In MS, the market for essentials is segmented from non-essentials, i.e. they are not freely tradeable with each other. We find that if the relative number of low-income individuals in the economy is large and “essentials” are consumed inelastically, MS outperforms direct transfers and subsidies. We also show that in our model, MS weakly dominates quantity rationing. We discuss how market segmentation can help policymakers to deal with issues such as automation and superstar phenomenon (Scheuer and Werning, 2017).
1 The Salience of Political Messages: Evidence from Soldier Deaths in India.

*with Apurav Yash Bhatiya*

1.1 Introduction

Leaders often try to influence voters by sending them political messages. But what makes voters more or less responsive to these messages? There is evidence that factors such as voters’ economic interests\(^1\) or socioeconomic background (e.g. religion)\(^2\) may play a role. However, another potentially important factor might be recent events. Consider, for instance, *the Caravan*—a group of roughly 7,000 migrants trying to seek asylum in the US. While the group did not represent a vast wave of immigration, it played into Donald Trump’s messaging on immigration.\(^3\) There is some suggestive evidence that the event, combined with Trump’s messaging around it (e.g. Trump referred to it as “the invasion”), moved public opinion.\(^4\)

There are two broad channels through which events might make political messages more resonant. First, they might serve as informative signals to voters. A second possibility—perhaps more plausible in the case of *the Caravan*—is that they might increase the salience of political messages. Salience Theory [Chetty et al. (2009), Bordalo et al. (2012), Bordalo et al. (2013)] argues that due to limited attention, the aspects of choice that are highlighted in certain ways, over-account in individual decision making. This literature suggests that event exposure can increase the salience of political messages in voters’ minds without changing the information content of voters.\(^5\) In this context, we study whether and how voter response to political messages changes with exposure to events related to the messages.

It is challenging to causally establish whether events increase the power of political messaging since local confounders often correlate with event exposure. We solve this challenge by using the 2019 national election in India to study this question. The messages, in this case, are Prime Minister (PM) Narendra Modi’s speeches between 2014 and 2019. Modi’s speeches often focused on his aggressive response to

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\(^1\)see, Lupu and Pontusson (2011)

\(^2\)see Wang (2021)

\(^3\)Caravan was roughly 7,000 apprehensions compared to 400,000 border apprehensions that year. There was also no spike in border apprehensions in 2018, see the report by Pew Research Centre (https://www.pewresearch.org/fact-tank/2020/11/04/after-surging-in-2019-migrant-apprehensions-at-u-s-mexico-border-fell-sharply-in-fiscal-2020-2/.)

\(^4\)For instance, a Monmouth University poll showed a 4 percentage points (p.p.) increase in people who considered illegal immigration a “very serious” issue between January and November.

\(^5\)We sketch a model based on Bordalo et al. (2020) in the Appendix to ground this idea.
deadly attacks on Indian soldiers. Consider the following message from an election rally in 2019: “I want to ask my first-time voters, can your first vote be dedicated to the soldiers who conducted the Balakot airstrikes, in the name of the martyrs who lost their lives in Pulwama.” It is evident that PM Modi was trying to persuade voters that he deserved credit for his aggressive response to extremist attacks in which Indian soldiers lost their lives.

The events related to these messages are the soldier deaths between 2014 and 2019. Soldiers are potentially hired from all over India and are placed in different conflict-prone zones. We exploit the fact that there is greater exposure to the death of a soldier in his home electoral constituency. The home electoral constituencies of the soldiers who die are potentially exogenous (we will test this hypothesis). If this is indeed the case, it deals with the issue of local confounders that might contaminate our estimates.

To estimate the impact of a soldier death on voting behaviour, we run a three-period difference-in-difference regression using national elections in India for the years 2009, 2014 and 2019. Given that the message from Modi about soldier deaths came between 2014-2019, we define the treatment group as an electoral constituency from where at least one soldier died between June 2014 - April 2019. Consequently, the control group is an electoral constituency from where no soldier died within the same period. We find that the vote share of PM Modi’s right of centre coalition parties increased by 4.6 p.p. for the treatment group in the 2019 election. These results are robust to including constituency fixed effects and time-variant controls like the electoral size of the constituency.

As a robustness check, we analyse pre-trends of vote shares of the treatment and the control group. We find that the unconditional mean of the vote shares of both groups is almost the same in the 2014 and 2009 national elections, implying that the common trend assumption holds. We also find that time-variant socio-economic variables like employment, income, caste, religion and education are uncorrelated

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6 We give evidence of this claim. Text analysis of his speeches reveals that the content of his speeches changed immediately after soldier deaths throughout his first tenure (2014-2019). See Section 1.4.2

7 To give some context for the extract above, Pulwama is a place in Indian Administered Kashmir where 44 Indian soldiers died in an extremist attack around two months before the election. In response to these attacks, the Indian Air-force carried out Air-strikes in Balakot, Pakistan.

8 There are three distinct regions. (i) The state of Jammu and Kashmir impacted by secessionist struggle (ii) The northeast region comprising of seven small states which are also impacted by violent secessionist movements, and (iii) the central-eastern region that is impacted by left-wing extremism (LWE). See Section 1.3 for more detail.

9 For details see Section 1.4.1

10 Since the electoral constituency map of India was redrawn in 2008 we cannot look for a trend before 2009 national election
with our treatment group.

Exploring why soldier deaths affect voting behaviour, we find a set of results consistent with the explanation that exposure to soldier deaths increases the salience of Modi’s message in the voters’ minds. We posit that if soldier deaths increase the salience of Modi’s messages, then only those soldier deaths should increase Modi’s vote share, which he referenced in his speeches. His reference to soldier deaths is crucial because only when a politician highlights an event or an issue, the voter associates the event with the politician’s agenda and consequently votes for him.\footnote{The highlighting of the issue by the politician can be important because of campaign advertising effects Bernhardt and Ghosh (2019), Hindu Nationalistic Identity getting salient Akerlof and Kranton (2000a) or memory recall Bordalo et al. (2020). We build our using Bordalo et al. (2020) in our model provided in Appendix 3.5 but are open to other interpretations.}

We do a text analysis of Modi’s speeches to identify which soldier deaths change their content. Soldiers fatality in India occur in geographically distinct regions,\footnote{There are three distinct regions. (i) The state of Jammu and Kashmir impacted by secessionist struggle (ii) The northeast region comprising of seven small states which are also impacted by violent secessionist movements, and (iii) the central-eastern region that is impacted by left-wing extremism (LWE). See Section 1.3 for more detail.} which allows them to be classified into (i) secessionist conflict and (ii) left-wing extremist (LWE) conflict. Text analysis of Modi’s speeches reveals that their content changed only in response to soldier deaths in the secessionist conflict but not in response to the LWE conflict. Splitting soldier deaths into these two categories, we find that the vote share of Modi’s coalition increased by 5.6 p.p. in the home constituencies of those soldiers who died in the secessionist conflict. LWE deaths do not, by contrast, significantly change voting behaviour, in line with our explanation. We also find that constituencies that received a death from the secessionist conflict are more likely to mention secessionist conflict as the most important election issue.

Notably, people in constituencies that received a death from the secessionist conflict are likely to give more credit to Modi for his aggressive response to soldier deaths, even though they are equally informed about the response.

Since political messages reach people through the media, we should find that voters’ media connectivity will matter. Consistent with this idea, we find that TV viewership affects voter responsiveness to soldier deaths. Moreover, since literature related to salience argues that recent events should affect decision making more, we should find that deaths closer to the election affect voting more.\footnote{See Tversky and Kahneman (1973) and Thaler and Sunstein (2008) for discussion on why recent events are more readily available. The empirical literature on salience in the field of political economy also find this to be true, see Colussi et al. (2021).} We find that indeed deaths closer to the election affect voting behaviour more.

A concern is that the changes we find in voting behaviour might be driven by secessionist deaths alone and not speeches. To address this concern, we also look at...
the 2014 national election, where there was negligible messaging about secessionist deaths from the PM and the main challenger.\footnote{At that time, the incumbent PM was Dr Manmohan Singh. The primary challenger was Mr Narendra Modi, who also focused on other issues during the campaign, like corruption and inclusive development.} If events alone were driving the results, we would expect that secessionist deaths in 2014 would have a similar effect on voting behaviour as in 2019. Consistent with the idea that political messages played a role, we find that secessionist deaths did not affect voting behaviour in 2014.

We also consider other possible explanations like whether the results are driven by differences in local media coverage about the issue, differences in the level of local election campaigning, or political participation.\footnote{We also consider other mechanisms, for instance Hindu Nationalism becoming salient. See Section 1.5 for further details.} However, the empirical findings are not consistent with these channels.\footnote{See Section 1.5 for greater details.}

1.1.1 Related literature

First and foremost, our paper contributes to the emerging literature on the role of salience in political economy. Fouka and Voth (2016b) documents that contemporary events during the Greek sovereign debt crisis increased the salience of memories of world-war II atrocities to affect consumer choices. Colussi et al. (2021) provide empirical evidence that minority salience affects voting. While focusing on how salience affects individual decision making, our paper differs from these papers by studying how political messages interact with event exposure to affect voting behaviour. Our paper is one of the first to document evidence that political messages become more salient in voters’ minds when exposed to events related to that message.

Our paper also contributes to the literature on how persuasion impacts socio-economic outcomes like inter-ethnic conflict (Yanagizawa-Drott, 2014), rise of Nazism (Adena et al., 2015) and ethnic identity (Blouin and Mukand, 2019). Our paper focuses on how persuasion affects voting behaviour [Enikolopov et al. (2011), Spenkuch and Toniatti (2018), Wang (2021)]. These papers use variation in media and campaign exposure to identify the effect of persuasive messages on public response. Our paper departs from them to study how changes in event exposure increase voters responsiveness to persuasive messages. Using soldiers deaths in India, we causally establish the relation between event exposure and responsiveness to persuasive political messages and voting behaviour. Thus, we show that political persuasion can lead to a differential impact among voters depending upon event exposure.
Finally, our paper also contributes to the literature on how local events and experiences shape political opinions; for instance, mass shootings in the US affecting voting behaviour (Yousaf, 2021), and weather shocks affecting perceptions about global warming (Egan and Mullin, 2017). Perhaps the closest paper to us in this regard is Gartner (2008). This paper builds a rational expectations theory to study the impact of Iraq war fatalities on American political opinion. It argues that soldier fatalities represent information on the cost of conflict, thus hurting the incumbent electorally and decreasing his vote share. Our paper provides an argument based on behavioural sciences that highlighting soldier deaths can sometimes help incumbent leaders. Incumbent leaders can highlight their response to these deaths, making them salient in the voters’ minds. We find evidence in India that supports this argument. We find that the incumbent vote share increased more in constituencies with greater exposure to soldier deaths. Hence, our paper demonstrates that soldier deaths are not necessarily costly for the incumbent, as documented in this literature.\footnote{Other papers also study the impact of soldier deaths on voting outcomes. Most of these studies, unlike our results, find a negative impact on the incumbent vote share. See, Karol and Miguel (2007), Kibris (2011).}

The rest of the paper is structured as follows. In the next section, we present the conceptual framework. Section 1.3 discusses the background and the data sources. Section 1.4 provides the main empirical results, robustness checks and other results consistent with our framework. Section 1.5 discusses other possible mechanisms, and finally, Section 1.6 concludes.

1.2 Conceptual framework
This section discusses the different channels through which exposure to events related to a politicians’ message affects voting behaviour. In particular, we discuss how the effect of two different yet plausible channels through which event exposure can affect voting behaviour can be disentangled, particularly in the case of soldier deaths in India.

One possible reason why soldier deaths affect voting behaviour is that soldier deaths serve as information regarding the conflict in which the soldier died (Gartner, 2008). Gartner (2008) argues that support for conflict is not a ‘blank check’ and soldier deaths provide information that the public use to decide their level of support for the conflict. Sometimes soldier deaths can be directly informative (for example, the trend of deaths over time partially reflects how problematic the issue is). They can also indirectly inform voters by providing a stimulus to gain informa-
In the case of India, total soldier deaths over time can provide information on how successful the state has been in dealing with the secessionist and LWE conflicts plaguing the country. They can also provide indirect stimulus to voters, and they can learn about how the current Government is dealing with the issue. An important aspect of this channel of information affecting voter choices is that it should start with voters being more informed about the issue.

In our context, Modi wants voters to give him credit for his aggressive response to soldier deaths. If information is the key, then voters exposed to soldier deaths should be, first and foremost, more informed about Modi’s response to soldier deaths. The response does not come directly because of soldier deaths, as these deaths are uninformative in themselves about the Government’s response. However, these deaths can make voters in the home constituencies more informed indirectly, for example, through their own initiative (learning through the internet), informative local media coverage, or social media platforms. We will compare how informed voters are about Modi’s response to soldier deaths in home constituencies of dead soldiers to voters in constituencies from where the soldiers’ did not die. We will also consider whether the results are explained by local media coverage, social media and internet usage.

The second channel through which soldier deaths can impact voting behaviour is by increasing the salience of the politicians’ message in the voters’ minds. In our context, Modi highlights soldier deaths because he wants voters to focus on the issue of national security and his aggressive response to soldier deaths while making voting decisions. It is critical to note that exposure to soldier deaths can increase the salience of Modi’s message in voters’ minds without any change in information. An increase in salience because of exposure to events can be due to many reasons. It could be the case that the effect of political campaigns increases because the politicians’ campaign on national security is now ‘personal’ to voters exposed to soldier deaths. It can also be the case that soldiers dying in terrorist attacks often committed by self-proclaimed Islamic extremist organisations makes the Hindu Nationalistic identity of voters salient and hence they vote for Modi.

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18 Karol and Miguel (2007)
19 Personal means that voters now identify with the campaign as they were exposed to the issue highlighted in the politicians’ campaign. This effect in the literature is called the campaign advertising effect. For theory on the campaign advertising effect, see Bernhardt and Ghosh (2019). An empirical paper measuring the effect of campaign advertising is Spenkuch and Toniatti (2018).
20 Hindu Nationalism is the ideological bedrock of Modi’s political party, the BJP. If voters’ Hindu Nationalistic becomes salient, then voting behaviour might change. There is a strand of economics literature starting from Akerlof and Kranton (2000a) that demonstrates that identity affects individual decision making.
It can also be the case that exposure to soldier deaths forms a memory in voters’ minds, which is recalled by political messages, which makes the issue salient.\textsuperscript{21}

The voter associates the event with the politician’s agenda and votes for him only when he refers to those events in his messages and campaign. Thus, if exposure to soldier deaths makes politicians’ message salient in voters’ minds, then it must be the case that only those soldier deaths that the politician highlights should affect voting behaviour. In our context, this implies that only soldier deaths related to the conflict that Modi focuses upon in his speeches should increase his vote share. Soldier deaths in conflicts not referenced by him should not affect voting behaviour. We test this in Section 1.4.2. We should also find that deaths that are closer to the election should affect voting behaviour more because literature related to salience theory argues that recent events/experiences change behaviour more \cite{Tversky and Kahneman (1973), Thaler and Sunstein (2008), Colussi et al. (2021)}. Also, given that political messages reach people through media, voters’ media connectivity should matter. We consider this in Section 1.4.4.

\section*{1.3 Background and data}
This section discusses the Indian context and data sources used to study the effect of event exposure on voting behaviour. First, we discuss the political spectrum in the national election of 2019 and the decade that preceded it. We go on to discuss the armed forces involved in handling internal security in conflict-prone zones in India. Finally, we discuss the data sources used.

\subsection*{1.3.1 Background}

\textbf{Political spectrum and elections in India}

The Indian political spectrum is more complex than a simple two-party electoral range.\textsuperscript{22} The most popular political force in the country is the incumbent PM Narendra Modi’s party, the Bhartiya Janta Party (BJP). The BJP is a Hindu nationalist party, and its political coalition is called the National Democratic Alliance (NDA).\textsuperscript{23} It has been in power at the national level since 2014. The main opposition party in India is the Indian National Congress (INC), which was in power between 2004-2014. The INC had its origin in the freedom struggle against the British back

\textsuperscript{21}We build a model based on Bordalo et al. (2020) in the appendix that grounds this idea.

\textsuperscript{22}List of all parties registered with the election commission of India as of 23-09-2021 can be found here https://eci.gov.in/files/file/13711-list-of-political-parties-symbol-main-notification-dated23092021/. An older list can be found here https://eci.gov.in/files/category/149-list-of-political-parties/.

\textsuperscript{23}We consider the coalition based on the following information https://www.elections.in/parliamentary-constituencies/national-democratic-alliance.html
in the 19th century. It can be characterised as a centre-left party, and its political coalition is called the United Progressive Alliance (UPA).\(^{24}\) There are also regional parties who play an important role in national elections. For example, Samajwadi Party (SP) is significant in the most populous Indian state of Uttar Pradesh and thus becomes nationally relevant. The different communist parties of India have a regional presence in some parts of the country. These parties together are popularly called the Left Front.\(^{25}\)

All the parties participate in different National and State level elections, which have a five-year cycle in India.\(^{26}\) India has a parliamentary system of democracy with a first-past-the-post system. In this paper, we focus on the National elections of 2009, 2014 and 2019 (also referred to as General Elections). The election results are publicly available only at the constituency level in India. Further, the map of electoral constituencies in India was redrawn in 2008. Hence we are restricted to comparing three election cycles starting from 2009.

**Armed forces and conflict regions**

The Indian state maintains special units of armed forces to deal with matters concerning internal security.\(^{27}\) These paramilitary forces are called ‘The Central Police Armed Forces of India.’ These forces comprise different organisations, including the Central Reserve Police Force (CRPF), Border Security Force (BSF), Assam Rifles (AR), Central Industrial Security Force (CISF), Indo Tibetan Border Police (ITBP), National Security Guard (NSG) and Seema Suraksha Bal (SSB).\(^{28}\) The organisation that reports more than two-thirds of the number of deaths in our database is the CRPF. They state their responsibility as follows: “CRPF is deployed in aid of civil power in matters relating to maintenance of law and order, internal security and counterinsurgency.”\(^{29}\) These forces are under the control of the Ministry of Home Affairs in India and are around 1 million in number.\(^{30}\) Soldiers can be potentially hired from any political constituency in India. They are stationed at various conflict-prone zones across India. We discuss these conflict zones below.

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\(^{24}\) We consider the coalition based on the following information https://www.elections.in/parliamentary-constituencies/united-progressive-alliance.html

\(^{25}\) https://www.britannica.com/topic/Left-Front

\(^{26}\) Conditional on a government enjoying the support of the parliament or state assembly respectively

\(^{27}\) Indian State has long maintained that the Kashmir issue along with other insurgencies in India are domestic issues. See the statement of the spokesperson for the Government of India in 2019 http://ddnews.gov.in/national/india-jammu-kashmir-issue-internal-matter-india

\(^{28}\) The details of each of them can be found here. https://www.mha.gov.in/node/95690/

\(^{29}\) https://www.police.gov.in/poi-internal-pages/central-armed-police-forces-capfs

\(^{30}\) As per MHA, the total sanctioned strength of these forces is 966914. (see, https://www.mha.gov.in/MHA1/Par2017/pdfs/par2016-pdf/ls-190716/315%20E.pdf
In India, there are multiple regions of conflict. Broadly they can be classified into three based on geographic distinctness. The first is the Kashmir region. It can be characterised as a secessionist movement and has an Islamic character to it. According to the South Asian Terrorist Portal (SATP), around 21,215 people lost their lives in this conflict between 2000 and September 2019. Another geographic region in India that is dealing with secessionist conflict is North-East India. This region comprises seven states, including Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura. Here there are multiple armed separatist factions like ULFA, NSCN (K) fighting the Indian state. According to SATP, around 11,696 people have lost their lives between the year 2000 and September 2019 in this region. The third geographic region that deals with violent extremism is India’s central region, the so-called ‘red corridor.’ This region is the bastion of Left-Wing Extremism. This violent left-wing movement is distinct from the other two movements. Its goal is not to establish a separate state from India but to use guerrilla warfare to install a “people’s government.” According to SATP, 10,432 people have died in this conflict from 2000 till 2019. Figure 1.1 shows the location of these conflict zones on India’s map. Kashmir and the North-East region has been classified as a secessionist conflict on the map. The states of Chhattisgarh, Jharkhand and Orissa have been shaded as red for the LWE conflict.

In our data set, we find that, between 2009-2019, 723 soldiers lost their lives on duty. Thus the fatality rate is less than 0.1%. The variation in the home constituencies of dead soldiers is shown in Figure 1.2.

Violent attack in Pulwama, Kashmir and its aftermath

Around two months before the start of the national elections in 2019, there was a suicide bombing in Pulwama located in the Indian state of Jammu and Kashmir. This attack, which came to be referred to as Pulwama attack (see the image in Figure 1.3), was allegedly carried out by a radical Islamic outfit called Jaish-e-Mohammed. As a result, forty-four soldiers belonging to the Central Armed Police Forces lost

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31 For details on conflict and terrorism in India, see https://satp.org/terrorism-assessment/india
33 Upadhyay (2006)
35 The LWE conflict often spills over to other surrounding states not shaded in the map. However, the soldier deaths in our data comprise all deaths in the LWE conflict across all states. For greater detail on regions affected by LWE conflict in India, see https://www.mha.gov.in/division_of_mha/left-wing-extremism-division
Figure 1.1: Conflict zones in India
Figure 1.2: Home constituencies of dead soldiers between 2014-2019
This attack invoked an aggressive response from the Indian Prime Minister. It is alleged that \textit{Jaish-e-Mohammed} runs its training camps in Pakistan, around the region called Balakot. On February 26, the Indian Air Force carried out airstrikes in Balakot, which came to be referred to as the \textit{Balakot Airstrikes} in the Indian Media.\textsuperscript{37} The location of Pulwama and Balakot on a map is provided in figure 1.4. Modi touted the ‘success’ of these strikes to garner political support for the election.\textsuperscript{38}

Importantly, this was not the only incident where violent attacks on Indian soldiers invoked a strong response from Modi’s Government. For example, in 2016, grenade attacks were carried out on security forces near the town of Uri in the state of Jammu and Kashmir, India.\textsuperscript{39} In retaliation, India made a preemptive strike against terrorist teams crossing the Line of Control and struck at the terrorist shelter locations, allegedly killing approximately 150 terrorists.\textsuperscript{40} Modi tried to garner political support for such aggressive responses to soldier deaths throughout his first term (2014-2019). Text analysis of Modi’s speeches suggests a general trend of sending political messages after soldier deaths. We discuss this in greater detail in Section 1.4.2.

\subsection*{1.3.2 Data}

The main dependent variable in our analysis is the vote share of PM Modi’s party in India. We also use the vote share of different political parties in India as the dependent variable. The election commission of India reports vote shares and winning parties of all national and state in India. We use the data collated by Bhogale et al. (2019) for the years 2009, 2014 & 2019. The data also reports the winning party in a particular constituency.

We use the publicly available data on the CRPF website and other government sources.

\begin{itemize}
  \item \textsuperscript{36}Feyyaz (2019)
  \item \textsuperscript{37}https://www.armscontrol.org/act/2019-05/features/pulwama-crisis-flirting-war-nuclear-environment
  \item \textsuperscript{38}Neutral agencies suggest that these strikes did not cause any significant damage to their desired target. See, Martin Howell; Gerry Doyle; Simon Scarr (March 5 2019), Satellite images show buildings still standing at the Indian bombing site, Reuters Quote: “The images produced by Planet Labs Inc, a San Francisco-based private satellite operator, show at least six buildings on the madrasa site on March 4, six days after the airstrike. There are no discernible holes in the roofs of buildings, no signs of scorching, blown-out walls, displaced trees around the madrasa or other signs of an aerial attack.
  \item \textsuperscript{39}https://www.bbc.co.uk/news/world-asia-india-37399969
  \item \textsuperscript{40}The Line of control is the effective border between India and Pakistan in the disputed region of Kashmir. For details on the Indian response, see https://eprints.lancs.ac.uk/id/eprint/89171/1/Saloni_Kapur_with_author_details.pdf
\end{itemize}
Figure 1.3: A newspaper clipping of the Pulwama attack

Figure 1.4: The location of Pulwama and Balakot in South Asia
websites for data on soldier deaths.\textsuperscript{41} These websites contain a martyr list of soldiers. In addition, the lists contain information on the incident, region of conflict and home address of these dead soldiers. We use these home addresses to determine the home constituency of the dead soldier. For a summary of these deaths, see Table 1.1.\textsuperscript{42}

For socio-economic variables, we use two data sets. One is the SHRUG data set (Asher and Novosad, 2019) which contains information on night lights, religion and share of Scheduled Castes (SC) and Scheduled Tribes (ST) population.\textsuperscript{43} The other data set is the individual level voter survey from the Centre for the Study of Developing Societies (CSDS), Delhi. This organisation conducts pre-election and post-election surveys for national and state elections in India and is widely regarded as the most respected election survey in India.\textsuperscript{44} They ask responders about their employment status, income levels, occupation, education, asset holding, gender, age and whether they live in a rural or urban area. We also use this survey to get information on media consumption, election activity, level of political participation and awareness about electoral issues. Further, this survey confirms voting behaviour at the individual level, which is available at the constituency level from Bhogale et al. (2019).

To study the media coverage about soldier deaths and the government reaction to them, we use data from broadcastseva.gov.in, a government website monitoring the content of various TV channels, including news channels. We also use the GDELT data, which monitors conflict news from print, broadcast, and web news media in over 100 languages from across every country in the world. We use their data to study how different types of conflict (secessionist and LWE) were covered by all media sources in India between 2009-2019. We use GDELT data to calculate the number of articles published per week and the number of sources reporting on the issue per week about different types of conflict in India.

Finally, to study the political messages conveyed by Modi, we web scrapped his political speeches from narendramodi.in, a website containing all his speeches. Together with data on soldier deaths, this data constitutes a novel data set, which we use to predict the effect of deaths on speech content.

\textsuperscript{41}bharatkeveer.com and hamari.police.com
\textsuperscript{42}We use newspaper reports to verify a random sample of these deaths. Any remaining errors are likely to bias our estimates downwards because of the Identification strategy that we use. See Section 1.4.1 for greater details.
\textsuperscript{43}The Indian constitution contains a schedule of certain castes and tribes, which were historically backward. For details, see Dushkin (1967).
\textsuperscript{44}Many important papers on Indian Politics use this dataset. For example, see Banerjee et al. (2019)
Table 1.1: Soldier deaths from 2009 - 2019

<table>
<thead>
<tr>
<th>Region</th>
<th>2009-14</th>
<th>2014-19</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secessionist</td>
<td>80</td>
<td>170</td>
<td>250</td>
</tr>
<tr>
<td>LWE</td>
<td>318</td>
<td>139</td>
<td>457</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>12</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>410</td>
<td>313</td>
<td>723</td>
</tr>
</tbody>
</table>

Notes: The Secessionist region includes deaths of Kashmir and North-East region. LWE stands for Left Wing Extremism. The Miscellaneous region includes deaths during helicopter crashes in rescue operations, administrative duty, road accidents and rescue operations.

1.4 Empirical results

We present the empirical results in four parts. Section 1.4.1 consists of our primary empirical specification and the baseline results that estimate the effect of a soldier death on voting behaviour. Section 1.4.2 discusses text analysis of Modi’s speeches to identify which soldier deaths are referenced in his speeches. We discuss robustness checks in Section 1.4.3. Section 1.4.4 discusses further evidence in favour of the explanation that exposure to soldier deaths increases the salience of politicians’ messages to increase his vote share. These results include the importance of media in translating events into votes and the impact of soldier deaths absent the political message.\(^{45}\)

1.4.1 Baseline results

Given that Modi focused on soldier deaths in his speeches before the 2019 national election, we would expect that Modi’s vote share is higher in constituencies with greater exposure to soldier deaths. The key observation that allows us to test this assertion is that exposure to soldier death is greater in the home constituency of the dead soldiers. We thus define our treatment and control group in the following way. The treatment group consists of the constituencies from where at least one soldier died between June 2014 and April 2019. The control group consists of those constituencies from where no soldier died between the same time period.\(^{46}\)

We run a three-period difference-in-difference regression to deal with possible

\(^{45}\)We also consider alternative explanations in Section 1.5

\(^{46}\)We use the total number of deaths as a robustness check. We discuss it in Section 1.4.3. It is worth noting that if some soldier deaths are omitted in our data set, but this omission is random, it leads to a downward bias in our estimated coefficients. This is because the treatment group is defined as ‘at least one soldier death.’ Thus, if soldier deaths are omitted, some constituencies that should have been counted as treated are now in the control group. However, no control group constituency is wrongly classified as treated. Hence, the coefficient can only be biased downwards.
underlying differences between treated and untreated constituencies. The treatment period is the 2019 national election. Hence, 2014 and 2009 national elections form the pre-treatment periods. Thus, we can compare our treatment and control groups in 2009 and 2014 and test whether treated and untreated constituencies are similar. We do that by looking at pre-trends of vote shares for the two groups.

Formally, we estimate the following regression equation.

\[ Y_{c,s,t} = \gamma_1 \text{Death}_{c,s} \times \text{Post}_t + \omega_1 \text{Death}_{c,s} + \omega_2 \text{Post}_t + \beta' x_{c,s,t} + \alpha_c + \alpha_t + \epsilon_{c,s,t} \quad (1.1) \]

The main dependent variable (\(Y_{c,s,t}\)) is the vote share of Modi’s political coalition, the NDA. The subscript \(c\) denotes the constituency, \(s\) denotes the state, and \(t\) denotes the general election year. The treatment group is a parliamentary constituency that received at least one soldier death between June 2014 and April 2019 (\(\text{Death}_{c,s}\)). \(\text{Post}_t\) takes the value 1 for general election year 2019 and 0 otherwise. We use time fixed effects (\(\alpha_t\)). We also include a set of controls (\(x_{c,s,t}\)), some of which are time-invariant, including \(\log\) (Distance to Kashmir Conflict), \(\log\) (Distance to LWE Conflict), \(\log\) (Distance to North-East Conflict), \(\log\) (Mean Night Lights), but some are time-variant including \(\log\) (electorate size) and lower caste (SC) population share and tribal (ST) population share. Standard errors are clustered at the constituency level.\(^{47}\) Other time-variant variables which can potentially affect voting behaviour, including the mean of \(\log\) (Age) in a constituency, fraction of voters with education below class 10, fraction of voters with education at or above class 10, fraction employed, the fraction of voters who are Hindu, fraction living in rural locality and mean average monthly income in a constituency, are estimated using the CSDS individual-level voter survey. We check whether these socioeconomic variables are correlated with the treatment group in Table 1.3. Finally, we include constituency fixed effects \(\alpha_c\).

The main results are reported in Table 1.2. We have Modi’s Hindu-right coalition (NDA) vote share as the dependent variable in all four columns. Table 1.2 reports coefficients on the treatment times post variable \(\gamma_1\) (Death x Post). We start in column 1 by reporting coefficients with only state fixed effects. The coefficient is 4.4 p.p. and is significant at 1%. This effect is large, and given that the mean vote share of the coalition is around 37%, this constitutes a more than 10% change in vote share. We add time fixed effects in column 2 and controls in column 3. It is worth noting that the coefficient and the standard errors remain stable across

\(^{47}\)We use Conley standard errors as a robustness check, see Section 1.4.3
columns. Column 4 includes constituency level fixed effects and thus corresponds to the main specification discussed in Equation 1.1. Column 4 shows that the vote share of NDA increased by 4.6 p.p. in home constituencies of dead soldiers. This result is statistically significant at the 1% level.

Table 1.2: Main result: NDA vote share

<table>
<thead>
<tr>
<th></th>
<th>Right Coalition Vote Share</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>Death × Post</td>
<td>0.044***</td>
<td>0.044***</td>
<td>0.045***</td>
<td>0.046***</td>
</tr>
<tr>
<td></td>
<td>(0.012)</td>
<td>(0.012)</td>
<td>(0.012)</td>
<td>(0.011)</td>
</tr>
<tr>
<td>Death</td>
<td>−0.005</td>
<td>−0.005</td>
<td>−0.007</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.009)</td>
<td>(0.009)</td>
<td>(0.009)</td>
<td></td>
</tr>
<tr>
<td>Post</td>
<td>0.102***</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.008)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>State FE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>National election year FE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Controls</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Constituency FE</td>
<td></td>
<td></td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td>Mean of dependent variable</td>
<td>0.371</td>
<td>0.371</td>
<td>0.371</td>
<td>0.371</td>
</tr>
<tr>
<td>Observations</td>
<td>1,614</td>
<td>1,614</td>
<td>1,614</td>
<td>1,614</td>
</tr>
<tr>
<td>R²</td>
<td>0.580</td>
<td>0.642</td>
<td>0.654</td>
<td>0.781</td>
</tr>
</tbody>
</table>

Notes: Controls: log(Mean Night Lights), log(Electorate Size), log(Distance to Kashmir Conflict), log(Distance to Maoist Conflict), log(Distance to North-East Conflict), Share of SC Population and Share of ST Population. Standard errors are clustered at the constituency level. The fixed effects are for each parliamentary constituency and national election year. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.

To check the validity of our identification assumption, we plot the unconditional mean of the vote share of the NDA for the treatment and the control groups for the election years of 2009, 2014 and 2019 in Figure 1.5. The mean vote share of the two groups is almost the same for the two groups in the 2014 and 2009 national elections before it diverges in the treatment period. So, not only is there a common trend in vote shares of the two groups before the 2019 election, the vote share is almost the same. This provides evidence that these constituencies voted very similarly before the treatment period.

Moreover, though we include constituency level fixed effects in our regression, there is a possibility that a time-variant socioeconomic control is biasing our coefficients. For example, migration can be changing the demographic characteristics of the electoral constituencies. To verify this is not the case, we regress socioeconomic variables like religion, caste, income, education, employment, age as the dependent
variable on the same set of $x$ variables discussed in Equation 1.1. The coefficient associated with the primary variable of interest (Death $\times$ Post) is provided in column 3 of Table 1.3 for the dependant variables, including the size of the electorate, mean of log(Age) in a constituency, fraction of voters with education below class 10, fraction with education at or above class 10, fraction employed, the fraction of voters belonging to different caste categories, the fraction of voters who are Hindu, fraction living in rural locality and mean average monthly income in a constituency. None of the socioeconomic variables is significantly correlated with our main dependant variable. We further verify using the individual-level voter survey in Section 1.4.3 that controlling for these variables does not change our main results.

In Table 1.4, we discuss the same specification as in Equation 1.1, but the dependant variable is the vote share of different political parties across the political spectrum. Column 1 is the vote share of the main Hindu-Right party, the BJP, which shows a similar increase in vote share as the whole coalition in column 2. The main opposition party (INC) and its political coalition (UPA) show a slight increase in vote share (columns 3 and 4 respectively), although with comparatively large standard errors. The increase in the vote share of the right is coming at the expense of the regional parties. This result is consistent with the interpretation that exposure to soldier deaths make voters think more about issues such as national security and less about regional election issues, as being conveyed by Modi’s speeches. Therefore, regional parties suffer.

The number of observations in each of the columns in Table 1.4 differs because
not all parties contest elections in every parliamentary constituency. This raises a possibility that parties might strategically choose to contest elections depending on the exposure to soldier deaths in a constituency. However, we do not find any evidence that parties are strategically contesting elections depending on soldier deaths. See Table A1 in the appendix.

In the following sub-section, we do a text analysis of Modi’s speeches to identify soldier deaths from which conflict regions are highlighted by Modi.

Table 1.3: Balance table: Time variant socio-economic variables

<table>
<thead>
<tr>
<th></th>
<th>Unconditional Mean</th>
<th>Death × Post</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Death &gt;= 1 (1)</td>
<td>Death = 0 (2)</td>
</tr>
<tr>
<td>Size of electorate (in millions)</td>
<td>1.524</td>
<td>1.500</td>
</tr>
<tr>
<td>Mean age</td>
<td>41.269</td>
<td>41.766</td>
</tr>
<tr>
<td>Fraction with education below class 10</td>
<td>0.335</td>
<td>0.345</td>
</tr>
<tr>
<td>Fraction with education at or above class 10</td>
<td>0.402</td>
<td>0.398</td>
</tr>
<tr>
<td>Fraction employed</td>
<td>0.601</td>
<td>0.618</td>
</tr>
<tr>
<td>Fraction SC caste</td>
<td>0.181</td>
<td>0.173</td>
</tr>
<tr>
<td>Fraction ST caste</td>
<td>0.128</td>
<td>0.117</td>
</tr>
<tr>
<td>Fraction OBC caste</td>
<td>0.362</td>
<td>0.409</td>
</tr>
<tr>
<td>Fraction Hindu religion</td>
<td>0.736</td>
<td>0.787</td>
</tr>
<tr>
<td>Fraction living in rural locality</td>
<td>0.788</td>
<td>0.690</td>
</tr>
<tr>
<td>Mean average monthly income</td>
<td>9143.941</td>
<td>9176.494</td>
</tr>
</tbody>
</table>

Notes: The column 3 presents regression coefficient for soldier deaths. The regression includes State PC and national election year fixed effects. Standard errors are clustered at the parliamentary constituency level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.

1.4.2 Text analysis

In this sub-section, we ask the following question: which type of soldier deaths matter? If event exposure increases the salience of politicians’ messages, then exposure to only those soldier deaths should affect voting behaviour that are referenced and highlighted in Modi’s speeches. To explore this hypothesis, we perform a text analysis of Modi’s speeches. To identify whether Modi references soldier deaths, we explore whether the content of Modi’s speeches changes in response to these deaths. We particularly examine whether his speeches play up soldier deaths in all conflicts or only specific conflicts.

Soldiers die in two types of conflict in India, which occur in geographically distinct regions and thus can be classified as secessionist and Left-Wing Extremist (LWE). We have information on the exact dates these deaths took place. We combine
Table 1.4: Main result: Political spectrum

<table>
<thead>
<tr>
<th></th>
<th>BJP</th>
<th>NDA</th>
<th>INC</th>
<th>UPA</th>
<th>Left</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death x Post</td>
<td>0.046***</td>
<td>0.046***</td>
<td>0.024*</td>
<td>0.018</td>
<td>-0.007</td>
<td>-0.061***</td>
</tr>
<tr>
<td></td>
<td>(0.010)</td>
<td>(0.011)</td>
<td>(0.012)</td>
<td>(0.014)</td>
<td>(0.025)</td>
<td>(0.017)</td>
</tr>
<tr>
<td>National election year FE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Controls</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Constituency FE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Mean of dependent variable</td>
<td>0.368</td>
<td>0.371</td>
<td>0.278</td>
<td>0.295</td>
<td>0.106</td>
<td>0.334</td>
</tr>
<tr>
<td>Observations</td>
<td>1,297</td>
<td>1,614</td>
<td>1,325</td>
<td>1,597</td>
<td>699</td>
<td>1,582</td>
</tr>
<tr>
<td>R²</td>
<td>0.888</td>
<td>0.781</td>
<td>0.784</td>
<td>0.626</td>
<td>0.820</td>
<td>0.740</td>
</tr>
</tbody>
</table>

Notes: Controls: log(Mean Night Lights), log(Electorate Size), log(Distance to Kashmir Conflict), log(Distance to Maoist Conflict), log(Distance to North-East Conflict), Share of SC Population and Share of ST Population. Standard errors are clustered at the constituency level. The fixed effects are for each parliamentary constituency and national election year. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.

this information with data on Modi’s speeches. In the website ‘narendramodi.in,’ his team that maintains the website tags these speeches according to their main content. We say that a speech is militaristic if it contains one of several tags such as: “Defence,” “National Security,” “Soldiers,” “Martyrs,” “CRPF.” Our results are robust to variation in classification to the tags used.

The regression equation that we estimate is given below:

\[ Y_t = \beta_1 \text{Secessionist Death}_t + \beta_2 \text{LWE Death}_t + \alpha_{my} + \epsilon_t \]

Notice that the unit of observation is a speech. The dependent variable \( Y_t \) is a dummy variable that takes the value 1 if speech contains militaristic content. The x-variables of interest are (i) Border Death which is a dummy variable that takes the value 1 for the first two (or three) speeches after secessionist death and (ii) Maoist Death which again is a dummy for the first two (or three) speeches after Maoist death. We have month-year (or month and year) fixed effects which we denote by \( \alpha_{my} \). The results are reported in Table 1.5.

In Table 1.5, column 1 is a specification run with month and year fixed effects, and column 2 runs with quarter-year fixed effects. In both specifications, we can see that a soldier death in the secessionist region predicts the militaristic content.

20

48The total list of words used are - “Defence,” “Security,” “National Security,” “Terrorism,” “Armed Forces,” “Army,” “Indian Army,” “Indian Air Force,” “Air Force,” “Indian Navy,” “Navy,” “Soldiers,” “Martyrs,” “Sandesh2Soldiers,” “National Cadet Corps,” “NCC,” “National War Memorial,” “Police,” “Central Reserve Police Force,” “CRPF,” “CISF,” “National Police Memorial,” “Pulwama,” “Pakistan,” “Surgical Strike.” These words are those that are related to armed forces or soldiers in India. We discuss the reason for including each word in detail in the online Appendix B.
of Modi’s speech. Around 28% of all Modi’s speeches contain militaristic content. This content goes up to around 38% immediately after a soldiers’ death in the secessionist region. The increase is statistically significant. However, for deaths in regions dealing with LWE, we do not find such a strong result. The coefficient, though positive, is smaller and statistically insignificant. These results strongly suggest that Modi’s speeches highlight soldier deaths in secessionist conflict but not in LWE conflict.

Table 1.5: Effect of soldier deaths on Modi’s speeches

<table>
<thead>
<tr>
<th></th>
<th>Militaristic Content Speeches</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>Secessionist Death</td>
<td>0.098**</td>
</tr>
<tr>
<td></td>
<td>(0.041)</td>
</tr>
<tr>
<td>LWE Death</td>
<td>0.038</td>
</tr>
<tr>
<td></td>
<td>(0.046)</td>
</tr>
<tr>
<td>Month FE</td>
<td>Y</td>
</tr>
<tr>
<td>Year FE</td>
<td>Y</td>
</tr>
<tr>
<td>Month × Year FE</td>
<td></td>
</tr>
<tr>
<td>P-value of test of treatment equality</td>
<td>0.351</td>
</tr>
<tr>
<td>Mean of dependent variable</td>
<td>0.278</td>
</tr>
<tr>
<td>Observations</td>
<td>790</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.116</td>
</tr>
</tbody>
</table>

Notes: LWE stands for Left Wing Extremism. P-value of test of treatment equality is the Wald test to check the equality between the coefficients of Secessionist Death and LWE Death. Robust standard errors are in parentheses. The fixed effects are for each month and year when the speech was delivered. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.

