Cognitive Ability and Voting: How Salt Influenced Elections in the 20th Century*

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Abstract

In response to elevated levels of iodine deficiency, salt was iodized in 1924. In utero iodine deficiency has been shown to have a significant negative impact on cognitive development. We examine the impact that an increase in average cognitive ability has on voting outcomes by comparing areas with a high level of iodine deficiency to areas with a low level of iodine deficiency before and after the iodization of salt. There is strong evidence that members of the Congress in the treatment states vote more liberal compared to the control states and that the vote share of the Demoratic Party candidates increase significantly.

Keywords:Cognitive Ability, Voting Outcomes, DW-Nominate

JEL Classification Codes:D72, I14

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1 Introduction

In utero iodine deficiency has been shown to have serious negative effects on cognitive development (Scrimshaw 1998). In the early twentieth-century United States, some areas of the country had low levels of iodine deficiency due to high concentrations of iodine in the soil whereas other states has high levels of iodine deficiency due to low concentrations of iodine in the soil. This paper studies the effects of a natural experiment in the US in which iodized salt made the local iodine concentration irrelevant. We examine the voting behavior of individuals and congressmen in high-deficiency and low-deficiency areas before and after the iodization of salt occured. The eradication of iodine deficiency and associated increase in cognitive ability is shown to lead to a dramatic increase in the vote share for Democratic Party candidates and a more liberal roll call voting record of the elected congressmen.

In the run up to World War I, the US military enlisted and gave medical examinations to over two and a half million men between the ages of eighteen and thirty. Love and Davenport (1920) documents the prevalence of 269 separate defects found in these men. A surprising amount of goiter was discovered during medical exams as nearly one percent of the population examined were found to have the disease (Love and Davenport 1920, p. 77). In fact, about one fourth of the individuals with simple goiter were rejected from military service because given the size of their neck it was not possible to wear a uniform.Goiter is a swelling of the thyroid gland and is most often caused by iodine deficiency, leading many to believe there was a larger problem of micronutrient deficiency in many areas of the US.

A disproportionate number of the men with simple goiter were born in Northern Michigan and Wisconsin. A meeting with the Michigan State Medical Society in June

1922 was called to discuss how to eradicate goiter. Feyrer, Politi and Weil (2010) review the process that lead the to decision to iodize salt and Markel (1987) provides an even more detailed account. By 1924, the major salt manufacturing companies distributed iodized salt nationally and placed advertisements in magazines and newspapers touting the benefits of including an adequate amount of iodine in one's diet.[1] There was a general trend in eating a nutritious diet and the salt companies figured that there was a large profit to be made with iodized salt (Markel 1987).

We are not the first to ask whether this rapid adoption of iodized salt had economic effects. Employing the same data on goiter rates, Feyrer et al. (2010) use a difference-in-difference estimation technique to examine the likelihood that someone who enlisted in the army was assigned to the Army Air Forces versus the Army Ground Forces. Enlistees take the Army General Classification Test and are given a score based on cognitive ability. Those with better scores are more likely to be assigned to the Army Air Forces. Using data on birth year and county of residence, they find that those born after the iodization of salt in areas that were highly iodine deficient see a greater increase in the probabiliy of joining the Army Air Forces relative to the group born before iodization than those born in low-deficient areas. They infer that this must mean that iodization of salt increased cognitive ability. Bleichrodt and Born (1994) conduct a metaanalysis of iodine deficiency and cognitive development and conclude that moderate iodine deficiency is associated with a loss of 10-15 IQ points.[2] The magnitude of the finding of Feyrer et al. (2010) is consistent with the metaanalysis.

[1] Advertisements would often contain phrases such as "Remember, too, that Morton's Iodized Salt protects children against simple goiter - that often unnoticed nutritional disease which is frequently accompanied by underdevelopment, irritability and backwardsness at school." (Women's Home Companion, June 1934)

[2] Qian, Wang, Watkins, Gebski, Yan, Li and Chen (2005) conducts a metaanalysis of studies in China and finds strikingly similar results.

