

Topic Salience and Political Polarization: Evidence from the German “PISA-Shock”^{*}

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Abstract

Does topic salience affect political polarization? On the one hand, parties might converge towards the median voter platform when a topic becomes more relevant for voters. On the other hand, parties might drift apart from each other to realign with their voters, thus following a cleavage pattern. In this paper, I investigate the impact of topic salience on the polarization of political debates about education in Germany. I exploit the exogenous increase in the salience of education induced by the "PISA-shock", the release of the first results of the PISA study in December 2001. Using parliamentary debates of all German state parliaments, I provide evidence of an increase in polarization due to the "PISA-shock", in line with parties following a cleavage pattern to gain electoral consensus. The effect is larger for parties for which education is a more salient topic. The large heterogeneity in the performance of German states revealed in June 2002 is not accompanied by a heterogeneous effect on polarization. This result suggests that topic salience, rather than actual information shock, drives the effect on polarization.

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1. Introduction

The interest in polarization of parliamentary debates has grown dramatically in the last years (Gentzkow et al. 2019; Goet 2019; Peterson and Spirling 2018; Fiva et al. 2022; Salla 2020). This strand of research has been fueled by recent advancements in the field of text analysis, which has opened the doors to the analysis of large corpora of texts, such as parliamentary debates. While this recent literature has mostly focused on *how* to measure polarization in parliamentary debates, it has been surprisingly silent on *why* it occurs. In this paper, I aim to fill the gap in this literature by providing causal evidence on a possible determinant of polarization in parliamentary debates: topic salience.

Theoretically, it is an open question in which direction topic salience might affect polarization of parliamentary debates. If the salience of a topic increases, parties might pursue a median voter strategy to appeal to more centrist voters, thus resulting in less polarized debates. The theoretical foundation for this argument follows Downs' (1957) seminal work on *median voter theorem*. Conversely, parties might exploit the increased salience to amplify their ideological distinctiveness, which would lead to an increase in polarization. Such behavior would be consistent with a *cleavage theory* framework, which dates back to Lipset and Rokkan (1967).

To answer this research question, I exploit the exogenous variation in the salience of a topic induced by an information shock in the context of German state parliaments. I analyze the impact of the "PISA-shock"—the release of the results of the first *Programme for International Student Assessment* (PISA) in December 2001—on the polarization of parliamentary debates about education. The German context provides an ideal setting to study my research question. Germany is a federal state, where each of its sixteen states has its own parliament with exclusive legislative authority on a set of topics, including education. Such density of parliamentary debates represents a *unicum* in this literature and allows me to compute topic-specific measures of polarization, while also controlling for a variety of possible confounding factors, such as the political leaning of each parliament or distance from the elections. I therefore leverage the exogenous increase in the salience of a topic, education, in a difference-in-differences framework, where the counterfactual group consists of debates in other topics. The outcome of interest, polarization, is defined as the extent to which opinions on an issue are opposed across parties. To the extent that to express different opinions people will use different words, more polarized speeches will be less similar. I therefore measure

polarization as the dissimilarity between speeches from a benchmark party and speeches from other parties in the same topic.

I find that topic salience induced by the “PISA-shock” had a substantial impact on parliamentary debates. First, I find a 22% increase in the share of speeches about education following the “PISA-shock”. Second, I find that the polarization of political debates about education increased substantially. Polarization increased by 8.5% of a standard deviation (SD) in the aftermath of the “PISA-shock”. The impact corresponds to about 21% of the average polarization between the main center-right (CDU/CSU) and center-left (SPD) parties in the German political landscape. The shock also had a long-lasting impact. It took roughly 6 years for polarization in education debates to go back its pre-shock level.

The interaction between speakers’ party affiliation and the treatment status reveals that the increase in polarization is driven by a cleavage between the main center-right (CDU/CSU) and center-left (SPD) parties. Overall, these aligns well with a *cleavage-theory* framework, where the main parties drift away from each other in their rhetoric over a subject matter. While the salience of education undoubtedly increased as a consequence of the “PISA-shock” in Germany, it is also possible that the increase in polarization was mostly driven by the negative sentiment around this topic. I address this issue by exploiting an additional feature of this setting: the release of state-specific PISA results in June 2002. This event showed large heterogeneities in performance across German states, with the best performing states in Germany placing themselves among the top performing countries. Nonetheless, I do not find significant heterogeneities in the impact of the shock on polarization with respect to the performance of each state. This finding seemingly suggests that salience, rather than the actual performance of the states, affected the polarization of parliamentary debates.