We thus test whether vote share is affected by exposure to all deaths or only secessionist deaths. In order to do that, we split our treatment group into two. The first group is the home constituency of a soldier who died in secessionist conflict (Secessionist Deaths). The second group is the home constituency who died in the LWE conflict (LWE Deaths). Given the changing content of Modi’s speeches after secessionist deaths and not LWE deaths, secessionist soldier deaths should affect his vote share, but exposure to LWE deaths should not. The exact regression equation that we estimate is given below.

$$Y_{c,s,t} = \gamma_1 \text{Secessionist Death}_{c,s} \times \text{Post}_t + \gamma_2 \text{LWE Death}_{c,s} \times \text{Post}_t$$
$$+ \omega_1 \text{Secessionist Death}_{c,s} + \omega_2 \text{LWE Death}_{c,s} + \omega_3 \text{Post}_t + \beta' x_{c,s,t} + \alpha_c + \alpha_t + \epsilon_{c,s,t}$$

(1.2)
All the variables are defined analogously as in Equation 1.1, and we also have the same set of controls and fixed effects. The results are reported in Table 1.6. It is clear from the table that the increase in vote share of Modi’s coalition is coming from the home constituencies of soldiers that died in the secessionist conflict and not from the home constituencies of soldiers who died in the LWE conflict. Column 4 of Table 1.6 includes constituency fixed effects and reports a 5.6 p.p. increase in vote share of Modi’s coalition. This result is significant at 1%. We will discuss several robustness checks of this result in the next sub-section.

Table 1.6: DID - By conflict region

<table>
<thead>
<tr>
<th></th>
<th>Right Coalition Vote Share</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td><strong>Secessionist Death × Post</strong></td>
<td>0.052***</td>
</tr>
<tr>
<td></td>
<td>(0.013)</td>
</tr>
<tr>
<td><strong>LWE Death × Post</strong></td>
<td>0.016</td>
</tr>
<tr>
<td></td>
<td>(0.014)</td>
</tr>
<tr>
<td><strong>Secessionist Death</strong></td>
<td>−0.014</td>
</tr>
<tr>
<td></td>
<td>(0.012)</td>
</tr>
<tr>
<td><strong>LWE Death</strong></td>
<td>0.0002</td>
</tr>
<tr>
<td></td>
<td>(0.010)</td>
</tr>
<tr>
<td><strong>Post</strong></td>
<td>0.103***</td>
</tr>
<tr>
<td></td>
<td>(0.007)</td>
</tr>
<tr>
<td><strong>State FE</strong></td>
<td>Y</td>
</tr>
<tr>
<td><strong>National election year FE</strong></td>
<td>Y</td>
</tr>
<tr>
<td><strong>Controls</strong></td>
<td>Y</td>
</tr>
<tr>
<td><strong>Constituency FE</strong></td>
<td>Y</td>
</tr>
<tr>
<td><strong>P-value of test of treatment equality</strong></td>
<td>0.073*</td>
</tr>
<tr>
<td><strong>Mean of dependent variable</strong></td>
<td>0.371</td>
</tr>
<tr>
<td><strong>Observations</strong></td>
<td>1,614</td>
</tr>
<tr>
<td><strong>R²</strong></td>
<td>0.580</td>
</tr>
</tbody>
</table>

Notes: LWE stands for Left Wing Extremism. Controls: log(Mean Night Lights), log(Electorate Size), log(Distance to Kashmir Conflict), log(Distance to Maoist Conflict), log(Distance to North-East Conflict), Share of SC Population and Share of ST Population. P-value of test of treatment equality is the Wald test to check the equality between the coefficients of Secessionist Death × Post and LWE Death × Post. Standard errors are clustered at the constituency level. The fixed effects are for each parliamentary constituency and national election year. *** , ** , * indicate significance at the 1, 5, and 10 percent critical level.

Further, if Modi’s speeches influence voters in the way salience theory suggests, we would expect voters exposed to secessionist deaths to say that secessionist conflicts were on their minds while deciding whom to vote for. We use a voter survey...
conducted by CSDS to examine this question. They ask voters about which election issues they consider to be the most important election issue. When asked if the voters chose topics such as “Terrorism,” “National Security,” “Pakistan related/surgical strike/cross-border terror/Pulwama attack,” we grouped these issues as ‘secessionist issues.’ On the other hand, if voters chose topics such as “Naxalism/Maoism,” which is how Indians refer to the LWE conflict, we grouped the issues as ‘LWE issues.’ We also combine the secessionist issues, the LWE issues, and issues such as “Mob lynchings” and “Law and Order,” together to group them as “general extremist issues.”

We test whether election issue variables created above are systematically associated with exposure to soldier deaths in various conflict regions. The regression equation that we estimate is given below:

\[
Y_{i,c,s,t} = \gamma_1 \text{Secessionist Death}_{c,s} \times \text{Post}_t + \gamma_2 \text{LWE Death}_{c,s} \times \text{Post}_t + \beta' x_{i,c,s,t} + \alpha_c + \alpha_t + \epsilon_{i,c,s,t}
\]  

Here \(Y_{i,c,s,t}\) is the election issue mentioned by the \(i_{th}\) individual in constituency \(c\), state \(s\) and time \(t\). The treatment groups are the same as before. We still have constituency and time fixed effects. We include individual-level socioeconomic controls such as log(Age), education level, employment dummy, caste categories dummies, gender, religion, urbanisation dummy and Income Band are now at the individual level. Standard errors are still clustered at the constituency level. The results are reported in Table 1.7.

The proportion of people who mention secessionist issues as the most important election issue is significantly higher in the home constituencies of soldiers who died in the secessionist conflict. The mention of general extremist issues does not go up in these regions. This result provides direct evidence that when political messages highlight soldier deaths, exposure to soldier deaths increases the issue’s salience in the voters’ minds. Moreover, mention of LWE issues does not go up in home constituencies of soldiers dying in LWE conflict, in line with the idea that event

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49 Other issues included are “Nationalism/patriotism,” “Article /Article A Kashmir issue.” The reasons for our classification is discussed in greater detail in online Appendix B.

50 All words that we include are “Naxalitte,” “Naxalism,” “Maoism,” “Naxalism/Maoism.”

exposure without the politicians’ message does not become salient in the voters’ minds.

Table 1.7: Election issues: Soldier deaths: 2014 - 2019

<table>
<thead>
<tr>
<th></th>
<th>Secessionist Death × Post</th>
<th>General Extremist</th>
<th>LWE Death × Post</th>
<th>Don’t Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secessionist Death × Post</td>
<td>0.021**</td>
<td>0.010</td>
<td>−0.001</td>
<td>−0.053</td>
</tr>
<tr>
<td>(0.009)</td>
<td>(0.012)</td>
<td>(0.001)</td>
<td>(0.035)</td>
<td></td>
</tr>
<tr>
<td>LWE Death × Post</td>
<td>0.006</td>
<td>0.011</td>
<td>0.002</td>
<td>0.009</td>
</tr>
<tr>
<td>(0.008)</td>
<td>(0.009)</td>
<td>(0.002)</td>
<td>(0.030)</td>
<td></td>
</tr>
<tr>
<td>National election year FE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Controls</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Constituency FE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>P-value of test of treatment equality</td>
<td>0.093*</td>
<td>0.988</td>
<td>0.187</td>
<td>0.263</td>
</tr>
<tr>
<td>Observations</td>
<td>48,248</td>
<td>48,248</td>
<td>48,248</td>
<td>48,248</td>
</tr>
<tr>
<td>R²</td>
<td>0.066</td>
<td>0.080</td>
<td>0.019</td>
<td>0.141</td>
</tr>
</tbody>
</table>

Notes: LWE stands for Left Wing Extremism. Controls: Gender, log(Age), Education level, Employment, Caste categories dummies, Religion, Urbanisation level, Income Band. P-value of test of treatment equality is the Wald test to check the equality between the coefficients of Secessionist Death × Post and LWE Death × Post. Standard errors are clustered at the parliamentary constituency level. The fixed effects are for each parliamentary constituency and national election year. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.

1.4.3 Robustness

In this sub-section, we discuss the robustness of the main result of the previous sub-section: exposure to secessionist deaths increases the vote share of Modi’s coalition; however, exposure to LWE deaths does not.

First, we present the results using an individual-level survey with all time-varying controls. Though we presented the balance table with estimates of some vital time variable controls in Table 1.3, it is worth checking how controlling for these and some more time-variant controls at the individual level affect voting behaviour. We use the CSDS data set in which voters report the party they voted for, which becomes the dependant variable. Our main right-hand side variables remain the same but with many new time-varying controls, including the respondent’s religion, employment status, income band, education level, asset holding, caste category, gender, age and whether he/she lives in a rural or urban setting. The regression equation is the same as 1.3, except that now the Y variable is a dummy for the party the respondent voted for.
The results are reported in Table A2. The direction and significance of the coefficients remain the same, although the individual-level survey reports larger effects on the treatment and larger standard errors. One explanation of the differing magnitude is the ‘silent voter hypothesis,’ which many political analysts believe to be true for India.\footnote{https://www.livemint.com/elections/lok-sabha-elections/how-exit-polls-landed-on-a-modi-return-1558373860298.html} According to this hypothesis, voter surveys often overestimate the vote share of those parties supported by upper castes because upper castes are more vocal in their support. The lower castes are silent or even misreport their voting choices in surveys. Thus, if upper castes were more likely to vote for the right coalition in case of soldier death, the survey results would report a higher coefficient on the treatment times post variable. We find evidence for this hypothesis as parliamentary constituencies with a larger population of upper castes shows a larger effect on vote share because of soldier death even using the election commission data. See Table A3.

We also check whether the home constituencies of dead soldiers voted differently than those from where soldiers did not die before the 2019 election. We check this by assigning our treatment, i.e. soldier deaths between 2014-2019 to the 2014 election. Table A4 in the appendix reports the result. The results indicate that soldier deaths between 2014-2019 do not affect voting behaviour before they occur. This is evidence for the common trends assumption.

Carozzi, Pinchbeck and Repetto (2021) argue that soldier deaths can also affect long term behaviour. We test this by checking the effect of deaths between 2009-2014 in the 2019 election. Results are reported in Table A5. We do not find any long term effects of soldier deaths. Given that papers based on salience theory Colussi et al. (2021) argue that recent events matter much more than earlier ones, we should find that older deaths do not affect voting behaviour. Thus, we find results in line with salience theory.

Our results can also be biased if home constituencies of dead soldiers send more soldiers in the armed forces because they are ‘more nationalistic.’ Given the lack of publicly available data on constituency level recruitment, the total death count in a constituency can be considered as a proxy for recruitment in a constituency. We interact the total deaths in a constituency between 2004 and 2014 with our main treatment variable, home constituencies of secessionist soldier deaths between 2014 and 2019. Again, the interaction does not affect our result. See Table A6. This result suggests that our results are robust to recruitment from a constituency.

We further perform a randomisation test to assess the statistical significance of
our main results. We randomly assign placebo soldier deaths to different parliamentary constituencies in our data. We then estimate the same regression using 100 different sets of placebo soldier deaths. Using this procedure, we find that more than 99% of the placebo interaction coefficients exhibit smaller t-statistics than the actual assignment. We show the entire distribution of t-statistics from this randomisation test in Figure A1 in the Appendix. This result confirms that our findings are unlikely to be a matter of coincidence.

Though we have controlled for many socioeconomic variables and checked that the pre-treatment vote share of the treatment and control groups is almost the same, the reader might still be concerned that these constituencies are not comparable. To address this concern, we check our results within a sub-sample of constituencies, where the treatment group remains the same as before. However, the control group now consists of only those constituencies that share a physical boundary with the treatment group. In these constituencies, the exposure to soldier deaths should be still lower than the treatment group. At the same time, they are much more likely to share other unobserved characteristics of our treatment group. We present the results in Table A7. The coefficient associated with the home constituencies of soldiers that died in secessionist conflict is still positive and significant though lower in magnitude. This lower magnitude aligns with the idea that neighbours are less exposed to the soldier deaths than the treatment group but more exposed to them than the non-neighbours.

We have used a dummy variable specification as our main specification, where treatment is defined as a parliamentary constituency with at least one soldier death in a given period. We also check our results using ln(0.001 + no. of deaths in a constituency) as the dependent variable. Our results are robust to this specification as well. See Table A8. The coefficient is similar to our dummy variable coefficient suggesting that the second death has minimal impact on voting.

Finally, if the home constituencies of the dead soldiers display spatial proximity, our main regression’s standard errors are potentially wrongly estimated. We thus also run our regressions using Conley standard errors Conley (1999). Taking different distance levels ranging from 150 km to 600 km, we find that standard errors remain remarkably stable. See Table A9.

1.4.4 Further results

In this sub-section, we present results that provide further evidence supporting our interpretation of the main results.

One might ask how vital the media connectivity of an individual voter is in
translating the soldier death into a change in voting behaviour. Since political messages reach people through media, we should find that higher media consumption increases the likelihood of political messages reaching the voter and highlighting soldier deaths and national security issues. To test this, we use our individual-level voter survey. In this survey, respondents were asked about their consumption of various news media sources like TV news, newspapers, radio news and the internet.\textsuperscript{53} We create two measures using this survey data. First, we create a standardised measure of media consumption using the responses of the survey.\textsuperscript{54} Second, we create a dummy measure that takes the value 1 if an individual watches news on media daily, or 4-5 times a week. Using these measures, we estimate the following regression equation:

\[
Y_{i,c,s,t} = \gamma \text{Secessionist Death}_{c,s} \times \text{Post}_t \times \text{Media}_{i,c,s,t} + \omega_1 \text{Secessionist Death}_{c,s} \times \text{Post}_t \\
+ \omega_2 \text{Secessionist Death}_{c,s} \times \text{Media}_{i,c,s,t} + \omega_3 \text{Post}_t \times \text{Media}_{i,c,s,t} \\
+ \omega_6 \text{Media}_{i,c,s,t} + \beta' x_{i,c,s,t} + \alpha_c + \alpha_t + \epsilon_{i,c,s,t}
\]

where ‘\(i\)’ is an individual survey respondent, ‘\(c\)’ is the parliamentary constituency, ‘\(s\)’ is the state, and ‘\(t\)’ is the general election year. \(Y_{i,c,s,t}\) is a dummy that takes the value 1 if respondent voted for NDA. Secessionist Death_{c,s} is a dummy for a constituency that received a soldier death in the secessionist region between June 2014 and April 2019. Post_{t} takes the value 1 for GE Year 2019 and 0 otherwise. Media_{i,c,s,t} is the amount of media consumption by an individual i. We also have individual level controls, including religion, employment, income, education, caste, gender, age, and urbanisation. Standard errors are clustered at the parliamentary constituency level.

Table 1.8 presents the results for the standardised measure. Different columns present the coefficient of interest for each media source. We see that TV viewers are most affected within the constituencies that received soldier deaths from secessionist regions. We also present the results using the dummy measure in Table A10 in the Appendix. The intuition behind these results is straightforward. Given Modi’s very high presence on the medium of television,\textsuperscript{55} those who have a higher TV consumption are more likely to receive his political messages that highlight soldier deaths.

\textsuperscript{53}The questions are of the following form- ‘How regularly do watch news on television - daily, sometimes, rarely or never?’. The respondents have to choose one of the following options: "1: Daily", "2: At least 3-4 times in a week", "3: At least once a week", "4: Never" and "8: Can’t say/Don’t know".

\textsuperscript{54}z = \frac{x - \mu}{\sigma}

\textsuperscript{55}https://theprint.in/opinion/telescope/pm-modi-has-become-indias-tv-god-while-cry-baby-opposition-blamed-for-too-much-politics/580724/
deaths. And hence, they are more likely to vote for Modi in case of a soldiers’ death.

Table 1.8: Media results: 2014 - 2019

<table>
<thead>
<tr>
<th></th>
<th>Right Coalition Vote Share</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>Secessionist Death × Post</td>
<td>0.104***</td>
</tr>
<tr>
<td></td>
<td>(0.038)</td>
</tr>
<tr>
<td>Secessionist Death × Post × TV</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
</tr>
<tr>
<td>Secessionist Death × Post × Newspaper</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.016)</td>
</tr>
<tr>
<td>Secessionist Death × Post × Radio</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.020)</td>
</tr>
<tr>
<td>Secessionist Death × Post × Internet</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| National election year FE     | Y              | Y              | Y              | Y              | Y              |
| Controls                      | Y              | Y              | Y              | Y              | Y              |
| Constituency FE               | Y              | Y              | Y              | Y              | Y              |
| Observations                  | 74,836         | 74,082         | 73,593         | 73,340         | 72,235         |
| R²                            | 0.218          | 0.219          | 0.218          | 0.217          | 0.220          |

Notes: Controls: Gender, log(Age), Education level, Employment, Caste categories dummies, Religion, Urbanisation level, Income Band. Standard errors are clustered at the parliamentary constituency level. The fixed effects are for each parliamentary constituency and national election year. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.

Given that we argue that exposure to soldier deaths makes the political messages regarding them salient in the voters’ minds, salient theory predicts that soldier deaths that occurred closer to the election date should affect voting behaviour more than earlier soldier deaths. Empirical papers based on salience theory demonstrate that recent events affect choices more (Colussi et al., 2021). To test this, we divide the deaths based on the year they took place. We find that deaths closer to the election have a higher coefficient, with the coefficient falling over time. We report the results in 1.9.

We argue that event exposure changes voting behaviour only when these events are highlighted in political messages, so soldier deaths should not affect voting behaviour much without political messages. We saw evidence for this in Table 1.6, with LWE deaths not changing voting behaviour in any significant way in the 2019 national election. However, it can be the case that secessionist deaths affect voting

56 Tversky and Kahneman (1973) and Thaler and Sunstein (2008) also argue that recent memories are stronger and thus affect our choices more.
Table 1.9: Timing of soldier death: Splitting by year

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secessionist Death 1 Year Before Election $\times$ Post</td>
<td>0.084***</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.018)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secessionist Death More Than 1 Year $\times$ Post</td>
<td>0.035**</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secessionist Death 2 Year Before Election $\times$ Post</td>
<td></td>
<td>0.059***</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.015)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secessionist Death More Than 2 Year $\times$ Post</td>
<td></td>
<td>0.052**</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.023)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secessionist Death 3 Year Before Election $\times$ Post</td>
<td></td>
<td></td>
<td>0.057***</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.013)</td>
<td></td>
</tr>
<tr>
<td>Secessionist Death More Than 3 Year $\times$ Post</td>
<td></td>
<td></td>
<td></td>
<td>0.054</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.045)</td>
</tr>
<tr>
<td>Secessionist Death 4 Year Before Election $\times$ Post</td>
<td></td>
<td></td>
<td></td>
<td>0.057***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.012)</td>
</tr>
<tr>
<td>Secessionist Death More Than 4 Year $\times$ Post</td>
<td></td>
<td></td>
<td></td>
<td>-0.006</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.067)</td>
</tr>
</tbody>
</table>

|                      | Y       | Y       | Y       | Y       |
| National election year FE |         |         |         |         |
| Controls              | Y       | Y       | Y       | Y       |
| Constituency FE       | Y       | Y       | Y       | Y       |
| Mean of dependent variable | 0.371  | 0.371  | 0.371  | 0.371  |
| Observations          | 1,614   | 1,614   | 1,614   | 1,614   |
| R$^2$                 | 0.782   | 0.781   | 0.781   | 0.782   |

Notes: Controls: log(Mean Night Lights), log(Electorate Size), log(Distance to Kashmir Conflict), log(Distance to Maoist Conflict), log(Distance to North-East Conflict), Share of SC Population and Share of ST Population. Standard errors are clustered at the constituency level. The fixed effects are for each parliamentary constituency and national election year. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.
behaviour even when any politician or leader does not talk about them. To test this, we look at the 2014 national election where there was negligible political messaging regarding the secessionist conflict. For example, in 2014, Narendra Modi, the challenger, focused on issues like inflation and corruption under the previous government. The incumbent PM, Dr Manmohan Singh, also did not draw any attention to the secessionist conflict. Hence, we check whether soldier deaths between 2009 and 2014 affected voting behaviour in the 2014 election. We find those home constituencies of soldiers that died in the secessionist conflict did not vote differently compared to other constituencies. The results are reported in Table 1.10.

Table 1.10: Effect of secessionist deaths in 2014 election

<table>
<thead>
<tr>
<th>Vote Share</th>
<th>BJP</th>
<th>NDA</th>
<th>INC</th>
<th>UPA</th>
<th>Left</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secessionist Death × Post</td>
<td>−0.026</td>
<td>−0.014</td>
<td>0.011</td>
<td>0.024</td>
<td>−0.002</td>
<td>−0.009</td>
</tr>
<tr>
<td>National election year FE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controls</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constituency FE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean of dependent variable</td>
<td>0.368</td>
<td>0.371</td>
<td>0.278</td>
<td>0.295</td>
<td>0.106</td>
<td>0.334</td>
</tr>
<tr>
<td>Observations</td>
<td>861</td>
<td>1,072</td>
<td>904</td>
<td>1,063</td>
<td>519</td>
<td>1,049</td>
</tr>
<tr>
<td>R²</td>
<td>0.926</td>
<td>0.830</td>
<td>0.831</td>
<td>0.717</td>
<td>0.929</td>
<td>0.826</td>
</tr>
</tbody>
</table>

Notes: Controls: log(Mean Night Lights), log(Electorate Size), log(Distance to Kashmir Conflict), log(Distance to Maoist Conflict), log(Distance to North-East Conflict), Share of SC Population and Share of ST Population. Standard errors are clustered at the constituency level. The fixed effects are for each parliamentary constituency and national election year. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.

Another concern that the reader might have is that our results might capture the effect of a charismatic speaker like Modi rather than a more general effect of any leader/politician sending a political message. Given that some politicians with better oratory or leadership skills are more effective in highlighting events than others, the effect of political messages can differ depending upon which politician is sending the message. However, it is still worth checking whether similar results hold for some other politician at a different point in time. To do that, we study the impact of Prime Minister Manmohan Singh’s message in the 2014 national election. His political message heavily focused on left-wing extremism, which he called “the greatest internal security threat to our country.”

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57 The election manifesto of the BJP talked about national security issues on page 37 of its 42-page manifesto. See https://www.thehindu.com/multimedia/archive/01830/BJP_election_manif_1830927a.pdf

58 https://www.thehindu.com/news/national/Manmohan-naxalism-the-greatest-internal-threat/article16886121.ece
orator as Modi, having the “bully pulpit” of the PM’s office should have led to some public response because of his message.\textsuperscript{59} Moreover, he promoted significant military as well as development plans to deal with the issue of LWE.\textsuperscript{60} The results of this exercise are presented in Table 1.11. We find that the vote share of Singh’s incumbent party (INC) increased by 3.2 p.p. in the home constituencies of soldiers who died in the LWE violence. The larger political coalition of his party (UPA) shows a larger increase.\textsuperscript{61}

Table 1.11: Diff-in-diff (Treatment period - 2014): Political spectrum

<table>
<thead>
<tr>
<th></th>
<th>Vote Share</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BJP</td>
</tr>
<tr>
<td>LWE Death × Post</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td>(0.011)</td>
</tr>
<tr>
<td>Secessionist Death × Post</td>
<td>−0.026</td>
</tr>
<tr>
<td></td>
<td>(0.016)</td>
</tr>
<tr>
<td>National election year FE</td>
<td>Y</td>
</tr>
<tr>
<td>Controls</td>
<td>Y</td>
</tr>
<tr>
<td>Constituency FE</td>
<td>Y</td>
</tr>
<tr>
<td>P-value of test of treatment equality</td>
<td>0.159</td>
</tr>
<tr>
<td>Mean of dependent variable</td>
<td>0.323</td>
</tr>
<tr>
<td>Observations</td>
<td>861</td>
</tr>
<tr>
<td>R\textsuperscript{2}</td>
<td>0.926</td>
</tr>
</tbody>
</table>

Notes: LWE stands for Left Wing Extremism. Controls: log(Mean Night Lights), log(Electorate Size), log(Distance to Kashmir Conflict), log(Distance to Maoist Conflict), log(Distance to North-East Conflict), Share of SC Population and Share of ST Population. P-value of test of treatment equality is the Wald test to check the equality between the coefficients of Secessionist Death × Post and LWE Death × Post. Standard errors are clustered at the constituency level. The fixed effects are for each parliamentary constituency and national election year. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.

1.5 Other potential mechanisms

We have argued that exposure to soldier deaths matters because they increase the salience of political messages in voters’ minds. However, it can be the case that

\textsuperscript{59} The following article notes the difference in the speech delivering styles of the two leaders. See https://www.livemint.com/Opinion/pL6iS5224P1ShKfe1II78/J/Narendra-Modi-vs-Mannohan-Singh-A-tale-of-two-speeches.html


\textsuperscript{61} It is worth noting that results based on survey data are not as strong for LWE deaths in the 2014 election as they are in the election commission reports. This might be because the Congress party did not make the LWE conflict an important election issue despite their PM saying otherwise. The INC election manifesto of 2014 does not discuss national security issues until page 47 of its 50-page election manifesto. We quote their manifesto on the issue of LWE here: “We will continue to address the challenge of Left Wing Extremism with a firm hand. We will strengthen the numbers, equipment and infrastructure for our security forces posted in these areas, even as we continue to pursue a development agenda to empower the people in these areas (see, https://www.thehindu.com/multimedia/archive/01813/Congress_Manifesto_1813003a.pdf)
exposure matters because it makes voters more informed. We look at whether voters exposed to soldier deaths are more informed about the Indian state’s response to them: the Balakot airstrikes. To test this, we run the following regression:

\[ Y_c = \gamma_1 \cdot \text{SecessionistDeath}_{c,s} + \gamma_2 \cdot \text{LWEDeath}_{c,s} + \beta' x_{c,s} + \alpha_s + \epsilon_{c,s} \]

where \( Y_c \) is based on how the survey voters responded to the following question: have you heard about the Balakot airstrikes? Table 1.12, column 1 reports that knowledge about the airstrikes does not correlate with exposure to soldier deaths. This result is in line with the fact that soldier deaths are uninformative about the airstrikes. However, columns 2-4 indicate that greater exposure to dead soldiers who died in secessionist conflict are more likely to give more credit to Modi for the airstrikes (rather than to Air-force or both Modi and Air-force). These results are consistent with our idea that event exposure makes voters more responsive to PM Modi’s message that he deserves credit for the airstrikes.\(^{62}\)

However, it can still be the case that voters in constituencies with soldier deaths might be more informed about other aspects of the secessionist conflict because of differential media coverage. To explore this, we look within a single media market. We already found that it is TV viewers who are particularly moved by soldier deaths in secessionist regions and vote for the NDA (see Table A10). Thus, we look at the biggest single TV media market in India, Uttar Pradesh. It is important to note that TV news is not decentralised below the state level in India. This state which has a population of over 200 million, has a Hindi-speaking population primarily. According to the government regulatory authority responsible for regulating TV broadcasts in India, there are nine regional news channels and around 30 national news channels broadcast in the state of UP in the Hindi language.\(^{63}\) The content in all these channels is the same across all of the state. Table A11 presents the results for running our main specification of the individual-level survey data, i.e. Equation 1.3, just for the state of Uttar Pradesh. We can see that even within the state of UP, our results hold. Individuals are more likely to vote for PM Modi’s party within a single media market in-home constituencies of a soldier who died in the secessionist

\(^{62}\)Modi explicitly asked voters to vote for Balakot airstrikes in election rallies. See the quote in the introduction of the paper.
\(^{63}\)http://broadcastseva.gov.in/
conflict.\textsuperscript{64}

Though we have discussed TV media coverage, according to studies done by Columbia Journal Review, social media has become a crucial campaigning tool in recent years in India.\textsuperscript{65} Hence, messages can circulate on social media about soldier deaths and PM Modi’s response to them. Thus, we interact social media consumption with our treatment. However, we find that the interaction term is not significant (see Table A13). Overall, the results above indicate that it is unlikely that the change in voting behaviour that we document due to exposure to soldier deaths is entirely driven by differences in informativeness amongst the voters.

Table 1.12: Credit for air strikes: Soldier deaths: 2014 - 2019

<table>
<thead>
<tr>
<th></th>
<th>Heard about Strikes</th>
<th>Credit-Modi</th>
<th>Credit-AF</th>
<th>Credit-Both</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secessionist Death</td>
<td>-0.008</td>
<td>0.060**</td>
<td>-0.033</td>
<td>-0.016</td>
</tr>
<tr>
<td></td>
<td>(0.021)</td>
<td>(0.027)</td>
<td>(0.027)</td>
<td>(0.026)</td>
</tr>
<tr>
<td>LWE Death</td>
<td>0.003</td>
<td>-0.035**</td>
<td>0.019</td>
<td>0.054**</td>
</tr>
<tr>
<td></td>
<td>(0.018)</td>
<td>(0.017)</td>
<td>(0.023)</td>
<td>(0.024)</td>
</tr>
<tr>
<td>State FE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Controls</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Observations</td>
<td>21,035</td>
<td>15,992</td>
<td>15,992</td>
<td>15,992</td>
</tr>
<tr>
<td>R\textsuperscript{2}</td>
<td>0.147</td>
<td>0.038</td>
<td>0.079</td>
<td>0.061</td>
</tr>
</tbody>
</table>

Notes: LWE stands for Left Wing Extremism. Controls: Gender, log(Age), Education level, Employment, Caste categories dummies, Religion, Urbanisation level, Income Band. P-value of test of treatment equality is the Wald test to check the equality between the coefficients of Secessionist Death and LWE Death. Standard errors are clustered at the parliamentary constituency level. The fixed effects are for each state. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.

Another possible reason for an increase in the vote share of Modi’s party is that events such as soldier deaths and the associated speeches by the leader can make the local party cadre more active in campaigning. Previous literature in political economy notes that local campaigning does affect voting behaviour (Madestam et al., 2013). This local campaigning can indirectly affect voting rather than a direct effect that follows from a salience theory. However, results are not explained by local campaigning differences. Analysing the voter survey data illustrates that visits of party workers did not increase the effect of soldier deaths on the vote share in the 2019 election. See Table A14 in the appendix.

\textsuperscript{64}To complete the local media coverage analysis, we also study coverage by print media and e-newspapers. We have acquired data on a leading daily Hindi newspaper. We are analysing how news coverage differs along with different electoral constituencies. We will add those results to our paper soon.

\textsuperscript{65}https://www.cjr.org/tow_center/India-WhatsApp-analysis-election-security.php
It can also be the case that soldiers’ deaths increased political participation in their home constituency by increasing voter turnout or other election activities like campaign contributions, election meetings, door-to-door canvassing, distributing election leaflets and processions. We report the results on election turnout in Table A15 for the 2019 election year. We find that the home constituencies of dead soldiers did not experience differential turnout. Similarly, Table A16 indicates that participation of voters in campaign contribution, door-to-door canvassing, distributing election leaflets did not increase in home constituencies of dead soldiers in the 2019 election. We also find that people attended fewer election meetings and processions in constituencies that received soldier deaths in secessionist regions. This result could be observed in these constituencies if people had already decided how they would vote before the local election campaign because of the soldier deaths and Modi’s speeches. We find results suggesting that this can be the case (see Table A17).

Another explanation for the 2019 election results is that Islamic fundamentalism in Kashmir is increasing the support for far-right parties in India (Abbas, 2017). As discussed in the background section, the secessionist conflict in Kashmir is linked to Islamic fundamentalism. Thus soldier deaths in Kashmir might fuel anger against Islamic fundamentalism in voters, and they might vote for the Hindu right parties. We might have wrongly classified deaths as ‘secessionist’ by clubbing together deaths in the Kashmir and North-East regions. However, only deaths in the Kashmir region affect voting behaviour since the secessionist conflict in the North-East region does not have an Islamic character.

To check this, we split our soldier deaths into three groups: deaths in Kashmir, in the North-East, and the LWE region. If it were just Islamic fundamentalism increasing the vote share of the BJP in India, only soldier deaths from Kashmir would matter and soldier deaths from the North-East region would not. However, we find that soldier deaths from both Kashmir and North-East increased the vote share of the BJP and NDA in the home constituencies of dead soldiers in the 2019 general elections (See, Table A18).

It is possible that militaristic reporting by media makes event exposure salient in voters’ minds rather than the politician’s message. However, in the case of India, we think it is reasonable to argue that media is passive, i.e. it follows the political message of the leader. To verify this claim, we study media coverage of different types of conflict using the GDELT data. We study the number of articles and the number of news sources covering secessionist and LWE conflict between 2009 and 2019. The purpose of this exercise is to check whether different political messages
about the types of conflict affect the media coverage, controlling for the severity of the issue. Between the 2009 and 2014 period, PM Manmohan Singh focused on the LWE conflict. Thus if the media was passive, it should focus on LWE conflict more. On the other hand, between 2014 and 2019, PM Modi focused on secessionist conflict. Thus media should focus on secessionist conflict more. To check this, we run the following regression:

\[
Y_{c,w} = \text{Secessionist}_c + \text{Year}(14-19) + \text{Secessionist}_c \times \text{Year}(14-19)
+ \text{Number of Soldier Deaths}_{c,w} + \text{Goldstein Scale}_{c,w} + \alpha_w
\]

where \(Y_{c,w}\) is the standardised measure of the number of articles or the number of sources coming from a conflict region \(c\) in a week \(w\). The articles and sources included only report on the Secessionist conflict and LWE conflict in India. \text{Seccessionist}_c\ is a dummy that takes the value 1 if the article is about secessionist conflict region. This makes LWE conflict the base category. \text{Year}(14-19)\ is also a dummy that takes the value 1 if the article came out between June 2014 and April 2019. Controls include the number of soldier deaths and the Goldstein scale (a measure of the severity of the conflict). We also include week fixed effects \(\alpha_w\).

Table 1.13 reports the result. Columns 1 and 2 report results with LWE conflict as the base category and Secessionist conflict as the dummy. In Columns 3 and 4, the base and dummy are reversed.\(^{66}\) We find that controlling for the number of deaths and the Goldstein scale, there was more media coverage of LWE conflict between 2009 and 2014 compared to secessionist conflict and more media coverage of the secessionist conflict between 2014 and 2019 compared to the LWE conflict. This is evidence indicating that political messages about the types of conflict affect the media coverage controlling for the severity of the issue.

Finally, we discuss the case that local incumbent leaders can take advantage of soldier deaths in their respective constituencies by helping the martyr’s family and increasing their media presence. This local initiative can increase their vote share, which is reflected in the party’s vote share. If this was the case, then the way we interpret our results would be misleading as people are not being responsive to the message of the central leadership but instead responding to the initiatives of the local leadership. To test this, we interact our main variable of interest, soldier deaths in secessionist region times post, with a dummy that takes the value 1 if the incumbent

\(^{66}\)Obviously, both regressions give the same result. We report both for ease of interpretation.
Table 1.13: Media coverage of conflict

<table>
<thead>
<tr>
<th></th>
<th>STD(# Articles)</th>
<th>STD(# Sources)</th>
<th>STD(# Articles)</th>
<th>STD(# Sources)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secessionist Conflict</td>
<td>−0.060**</td>
<td>−0.210***</td>
<td>−0.060**</td>
<td>−0.210***</td>
</tr>
<tr>
<td></td>
<td>(0.015)</td>
<td>(0.008)</td>
<td>(0.015)</td>
<td>(0.008)</td>
</tr>
<tr>
<td>LWE Conflict</td>
<td>−</td>
<td>−</td>
<td>0.060***</td>
<td>0.210***</td>
</tr>
<tr>
<td></td>
<td>(0.015)</td>
<td>(0.008)</td>
<td>(0.015)</td>
<td>(0.008)</td>
</tr>
<tr>
<td>Secessionist Conflict × Year (14-19)</td>
<td>0.134***</td>
<td>0.191***</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td></td>
<td>(0.008)</td>
<td>(0.006)</td>
<td>(0.008)</td>
<td>(0.006)</td>
</tr>
<tr>
<td>LWE Conflict × Year (14-19)</td>
<td>−</td>
<td>−</td>
<td>−0.134***</td>
<td>−0.191***</td>
</tr>
<tr>
<td></td>
<td>(0.008)</td>
<td>(0.006)</td>
<td>(0.008)</td>
<td>(0.006)</td>
</tr>
<tr>
<td>Week-year FE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Conflict region FE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Mean of dependent variable</td>
<td>9.933</td>
<td>1.613</td>
<td>9.933</td>
<td>1.613</td>
</tr>
<tr>
<td>Observations</td>
<td>1.969</td>
<td>1.969</td>
<td>1.969</td>
<td>1.969</td>
</tr>
</tbody>
</table>

Notes: Number of Articles is the total number of source documents containing one or more mentions of this event. Number of Sources is the total number of information sources containing one or more mentions of this event. LWE stands for Left Wing Extremism. Standard errors are clustered at the conflict region level. The fixed effects are for each conflict region and week. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.

belonged to the same party as the central leadership. The results are presented in Table A19. We find that the local incumbent of the party in power (BJP or NDA) does not significantly increase the effect of soldier death on vote share.

1.6 Conclusion

Political persuasion matters. Leaders have used speeches and messages to persuade citizens and voters in many parts of the world at different points in time. However, we only have a limited understanding of what makes voters responsive to these messages. This paper found that event exposure can make political messages more salient in the voters’ minds and consequently change their voting decisions. Using the 2019 national elections in India, we found that voters more exposed to soldier deaths in the secessionist conflict were more responsive to Modi’s militaristic speeches that followed these deaths. This led to an increase in the vote share of his party in constituencies with higher exposure. We also find that soldier deaths affect voting behaviour only if there is political messaging regarding the conflict region in which they die. Thus, soldier deaths in LWE regions did not cause an increase in

[^67]: See many examples in this article. http://projects.leadr.msu.edu/makingmodernus/exhibits/show/the-first-modern-president/pulpit

36
vote share.

Importantly, these results are valid not only for the 2019 elections. We find similar results for the 2014 national election in India. At that time, there was no political messaging regarding secessionist conflict; however, PM Singh focused on the LWE threat and took steps to deal with it. Thus, in line with our conceptual framework, we found that secessionist deaths did not affect vote share. However, the vote share of PM Singh’s political coalition increased in the home constituencies of soldiers who died in the LWE. We also find that soldier deaths close to the election have a higher impact on voting behaviour. Also, media connectivity of voters matters in translating the deaths of soldiers into votes.

Many times political messages and events are informative. However, persuasion often works for reasons which are beyond updating of beliefs. In this paper, we document evidence that when political messages highlight specific events, they make voters responsive to those events. However, without the political messages, the same events do not affect voting behaviour much. We think that this reference to events is vital because voters associate the event with the politician’s agenda and vote for him only when a politician highlights an event. Our work contributes to enhancing the understanding of political persuasion. It also helps us understand how politicians can influence election agendas and voting behaviour, given the events and experiences of the electorate. We hope this paper motivates further research that helps us understand the behavioural underpinnings of voting behaviour.

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68 Arceneaux (2006)
69 Druckman (2004)
2 Resisting Modernisation due to Foreign Occupation: The Role of Religious Identity.

with Amit Chaudhary

2.1 Introduction

Religious groups sometimes resist modern inventions/institutions that lead these groups to lower human capital outcomes. In this context, we study whether religious groups living under colonial regimes are affected by institutions introduced by the coloniser. There is some anecdotal evidence that suggests that this might happen. For example, Iranians have expressed apprehensions about the COVID-19 vaccines after their ‘supreme leader’, Ali Khamenei banned such vaccines from the US and Britain. In this paper, we particularly focus on how deposing a ruler affects the literacy outcomes of his religious group under foreign occupation.

Deposing the ruler can affect the literacy outcomes of his religious group due to many reasons. For instance, foreign occupiers might discriminate against the religious group of the deposed ruler due to fear of rebellion. It can also be the case that, when the ruler is deposed, his religious community may feel aggrieved. Thus, they might refuse to take up modern education introduced by the occupiers, even against their economic interests. On the other hand, the impact of foreign occupation can also be positive. For example, the religious group of the ruler might have acquired certain economic advantages under his regime and continue to prosper under the foreign rulers. Similarly, suppose the local ruler and foreign occupier reach an amicable settlement on the terms of rule. In that case, the ruler may facilitate the participation of his religious community in the education system introduced by the occupier.

We study this question in the context of the colonisation of India. Two large religious communities, Hindus and Muslims, lived together in the country before British colonisation. The British, during the process of colonisation, deposed many existing rulers. These rulers belonged to different religions, predominantly Hinduism and Islam. We construct a novel data set combining the religion of the deposed ruler

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1See Martinez-Bravo and Stegmann (2020)
2https://indianexpress.com/article/world/iran-covid-vaccine-ban-us-uk-7138369/
After this, the Iranian Government disallowed foreign companies to test COVID-19 vaccines on the Iranian people (See: https://www.thehindu.com/news/international/iran-bans-foreign-companies-from-testing-covid-19-vaccines-on-iranians-says-president/article33536728.ece)
3Others include rulers of religions like Sikhism. We discuss this in greater detail in the main body of the paper
using the Imperial Gazetteer of India (Hunter, 1908), with the literacy outcomes of Hindus and Muslims at the district level using census data for 1881, 1911 and 1921.

We find that Muslim literacy is 2 percentage points (p.p.) lower in districts where the ruler deposed by the British was Muslim. Similarly, Hindu literacy is 1.5 p.p. lower in regions where the deposed ruler was Hindu. These results are robust to controlling for demographic variables such as population shares of different religions, population shares of different castes, and average household size. They are also robust to including local geographic factors like a coastal dummy, major census city, altitude, latitude, and longitude. We also include local development measures as controls, including urbanisation, occupation classes (industry and agriculture) and port city.

Moreover, though we have many geographic, demographic and economic controls, bias caused by omitted variables is still a possibility. We deal with it in two ways. First, we take the difference in literacy rates of the two religious communities as the dependent variable. This difference cancels out any variable affecting literacy across districts. Our results remain robust to this specification.

Second, we use an instrumental variable approach. We use the spatial progression of the Maratha Hindu rebellion from the birthplace of Shivaji to identify the exogenous variation in the religion of the ruler. Shivaji was a rebel king who became a symbol of the Maratha Hindu Rebellion (Vartak, 1999). Results are robust to this specification as well.