While a lot of attention is focused on the detrimental effects of iodine deficiency in utero, it is possible that interventions that supplement iodine can benefit older children as well. In a double-blind experiment in Albania, Zimmermann, Connolly, Bozo, Bridson, Rohner and Grimci (2006) finds that providing iodine to 10-12 year olds that live in moderately deficient areas has a significant impact on their cognitive functions, espcially for information processing, fine motor skills and visual problem solving. It is therefore possible that we will find a break in the trend of voting patterns before 1942, when the first group exposed to iodized salt turn eighteen and are eligible to vote.

Lee, Moretti and Butler (2004) shows that voters typically elect policies rather than affect them. That is, a candidate cannot credibly committ to a moderate platform once elected. Any change in voting records is therefore likely to be the result of changes in candidate ideology.

The rest of paper is organized as follows: Section 2 described in more detail the data on goiter rates and measures of voting outcomes. Section 3 outlines our empirical model and estimation strategy. Section 4 provides the results, Section 5 details ongoing work on this project and Section 6 concludes.

2 Data

2.1 Goiter Rates

Information about goiter rates comes from men aged 18-30 who were drafted for or enlisted in the military during 1917-18.[3] The quick mobilization of men needed for World War I and the required testing to ensure they were fit for service creates a snapshot of

[3] We thank Dimitra Politi for sharing the data that was coded from Love and Davenport (1920).

physical and mental defects for a large population. Love and Davenport (1920) categorizes this information on the approximately 2.5 million men that were tested. Records on 269 medical conditions are provided in rates per 1,000 men. Rates are given both at the state level as well as 151 regions of the US based on collections of counties.

Following Feyrer et al. (2010), we label the top 25% of the distribution as high goiter, or a state with goiter rate above 5.4 per thousand. This is population weighted so we define 17 of the states as having a high goiter rate. The median rate is about 2.5 per thousand. In general, east coast states have rates below 1 per thousand, which follows the literature that coastal areas are more enriched with iodine (Fuge 2007). Iodine is found naturally in soil and travels by wind and rain. Rates are not, however, linear in distance from the ocean.

Given that there is a large amount of variation of goiter rates within states, we will eventually turn our analysis to the congressional district level. This is ongoing work as we must assign goiter rates to the congressional districts for each congress in the twentieth century. Congressional district boundaries change with each census and to our knowledge these maps are not available in GIS format.

2.2 Voting Records and Issues

For each session of congress, senators and congressmen are assigned a score which ranges from -1 for very liberal to 1 for very conservative by a DW-Nominate score (Poole 2011). For example, in 2008 Senator Barack Obama had a score of -0.441, Senator John McCain had a score of 0.412 and the average Senate score was -0.015. These scores are based on the actions of the invidivuals during roll call votes. As such, there is data for how each member of congress voted for every isntance of a roll call vote as well as information on the issue being voted upon.

Figure 1 shows the average DW-Nominate score during the twentieth century for members of the House of Representatives in high and low iodine deficiency states. The low deficiency states have a fairly constant average DW-Nominate score that is close to zero. The high deficiency states has an average score above 0.2 until the late 1930s when it starts to drop. After this point the two scores follow a similar trend, except the high-defieincy state trend is a little noisier. There is a vertical line at 1944 because this is eighteen years after the first group exposed to iodized salt in utero would be able to vote.

A second component of the score captures attitudes towards civil rights. Figure 2 illustrates changes over time for the average score by deficiency level. A score of -1 represents a congressman that supports civil rights completely. The high deficiency area is well above the low deficiency area from 1900-1930 and then it drops dramatically whereas the average low deficiency score remains fairly constant for 1930 onward. The graph stops at 1980 because the scores for congressmen started to converge at this point.

We also examine the vote share of the Democratic candidate. Data was collected by King (1994) for each congressional district from 1898-1992. We average the vote share for the Democratic candidate for all districts within a state for each congress. Given that there is variation within states we will eventually extend this analysis to the congressional district level when we have iodine deficiency rates at this level. Average vote share for the Democratic candidate over time are presented in Figure 3. From 1900 until about 1970, the Democratic candidate averaged around 60-70% of the vote share in the low-deficiency states. The high-deficiency states started out much lower, around 30-40% but jumped to 50% around 1930. From about 1970 onward both trends hovered around 50%.