This study contributes to two strands of the literature. First, I contribute to the growing literature investigating political polarization. The large majority of studies in this field have focused on the determinants of polarization among voters. This strand of research has shown relationship between the rise in political polarization and rising import competition (Autor et al. 2020), intensified media partisanship (DellaVigna and Kaplan 2007; Levendusky 2013; Prior 2013), and financial crises (Mian et al. 2014; Funke et al. 2016). A polarized electorate can lead to more polarization in political speech, but this link is far from being established in the literature. In fact, causal evidence on the determinants of polarization in the content of political speech is largely

absent. This is surprising given the outburst of studies investigating polarization in parliamentary debates observed in the last years, with evidence from the US (Gentzkow et al. 2019; Lauderdale and Herzog 2016; Jensen et al. 2012), the UK (Peterson and Spirling 2018; Goet 2019), Norway (Fiva et al. 2022), and Finland (Salla 2020).¹ I therefore contribute to this literature by providing evidence of topic salience as a possible determinant of polarization in parliamentary debates.

Second, I contribute to the political economy of education literature. I show that the “PISA-shock” influenced the political discourse about education in Germany by increasing the salience of education. Other studies have highlighted the role of interest groups, unions (McDonnell and Weatherford 2013; Galey-Horn et al. 2020), and teacher strikes (Lyon and Kraft 2021) in shaping education policymaking. Public opinion and interest groups are often considered to have a greater role in shaping education policy than insights drawn from empirical data (West and Woessmann 2021). I challenge this notion by providing evidence on the far-reaching consequences of the introduction of international standardized assessment, such as PISA, on the policy-making debate about education. A likely reason behind the impact of the “PISA-shock” is that PISA introduced accountability for policymakers in education. Accountability has been often cited as a key factor to improve the quality of education systems (Bergbauer et al. 2021; Woessmann 2009; Figlio and Loeb 2011; Global Education Monitoring Report Team 2017). In fact, the lack of comparable student assessments in many countries prevented policymakers from being held accountable for students’ performance. This dramatically changed after PISA, as the strong reaction of German policy makers clearly illustrates. The influence of PISA, and the “PISA-shock”, for policymaking in education in various countries has been widely acknowledged in the literature.² To the best of my knowledge, no study has attempted to establish a causal relationship between PISA results and the political debate about education. I therefore fill the gap in this literature by providing causal evidence on how the international standardized assessment like PISA can shape education policymaking.

¹Using US congressional vote choices rather than parliamentary debates, Canen et al. 2020a, 2020b highlight the role of party discipline as a driver of political polarization.

²A vast literature has discussed the implication of PISA for education policy in various countries (Bieber and Martens 2011; Rinne et al. 2004; Grek 2009; Martens and Niemann 2013; Breakspear 2012, among others). A large number of studies have also investigated the consequences of the “PISA-shock” in Germany (Davoli and Entorf 2018; Ertl 2006; Neumann et al. 2010; Tillmann 2004; Waldow 2009, among others).

The remainder of this paper is structured as follows. In Section 2, I provide details about the “PISA-shock” and the German political system. In Section 3, I present the data used for the analysis and descriptive statistics. In section 4, I present the main results. Section 5 concludes.

2. Institutional Background

2.1. The “PISA-shock”

The publication of the results of the first PISA study on the 4th of December 2001 represented a watershed in the discourse on education in Germany. The poor largely unequal performance of German students in PISA sparked heated public debates, with newspapers’ headlines such as “Catastrophic Results for German Students” (FAZ 2001), “A Disaster in Almost Every Respect” (TAZ 2001), or “Are German students stupid?” (Der Spiegel 2001) populating German newspapers for months. In the two months after the publication of the PISA results, the OECD calculated that daily and weekly newspapers published 774 pages of printed article about this event in Germany, compared to 8 in Finland, the “PISA champion country”, 32 in France, whose placement was well above Germany in the PISA ranking, and 16 in Italy, whose performance was akin to Germany. The “tsunami-like” impact of this event in Germany (Gruber 2006) was so great that it was soon dubbed the “PISA-shock” and its consequences shaped the public and political debate about education in the following years. In June 2002, roughly 6 months after the “PISA-shock”, results for German federal states were published and revealed large differences in achievement between the states.³ Although there were already some indications of such heterogeneities (for example, Ebenrett et al. 2003), this event further fueled the already heated debate about education.