Exploring mechanisms, we find a set of results consistent with the hypothesis that when the western colonisers replaced Islamic rulers, Muslims’ ‘sense of pride’ was hurt. Thus, they refused to take up western education (Lewis, 2003; Aziz, 1967). Abdul Lateef, a Muslim reformer promoting modern education in colonial Bengal (province in India), describes the condition in 1885, in his own words:

"Mahomedan youth kept themselves aloof from the English schools and the new knowledge. This was attributed to the natural pride and the great bigotry of the Mahomedans .......... It was an obvious effect of history"

Belmekki (2007), reviewing the impact of British rule on Muslims in India, states that:

“When Muslim hegemony was gone and real power lay with the British, the Muslims would not, could not, forget that they had once ruled over the land. Their reaction was bitter and truculent”

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4For the full quote, see Section 2.3. These excerpts are taken from Firdous (2015).
5Belmekki (2007) refers to Aziz (1967)
The above argument depends on the subjects identifying with the ruler. We posit that this ‘self-identification’ with the ruler will be higher in the core of the kingdom than in the periphery.\(^6\) Thus, it should be the case that the resistance to western education is stronger at the core of the kingdom than the periphery. We define the periphery as the districts that share a border with states ruled by kings of other religions (all others are considered core). We find that all the negative effect on literacy associated with the religion of the deposed comes from the core of the annexed kingdom.

Thus, we not only find evidence consistent with the hypothesis that Muslims resisted western education because they did not like losing political power, but ours is the first paper to document a similar effect for Hindus. Though the historical literature focuses on Muslims not taking up western education, we find Hindu literacy is also lower where a Hindu ruler was deposed. Thus, the results shed light on the fact that even followers of non-Islamic religions disliked their rulers being removed and refused to take up western education.

We consider other plausible mechanisms that could explain the above results. For example, Metcalf and Metcalf (2006) argue that the British excluded the old (Muslim) aristocracy from all higher posts in the government because they discriminated against the community that had previously held political power. This discrimination could lower the education outcomes of Muslims because this would lower their incentives to get educated. However, using employment records of the British bureaucracy, we find that Muslim employment rates in these services are not lower in regions where the final ruler was Muslim. The same is true for Hindus.\(^7\)

Another plausible reason for these results could be that Muslim literacy is lower under Muslim kings and Hindu literacy lower under Hindu kings, even if the ruler is not deposed by the British. To check the importance of the deposition of the ruler, we document literacy outcomes of those regions in India that were under the indirect rule of the British.\(^8\) In these regions, the local rulers were not deposed.

\(^6\) Many historians have argued that the sovereignty of kings at the end of the medieval period in India (after the year 1707) existed only in core regions of their state and not in the periphery. See, Malik (1990), and Stein (1999). Also, political theorists who study kingdoms and empires argue that the relationship between rulers and subjects in the periphery is different from the relationship between rulers and subjects in the core. We discuss this more in Section 2.3.

\(^7\) The British might not discriminate at the employment level against the community of the deposed ruler but might provide fewer educational opportunities to them at the level of the provisioning of schools and educational scholarships. However, this does not seem to be true as they particularly made sure that communities that were not doing well in terms of school enrollment (usually Muslim) were eligible for scholarships and reduced fees in public schools, and the colonial government established a number of schools in Muslim majority districts (Progress of Education in India, Quinquennial Reviews, 1897–1927, (Cotton, 1898)).

\(^8\) See, Iyer (2010)
They were responsible for the local administration and collected revenue on behalf of the British. Chaudhary and Rubin (2016) found higher Muslim literacy in districts ruled by Muslim kings and did not find a negative effect for Hindus under Hindu kings. These results are consistent with the claim that the ruler’s deposition plays a vital role in lowering the literacy outcomes of his religious group.

We see our paper as the first to provide empirical evidence that foreign occupation can adversely affect the literacy outcomes of the religious group of the deposed ruler. Though providing evidence for the exact mechanism is beyond the scope of this paper, the set of results are consistent with the hypothesis that when foreign occupiers dislodge local rulers, the religious group of the local rulers show resistance to the inventions/institutions introduced by the occupiers. Thus, we give some quantitative evidence supporting the hypothesis espoused by many historians like Lewis (2003), and Aziz (1967). However, we also show that, though these historians have mainly discussed this resistance hypothesis for Islam and its followers, we find similar effects for Hindus in India.

2.1.1 Related literature

Religion and Human Capital formation: Our paper contributes to the literature on how the religion of people affects their human capital formation (Becker and Woessmann (2009), Saleh (2018)). These papers discuss how certain religious practices affect human capital formation. Our work departs from these papers by highlighting the role of religion as an identity rather than as just a practice. Our paper documents results that strongly suggest that religious identity can make individuals and groups take decisions that decrease their human capital outcomes, thus hurting their economic interests.

Religion and modernity: Another strand of literature that our paper contributes to is the literature that studies the relationship between religion and modernity (Carvalho (2013), Binzel and Carvalho (2017), Bazzi et al. (2019)). These papers focus on how modern life and reforms led to a revival of religious practices in various places. Our paper focuses on how religious groups resisted modernity because of their religious identity. We find evidence consistent with the hypothesis that Islamic civilisation resisted modern education because of losing political power (Lewis (2003), Aziz (1967)). We also provide evidence that this resistance was not limited to Muslims. Hindus in British India also resisted western education where the deposed ruler was Hindu.

9There is a strand of literature on identity and economic outcomes starting from Akerlof and Kranton (2000b).
Resistance to western interventions: Finally, our paper contributes to the literature that studies resistance to specific western interventions by people most likely to gain from those interventions. Lowes and Montero (2018) argue that forced medical interventions reduced trust in medicine in Africa. Martinez-Bravo and Stegmann (2020) argue that misinformation against vaccines by the Taliban was effective in reducing the demand for them in Pakistan. We contribute to this literature by providing evidence consistent with the hypothesis that resistance to western education emerged in religious groups because of their opposition to the foreign occupation that deposed their local ruler.

The rest of the paper is structured as follows. The next section discusses the conceptual framework. Section 2.3 discusses the historical background and data sources used in the empirical analysis. Section 2.4 discusses the main results of the paper. Section 2.5 discusses the plausibility of various other mechanisms and robustness checks. Finally, Section 2.6 concludes.

2.2 Conceptual framework

In this section, we discuss the different channels through which deposing a ruler can change the literacy outcomes of his subjects under foreign occupation. In particular, we discuss how two different yet plausible mechanisms give different testable predictions. The framework developed helps us disentangle how deposing the ruler changed the literacy outcomes of his religious group.

First, we will discuss the reason proposed by Lewis (2003) and Aziz (1967), and what kinds of predictions should be seen in the data if this reason was valid. These historians have argued that followers of Islam were reluctant to pursue education provided by the West because they resented losing political power to western regimes. If this argument is correct, then the first prediction that should hold is that Muslims should have lower literacy in those regions where Islamic rulers directly lost power to western occupiers as opposed to regions where they did not hold political power when western powers took over.

Moreover, though these historians have discussed this behaviour only among Muslims, the above argument is independent of Islam’s religious practice or teachings. Any religious group whose ruler is deposed by a foreign power should then resist the education system introduced by the foreign occupier. Thus, even though historians have not discussed this effect for Hindus in India, we still should find similar effects for them. Hindus should also have lower literacy in those regions where Hindu rulers directly lost power to the British as opposed to regions where they did not hold political power when the British occupied the region.

However, the above argument does rely on a homogeneous religious identity
of the subjects and their amicable association with the deposed ruler. Thus, if a religious group has more within-group fragmentation and some of these groups do not have an amicable association with the deposed ruler, they would not mind the British deposing the ruler. Thus, we would find that the negative relationship between literacy and religion of the deposed ruler will be lower for such a religious group. This sort of within-group fragmentation is usually considered to be higher among Hindus due to the historical presence of the caste system. Moreover, some of these castes supported the British against the local Hindu rulers. For example, the caste of Mahars (considered untouchables in the caste hierarchy) supported the British against the local Peshwa (upper caste brahmin) Hindu rulers in the Battle of Koregaon. Thus, the effect of deposing the local ruler should be lower among Hindus than a comparatively more monolithic identity of the followers of Islam.

The argument of Aziz (1967) crucially rests on subjects identifying with the deposed ruler. Historians argue that the sovereignty of kings did not extend beyond the core region of the kingdom at the end of the medieval period in India. Thus, subjects in periphery districts might not feel as associated with the ruler as subjects in the core. If we assume that ‘self-identification’ with the ruler is higher at the kingdom’s core than at the periphery, then the above hypothesis yields additional predictions. Particularly, given that subjects at the periphery do not consider the ruler to be sovereign, the resistance to western education should be weaker there than in the core. We test this prediction in Section 2.4.

Another prediction that emerges from analysing the above historical argument is that if the British colonisers and the local rulers reach an amicable settlement concerning the terms of rule, then the religious group of the local ruler should not resist western education. In the case of colonial India, this implies that districts that were under the indirect rule of the British should behave differently than those under direct rule. Under indirect rule, the local rulers were not generally deposed but were responsible for the local administration and collected revenue on behalf of the British. Hence, if districts are ruled indirectly, then the literacy of the subjects should not be lower under the ruler of their religion. We also investigate this in our analysis.

Notice that the predictions discussed above not only follow from the hypothesis espoused by Lewis (2003) and Aziz (1967) but also from the arguments put

\footnote{\textsuperscript{10}see, Deshpande (2010)}

\footnote{\textsuperscript{11}see, Geppert and Müller (2015)}

\footnote{\textsuperscript{12}This is the time of the collapse of the Mughal Empire after 1707. For greater details, see Section 2.3}

\footnote{\textsuperscript{13}see, Iyer (2010) for greater details}
forward by Metcalf and Metcalf (2006), that the British excluded the community that previously held political power from the higher posts in their government. If this were true, then the community of the deposed ruler will have lower incentives to get educated as they would have limited opportunities following the education acquired. This effect of discrimination in jobs would also reflect in the literary statistics. However, this argument requires that the employment records of British bureaucracy also show lower Muslim employment in regions where the deposed ruler was Muslim and lower Hindu employment in regions where the deposed ruler was Hindu. We thus test this prediction using the employment records of the British bureaucracy.

Note that even if some Muslims are not taking up education because of their dislike of the British colonisers who overthrew their king, those who do get educated will still find government jobs if the British do not discriminate against them. Thus, the hypothesis of Aziz (1967) is not disproved even if Muslims are well represented in government jobs in districts where the deposed ruler was Muslim.

In the next section, we discuss the historical background and the state of education in India before the 1881 census. This section provides the reader with a summary of political conditions in pre-colonial India, how the British annexed different kingdoms and how literate the population was before the British implemented their education policy.

2.3 Historical background and data

2.3.1 Background

The empire that dominated most of the modern-day region of India, Pakistan and Bangladesh for almost two centuries starting from 1526 is the Mughal Empire. It reached its peak in the 17th century when it extended over most of the Indian subcontinent and parts of Afghanistan. The empire territory extended over four million square kilometres (Turchin et al., 2006). The Mughal dynasty was Muslim, and the empire had an Islamic identity (Dale, 2009). We do our analysis on districts of colonial India which were part of the Mughal Empire in 1707 when it started to disintegrate after the death of Emperor Aurangzeb. Figure 2.1 gives the extent of the Empire.

The dissolution of the empire was followed by the emergence of small successive states ruled by Hindu and Muslim kings. Figure 2.2 shows the religions of different rulers across India. Meanwhile, the East India Company, which began as a trading company chartered in 1600, amassed significant profits and an army started annexing Indian territory, starting with Bengal in 1757 and the Battle of Plassey
Figure 2.1: Muslim Empire boundaries in 1707

(Metcalf and Metcalf, 2006). The East India Company conquered many kingdoms, deposed the kings, and established themselves as the supreme power in India. The British annexation continued up to 1857, which was the year of the Indian Mutiny or the First War of Independence. Then, the Company rule ended, and the British government took direct control over the territories.

These rapid changes in the Indian sub-continent brought major economic and social changes as well. In particular, the old political and social hierarchy went through a change. Nawab Abdul Lateef, a Muslim educator in the Bengal Province of colonial India\(^\text{14}\), noticed how these political and social changes affected his religious community, i.e., the region’s Muslims. In 1885, recalling his experiences as a District Magistrate in 24 Parganas (a district in Bengal), he wrote\(^\text{15}\):

“The Mahomedans saw themselves left behind in the race of life by their Hindu fellow-subjects, over whom they had not only exercised political power before the British regime, but also, not long before, and even under the British, had maintained a social ascendancy.”

Trying to explain the reason for this condition, he adds:

\(^{14}\)He was noted as among the twelve most prominent Indian men in 19th century Bengal (Bradley-Birt, 1910)

\(^{15}\)These excerpts are taken from Firdous (2015).

45
Mahomedan youth kept themselves afool from the English schools and the new knowledge. This was attributed to the natural pride and the great bigotry of the Mahomedans. The imputation was not wholly unmerited, yet it was not the whole truth. The pride was somewhat a matter of course. It was the obvious effect of history, but no effort was made to soften it. The British government, in the consciousness of irresistible might, felt itself under no obligation to conciliate prejudice. The Mahomedan bigotry, such as it was, was not inherently worse than that of other communities.”

This quote is insightful. First, it points to his belief that Muslims resisted English schools and western knowledge because of the ‘natural pride’ they felt, having once been the dominant political and social force in the region. Second, it also notes that this ‘bigotry’ was not ‘inherently worse’ among the Muslims than other communities. Thus, Lateef hints that other religious communities would behave the same if removed from political and social ascendancy.

Worried about the conditions of his fellow community members, Lateef made efforts to rid his people of this prejudice. In one such effort, he established the Mohamedan Literary Society in 1863 and at its inauguration, he again notes:

“Being fully aware of the prejudice and exclusiveness of the Mohamedan community, and anxious to imbue its members with a desire to interest themselves...”
in Western learning and progress, and to give them an opportunity for the
cultivation of social and intellectual intercourse with the best representatives
of English and Hindu Society, I founded the Mahomedan Literary Society.”

Many historians (Aziz (1967), Khan (1989), Masselos (1996)) in India have also
attributed the Muslim community’s resistance to modern education introduced by
the British to resentment because the British supplanted Muslims as political mas-
ters. To quote one of them, Masselos (1996) claims that Muslims lived ‘in a nostalgia
of their past glories’.

“It was argued that psychologically they (Muslims) had not recovered from
their loss of power when they were supplanted as rulers of the subcontinent
by the British and that they lived in the past, in a nostalgic world of former
glories (page: 119).”

Though many historians have talked about Muslims resisting western knowledge
because they lost political power, it seems that few historians followed up on Lateef’s
insight to look for similar ‘bigotry’ among the Hindus where they had lost political
power. Though there is some discussion of how Hindus were not inclined to take up
western education, which was linked to Christian missionaries (Majumdar, 1951),
there is limited research that linked to them to losing political power. Our paper is,
thus, (to the best of our knowledge) the first to test this hypothesis empirically for
both communities and find the results consistent with Lateef’s insight.

Further, in our conceptual framework, we note that, if we assume that the sub-
jects associate themselves more with the king in the core of the kingdom than the
periphery, then resistance to western education due to deposing the king would be
higher in the core. We think this is a natural assumption to have given the histori-
cal context we are studying. When the Mughal Empire disintegrated, Malik (1990)
argues that the concepts of core and periphery came to be defining features of 18th
century pre-colonial India. Generally, the status of entities and individuals in the
kingdom’s core often significantly differs from that of the periphery. Often peripheral
actors are kept at a distance and do not identify with the sovereignty of the kings
who rule them. They are even subject to open discrimination and exploitation.16

An excellent example of this phenomenon is the Maratha-Rajput rivalry in the
late eighteenth/early nineteenth century in India.17 The Maratha (a Hindu sub-
group geographically associated with the southwest region of India) Empire began
with the rebel-king Shivaji. It became the dominant power in India at that time

16 For a detailed discussion on this issue, look into Bevir (2010)
17 To see extensive discussion on the Maratha-Rajput rivalry see Gupta (1970)
till the British defeated and tamed their power in the Anglo-Maratha Wars.\textsuperscript{18} As they expanded north, they encountered resistance from Rajput kings (Hindu kings associated with the north-west region of India) who traditionally shared a good relationship with the Mughal Empire.\textsuperscript{19} The Marathas were successful in their military expansion against the Rajput kings and forced them to pay tributes and taxes.\textsuperscript{20} Thus, one would expect that Hindus who associated themselves with Rajput kings did not mind when Maratha rule was replaced by the British in their region.

In general, we think it is reasonable to assume that the association of Hindus with their kings would be higher in the core of the kingdom than far away. The same should be valid for Muslims as well. We find the results in line with this assumption in Section 2.4. In the following sub-section, we discuss the state of education in the Indian sub-continent before the 1881 census.

### 2.3.2 State of education in the early nineteenth century

Unfortunately, there is no systematic record of literacy among the Indian masses before the British rule in India. The earliest anthropological surveys were carried out in the eastern region of India by Francis Buchanan between 1807-1814.\textsuperscript{21} The surveys were again recompiled by Martin Montgomery.\textsuperscript{22} Another set of reports, called the Adam’s Reports (Adam, 1835, 1836, 1838), prepared by a Scottish missionary on the state of vernacular education in Bengal and Bihar (1835-1838), is the first documented measure of literacy available that is disaggregated for different religious groups.

Before we summarise the findings of these surveys, we note that caution is necessary to make inferences. First, these are available only for a few districts in the eastern part of India. Second, these reports were created using second-hand information.

\textsuperscript{18} For a review of the Anglo-Maratha wars, see Deshpande (2006)
\textsuperscript{19} See Zaidi (1994)
\textsuperscript{20} See Gupta (1970)
\textsuperscript{21} Francis Buchanan also covered southern India in his surveys, comprising regions of Mysore, Canara and Malabar. These regions are not included in our sample because either they were not part of the Mughal Empire, and if they were, then they remained a Princely state.
\textsuperscript{22} (Martin, 1838)
tion and hearsay. Thus, the scientific validity of these surveys is far from certain. However, they are important as they are still the best sources of information (even if partial) on the state of education in the early nineteenth century.

Table 2.1: District level education attainment survey done by Francis Buchanan during 1807-1814

<table>
<thead>
<tr>
<th>District</th>
<th>Literate</th>
<th>Population</th>
<th>Literacy rate</th>
<th>Literacy rate (1881)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purnea</td>
<td>16,550</td>
<td>2,904,360</td>
<td>0.6</td>
<td>2.7</td>
</tr>
<tr>
<td>Patna-Gaya</td>
<td>25,890</td>
<td>3,364,420</td>
<td>0.8</td>
<td>4.1</td>
</tr>
<tr>
<td>Shahabad</td>
<td>7,045</td>
<td>1,419,520</td>
<td>0.6</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Notes: Francis Buchanan surveyed the districts of East India Company from 1807-1814. The statistical tables and notes contain the state of education in the districts of Bengal and Behar. Literacy is taken as the number reported as men fit to act as the writers and born in the division. The survey also contains information on the demographics, including population. Districts in Buchanan’s survey are mapped with the districts from the 1881 census. Behar and Patna city is mapped to Gaya and Patna (1881).

Both surveys agree that the state of education was in a bad situation. We present the summary statistics from Buchanan’s survey in Table 2.1 and Adam’s Report in Table 2.2. Table 2.1 provides literacy outcomes from three regions in eastern India. The literacy rate for all districts was below 1% for all regions. Hence, this suggests that the overall literacy levels in India were low in the early eighteenth century.

Second, Table 2.2 indicates that even as early as the 1830s, Hindus seem to have taken more advantage of the educational institutions under the British rule than Muslims in the eastern part of India. It is important to note that Muslim kings ruled this region of India, and hence the early evidence is in line with our conceptual framework.

Overall, these results compared to the 1881 census data suggest that education among the masses only picked up once the British altered the mass education policy.

Adam’s report is a report collecting information from various sources and provides suggestions in great detail on how to improve the state of vernacular education in the region. Adam notes down that his report is a collection of information from second-hand sources:

“I have not introduced into this report any statement of facts resting on my observation and authority, but have merely attempted to bring into a methodised form the information previously existing in detached portions respecting the state of education. The details, therefore, which follow must be regarded as the results of the observations of others, and as depending upon their authority, and all that I have done is to connect them with each other and present them in consecutive order. (page: 15).”

There is also another region called Rangpur covered in Buchanan’s survey. However, the data collection or reporting seems to be erroneous. It reports a literacy of 5.2% in this region in 1807, while other districts in the same region have less than 1% literacy. Moreover, the Rangpur region reports 6.2% literacy in 1881, implying only an increase of about 20%. Whereas the other districts which are reported in the Buchanan report 400-500% increase.
Table 2.2: Literacy rates for Bengal and Bihar districts from Adam’s report (1835)

<table>
<thead>
<tr>
<th>District</th>
<th>Muslim literacy(%)</th>
<th>Hindu literacy(%)</th>
<th>Literacy(%)</th>
<th>Literacy (1881)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moorshidabad</td>
<td>0.21</td>
<td>1.67</td>
<td>0.99</td>
<td>2.72</td>
</tr>
<tr>
<td>Beerbhoom</td>
<td>0.24</td>
<td>1.52</td>
<td>1.28</td>
<td>4.44</td>
</tr>
<tr>
<td>Burdwan</td>
<td>0.68</td>
<td>2.42</td>
<td>2.07</td>
<td>4.51</td>
</tr>
<tr>
<td>South Behar</td>
<td>0.98</td>
<td>0.93</td>
<td>0.93</td>
<td>2.07</td>
</tr>
<tr>
<td>Tirhoot</td>
<td>0.05</td>
<td>0.44</td>
<td>0.40</td>
<td>1.63</td>
</tr>
</tbody>
</table>

Notes: Adam, in 1835, did the survey on the state of education in Bengal and Bihar. Adam’s survey recorded the number of adults who can merely read and write. The data of surveyed district in 1835 with the district level literacy data from 1881 census. South Behar (1835) is mapped to Gaya (1881) and Tirhoot (1835) to Muzzafarpur (1881).

after Wood’s despatch (1854). Hence, we think that literacy and education were so rare before this period that they can be ignored without biasing our regression coefficients.

2.3.3 Data

We used the historical atlas of Schwartzberg (1978) to measure the extent of the Mughal Empire. We superimposed it onto the Indian census maps using Singh and Banthia (2004) to get the districts in British India that we include in our sample. We collated district level GIS centroids from Donaldson (2018). The Indian Censuses of 1881, 1911 and 1921 cover most of the provinces of Assam, Bengal, Bihar & Orissa, Bombay, Central Province, Madras, Punjab and United Province. The censuses provide data at a district level on literacy, population, area, religion, caste, occupation, urbanisation and geographical indicators like rainfall, latitude and longitude.

Enumerators consider a person literate when he or she can read or write in any language. To remain consistent with the definition of literacy, for the 1881 census, we removed those who were “under instruction” or still learning to read and write. The disaggregated literacy rate of Hindus and Muslims is available in the census.

We followed the list of cities provided by the census of India and map the cities with districts containing those cities. We included the list of major medieval port cities from Jha (2013) in our empirical analysis. The year of annexation by the

25To know more about the Wood’s despatch see: https://babel.hathitrust.org/cgi/pt?id=hvd.32044105337398&view=plaintext&seq=655&q1=bengal_20language.
26We used the matching of Mughal Empire and Census boundaries using spatial overlay technique.
27We exclude Bombay, Calcutta and Madras cities as they are significantly different from the rural districts of India.
28Age and gender-based specific literacy numbers are available to test for the robustness of results.
British ranges from the year 1757 to 1871. We also include the years of Muslim rule as measured by Jha (2013).

Table 2.3: Descriptive statistics of the Colonial India districts (1911 & 1921)

<table>
<thead>
<tr>
<th></th>
<th>count</th>
<th>mean</th>
<th>sd</th>
<th>min</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muslim Literacy</td>
<td>367</td>
<td>0.06</td>
<td>0.05</td>
<td>0.01</td>
<td>0.24</td>
</tr>
<tr>
<td>Hindu Literacy</td>
<td>383</td>
<td>0.07</td>
<td>0.05</td>
<td>0.02</td>
<td>0.23</td>
</tr>
<tr>
<td>Literacy gap</td>
<td>367</td>
<td>0.01</td>
<td>0.07</td>
<td>-0.17</td>
<td>0.21</td>
</tr>
<tr>
<td>% Hindu</td>
<td>383</td>
<td>0.68</td>
<td>0.28</td>
<td>0.04</td>
<td>0.99</td>
</tr>
<tr>
<td>% Muslim</td>
<td>367</td>
<td>0.26</td>
<td>0.27</td>
<td>0.00</td>
<td>0.91</td>
</tr>
<tr>
<td>% Christian</td>
<td>389</td>
<td>0.01</td>
<td>0.02</td>
<td>0.00</td>
<td>0.28</td>
</tr>
<tr>
<td>% Sikhs</td>
<td>389</td>
<td>0.01</td>
<td>0.05</td>
<td>0.00</td>
<td>0.42</td>
</tr>
<tr>
<td>% Tribes</td>
<td>389</td>
<td>0.05</td>
<td>0.15</td>
<td>0.00</td>
<td>0.95</td>
</tr>
<tr>
<td>% Others</td>
<td>389</td>
<td>0.01</td>
<td>0.05</td>
<td>0.00</td>
<td>0.69</td>
</tr>
<tr>
<td>% Brahman Caste</td>
<td>389</td>
<td>0.05</td>
<td>0.04</td>
<td>0.00</td>
<td>0.24</td>
</tr>
<tr>
<td>% Low Castes</td>
<td>389</td>
<td>0.15</td>
<td>0.08</td>
<td>0.00</td>
<td>0.38</td>
</tr>
<tr>
<td>% Rural</td>
<td>389</td>
<td>0.90</td>
<td>0.09</td>
<td>0.32</td>
<td>1.00</td>
</tr>
<tr>
<td>Agriculture accp. %</td>
<td>389</td>
<td>0.71</td>
<td>0.13</td>
<td>0.28</td>
<td>1.18</td>
</tr>
<tr>
<td>Industry occup. %</td>
<td>389</td>
<td>0.11</td>
<td>0.06</td>
<td>0.00</td>
<td>0.34</td>
</tr>
<tr>
<td>Commerce occup. %</td>
<td>389</td>
<td>0.07</td>
<td>0.03</td>
<td>0.00</td>
<td>0.23</td>
</tr>
<tr>
<td>Profession occup. %</td>
<td>389</td>
<td>0.02</td>
<td>0.01</td>
<td>0.00</td>
<td>0.04</td>
</tr>
<tr>
<td>Normal rainfall</td>
<td>389</td>
<td>49.06</td>
<td>31.81</td>
<td>3.52</td>
<td>259.00</td>
</tr>
<tr>
<td>Latitude</td>
<td>387</td>
<td>24.81</td>
<td>4.42</td>
<td>13.06</td>
<td>33.57</td>
</tr>
<tr>
<td>Longitude</td>
<td>387</td>
<td>80.92</td>
<td>6.21</td>
<td>67.00</td>
<td>94.65</td>
</tr>
<tr>
<td>Total Area(sq km)</td>
<td>389</td>
<td>3624.51</td>
<td>2108.98</td>
<td>101.00</td>
<td>13888.00</td>
</tr>
<tr>
<td>Average Household size</td>
<td>389</td>
<td>4.79</td>
<td>0.47</td>
<td>3.56</td>
<td>6.22</td>
</tr>
<tr>
<td>Total population size</td>
<td>389</td>
<td>1032642.78</td>
<td>673051.61</td>
<td>39320.00</td>
<td>4837730.00</td>
</tr>
<tr>
<td>Real Income</td>
<td>324</td>
<td>22459573.95</td>
<td>16700272.81</td>
<td>248381.41</td>
<td>1.23e+08</td>
</tr>
<tr>
<td>Year annexed by British</td>
<td>387</td>
<td>1809.60</td>
<td>32.42</td>
<td>1757.00</td>
<td>1871.00</td>
</tr>
<tr>
<td>Years of Muslim rule</td>
<td>379</td>
<td>79.33</td>
<td>39.65</td>
<td>-98.00</td>
<td>161.00</td>
</tr>
<tr>
<td>Distance from Junnar</td>
<td>387</td>
<td>1157.79</td>
<td>473.51</td>
<td>76.64</td>
<td>2292.32</td>
</tr>
</tbody>
</table>

Notes: This table lists the districts of British India defined by 1911 and 1921 Indian Census which were part of Mughal empire (1707) and ruled directly (excluding princely states).

- Census document does not report the Literacy rate of Muslims in certain cities where there is negligible Muslim population. We do robustness checks excluding such sample completely.
- Donaldson (2018) only reports the Income of districts where the agriculture data is available.
- Years of Muslim rule is from the establishment of Muslim dynasty in India till the Annexation by British powers.

The summary statistics of the variables in the data are shown in Table 2.3 for 1911 and 1921. The descriptive statistics in Table 2.3 reveal that the average literacy of Hindus and Muslims was similar with large heterogeneity across the districts. The Hindu-Muslim literacy gap across districts varied from -16% to 21% and shows a large difference in inter-religion education outcomes across districts of colonial India. The average population share of Muslims was 25% across districts against 70% of Hindus. It is clear that Muslims were not just a small minority but constituted a sizeable part of the Indian population. The summary statistics of the variables for...
1881 is shown in Table B1.

We also constructed a novel data set from the Imperial Gazette (Hunter, 1908) to get the religion and dynasty of the deposed ruler. It gives us the year of annexation. The Imperial Gazette is a twenty-six volume historical reference document. It lists the administrative provinces, districts, and town names in India and provides their socio-economic statistics. The Imperial Gazette outlines the history of every district. The history of the district contains information on past rulers and the date of annexation by the British. We use this gazette to determine the name of the last ruler and the year of annexation by British variables manually. To minimise the measurement error, we cross-check the details of the deposed ruler annexed by the British with historical sources (Majumdar, 1951).

Figure 2.2 shows the districts in 1911 marked by the religion of the deposed ruler. The data for the religion of the deposed ruler in the colonial Indian districts that existed as of the 1911 census is presented in Table 2.4. The British annexed 97 districts whose rulers were Muslim, and 57 districts that had Hindu rulers. Districts where the deposed ruler followed another religion or where the ruler’s religion is uncertain because of the complex political climate of the time are dropped in robustness tests.

Table 2.4: Province-wise distribution of religion of last ruler in Districts (1911)

<table>
<thead>
<tr>
<th>Province</th>
<th>Hindu</th>
<th>Muslim</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assam</td>
<td>2</td>
<td>3</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>Bengal</td>
<td>1</td>
<td>25</td>
<td>1</td>
<td>27</td>
</tr>
<tr>
<td>Bihar &amp; Orissa</td>
<td>6</td>
<td>15</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Cental Provinces</td>
<td>18</td>
<td>0</td>
<td>4</td>
<td>22</td>
</tr>
<tr>
<td>Madras</td>
<td>0</td>
<td>11</td>
<td>0</td>
<td>11</td>
</tr>
<tr>
<td>Punjab</td>
<td>4</td>
<td>0</td>
<td>24</td>
<td>28</td>
</tr>
<tr>
<td>United Provinces</td>
<td>9</td>
<td>35</td>
<td>4</td>
<td>48</td>
</tr>
<tr>
<td>bombay</td>
<td>16</td>
<td>8</td>
<td>0</td>
<td>24</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>56</strong></td>
<td><strong>97</strong></td>
<td><strong>40</strong></td>
<td><strong>193</strong></td>
</tr>
</tbody>
</table>

Notes: This table lists the districts of British India defined by 1911 Indian Census which were part of Mughal empire (1707) and ruled directly (excluding princely states). Punjab province has majority of Sikh rulers who were deposed by British. Assam had neo-Tai and confluence of Tribal, Hindu and Buddhist religion which are tagged as others in table.

Finally, we constructed novel data on the employment of Indians in the British government using the civil list of 1871 (Quarterly Indian Civil List, October 1871). We digitised the provincial civil list of nine provinces of the British government. We used the “district distribution list” of the civil list to find the identity of civil servants employed in the district. We used the names to classify them into Indian-
sounding names and European names. We then classified the Indian names using names and surnames into Hindu and Muslim (and others).

Given that historians like Metcalf and Metcalf (2006) and Ahmad (1991) have argued that the British kept Muslims from important posts of authority in the government, we focus on civil lists because it notes the important administrative jobs. These jobs are classified as necessary enough to call for loyalty and prestige from the crown as civil servants. Also, the remuneration was directly received from the crown of central colonial administration, which has a component of pension attached showing direct linkage to the colonisers (Mcilvenna, 2019).

The next section presents the main results of our paper.

2.4 Main results

The main regression equations that we estimated are given below. We want to estimate the effect of the religion of the deposed ruler on the literacy of his subjects under British rule. First, we estimate Equations (2.1) and (2.2) using ordinary least squares regressions with many district-level controls. These Equations are given below:

\[
\text{Muslim Literacy}_{it} = \alpha_1 + \beta_1 \text{Muslim Deposed Ruler}_i + \gamma'_1 X_{it} + \epsilon_{it} \tag{2.1}
\]

\[
\text{Hindu Literacy}_{it} = \alpha_2 + \beta_2 \text{Hindu Deposed Ruler}_i + \gamma'_2 X_{it} + \mu_{it} \tag{2.2}
\]

where Muslim and Hindu literacy is given for each district \(i\) in time 1881, 1911, and 1921. The Religion of Deposed Ruler in Equation 2.1 is a time-invariant dummy that takes the value 1 if the deposed ruler is Muslim. The Religion of Deposed Ruler in Equation 2.2 is again a time-invariant dummy that takes the value 1 if the deposed ruler is Hindu. \(X\) is the set of control variables for district \(i\) in time \(t\). The demographic controls include population shares of different religions, population shares of different castes, and average household size. We also have a set of geographic controls: a coastal dummy, a dummy for a major census city including Calcutta and Bombay, and the altitude, latitude, and longitude of the district centroid. Finally, we added a set of economic controls which included occupation classes (industry, agriculture, services), port city and urbanisation. These controls are important as demography, geography and economic factors can be correlated with the religion of the deposed ruler and thus bias our estimates.

The first column of Table 2.5 shows that there is a negative relationship between Muslim literacy and the religion of the deposed ruler being Muslim. Muslim literacy

\[29\text{The top rank we found was district collector / judge. The lowest position we can see is of Naib Tehsildar or assistant superintendent.}\]
| Table 2.5: Association between religion of last ruler and Muslim literacy in Colonial India |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|
|                                  | (1)             | (2)             | (3)             | (4)             |
| Muslim ruler                    | -0.0150***     | -0.0205***     | -0.0228***     | -0.0194***     |
|                                 | (0.00520)      | (0.00468)      | (0.00719)      | (0.00789)      |
| Geographic controls             | NO              | YES             | YES             | YES             |
| Demographic controls            | NO              | NO              | YES             | YES             |
| Economic controls               | NO              | NO              | NO              | YES             |
| Year FE                         | YES             | YES             | YES             | YES             |
| Observations                    | 549             | 547             | 365             | 365             |

Notes: Significance levels at * p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses corrected for district-level clustering. The Muslim ruler dummy (Hindu ruler Dummy) is assigned as one when the religion of last ruler whose territory British annexed is Muslim (Muslim). Demographic controls include population shares of different religions, population shares of different castes, average household size. Geographic controls: coastal dummy, major census city in colonial India, altitude, latitude, and longitude. Economic controls which include occupation classes (industry, agriculture etc.), port city and urbanization.

is 1.5 p.p lower in a district where the deposed ruler was Muslim compared to a district where the deposed ruler was non-Muslim. It is statistically significant, even without any controls. In column 2 of Table 2.5, we add geographic controls. The magnitude of the coefficient of interest becomes larger after adding geographic controls. This suggests that Muslim rulers ruled geographical regions that had higher literacy.

In columns 3 and 4, we add demographic and economic controls. The number of observations in these columns decreases because we do not have these controls for 1881. A large Muslim population might be associated with the sorting of Muslims in poorer districts (Chaudhary and Rubin, 2011). We thus control for population shares of Muslims (and other religions). We also add occupation because occupations often were divided along religious lines.\footnote{see (Jha, 2013). This paper also argues that port cities had affluent Muslim populations, and thus, port cities are also controlled for.} Caste distribution within a district is also used as a control as it can affect literacy. Column 4 of Table 2.5 shows that the coefficient associated with the religion of the deposed ruler is still negative and statistically significant. Muslim literacy decreases by 1.94 percentage points. The mean Muslim literacy in 1911 was 6%. Thus, the Muslim literacy rate in the districts which Muslim rulers ruled is substantially lower than in those previously ruled by non-Muslims under colonial rule.

The first column of Table 2.6 reports the coefficient for the religion of the deposed
ruler from Equation 2.2, without controls. There is a negative relationship between Hindu literacy and the religion of the deposed ruler being Hindu. The coefficient is -2.5 p.p and statistically significant. In column 2, we add geographic controls and the coefficient decreases in absolute terms to -1.5 p.p. This is consistent with the results in Table 2.5 column 2, as it suggests that non-Hindu (Muslim) kings ruled geographical regions with higher literacy.

Table 2.6: Association between religion of last ruler and Hindu literacy in Colonial India

<table>
<thead>
<tr>
<th></th>
<th>Hindu ruler</th>
<th>Hindu ruler</th>
<th>Hindu ruler</th>
<th>Hindu ruler</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>Hindu ruler</td>
<td>−0.0253***</td>
<td>−0.0152***</td>
<td>−0.00978*</td>
<td>−0.0106**</td>
</tr>
<tr>
<td></td>
<td>(0.00501)</td>
<td>(0.00416)</td>
<td>(0.00508)</td>
<td>(0.00498)</td>
</tr>
<tr>
<td>Geographic controls</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Demographic controls</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Economic controls</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>Year FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Observations</td>
<td>565</td>
<td>563</td>
<td>365</td>
<td>365</td>
</tr>
</tbody>
</table>

Notes: Significance levels at * p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses corrected for district-level clustering. The Muslim ruler dummy (Hindu ruler Dummy) is assigned as one when the religion of last ruler whose territory British annexed is Muslim (Muslim). Demographic controls include population shares of different religions, population shares of different castes, average household size. Geographic controls: coastal dummy, major census city in colonial India, altitude, latitude, and longitude. Economic controls which include occupation classes (industry, agriculture etc.), port city and urbanization.

In columns 3 and 4 of Table 2.6, we add demographic and economic controls. We still have a negative association with the religion of the deposed ruler in the years 1911 and 1921, but with a smaller coefficient. As discussed in the conceptual framework, if the religious community of deposed rulers has within-group fragmentation, then that community will have a lower negative effect of deposing the ruler. The within-group fragmentation is considered higher for the Hindu religion than Muslims due to inter-caste fragmentation.31 Our Y variable is not available at the caste level. Thus, even though we control caste shares in the population, in line with our conceptual framework, we find a lower effect of the religion of the deposed ruler on Hindu literacy.

Hence, Table 2.5 and Table 2.6 report results that are in line with the predictions discussed in Section 2.2 associated with the hypothesis of Aziz (1967) and Lewis (2003). Another prediction stems from extending this argument a little further. If

---

31 Many Hindu Communities fought against Peshwa rulers who were high caste Maratha rulers. Particularly, the low caste Mahars supported the British against them. See, pages 39-52 in Geppert and Müller (2015)
subjects at the core of the kingdom are more closely associated with the ruler than those at the periphery, then the resistance to western education due to deposing the local ruler would be more in the core of the kingdom. We now test this prediction from our framework.

To test this we divide our sample into core districts and periphery districts, where periphery districts are the ones that share their boundary with kingdoms that are ruled by rulers of other religions. All the remaining districts are considered to be core. The above definition gives us 61 periphery districts and 132 core districts. The regression equations that we estimate are given below:

\[
\text{Muslim Literacy}_{it} = \alpha + \beta_1 \text{Muslim Deposited Ruler}_i + \beta_2 \text{Periphery}_i + \beta_3 \text{Hindu Deposited Ruler} \times \text{Periphery}_i + \gamma_1 X_{it} + \epsilon_{it} \tag{2.3}
\]

\[
\text{Hindu Literacy}_{it} = \alpha + \beta_1 \text{Religion of Deposited Ruler}_i + \beta_2 \text{Periphery}_i + \beta_3 \text{Religion of Deposited Ruler} \times \text{Periphery}_i + \gamma_2 X_{it} + \mu_{it} \tag{2.4}
\]

<table>
<thead>
<tr>
<th>Table 2.7: OLS : Periphery districts and Muslim ruler</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
</tr>
<tr>
<td>Muslim ruler</td>
</tr>
<tr>
<td>Periphery</td>
</tr>
<tr>
<td>Muslim ruler \times Periphery</td>
</tr>
<tr>
<td>Geographic controls</td>
</tr>
<tr>
<td>Demographic controls</td>
</tr>
<tr>
<td>Economic controls</td>
</tr>
<tr>
<td>Year FE</td>
</tr>
<tr>
<td>N</td>
</tr>
</tbody>
</table>

Notes: Significance levels at * p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses corrected for district-level clustering. The Muslim ruler dummy (Hindu ruler Dummy) is assigned as one when the religion of last ruler whose territory British annexed is Muslim (Muslim). Demographic controls include population shares of different religions, population shares of different castes, average household size. Geographic controls: coastal dummy, major census city in colonial India, altitude, latitude, and longitude. Economic controls which include occupation classes (industry, agriculture etc.), port city and urbanization.

Tables 2.7 and 2.8 report the results. It is clear from both the tables that periphery districts in themselves hurt literacy in line with Foa (2016). Foa (2016) argues that pre-colonial states in India were in constant conflict with one another.
and thus this could lower the literacy rate in these periphery districts that were more exposed to inter-kingdom warfare. However, the interaction between the religion of the deposed ruler and the periphery district is positive, and even significant in case where the ruler was Muslim. It is also clear from the tables that all the negative effects of the religion of the deposed ruler on the literacy of the subjects can be found in core districts. These results strongly suggest that the negative effect on literacy is the outcome of the connection that subjects in the core of these kingdoms had with the kings with whom they shared a religious identity, which made them resist western education.