Taken together, these graphs present some visual evidence that once salt was iodized the voting behavior of those that were most affected changed relative to those that did not experience a rapid change in iodize deficiency. We next attempt to quantify these effects empirically.

3 Empirical Strategy

Our estimation strategy relies on the quick adoption of iodized salt and that low-deficiency areas are a good control for high-deficiency areas. Given the historical nature of the data we do not have much information on demographic characteristics or economic outcomes for the different areas. We rely heavily on state and year fixed effects to capture unobserved trends. Our general framework is to run regressions of the form:

$$\text{DW}_{st} = \beta \text{Deficient}_s * \text{Post} + \gamma_s + \eta_t + \varepsilon_{st} \tag{1}$$

where DW_{st} is the average DW-Nominate score for the represenatives in state s in year t, Deficient refers to states with a goiter rate above 5.4 per thousand as measured in 1917-1918, Post equals one for years after 1942 and zero for years before, and γ_s and η_t are state and year fixed effects. We hypothesize that an effect on voting should occur after the treated individuals are eligible to vote, so eighteen years after iodization of salt. Standard errors are clustered at the state level. β is our main coefficient of interest as it tells us how the high-deficient states change relative to the low-deficient states. We run similar regressions with a measure of support for civil rights and the vote share of the Democrat Party candidate on the left hand side.

We then allow for the effect to change over time and augment our regressions in the following way:

$$\text{DW}_{st} = \sum_{d=1}^{5} \beta_d \text{Deficient}_s * \text{Post Decade}_d + \gamma_s + \eta_t + \varepsilon_{st}. \tag{2}$$

Instead of grouping all of the years after 1944 together, we all the effect to differ from 1944-1953, 1954-1963, 1964-1973, 1974-1983 and 1984-1993. As a larger percentage of the population becomes exposed to iodized salt in utero, it is likely that the magnitude will increase.

4 Results

Column 1 of Table 1 shows that relative to the low-deficiency states, the average score for a member of the House of Representatives moves 0.186 points to the left. The standard deviation of the DW-Nominate score during this period is 0.263, so this represents about a 70% of a standard deviation move to the left. Column 2 of Table 1 gives the analysis for the measure of civil rights. We find a similar result, that the treated group moves about three quarters of a standard deviation to the left relative to the control group. Both of these results are highly statistically significant indicated that cognitive ability has an impact on the way people vote.

We extend the analysis to allow this effect to vary as more of the population is exposed to the treatment. That is, in 1944 most of the voters and all of the elected officials would have been born before the iodization of salt. We therefore interact the dummy variable for high-deficiency states with decade level fixed effects. Specifically, we have an indicator for years 1944-1953, 1954-1963, 1964-1973, 1974-1983 and 1984-

1993. The results for the general DW-Nominate score and the civil rights score are found in Columns 3 and 4 of Table 1 respectively. Results suggest that the general DW-Nominate score moves further to the left as the proportion of the voting eligible population exposed to the iodization of salt increases. This makes sense if the treatment causes individual voters to demand a more liberal leaning politician or if the treatment causes politician to be more liberal minded regardless of general voter preferences. A relatively small proportion of potential voters will have been exposed to the iodized salt in utero by 1944 so we should expect to see the magnitude of the effect increase over time. The effect on the civil rights variable is largest during the first decade then decreases over time. It has been noted that this measure converged by about 1980 so seeing the change in high-deficient areas relative to low-deficient areas peter out over time is not surprising.[4]

Table 2 conducts a similar analysis but for Senators instead of members of the House of Representatives. The magnitude of the effect is strikingly similar considering that it is not possible to compare score across the two chambers of congress. Compared to the low-deficiency states, the average score for a senator moves 0.20 points to the left. Senators in high-deficiency states become more liberal on civil rights issues as well.

We next ask whether the change in cognitive ability induced by iodized salt influences the party of elected candidates. Column 1 of Table 3 shows that the share of the vote received by the candidate from the Democratic Party inceases by over ten percentage points in the high-deficiency states compared to the low-deficiency states. Column 2 of Table 3 indicates that effect grows over time, as more voting eligible individuals have

[4]Choosing the top quartile as high goiter may seem arbitrary. We find slightly larger effects if we compare the top quartile to the bottom quartile. We find slightly smaller effects if we use the mean as the cutoff instead of the top quartile. The mean is close to the top quartile, however, so this does not come as a surprise.

been exposed to iodized salt.