Several reasons lie behind the stir caused by the publication of the first PISA results. First, PISA contradicted the public’s perception of the German education system, an assessment that was characterized by self-confidence and belief in its efficiency, which reflected the strong country’s economy (Davoli and Entorf 2018). Second, it represented a threat to a major exporting economy that relies on human capital and skills for its competitive advantage. Third, PISA, and the *International Mathematics and Science Study* (TIMSS) before it, ended a long phase of German abstention from international

³ Results were published for all states but Berlin and Hamburg, which did not meet the required criteria for overall reporting (Artelt et al. 2002). State-specific results are reported in Table A2.

large-scale assessments (Waldow 2009). In fact, Germany's participation and low performance in the first TIMSS study in 1995 was the first wake-up call for the German education system, but this event, unlike PISA, was largely ignored by the German media (OECD 2011). Germany's decade-long abstention from international assessments was in line with educators' mainstream paradigm that "what is important about education cannot be measured" (Bos and Postlethwaite 2002). PISA abruptly ended this phase, and Germany committed itself to participating in international assessments for years to come.

The "PISA-shock" provided a formidable impetus for reforms in the German education systems. While an exhaustive exposition of such reforms is outside the scope of this paper,⁴ they mostly revolved around three areas: developing a monitoring system with common educational standards and central examination, expanding "all-day school" offers, and reforming the tracking system.

Many factors were behind the *genesis* of the "PISA-shock" and its consequences had far-reaching implications for the German education system. Yet, the entire German story was ultimately about accountability (OECD 2011). The lack of transparent assessments of the German education system prevented policymakers from being held accountable for its performance. The "PISA-shock" marked the end of this phase and Germany embraced a new paradigm based on international benchmarking and national education standards.

2.2. The German Political System

Germany is a federal country and comprises 16 states (*Länder*).⁵ Each state (*Land*) has its own constitution, elects its own parliament creates its own government. Matters of national importance, such as foreign affairs, defense, or citizenship, are competence of the federal parliament (*Bundestag*) and government, while each state parliament (*Landtag*) has full autonomy on various subject matters, such as education, culture, police, or the press.⁶ Elections in federal states occur at different times and with

⁴ Interested readers may find detailed accounts in Davoli and Entorf 2018; Waldow 2009; Gruber 2006; Ertl 2006; OECD 2011, among others.

⁵ An exhaustive description of the German political system is outside the scope of this paper. In this section, I aim at highlighting only the features that are most relevant for the scope of this paper.

⁶ A further category, which subjects such as environment, nature protection or land use, are jointly regulated by the federal and state parliaments. Interested readers may find the complete list of competences in <https://www.bpb.de/medien/189018/Foederalismus.pdf>.

different electoral laws. A typical legislative period lasts 5 years.⁷ Parliamentary debates in each state parliaments occur regularly, and, on average, 1.9 parliamentary sessions take place each month in each state.

The main political forces in the German political systems are the Christian-Democratic Union (CDU) with its sister Bavarian denomination (CSU), and the Social-Democrats (SDP). The second tier of political forces in the period 2000-2008 consists of the Liberals (FDP) and the Greens (GRÜNE).

3. Data and Descriptive Statistics

3.1. Data

The main source of data for this paper consists parliamentary debates of the 16 German states for the period 2000-2008. Parliamentary debates constitute the preferred data source to measure the polarization for a variety of reasons. First, they convey timely and abundant information as opposed to voting patterns of member of parliaments, an alternative measure that has often been used to measure. Second, parliamentary debates are a crucial way through which politicians obtain visibility in the media (Tresch 2009; Salmond 2014; Maltzman and Sigelman 1996) and express their views (Proksch and Slapin 2012), thus making them relevant for the policymaking process.

Germany is also the ideal setting for this study. Germany is a federal state, and each state has its own state parliaments. State parliaments are responsible for legislation on various subject matters, including education. With respect to other studies using parliamentary debates (Fiva et al. 2022; Salla 2020; Peterson and Spirling 2018; Goet 2019), this setting yields a much higher density of parliamentary debates, which is crucial to overcome the high-dimensionality issue inherent to text data (Gentzkow et al. 2019). Moreover, state elections do not occur at the same time, which ensures that my results are not driven by the idiosyncratic distance from upcoming elections or political leanings.