Table 2.8: OLS : Periphery districts and Hindu ruler

<table>
<thead>
<tr>
<th></th>
<th>Muslim literacy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>Hindu ruler</td>
<td>−0.0214***</td>
</tr>
<tr>
<td></td>
<td>(0.00738)</td>
</tr>
<tr>
<td>Periphery</td>
<td>−0.0137**</td>
</tr>
<tr>
<td></td>
<td>(0.00569)</td>
</tr>
<tr>
<td>Hindu ruler × Periphery</td>
<td>0.00853</td>
</tr>
<tr>
<td></td>
<td>(0.00849)</td>
</tr>
<tr>
<td>Geographic controls</td>
<td>YES</td>
</tr>
<tr>
<td>Demographic controls</td>
<td>YES</td>
</tr>
<tr>
<td>Economic controls</td>
<td>NO</td>
</tr>
<tr>
<td>Year FE</td>
<td>YES</td>
</tr>
<tr>
<td>N</td>
<td>357</td>
</tr>
</tbody>
</table>

Notes: Significance levels at * p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses corrected for district-level clustering. The Muslim ruler dummy (Hindu ruler Dummy) is assigned as one when the religion of last ruler whose territory British annexed is Muslim (Muslim). Demographic controls include population shares of different religions, population shares of different castes, average household size. Geographic controls: coastal dummy, major census city in colonial India, altitude, latitude, and longitude. Economic controls which include occupation classes (industry, agriculture etc.), port city and urbanization.

To alleviate concerns about omitted variables bias, we first reported results using a specification that estimates the literacy gap between Hindus and Muslims in a district. This specification rules out across district geographic, demographic and economic variables that might have been omitted effects. Although we control for many of these factors, there is still a possibility that some variable, for example, quality of schools, is omitted to affect literacy rates. However, if we assume that these variables should affect different religious groups alike, then the literacy gap between the two groups should not be affected by these factors.

Thus we ran the literacy gap specification, i.e., Hindu literacy - Muslim literacy is
regressed on a dummy for the religion of the deposed ruler (Muslim = 1, in columns 1 and 2) and found the literacy gap to be positive, consistent with our main results (Table B2). The Hindu-Muslim literacy gap increases by three-fourth times the sample average (column 2) in regions with a Muslim king. In columns 3 and 4, we changed the dummy variable. Now it took the value 1 if the ruler was Hindu. Again the results were robust and statistically significant.

As a second robustness check, we ran an IV regression. Our instrument exploits the concentric diffusion of the Hindu (Maratha) empire from the birthplace of Shivaji, a Hindu king who rebelled against the Mughal Empire, thus becoming a symbol of Maratha Hindu identity. Shivaji was born in 1630 in a place called Junnar in southwest India. Our instrument for the religion of the deposed ruler is the distance from Junnar, as districts closer to Junnar were more likely to be ruled by the Hindu Maratha kings. We construct a measure of distance using pre-industrial era measures of distance and transportation costs based on Ozak (2018). We use this measure of distance from Junnar as an instrument for the religion of the deposed ruler in colonial India.

### Table 2.9: IV results for Muslim literacy

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Least cost</td>
<td>0.0362***</td>
<td>(0.00627)</td>
</tr>
<tr>
<td>Muslim ruler</td>
<td>−0.0307*</td>
<td>(0.0176)</td>
</tr>
<tr>
<td>Geographic controls</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Demographic controls</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Economic controls</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Year FE</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>N</td>
<td>365</td>
<td>365</td>
</tr>
<tr>
<td>Kleibergen-Paap Wald F statistics</td>
<td>33.4</td>
<td></td>
</tr>
</tbody>
</table>

Notes: Significance levels at * p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses corrected for district-level clustering. The Muslim ruler dummy (Hindu ruler Dummy) is assigned as one when the religion of last ruler whose territory British annexed is Muslim (Muslim). Demographic controls include population shares of different religions, population shares of different castes, average household size. Geographic controls: coastal dummy, major census city in colonial India, altitude, latitude, and longitude. Economic controls which include occupation classes (industry, agriculture etc.), port city and urbanization.

32 Majumdar et al. (1958) describes Shivaji and his Maratha empire in these words “The Maratha nation he built up defied the Mughal Empire during and after Aurangzeb’s reign and remained a dominant power in India during the 18th century. The Maratha power also competed with the English for supremacy in India till it was finally crushed in the time of Lord Hastings”
The first column of Table 2.9 reports the first stage estimates of our instrument. We see that our instrument strongly correlates with the religion of the deposed ruler. The Kleibergen-Paap Wald F statistic of the instrument from the first stage is 33.4 (also reported in column 1 of Table 2.9). Together, these results provide evidence that our instrument has a strong first stage. Column 2 reports the IV estimates of the coefficient associated with the religion of the deposed ruler. The coefficient is negative as the OLS estimate, but the negative effect is larger for the IV estimate (-3.07 for IV versus -1.94 for OLS).

Table 2.10 presents IV results on Hindu literacy. The IV estimate is again negative as the OLS estimate, but (as for Muslims) the negative effect is larger for the IV estimate. This difference in estimates can be because of potential differences between the compliers and the full sample. Given that we argue in our conceptual framework that subjects living closer to the core of the kingdom feel more connected with the king, Hindus living in regions closer to Junnar may have a stronger ‘self-identification’ with the Hindu kings. Similarly, Muslims living further away from Junnar may have stronger ‘self-identification’ with the Muslim kings. This could push the IV estimates upwards for both Hindus and Muslims. It should be noted that the IV results are robust to using a Euclidean measure of distance from Junnar as well (Tables B3 and B4).

We can summarise the results in this section as follows. First, the literacy of a religious group is negatively associated with the religion of the deposed ruler if they shared religious identity. This negative effect is robust and valid for both Muslims and Hindus in colonial India. Second, the negative effect of the religion of the deposed ruler on literacy is much stronger at the core of a kingdom than at the periphery. We interpret these results as evidence for the hypothesis that when rulers are deposed, their subjects, who feel that they share an identity with them (usually the religious group of the ruler living in the core of the kingdom), resist participating in the institutions introduced by the occupier, even if it is against their economic interest. In the next section, we discuss some other mechanisms that can explain the results.

2.5 Other mechanisms and robustness checks

Another reason that could lead to an adverse effect of the religion of the deposed ruler on literacy rates under the British is that the British discriminated against Muslims and Hindus in colonial India. Second, the negative effect of the religion of the deposed ruler on literacy is much stronger at the core of a kingdom than at the periphery. We interpret these results as evidence for the hypothesis that when rulers are deposed, their subjects, who feel that they share an identity with them (usually the religious group of the ruler living in the core of the kingdom), resist participating in the institutions introduced by the occupier, even if it is against their economic interest. In the next section, we discuss some other mechanisms that can explain the results.

33 The difference between OLS and IV estimates is larger for Hindus. This is probably because historians argue that Marathas, though Hindus, were still considered occupiers by Hindus in many regions away from their heartland, for example, among the Rajput kings of the north. Thus the potential differences between the compliers and the full sample are likely to be higher for Hindus than for Muslims. To see an extensive discussion on the Maratha-Rajput rivalry, see Gupta (1970).
Table 2.10: IV results for Hindu literacy

<table>
<thead>
<tr>
<th></th>
<th>Hindu literacy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>Least cost</td>
<td>−0.0348***</td>
</tr>
<tr>
<td>Hindu ruler</td>
<td>−0.0607***</td>
</tr>
<tr>
<td>Geographic controls</td>
<td>YES</td>
</tr>
<tr>
<td>Demographic controls</td>
<td>YES</td>
</tr>
<tr>
<td>Economic controls</td>
<td>YES</td>
</tr>
<tr>
<td>Year FE</td>
<td>YES</td>
</tr>
<tr>
<td>N</td>
<td>365</td>
</tr>
<tr>
<td>Kleibergen-Paap Wald F statistics</td>
<td>28.3</td>
</tr>
</tbody>
</table>

Notes: Significance levels at * p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses corrected for district-level clustering. The Muslim ruler dummy (Hindu ruler Dummy) is assigned as one when the religion of last ruler whose territory British annexed is Muslim (Muslim). Demographic controls include population shares of different religions, population shares of different castes, average household size. Geographic controls: coastal dummy, major census city in colonial India, altitude, latitude, and longitude. Economic controls which include occupation classes (industry, agriculture etc.), port city and urbanization.

the deposed ruler’s religious community. Metcalf and Metcalf (2006) argue that the British discriminated against Muslims and kept them away from positions of authority because they were the previous ruling class. If this were true, then this would provide lower incentives for Muslims to become educated. By the same logic, the British will discriminate against Hindus in regions where Hindu kings ruled, thus lowering the literacy of Hindus.

However, this policy would imply that the employment patterns of the two communities should also follow a pattern similar to literacy, i.e. the Muslim community should have lower employment levels under the British where the deposed ruler was Muslim. Similarly, Hindus should have lower employment levels where the deposed ruler was Hindu. To test this, we collated a novel data set by digitising the civil lists of employees working for the British government in different districts in 1871 (Quarterly Indian Civil List, October 1871)34. We used the names of civil servants to classify them into Hindus and Muslims (and others)35. We then estimated the

34Given that historians like (Metcalf and Metcalf, 2006) and (Ahmad, 1991) have argued that the British kept Muslims from important posts of authority in the Government, we focus on civil lists jobs defined by Mcilvenna (2019). See, the sub-section on data in Section 2.3 for details

35Admittedly, there can be errors in classification based on names. However, this is the best possible available historical record for employment under the British. Also, the results are robust to be just driven by the wrong classification.
following regression equations.

\[
\text{Muslim Employment}_{it} = \alpha_1 + \beta_1 \text{Muslim Deposed Ruler}_i + \gamma'_1 X_{it} + \epsilon_{it} \quad (2.5)
\]

\[
\text{Hindu Employment}_{it} = \alpha_1 + \beta_1 \text{Hindu Deposed Ruler}_i + \gamma'_1 X_{it} + \epsilon_{it} \quad (2.6)
\]

Table 2.11: OLS Muslim employment (1881)

<table>
<thead>
<tr>
<th></th>
<th>Muslim employment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>Muslim ruler</td>
<td>0.0236</td>
</tr>
<tr>
<td></td>
<td>(0.0201)</td>
</tr>
<tr>
<td>Demographic (population)</td>
<td>NO</td>
</tr>
<tr>
<td>Geographic controls</td>
<td>NO</td>
</tr>
<tr>
<td>N</td>
<td>173</td>
</tr>
</tbody>
</table>

Notes: Significance levels at * p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses corrected for district-level clustering. The Muslim ruler dummy (Hindu ruler Dummy) is assigned as one when the religion of last ruler whose territory British annexed is Muslim (Muslim). Demographic controls include population shares of different religions, population shares of different castes, average household size. Geographic controls: coastal dummy, major census city in colonial India, altitude, latitude, and longitude. Economic controls which include occupation classes (industry, agriculture etc.), port city and urbanization.

where Muslim Employment, is the number of Muslims in the civil list in district i divided by the population of Muslims in the district. Hindu Employment, is defined analogously. The results are reported in Tables 2.11 and 2.12. We did not find a negative effect on employment of a particular community in an Indian district because of the religion of the deposed ruler. On the contrary, Muslims were employed more in districts where the deposed ruler was Muslim. The positive association of the religion of the deposed ruler being Muslim with Muslim Employment might be because the British tried to promote Muslim participation in government institutions in regions where they were perceived to be left behind (Chaudhary and Rubin, 2011).

Given that we know that Muslims were resisting western education in regions where their ruler had been deposed, the British might have employed more Muslims as civil servants to incentivise them to take up education. Moreover, controlling for this employment data does not alter the signs or affect the significance level of the coefficients of our main results in the 1881 data (see Tables B5 and B6 reporting
Table 2.12: OLS Hindu employment (1881)

<table>
<thead>
<tr>
<th></th>
<th>Hindu employment (1)</th>
<th>Hindu employment (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hindu ruler</td>
<td>0.0298</td>
<td>0.0419</td>
</tr>
<tr>
<td></td>
<td>(0.0276)</td>
<td>(0.0345)</td>
</tr>
<tr>
<td>Demographic</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>(population)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geographic</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>controls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>173</td>
<td>172</td>
</tr>
</tbody>
</table>

Notes: Significance levels at * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses corrected for district-level clustering. The Muslim ruler dummy (Hindu ruler Dummy) is assigned as one when the religion of last ruler whose territory British annexed is Muslim (Muslim). Demographic controls include population shares of different religions, population shares of different castes, average household size. Geographic controls: coastal dummy, major census city in colonial India, altitude, latitude, and longitude. Economic controls which include occupation classes (industry, agriculture etc.), port city and urbanization.

the results estimating the following equations respectively

$$\text{Muslim Literacy}_{it} = \alpha_1 + \beta_1 \text{Religion of Deposed Ruler}_i + \beta_2 \text{Muslim employment}_i + \beta_3 \text{Hindu employment}_i + \gamma'_1 X_{it} + \epsilon_{it}$$ (2.7)

$$\text{Hindu Literacy}_{it} = \alpha_1 + \beta_1 \text{Religion of Deposed Ruler}_i + \beta_2 \text{Muslim employment}_i + \beta_3 \text{Hindu employment}_i + \gamma'_1 X_{it} + \epsilon_{it}$$ (2.8)

The British might not have discriminated against the community of the deposed ruler in government jobs but not provide that community with schooling opportunities. However, this argument is refuted by historical evidence (see Cotton (1898)). According to data reported from Progress of Education in India, Quinquennial Reviews (1897–1927), the British gave incentives to communities that were not doing well in school enrollment (usually Muslims) through scholarships, reduced fees and establishing many schools in districts that were lagging.

Another reason why the literacy of a religious community may have lagged in the region of the deposed ruler is that religious institutions of that religion were stronger there. These institutions can dissuade their followers from taking up secular education, thus lowering the group’s literacy outcomes. Chaudhary and Rubin (2011) argue that the years of rule can be taken as a proxy for the strength of religious institutions and shows that years of Muslim rule is negatively associated with Muslim literacy.
We controlled for this effect in two ways. First, we controlled for the year of annexation in our main specification i.e., Equations 2.1 and 2.2. Since a later date of the year of annexation implies more time under a ruler associated with religious institutions, the year of annexation becomes a proxy for the strength of religious institutions (in line with Chaudhary and Rubin (2011)). The results are reported in Tables B7 and B8. It is clear from Tables B7 and B8 that the coefficient associated with the religion of the deposed ruler remains negative and significant, even after including the year of annexation.

Second, we use years of Muslim rule since the medieval period in a district (as per Jha (2013)) as a proxy for the strength of religious institutions. We note that this proxy measure can also be considered to be the strength of the bond between the ruler and his subjects. One would expect that more years of Muslim rule created a stronger bond between the Muslim community and the ruling elite. Thus it is not clear whether its association with literacy rates represent the strength of Muslim institutions (Chaudhary and Rubin, 2011) or the religious identity based bond discussed by Aziz (1967). Moreover, this measure heavily correlates with the primary variable of interest, i.e. the religion of the deposed ruler. For instance, if the deposed ruler was Muslim in a district, it was more likely that Muslims had ruled that district for more years.

Nonetheless, we ran our primary OLS equations, controlling for years of Muslim rule. We present these results in Tables B9 and B10. As we see from Table B9, the inclusion of years of Muslim rule causes the coefficient associated with the religion of the deposed ruler on literacy to fall in the case of Muslims. However, it remains negative and significant at the 10% level. Thus, even if religious institutions did play a role, the results indicate some independent effect of removing the ruler by the British. Table B10 shows that years of Muslim rule does not predict Hindu literacy.

We now discuss the evidence that further highlights the importance of the British removal of the local ruler in making his religious community resist western education. The British had two distinct ways of governing the different parts of India (Iyer, 2010). First was by direct rule, under which the administration’s command was under the Governor-General of the East India Company until 1857 and then under the command of the Viceroy of India, who was answerable to the British Parliament. The second was by indirect rule, under which local rulers administered the local population and collected taxes on behalf of the British.

Until now, our analysis only covers directly ruled British India because the rulers has been deposed in regions where direct rule had been established. Indirectly ruled regions, that also came to be known as princely states, continued to be ruled by
local kings. These kings belonged to different religions. Thus, studying the impact of the religion of the ruler on the literacy of his subjects in these princely states provides a quasi-experiment as to what would have happened if the local rulers had not been deposed.

As per our conceptual framework (Section 2.2), deposing the ruler was essential to making locals resist western education. Hence, our framework predicts that we should not find a negative effect of the ruler’s religion on the literacy of the subjects if local rulers are not deposed but remain the administrators in their respective kingdoms. Chaudhary and Rubin (2016) study the effect of the religion of the ruler on literacy rates of Hindus and Muslims in these princely states. They found that Muslim rulers had no impact on Muslim literacy but had a negative and significant impact on Hindu literacy. This result is in line with the intuitive notion that Muslim kings perhaps neglected the literacy of their Hindu subjects or the Hindus found education much less valuable as fewer opportunities were available to them in an administration governed by Muslims.

Importantly for the argument in this paper, these results indicate that the negative effect of the religion of the ruler on the literacy rate is unlikely due to the explanation that Muslims were already behind under Muslim kings, even before annexation took place, while Hindus were already behind under Hindu kings. On the other hand, the results in Chaudhary and Rubin (2016) strongly suggest the removal of the local ruler did play an essential role in how these communities responded to the new opportunities available under the foreign occupiers.

We also do other robustness checks. Given that pre-colonial India was in political turmoil, sometimes we could not classify whether a particular district was under the political control of a Hindu or Muslim king before the British took over. Moreover, kings sometimes neither belonged to the Hindu or Muslim religion. For example, Sikhs controlled most of the Punjab region before the British took over. To ensure these districts are not affecting our results, we test whether our main results are robust to excluding the category when the annexed ruler is of the “other” religion. Table B11 and Table B12 report the results. We find that both Muslim and Hindu literacy remains negatively and significantly correlated with the religion of the deposed ruler.

A small community which were earlier the ruling class might be ‘directly’ affected when removed from power as they may be imprisoned or exiled, affecting human capital formation within that community. Thus, we test whether the results are just driven by districts where the share in the population of a particular religion is small. We test this by removing the districts with a share of Muslim (Hindu) population
of less than 1%, 2%, 3%, and 4%. The results in Tables B13 and B14 indicate robustness to the exclusion of such districts.

2.6 Concluding remarks
Citizens of a country often identify themselves with the state and are willing to pay an economic price to support its regime. For instance, Fouka and Voth (2016a) found that after a political conflict erupted between the German and Greek governments during the Greek sovereign debt crisis, German car sales in Greece declined.\textsuperscript{36} In the pre-modern era, when citizens were subjects, this ‘self-identification’ was closely related to the religious identity shared by the regime and the subjects. In this paper, we have demonstrated that deposing the ruler lowered the literacy outcomes of the subjects who shared their religious identity with the ruler in colonial India.

Importantly, we show that this is true for both the Hindu and the Muslim communities, despite the historians focusing on Muslims. This one-sided observation may have arisen because over 66% of the total Muslim population in our sample lived in regions where the deposed ruler was Muslim in 1911. On the other hand, only 26% of the total Hindus lived in regions ruled by Hindu kings. Thus, an observer who does not have access to district-level data may end up missing the effect on Hindus. Nonetheless, the empirical analysis supports the hypothesis that even Hindus resisted western education where they lost political power. Moreover, we show that this resistance was higher at the core of the kingdoms than at the periphery, consistent with the idea that subjects identify more with the ruler in the core of the kingdom than in the periphery region.

Though grounded in a historical context, these results can shed light on some contemporary world issues. For instance, anti-western sentiment in the Muslim world has been linked to military interventions in Muslim countries.\textsuperscript{37} Our findings suggest that the policymakers, to ascertain the long-term effects of any intervention, must consider how it garners the trust and support of the local regime and the population. If that is not the case, then even well-intentioned, welfare-improving interventions can backfire.

\textsuperscript{36}Similarly, a survey conducted in India reported that many citizens claim they reduced the usage of Chinese products substantially after the escalation of border issues between the two countries in June 2020. For the full story please see https://economictimes.indiatimes.com/news/defence/a-year-after-india-china-faceoff-in-china-43-indians-stopped-buying-chinese-products-localcircles-survey/articleshow/83522565.cms

\textsuperscript{37}See this report published by CTC, West Point. https://ctc.usma.edu/military-interventions-jihadi-networks-terrorist-entrepreneurs-islamic-state-terror-wave-rose-high-europe/

with Raghav Malhotra

3.1 Introduction

One interesting feature of the 21st century is increasing production accompanying rising distributional inequity. Strikingly, a staggering number can no longer consume what most would agree “essential”. For example, deaths in the US related to lack of healthcare are increasing at an alarming pace. In this paper, we argue that policymakers must confront this by expanding the interventions traditionally available to the state. Thus, we introduce a new policy instrument, Market Segmentation, and demonstrate, under certain conditions, its superior performance to conventional instruments.

Traditionally, economics has dealt with problems of redistribution using two broad approaches. The first one is taxation, pioneered by Ramsey (1927), Diamond and Mirlees (1971). Here, the planner collects tax revenue and uses it to facilitate direct transfers or subsidise goods. The second is rationing essential goods through direct quantity controls (Tobin, 1970) or through price controls (Weitzman, 1977). To demonstrate that Market Segmentation outperforms these instruments, we construct a GE exchange economy with stylised features. Market Segmentation (MS henceforth) means that not every good type is freely trade-able for others.

We explain how MS works using a simple example. Take a setup with a scarce resource like medicine (typed essential). Assume that its equitable distribution is beneficial for society. However, it is individually rational to consume more. Refer to people endowed with medicines as “pharmas”. Further, there are 2 other types of goods: 1) luxuries, which are endowed unequally; examples can be gold, stocks, and 2) universal goods, which are equally endowed; for example, manual labour/time. Without any intervention, the poor (who are not endowed with luxuries) are “priced out” of the medicine market.

Now suppose the planner allows medicines to be purchased only by manual labour income, reducing the demand of the rich for medicines and thus the equilibrium price, enabling an equitable distribution and enhancing welfare. Furthermore, this does

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1Piketty (2014)
2A 2019 poll by Gallup found that the number of people putting off care due to costs has increased from 12% to 25% (Saad, 2019).
3Equivalently, the planner could set a maximum any single person can spend tax free on all goods deemed ‘essential’. We discuss this in greater detail later.
not restrict trade within luxuries. MS can clearly increase welfare. However, it is interesting to see if and when it outperforms other available instruments. Thus, we compare MS to commodity taxation and using the generated revenue to subsidise medicines or facilitate direct transfers.

It turns out that if the supply for medicines is inelastic, subsidies only lead to a small corresponding supply increase and overly benefit ‘pharmas’ via price increases. Similarly, if the number of poor is relatively large, then under direct transfers, the effective transfer to each of them is small. Pairing that with inelasticity of medicine, transfers also increase price, turning out ineffective. Moreover, commodity taxation is distortionary. Thus, MS is the most effective and also minimises dead weight loss.

Now suppose there are 2 kinds of afflictions in society, diabetes and hypertension. They affect individuals heterogeneously and require different medicines. The planner can allocate a specific bundle of medicines to everyone via direct quantity rationing\(^4\) (or in-kind transfers).\(^5\) The planner could also cap each type of medicine any person could buy.\(^6\) However, with direct rationing or in-kind transfers, diabetes afflicted people receive hypertension medicines or vice-versa. In the case of quantity caps, the rich buy the maximum amount of both medicines, leaving less for the poor. Under segmentation, everyone buys that essential good which they need more. Thus segmentation performs better than policies that ration directly.

Summarizing the argument in 2 steps, first, if the demand and supply of the essential good are inelastic and the relative number of poor in the society is large, MS dominates DT and TS. Secondly, our method can exploit Walrasian equilibria’s “self-selection” properties when individuals have heterogeneous preferences over essential goods to increase welfare for the poor. We defer to Weitzman (1977), “Other things being equal, the price system has greater comparative effectiveness in sorting out the deficit commodity and in getting it to those who need it most when wants are more widely dispersed ”.

Importantly we note that to implement MS, the planner need not know individual endowments or preferences, but only their distributions in society. However, to enforce segmentation, the planner must stop the rich from providing side payments to “pharmas” or other owners of essential goods. Thus, the additional information planner needs to observe\(^7\) is the final income of owners of essential goods. We discuss further implementation issues in the main body of the paper.

We also study ‘partial’ Market Segmentation, allowing some trade between seg-
mented markets (after paying segmentary taxes). We show that complete Market Segmentation is never optimal in our setup. Optimally set segmentary taxes always dominate complete segmentation because ‘segmentary tax revenue’ increases with the tax rate as there is inelastic demand for essential good. However, there is no revenue at a high enough “segmentary” tax rate because no capital goods are exchanged for essential goods. Thus, the planner generically prefers to tax a little less than the complete segmentation level, providing transfer with the revenue generated.\(^8\) We then go on to characterise the optimal segmentary taxes in our model.\(^9\)

Finally, we show that segmentary taxation and commodity taxation are complementary in nature and should \emph{almost always} be used together, i.e. using them together weakly dominates using any of them alone.\(^10\) Thus, our work enhances the set of instruments available to policymakers.

We introduce segmentary taxes as a policy instrument but do not pretend to have generally solved the problem. We provide sufficient conditions under which MS dominates TS and DT. We show that a utilitarian social planner facing essential goods that are price inelastic in demand and supply,\(^11\) and many poor people who can consume only essential goods in equilibrium, finds that MS dominates TS and DT. Moreover, considering the welfare of the poor,\(^12\) we show that MS weakly dominates quantity controls. We note that this is just a small step in solving the general solution to the problem. We hope that the reader has the following 4 simple takeaways.

First, when essential goods are inelastic with respect to price, and there is endowment inequality in the population, traditional policies like subsidies are ineffective. Second, direct transfers are effective, but only when essentials are “mildly” inelastic and transfers provided are large with respect to the current expenditure of the poor

\(^8\)This transfer generates an increase in consumption which is always larger than the change in consumption due to reduction of tax

\(^9\)The kind of taxes which we call segmentary do exist in real-world settings, though they have not yet been theoretically explored as a policy instrument. One example of such a tax would be the capital gains tax in India. See, (https://cleartax.in/s/capital-gains-income) and many other countries including the US; (See, Matthew Frankel (2017-12-22)). ”Your Guide to Capital Gains Taxes in 2018”

\(^10\)A sufficient condition being that as long as using any one policy is not good enough to get us to first best

\(^11\)For our results to hold, the price inelasticity of demand and supply of “essentials” is a sufficient condition. Research estimating the price elasticity of demand on goods like housing and healthcare finds these to be inelastic. Hanushek and Quigley (1980) estimate price inelasticity of demand housing to be -0.64 in Pittsburgh and -0.45 in Phoenix. Recent papers also substantiate their claims. Albouy et al. (2016) state, ‘Since 1970, housing’s relative price, share of expenditure, and unaffordability have all grown’. For healthcare, Ellis et al. (2017) find elasticity estimates to be between -0.17 and -0.35, even lower than those for housing demand. Also, the elasticity of supply of these goods is low in the short run and is estimated to be falling even in the long run (See: Aastveit et al. (2016))

\(^12\)With a large number of poor in the economy, this translates to an overall improvement in welfare taking into account the utilitarian criteria
(which can occur only if there are a few of them in the population in a balanced budget). Third, when essential goods are highly inelastic, and the planner cannot afford transfers that are large relative to their endowments, segmentation is the only market policy that remains effective. Furthermore, if needs are heterogeneous in the population, segmentation performs better than policies advocating in-kind transfers or quantity controls.

We believe results are significant because of particular challenges facing policymakers today. One of them is automation. To quote the Boston Globe, 2016: “nothing humans do as a job is uniquely safe anymore. From hamburgers to healthcare, machines can be created to successfully perform such tasks with no need or less need for humans, and at lower costs than humans”. Automation can lead to a situation where machines start performing many tasks, consigning erstwhile ‘skilled’ labour performing these to unskilled work. This displacement increases the relative number of unskilled (poor) workers in society. As discussed above, Market Segmentation is more effective than the other policies if the relative number of poor in the society is large.

Market Segmentation can also help policymakers dealing with the challenges of the so-called ‘superstar phenomenon’ (see Scheuer and Werning (2017)). If superstars cannot be taxed in labour because of convex returns, then protecting the prices of essential goods by explicit segmentation becomes very important. In general, it should be noted that any phenomenon that increases inequality in endowment distribution and increases dead-weight loss in taxation renders MS a more effective policy.

The rest of the paper is structured as follows. We conclude this section with a discussion of the related literature and our contribution. Then in Section 3.2, we present a simple example that brings forth the main argument of this paper. Section 3.3 presents the main model and results. Section 3.4 discusses applications of the taxes, including implementation in greater detail. Finally, Section 3.5 concludes.

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13 https://www.bostonglobe.com/ideas/2016/02/24/robots-will-take-your-job/5iXIKomQ7uQBEzTJOXT

14 However we also note that if robots replace unskilled workers themselves, but there are still jobs for skilled humans, then direct transfers can achieve better outcomes than segmentation. When value of universal good in the economy goes down, then the purchasing power of the poor people in the economy goes down rampyproofly. Thus, increasing the purchasing power of the poor through direct transfers becomes very important, causing the DT regime to dominate the MS and TS regimes, which only affect welfare by lowering prices of essential goods. The TS regime is dominated by other regimes in both scenarios and generally performs poorly due to price inelasticity. We discuss this in greater detail in the main body of the paper.
3.1.1 Related literature

Our paper contributes to the extensive literature on Redistributive Approaches in Public Finance. As discussed before, there are two distinct ways in the literature: (i) Taxation and (ii) Rationing of essential goods. We set up our model in the commodity taxation framework of Diamond and Mirlees (1971), although we consider an exchange economy. However, our focus is to ration essential goods by lowering the price of essential goods by segmenting them from non-essential goods. Thus our work also relates to rationing via price controls, as in Weitzman (1977), Bulow and Klemperer (2012), Condorelli (2013) and Dworczak et al. (2020). Our segmentary taxes combine the two approaches in public finance by using a tax between different types of goods (in particular essential and capital goods) to ration essential goods by lowering their prices. Thus, it is an instrument of price control.

Gadenne (2020) builds a theoretical model to show that quantity rationing (To-bin, 1970) is equivalent to non-linear taxation and finds that quantity rationing of essential goods is welfare-enhancing in India. We note that Market Segmentation is closely related to non-linear taxation, showing MS is a more efficient policy instrument than quantity rationing or non-linear taxation, particularly when needs are heterogeneously distributed in the population.

Here we note that our main result can generalise to the non-linear taxation literature on labour starting from Mirrlees (1971). Although, Atkinson and Stiglitz (1976) show that if utility is separable between labor and consumption, only labor taxes suffice to improve welfare. However, Naito (1999) notes this result does not hold if relative prices in the economy can change. Similarly, Saez (2002a) notes that Atkinson and Stiglitz (1976) result holds only if all individuals share the same subutility of consumption.

In Appendix Section .1, we build on the framework of Saez (2002b) and combine it with some features of Saez (2004). Saez (2004) discusses the different implications of labour and commodity taxation in the short run vs the long run. We assume that in the production of luxuries individuals choose occupations (what Saez (2004) refers to as a ‘long run outcome’), whereas in essential good production, the amount of people who produce this good is fixed, and only supply response changes (‘short run outcomes’). In such a setup, MS dominates non-linear labour taxation as well when the demand and supply of essential good is price inelastic. We think that price inelasticity of demand is a natural condition for essential goods. Moreover, the price inelasticity of supply may represent some institutional constraints or fixed factors for production of essential goods. For example many studies point out it is difficult
to train more healthcare workers because of technological constraints. Similarly, shortages in land in case of urban housing makes supply constraints real even in the long run. For ease of exposition, we keep the main body of our paper in the framework of Diamond and Mirlees (1971).

There is a branch of literature that tries to characterise optimal non-linear taxes on income in different contexts and frameworks [see Stantcheva (2014); Piketty et al. (2014); Saez and Stantcheva (2016); Stantcheva (2020)]. We think combining non-linear taxes with segmentation would be promising for future work. In this paper, however we limit ourselves to discuss how linear commodity taxation is complimentary to MS.

Before discussing the applications of MS, we note the critical work of Piketty (2014) that has brought much-needed attention to the increasing inequality in the 21st century. Recent research on the effects of automation on growth and income shares of inputs, for example, Aghion et al. (2017); Acemoglu and Restrepo (2019); Mookherjee and Ray (2020), further highlight the need to deal with automation driven inequality directly.

Our paper contributes to the literature which focuses on taxation and redistribution with automation (see, Guerreiro et al. (2017); Costinot and Werning (2020); Thummel (2020)). In the framework of Guerreiro et al. (2017), technical progress in automation and endogenous skill choice can lead to a massive rise in income inequality. Costinot and Werning (2020) use a sufficient statistic approach to characterise optimal tax on robots. Thummel (2020) is the closest to our work because he discusses general equilibrium effects of taxation to change relative prices and thus distribution while taxing robots in his paper.

Our paper departs from the above work in a few crucial aspects. First, we distinguish between essential and inessential goods, highlighting the possibility of segmenting these markets, enhancing welfare. Second, we show that different policies are more efficient at increasing welfare under the different effects of automation which we consider. Moreover, we argue that the effects of automation may require planners to expand the available instruments of redistribution. Similarly, the precise nature of labour markets that produce either ‘superstar effects’ (Scheuer and Werning, 2017) or ‘winner-take-all’ (Scheuer and Slemrod, 2019) scenarios makes MS more relevant.

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15https://www.washingtonian.com/2020/04/13/were-short-on-healthcare-workers-why-doesn-the-u-s-just-make-more-phrmas describes the legislative problems in expanding pharma supply. Levit et al. (2009) summarizes the institutional constraints to expanding physician supply.

16For example: Consider the problems discussed by Indian policy makers. See, https://niti.gov.in/indias-housing-conundrum
To the best of our knowledge, our paper is the first to introduce segmentary taxes. Thus, though our results are similar in scope and goal to the papers above, our approach is entirely novel. More importantly, we expand the set of policy instruments available to the state and demonstrate conditions under which our proposal performs better than existing instruments. The following section provides a simple example that distils our main result’s central intuition.

### 3.2 A simple example

The example is constructed for a clear exposition of the forces behind the main results of this paper.

Consider an economy of three goods (1, 2 and 3), each representing a type. There are also three kinds of individuals (A, B and C). The social planner wants to maximize the sum of the utility functions

\[
W = aU^A + bU^B + cU^C
\]

where \(U^A, U^B\) and \(U^C\) are utility functions for individuals A, B and C respectively, and \(a, b\) and \(c\) are the weights attached to different individuals respectively (one can think of the weights as the number of individuals of each type). We assume an identical log-linear utility function for each individual of the form

\[
U = k\log x_1 + x_2 + x_3.
\]

To give some real-world flavour to this example, consider good 1 to be health services, good 2 to be time and good 3 to be wealth. Hence the utility function captures the intuitive idea that no health services is hugely detrimental to an individual’s welfare. Notice that in this example, there is only one luxury good, i.e. wealth.

Under this setup, one can easily see that Market Segmentation improves welfare over a laissez-faire economy if \(e \ll k\), where \(e\) is the endowment of the universal good in the economy and the relative number of poor in the economy is large.\(^{17}\) This is because segmentation lowers the price of the essential good for the poor, making them better off. However, it never betters commodity taxation. We can see that in an economy where the luxury type of goods has only one member, a planner can replicate segmentation with an infinite tax on the luxury good. Thus, we emphasise here that an infinite commodity tax mimics segmentation in the absence of dead-weight loss.

Hence, we move to a 4 good economy, creating an environment where there are gains from trade and a possibility of dead-weight loss. In this setup, we first show that low (non-distortionary) taxation and transfers are eventually dominated by Market Segmentation as the relative number of the poor in the economy increase. This is because the per-capita effect of the transfers gets lower reducing it’s effec-

\(^{17}\)See Appendix Section .0.1
tiveness.

Then, we allow for high (distortionary) taxation, which generates both transfers and a reduction in price (which we refer to as price-effect) by restricting demand, but at the same time creates a dead-weight loss. Again, we show that the possible gains of high taxes are eventually outweighed by the dead-weight loss they generate, making Market Segmentation a better policy to increase overall welfare in the economy.

In general, we want to highlight that the levels of taxation required to enforce the allocation of resources the planner desires are too high and create large dead-weight losses when the relative number of poor in the economy is large. In this scenario, segmentation is a middle ground. We now go to our 4 good example.

**Four good economy with gains from trade**

We have 4 goods in the economy - 1 essential good, 1 universal good and 2 luxury goods. There are still 3 kinds of individuals - A (pharmas), B (poor) and C (rich), but for C, we have two sub-kinds - C1 and C2, since they are endowed with different kinds of luxury goods in the economy.

The endowments are as follows.

\[
\begin{bmatrix}
e_A \\
e_B \\
e_{C1} \\
e_{C2}
\end{bmatrix} = \begin{bmatrix} 1 & e & 0 & 0 \\
0 & e & 0 & 0 \\
0 & e & 0 & W \\
0 & e & W & 0
\end{bmatrix}
\]

Also, we assume heterogeneous preferences\(^{18}\) so that trading luxury goods is better for social welfare.

For agents A and B, the utility function is.

\[
U = k\log x_1 + x_2 + \frac{x_3}{2} + \frac{x_4}{2}
\]

The other 2 agents have similar linear utility functions; however, they prefer to consume the good they are not endowed with. Thus we have,

\[
U_{c1} = k\log x_1 + x_2 + \frac{x_3}{4} + \frac{x_4}{2}
\]

\(^{18}\)This is mainly for the case of linearity in non-essential goods. If convex preferences replace linearity, this should not be needed.
\[ U_{c2} = k \log x_1 + x_2 + \frac{x_3}{2} + \frac{x_4}{4} \]

Further, we assume that, without any intervention, the poor only consume essential goods (are on the boundary), whereas the rich consume both essential goods and luxuries. In this setup, this is true when

\[ e < k < \frac{W}{2} \]

**Laissez Faire**

We solve for the equilibrium allocation without any intervention as a baseline.\(^{19}\)

**Remark 1.** Keep in mind that only the distribution of the essential good is welfare relevant. Its price (with respect to the universal good) is \( p^* = ne + 3k \). Moreover, there is no dead-weight loss by definition. The essential good is distributed as follows,

\[ x^* = \begin{bmatrix} x^A_1 \\ x^B_1 \\ x^C_1 \\ x^C_2 \end{bmatrix} = \begin{bmatrix} \frac{k}{ne+3k} \\ \frac{e}{ne+3k} \\ \frac{k}{ne+3k} \\ \frac{k}{ne+3k} \end{bmatrix} \]

Where \( n \) is the number of poor in the economy.

**Market Segmentation (MS regime)**

The utility maximisation exercise remains identical, but now the endowments have changed. In particular, since the rich cannot use luxuries to buy health services, their endowments are effectively identical to the poor. However, the pharma still consumes the essential good at the ‘satiation level’ in equilibrium.

Now again, as before let \( e < k < \frac{W}{2} + 1 \), then we know, as before, that poor people (B) will demand \( x^B_1 = \frac{x}{p_1} \) but now the rich (C) will also demand \( x^C_1 = \frac{x}{p_1} \). Moreover, assuming income of individual A is \( m_A = p_1 + 1 > k \) in equilibrium, individual A will demand \( x^A_1 = \frac{k}{p_1} \).

Market clearing requires

\[ x^A_1 + n \times x^B_1 + 2x^C_1 = 1 \]

\(^{19}\)See Appendix Section .0.3
Hence now we get,

\[ p_{MS} = e(n + 2) + k = p^* - 2(k - e) \]

where \( p_{MS} \) is price under Market Segmentation.

Notice that, price goes down given \( e << k \). This is the “price reduction” that increases the welfare of the poor.

It should be noted that under MS, there is no distortion to equilibrium allocation of luxuries, i.e. goods 3 and 4. The equilibrium essential good allocations are now as follows,

\[
   x_{MS} = \begin{bmatrix}
   x^A_1 \\
   x^B_1 \\
   x^C_1 \\
   x^C_2 \\
   
   \end{bmatrix}
   = \begin{bmatrix}
   k & ne & k & 2e \\
   ne + k + 2e & e & e & e \\
   ne + k + 2e & e & ne + k + 2e & 2e \\
   ne + k + 2e & e & ne + k + 2e & 2e \\
   \end{bmatrix}
\]

Notice that consumption of the poor has also increased

\[
   x^B_1 = \frac{e}{(n + 2)e + k} = x^* + \frac{2e(k - e)}{(n + 2)e + k} \frac{1}{p^*}
\]

**Taxation and Direct Transfers (DT regime)**

We now discuss a regime where the policymaker can raise revenue by taxing luxuries and provide direct transfers to all individuals in the economy (Universal Basic Income). We observe that direct transfers, and their welfare effects, become less and less important as the number of poor people increases. On the other hand, the price reduction achieved through both taxation or Market Segmentation remains significant and is more efficiently achieved with segmentation, avoiding dead-weight loss.

Thus, we first discuss the case of non-distortionary taxation to focus on the decline of transfers. Then, we allow distortionary taxation and show how the welfare gain allowing distortion is bounded (for any tax rate) as \( n \) goes to infinity. However, the deadweight loss is independent of \( n \).

Denote the (relative) tax rate by \( t \). A tax rate of \( t \) implies that if the consumer pays \( p \), the producer receives \( p(1-t) \). The tax is imposed on luxuries and distributed equally amongst all agents in the economy.

**Definition 1** (Distortion free taxation). *There should be no distortion to equilibrium...*
allocations of luxury goods, i.e. good 3 and 4.

Distortion free taxes

Lemma 1. The maximum distortion-free tax rate is $t = \frac{1}{2}$, and the amount raised by taxes is $\frac{W}{2}$ in terms of the numeraire. Observe that this is independent of $n$.

Proof. Given the linearity of luxury goods and weights associated with them in the utility function of the rich ($\frac{1}{2}$ and $\frac{1}{4}$), it is clear that the rich will exchange their goods only if taxes are less than or equal to $\frac{1}{2}$. Both luxury goods are brought to the market generating a revenue of $\frac{W}{2}$.