Given this robust finding that treating iodine deficiency, a condition that causes problems with cognitive development, is associated with more liberal voting records, we aim to uncover why such a finding makes sense. Is the change in cognitive ability driving something else that explains the change in voting patterns? Ansolabehere and Hersh (2011) note that previous work explaining who participates in the voting process based on race, gender and age is flawed due to survey bias. While it is possible that migrational sorting resulted in response to changes in iodine levels we instead focus on other economic outcomes. A similar iodization of salt intervention in Switzerland is estimated to have increased the probability of graduating from tertiary education by about one percentage point (Politi 2011a). Politi (2011b) goes on to find that individuals from areas of high iodine deficiency moved into higher paying jobs that were less labor-intensive. Using a similar methodology from an intervention in Tanzania, Field, Robles and Torero (2009) find that treating iodine deficiency leads individuals to receive about a half an extra year of schooling. We are currently in the process of gathering data on educational attainment for the 20th century United States.

We turn our attention to changes in income. Figure 4 shows average trends in per-capita income for high-deficiency states and low-deficiency states. Average per-capita income is nearly identical for the two groups until about 1942 when the high-defiency trend moves above the low-deficiency trend. At this point the first individuals exposed to iodized salt in utero are likely to join the workforce. Given that this is also the midst of World War II, there may be another explanation for the jump. However, the difference between the trends persists. Regressions with a similar framework from before are found in Table 4. The results confirm that this group saw an increase in income relative to the group not affected by the iodization of salt, but the magnitude is small. We discuss briefly in Section 5 our planned future work to understand why an increase in cognitive ability would lead to voting more liberally.

5 Ongoing Work

We are in the process of extending this work in seveal ways. First, we are moving our analysis to the congressional district level to exploit variation in iodine deficiency level and voting records within the states. While we are encouraged by the significance of our findings at the state level with the state and year fixed effects, we are confident that we are missing out on a lot of variation at this aggregate level. The main challenge to extending the analysis to the congressional district level is mapping the goiter rates from the 151 collection of counties into the congressional districts. Second, we want to uncover which specific issues are driving the results. How do voting records on issues such as welfare, taxes, national defense and the environment change? In a related issue, we will take into account that we know the tenure of the congressmen. Do individuals change their policy or to voters elect politicians with different platforms? Finally we want to uncover the mechanism for why the high-deficiency areas begin to vote more liberally relative to the low-deficiency areas after the iodization of salt. Perhaps there is also a surge in educational attainment or a drop in fertility rates that correspond to the elevated level of income and these measures relate to liberal voting.

6 Conclusion

Iodine deficiency has been shown to hamper cognitive development. The introduction of iodized salt in 1924 serves as a nationwide intervention to combat iodine deficiency and its associated ills. While other work has shown that this particular intervention has a positive effect on cognitive ability (Feyrer et al. 2010), we show that there are other outcomes. In particular, voting records of congressmen from areas that saw that biggest benefit from iodization moved almost three quarters of a standard deviation to the left relative to congressmen from relatively unaffected areas. The Democratic candidate vote share increased by around ten percentage points in these areas as well. Our results are significant with the inclusion of state and year fixed effects to account for unobserved trends.

In ongoing work we aim to explain why a group that sees its average IQ increase would vote more liberally. We provide evidence that these individuals see a slight increase in income, but this reinforces the idea that iodizing salt has a positve impact on cognitive ability rather than explains the voting patterns.