I obtained the entire population of parliamentary debates for the period of interest of each German state by scraping each state's official website.⁸ I then created a dataset that includes all speeches from the 16 German states for the period 2000-2008 as well as

⁷ Except for Bremen, where legislatures last 4 years.

⁸ Parliamentary debates of Saarland are not available in the official website for the period considered in this analysis. Nevertheless, these debates were made available for my research upon my request.

other additional information such as the state, date, name of the speaker, party, and other relevant information. I complemented this dataset with information about the date of the latest and next election and with the shares obtained by the two major German parties, the CDU/CSU and SPD, in the latest election in each state.⁹

The unit of analysis is a speech as recorded in the parliamentary debates. I consider a speech the continuous utterance issued by the same person. During a speech, speakers are often interrupted by remarks of other speakers, applause etc. Such interruptions are excluded from the speeches.

Other data sources include the “Politbarometer”, a survey performed since 1977 conducted at monthly intervals to poll opinions and attitudes of the German voting-age population (Forschungsgruppe Wahlen 2019).

3.2. Descriptive Statistics

The entire dataset consists of 622,946 speeches. I drop all the speeches by the President of each state parliament, 327,498 speeches, as these are strictly procedural and not informative of the political debates. I also drop all speeches with less than 100 words, namely 100,816 speeches, as these are too short to be reliably classified among different topics. The resulting sample consists of 210,006 speeches, and descriptive statistics of the dataset are reported in Table 1. The average length of a speech is 663.6 words. The share of speeches by ministers of each state parliament is 24%. The share of speeches issued by member of the main center-right party, CDU/CSU, is 34%, while the share for main center-left party, SPD, is 27%. These parties represent the main political forces in Germany and are the only parties that have been part of each German state parliament in the entire period considered. The second tier of political forces in the German landscape in this period is represented by the Green party and the FDP, the liberal party, with a share of speeches of 14% and 11%, respectively. Speeches from these four parties make up 86% of the entire corpus of parliamentary debates. None of the remaining parties reach the threshold of 5% of all the speeches in the corpus.

I developed an algorithm that can classify speeches about education, as it constitutes the main topic of interest. The algorithm combines both supervised and unsupervised machine learning methods. I first manually labelled a subset of the speeches (3,346) as education vs non-education speeches. I then used an unsupervised machine learning

⁹ I retrieved these data from Metawahl, an open-source project that collects data of all German elections.

method, topic modeling with 20 topics,¹⁰ to identify latent topics in the entire corpus of speeches. Topic modeling assigns to each speech a set of weights that indicate the weight of each of the 20 topics in the speech, with weights summing up to one for each speech. I used such weights as regressors to train a supervised machine learning method that classifies education speeches. The share of speeches classified as being about education in the dataset through this algorithm is 8.9%, or 18,703 speeches. The topics of the other speeches are classified using topic modelling and assigning the topic with the highest weight to each speech. I report the share of speeches by topic in Figure A1.

I define polarization as the extent to which opinion on a topic are opposed. Assuming that politicians use different words to express different opinions, the more polarized the speeches, the less similar they are. I therefore measure the level of polarization in parliamentary debates using the inverse of the standardized cosine similarity, a measure of text similarity, between the speeches from a benchmark party and all other speeches in the same topic and legislative period. In the main specification, the benchmark party consists of the party with the largest share of speeches in the parliamentary debates, namely the CDU/CSU. Alternatives to this benchmark party, such as using the second largest party in terms of share of speeches, namely the SPD, or governing parties, yield qualitatively similar results. To compute the cosine similarity, I first perform standard preprocessing steps such as removal of stopwords, punctuation and numbers. I then compute the term-frequency inverse-document frequency (tf-idf) scores of the speeches. This representation of the text is aimed at reducing the dimensionality of the speeches by downweighing very frequent or very infrequent terms in the entire corpus of the speeches. I perform tf-idf separately for each topic in order to capture topic-specific vocabulary. I validate the polarization measure by computing the average polarization between a benchmark party and other parties in Table A1. The polarization measure aggregated at the party level is much lower for the CDU/CSU (SPD) when the CDU/CSU (SPD) is used as the benchmark party, thus confirming that the measure does capture differences in the speeches issued by member of different parties.