The amount raised as revenue (R) is transferred anonymously to all agents in the economy. Under this regime, the demand for the essential good for the poor is $e + \frac{R}{p_{DT}(n+3)}$, and for the pharma and the rich is $k + \frac{R}{p_{DT}}$, where $p_{DT}$ is the price under distortion free taxation. Thus, the equilibrium price and quantity in this regime is given by,

$$3k + \frac{R}{p_{DT}} + 1 + \frac{R}{p_{DT}(n+3)} = 1$$

$$\Rightarrow p_{DT} = 3k + ne + R\frac{n}{(n + 3)} = p^* + R - R\frac{3}{n + 3}$$

The consumption of the poor is

$$x^B_1 = \frac{e + \frac{R}{p_{DT}(n+3)}}{p_{DT}} = x^* + \frac{p^*(e + \frac{R}{(n+3)}) - ep_{DT}}{p_{DT}p^*} = x^* + \frac{3kR}{(n + 3)(p^* + R - R/(n + 3))}$$

Which gives us

$$x^B_1 = x^* + \hat{R}\frac{3k}{p^* + R - R/(n + 3)}$$

where $\hat{R}$ is the per capita transfer.

Welfare comparison

Now we compare the welfare in the two regimes. Notice that we only need to analyse welfare generated by the consumption of essential goods. Both in Market Segmentation and non-distortionary taxation regimes, the non-essential goods are efficiently distributed.
Intuitive argument

The consumption gain of the poor in Market Segmentation is

\[
\frac{2e(k - e)}{(n + 2)e + kp^*} = \frac{2e(k - e)}{[p^* - 2(k - e)]p^*}
\]

while the gain to the poor under transfers is

\[
\frac{3kR}{(n + 3)(p^* + R - R/(n + 3))p^*}
\]

Comparing the two we get, for transfers to be effective,

\[
\frac{3kR}{(n + 3)(p^* + R - R/(n + 3))p^*} > \frac{2e(k - e)}{[p^* - 2(k - e)]p^*}
\]

\[
\implies \frac{1}{n + 3} \frac{[p^* - 2(k - e)]}{[p^* + R - R/(n + 3)]} > \frac{2e(k - e)}{3Rk}
\]

For which to hold, \( \frac{R}{n} \) must be small, which means that R must be large compared to \( e \).

When \( n \) increases and \( e \) and \( R \) are fixed, then the inequality reverses, and segmentation is better.

Given that \( n \) is large in the economy, the welfare of the poor translates to overall welfare. We show in the Appendix Section .0.3 that as \( n \) goes to infinity, \( W_{MS} > W_{DT} \), where \( W_{MS} \) and \( W_{DT} \) are welfare under MS and distortion free taxes, for all \( k > 1 \).

Distortionary taxes

Suppose the tax rate is above half, the demand function of the rich changes. They will either only use universal goods to buy essential goods or sell their luxuries to buy essential goods at a higher price. The first thing which can be observed in this setup is that there is a large amount of distortion, \( \frac{W}{2} \) because no luxuries are traded for each other.

We know that in equilibrium, the price of the luxury must be \( \frac{1}{2} \). If they use luxuries to buy essential goods, then the relative prices faced by them is \( \frac{p}{\frac{1}{2}(1-t)} \). Thus the demand can be given by

\[
x^C_1 = \max\left\{ \frac{(1-t)k}{2}, \frac{1}{p} \right\}
\]

Suppose the planner levies a tax \( t > \frac{1}{2} \) and raises income \( R \), the planner then
redistributes this as a lump-sum transfer, leading to a price,

\[ p = (1 - t)k + k + ne + \frac{Rn}{n + 3} \]

To compute the total tax revenue collected by the government, we first determine the income from luxuries that the rich must earn to fulfill their demand for essentials. Since his total demand is given by 3.1, they must earn

\[ \frac{(1 - t)k}{2} - 1 \]

Let the amount he needs to sell to receive this much income is given by \( A \). As the price of the luxury is \( \frac{1}{2} \), the following must hold,

\[ A \times \frac{1}{2}(1 - t) = \frac{(1 - t)k}{2} - 1 \]

\[ A = k - \frac{2}{1 - t} \]

\[ \implies R = 2 \times A \times \frac{1}{2} t = kt - \frac{2t}{1 - t} \quad (3.2) \]

Note that the above equation demonstrates that government revenue is independent of the endowment of the luxury good. Given that the taxes are bounded from above by 1, we have tax revenue that is bounded. Thus we can see that the gain from distortion is small. On the other hand, the dead-weight loss can be arbitrary. Also, any price effect from distortionary taxes is lower than complete segmentation. Putting the above facts together explains our result. For formal proof, see the Appendix Section .0.3.

We now give some examples of numerical computations of subsidies MS and transfers and how they perform.

**Graphs**

We now plot the behaviour of different regimes in our setup with \( I = 20 \) and \( k = 2, 3 \).
3.3 Model

Goods and Agents

The set of goods are given by \( X^k = \{x_1, \ldots, x_k\} \) which are drawn from a finite dimensional subset of \( \mathcal{G} \subset \mathbb{R}^k \). These are then divided into 2 distinct sub-classes which we term as essential and non-essential. We define essential and non-essential goods going forward.

The economy has finitely many agents given by \( I = 1, \ldots, N \). These agents are heterogeneous with respect to both endowments and preferences. Preferences are
separable over goods, such that for individual \( i \),

\[
U^i = \sum_{k=1}^{K} b^i_k u_k(x_k)
\]

Where \( b_i \) is an idiosyncratic component and \( u_k(x_k) \) varies good by good but is constant across individuals. Essential goods and non-essential goods are defined as follows.

**Essential goods:** A good \( x_k \) is called essential if \( u'(0) = \infty \).

**Non-essential goods:** A good \( x_k \) is called non-essential if \( u'(t) = c \ \forall t \), where \( c \geq 0 \) is a finite constant.

The above two definitions imply that agents have quasilinear utility. With respect to endowment distribution \( e_i \), individuals are divided into (at least) 3 groups.

**Poor:** An individual is called poor if he is *only* endowed with the universal good. We think of this good as manual labour or time. They are given by \( I_p = 1, \ldots, n \).

**Rich:** An individual is called rich if he is endowed with a positive amount of any non-essential good (along with the universal good). They are given by \( I_r = 1, \ldots, m \).

**Don:** An individual is called a don if he is endowed with a positive amount of any essential good (along with the universal good). They are given by \( I_d = 1, \ldots, d \).

We assume that the dons and the rich are completely separate groups and do not share any overlap. Thus, \( N = n + m + d \). This allows us to completely define our environment as an economy given below

\[
E = (\mathcal{G}, I, \cup_{i=1}^{N}\{U_i\}, \cup_{k=1}^{K}\{e_k\})
\]

which is a tuple of goods, utilities and endowments.

**The Social Planner**

We model the social planner in our economy who can define and implement taxes and transfers on the goods *traded* by the agents in the market. As such, we rule out taxing endowments directly and allow taxes on only those endowments that are traded in the market. The social planner is utilitarian and wants to maximise the sum of weighted utilities of the three groups of agents in the economy. However, the planner is constrained to keep the budget balanced, i.e. they can only commit to policies that are revenue neutral. Hence, the planner faces the following trade-off:
though she wants to create equality in the consumption of essential goods, she does not want to cause excess distortions in the trade of non-essential goods by levying high taxes.

Policies available to the social planner

The planner can define a function which maps each initial endowment \((e)\) to a final budget set \((B)\). The policy space can be defined as a family of such functions. Thus a planner would choose suitable policy parameters (as per the respective policies defined below), which represents a function that maps each initial endowment to a final budget set.

We analyse four policies that the planner can use in order to maximise his objectives. The definition of each policy is given below.

Taxation and Direct Transfers (DT or transfers henceforth): The planner can tax trades on non-essentials and use the tax to provide direct transfers to agents in the economy. Formally, the DT policy is defined as picking \(\tau_k\) and \(R\) for each endowment level \((e)\), such that

\[
B_{DT}(e) = \sum_{k=1}^{K} p_k (1 + \tau_k \zeta_k)(x_k - e_k) + R \leq 0
\]

where \(\zeta_k\) is a variable which takes the value of 1 when \(x_k - e_k \geq 0\), else 0, \(R\) is the anonymous transfer received by each individual in the economy and \(\tau_k \geq 0\) are taxes on each good \(k\).

Taxation and Subsidy (TS or subsidies henceforth): The planner can tax trades on non-essentials and use the tax to subsidize the essential goods to agents in the economy. Formally, the TS policy is defined as picking \(\tau_k\) and \(\sigma_k\) for each endowment level \((e)\), such that,

\[
B_{TS}(e) = \sum_{k=1}^{K} p_k (1 + (\tau_k - \sigma_k) \zeta_k)(x_k - e_k) \leq 0
\]

where \(\zeta_k\) is a variable which takes the value of 1 when \(x_k - e_k \geq 0\), else 0, \(\tau_k \geq 0\) and \(\sigma_k \geq 0\) are the taxes and subsidies on each good \(k\) respectively.

Notice that we are assuming that all taxes are payed by net sellers in both DT and TS.

Quantity Rationing (QR or rationing henceforth): For any essential good \(x_k\),
the planner can decide the quantity level $q_k$, such that each individual can buy the
given quantity of a good at a rationed (lower) price $\hat{p}_k$. Formally, the QR policy is
defined as

$$B_{QR}(e) = \sum_{k=1}^{K} (\hat{p}_k \min\{x_k - e_k, q_k\} + p_k \max\{x_k - e_k - q_k, 0\}) \leq 0$$

Finally, we introduce a new policy which we refer to as Market segmentation,
where an individual incurs a tax if he trades one type of goods for another.

**Market Segmentation (MS or segmentation henceforth):** In our setup, the
policy entails segmentation between non-essential goods but excluding the universal
good, and the essential goods including the non-universal good.\(^{20}\) Formally, the MS
policy is defined as picking $\tau_{MS}$ and $R_{MS}$ for each endowment level $(e)$, such that

$$B_{MS}(e) = \sum_{\text{essentials}} p_k(x_k - e_k) \leq y + R_{MS} \cap \sum_{\text{luxuries}} p_k(x_k - e_k) \leq -(1 + \zeta_k \tau_{MS})y$$

where $\zeta_k = 1$ when $y > 0$, else 0, $R_{MS}$ is the anonymous transfer received by each
individual in the economy and $\tau_{MS} \geq 0$ is the segmentary tax level.

We refer to $\tau_{MS} = \infty$ as complete market segmentation.

**Utility Maximisation**

We assume that individual agents are price takers and maximise utility subject to a
budget constraint, and actions of the social planner. Agents maximise utility taking
the prices (possibly nonlinear), endowments and social planners policy as given.

$$\max_{x \in \mathcal{B}(e_i)} U_i(x)$$

where $\mathcal{B}(e_i)$ represents the budget set of an individual agent given his endowment
and the social planner’s policy decisions.

We will always remain in an environment where the poor only consume essential
goods in a laissez-faire economy. Formally that would imply $u'(\frac{m}{p}) > b_k \forall k, \forall i$ where
$m$ is the income of the poor and $p$ is the price of essential good in a laissez-faire
setup.

\(^{20}\)We take universal good to be non-essential good keeping in line with the example discussed
in section 2.
We now state a lemma that illustrates that if the preference distribution in an economy is symmetric (we formally define this symmetry below), welfare under different policy choices of the planner, does not depend on the number of goods in the economy. This allows us to prove general results for the case where there is only one (or two) essential good(s).

**Definition 2** (Aggregate Symmetry). Consider an economy with $k$ essential goods for which preferences are heterogeneous. The preferences for each individual are defined by a vector of parameters $(b_1, \ldots, b_k)$. We say that an economy satisfies aggregate symmetry if the following holds: Given the distribution of preferences is $\mu \in \Delta b^k$ and the CDF corresponding to $\mu$ is $F(b_1, \ldots, b_n)$, then for any $i, j \leq n$ it must be that $F(\ldots, b_i, \ldots, b_j) = F(\ldots, b_j, \ldots, b_i)$. 

**Lemma 2.** Under aggregate symmetry, the social planner must treat all essential goods in a symmetric way to maximise social welfare.

*Proof Idea:* The planner wants to maximise social welfare by using policy parameters defined above. To show that all goods are treated in a symmetric way, first notice that the frontier of allocations encloses a convex set because demand (excess supply) functions are convex (as utility functions are convex). Now suppose planner treats goods in an asymmetric way, i.e. uses different policy levels for different goods. This will imply an asymmetric final allocation. However, because of aggregate symmetry, a symmetric permutation of the allocation remains feasible. Moreover, due to convexity of the individual utility function, the intermediate allocation has a strictly higher welfare value to the planner because he is maximising the weighted sum of the utilities. Hence, at maxima, the goods must have symmetric allocations. For a formal proof, see Appendix 3.5.

**Lemma 3.** Given all essential goods are treated in a symmetric way by the planner, the number of essential goods in an economy do not matter.

*Proof Idea:* As all goods are treated symmetrically by the planner, we can simply constrain the planner to consider policies where all goods are treated identically. This reduces to a problem where the planner only chooses a policy for only one good, and the rest of the goods follow the same policy due to symmetry. For a formal proof, see Appendix 3.5.

Given that the number of essential goods in an economy does not affect the planners maximisation problem, it is sufficient to consider one (or as many as you need) essential good. Let us call this essential good $x$ with price $p$. There is one unit of essential good owned by one don. The consumption of essential goods is given by $x_d$, $x_r$ and $x_p$ for the don, the rich and the poor respectively. We now state a lemma
showing that the demand for the essential good is just a function of its price in our setup.

**Lemma 4.** If the utility function is quasi-linear and the price of the universal good is taken as the numeraire, then for all types of agents (poor, rich and dons), the demand for essential good is independent of prices of other goods.

**Proof Idea:** This is true because the poor only consume essential goods and their income depends on the price of numeraire good. For others, the first order conditions equate marginal utility of essential good with price ratio of essential good and numeraire good. For a formal proof, see (Varian, 2014, p. 104).

In such a set-up, we can now find the equilibrium prices in the Laissez Faire (LF), MS and DT regime.

By market clearing condition, under laissez faire, we get

\[ 1 = n \frac{e}{p} + mx_r(p) + x_d(p) \]

where \(x_r(p)\) is the demand of essential good by the rich and \(x_d(p)\) is the demand for the essential good for the don. Under free markets, we assume \(x_r(p) = x_r(p) = x(p)\). This gives us the LF price, \(p_{LF}\)

\[ 1 = n \frac{e}{p_{LF}} + (m + 1)x(p_{LF}) \]

Similarly, equilibrium conditions under MS, will give the price \(p_{MS}\)

\[ p_{MS} = x(p_{MS})p_{MS} + (n + m)e \]

\[ \implies p_{MS} = \frac{(n + m)e}{1 - x(p_{MS})} \]

And, from the equilibrium conditions under DT regime, we get the price \(p_{DT}\)

\[ p_{DT} = ne + \frac{Rn}{n + m + 1} + mp_{DT}x(p_{DT}, \tau) + p_{DT}x(p_{DT}) \]

\[ \implies p_{DT} = \frac{n(1 + \frac{R}{n + m + 1})}{1 - (m + 1)x(p_{DT})} \]

where \(R\) is the total revenue collected in the DT regime and \(x(p_{DT}, \tau)\) is the consumption by the rich.

Given that we now know how prices are determined in our General Equilibrium model under different policies, we state the first theorem of our paper. We compare

\[ \frac{dp}{dT} > 0 \]
the policy of Market Segmentation (MS) with the policy of Direct Transfers in this theorem.

**Theorem 1.** Whenever the essential good is price inelastic, and there are significant gains from trade within the luxury good market,\(^{22}\) then as the number of poor in the economy increases, complete Market Segmentation dominates anonymous direct transfers to individuals.

We prove this theorem through a series of claims. We first prove that if the essential good is price inelastic and the number of poor in the economy is high, commodity taxation, which is 'segmentary' in nature, gives higher social welfare than any level of non-distortionary taxation. The reason for this is three-fold. First, if \(n\) is high, the effective transfer to the poor is low. Second, with inelasticity of essential good, non-distortionary taxation does not decrease the demand of the rich by a lot and consequently just results in price increases. Third, the gain from non-distortion is bounded and independent of \(n\). We now formally state the claim.

**Claim 1.1.** Suppose the essential good is price inelastic, and there are many poor in the economy. In that case, social welfare in a regime where commodity taxation at the segmentary level dominates welfare for any non-distortionary taxation.

**Proof.** For formal proof, see Appendix Section .0.3. □

The second important step is to note that though commodity taxation at segmentary level \((\tau_s)\) dominates non-distortionary taxation, \(\tau_s\) is dominated by some distortionary level of taxation which does not lead to complete segmentation. This is again because of inelasticity. Due to price inelasticity of the essential good, the tax revenue increases in tax rate but becomes suddenly zero at segmentation level. We show that the gain from going to complete segmentation level is always dominated by the revenue that can be generated by taxing a little less. We now formally state this claim as well.

**Claim 1.2.** Suppose price elasticity of demand for the essential good is inelastic. In that case, there exists a distortionary level of commodity taxation that is always better than a level of commodity taxation complete segmentation policy.

**Proof Idea.** The key observation is as follows:- Even though the demand behaviour

\[^{22}\text{This means that the dead weight loss in the economy at the level if there is no trade between luxury goods is greater than } G.\text{ Where } G = n\left(U\left(\frac{c+\frac{n}{p^*}}{p^*}\right) - U\left(\frac{c}{p^*}_{DT}\right)\right) + m\left(U\left(x(p^*, \tau)\right) - U\left(x(p^*)\right) - U\left(p_{DTS}\right) - DWL_{DT*} + DWL_{DTS}\right),\text{ we show this to be bounded.}\]
varies continuously at the cutoff tax $\tau_s$, the revenue from said tax falls to zero discontinuously. For a formal proof, again see Appendix Section .0.3.

Given Claim 1.2, we can say that there exists an optimal level of optimal segmentation which is distortionary, i.e. causes dead-weight loss (DWL). Let this level of taxation be called $\tau_{DT^*}$ and corresponding level of revenue be $R_{DT^*}$. We now show that the gain from moving from $\tau_s$ to $\tau_{DT^*}$ is bounded and independent of $n$.

**Claim 1.3.** The gain in welfare from moving $\tau_s$ to $\tau_{DT^*}$ by generating a revenue $R_{DT^*}$ is bounded and independent of $n$.

*Proof Idea.* Again, the idea for this proof crucially depends on the elasticity of essential goods and a large $n$. Although some revenue ($R_{DT}$) is generated and distributed to all agents at the optimal distortionary taxation level, it does not help the poor much. Given price inelasticity, the transfers translate into price increases, and welfare gain is limited. Again, for the formal proof, see Appendix Section .0.3.

Let this gain be called $G$. We now state the final claim, which completes the proof.

**Claim 1.4.** If the dead-weight loss due to optimal distortionary taxation is more than the above gain ($G$), then Market Segmentation is welfare improving than optimal segmentary taxation.

*Proof.* Welfare under Market Segmentation ($W_{MS}$) is given by

$$W_{MS} = W_{DTS} + DWL$$

$$W_{DT^*} = W_{DTS} + G$$

Hence,

$$W_{MS} - W_{DT^*} > 0 \iff DWL > G$$

Now we attach some computational experiments to show that under price inelasticity of essential good, welfare under MS overtakes welfare under DT quite fast.

After proving that MS dominates DT when $n$ is large and essential goods are price inelastic, we now show that DT dominates a subsidy regime under the same conditions. We find that it is better to use any revenue generated from commodity taxes as a universal direct transfer than a subsidy for essential goods. Together, this lets us conclude that MS dominates the subsidy regime as well.
Theorem 2. Given any fixed amount of Tax revenue $R$, direct transfers are more efficient than a subsidy for essential goods if the number of poor in the economy goes to infinity.

Proof Idea. First of all, notice that given a fixed amount of tax revenue, the deadweight loss generated by the two regimes are equal. Thus, we only need to focus on the distribution of essential good in the economy. Further, notice that subsidies work by driving a price wedge between sellers and buyers. This, in turn, increases commodity supply by increasing the price sellers receive. On the other hand, transfers increase the price for both the rich and the sellers, thus decreasing their consumption and increasing net supply for the poor.

This means that even though the price increases may be small in the direct transfers regime relative to the subsidy case, the inelasticity of demand implies that a large change in price for a few won’t be as effective as a small change in price for a large number of people. Given that the number of people affected by direct transfers is always larger than subsidies, they are more efficient. For a formal proof, please see Appendix Section .0.3.

Theorem 1 and Theorem 2 together present the primary insight of our paper. Suppose the essential good is inelastic and society is highly unequal in terms of endowment distribution. In that case, Market Segmentation performs better at improving utilitarian social welfare than using revenue generated by commodity taxation.
Figure 3.4: Transfers always dominate subsidies

However, one can argue that the outcomes generated by the Market Segmentation policy can be implemented using direct quantity rationing as well. We now show that quantity rationing (which can be implemented by non-linear taxation of the essential good)\(^{23}\) mimics Market Segmentation if there is one good. However, the poor in the economy are better off under Market Segmentation if there is more than one essential good and heterogeneity in preferences over essential goods. Thus, if a large number of poor are present in the economy then MS weakly dominates direct quantity rationing.

**Theorem 3.** Let there be two essential goods in an economy. Moreover, let there be individual preference heterogeneity over these essential goods. In this setup, Market Segmentation improves welfare of the poor more than quantity rationing of essential goods.

**Proof Idea.** Given there is individual level heterogeneity in preferences over essential goods, MS takes advantage of this heterogeneity which QR is not able to do. Under MS, the rich consume the essential good they prefer more. Under QR, an upper limit is set on the consumption of each essential good. Thus, the rich can consume as much as they can of each of them. This implies that less is left for the poor under QR, particularly those poor people who have more ‘one-sided’ preferences, i.e. vastly prefer one essential good to the other. As Weitzman (1977), notes price systems can better address heterogeneity of needs within a population. MS dominating QR is

\(^{23}\)See, (Gadenne, 2020)
a perfect example of this astute observation. Again, for a formal proof, see the Appendix Section .0.3.

We have shown that complete Market Segmentation, i.e. not allowing any trade between essential and luxury goods, can be a more effective policy than direct transfers, subsidies and quantity rationing under certain conditions. However, do we necessarily want to ‘completely’ segment the market of essential goods and luxury goods? In particular, a planner might allow what we call a segmentary tax. This tax is levied if luxury good income is used to buy essential goods but not if luxury goods are traded amongst themselves. We call this policy - Partial Market Segmentation.

It is clear that for a high enough segmentary tax, luxury goods will not be used to buy essential goods. We refer to this level of taxation as the complete Market Segmentation tax $\tau_{CMS}$. The next theorem demonstrates that if essential goods are price inelastic, partial market segregation is always better than complete segregation, i.e. at least some trade should be allowed between capital goods and essential goods even if the segmentary tax is high. This is because the revenue earned by lowering the tax a little from the segmentary level improves welfare more than the decrease in welfare that occurs because the price of essential goods increases when we lower the tax.

**Theorem 4.** If price elasticity of demand for the essential good always below 1, then a partial segmentation policy is always better than a complete segmentation policy.

**Proof Idea.** The intuition for this theorem is essentially the same as that of claim 1.2 of Theorem 1. Due to price inelasticity of essential good, the tax revenue is increasing in tax rate but becomes suddenly zero at segmentation level. The gain from going to complete segmentation level is always dominated by the revenue that can be generated by taxing a little less. This is because the demand behaviour varies continuously at the cutoff tax $\tau_{CMS}$, the revenue from said tax falls to zero discontinuously. For the main proof, please refer to Appendix Section .0.3.

Given that elasticity plays a key role in the above argument, we now show some graphs comparing consumption in the partial segmentation regime compared to complete segmentation regime with varying levels of elasticity. As price elasticity of essential good is increasing, the difference between the two regimes is going down because the loss in revenue due to taxing more decreases with increase in elasticity. But for all level of price elasticity less than 1, it is clear that partial segmentation dominates complete segmentation.

Given, we have shown in our setup that complete segmentation is never optimal, we now characterise the optimal segmentary tax. Moreover, notice under the con-
conditions where Theorem 2 holds, i.e. large \( n \) and price inelasticity of essential goods, we know that whatever revenue that these taxes will generate should be used as direct transfers rather than a subsidy.

**Theorem 5.** At the Optimal segmentary tax

\[
\begin{align*}
    & w_r \lambda_r \left[ \frac{\partial t}{\partial \tau} (1+\tau) - \left( p_1(x_1-e_1) + p_2(x_2-e_2) - t \right) \right] + w_d \lambda_d \frac{\partial t}{\partial \tau} + w_p \lambda_p \frac{\partial t}{\partial \tau} = \sum \mu_k \sum \frac{dx(p, \tau)}{d\tau}
\end{align*}
\]

where \( w_r, w_d \) and \( w_p \) are the weights of the rich, the don and the poor respectively. \( \lambda \) is the multiplier associated with each group and \( \mu \) is the multiplier associated with the resource constraint.

**Proof Idea.** To understand this condition, we have to consider the cost and benefits of using a segmentary tax. When we increase the segmentary tax, it has two major effects. First, it increases the ‘segmentary tax’ revenue which can be used as transfers. Second, it also decreases the price of the essential good by making it more expensive for the rich, thus effectively ‘freeing’ up the resource. In the equation above, the left-hand side represents the weighted utility to society of the transfer that an additional tax unit allows the planner to provide. It also captures the loss of utility to the rich due to an increase in taxes. The right hand side represents the increase in utility to the society by ‘freeing up’ the essential good via a reduction in demand of the rich. Notice that if the rich have a low weight \( w_r \) in the equation above, then the optimal segmentary taxes will be very high and close to the complete segmentation level because tax revenue is increasing in tax rate for inelastic goods. For a formal proof, see the Appendix Section .0.3.

In this section, we presented a formal general equilibrium model to demonstrate when the policy of Market Segmentation dominates Direct Transfers, Subsidy and...
Direct Quantity Rationing implemented via non-linear taxation. We also discussed how Partial MS is always better than Complete MS, when the essential good is price inelastic and then went on to characterize the optimal segmentary tax. In the next section, we will discuss some applications of these taxes and how they can be implemented.

3.4 Applications and implementation of segmentary taxes

This section discusses how segmentation and segmentary taxes can have important applications to deal with issues facing the world economy today. We also discuss how they can be implemented and how they are related to other policy instruments available at the disposal of a social planner.

3.4.1 Applications

Automation

An issue that will starkly affect the economy and distribution in the near future is automation. Scott Santens in a 2016 article of the Boston Globe summarises the problem quite succinctly in the following words: “nothing humans do as a job is uniquely safe anymore. From hamburgers to health-care, machines can be created to successfully perform such tasks with no need or less need for humans, and at lower costs than humans”. He is not the only one who has raised this as a matter of concern. Recent work by prominent economists highlight the need to deal with automation driven inequality (see, (Aghion et al., 2017) ; (Acemoglu and Restrepo, 2019); (Mookherjee and Ray, 2020)).

In this section, we study the application of various policy instruments discussed in the previous section to deal with the problems that will possibly arise due to automation. We argue that automation can have two different types of impact on the endowment/skill distribution in the economy. First, it can lead to a situation where machines start performing many tasks, consigning erstwhile ‘skilled’ labour performing these to unskilled work. We call this the ‘displacement effect’ of automation. It increases the relative number of unskilled (poor) workers in society. On the other hand, automation can also have a different impact on the endowment distribution if robots erode the value of unskilled workers in the labour market without having a considerable impact on skilled jobs. We call this the ‘erosion effect’.

We show that this distinction is important because it leads to different policy prescriptions due to different impacts of automation. Since the displacement effect
of automation renders skilled workers unskilled, this is akin to \( n \) (i.e. the relative number of poor) increasing in our model. As discussed in Theorem 1 and Theorem 2 of this paper, if essential goods are price inelastic and there are sufficient gains from trade within the luxury good market, as \( n \) increases, MS dominates DT and subsidy regime. Hence, we argue that if automation leads to high displacement in the economy, MS can potentially be more effective than other policies at dealing with its distributional impact.

However, if automation produces more of the erosion effect, direct transfers are more effective at dealing with the issue than segmentation. This is because when value of universal good in the economy goes down, then the purchasing power of the poor people in the economy goes down rapidly. Thus increasing the purchasing power of the poor through direct transfers becomes very important, causing the DT regime to dominate the MS and TS regimes, which only affect welfare by lowering prices of essential goods.

To study the impact of the ‘erosion effect’ more formally, we go back to our basic model of Section 3.3. We model this effect as a fall in the value of parameter \( b \) associated with the universal good (\( e \)) in the utility function of all consumers in the economy. We next state a theorem formally proving that as the value of the universal endowment falls in the utility functions of individuals in an economy, DT dominates MS.

**Theorem 6.** As the value of the universal endowment falls in the utility functions of individuals in an economy \((b \to 0)\), direct transfers are more effective in improving social welfare than Market Segmentation.

We again prove this theorem in a series of claims. The first claim establishes a strong intuitive and mathematical link between the weight of the universal good (\( b \)) and the actual endowment of the universal good with each individual in an economy.

**Claim 6.1.** Let \( b \) be the weight associated with the universal good in all individuals’ utility function and let \( e \) be the endowment of the universal good with each individual in the economy. As \( b \to 0 \), equilibrium bundle in this economy produces same the welfare as \( e \to 0 \).

**Proof Idea.** The intuition behind this claim is simple. If the marginal value of the good goes to zero, nobody is willing to pay for it in the market. Consequently, the income it generates is zero. This is akin to an individual losing his endowment as that endowment itself ceases to be valuable. The formal proof is given in Appendix Section .0.3.
This claim implies that we can study a decrease in the marginal value of the endowment as a decrease in the amount of endowment holding the marginal value constant. Thus, now we discuss the relative marginal utilities of various groups as the universal good’s endowment goes to zero.

**Claim 6.2.** As the endowment of the universal good goes to zero, the ratio of marginal utility of the poor to the marginal utility of the rich goes to infinity. Thus, only the utility of the poor remains welfare relevant.

**Proof Idea.** Again the intuition for this claim is straightforward. We know that the poor are just endowed with universal good e. If that is falling in the economy, they cannot even consume a little of the essential good. We have assumed that as consumption of essential good goes to zero, \( u'(x) \to \infty \). Whereas, given the rich (and the dons) have positive incomes from sale of other goods they are endowed with, their consumption is bounded below. Thus the marginal utility is strictly bounded. Together, this proves the claim. For a formal proof, please refer to Appendix Section .0.3.

Finally, the claim below completes the proof.

**Claim 6.3.** As the endowment of the universal good in the economy goes to zero, the direct transfer dominates complete Market Segmentation.

**Proof Idea.** We know that the MS regime improves social welfare by lowering the demand of the rich and thus, in turn, lowering prices of essential good, making it easier for the poor people to buy more. However, if poor people have no income because they have no endowment, even lower prices cannot improve welfare. Thus increasing the purchasing power of the poor through direct transfers becomes very important if automation is eroding even minimal purchasing power of even a few people in the economy. For a formal proof, please refer to Appendix Section .0.3.

**Theorem 7.** As the value of the universal endowment falls in the utility functions of individuals in an economy (\( b \to 0 \)), direct transfers are more effective in improving social welfare than subsidy on the essential good.

**Proof Idea.** This theorem follows using similar claims used above.\(^{24}\) As the weight associated with the universal good goes to 0 (\( b \to 0 \)), it is as if the endowment of universal good (e) is going to zero. If \( e \to 0 \), then the ratio of marginal utility of the poor to the rich (or don) goes to infinity.

\(^{24}\)In particular, claim 6.1 and 6.2, remain exactly the same. Claim 6.3 needs to be modified to now discuss DT vs TS (rather than DT vs MS). However, the basic idea remains the same. For a former proof see the appendix.
Moreover, as in the case of MS, subsidies also work by lowering prices of the essential goods. However, as \( e \to 0 \), the poor have little to no purchasing power. Hence, increasing the purchasing power of the poor through direct transfers becomes very important, giving us the result. Again, the formal proof is in Appendix Section .0.3.

**Convex returns to labour**

Recent work shows that emergent trends in the 21st century like the ‘superstar phenomenon’ (Scheuer and Werning, 2017) and markets with winner-take-all characteristics (see (Scheuer and Slemrod, 2019)) render conventional policies like non-linear labour taxation only mildly effective. In such labour markets, superstars or winners cannot optimally face a high marginal income tax on labour because of convex returns. Market Segmentation can help policymakers dealing with these challenges.

Though we set up our exercise in a general equilibrium exchange economy, our argument that MS can protect the prices of essential goods from rising to unaffordable levels is quite general. It remains true even if we introduce production and allow non-linear labour taxation. In Appendix Section .1, we show that our fundamental insight holds in an economy with production, heterogeneous labour productivity, and non-linear taxation.

The intuition for the results essentially remains the same. If the essential good is inelastic, then the dead-weight loss in the production due to the high non-linear labour taxation required to keep its price low outweighs its benefits. Again, it is
better to segment consumption into essential and luxury goods under this scenario. The planner can then cap expenditure on essential goods, leading to a more equitable distribution of essential goods while avoiding deadweight loss in production. People still have incentives to work hard to increase their income to consume luxuries, but they cannot spend on essentials which keeps prices low. In other words, even if healthcare and affordable housing is rationed through Market Segmentation, people still have incentives to work hard in order to consume more i-phones, Nike sneakers and trips to Europe.

In general, it should be noted that any phenomenon that increases inequality in endowment distribution and increases dead-weight loss in taxation renders MS a more effective policy than DT or TS. We think this general insight of our paper might be applicable in other important socio-economic spheres as well.

When should there be a price to cut the queue?

As a final discussion on applications of our results, we note that our discussion comparing the effectiveness of MS (DT or TS) can also be thought of as comparing the effectiveness of QR to (DT or TS). QR is a traditional policy followed in many places, for example, the National Health Service (NHS) of the UK.25

Our model can be used to have a more informed discussion on whether the NHS should continue to operate the way it does or whether cash transfers with a privatised health care system would fare better. Our model suggests that if healthcare provision is inelastic in demand and supply and there is significant income inequality within the population, providing health services through rationing would be better.

Perhaps, an application of Theorem 4 of our model suggests specific changes that can be made to the rationing system. Theorem 4 proves that if essential goods are price inelastic, it is better to partially segment the essential good market. This implies that under our assumptions, even in NHS style systems that ration essential goods, there should always be a price to cut the queue. The revenue raised should be used as transfers to improve the distribution of health services in the economy. This is akin to Dworczak et al. (2020), who show that a similar 2 price system is optimal in a specialised mechanism design setup.

Having discussed some applications of the MS policy, we move on to discuss how it can be implemented. We discuss its implementation alone as well as with the complimentary policy instrument of commodity taxation with direct transfers.

25For more detail on how NHS works see their stated constitution https://www.gov.uk/government/publications/the-nhs-constitution-for-england/the-nhs-constitution-for-england
3.4.2 Implementation

In this sub-section, we discuss how a social planner can implement MS if she decides to. It is important to note that the planner need not know individual endowments or preferences of different people in the economy, but only their overall distribution. In this regard, the policy of Market Segmentation and commodity taxation require equivalent information to be implemented.

However, to enforce segmentation, the planner must stop the rich from providing side payments to “dons” or other owners of essential goods. To prevent these side payments from undermining the policy’s fundamental objective, the planner needs to observe the final income of owners of essential goods. Suppose the final income of the planner turns out to be higher than his endowment of essential goods times the market price under segmentation. In that case, the planner can know how much worth of ‘black market’ transactions occurred and take action accordingly.

Admittedly, implementing MS would require a cost of monitoring and the possibility of black market transactions. However, similar problems exist in implementing policy instruments like taxation and quantity rationing. Tax evasion is a topic well studied in economics which notes the high prevalence of it in many socio-economic settings.\textsuperscript{26} Similarly, tax compliance and revenue collection are costly,\textsuperscript{27} perhaps costlier than monitoring the income of a few individuals in an economy. Similarly, quantity rationing has its problems with implementation, including high cost and corruption.\textsuperscript{28}

We think that all these costs, the feasibility of monitoring and the possibility of the emergence of black markets should be considered while weighing the costs and benefits of different policies considered in this paper before implementing them. However, we see no reason ex-ante to disregard MS on these grounds because other policies also deal with similar issues.

Another possible issue with implementing MS can be a lack of a universal good in the real world. In the main model discussed in Section 3.3, MS works by segmenting the market for essential goods and universal good from the market of luxuries. Since everyone is endowed with universal good in our setup, this creates an equitable distribution among all essential goods. However, it might be the case that there is no universal good in the economy. After all, manual labour might also have

\textsuperscript{26}see, Slemrod (2007)
\textsuperscript{27}Pope (2002)
\textsuperscript{28}The Public Distribution System (PDS) in India works on the principle of quantity rationing (see, Gadenne (2020)) Many have noted corruption in its implementation at various levels. See, https://www.ndtv.com/india-news/corrupt-public-distribution-system-says-supreme-court-panel-412887
heterogeneous productivity across individuals.

In such scenarios, MS can simply be implemented by expenditure ceilings on goods typed as essential. The planner can just determine the Rawlsian income in the economy, i.e. the income earned by the lowest individual in the economy and set that as an expenditure ceiling. In effect, this policy will produce the same equilibrium outcomes as the model with a universal good. Using expenditure ceilings allows planners to choose the ceiling at a possibly higher level than the Rawlsian income. The optimum level of the ceiling will depend on the distribution of endowments in the economy and thus can be a topic of future research.

Finally, we note in this section that Market Segmentation and commodity taxation with direct transfers are two policies that are complementary in nature. Thus, the planner does not necessarily have to choose one over the other but can implement them together. We now present a theorem that proves that unless one policy (MS or DT) in itself achieves the first-best outcome, then the policy of Market Segmentation and the policy of commodity taxation should be used together to improve social welfare in our setup.

**Theorem 8.** Assume that the poor people are consumption constrained even after implementing either one of the two policies (i.e. segmentary taxes or commodity taxation with direct transfers). Under this condition, using the other policy together with the first one improves social welfare.

**Proof Idea.** This is a natural result because DT and MS work to improve welfare using completely different approaches. Transfers increase the purchasing power of the poor, thus helping to create equitable consumption of essential goods. On the other hand, segmentation drives down the prices of these essential goods. Hence, they turn out to be complementary and work well together. For a formal proof, see the appendix.

We show this below with the help of figures plotting welfare on the y-axis against the number of poor people on the x-axis. The figures demonstrate that welfare improves when they are implemented together.

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29The name Rawlsian income follows the tradition of social choice literature where the social welfare function which maximised of the least well-off individual is called Rawlsian. See https://plato.stanford.edu/entries/social-choice/#DocParDisDisDil
3.5 Conclusion

It is common for policymakers to intervene in a laissez-faire market equilibrium to improve social welfare, particularly to alter the allocation of goods for redistributive purposes. This paper introduces a new policy instrument (Market Segmentation) and studies existing instruments (Direct Transfers, Subsidies and Quantity Rationing) used to ration essential commodities. Our model, though stylized, provides a systematic framework to think about how different policies can be more welfare-enhancing in different conditions.

Policymakers and researchers need to understand the conditions under which to use specific policies. In particular, our model assumes quasi-linear utility, significant inequality in endowment distribution and existence of dead-weight loss under taxation. It should be noted that though we think that quasi-linear utility is a natural way to represent preferences when there are two types of goods (essentials and luxuries), the intuition of the results extends beyond quasi-linearity. For Market Segmentation (MS) to work at-least two types of must exist goods in the economy, with the following properties.

First, there must be at least one type which is distribution relevant to the planner (essentials).\textsuperscript{30} Second, there must be another type (luxuries), that is not relevant in terms of distribution. However, they being traded (or produced) is important for

\textsuperscript{30}Formally, under separability, this means the utility function for the essential good is concave and satisfies the Inada conditions
social welfare. As long as there are some goods which are distributionally relevant and another type on which taxation produces dead-weight losses, MS becomes a policy of significant relevance to the policy maker.

Even when the above conditions hold, MS may not be the best policy. Perhaps the main contribution of our work is to demonstrate that under certain conditions, w.r.t. elasticity of essential goods and the number of low-income individuals, MS performs better than two commonly used policies, i.e. subsidies and direct transfers. We also show MS weakly dominates quantity rationing (QR) in our model.

Crucially, different policies’ relative effectiveness depends on the price inelasticity of demand and supply of essential goods. The lack of response of demand and supply to price is what renders direct transfers and subsidies ineffective compared to MS. Thus, policymakers need to carefully study the elasticity condition of the essential goods before making a policy decision.

The price elasticity of demand being inelastic might be an innocuous condition; however, the price elasticity of supply being inelastic is not, particularly in the long run. The supply of many essential goods may significantly respond to prices in the long run, for example, food grains. However, there might be many scenarios where supply is constrained even in the long run due to technological constraints. For example, affordable housing in a city is constrained by the availability of land; similarly, increasing the supply of cardiac surgeons might be difficult even in the long run due to the nature of training needed. Thus, we think that policymakers should be careful in applying our results to the real world. That may be why the complementarity of MS and DT as policy instruments is a particularly nice property helping the policy makers. Since complimentarity implies MS should be considered (alongside DT) even if the conditions we lay out are not entirely verifiable.

In this paper, we also demonstrate that under the same elasticity conditions discussed above, DT is better than TS. Under DT, both rich and essential good providers reduce their demand for essential goods, leading to more equitable distribution. However, under TS, only essential good providers are affected. The inelasticity of demand implies that a large change in price for a few will not be as effective as a slight change in price for many. We also find that partial segmentation is better than complete segmentation under inelasticity because the segmentary tax revenue increases in tax rate but jumps to zero, in a discontinuous fashion, at the complete segmentary level. We also consider different applications of our results and discuss how our model and results might have many real-world applications.

31It takes 16 years of training post high school to train a cardiothoracic surgeon in the USA and similar time in Germany according to Tchantchaleishvili et al. (2010)
We also think that many more sophisticated instruments can be constructed using our method of taxing transactions between types of goods. We think our paper can provide a base for promising future research to deal with questions of inequality, taxation and even instruments to promote (dis)saving and investment.
Appendix A

In this section, we build a model based on Bordalo et al. (2020) to help us understand how political messages and events might interact with each other to shape public opinion. Bordalo et al. (2020) consider a consumer-choice setting where choice contexts cue agents to recall memories associated with that context. These memories, in turn, affect the agent’s consumer choices.

We adapt this model to a political-economy setting. Events that voters are exposed to enter their memory bank in our model. The messages from the politician cue recall of only those events that are associated with the message. For example, in our context, Modi talking about extremist conflict in the country, and his response to attacks on soldiers cues recall of memories associated with soldier deaths. Consequently, these memories that are cued by the messages affect voters’ opinions and behaviour. The model, though simple, gives testable predictions. We present the formal model below.