Figure 1: DW-Nominate Score by Deficiency Level

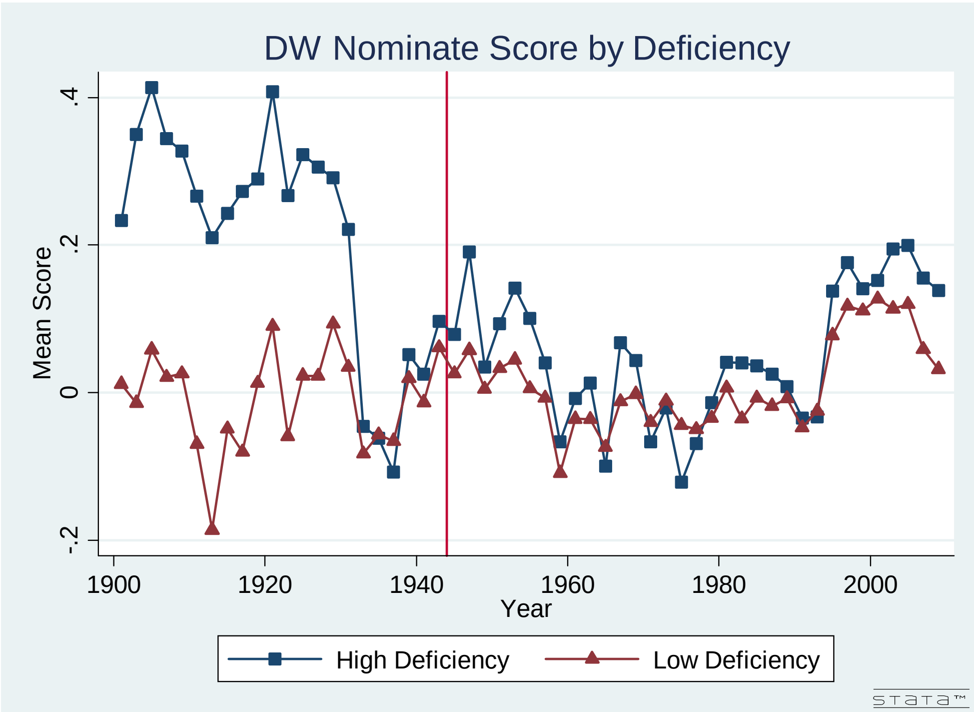

Figure 2: Civil Rights Score by Deficiency Level

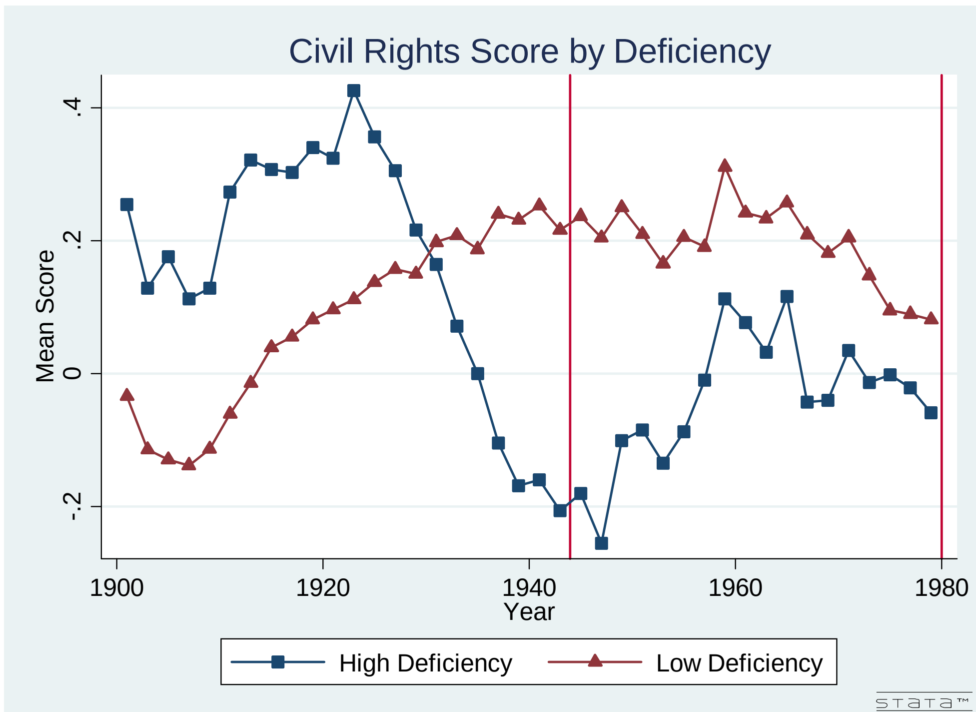

Figure 3: Democrat Candidate Vote Share by Deficiency Level

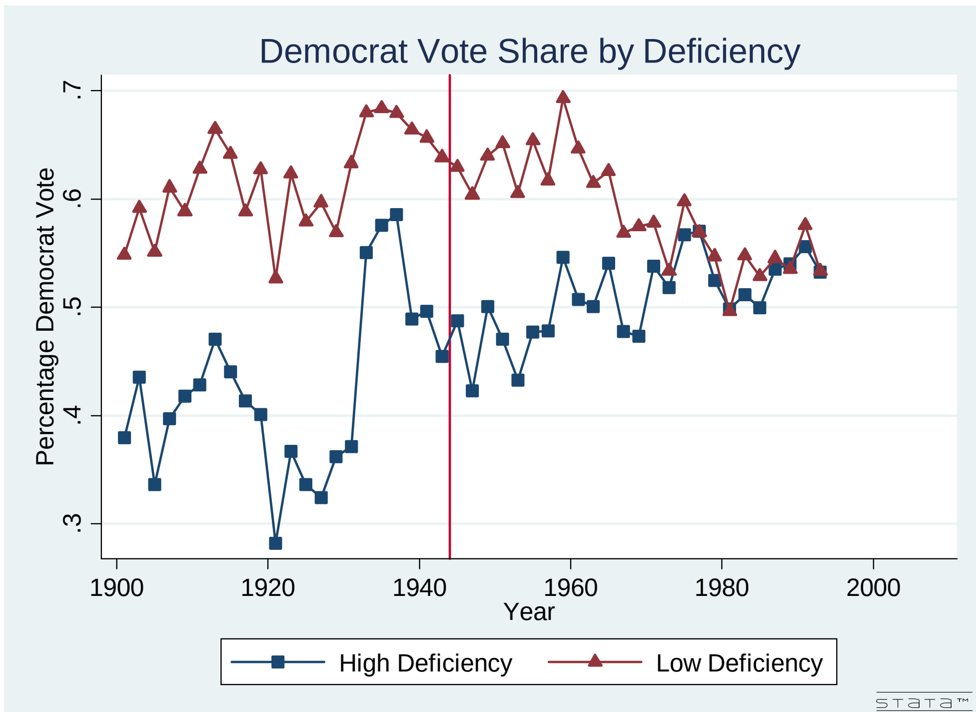

Figure 4: Per-Capita Income by Deficiency Level

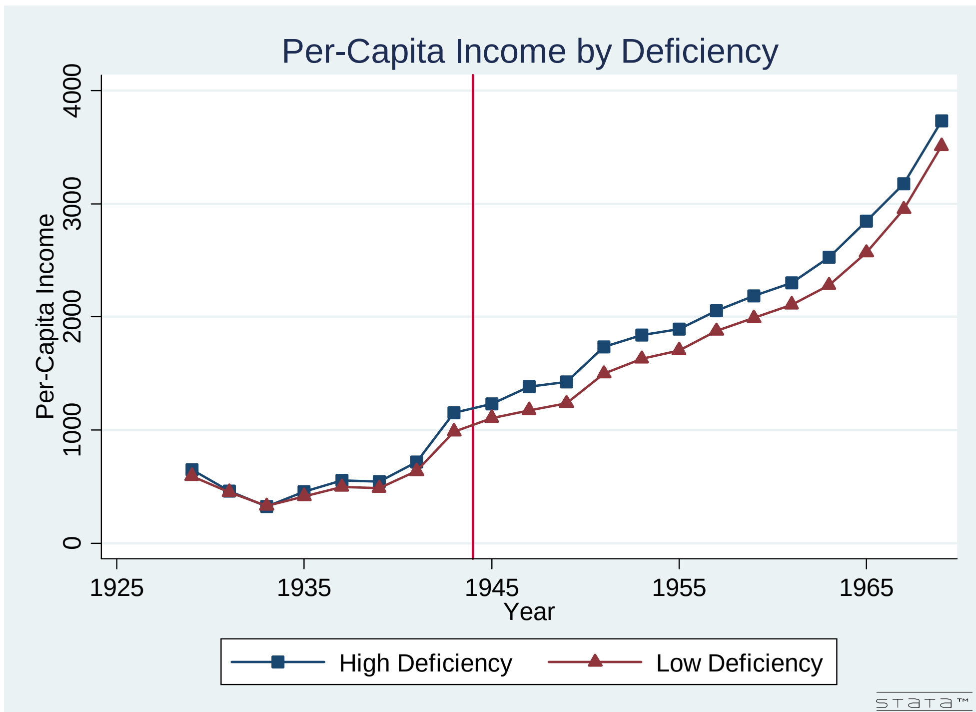

Table 1: Iodine Deficiency and House of Representatives Scores

	DW Score	Civil Rights	DW Score	Civil Rights
High-Deficiency X Post	-.186	-.317		
	(.070)***	(.082)***		
High-Deficiency X Post Decade 1			-.104	-.443
			(.039)**	(.076)***
High-Deficiency X Post Decade 2			-.129	-.296
			(.053)**	(0.090)***
High-Deficiency X Post Decade 3			-.171	-.279
			(.054)***	(0.096)***
High-Deficiency X Post Decade 4			-.176	-.206
			(.056)***	(.102)**
High-Deficiency X Post Decade 5			-.162	
			(.051)***	
R^2	0.333	0.622	0.325	0.626

* p<0.10, ** p<0.05, *** p<0.01. All regressions include state and year fixed effects. Standars errors are clustered at the state level. Post refers to the period 1944 an after. Post Decade 1 is 1944-1953, Post Decade 2 is 1954-1963, Post Decade 3 is 1964-1973, Post Decade 4 is 1974-1983 and Post Decade 5 is 1984-1993.