There are a total of J voters (1, 2,..., J), and each must decide whether to vote for a politician or not (V = 0 or 1). In our model, an individual’s decision about whom to vote for depends on the types of events they are thinking about while making this decision. There are three types of events that may take place in our economy. The first type is the soldier deaths (e1). Without loss of generality, we assume that if voters think about soldier deaths, it casts a favourable light on the politician and his policies. In our context this is because Modi touted his aggressive response to soldier deaths. The second type of event is an event that also casts the politician in a favourable light (e2); for example, launching welfare schemes for the poor. And, the third type of event casts the politician in an unfavourable light (e3); for example, negative economic shocks in the country. The voter supports the politician if he spends more time thinking about positive than negative events, weighted by the importance of each type of events. Mathematically, voters supports the politician (V = 1) if \( \sum \alpha_i W_i > 0 \), where \( W_i \) denotes fraction of time spent thinking about event \( i \), \( i \in \{1, 2, 3\} \) and \( 1 > \alpha_1 > 0, 1 > \alpha_2 > 0 \) and \( -1 < \alpha_3 < 0 \). \( \alpha_2 / \alpha_1 \) represents the relative importance of other events that help the politician vis-a-vis soldier deaths.

The politician chooses which type of event to speak about, \( S \in \{1, 2, 3\} \), to maximise his vote share. The politician is constrained to speak on only one type of event.\(^{32}\) The messages that he sends or the speeches that he makes influence

\(^{32}\)This model trivially extends to n types of events and politician constrained to speak about m
what voters think about. An individual voter’s $W_i$ are influenced by the politician’s speech as follows:

$$W_i = \frac{b_i}{b_1 + b_2 + b_3}$$

where each $b_i = e_i \times s_i \times m + \varepsilon_i$. $e_i$ denotes whether the voter is exposed to the event that took place. In the simplest form, this exposure can be represented as a dummy variable, taking the value 1 if there is exposure. $s_i$ is a dummy variable taking the value 1 only if the politician spoke about event $i$. $m$ denotes the amount of media coverage of the speech. We define $m$ to be a continuous variable distributed between 0 and 1. In our model, media is passive i.e. it always covers what the politician speaks about. We give evidence of this claim in the Indian context later.\footnote{See section 1.5 for details.} For each voter $j$, $\varepsilon_i \sim U[0, 1]$ is an idiosyncratic shock, where $U$ is a uniform distribution. At an individual level, this can represent heterogeneity at the individual level preferences.

Notice that each voter $j$ can differ across three dimensions in our model. She might be exposed to a particular event or not ($e_{i,j}$), she might be exposed to the media more or less ($m_j$), and there might be intrinsic differences in what each one thinks about ($\varepsilon_{i,j}$). Given these differences, the politician maximises his vote share by choosing a particular type of event he highlights in his speeches. We now present the first result of our model as the following lemma.

**Lemma 1:** The politician speaks about soldier deaths if $\alpha_1 E_1 > \alpha_2 E_2$ and event 2 otherwise, where $E_i$ denotes the fraction of voters who experience event $i$.

The formal proof is given below. The intuition of the result is straightforward. The politician will never talk about the type 3 event as that will hurt his vote share. Furthermore, given that $\frac{\alpha_2}{\alpha_1}$ represents the relative importance of the other event that helps the politician vis-a-vis soldier deaths, the politician’s choice depends on the relative number of people exposed to soldier deaths as opposed to the ones exposed to an event of type 2. If the relative number of people exposed to soldier deaths is high, then talking about soldier deaths makes relatively more voters think about an issue that maximises his vote share.

**Proof: Lemma 1**

The politician wants to maximise his vote share i.e.

$$\sum \left[ \sum \alpha_i W_i > 0 \right]$$

events, such that $m < n$. All the results that follow will still hold.
under the constraint that he can speak about only one kind of event $S \in \{1, 2, 3\}$. 

Let $E_i$ be the fraction of voters who received event $e_i$. 

His vote share if speaks about $e_1$ i.e. $s_1 = 1$, $s_2 = 0$ and $s_3 = 0$

$$= E_1 \left[ \alpha_1 \frac{m \times e_1 \times s_1 + \varepsilon_1}{D} + \alpha_2 \frac{\varepsilon_2}{D} + \alpha_3 \frac{\varepsilon_3}{D} > 0 \right] + (1 - E_1) \left[ \alpha_1 \frac{\varepsilon_1}{D} + \alpha_2 \frac{\varepsilon_2}{D} + \alpha_3 \frac{\varepsilon_3}{D} > 0 \right]$$

where $D = m + \varepsilon_1 + \varepsilon_2 + \varepsilon_3$.

His vote share if speaks about $e_2$ i.e. $s_2 = 1$, $s_1 = 0$ and $s_3 = 0$

$$= E_2 \left[ \alpha_1 \frac{\varepsilon_1}{D} + \alpha_2 \frac{m \times e_2 \times s_2 + \varepsilon_2}{D} + \alpha_3 \frac{\varepsilon_3}{D} > 0 \right] + (1 - E_2) \left[ \alpha_1 \frac{\varepsilon_1}{D} + \alpha_2 \frac{\varepsilon_2}{D} + \alpha_3 \frac{\varepsilon_3}{D} > 0 \right]$$

where $D = m + \varepsilon_1 + \varepsilon_2 + \varepsilon_3$.

Given $\varepsilon_i \sim U[0, 1]$, and given the politician wants to maximise his vote share, he speaks about soldier deaths ($e_1$) if and only if $\alpha_1 E_1 > \alpha_2 E_2$.

Q.E.D.

The next proposition is the main result of the model.

**Proposition 1:** If a politician discusses soldier deaths ($S = 1$),

1. Voters exposed to soldier deaths ($e_1 = 1$) are more likely to support the politician than voters not exposed ($e_1 = 0$).

2. The likelihood a voter supports the politician does not depend upon exposure to events 2 and 3 ($e_2, e_3$).\(^{34}\)

3. Voters exposed to soldier deaths ($e_1 = 1$) are more likely to support the politician if they consume more media ($m$ is greater).

The proof is given below. Here we discuss the intuition of the results. To understand part 1 of the proposition, notice that the politician is discussing soldier deaths in his speeches, and hence memories of soldier deaths are recalled in the voters’ minds. It is this memory that makes a voter more likely to vote for the politician only cues own experience (event exposure) only when reminded by the politician. In general, voter can cue his own personal experience without the political messages as well. But the general argument of our paper is that because of vast experiences of each individual, memories of particular events are more likely to be cued if there are political messages about them. This particular functional form is just for simplicity.

\(^{34}\)The result above follows because of the particular functional form. This assumes that a voter only cues own experience (event exposure) only when reminded by the politician. In general, voter can cue his own personal experience without the political messages as well. But the general argument of our paper is that because of vast experiences of each individual, memories of particular events are more likely to be cued if there are political messages about them. This particular functional form is just for simplicity.
politician. However, only voters exposed to the soldier deaths have the required event in their memory bank; thus, they are more likely to vote for the politician.

Part 2 of the proposition sheds light on a crucial aspect of the model. Given that we have a single politician in the model and that politician is speaking, in the case we consider, about soldier deaths, the memories of other events ($e_2$ and $e_3$) are not recalled in the voters’ minds. Given that this memory is not recalled, the exposure to these events becomes insignificant because even exposed voters are not more likely to think about them when making voting decisions.

Part 3 of the proposition follows because the politicians’ messages reach the voters through some form of media in our model. Hence, if voters consume more media, they are likely to be reminded of soldier deaths. Since they change voting behaviour only if the memory of soldier death is recalled, the likelihood of supporting the politician increases if they consume more media.

**Proof: Part (i) of proposition 1**

Suppose voter $x$ is exposed to soldier death ($e_1 = 1$) and voter $y$ is not ($e_1 = 0$).

To prove: $P_x(V = 1) = P_x(\sum \alpha_i W_i > 0) > P_y(\sum \alpha_i W_i > 0) = P_y(V = 1)$

Take LHS, given $S = 1$ and $e_1 = 1$, we get

$$P_x(\sum \alpha_i W_i > 0) = P (\alpha_1 \frac{m + \varepsilon_1}{D_x} + \alpha_2 \frac{\varepsilon_2}{D_x} + \alpha_3 \frac{\varepsilon_3}{D_x} > 0)$$

where $D_x = m + \varepsilon_1 + \varepsilon_2 + \varepsilon_3$

Take RHS, given $S = 1$ and $e_1 = 0$, we get

$$P_y(\sum \alpha_i W_i > 0) = P (\alpha_1 \frac{\varepsilon_1}{D_y} + \alpha_2 \frac{\varepsilon_2}{D_y} + \alpha_3 \frac{\varepsilon_3}{D_y} > 0)$$

where $D_y = m + \varepsilon_1 + \varepsilon_2 + \varepsilon_3$

Given $m > 0$ and $-1 < \alpha_i < 1 \ \forall i$, $P_x > P_y$.

Q.E.D.

**Proof: Part (ii) of proposition 1**

Suppose voter $x$ is exposed to the event $e_2$ and voter $y$ is not.

Also, $S = 1$

To prove: $P_x(V = 1) = P_x(\sum \alpha_i W_i > 0) = P_y(\sum \alpha_i W_i > 0) = P_y(V = 1)$

Take LHS, we know $e_2 = 1$, but given $S = 1$, we have $s_2 = 0$
Thus,
\[ P_x(\sum \alpha_i W_i > 0) = P(\alpha_1 \frac{\varepsilon_1}{D} + \alpha_2 \frac{\varepsilon_2}{D} + \alpha_3 \frac{\varepsilon_3}{D} > 0) \]
where \( D = \varepsilon_1 + \varepsilon_2 + \varepsilon_3 \)

Take RHS, we know \( e_2 = 0 \)
Thus,
\[ P_y(\sum \alpha_i W_i > 0) = P(\alpha_1 \frac{\varepsilon_1}{D} + \alpha_2 \frac{\varepsilon_2}{D} + \alpha_3 \frac{\varepsilon_3}{D} > 0) \]
where \( D = \varepsilon_1 + \varepsilon_2 + \varepsilon_3 \)
Hence, LHS = RHS.

\textbf{Proof: Part (iii) of proposition 1}
Suppose both voter \( x \) and \( y \) are exposed to soldier death (\( e_1 = 1 \)).
W.L.O.G., let \( m_x > m_y \).
To prove: \( P_x(V = 1) = P_x(\sum \alpha_i W_i > 0) > P_y(\sum \alpha_i W_i > 0) = P_y(V = 1) \)
Take LHS, given \( S = 1 \) and \( e_1 = 1 \), we get
\[ P_x(\sum \alpha_i W_i > 0) = P(\alpha_1 \frac{m_x + \varepsilon_1}{D_x} + \alpha_2 \frac{\varepsilon_2}{D_x} + \alpha_3 \frac{\varepsilon_3}{D_x} > 0) \]
where \( D_x = m_x + \varepsilon_1 + \varepsilon_2 + \varepsilon_3 \)
Take RHS, given \( S = 1 \) and \( e_1 = 1 \), we get
\[ P_y(\alpha_1 \frac{m_y + \varepsilon_1}{D_y} + \alpha_2 \frac{\varepsilon_2}{D_y} + \alpha_3 \frac{\varepsilon_3}{D_y} > 0) \]
where \( D_y = m_y + \varepsilon_1 + \varepsilon_2 + \varepsilon_3 \)
Given \( m_x > m_y \) and \( -1 < \alpha_i < 1 \forall i \), \( P_x > P_y \).
Q.E.D.

Now we present a result that is a corollary of proposition 1. It discusses how much soldier deaths matter in our model when the politician does not discuss them.

\textbf{Corollary 1}: If a politician does not discuss soldier deaths (\( S = 2 \)), the likelihood a voter supports the politician does not depend upon exposure to soldier deaths (\( e_1 \)).

The intuition behind Corollary 1 is the same as the intuition behind part 2 of proposition 1. If the politician does not discuss soldier deaths, then even the voters exposed to soldier deaths do not recall the memory of these soldier deaths.
when making voting decisions and hence do not change their voting behaviour. The formal proof is in appendix 3.5.

**Proof: Corollary 1**

Suppose voter x was exposed to soldier death \( e_1 = 1 \) and voter y did not \( (e_1 = 0) \).

Also, \( S = 2 \).

To prove : \( P_x(V = 1) = P_x(\sum \alpha_i W_i > 0) = P_y(\sum \alpha_i W_i > 0) = P_y(V = 1) \)

Take LHS, we know \( e_1 = 1 \), but given \( S = 2 \), \( s_1 = 0 \) and \( s_3 = 0 \).

Thus we get,

\[
P_x(\sum \alpha_i W_i > 0) = P(\frac{\alpha_1 \varepsilon_1}{D} + \frac{\alpha_2 e_2 x m + \varepsilon_2}{D} + \frac{\alpha_3 \varepsilon_3}{D} > 0)
\]

where \( D = \varepsilon_1 + \varepsilon_2 + e_2 x m + \varepsilon_3 \)

Take RHS, we know \( e_1 = 0 \), and given \( S = 2 \), \( s_3 = 0 \).

Thus we get,

\[
P_y(\sum \alpha_i W_i > 0) = P(\frac{\alpha_1 \varepsilon_1}{D} + \frac{\alpha_2 e_2 x m + \varepsilon_2}{D} + \frac{\alpha_3 \varepsilon_3}{D} > 0)
\]

where \( D = \varepsilon_1 + \varepsilon_2 + e_2 x m + \varepsilon_3 \).

Hence, LHS = RHS.
Table A1: Parties decision to contest

<table>
<thead>
<tr>
<th></th>
<th>BJP</th>
<th>INC</th>
<th>Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death × Post</td>
<td>0.034</td>
<td>0.029</td>
<td>0.056</td>
</tr>
<tr>
<td></td>
<td>(0.025)</td>
<td>(0.032)</td>
<td>(0.040)</td>
</tr>
<tr>
<td>National election year FE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Controls</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Constituency FE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Mean of dependent variable</td>
<td>0.8</td>
<td>0.81</td>
<td>0.43</td>
</tr>
<tr>
<td>Observations</td>
<td>1,629</td>
<td>1,629</td>
<td>1,629</td>
</tr>
<tr>
<td>R²</td>
<td>0.716</td>
<td>0.598</td>
<td>0.631</td>
</tr>
</tbody>
</table>

Notes: Controls: log(Mean Night Lights), log(Electorate Size), log(Distance to Kashmir Conflict), log(Distance to Maoist Conflict), log(Distance to North-East Conflict), Share of SC Population and Share of ST Population. Standard errors are clustered at the constituency level. The fixed effects are for each parliamentary constituency and national election year. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.

Table A2: Individual level survey (Treatment: Soldier deaths between 2014 - 2019)

<table>
<thead>
<tr>
<th></th>
<th>BJP</th>
<th>NDA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Secessionist Death × Post</td>
<td>0.093**</td>
<td>0.079**</td>
</tr>
<tr>
<td></td>
<td>(0.040)</td>
<td>(0.040)</td>
</tr>
<tr>
<td>LWE Death × Post</td>
<td>0.011</td>
<td>0.013</td>
</tr>
<tr>
<td></td>
<td>(0.035)</td>
<td>(0.034)</td>
</tr>
<tr>
<td>National election year FE</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Controls</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Constituency FE</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>P-value of test of treatment equality</td>
<td>0.143</td>
<td>0.246</td>
</tr>
<tr>
<td>Observations</td>
<td>78,161</td>
<td>74,836</td>
</tr>
<tr>
<td>R²</td>
<td>0.244</td>
<td>0.277</td>
</tr>
</tbody>
</table>

Notes: LWE stands for Left Wing Extremism. Controls: Gender, log(Age), Education level, Employment, Caste categories dummies, Religion, Urbanisation level, Income Band. P-value of test of treatment equality is the Wald test to check the equality between the coefficients of Secessionist Death × Post and LWE Death × Post. Standard errors are clustered at the parliamentary constituency level. The fixed effects are for each parliamentary constituency and national election year. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.
Table A3: Heterogeneity by share of SC caste category
Soldier death period: 2014 - 2019

<table>
<thead>
<tr>
<th></th>
<th>Vote Share</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Right (BJP)</td>
</tr>
<tr>
<td>Secessionist Casualty × Post</td>
<td>0.092***</td>
</tr>
<tr>
<td></td>
<td>(0.030)</td>
</tr>
<tr>
<td>LWE Casualty × Post</td>
<td>-0.015</td>
</tr>
<tr>
<td></td>
<td>(0.026)</td>
</tr>
<tr>
<td>Secessionist Casualty × Post × Share SC Population</td>
<td>-0.273*</td>
</tr>
<tr>
<td></td>
<td>(0.162)</td>
</tr>
<tr>
<td>LWE Casualty × Post × Share SC Population</td>
<td>0.146</td>
</tr>
<tr>
<td></td>
<td>(0.143)</td>
</tr>
<tr>
<td>National election year FE</td>
<td>Y</td>
</tr>
<tr>
<td>Controls</td>
<td>Y</td>
</tr>
<tr>
<td>Constituency FE</td>
<td>Y</td>
</tr>
<tr>
<td>P-value of test of treatment equality</td>
<td>0.023**</td>
</tr>
<tr>
<td>Mean of dependent variable</td>
<td>0.368</td>
</tr>
<tr>
<td>Observations</td>
<td>1,297</td>
</tr>
<tr>
<td>R²</td>
<td>0.897</td>
</tr>
</tbody>
</table>

Notes: LWE stands for Left Wing Extremism. Controls: log(Mean Night Lights), log(Electorate Size), log(Distance to Kashmir Conflict), log(Distance to Maoist Conflict), log(Distance to North-East Conflict), Share of SC Population and Share of ST Population. P-value of test of treatment equality is the Wald test to check the equality between the coefficients of Secessionist Death × Post and LWE Death × Post. Standard errors are clustered at the constituency level. The fixed effects are for each parliamentary constituency and national election year. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.
Table A4: Backward treatment placebo regression: Assignment of deaths to the past general election

<table>
<thead>
<tr>
<th></th>
<th>Right Wing Vote Share</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td></td>
</tr>
<tr>
<td>Death</td>
<td>−0.002</td>
<td>−</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.008)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secessionist Death</td>
<td>−</td>
<td>−0.006</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.008)</td>
<td></td>
</tr>
<tr>
<td>LWE Death</td>
<td>−</td>
<td>0.0001</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.008)</td>
<td></td>
</tr>
<tr>
<td>National election year FE</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Controls</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Constituency FE</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Mean of dependent variable</td>
<td>0.371</td>
<td>0.371</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>1,614</td>
<td>1,614</td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.777</td>
<td>0.777</td>
<td></td>
</tr>
</tbody>
</table>

Notes: LWE stands for Left Wing Extremism. Controls: log(Mean Night Lights), log(Electorate Size), log(Distance to Kashmir Conflict), log(Distance to Maoist Conflict), log(Distance to North-East Conflict), Share of SC Population and Share of ST Population. Standard errors are clustered at the constituency level. The fixed effects are for each parliamentary constituency and national election year. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.

Figure A1: Simulation of random assignment of treatment
Table A5: Forward placebo
Assignment of treatment to next election

<table>
<thead>
<tr>
<th>Vote Share</th>
<th>BJP</th>
<th>NDA</th>
<th>INC</th>
<th>UPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secessionist Death Placebo × Post</td>
<td>0.016 (0.017)</td>
<td>0.020 (0.019)</td>
<td>0.012 (0.017)</td>
<td>−0.002 (0.019)</td>
</tr>
<tr>
<td>LWE Death Placebo × Post</td>
<td>0.012 (0.011)</td>
<td>0.015 (0.012)</td>
<td>0.014 (0.011)</td>
<td>0.012 (0.013)</td>
</tr>
<tr>
<td>National election year FE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Controls</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Constituency FE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>P-value of test of treatment equality</td>
<td>0.83</td>
<td>0.843</td>
<td>0.953</td>
<td>0.546</td>
</tr>
<tr>
<td>Mean of dependent variable</td>
<td>0.37</td>
<td>0.37</td>
<td>0.28</td>
<td>0.3</td>
</tr>
<tr>
<td>Observations</td>
<td>1,297</td>
<td>1,614</td>
<td>1,325</td>
<td>1,597</td>
</tr>
<tr>
<td>R²</td>
<td>0.885</td>
<td>0.778</td>
<td>0.783</td>
<td>0.626</td>
</tr>
</tbody>
</table>

Notes: LWE stands for Left Wing Extremism. Controls: log(Mean Night Lights), log(Electorate Size), log(Distance to Kashmir Conflict), log(Distance to Maoist Conflict), log(Distance to North-East Conflict), Share of SC Population and Share of ST Population. P-value of test of treatment equality is the Wald test to check the equality between the coefficients of Secessionist Death Placebo × Post and LWE Death Placebo × Post. Standard errors are clustered at the constituency level. The fixed effects are for each parliamentary constituency and national election year. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.

Figure A2: UPA vote share pre-trend
Table A6: Interaction: Total deaths in the constituency between 2004-2014

<table>
<thead>
<tr>
<th></th>
<th>Vote Share</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Right</td>
<td>Right to Centre - Right</td>
</tr>
<tr>
<td></td>
<td>BJP</td>
<td>NDA</td>
</tr>
<tr>
<td>Secessionist Casualty × Post</td>
<td>0.053***</td>
<td>0.047***</td>
</tr>
<tr>
<td></td>
<td>(0.016)</td>
<td>(0.017)</td>
</tr>
<tr>
<td>LWE Casualty × Post</td>
<td>0.026</td>
<td>0.033*</td>
</tr>
<tr>
<td></td>
<td>(0.018)</td>
<td>(0.019)</td>
</tr>
<tr>
<td>Secessionist Casualty × Post × Total Casualty</td>
<td>0.002</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td>(0.005)</td>
<td>(0.005)</td>
</tr>
<tr>
<td>LWE Casualty × Post × Total Casualty</td>
<td>−0.007*</td>
<td>−0.009*</td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
<td>(0.005)</td>
</tr>
</tbody>
</table>

National election year FE                 | Y | Y |
Controls                                   | Y | Y |
Constituency FE                            | Y | Y |
P-value of test of treatment equality      | 0.306 | 0.616 |
Mean of dependent variable                  | 0.37 | 0.37 |
Observations                                | 1,297 | 1,614 |
R²                                          | 0.889 | 0.782 |

Notes: LWE stands for Left Wing Extremism. Controls: log(Mean Night Lights), log(Electorate Size), log(Distance to Kashmir Conflict), log(Distance to Maoist Conflict), log(Distance to North-East Conflict), Share of SC Population and Share of ST Population. P-value of test of treatment equality is the Wald test to check the equality between the coefficients of Secessionist Death × Post and LWE Death × Post. Standard errors are clustered at the constituency level. The fixed effects are for each parliamentary constituency and national election year. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.
Table A7: Sub-sample of only neighbouring constituencies as controls

<table>
<thead>
<tr>
<th></th>
<th>Right Coalition Vote Share</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>Secessionist Death × Post</td>
<td>0.031**</td>
<td>0.031**</td>
<td>0.033**</td>
<td>0.035***</td>
</tr>
<tr>
<td></td>
<td>(0.013)</td>
<td>(0.013)</td>
<td>(0.013)</td>
<td>(0.013)</td>
</tr>
<tr>
<td>LWE Death × Post</td>
<td>−0.004</td>
<td>−0.003</td>
<td>−0.003</td>
<td>−0.003</td>
</tr>
<tr>
<td></td>
<td>(0.014)</td>
<td>(0.014)</td>
<td>(0.014)</td>
<td>(0.013)</td>
</tr>
<tr>
<td>State FE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>National election year FE</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td>Controls</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constituency FE</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>P-value of test of treatment equality</td>
<td>0.078*</td>
<td>0.087*</td>
<td>0.073*</td>
<td>0.052*</td>
</tr>
<tr>
<td>Mean of dependent variable</td>
<td>0.369</td>
<td>0.369</td>
<td>0.369</td>
<td>0.369</td>
</tr>
<tr>
<td>Observations</td>
<td>1,264</td>
<td>1,264</td>
<td>1,264</td>
<td>1,264</td>
</tr>
<tr>
<td>R²</td>
<td>0.568</td>
<td>0.627</td>
<td>0.644</td>
<td>0.786</td>
</tr>
</tbody>
</table>

Notes: LWE stands for Left Wing Extremism. Controls: log(Mean Night Lights), log(Electorate Size), log(Distance to Kashmir Conflict), log(Distance to Maoist Conflict), log(Distance to North-East Conflict), Share of SC Population and Share of ST Population. P-value of test of treatment equality is the Wald test to check the equality between the coefficients of Secessionist Death × Post and LWE Death × Post. Standard errors are clustered at the constituency level. The fixed effects are for each parliamentary constituency and national election year. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.
Table A8: Dependent variable: ln(0.001 + number of deaths)

<table>
<thead>
<tr>
<th>Vote Share</th>
<th>Right (BJP)</th>
<th>Right to Centre - Right (NDA)</th>
<th>Centre - Left (INC)</th>
<th>(UPA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ln(# Secessionist Casualty)</td>
<td>-0.0002 (0.0009)</td>
<td>0.0001 (0.0011)</td>
<td>-0.0016* (0.0010)</td>
<td>-0.0024** (0.0011)</td>
</tr>
<tr>
<td>ln(# LWE Casualty)</td>
<td>0.0006 (0.0007)</td>
<td>0.0005 (0.0008)</td>
<td>0.0003 (0.0009)</td>
<td>0.0004 (0.0010)</td>
</tr>
<tr>
<td>ln(# Secessionist Casualty) × Post</td>
<td>0.0056*** (0.0013)</td>
<td>0.0051*** (0.0015)</td>
<td>0.0008 (0.0015)</td>
<td>0.0011 (0.0017)</td>
</tr>
<tr>
<td>ln(# LWE Casualty) × Post</td>
<td>0.0004 (0.0012)</td>
<td>0.0011 (0.0014)</td>
<td>0.0020 (0.0016)</td>
<td>0.0017 (0.0017)</td>
</tr>
<tr>
<td>National election year FE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Controls</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Constituency FE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>P-value of test of treatment equality</td>
<td>0.013**</td>
<td>0.86*</td>
<td>0.648</td>
<td>0.832</td>
</tr>
<tr>
<td>Mean dependent variable</td>
<td>0.368</td>
<td>0.371</td>
<td>0.278</td>
<td>0.295</td>
</tr>
<tr>
<td>Observations</td>
<td>1,297</td>
<td>1,614</td>
<td>1,325</td>
<td>1,597</td>
</tr>
<tr>
<td>R²</td>
<td>0.8888</td>
<td>0.7816</td>
<td>0.7843</td>
<td>0.6279</td>
</tr>
</tbody>
</table>

Notes: LWE stands for Left Wing Extremism. Controls: log(Mean Night Lights), log(Electorate Size), log(Distance to Kashmir Conflict), log(Distance to Maoist Conflict), log(Distance to North-East Conflict), Share of SC Population and Share of ST Population. P-value of test of treatment equality is the Wald test to check the equality between the coefficients of ln(# Secessionist Casualty) × Post and ln(# LWE Casualty) × Post. Standard errors are clustered at the constituency level. The fixed effects are for each parliamentary constituency and national election year. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.

Table A9: Conley standard errors

<table>
<thead>
<tr>
<th>Right Coalition Vote Share</th>
<th>Clustered Standard Errors</th>
<th>Conley Standard Errors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>150 kms 250 kms 400 kms 600 kms</td>
<td>150 kms 250 kms 400 kms 600 kms</td>
</tr>
<tr>
<td>Secessionist Death × Post</td>
<td>0.056*** (0.012)</td>
<td>0.056*** (0.014)</td>
</tr>
<tr>
<td>LWE Death × Post</td>
<td>0.017 (0.013)</td>
<td>0.017 (0.010)</td>
</tr>
<tr>
<td>National election year FE</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Constituency FE</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Mean of dependent variable</td>
<td>0.37</td>
<td>0.37</td>
</tr>
<tr>
<td>Observations</td>
<td>1,614</td>
<td>1,614</td>
</tr>
</tbody>
</table>

Notes: LWE stands for Left Wing Extremism. Controls: log(Mean Night Lights), log(Electorate Size), log(Distance to Kashmir Conflict), log(Distance to Maoist Conflict), log(Distance to North-East Conflict), Share of SC Population and Share of ST Population. The fixed effects are for each parliamentary constituency and national election year. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.
Table A10: Media results (Dummy variable): Soldier deaths (2014 - 2019)

<table>
<thead>
<tr>
<th></th>
<th>NES_Voted_NDA</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secessionist Death × Post</td>
<td></td>
<td>0.104***</td>
<td>0.042</td>
<td>0.097**</td>
<td>0.105***</td>
<td>0.102***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.038)</td>
<td>(0.042)</td>
<td>(0.041)</td>
<td>(0.039)</td>
<td>(0.038)</td>
</tr>
<tr>
<td>Secessionist Death × Post × TV Dummy</td>
<td></td>
<td>-</td>
<td>0.096***</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.031)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secessionist Death × Post × Newspaper Dummy</td>
<td></td>
<td>-</td>
<td>-</td>
<td>0.023</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.029)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secessionist Death × Post × Radio Dummy</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.002</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.045)</td>
<td></td>
</tr>
<tr>
<td>Secessionist Death × Post × Internet Dummy</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.033</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.037)</td>
<td></td>
</tr>
</tbody>
</table>

National election year FE: Y Y Y Y Y
Constituency FE: Y Y Y Y Y

Observations: 74,836 74,082 73,593 73,340 72,235
R²: 0.218 0.219 0.218 0.217 0.220

Notes: LWE stands for Left Wing Extremism. Controls: Gender, log(Age), Education level, Employment, Caste categories dummies, Religion, Urbanisation level, Income Band. Standard errors are clustered at the parliamentary constituency level. The fixed effects are for each parliamentary constituency and national election year. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.


|                                | BJP Vote Share | (1)   | (2)   |
|--------------------------------|               |-------|-------|
| Secessionist Death × Post      |               | 0.196** | 0.168** |
|                                |               | (0.077) | (0.070) |
| LWE Death × Post               |               | -0.118 | -0.116* |
|                                |               | (0.072) | (0.063) |

National election year FE: Y
Controls: Y
Constituency FE: Y

P-value of test of treatment equality: 0.000*** 0.000***
Observations: 7,606 7,252
R²: 0.143 0.285

Notes: LWE stands for Left Wing Extremism. Controls: Gender, log(Age), Education level, Employment, Caste categories dummies, Religion, Urbanisation level, Income Band. P-value of test of treatment equality is the Wald test to check the equality between the coefficients of Secessionist Death × Post and LWE Death × Post. Standard errors are clustered at the parliamentary constituency level. The fixed effects are for each parliamentary constituency and national election year. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.
Table A12: Robustness: Dropping Uttar Pradesh

<table>
<thead>
<tr>
<th></th>
<th>NDA Vote Share</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Secessionist Death × Post</td>
<td>0.105**</td>
<td>0.094**</td>
</tr>
<tr>
<td></td>
<td>(0.041)</td>
<td>(0.041)</td>
</tr>
<tr>
<td>LWE Death × Post</td>
<td>0.025</td>
<td>0.028</td>
</tr>
<tr>
<td></td>
<td>(0.040)</td>
<td>(0.039)</td>
</tr>
<tr>
<td>National election year FE</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Controls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constituency FE</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>P-value of test of treatment equality</td>
<td>0.19</td>
<td>0.292</td>
</tr>
<tr>
<td>Observations</td>
<td>70,555</td>
<td>67,584</td>
</tr>
<tr>
<td>R²</td>
<td>0.189</td>
<td>0.217</td>
</tr>
</tbody>
</table>

Notes: LWE stands for Left Wing Extremism. Controls: Gender, log(Age), Education level, Employment, Caste categories dummies, Religion, Urbanisation level, Income Band. P-value of test of treatment equality is the Wald test to check the equality between the coefficients of Secessionist Death × Post and LWE Death × Post. Standard errors are clustered at the parliamentary constituency level. The fixed effects are for each parliamentary constituency and national election year. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.


<table>
<thead>
<tr>
<th></th>
<th>Right Coalition Vote Share</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Secessionist Death</td>
<td>0.138***</td>
<td>0.125***</td>
</tr>
<tr>
<td></td>
<td>(0.035)</td>
<td>(0.040)</td>
</tr>
<tr>
<td>Secessionist Death × WhatsApp</td>
<td>-</td>
<td>0.012</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.010)</td>
</tr>
<tr>
<td>Secessionist Death × Facebook</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secessionist Death × Twitter</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controls</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Observations</td>
<td>19,248</td>
<td>18,232</td>
</tr>
<tr>
<td>R²</td>
<td>0.100</td>
<td>0.100</td>
</tr>
</tbody>
</table>

Notes: Controls: Gender, log(Age), Education level, Employment, Caste categories dummies, Religion, Urbanisation level, Income Band. Standard errors are clustered at the parliamentary constituency level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.
Table A14: Visit party worker: Soldier deaths: 2014 - 2019

<table>
<thead>
<tr>
<th></th>
<th>Right Coalition Vote Share (2019)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>Secessionist Death × Post</td>
<td>0.104***</td>
</tr>
<tr>
<td></td>
<td>(0.038)</td>
</tr>
<tr>
<td>LWE Death × Post</td>
<td>0.010</td>
</tr>
<tr>
<td></td>
<td>(0.036)</td>
</tr>
<tr>
<td>Secessionist Death × Post × Visit Party Worker</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>LWE Death × Post × Visit Party Worker</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

|                                      | Y     | Y     |
| National election year FE                 |       |       |
| Constituency FE                           | Y     | Y     |
| P-value of test of treatment equality    | 0.099* | 0.147 |
| Observations                              | 74,836 | 74,836 |
| R²                                       | 0.218  | 0.218 |

Notes: LWE stands for Left Wing Extremism. Controls: Gender, log(Age), Education level, Employment, Caste categories dummies, Religion, Urbanisation level, Income Band. P-value of test of treatment equality is the Wald test to check the equality between the coefficients of Secessionist Death × Post and LWE Death × Post. Standard errors are clustered at the parliamentary constituency level. The fixed effects are for each parliamentary constituency and national election year. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.
Table A15: Turnout (Voter survey): Soldier deaths (2014 and 2019 election)

<table>
<thead>
<tr>
<th>Did You Vote Dummy</th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secessionist Death 2019 × Post</td>
<td>0.003</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.018)</td>
<td></td>
</tr>
<tr>
<td>LWE Death 2019 × Post</td>
<td>0.007</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.016)</td>
<td></td>
</tr>
<tr>
<td>Secessionist Death 2014 × Post</td>
<td>-</td>
<td>-0.024</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.017)</td>
</tr>
<tr>
<td>LWE Death 2014 × Post</td>
<td>-</td>
<td>0.024</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.015)</td>
</tr>
</tbody>
</table>

| | Y | Y |
| National election year FE |   |   |
| Controls | Y | Y |
| Constituency FE | Y | Y |
| P-value of test of treatment equality | 0.872 | 0.058* |
| Observations | 78,499 | 57,464 |
| R² | 0.083 | 0.086 |

Notes: LWE stands for Left Wing Extremism. Controls: Gender, log(Age), Education level, Employment, Caste categories dummies, Religion, Urbanisation level, Income Band. P-value of test of treatment equality is the Wald test to check the equality between the coefficients of Secessionist Death × Post and LWE Death × Post for the first regression and Secessionist Death 2014 × Post and LWE Death 2014 × Post for the second regression. Standard errors are clustered at the parliamentary constituency level. The fixed effects are for each parliamentary constituency and national election year. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.

Table A16: Election activity: Soldier deaths: 2014 - 2019

<table>
<thead>
<tr>
<th>Attend Meeting</th>
<th>Contribute/Collect Money</th>
<th>Door-to-Door Canvassing</th>
<th>Distribute Leaflet</th>
<th>Join Procession</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secessionist Death × Post</td>
<td>-0.057**</td>
<td>-0.013</td>
<td>-0.040*</td>
<td>-0.021</td>
</tr>
<tr>
<td></td>
<td>(0.026)</td>
<td>(0.012)</td>
<td>(0.022)</td>
<td>(0.021)</td>
</tr>
<tr>
<td>LWE Death × Post</td>
<td>0.008</td>
<td>-0.012</td>
<td>-0.005</td>
<td>-0.023</td>
</tr>
<tr>
<td></td>
<td>(0.032)</td>
<td>(0.015)</td>
<td>(0.023)</td>
<td>(0.022)</td>
</tr>
</tbody>
</table>

| Controls | Y | Y | Y | Y | Y |
| Constituency FE | Y | Y | Y | Y | Y |
| Observations | 78,229 | 42,310 | 42,381 | 42,314 | 78,162 |
| R² | 0.137 | 0.089 | 0.127 | 0.119 | 0.102 |

Notes: LWE stands for Left Wing Extremism. Controls: Gender, log(Age), Education level, Employment, Caste categories dummies, Religion, Urbanisation level, Income Band. P-value of test of treatment equality is the Wald test to check the equality between the coefficients of Secessionist Death × Post and LWE Death × Post. Standard errors are clustered at the parliamentary constituency level. The fixed effects are for each parliamentary constituency and national election year. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.
### Table A17: When decided vote: Soldier deaths: 2014 - 2019

<table>
<thead>
<tr>
<th></th>
<th>Polling Day</th>
<th>Few Days Before Polling</th>
<th>During Campaign</th>
<th>Before Campaign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secessionist Death × Post</td>
<td>-0.004</td>
<td>0.019</td>
<td>-0.065**</td>
<td>-0.069*</td>
</tr>
<tr>
<td></td>
<td>(0.020)</td>
<td>(0.019)</td>
<td>(0.032)</td>
<td>(0.037)</td>
</tr>
<tr>
<td>LWE Death × Post</td>
<td>0.016</td>
<td>0.025</td>
<td>-0.032</td>
<td>-0.003</td>
</tr>
<tr>
<td></td>
<td>(0.025)</td>
<td>(0.019)</td>
<td>(0.035)</td>
<td>(0.038)</td>
</tr>
<tr>
<td>National election year FE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Controls</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Constituency FE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>P-value of test of treatment equality</td>
<td>0.184</td>
<td>0.571</td>
<td>0.851</td>
<td>0.508</td>
</tr>
<tr>
<td>Observations</td>
<td>68,857</td>
<td>68,857</td>
<td>68,857</td>
<td>68,857</td>
</tr>
<tr>
<td>R²</td>
<td>0.100</td>
<td>0.087</td>
<td>0.112</td>
<td>0.134</td>
</tr>
</tbody>
</table>

Notes: LWE stands for Left Wing Extremism. Controls: Gender, log(Age), Education level, Employment, Caste categories dummies, Religion, Urbanisation level, Income Band. P-value of test of treatment equality is the Wald test to check the equality between the coefficients of Secessionist Death × Post and LWE Death × Post. Standard errors are clustered at the parliamentary constituency level. The fixed effects are for each parliamentary constituency and national election year. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.

### Table A18: Splitting secessionist conflict: Soldier death period (2014 - 2019)

<table>
<thead>
<tr>
<th></th>
<th>Right BJP</th>
<th>Right to Centre - Right NDA</th>
<th>Centre - Left INC</th>
<th>Left UPA</th>
<th>Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kashmir Death × Post</td>
<td>0.047***</td>
<td>0.049***</td>
<td>-0.003</td>
<td>-0.001</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td>(0.011)</td>
<td>(0.012)</td>
<td>(0.014)</td>
<td>(0.016)</td>
<td>(0.025)</td>
</tr>
<tr>
<td>North East Death × Post</td>
<td>0.057***</td>
<td>0.054**</td>
<td>-0.020</td>
<td>-0.030</td>
<td>-0.060</td>
</tr>
<tr>
<td></td>
<td>(0.020)</td>
<td>(0.024)</td>
<td>(0.022)</td>
<td>(0.024)</td>
<td>(0.043)</td>
</tr>
<tr>
<td>LWE Death × Post</td>
<td>0.005</td>
<td>0.013</td>
<td>0.027*</td>
<td>0.026</td>
<td>0.037</td>
</tr>
<tr>
<td></td>
<td>(0.012)</td>
<td>(0.014)</td>
<td>(0.016)</td>
<td>(0.017)</td>
<td>(0.031)</td>
</tr>
<tr>
<td>National election year FE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Controls</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Constituency FE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Mean of dependent variable</td>
<td>0.368</td>
<td>0.371</td>
<td>0.278</td>
<td>0.295</td>
<td>0.106</td>
</tr>
<tr>
<td>Observations</td>
<td>1,297</td>
<td>1,614</td>
<td>1,325</td>
<td>1,597</td>
<td>699</td>
</tr>
<tr>
<td>R²</td>
<td>0.889</td>
<td>0.782</td>
<td>0.784</td>
<td>0.627</td>
<td>0.823</td>
</tr>
</tbody>
</table>

Notes: LWE stands for Left Wing Extremism. Controls: log(Mean Night Lights), log(Electorate Size), log(Distance to Kashmir Conflict), log(Distance to Maoist Conflict), log(Distance to North-East Conflict), Share of SC Population and Share of ST Population. Standard errors are clustered at the constituency level. The fixed effects are for each parliamentary constituency and national election year. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.
Table A19: Heterogeneity by local incumbent: Soldier death (2014 - 2019)

<table>
<thead>
<tr>
<th></th>
<th>Vote Share</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Right</td>
</tr>
<tr>
<td></td>
<td>BJP</td>
</tr>
<tr>
<td>Secessionist Casualty × Post</td>
<td>0.057**</td>
</tr>
<tr>
<td></td>
<td>(0.027)</td>
</tr>
<tr>
<td>LWE Casualty × Post</td>
<td>0.049*</td>
</tr>
<tr>
<td></td>
<td>(0.025)</td>
</tr>
<tr>
<td>Secessionist Casualty × Post × NDA Incumbent 2014</td>
<td>0.008</td>
</tr>
<tr>
<td></td>
<td>(0.029)</td>
</tr>
<tr>
<td>LWE Casualty × Post × NDA Incumbent 2014</td>
<td>−0.053*</td>
</tr>
<tr>
<td></td>
<td>(0.028)</td>
</tr>
</tbody>
</table>

|                                      |            |                      |
| National election year FE            | Y          | Y                    |
| Controls                             | Y          | Y                    |
| Constituency FE                      | Y          | Y                    |
| P-value of test of treatment equality | 0.847     | 0.34                 |
| Mean of dependent variable           | 0.368      | 0.371                |
| Observations                         | 1,297      | 1,614                |
| R²                                   | 0.891      | 0.782                |

Notes: LWE stands for Left Wing Extremism. Controls: log(Mean Night Lights), log(Electorate Size), log(Distance to Kashmir Conflict), log(Distance to Maoist Conflict), log(Distance to North-East Conflict), Share of SC Population and Share of ST Population. P-value of test of treatment equality is the Wald test to check the equality between the coefficients of Secessionist Death × Post and LWE Death × Post. Standard errors are clustered at the constituency level. The fixed effects are for each parliamentary constituency and national election year. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.
Table A20: Media coverage of conflict

<table>
<thead>
<tr>
<th></th>
<th>IHS(# Articles)</th>
<th>IHS(# Sources)</th>
<th>IHS(# Articles)</th>
<th>IHS(# Sources)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secessionist Conflict</td>
<td>−0.047***</td>
<td>−0.093***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
<td>(0.006)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LWE Conflict</td>
<td>−</td>
<td>−</td>
<td>0.047***</td>
<td>0.093***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.004)</td>
<td>(0.006)</td>
</tr>
<tr>
<td>Secessionist Conflict × Year (14-19)</td>
<td>0.229***</td>
<td>0.147***</td>
<td>(0.0003)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>LWE Conflict × Year (14-19)</td>
<td>−</td>
<td>−</td>
<td>−0.229***</td>
<td>−0.147***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.0003)</td>
<td>(0.003)</td>
</tr>
</tbody>
</table>

Week-year FE | Y | Y | Y | Y |
Conflict region FE | Y | Y | Y | Y |
Mean of dependent variable | 9.933 | 1.613 | 9.933 | 1.613 |
Observations | 1,969 | 1,969 | 1,969 | 1,969 |

Notes: Number of Articles is the total number of source documents containing one or more mentions of this event. Number of Sources is the total number of information sources containing one or more mentions of this event. LWE stands for Left Wing Extremism. Standard errors are clustered at the conflict region level. The fixed effects are for each conflict region and week. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level.

Table A21: Soldier deaths from 2009 - 2019

<table>
<thead>
<tr>
<th>Region</th>
<th>National Election Time Period</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2009-14</td>
<td>2014-19</td>
</tr>
<tr>
<td>Kashmir</td>
<td>43</td>
<td>130</td>
</tr>
<tr>
<td>North-East</td>
<td>37</td>
<td>40</td>
</tr>
<tr>
<td>LWE</td>
<td>318</td>
<td>139</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>410</td>
<td>313</td>
</tr>
</tbody>
</table>

Notes: The Secessionist region includes deaths of Kashmir and North-East region. LWE stands for Left Wing Extremism. The Miscellaneous region includes deaths during helicopter crashes in rescue operations, administrative duty, road accidents and rescue operations.
### Appendix B

Table B1: Descriptive statistics of the Colonial India districts (1881)

<table>
<thead>
<tr>
<th></th>
<th>count</th>
<th>mean</th>
<th>sd</th>
<th>min</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muslim literacy</td>
<td>182</td>
<td>0.03</td>
<td>0.02</td>
<td>0.01</td>
<td>0.16</td>
</tr>
<tr>
<td>Hindu literacy</td>
<td>182</td>
<td>0.04</td>
<td>0.05</td>
<td>0.01</td>
<td>0.50</td>
</tr>
<tr>
<td>Literacy gap</td>
<td>182</td>
<td>0.01</td>
<td>0.05</td>
<td>-0.10</td>
<td>0.38</td>
</tr>
<tr>
<td>% Hindu</td>
<td>183</td>
<td>0.72</td>
<td>0.30</td>
<td>0.00</td>
<td>2.41</td>
</tr>
<tr>
<td>% Muslim</td>
<td>183</td>
<td>0.23</td>
<td>0.26</td>
<td>0.00</td>
<td>0.88</td>
</tr>
<tr>
<td>Normal rainfall</td>
<td>194</td>
<td>49.17</td>
<td>31.82</td>
<td>3.52</td>
<td>259.00</td>
</tr>
<tr>
<td>Latitude</td>
<td>194</td>
<td>24.83</td>
<td>4.43</td>
<td>13.06</td>
<td>33.57</td>
</tr>
<tr>
<td>Longitude</td>
<td>194</td>
<td>80.90</td>
<td>6.23</td>
<td>67.00</td>
<td>94.65</td>
</tr>
<tr>
<td>Year annexed by British</td>
<td>194</td>
<td>1809.70</td>
<td>32.47</td>
<td>1757.00</td>
<td>1871.00</td>
</tr>
<tr>
<td>Years of Muslim rule</td>
<td>190</td>
<td>79.39</td>
<td>39.67</td>
<td>-98.00</td>
<td>161.00</td>
</tr>
<tr>
<td>Distance from Junnar</td>
<td>194</td>
<td>1158.28</td>
<td>473.61</td>
<td>76.64</td>
<td>2292.32</td>
</tr>
</tbody>
</table>

Notes: This table lists the districts of British India defined by 1881 Indian Census which were part of Mughal empire (1707) and ruled directly (excluding princely states).

\(^a\): Census document does not report the Literacy rate of Muslims in certain cities where there is negligible Muslim population. We do robustness checks excluding such sample completely.

\(^b\): Years of Muslim rule is from the establishment of Muslim dynasty in India till the Annexation by British powers.
### Table B2: Literacy gap

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muslim ruler</td>
<td>0.0120</td>
<td>0.0175**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.00884)</td>
<td>(0.00758)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hindu ruler</td>
<td></td>
<td>−0.0579**</td>
<td>−0.0251**</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.00738)</td>
<td>(0.00741)</td>
<td></td>
</tr>
<tr>
<td>Geographic controls</td>
<td>NO</td>
<td>YES</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>Demographic controls</td>
<td>NO</td>
<td>YES</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>Economic controls</td>
<td>NO</td>
<td>YES</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>Year FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Observations</td>
<td>549</td>
<td>365</td>
<td>549</td>
<td>365</td>
</tr>
</tbody>
</table>

Notes: Significance levels at * p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses corrected for district-level clustering. The Muslim ruler dummy (Hindu ruler Dummy) is assigned as one when the religion of last ruler whose territory British annexed is Muslim (Muslim). Demographic controls include population shares of different religions, population shares of different castes, average household size. Geographic controls: coastal dummy, major census city in colonial India, altitude, latitude, and longitude. Economic controls which include occupation classes (industry, agriculture etc.), port city and urbanization.

### Table B3: IV results for Muslim literacy

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance from Junnar</td>
<td>0.000741***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.000180)</td>
<td></td>
</tr>
<tr>
<td>Muslim ruler</td>
<td></td>
<td>−0.0691***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0240)</td>
</tr>
<tr>
<td>Geographic controls</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>Demographic controls</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>Economic controls</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>Year FE</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>365</td>
<td>365</td>
</tr>
<tr>
<td>Kleibergen-Paap Wald F statistics</td>
<td>17.0</td>
<td></td>
</tr>
</tbody>
</table>

Notes: Significance levels at * p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses corrected for district-level clustering. The Muslim ruler dummy (Hindu ruler Dummy) is assigned as one when the religion of last ruler whose territory British annexed is Muslim (Muslim). Demographic controls include population shares of different religions, population shares of different castes, average household size. Geographic controls: coastal dummy, major census city in colonial India, altitude, latitude, and longitude. Economic controls which include occupation classes (industry, agriculture etc.), port city and urbanization.
Table B4: IV results for Hindu literacy

<table>
<thead>
<tr>
<th></th>
<th>Hindu literacy</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Hindu ruler</td>
<td>−0.0493***</td>
<td>(0.0150)</td>
</tr>
<tr>
<td>Distance from Junnar</td>
<td>−0.000957***</td>
<td>(0.000167)</td>
</tr>
<tr>
<td>Geographic controls</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Demographic controls</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Economic controls</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Year FE</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>N</td>
<td>365</td>
<td>365</td>
</tr>
<tr>
<td>Kleibergen-Paap Wald F statistics</td>
<td>32.9</td>
<td></td>
</tr>
</tbody>
</table>

Notes: Significance levels at * p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses corrected for district-level clustering. The Muslim ruler dummy (Hindu ruler Dummy) is assigned as one when the religion of last ruler whose territory British annexed is Muslim (Muslim). Demographic controls include population shares of different religions, population shares of different castes, average household size. Geographic controls: coastal dummy, major census city in colonial India, altitude, latitude, and longitude. Economic controls which include occupation classes (industry, agriculture etc.), port city and urbanization.

Table B5: OLS Muslim literacy with employment as control (1881)

<table>
<thead>
<tr>
<th></th>
<th>Muslim literacy</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Muslim ruler</td>
<td>−0.00632*</td>
<td>−0.00865**</td>
</tr>
<tr>
<td></td>
<td>(0.00330)</td>
<td>(0.00409)</td>
</tr>
<tr>
<td>Muslim employment</td>
<td>−0.0294**</td>
<td>(0.0137)</td>
</tr>
<tr>
<td>Hindu employment</td>
<td>−0.0312**</td>
<td>(0.0143)</td>
</tr>
<tr>
<td>Demographic (population)</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>Geographic controls</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>N</td>
<td>182</td>
<td>171</td>
</tr>
</tbody>
</table>

Notes: Significance levels at * p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses corrected for district-level clustering. The Muslim ruler dummy (Hindu ruler Dummy) is assigned as one when the religion of last ruler whose territory British annexed is Muslim (Muslim). Demographic controls include population shares of different religions, population shares of different castes, average household size. Geographic controls: coastal dummy, major census city in colonial India, altitude, latitude, and longitude. Economic controls which include occupation classes (industry, agriculture etc.), port city and urbanization.
Table B6: OLS Hindu literacy with employment as control (1881)

<table>
<thead>
<tr>
<th></th>
<th>Hindu Literacy (1)</th>
<th>Hindu Literacy (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hindu Ruler</td>
<td>-0.0195**</td>
<td>-0.0156***</td>
</tr>
<tr>
<td></td>
<td>(0.00836)</td>
<td>(0.00493)</td>
</tr>
<tr>
<td>Hindu employment</td>
<td>-0.0347</td>
<td>-0.0460</td>
</tr>
<tr>
<td></td>
<td>(0.0227)</td>
<td>(0.0479)</td>
</tr>
<tr>
<td>Muslim employment</td>
<td>-0.0263</td>
<td>-0.0823*</td>
</tr>
<tr>
<td></td>
<td>(0.0290)</td>
<td>(0.0428)</td>
</tr>
<tr>
<td>Demographic (population)</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Geographic controls</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>N</td>
<td>171</td>
<td>171</td>
</tr>
</tbody>
</table>

Notes: Significance levels at * p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses corrected for district-level clustering. The Muslim ruler dummy (Hindu ruler Dummy) is assigned as one when the religion of last ruler whose territory British annexed is Muslim (Muslim). Demographic controls include population shares of different religions, population shares of different castes, average household size. Geographic controls: coastal dummy, major census city in colonial India, altitude, latitude, and longitude. Economic controls which include occupation classes (industry, agriculture etc.), port city and urbanization.

Table B7: OLS: Muslim literacy: Years since annexation

<table>
<thead>
<tr>
<th></th>
<th>Muslim Literacy (1)</th>
<th>Muslim Literacy (2)</th>
<th>Muslim Literacy (3)</th>
<th>Muslim Literacy (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muslim Ruler</td>
<td>-0.0248***</td>
<td>-0.0278***</td>
<td>-0.0243***</td>
<td>-0.0212***</td>
</tr>
<tr>
<td></td>
<td>(0.00577)</td>
<td>(0.00483)</td>
<td>(0.00727)</td>
<td>(0.00793)</td>
</tr>
<tr>
<td>Geographic controls</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Demographic controls</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Economic controls</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>Year FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>N</td>
<td>547</td>
<td>547</td>
<td>365</td>
<td>365</td>
</tr>
</tbody>
</table>

Notes: Significance levels at * p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses corrected for district-level clustering. The Muslim ruler dummy (Hindu ruler Dummy) is assigned as one when the religion of last ruler whose territory British annexed is Muslim (Muslim). Demographic controls include population shares of different religions, population shares of different castes, average household size. Geographic controls: coastal dummy, major census city in colonial India, altitude, latitude, and longitude. Economic controls which include occupation classes (industry, agriculture etc.), port city and urbanization.
Table B8: OLS: Hindu literacy : Years since annexation

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hindu ruler</td>
<td>−0.0267***</td>
<td>−0.0134***</td>
<td>−0.00965*</td>
<td>−0.0102**</td>
</tr>
<tr>
<td></td>
<td>(0.00572)</td>
<td>(0.00438)</td>
<td>(0.00518)</td>
<td>(0.00502)</td>
</tr>
<tr>
<td>Geographic controls</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Demographic controls</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Economic controls</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>Year FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>N</td>
<td>563</td>
<td>563</td>
<td>365</td>
<td>365</td>
</tr>
</tbody>
</table>

Notes: Significance levels at * p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses corrected for district-level clustering. The Muslim ruler dummy (Hindu ruler Dummy) is assigned as one when the religion of last ruler whose territory British annexed is Muslim (Muslim). Demographic controls include population shares of different religions, population shares of different castes, average household size. Geographic controls: coastal dummy, major census city in colonial India, altitude, latitude, and longitude. Economic controls which include occupation classes (industry, agriculture etc.), port city and urbanization.

Table B9: Length of Muslim rule : Muslim literacy

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muslim ruler</td>
<td>−0.0144***</td>
<td>−0.0179***</td>
<td>−0.0175**</td>
<td>−0.0152*</td>
</tr>
<tr>
<td></td>
<td>(0.00523)</td>
<td>(0.00604)</td>
<td>(0.00871)</td>
<td>(0.00879)</td>
</tr>
<tr>
<td>Years of Muslim rule</td>
<td>−0.00897***</td>
<td>−0.00714***</td>
<td>−0.00666**</td>
<td>−0.00680**</td>
</tr>
<tr>
<td></td>
<td>(0.00120)</td>
<td>(0.00203)</td>
<td>(0.00309)</td>
<td>(0.00283)</td>
</tr>
<tr>
<td>Geographic controls</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Demographic controls</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Economic controls</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>Year FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>N</td>
<td>547</td>
<td>547</td>
<td>365</td>
<td>365</td>
</tr>
</tbody>
</table>

Notes: Significance levels at * p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses corrected for district-level clustering. The Muslim ruler dummy (Hindu ruler Dummy) is assigned as one when the religion of last ruler whose territory British annexed is Muslim (Muslim). Demographic controls include population shares of different religions, population shares of different castes, average household size. Geographic controls: coastal dummy, major census city in colonial India, altitude, latitude, and longitude. Economic controls which include occupation classes (industry, agriculture etc.), port city and urbanization.
Table B10: Length of Muslim rule: Hindu literacy

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hindu ruler</td>
<td>$-0.0161^{***}$</td>
<td>$-0.0164^{**}$</td>
<td>$-0.0118^{**}$</td>
<td>$-0.0105^{**}$</td>
</tr>
<tr>
<td></td>
<td>(0.00608)</td>
<td>(0.00816)</td>
<td>(0.00495)</td>
<td>(0.00493)</td>
</tr>
<tr>
<td>Years of Muslim rule</td>
<td>0.00576$^{***}$</td>
<td>0.000785$^{*}$</td>
<td>$-0.00222$</td>
<td>$-0.000394$</td>
</tr>
<tr>
<td></td>
<td>(0.00187)</td>
<td>(0.00396)</td>
<td>(0.00220)</td>
<td>(0.00234)</td>
</tr>
<tr>
<td>Geographic controls</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Demographic controls</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Economic controls</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>Income control</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Year FE</td>
<td>563</td>
<td>182</td>
<td>365</td>
<td>365</td>
</tr>
</tbody>
</table>

Notes: Significance levels at * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses corrected for district-level clustering. The Muslim ruler dummy (Hindu ruler Dummy) is assigned as one when the religion of last ruler whose territory British annexed is Muslim (Muslim). Demographic controls include population shares of different religions, population shares of different castes, average household size. Geographic controls: coastal dummy, major census city in colonial India, altitude, latitude, and longitude. Economic controls which include occupation classes (industry, agriculture etc.), port city and urbanization.

Table B11: Muslim Literacy: Excluding religions 1)Gurkhas 2)Mixed/Tribal 3)Neo-Hindu/Tai 4)Sikhs 5)Uncertain

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muslim ruler</td>
<td>$-0.0138^{*}$</td>
<td>$-0.0195^{**}$</td>
<td>$-0.0216^{***}$</td>
<td>$-0.0181^{**}$</td>
<td>$-0.0213^{***}$</td>
</tr>
<tr>
<td></td>
<td>(0.00729)</td>
<td>(0.00809)</td>
<td>(0.00824)</td>
<td>(0.00875)</td>
<td>(0.00805)</td>
</tr>
<tr>
<td>Geographic controls</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Demographic controls</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Economic controls</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Year FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>N</td>
<td>359</td>
<td>361</td>
<td>358</td>
<td>318</td>
<td>357</td>
</tr>
</tbody>
</table>

Notes: Significance levels at * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses corrected for district-level clustering. The Muslim ruler dummy (Hindu ruler Dummy) is assigned as one when the religion of last ruler whose territory British annexed is Muslim (Muslim). Demographic controls include population shares of different religions, population shares of different castes, average household size. Geographic controls: coastal dummy, major census city in colonial India, altitude, latitude, and longitude. Economic controls which include occupation classes (industry, agriculture etc.), port city and urbanization.
Table B12: Hindu Literacy: Excluding religions 1) Gurkhas 2) Mixed/Tribal 3) Neo-Hindu/Tai 4) Sikhs 5) Uncertain

<table>
<thead>
<tr>
<th>Hindu ruler</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hindu ruler</td>
<td>−0.0105** (0.00496)</td>
<td>−0.0105** (0.00501)</td>
<td>−0.0106** (0.00503)</td>
<td>−0.00786 (0.00472)</td>
<td>−0.0129** (0.00515)</td>
</tr>
<tr>
<td>Geographic controls</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Demographic controls</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Economic controls</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Income control</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Year FE</td>
<td>359</td>
<td>361</td>
<td>358</td>
<td>318</td>
<td>357</td>
</tr>
</tbody>
</table>

Notes: Significance levels at * p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses corrected for district-level clustering. The Muslim ruler dummy (Hindu ruler Dummy) is assigned as one when the religion of last ruler whose territory British annexed is Muslim (Muslim). Demographic controls include population shares of different religions, population shares of different castes, average household size. Geographic controls: coastal dummy, major census city in colonial India, altitude, latitude, and longitude. Economic controls which include occupation classes (industry, agriculture etc.), port city and urbanization.

Table B13: Muslim literacy: Excluding district with low Muslim population share (1)<1%, (2)<2%, (3)<3%, and (4)<4%

<table>
<thead>
<tr>
<th>Muslim ruler</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muslim ruler</td>
<td>−0.0166** (0.00697)</td>
<td>−0.0117* (0.00627)</td>
<td>−0.0132** (0.00611)</td>
<td>−0.0138** (0.00690)</td>
</tr>
<tr>
<td>Geographic controls</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Demographic controls</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Economic controls</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Year FE</td>
<td>356</td>
<td>341</td>
<td>339</td>
<td>320</td>
</tr>
</tbody>
</table>

Notes: Significance levels at * p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses corrected for district-level clustering. The Muslim ruler dummy (Hindu ruler Dummy) is assigned as one when the religion of last ruler whose territory British annexed is Muslim (Muslim). Demographic controls include population shares of different religions, population shares of different castes, average household size. Geographic controls: coastal dummy, major census city in colonial India, altitude, latitude, and longitude. Economic controls which include occupation classes (industry, agriculture etc.), port city and urbanization.
Table B14: Hindu literacy: Excluding district with low Hindu population share (1)<1%, (2)<2%, (3)<3%, and (4)<4%

<table>
<thead>
<tr>
<th>Hindu ruler</th>
<th>Hindu literacy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>Hindu ruler</td>
<td>-0.0106**</td>
</tr>
<tr>
<td></td>
<td>(0.00498)</td>
</tr>
</tbody>
</table>

Geographic controls | YES | YES | YES | YES
Demographic controls | YES | YES | YES | YES
Economic controls | YES | YES | YES | YES
Year FE | YES | YES | YES | YES
N | 365 | 365 | 365 | 364

Notes: Significance levels at * p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses corrected for district-level clustering. The Muslim ruler dummy (Hindu ruler Dummy) is assigned as one when the religion of last ruler whose territory British annexed is Muslim (Muslim). Demographic controls include population shares of different religions, population shares of different castes, average household size. Geographic controls: coastal dummy, major census city in colonial India, altitude, latitude, and longitude. Economic controls which include occupation classes (industry, agriculture etc.), port city and urbanization.
Appendix C

.0.1 Example 3 good

Since the utility functions of each type is identical, the utility maximization will lead to the following demand functions

\[ x_1 = \frac{k}{p_1} \quad \text{if } m \geq k \]
\[ x_1 = \frac{m}{p_1} \quad \text{if } m < k \]
\[ x_2 = x_3 = 0 \quad \text{if } m < k \]
\[ x_2 + x_3 = m - k \quad \text{if } m \geq k \]

where \( m = p_1.e_1 + p_2.e_2 + p_3.e_3 \)

For markets to clear, we require \( p_2 = p_3 \). Let that be the numeraire. Hence we know \( m_B = 1 \) and \( m_C = I + 1 \) and \( m_A = p_1 + 1 \)

Now if \( 1 < k < I + 1 \), then we know that type B will demand \( x_1^B = \frac{1}{p_1} \) and individual C will demand \( x_1^C = \frac{k}{p_1} \). Moreover assuming in equilibrium, \( m_A = p_1 + 1 > k \) individual A will also demand \( x_1^C = \frac{k}{p_1} \).

Market clearing condition requires \( x_1^A + nx_2^B + x_1^C = 1 \), hence we get \( p_1^* = n + 2k \) and the following equilibrium allocations. (Note this implies \( m_A > k \))

- Pharma (A) - \( \left( \frac{k}{n+2k}, x_2^{A*}, 0 \right) \)
- Poor (B) - \( \left( \frac{1}{n+2k}, 0, 0 \right) \)
- Rich (C) - \( \left( \frac{k}{n+2k}, 0, x_3^{C*} \right) \)

Market Segmentation

In this example, we define complete Market Segmentation as the following

**Definition 3** (Market Segmentation). There is an infinite tax if one uses capital good income to buy essential good or universal good. There is no tax on any other transaction.

Notice that this definition of complete Market Segmentation implies that capital
good income cannot be used to buy essential good or universal good but essential
good income can be used to buy capital goods without any tax.

Now let us solve for equilibrium and calculate the social welfare with this policy
intervention.

The utility maximisation exercise remains identical as before but now the en-
dowments level have changed. However $p_2$ need not be equal to $p_3$ in equilibrium.
Importantly though, since the rich type cannot use wealth to buy health services,
he becomes identical to endowment to the poor type. Thus we get the following
demand functions.

Now again as before let $1 < k < 6$, then we know, as before, that type B
will demand $x^B_1 = \frac{1}{p_1}$ but now type C will also demand $x^C_1 = \frac{1}{p_1}$. Moreover again
assuming in equilibrium, $m_A = p_1 + 1 > k$ individual A will demand $x^A_1 = \frac{k}{p_1}$.

Market clearing condition requires $x^A_1 + nx^B_2 + x^C_1 = 1$, hence now we get
$p^*_1 = k + n + 1$ and the following equilibrium allocations. (Note this implies $m_A > k$)

Type A (The pharma) - $(\frac{k}{k+n+1}, x^A_2, 0)$
Type B (The poor guy) - $(\frac{1}{k+n+1}, 0, 0)$
Type C (The rich guy) - $(\frac{1}{k+n+1}, 0, x^C_3)$

where $x^A_2 = 3$ and $x^C_3 = I$.

The social welfare with any such allocation would be

$$W^{MS} = (n + 1)k\log\left[\frac{1}{k + n + 1}\right] + k\log\left[\frac{k}{k + n + 1}\right] + I + 3 \quad (3)$$

.0.2 Welfare comparison

Given the social welfare in the two regimes, we can compare them and see when
segmenting markets would be better.

$$W^{MS} > W^{FM}$$

iff

$$(n + 1)k\log\left[\frac{1}{k + n + 1}\right] + k\log\left[\frac{k}{k + n + 1}\right] > nk\log\left[\frac{1}{n + 2k}\right] + 2k\log\left[\frac{k}{n + 2k}\right]$$

or,

$$\log\left[\frac{k}{(n + 1 + k)^{n+2}}\right] > \log\left[\frac{k^2}{(n + 2k)^{n+2}}\right]$$

Since log is an increasing function, this implies that for above to hold we need
\[
\frac{k}{(n + 1 + k)^{n+2}} > \frac{k^2}{(n + 2k)^{n+2}}
\]

and hence we get

\[
(n + 2k)^{n+2} > (n + 1 + k)^{n+2}
\] (4)

Given that we had assumed that \(1 < k < I + 1\) we can check that the above inequality holds for a large enough \(n\). Hence we can say that Market Segmentation improves social welfare for these values of \(k\).

The rationale behind such a result is simple. Market Segmentation removes the wealth endowment from the economy and thus lowers the price of good 1 (the health services) in equilibrium. Thus the poor people are able to afford more of that good and their welfare improves. The welfare of the rich guy falls due to his inability to use his wealth now to buy health services but that fall is offset by the gains of others for a sufficiently high value of \(k\) which is a measure of importance of good \(k\) to an individual’s welfare.

It is clear from the above example that Market Segmentation can improve social welfare in some scenarios. But a similar result could have been achieved using some kind of commodity taxation as well. It is ex-ante unclear, at least to us, as to which policy would be more welfare enhancing. Let us state now a Lemma which shows that in the conditions described in the example above, a commodity tax regime is weakly preferred to complete Market Segmentation. To do that, we formalise the conditions of the example below.

**Definition 4** (Perfectly Identical Preferences). *If all agents have have the exact same preferences, then we call them Perfectly Identical Preferences (PIP).*

**Lemma 5.** *If the preferences of all individuals are PIP in an \(n\)-good economy with 1 essential good, 1 universal good and \(n-2\) non-universal goods, then a tax regime is weakly preferred to Market Segmentation.*

**Proof.** If we have log-linear utility functions, a utilitarian social welfare function, and preferences are PIP the social welfare is independent of trade in the linear goods. Hence, the maximum social welfare under Market Segmentation can be simply achieved by a very high tax on all non-universal goods. 

Hence, we can say that in the example discussed above, the Market Segmentation equilibrium can just be achieved by a very high commodity tax on good 3.

Therefore, Market Segmentation can only be better if trade in the linear goods also improves social welfare. Thus we expand our horizon a little and discuss a four
.0.3 Example 4 goods

Laissez Faire allocation

Again because of the utilities, for the market to clear \( p_2 = 2p_3 = 2p_4 \) take \( p_2 = 1 \)

We assume there are \( n \) poor people, there are 2 rich people and 1 pharma. Utility maximisation gives us

\[
x_1 = \frac{k}{p_1} \quad \text{if } m \geq k
\]

\[
x_1 = \frac{m}{p_1} \quad \text{if } m < k
\]

Let \( 1 < k < \frac{I}{2} + 1 \), therefore for market clearing we need

\[
n \times \frac{1}{p_1} + 3 \times \frac{k}{p_1} = 1
\]

which implies the market clearing price is \( n + 3k \). The equilibrium allocations are given in the Appendix.

Type A (The pharma) - \((\frac{k}{n+3k}, x_2^{A*}, x_3^{A*}, x_4^{A*})\)

Type B (The poor guy) - \((\frac{1}{n+3k}, 0, 0, 0)\)

Type C1 - \((\frac{k}{n+3k}, x_2^{C*}, 0, x_4^{C*})\)

Type C2 - \((\frac{k}{n+3k}, x_2^{C*}, x_3^{C*}, 0)\)

where \( x_2^{A*} + nx_2^{B*} + 2x_3^{A*} = n + 3, x_3^{A*} + nx_3^{B*} + 2x_3^{C*} = I \) and \( x_4^{A*} + nx_4^{B*} + x_4^{C*} = I \)

Market Segmentation allocation

Type A (The pharma) - \((\frac{k}{n+2+k}, x_2^{A*}, x_3^{A*}, x_4^{A*})\)

Type B (The poor guy) - \((\frac{1}{n+2+k}, 0, 0, 0)\)

Type C1 - \((\frac{1}{n+2+k}, x_2^{C*}, 0, x_4^{C*})\)

Type C2 - \((\frac{1}{n+2+k}, x_2^{C*}, x_3^{C*}, 0)\)

where \( x_2^{A*} + nx_2^{B*} + 2x_3^{A*} = n + 3, x_3^{A*} + nx_3^{B*} + 2x_3^{C*} = I \) and \( x_4^{A*} + nx_4^{B*} + x_4^{C*} = I \)

Direct Transfer regime

\[35\]This is more realistic setting as well
Type A (The pharma) - \((\frac{k}{p_{DT}}, x_2^{A*}, x_3^{A*}, x_4^{A*})\)
Type B (The poor guy) - \((1 + \frac{I}{n+3}, 0, 0, 0)\)
Type C1 - \((\frac{k}{p_{DT}}, x_2^{C*}, 0, x_4^{C*})\)
Type C2 - \((\frac{k}{p_{DT}}, x_2^{C*}, x_3^{C*}, 0)\)

where \(x_2^{A*} + nx_2^{B*} + 2x_3^{A*} = n+3\), \(x_3^{A*} + nx_3^{B*} + 2x_3^{C*} = I\) and \(x_4^{A*} + nx_4^{B*} + x_4^{C*} = I\)

**Welfare comparison: Non-distortionary case**

Comparing, we get,

\[
k \log \left( \frac{k}{p_{MS}} \right) + (n + 2)k \log \left( \frac{1}{p_{MS}} \right) > k \log \left( \frac{k}{p_{DT}} \right) + 2k \log \left( \frac{k}{p_{DT}} \right) + nk \log \left( \frac{1 + \frac{I}{2(n+3)}}{p_{DT}} \right)
\]

which would imply that

\[
log \left( \frac{k}{(p_{MS})^{n+3}} \right) > log \left( \frac{k^3(1 + \frac{I}{2(n+3)})^n}{p_{DT}^{n+3}} \right)
\]

which again means that

\[
\left\{ \frac{p_{DT}}{p_{MS}} \right\}^{n+3} > k^2 (1 + \frac{I}{2(n+3)})^n
\]

We can compute

\[
\frac{p_{DT}}{p_{MS}} = \frac{3k + n + I \frac{n}{2(n+3)}}{n + k + 2} = \left\{ 1 + \frac{2k - 2 + I \frac{n}{2(n+3)}}{n + k + 2} \right\}
\]

As \(n\) goes to infinity the LHS

\[
\left\{ \frac{p_{DT}}{p_{MS}} \right\}^{n+3} \rightarrow e^{2k-2+\frac{I}{2}} = e^{2k-2} (e)^{\frac{I}{2}}
\]

the RHS goes to

\[
k^2 (e)^{\frac{I}{2}}
\]

now as

\[
e^{k-1} > k
\]

which is true for all \(k > 1\). Thus, there exists some \(n\) after which the LHS is bigger than the RHS.

**Welfare comparison: Distortionary case**

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First of all, it should be clear that the goods that matters in the welfare calculation are only the essential goods and the capital goods that are not brought into the market (which produces dead weight loss). We will show that the welfare gain from using the distortionary tax regime rather than the non-distortionary tax regime is bounded as \( n \) increases. Furthermore, welfare loss is dependent on \( I \) and increases as \( I \) increases. This essentially means that for a large enough \( n \) and \( I \), the non-distortionary tax regime is strictly worse than distortionary tax regime.

The total welfare under this policy is

\[
\frac{k \log k}{p} + 2k \log \frac{1/2(1-t)k}{p} + nk \log 1 + \frac{T}{n+3} \frac{p}{p}
\]

Further we know distortionary price \( p \) is

\[
p = (1 - t)k + k + n + \frac{Tn}{n + 3}
\]

The welfare gain to the poor is

\[
n \log \left( \frac{1 + \frac{(1-t)k-2}{n+3}}{p} \right) - n \log \frac{1}{p_{MS}}
\]

plugging in \( p_{MS} = n + 2 + k \) and simplifying, we get,

\[
n \log \left( \frac{n + k + 2}{n + (1-t)k + Tn/(n + 3)} \right) \times \left( 1 + \frac{(1-t)k-2}{n+3} \right)
\]

\[
= n \log \left( \frac{n + k + 2}{n + (1-t)k + Tn/(n + 3)} \right) + n \log \left( 1 + \frac{(1-t)k-2}{n+3} \right)
\]

\[
= n \log \left( 1 + \frac{2 + kt - Tn/(n + 3)}{n + (1-t)k + Tn/(n + 3)} \right) + n \log \left( 1 + \frac{(1-t)k-2}{n+3} \right)
\]

which is an expression of the sort

\[
n \log \left( 1 + \frac{f_1}{n} \right) + n \log \left( 1 + \frac{f_2}{n} \right)
\]

which we know is bounded above as \( n \) goes to infinity.

Thus, welfare gain from using distortionary commodity taxation is bounded above. However, the dead weight loss due to this commodity taxation can be arbitrarily high and is independent of \( n \). Dead weight loss in our example depends on \( I \) and thus for a high enough \( I \) and as \( n \) increases, segmentation becomes better than taxation and subsidy regime.
Proof of Lemma 0.2

We know that the set of achievable allocations in an economy is convex. Let \((x_1, \ldots, x_k)\) be an asymmetric allocation that is optimal, i.e. maximises the social welfare function. Also given we have aggregate symmetry in the economy for any \(i, j\) pair \(x_i \neq x_j\), if \(((x_1, \ldots, x_i, \ldots, x_j, \ldots, x_k))\) is feasible so is \(((x_1, \ldots, x_j, \ldots, x_i, \ldots, x_k))\).

Now because the set of individual allocations are convex, \(((x_1, \ldots, x_i + \frac{x_j}{2}, \ldots, x_i + \frac{x_j}{2}, \ldots, x_k))\) must also be feasible. However, because utility functions of the agents are convex, these average allocations (which are feasible) increase the social welfare. Hence, the original asymmetric allocation cannot be the maximum. Thus, we can have a maxima under aggregate symmetry only if the allocation is symmetric.

Proof of Lemma 0.3

We have established that the planner must treat all essential goods symmetrically to maximise social welfare.

Formally, Define

\[ V^*_{sym} = \max_{\tau_1 = \tau_2 = \ldots = \tau_n} V(\tau_1, \ldots, \tau_n) \]

and

\[ V^* = \max_{\tau_1, \ldots, \tau_n} V(\tau_1, \ldots, \tau_n) \]

notice that \(V^*_{sym} \leq V^*\) because it is a maximization on a restricted set, however by the above lemma \(V^*\) must be such that \(\tau_1 = \tau_2 = \ldots = \tau_n\)

which means that \(V^*_{sym} \geq V^*\) so they must be equal, and we can only consider the maximisation over the space \(\tau_1 = \tau_2 = \ldots = \tau_n\)

Further notice that \(V^*_{sym} = \sum_{\text{individuals}} U_i(x_i(\tau_k))\)

We know that due to aggregate symmetry, the planner must treat all essential goods symmetrically. Hence, we can consider the price of all essential goods as being determined by an aggregate essential good (or an average good, or as many identical essential goods) to maximise the social welfare function.

Proof of Theorem 1

Proof of Claim 1.1

Proof. We have to show that commodity taxation at the segmentation level dominates non-distortionary taxation. The welfare at the segmentary level of commodity
taxation ($\tau_{DTS}$) is

$$(n + m)u\left(\frac{e}{p_{DTS}}\right) + u(x(p_{DTS})) - DWL = W_{DTS}$$

the welfare at non-distortionary taxes is

$$nu\left(\frac{e}{p_{Dt}}\right) + mu(x(p_{Dt}, \tau)) + u(x(p_{Dt})) = W_{Dt}$$

subtracting we get,

$$W_{DTS} - W_{Dt} = n(u\left(\frac{e}{p_{DTS}}\right) - u\left(\frac{e}{p_{Dt}}\right)) + m(u\left(\frac{e}{p_{DTS}}\right) - u(x(p_{Dt}, \tau))) + (u(x(p_{DTS})) - u(x(p_{Dt}))) - DWL$$

for this to be positive

$$DWL < n(u\left(\frac{e}{p_{DTS}}\right) - u\left(\frac{e}{p_{Dt}}\right)) + m(u\left(\frac{e}{p_{DTS}}\right) - u(x(p_{Dt}, \tau))) - (u(x(p_{DTS})) - u(x(p_{Dt})))$$

RHS can be written as

$$n\left[(u\left(\frac{e}{p_{DTS}}\right) - u\left(\frac{e}{p_{Dt}}\right)) + m\left((u\left(\frac{e}{p_{DTS}}\right) - u(x(p_{Dt}, \tau))) + \frac{1}{n}\left((u(x(p_{DTS})) - u(x(p_{Dt})))\right)\right)\right]$$

because all terms are of the same order of magnitude and $n$ is increasing, eventually only the first term remains relevant. Hence we get,

$$n(u\left(\frac{e}{p_{DTS}}\right) - u\left(\frac{e}{p_{Dt}}\right)) \approx nu'\left(\frac{e}{p_{Dt}}\right) \left[\frac{e}{p_{DTS}} - \frac{e}{p_{Dt}}\right]$$

which gives us

$$= nu'\left(\frac{e}{p_{Dt}}\right) \frac{1}{n} \left[m(x_r(p_{Dt}) - \frac{e}{p_{DTS}}) + x_d(p_{Dt}) - x_d(p_{DTS})\right]$$

$$= u'\left(\frac{e}{p_{Dt}}\right) \left[m(x_d(p_{Dt}) - \frac{e}{p_{DTS}}) + x_d(p_{Dt}) - x_d(p_{DTS})\right]$$

Now for a large $n$ and a small $e$, the following is true.

$$m(x_r(p_{Dt}) - \frac{e}{p_{DTS}}) > \frac{e}{p_{Dt}}$$
we can use this to bound the above expression by

\[ u'(\frac{e}{p_{dt}}) \left[ \frac{e}{p_{dt}} + x_d(p_{dt}) - x_d(p_{DTS}) \right] \]

This now can be written as

\[ u'(\frac{e}{p_{dt}}) \left[ \frac{e}{p_{dt}} \right] - u'(\frac{e}{p_{dt}}) \left[ x_d(p_{DTS}) - x_d(p_{dt}) \right] \]

The first term is unbounded, to see this, notice that

\[ u'(\frac{e}{p_{dt}}) \left[ \frac{e}{p_{dt}} \right] \]

can be written as \( p^* x(p^*) \) where \( p^* \) is the price which supports \( \xi \) or \( x^{-1}(\xi) \) further as \( \xi \) goes to zero its inverse goes to infinity, which means \( p^* x(p^*) \) is unbounded by the elasticity condition.

The second term is bounded, to see this

\[ u'(\frac{e}{p_{dt}}) \left[ x_d(p_{dt}) - x_d(p_{DTS}) \right] \approx u'(\frac{e}{p_{dt}}) \frac{dx}{dp} (p_{dt} - p_{DTS}) \]

further, at the segmentation price,

\[ u'(\frac{e}{p_{dt}}) = \lambda p_{dt} \]

this gives us

\[ \lambda p_{dt} \frac{dx}{dp} (p_{dt} - p_{DTS}) \]

by inelasticity

\[ \frac{d}{dp}(px) \geq 0 \implies \frac{dx}{dp} \leq x(p) \]

which can be plugged in to bound the above expression

\[ x(p_{dt})(p_{dt} - p_{DTS}) = \frac{e}{p_{dt}} (p_{dt} - p_{DTS}) \]

which is clearly bounded and less than \( e \).

\[ \square \]

**Proof of Claim 1.2**

**Proof.** Let \( \tau_{DTS} \) be the complete segmentation level of commodity tax. A slight decrease in tax rate from this level has three effects on welfare. First, decrease in tax rate raises some tax revenue for the planner which can be used as a direct
transfer to improve welfare. This is given by the following expression $\frac{dW}{dT} \times \frac{\delta T}{\delta r}$. On the other hand, the decrease in tax rate causes the price of the essential good to rise for the poor people which decreases welfare. This is given by $\frac{dW}{dx_{ess}} \frac{\delta x_{ess}}{\delta p} \frac{\delta p}{\delta r}$. Third, the dead weight-loss in the economy also decreases. This is given by $\frac{dW}{dWL} \times \frac{\delta dWL}{\delta r}$.

Thus what we want to show is that as we go from $\tau_{DTS}$ to $\tau_{DTS} - \epsilon$, where $\epsilon > 0$ but arbitrarily small

$$\frac{dW}{dT} \times \frac{\delta T}{\delta r} + \frac{dW}{dWL} \times \frac{\delta dWL}{\delta r} \times \frac{\delta p}{\delta r} > \frac{dW}{dx_{ess}} \frac{\delta x_{ess}}{\delta p} \frac{\delta p}{\delta r} \quad (\text{.7})$$

Now notice that close to the complete segmentation tax rate, i.e. $\tau_{DTS} - \epsilon$ the tax derivative of demand is close to zero. However, the income raised close to $\tau_{DTS}$ is large and positive. This is because the price derivative of demand is a continuous function of price and price is a continuous function of tax rate, thus we can say that tax derivative of demand is continuous function in price. Moreover, we know that it is exactly zero at the cutoff tax, thus it must be close to zero around it. However, if the good is inelastic, the total expenditure on the commodity is an increasing function of price (and tax rate) and thus tax revenue which is an increasing function of tax rate till $\tau_{DTS}$ where it falls discontinuously to zero. Hence, as $\tau \to \tau - \epsilon$ then $\frac{\delta x_{ess}}{\delta p} \frac{\delta p}{\delta r} \to 0$ but $\frac{\delta T}{\delta r} \to R >> 0$.

Now given that $\frac{dW}{dT} > 0$, we get that .7 holds. Q.E.D

Proof of Claim 1.3

Now we claim that the gain from revenue which the planner gets when he implements distortion can be less than the DWL.