Table 2: Iodine Deficiency and Senator Scores

	DW Score	Civil Rights	DW Score	Civil Rights
High-Deficiency X Post	-.200	-.475		
	(.084)**	(.144)***		
High-Deficiency X Post Decade 1			-.018	-.530
			(.059)	(.145)***
High-Deficiency X Post Decade 2			-.225	-.485
			(.075)***	(0.155)***
High-Deficiency X Post Decade 3			-.244	-.410
			(.060)***	(0.160)**
High-Deficiency X Post Decade 4			-.067	-.476
			(.068)	(.161)**
High-Deficiency X Post Decade 5			-.032	
			(.083)	
R^2	0.235	0.417	0.231	0.418

* p<0.10, ** p<0.05, *** p<0.01. All regressions include state and year fixed effects. Standars errors are clustered at the state level. Post refers to the period 1944 an after. Post Decade 1 is 1944-1953, Post Decade 2 is 1954-1963, Post Decade 3 is 1964-1973, Post Decade 4 is 1974-1983 and Post Decade 5 is 1984-1993.

Table 3: Iodine Deficiency and Democrat Candidate Vote Share

	Dem Vote Share	Dem Vote Share
High-Deficiency X Post	.116	
	(0.031)***	
High-Deficiency X Post Decade 1		0.029
		(0.018)
High-Deficiency X Post Decade 2		0.050
		(0.025)*
High-Deficiency X Post Decade 3		0.132
		(0.037)***
High-Deficiency X Post Decade 4		0.177
		(.044)***
High-Deficiency X Post Decade 5		0.189
		(0.050)***
R^2	0.724	0.725

* p<0.10, ** p<0.05, *** p<0.01. All regressions include state and year fixed effects. Standars errors are clustered at the state level. Post refers to the period 1944 an after. Post Decade 1 is 1944-1953, Post Decade 2 is 1954-1963, Post Decade 3 is 1964-1973, Post Decade 4 is 1974-1983 and Post Decade 5 is 1984-1993.

Table 4: Iodine Deficiency and Per-Capita Income

	Income	Income
High-Deficiency X Post	164.93	
	(93.44)*	
High-Deficiency X Post Decade 1		117.63
		(39.75)***
High-Deficiency X Post Decade 2		60.25
		(89.85)
High-Deficiency X Post Decade 3		89.84
		(109.2)
High-Deficiency X Post Decade 4		502.30
		(273.75)*
R^2	0.980	0.981

* p<0.10, ** p<0.05, *** p<0.01. All regressions include state and year fixed effects. Standars errors are clustered at the state level. Post refers to the period 1944 an after. Post Decade 1 is 1944-1953, Post Decade 2 is 1954-1963, Post Decade 3 is 1964-1973 and Post Decade 4 is 1974-1983.

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