If the planner extracts revenue R by a tax $\tau$ the total welfare of the economy is

$$W^* = n(U(e + \frac{R}{p*}) + mU(x(p*, \tau)) + U(x(p*)) - DWL_{DT*}$$

comparing this to the full segmentation tax rate, we get,

$$W^* - W_{DTS} = n(U(e + \frac{R}{p*}) - U(e + \frac{e}{p_{DTS}})) + m(U(x(p*, \tau)) - U(p_{DTS}, \tau)) + U(x(p*)) - U(p_{DTS}) - DWL_{DT*} + DWL_{DTS}$$

It is clear that $m(U(x(p*, \tau)) - U(p_{DTS}, \tau)) + U(x(p*)) - U(p_{DTS}) - DWL_{DT*} + DWL_{DTS}$ is bounded and hence we call it M. Thus, we get
\[
n(U(e + \frac{R}{n+3}) - U(e)) + M
\]

\[
nu'(\frac{e}{p_{DT}}) = \frac{1}{n} [1 - m(x(p, \tau) - x(p)) - (1 - m(x(p_{DT}, \tau) - x(p_{DT}, \tau)))] + M
\]

Given that change in utility can be approximated as the marginal utility times the change in consumption we get,

\[
= u'(\frac{e}{p_{DT}}) [-m(x(p, \tau) + x(p_{DT}, \tau) + x(p_{DT}) - x(p))] + M
\]

\[
= u'(\frac{e}{p_{DT}}) \left[ -m \left( \frac{dx}{d(p*(1-\tau))}(p*(1-\tau) - p_{DT}) \right) \right] + M
\]

Now we know that at segmentation level of commodity segmentation, marginal utility of the poor must be equal to the marginal utility of the rich, i.e. \( u'(\frac{e}{p_{DT}}) = \lambda p_{DT} \)

\[
= \lambda p_{DT} \left[ -m \left( \frac{dx}{d(p*(1-\tau))}(p*(1-\tau) - p_{DT}) \right) \right] + M
\]

Now this expression is bounded due to the in-elasticity condition Q.E.D.

**Proof of Theorem 2**

*Proof.* We know

\[
W_{DT} = nu(1+\frac{n}{p_{DT}}) - nu\left(\frac{1}{p_{LF}}\right) + mu(x_r(p_{DT})) - mu(x_r(p_{LF})) + u(x_d(p_{DT})) - u(x_d(p_{LF}))
\]

\[
p_{LF} = \frac{n}{1 - (m + 1)x_{LF}}
\]

\[
p_{DT} = \frac{n + R \frac{n}{n+m+1}}{1 - mx_r(p_{DT}, \tau) - x_d(p_{DT}, \tau)}
\]

In an market equilibrium with subsidy on essential good, the following equation
must hold.

\[ 1 = x(p_s + \Delta p) + \frac{n}{p_s} + mx(p_s) \]

\[ \implies p_s = \frac{n}{1 - mx(p_s) - x(p + \Delta p)} \]

where \( p_s \) is the price in the subsidy regime and \( \Delta p \) is the price paid by government to the don on each unit sold. Therefore, in a balanced budget

\[ R = (1 - x_{ds}) \Delta p \]

So we get,

\[ p_s = \frac{n}{1 - mx(p_s) - x(p + \frac{n}{1 - x_{ds}})} \] (8)

where \( x_{ds} \) is the consumption of don in the subsidy regime.

Further

\[ W_s = nu(\frac{1}{p_s}) - nu(\frac{1}{p_{LF}}) + mu(x_r(p_s)) - mu(x_r(p_{LF})) + u(x_d(p_s)) - u(x_d(p_{LF})) \]

\[ W_{DT} - W_S = n \left[ u \left( \frac{1}{n}(1 - m x_r - x_d) \right) - u \left( \frac{1}{n}(1 - m x(p_s) - x(p + \frac{R}{1 - x_{ds}})) \right) \right] \]

\[ + m \left[ u(x_r(p_{DT})) - u(x_r(p_s)) \right] + \left[ u(x_d(p_{DT})) - u(x_d(p_s)) \right] \] (9)

Since all terms are of the same order of magnitude and \( n \) is increasing, eventually only the first term remains relevant. Hence, for a large \( n \) we can say the following

\[ W_{DT} - W_S = n \left[ u'(.) \left( \frac{1}{n}(1 - m x_r - x_d) - \frac{1}{n}(1 - m x_r p_s - x_d p_s) \right) \right] \] (10)

Given \( u'(.) > 0 \), to show that \( W_{DT} - W_{MS} > 0 \) we need to show that

\[ m(x(p_s) - x(p_{DT})) + (x_r p_s + \frac{R}{1 - x_{ds}} - x_r(p_{DT})) > 0 \]

\[ \approx m \frac{dx}{dp} \big|_{p=p_{DT}} (p_s - p_{DT}) + \frac{dx}{dp} \big|_{p=p_{DT}} (p_s + \frac{R}{1 - x_{ds}} - p_{DT}) \]

\[ = \frac{dx}{dp} \big|_{p=p_{DT}} \left[ (m + 1)(p_s - p_{DT}) - \frac{R}{1 - x_{ds}} \right] \] (11)
Notice that $p_s < p_{LF}$ which means that
\[
p_{DT} - p_s > p_{DT} - p_{LF} = \frac{n + R \frac{n}{n+m+1}}{1 - mx_r(p_{DT}, \tau) - x_d(p_{DT}, \tau)} - \frac{n}{1 - (m + 1)x_{LF}}
\]
Given that $x_r(p_{DT}, \tau) < x_r(p_{LF})$ and $x_d(p_{DT}, \tau) < x_d(p_{LF})$ we know
\[
p_{DT} - p_s > p_{DT} - p_{LF} > R \frac{n}{n + m + 1} \frac{1}{(1 - mx_r(p_{DT}, \tau) - x_d(p_{DT}, \tau))(1 - (m + 1)x_{LF})}
\]
For a large $n$, the above equation implies
\[
p_s - p_{DT} \geq R
\]
Putting this back in equation .11, we get
\[
\frac{dx}{dp} \bigg|_{p = p_{DT}} = (m + 1)R - \frac{R}{1 - x_d}
\]
This implies that for a large $n$ as long as $m + 1 > \frac{1}{1 - x_d}$ direct transfers are better than subsidy. Also, notice that as $n \to \infty$, $x_d \to 0$. Thus, the condition simply implies $m > 0$, i.e. there are positive number of rich people in the economy.

This comes from the fact that subsidy only decreases consumption of the 'dons' but direct transfers decreases the consumption of both the rich and the dons. Given, inelasticity and large number of poor in the economy, this makes direct transfers more efficient than subsidy.

Proof of Theorem 3

Proof. Suppose there are 2 essential goods called $x^1$ and $x^2$. Different people in economy prefer $x^1$ and $x^2$ differently. The preference heterogeneity in the population is indexed by parameter $\alpha \in [0, 1]$. Thus utility function can be given as
\[
U_\alpha(X) = \alpha u(x^1) + (1 - \alpha)u(x^2) + \sum b_i x_i
\]
The preferences in the population are described by a density $f(\alpha) \in \Delta[0, 1]$. For sake of simplicity, we assume the distribution is symmetric, i.e. $f(\alpha) = f(1 - \alpha)$. Let the endowment of the universal good be $e$.

Let us first consider the MS regime. Under MS, the symmetry in the distribution of $\alpha$ implies that prices of both $x^1$ and $x^2$ must be equal in equilibrium. Let us call that p. Equilibrium condition under Market Segmentation gives us the following
equation
\[ x_1^1(p) + nE_{\alpha \sim f}[x_p^{1\alpha}(p)] + mE_{\alpha \sim f}[x_r^{1\alpha}(p)] = 1 \]
similarly for the second good,
\[ x_2^2(p) + nE_{\alpha \sim f}[x_p^{2\alpha}(p)] + mE_{\alpha \sim f}[x_r^{2\alpha}(p)] = 1 \]
Adding both equations we get,
\[ x_1^1(p) + nE_{\alpha \sim f}[x_p^{1\alpha}(p)] + mE_{\alpha \sim f}[x_r^{1\alpha}(p)] + x_2^2(p) + nE_{\alpha \sim f}[x_p^{2\alpha}(p)] + mE_{\alpha \sim f}[x_r^{2\alpha}(p)] = 2 \]
Now given that under Market Segmentation both the poor and the rich can only use universal good to buy essential goods, we must have \( x_1^1(p) + x_2^2(p) = \varepsilon_p \). Thus, multiplying the above equation by \( p \), we get
\[ p(x_1^1(p) + x_2^2(p)) + (n + m)e = 2p \implies p = \frac{(n + m)e}{2 - x_1^1(p) - x_2^2(p)} \]
At these prices, different individuals buy different amount of essential goods, depending on their respective value of \( \alpha \).
Now, suppose the planner were to attempt to mimic the outcome of the above Market Segmentation policy with a rationing policy. This rationing policy can be implemented by a non-linear tax.\(^{36}\) This would mean an infinite tax on consumption above a certain level \( \bar{q} \).
If the poor have to be given the same utility with the rationing policy, then it must be the case that \( \bar{q}_1 = \bar{q}_2 = \frac{\varepsilon}{p_{ms}} = \frac{2 - x_1^1(p) + x_2^2(p)}{(n + m)} \). This is because if \( \bar{q}_1 < \frac{\varepsilon}{p_{ms}} \), then the poor with \( \alpha = 1 \) will be definitely worse off than the segmentation regime. However, if \( \bar{q} \) is as above then, the aggregate consumption of the rich with is not \( mE_{\alpha \sim f}[x_{\alpha}(p)] \). It is between \( mE_{\alpha \sim f}[x_{\alpha}(p)] \) and \( m\bar{q} \) for each essential good, where \( \bar{q} >> E_{\alpha \sim f}[x_{\alpha}(p)] \). This is because the rich are no longer income constrained. Thus, we have a situation of excess demand in the market. Under excess demand market is not cleared and thus the the social planner has to set a new \( \bar{q}_n \) which is less than \( \bar{q} \) to clear the market. As discussed above, this makes the poor worse off.

Proof of Theorem 4

Proof. Let \( \tau^{cns} \) be the complete segmentation level of tax. A slight decrease in tax rate from this level has two effects on welfare. First, decrease in tax rate raises

\(^{36}\)see, Gadenne (2020) for details
some tax revenue for the planner which can be used as a direct transfer to improve welfare. This is given by the following expression \( \frac{dW}{dT} \times \frac{\delta T}{\delta \tau} \). On the other hand, the decrease in tax rate causes the price of the essential good to rise for the poor people which decreases welfare. This is given by \( \frac{dW}{dx_{ess}} \frac{\delta x_{ess}}{\delta p} \frac{\delta p}{\delta \tau} \).

Thus what we want to show is that as we go from \( \tau^{cms} \) to \( \tau^{cms} - \epsilon \), where \( \epsilon > 0 \) but arbitrarily small

\[
\frac{dW}{dT} \times \frac{\delta T}{\delta \tau} > \frac{dW}{dx_{ess}} \frac{\delta x_{ess}}{\delta p} \frac{\delta p}{\delta \tau} \tag{12}
\]

Now notice that close to the complete segmentation tax rate, i.e. \( \tau^{cms} - \epsilon \) the tax derivative of demand is close to zero. However, the income raised close to \( \tau^{cms} \) is large and positive. This is because the price derivative of demand is a continuous function of price and price is a continuous function of tax rate, thus we can say that tax derivative of demand is continuous function in price. Moreover, we know that it is exactly zero at the cutoff tax, thus it must be close to zero around it. However, if the good is inelastic, the total expenditure on the commodity is an increasing function of price (and tax rate) and thus tax revenue which is an increasing function of tax rate till \( \tau^{cms} \) where it falls discontinuously to zero. Hence, as \( \tau \to \tau - \epsilon \) then \( \frac{\delta x_{ess}}{\delta p} \frac{\delta p}{\delta \tau} \to 0 \) but \( \frac{\delta T}{\delta \tau} \to R \gg 0 \).

Now given that \( \frac{dW}{dT} > 0 \), we get that .12 holds. Q.E.D

\[\square\]

Proof of Theorem 5

The planners problem is to maximise the following equation with respect to segmentary tax rate \( \tau \).

\[
w_p V_p(p, \tau) + w_d V_d(p, \tau) + w_r V_r(p, \tau) \tag{13}
\]

subject to

\[
\sum x_i(p, \tau) = \sum c_i \forall k \tag{14}
\]

where \( V_p \) is the indirect utility function of the poor, \( V_r \) is the indirect utility function of the rich, \( V_d \) is the indirect utility function of the don, \( k \) are the different goods and \( w \) is the weight associated with each good.

Thus, setting up the Lagrange for the planner in order to maximise with respect to \( \tau \), we get
\[ L = w_p V_p(p, \tau) + w_d V_d(p, \tau) + w_r V_r(p, \tau) + \sum \mu_k \left[ \sum e_i - \sum x_i(p, \tau) \right] \]

Differentiating with respect to \( \tau \), we get
\[ w_p \frac{dV_p}{d\tau} + w_d \frac{dV_d}{d\tau} + w_r \frac{dV_r}{d\tau} = \sum \mu_k \sum \frac{dx(p, \tau)}{d\tau} \] (15)

Now to get the expressions of the indirect utility functions for each type of individuals, we carry on the utility maximisation exercise for each of them.

The market is segmented, i.e. essential goods and universal goods are in one sub-market \((x_1, x_2)\) and capital goods are in another sub-market \((x_3, \ldots, x_K)\). Also, suppose there is a market for assets introduced by the planner, which we call \(y\). This asset enables people to transfer income from the market for capital goods to the market for essential goods. And this is taxed by the planner at the rate of \(\tau\), that is to say there is a wedge between the buying price and selling price for the asset. This tax generates a tax revenue which we assume is equally distributed between all individuals. Let this be \(t\). In these conditions, the utility maximisation problem of the rich individual is the following.

Maximise
\[ U_r(x) \]
subject to
\[ p_1(x_1 - e_1) + p_2(x_2 - e_2) \leq y + t \]
\[ \sum p_k(x_k - e_k) \leq -(1 + \tau)y \]

Assuming that both equations bind
\[ (1 + \tau) [p_1(x_1 - e_1) + p_2(x_2 - e_2) - t] + \sum p_k(x_k - e_k) \leq 0 \]

Let \(V_r(p, \tau)\) be the indirect utility function which we get from maximising the above rich agent’s problem. Using the envelope theorem and differentiating with respect to the tax and we get that.
\[ \frac{\partial V}{\partial \tau} = \frac{\partial L}{\partial \tau} = -\lambda_r \left[ (p_1(x_1 - e_1) + p_2(x_2 - e_2) - t - \frac{\partial t}{\partial \tau}(1 + \tau) \right] \]

If preferences are quasi-linear, then the \(\lambda_r\) is 1.

Now the don doesn’t own any non-essential endowment so his utility maximisa-
tion problem can be given as the following.

Maximise \( U_d(x) \) subject to

\[
p_1(x_1 - e_1) + p_2(x_2 - e_2) - t + \sum p_k(x_k - e_k) \leq 0
\]

So,

\[
\frac{dV_P}{d\tau} = -\lambda_d(\frac{\partial t}{\partial \tau})
\]

Again, if preferences are quasi-linear, then the \( \lambda_d \) is 1.

Now looking at the problem for the poor, we know that they own only poor goods.

Max \( U_p(x) \) subject to

\[
p_1(x_1 - e_1) + p_2(x_2 - e_2) - t \leq 0
\]

Which gives us

\[
\frac{dV_P}{d\tau} = -\lambda_p(\frac{\partial t}{\partial \tau})
\]

where \( \lambda_p = \frac{\mu_p}{p_1} \)

Putting the above values of the derivative of the indirect utility function back into equation .15, we get

\[
w_r \lambda_r \left[ \frac{\partial t}{\partial \tau} (1 + \tau) - \left( p_1(x_1 - e_1) + p_2(x_2 - e_2) - t \right) \right] + w_d \lambda_d \frac{\partial t}{\partial \tau} + w_p \lambda_p \frac{\partial t}{\partial \tau} = \sum \mu_k \sum \frac{dx(p, \tau)}{d\tau}
\]

**Proof of Theorem 6**

**Proof of Claim 6.1**

The utility function we defined for the economy can be given by

\[
U = u(x_1) + bx_2 + ...
\]

Further let each individual be endowed with \( e \) units of \( x_2 \) good. In this economy, the first order conditions from the maximization problems of the rich and the don, we get

\[
\frac{u'(x_1)}{b} = \frac{p_1}{p_2} \quad \text{and} \quad \frac{u'(x_1)}{p_1} = \frac{b}{p_2}
\]
Let us define, \( p^* = \frac{b \cdot h}{p_2} \).

The utility maximization problems of the poor gives us,

\[
x_1 = \frac{p_2 \times e}{p_1}
\]

which can be written as

\[
x_1 = \frac{b \times e}{p^*}
\]

Thus, the 3 equations below uniquely pin down consumption of the rich and the poor.

\[
\begin{align*}
  u'(x) &= p^* \\
  x_p &= \frac{b \cdot e}{p^*} \\
  \sum x_i &= 1
\end{align*}
\]

Now since the \( u'(x) \) is independent of \( b \) and \( x \) and is bounded above zero by assumption, thus \( p^* \) is also bounded above zero. Thus, we find that in equilibrium

\[ b \rightarrow 0 \implies x_p \rightarrow 0 \iff e \rightarrow 0 \implies x_p \rightarrow 0 \]

**Proof of Claim 6.2**

*Proof.* Suppose, for the rich the marginal utility of consuming the essential good is \( \lambda p \) where \( \lambda \) is the marginal utility of income, which we know to be bounded above zero given all other goods are linear.

Thus, the ratio of marginal utility of the poor to the marginal utility of the rich

\[ \frac{u'(\xi)}{\lambda p} \]

Now we know that as \( e \rightarrow 0 \), \( \lambda p \) is bounded. However, \( e \rightarrow 0 \implies u'(0) \rightarrow \infty \) by assumption.

\[ \square \]
Proof of Claim 6.3

Proof.

\[ W_{DT} = n \epsilon + \frac{T}{n + m + 1} \]

(20)

where,

\[ p_{DT} = \frac{\epsilon n + T}{n + m + 1} \]

and \( x_{DT} \) is the consumption of don and rich people is the transfer regime.

Under Market Segmentation, we know that

\[ W_{ms} = (n + m) \frac{\epsilon}{p_{ms}} \]

(21)

\[ p_{ms} = \frac{\epsilon (n + m)}{1 - x(p_{ms})} \]

where \( x_{ms} \) is the consumption of don in segmentation regime.

Subtracting the .21 from .20, we get

\[ W_{DT} - W_{ms} = 1 - (m + 1)x(p_{DT}) - (1 - x(p_{DT})) \]

(22)

which reduces to the condition

\[ x(p_{ms}) - (m + 1)x(p_{DT}) \]

Now as \( \epsilon \to 0 \), we know that consumption of the don in the Market Segmentation regime, i.e. \( x(p_{ms}) \to 1 \). This is because he ends up consuming all the good in this regime as both the rich and the poor people are not able to demand anything when their endowment goes to zero.

On the other hand, under the direct transfer regime, the poor people do receive positive transfers and thus demand strictly positive amount of essential good even when their endowment goes to zero. Thus the consumption of the don and the rich people combined is bounded strictly below 1, i.e. as \( \epsilon \to 0 \), \((m+1)x(p_{DT}) \to z << 1. \)

Hence, .22 is strictly positive. Q.E.D

Proof of Theorem 7

The first two parts of the proof are the same as claim 6.1 and 6.2 as above. Below we prove another claim that concludes the proof.
Claim 7.1. As endowment of the universal good in the economy goes to zero, the direct transfer increases social welfare more than subsidy on the essential good.

Proof of Claim 7.1

Proof. Welfare under direct transfers can be given by

\[ W_{DT} = n \frac{\epsilon + \frac{T}{n + m + 1}}{p_{DT}} \]  

(23)

where,

\[ p_{DT} = \frac{en + T \frac{n}{n + m + 1}}{1 - (m + 1)x_{DT}} \]

and \( x_{DT} \) is the consumption of the don and rich people is the transfer regime.

Under subsidies, we know that

\[ W_S = n \frac{\epsilon}{p_s} \]  

(24)

where,

\[ p_s = \frac{en}{1 - m.x(p_s) - x_{ds}(p + \frac{T}{1 - x_{ds}})} \]

and \( x_{ps} \) is the consumption of rich people and \( x_{ds} \) is the consumption of the don in the subsidy regime.

Subtracting the two welfare equations above, we get

\[ W_{DT} - W_S = 1 - (m + 1)x_{DT} - \left( 1 - x(p_s) - mx(p_s + \frac{T}{1 - x_{ds}}) \right) \]  

(25)

Which reduces to the condition

\[ mx(p_s) + x(p_s + \frac{T}{1 - x_{ds}}) - (m + 1)x(p_{DT}) \]

Now as \( \epsilon \to 0 \), we know that consumption of the don and the consumption of the rich people in the subsidy regime, i.e. \( mx(p_s) + x(p_s + \frac{T}{1 - x_{ds}}) \to 1 \). This is because they end up consuming all the goods in this regime as the poor people are not able to demand anything when their endowment goes to zero even in presence of the subsidy.

On the other hand, under the direct transfer regime, the poor people do receive positive transfers and thus demand strictly positive amount of essential good even when their endowment goes to zero. Thus the consumption of the don and the rich
Proof of Theorem 8

First, we show that in a regime with only commodity taxation and direct transfers, some positive value of segmentary taxes makes the poor better off. We know that because of market clearing condition the following equation must be true.

\[ 1 = x_d(p) + nx_p(p) + mx_r(p) \quad (26) \]

where \( x_d(p) \) is the consumption of the essential good by the don, \( x_p(p) \) is the consumption of the poor and \( x_r(p) \) is the consumption of the rich.

Let the segmentary tax be high enough so that the price of the essential commodity increases for the rich.\(^{37}\) Thus, we know at this level of segmentary tax the consumption of the rich decreases at any given price. Thus the following equation must be true after the implementation of the segmentation policy. So we now get

\[ 1 = x_d(p + \delta p) + nx_p(p + \delta p) + m(x_r(p) - \delta S) \quad (27) \]

where \( \delta S \) is the change in rich consumption due to segmentation.

Subtracting .26 from .27, we get

\[ (x_d(p + \delta p) - x_d(p)) + n(x_p(p + \delta p) - x_p(p)) = m\delta S \quad (28) \]

Given that the RHS of the equation is positive, the LHS must also be positive, which means \( \delta p \) must be negative. Thus the welfare of the poor, which is \( \frac{e + T}{n \epsilon + m + 1} \) increases with the use of segmentary taxes. Now we show that the converse is also true. If any regime with optimal segmentary taxes does not achieve first best outcome, then if commodity taxation generates some tax income, it makes the poor better off.

The consumption of the poor in the segmentation economy can be given by

\[ [1 - x_d(p_{ms}) - mx_r(p_{ms})], \]

where \( x_d(p_{ms}) \) is the consumption of the don \( x_r(p_{ms}) \) is the consumption of the rich. We want to show that

\[ [1 - x_d(p_{ms} + \delta p) - mx_r(p_{ms} + \delta p)] > [1 - x_d(p_{ms}) - mx_r(p_{ms})] \quad (29) \]

\(^{37}\)We know such a tax exists because complete segmentation level of tax will always exist that will definitely increase the price for the rich.
where $\delta p$ is the change in price after commodity taxation and direct transfers. So we want to show that for any given price $p$ and endowment $i$, introduction direct transfers increases the price, i.e. $\delta p$ is positive which concludes the above proof.

So, let us suppose that in the segmentary equilibrium, poor have income $i$, and the price of the commodity is $p$, from the market clearing condition we get,

$$p = px_d + ni + mp_x_r$$

Now suppose we provide direct transfers of $T$ to the population, we get,

$$p_{DT} = p_{DT}x_d(p_{DT}) + p_{DT}m x_r(p_{DT}) + ni + T \frac{n}{n + m + 1}$$

Implicitly differentiating this equation with respect to $T$, we get

$$\frac{dp}{dT} = \frac{n}{n + m + 1} + [mx_r + x_d] \frac{dp}{dT} + p \left( \frac{mdx_r}{dp} + \frac{dx_d}{dp} \right) \frac{dT}{dT}$$

which means that

$$\frac{dp}{dT} = \frac{1}{(1 - [mx_r + x_d]) - p \left( \frac{mdx_r}{dp} + \frac{dx_d}{dp} \right) \frac{n}{n + m + 1}}$$

which is positive because $mx_r + x_d < 1$ and $\left[ \frac{dx_r}{dp} + \frac{dx_d}{dp} \right] < 0$. Thus, increasing $T$ always increases price.

Thus we can be sure that introducing taxes increases the equilibrium price of the essential good, i.e. $\delta p$ is positive. So the new welfare for the poor which is $1 - x_r(p + \delta P) - x_d(p + \delta p)$ is higher than the old. Q.E.D

.1 Analysing Market Segmentation in a labour supply model

We augment the basic discrete job labour model of Saez (2002b) with a distinction between two types of consumption goods. The first type is luxury goods which are produced using labour and a CRS production technology. The second type is essential goods which are endowed to a few people. Keeping up with the main model of the paper, we call the people endowed with essential goods as ‘dons’.

38This includes the transfers received from tax revenue generated from segmentary tax.
1.1 Consumers

Consumers are identical in utility, but have a distribution of ability \( \theta_i = [0, h] \). We interpret \( \theta_i \) as the effort agent \( i \) has to exert to do the high productivity job. Each individual is endowed with 1 unit of labour, which they use to work at high productivity or low productivity jobs. Let \( f(.) \) and \( F(.) \) be the probability density function and cumulative density function for \( \theta_i \).

Individuals earn wages from labour and consume essentials and luxuries, taking prices as given. Other than the effort level required for the individuals in the high productivity jobs, individuals are identical. So we can write the utility of individual \( i \) as

\[
U_i(x, e) = u(e) + x - \theta_i
\]

where \( x \) is the luxury and \( e \) is the essential good. \( u'(.) > 0, u''(.) <= 0 \) and \( \lim_{x \to 0} u''(.) \to \infty \).

For sake of simplicity of exposition we can assume that

\[
u(e) = \frac{x^\alpha}{\alpha} \quad \text{where} \quad \alpha < 0\]

In this setup, the demand of the essential good for the rich is

\[
e(p) = p^{\frac{1}{\alpha - 1}}
\]

and expenditure on the good is

\[
pe(p) = p^{\frac{\alpha}{\alpha - 1}}
\]

which is an increasing function of price.

1.2 Production

Both the high productivity job and the low productivity job produce the luxury good. However, they both differ in the production function.

For the low skill job, we

\[
f(L) = c_1 L
\]

For the high skill job, we have

\[
f(L) = c_h L
\]
We assume that ‘dons’ are endowed with 1 unit of essential goods and do not provide labour for production.

Due to perfect competition, each individual gets a wage equal to his marginal product. So the individual working in a high skill job gets paid $w_h = c_h$, and the individual working in a low skill job gets paid $w_l = c_l$.

### 1.3 Laissez Fair (LF) Equilibrium

Suppose that individual $i$ works at the high skill job we can write his (indirect) utility function as a function of wage and prices. If he takes the high skill job, we get

$$V_i(c_h, p) = V(c_h, p) - \theta_i$$

and at the low skill job,

$$V_i(c_l, p) = V(c_l, p)$$

An individual takes a high skill job if and only if the following condition holds

$$V(c_l, p) < V(c_h, p) - \theta_i \iff \theta_i < V(c_h, p) - V(c_l, p)$$

Let us define $m$ as a measure of people who take up the high skill job under LF regime, i.e.

$$m = \int_0^V(c_h, p) - V(c_l, p) f(\theta) d\theta$$

Similarly, $n$ is defined as a measure of people who take up the low skilled job.

$$n = \int_{V(c_h, p) - V(c_l, p)}^h f(\theta) d\theta$$

Assuming that $c_h > a$, and $c_l < a$, consumption of the essential good of the high skill job takers (rich) and the don is $e(p)$, the consumption of the low skill job takers (poor) is $\frac{c_l}{p}$. Thus, market clearing condition for the essential good is

$$n \frac{c_l}{p_{LF}} + me(p_{LF}) + e(p_{LF}) = 1$$

which gives the following equilibrium price

$$p_{LF}(1 - (m + 1)e(p_{LF})) = nc_l$$
or

\[ p_{LF} = \frac{1}{(1 - (m + 1)e(p_{LF}))} n^{c_l} \]

1.4 Government intervention

Now suppose the government wants to intervene in the economy and maximize the utilitarian social welfare function \( \sum U_i \).

We prove a lemma that shows that with a utilitarian social welfare function and quasi-linear utility function, maximizing \( \sum U_i \) is equivalent to (almost) maximizing the consumption of the poor when the essential good is price inelastic, and the number of poor goes to infinity. More formally, the social welfare function becomes lexicographic in the consumption of the poor. The planner first tries to maximize the welfare of the poor. Only after that, he cares about other criteria that affect welfare.

**Lemma 6.** If the essential good is price inelastic and the relative number of poor in the economy is very large, then the planner becomes lexicographic in the utility of poor people. This is because the ratio of marginal utility of the poor to the marginal utility rich goes to infinity.

**Proof.** Suppose, for the rich, the marginal utility of consuming the essential good is \( \lambda p \) where \( \lambda \) is the marginal utility of income and \( p \) is the price of essential good. We also know that \( \lambda \) is bounded above zero given luxury good is linear. Thus, the ratio of marginal utility of the poor to the marginal utility of the rich is

\[ \frac{u'(c_l)}{\lambda p} \]

Suppose this does not go to infinity as \( n \) tends to infinity for an inelastic good, i.e. it is bounded.

Then, we get

\[ \frac{1}{\lambda p} u'\left(\frac{c_l}{p}\right) \leq c \quad \text{as} \quad n \to \infty \]

We know that since \( p \) is increasing in \( n \), thus, as \( n \) goes to infinity \( p \) also goes to infinity. Therefore we get

\[ \frac{1}{\lambda p} u'\left(\frac{c_l}{p}\right) \leq c \quad \text{as} \quad p \to \infty \]

With a quasi-linear utility function, if this is true for \( p \to \infty \), then it must be true

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39Formally this means there exists \( \bar{n} \), such that \( \forall n \geq \bar{n} \), the result holds
for all $p$, i.e.

$$u'(\frac{c_l}{p}) \leq \lambda c.p \quad \forall p$$

Since this is true for all $p$, it must be true for $p = \frac{c_l}{x(p)}$ as well, where $x(p)$ is the demand for the essential good. Thus we get that

$$u'(x(p)) = u'(\frac{c_l}{x(p)}) \leq \lambda c \frac{c_l}{x(p)} \quad (32)$$

$$\quad (33)$$

Now from the first order conditions, we also know that $p = \lambda u'(x(p))$ Thus we get that $px(p) \leq \lambda^2 c.c_l$ which means that $p(x(p))$, i.e. expenditure is bounded above.

However, given that the good is strictly inelastic, we know that the expenditure function increases in $p$, i.e.

$$\frac{d}{dp}(px) > 0 \quad (34)$$

and thus expenditure on the commodity must not be bounded. Q.E.D.

Now that we have established that under the above conditions, the social planner has a lexicographic preference to maximise the consumption of essential goods, we now compare two interventions that increase the welfare of the poor. One is that of a non-linear labour taxation regime, and the second is that of segmenting the market for essential goods. We first discuss the taxation regime.

**Non-linear taxation**

**Remark 2.** In any regime in the measure of poor is $n$, the following equation must hold

$$1 = (n + m - m(t)) \frac{c_l}{p} + m(t)e(p, t) + e(p)$$

which can be rearranged to

$$p = (n + m - m(t))c_l + p(m(t)e(p, t) + e(p))$$

this means that

$$p \geq (n + m - m(t))c_l$$

which means it goes to infinity as $n$ goes to infinity.

Our setup, with two jobs, means the government can tax the high skilled job
holders and use that money to give transfers to low-skilled jobholders. Let the
government set $t_h$ as tax for the high skilled job and $t_l$ as a transfer for the low
skilled job.

Under this setup, If a worker takes the high skill job then he gets the utility

$$V_i(c_h - t_h, p) = V(c_h - t_h, p) - \theta_i$$

and at the low skill job, he gets

$$V_i(c_l + t_l, p) = V(c_l + t_l, p)$$

An individual takes a high skill job if and only if the following condition holds

$$V(c_l + t_l, p) < V(c_h - t_h, p) - \theta_i \iff \theta_i < V(c_h - t_h, p) - V(c_l + t_l, p)$$

Let us define $m_1$ as a measure of people who take up the high skill job under this
system of non-linear taxation, i.e.

$$m_1 = \int_0^{V(c_h - t_h, p) - V(c_l + t_l, p)} f(\theta) \, d\theta$$

Given tax rate is set at $t_h > 0$, this leads to a reduction of supply at high skill
jobs, i.e. $m_1 < m$. Also due to the budget balance condition, the transfer to the
poor has to be

$$t_l = \frac{t_h m_1}{n + m - m_1}$$

Also, in equilibrium the following condition must hold

$$1 = (n + m - m(t_h))(\frac{c_l + t_l}{p}) + m(t)e(p, t) + e(p)$$

$$p = (n + m - m(t_h))(c_l + t_l) + pm(t)e(p, t) + pe(p)$$

which gives the following equilibrium price.

$$p = \frac{1}{1 - m(t)e(p, t) - e(p)}(n + m - m(t_h))(c_l + t_l)$$

Clearly, the price is an increasing function of $n$. Now also notice that both $m_1$
and $t_l$ are functions of $t_h$. So we can say that number of people working in the high
productive job $m$ is a function of $t_h$ where $t_h = 0$ is the special case of laissez faire
economy. Also notice that if $t_h \geq c_h - c_l$, no one works in the high productivity
jobs. Thus, \( m_1 = 0 \). Hence, effectively \( t_h \) and \( m_1 \) are both bounded in our setup.

Moreover, in this economy, the dead-weight loss is given by

\[
DWL = \int_{m_1}^m (c_h - c_l - \theta_i) f(\theta) d\theta
\]

Having set up the non-linear taxation regime, we now discuss the segmentation regime.

**Segmentation**

Under this setup, complete segmentation is a scenario where the planner caps the expenditure on essential goods at \( c_l \). Thus, the people who work in the high productivity jobs and the low productivity jobs consume an equal amount of essential goods in complete segmentation. However, the high productivity workers can potentially consume luxuries. We discuss the social welfare and dead-weight loss in this setup.

Given individual ability \( \theta_i \), an agent works in the high productivity jobs iff

\[
V_i(c_h, p) = u\left(\frac{c_l}{p}\right) + c_h - c_l - \theta_i \geq u\left(\frac{c_l}{p}\right) = V_i(c_l, p)
\]

and for production

\[
\theta_i \leq c_h - c_l
\]

In equilibrium, the following must hold.

\[
1 = (n + m)\frac{c_l}{p} + e(p)
\]

where \( \frac{c_l}{p} \) is the consumption of both high and low productivity workers and \( e(p) \) is the consumption of the don. Moreover, the dead-weight loss is given by

\[
DWL = \int_{c_h - c_l}^m (c_h - c_l - \theta_i) f(\theta) d\theta
\]

Now we prove our main result. We know that when \( n \to \infty \), the social welfare is lexicographic in the welfare of the poor. Thus we first compare the welfare of the poor in both regimes and then compare the dead-weight loss. We show that when \( n \to \infty \), consumption of the poor is always increasing in \( t_h \). Thus, \( t_h \) is set at the maximum level possible, i.e. \( t_h = c_h - c_l \). Moreover, at this level \( m(t_h) = 0 \). At this level, the dead-weight loss in luxury good production is at the highest level, i.e. no one works in high-productivity jobs. Hence, the production of luxury goods is at the lowest possible level. On the other hand, if we use segmentation, i.e. allow the
rich to spend only $c_i$ on the essential goods, we have the same allocation of essential goods but greater production of luxury goods in the economy. Formally, we state this result as a theorem below.

**Theorem 9.** *If the essential good is price inelastic, as the number of poor in the economy increases, complete Market Segmentation dominates a non-linear labour supply taxation.*

First, we consider what tax level $t_h$ maximises welfare under the non-linear taxation regime. Given that the tax rate for the planner is $t_h$, the measure of high productivity job workers in the economy is $m(t_h)$. Let $e_{poor}$ be the consumption of the essential good of the poor, $e(p(t_h), t_h)$ be the consumption of the rich and the $e(p(t_h))$ be the consumption of the ‘don’. Notice that the taxes affect the rich in two ways: Directly and indirectly (through price). For the dons the effect is only indirect.

The consumption of the poor in this regime can be written by

$$e_{poor} = \frac{1}{n} [1 - m(t_h)e(p(t_h), t_h) - e(p(t_h))].$$

Differentiating w.r.t. $t_h$

$$\frac{de_{poor}}{dt_h} = \frac{1}{n} \left[ -\frac{dm(t_h)}{dt_h} e(p(t_h), t_h) - m(t_h) \frac{de(p(t_h), t_h)}{dt_h} - (m(t_h) + 1) \frac{de p}{dp dt_h} \right].$$

Because of inelasticity of essential good we know that

$$\frac{\delta e}{\delta p} p + e(p) \geq 0 \implies \left| \frac{\delta e}{\delta p} \right| \leq \frac{e(p)}{p}$$

Given that $\frac{\delta e(p(t_h), t_h)}{\delta t_h} \text{ and } \frac{dm(t_h)}{dt_h}$ are always less than equal to zero, we can lower bound the above term by

$$\frac{1}{n} \left[ -\frac{dm(t_h)}{dt_h} e(p(t_h), t_h) - m(t_h) \frac{de(p(t_h), t_h)}{dt_h} + (m(t_h) + 1) \frac{e(p)}{p} \frac{dp}{dt_h} \right].$$

Now we show that for a large $n$ the above term is always positive.

First notice that given

$$t_l = \frac{t_h m_1}{n + m - m_1}$$

and

$$p = (n + m - m(t_h))(c_l + t_l) + pm(t)e(p, t) + pe(p)$$

$$\implies p = (n + m - m(t_h))(c_l) + m(t_h) t_h + m(t_h) e(p, t_h) p + e(p) p$$
\[
\frac{dp}{dt} = \frac{dm}{dt} \left[ t - c_1 + pe(p, t) \right] + m(t) + m(t) \left[ p \left( \frac{\delta e(.)}{\delta p} \frac{dp}{dt_h} + \frac{\delta e(.)}{\delta t_h} \right) + e(p) \frac{dp}{dt} \right] + \frac{dp}{dt} \left[ e(p) + p \frac{\delta e}{\delta p} \right]
\]

which gives us

\[
\frac{dp}{dt} = \left[ 1 - (m(t) + 1) \left[ e(p) + p \frac{\delta e}{\delta p} \right] \right]^{-1} \left[ \frac{dm}{dt} \left( t - c_1 + pe(p, t) \right) + m(t)(1 + p \frac{\delta e(p, t)}{\delta t}) \right]
\]

Now let us compute

\[
\frac{e(p) \, dp}{p \, dt} = \left[ 1 - (m(t) + 1) \left[ e(p) + p \frac{\delta e}{\delta p} \right] \right]^{-1} \left[ e(p) \frac{dm}{dt} \left[ \frac{t}{p} - \frac{c_1}{p} + e(p, t) \right] \right]
\]

\[
+ \left[ 1 - (m(t) + 1) \left[ e(p) + p \frac{\delta e}{\delta p} \right] \right]^{-1} \left[ \frac{m(t)e(p)}{p} \left[ 1 + p \frac{\delta e(p, t)}{\delta t} \right] \right]
\]

Now putting this term back in .37, we get

\[
\frac{1}{n} \left[ - \frac{dm(t_h)}{dt_h} e(p(t_h), t_h) - m(t_h) \frac{\delta e(p(t_h), t_h)}{\delta t_h} \right]
\]

\[
+ (m(t_h) + 1) \left[ 1 - (m(t) + 1) \left[ e(p) + p \frac{\delta e}{\delta p} \right] \right]^{-1} \left[ e(p) \frac{dm}{dt} \left[ \frac{t}{p} - \frac{c_1}{p} + e(p, t) \right] \right]
\]

\[
+ \left[ 1 - (m(t) + 1) \left[ e(p) + p \frac{\delta e}{\delta p} \right] \right]^{-1} \left[ \frac{m(t)e(p)}{p} \left[ 1 + p \frac{\delta e(p, t)}{\delta t} \right] \right]
\]

Given \[1 - (m(t) + 1) \left[ e(p) + p \frac{\delta e}{\delta p} \right]\] is positive and \[\frac{1}{p} \geq -\frac{\delta e}{\delta t},\] we know that 1st, 2nd and 4th term are positive. We now compare 1st and 3rd term and show that their sum is positive.

Adding we get

\[
- \frac{dm(t_h)}{dt_h} e(p(t_h)) \left[ 1 - \left[ 1 - m(t)e(p(t)) \right] - \left[ e(p) + p \frac{de}{dp} \right] \right]^{-1} \left[ \frac{t}{p} - \frac{c_1}{p} + e(p, t) \right]
\]

Now we know as \(n \to \infty\)

\[
\left[ 1 - m(t)e(p(t)) \right] - \left[ e(p) + p \frac{de}{dp} \right] \to 1
\]

and

\[
\left[ \frac{t}{p} - \frac{c_1}{p} + e(p, t) \right] \to 0
\]

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Thus,

$$- \frac{dm(t_h)}{dt_h} e(p(t_h)) \left[ 1 - \left[ 1 - m(t)e(p(t)) - \left[ e(p) + p \frac{de}{dp} \right]^{-1} \right] \left[ \frac{t}{p} - \frac{c_l}{p} + e(p(t), t) \right] \right] \geq 0$$

Thus, we know as $n \to \infty \frac{d\epsilon_{power}}{dt_p} \geq 0$, hence $t_h$ is set at the maximum level, i.e. $t_h = c_h - c_l$. Consumption of the low skilled job holders (in this case everyone except the dons) is given by $\frac{c_l}{p}$.

Moreover, at this level of taxation $m(t_h) = 0$ and thus the dead-weight loss is given by

$$DWL = \int_0^m (c_h - c_l - \theta_i) f(\theta) d\theta$$

Under complete segmentation, the consumption of the low skilled job holders (again everyone except the dons) is same as the above, i.e. $\frac{c_l}{p}$.

However, the dead-weight loss is

$$DWL = \int_{c_h - c_l}^m (c_h - c_l - \theta_i) f(\theta) d\theta$$

Given $c_h - c_l >> 0$ by assumption, the dead-weight loss in the segmentary regime is much more lower. Q.E.D.
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