¹⁰ The true number of topics is unknown to the researcher; I chose 20 topics as this was the number of topics that yielded the best result in terms of prediction of the topic education.

TABLE 1—DESCRIPTIVE STATISTICS

	Mean	SD	Min/Max
	(1)	(2)	(3)
Word Count	663.57	(622.52)	100.0-17503.0
Share CDU/CSU	0.34	(0.47)	0.0-1.0
Share SPD	0.27	(0.44)	0.0-1.0
Share GREENS	0.14	(0.34)	0.0-1.0
Share FDP	0.11	(0.32)	0.0-1.0
Share Ministers	0.24	(0.42)	0.0-1.0
Share Gov. Speeches	0.53	(0.50)	0.0-1.0
Share Education Speeches	0.09	(0.28)	0.0-1.0
# Observations		210,006	
# States		16	
# Parl. Sessions		3,277	

Notes: Descriptive statistics from parliamentary debates. The share of speeches is reported separately only for parties for which the total number of speeches is larger than 5% of the entire corpus of speeches.

The performance in the PISA 2000 reading test of each German state is reported in Table A2. State-specific results were released on the 25th of June 2002, almost seven months after the PISA-Shock. There is a large heterogeneity in the performance. The average score of the best performing German state, Bayern, is 62% of a standard deviation higher than the lowest performing state, Bremen. In an international perspective, this corresponds to the distance between the best performing state in the reading test of PISA 2000, Finland, and Germany, whose performance was well below the OECD average. It is also important to note that the state-specific results of Berlin and Hamburg were not released due to low participation rates.

The “PISA-Shock” had a substantial impact on the public debate about education. In Figure 1, I report the share of respondents that indicate education as the most or second most important problem in Germany.

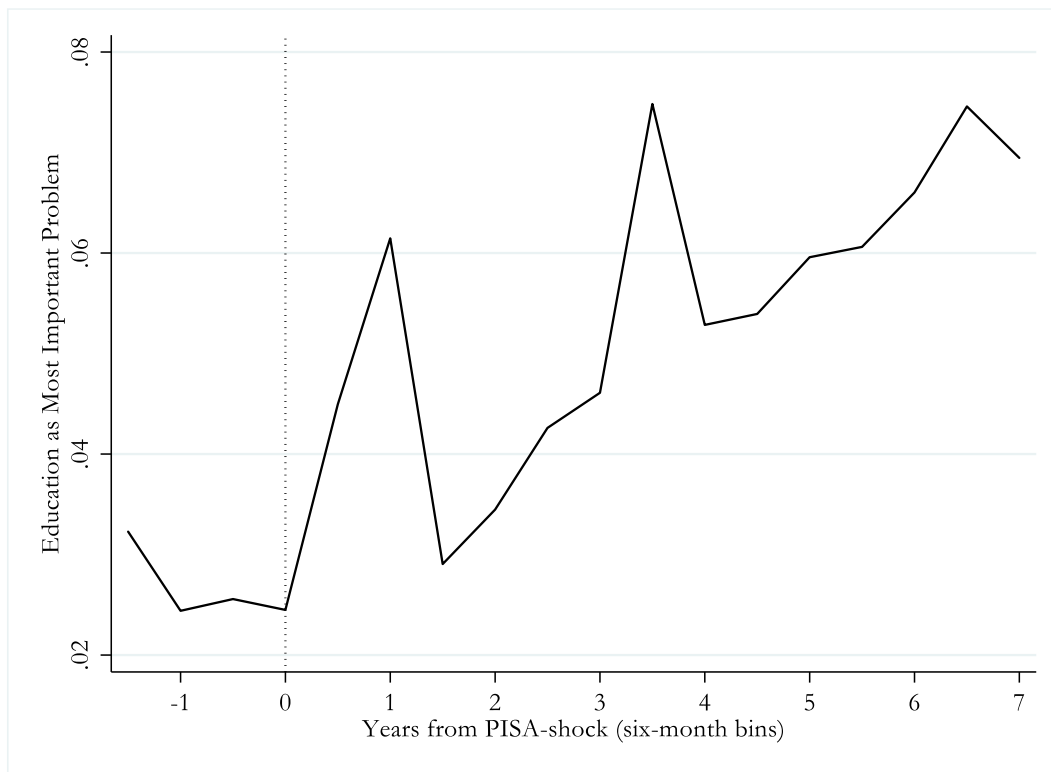


FIGURE 1. EDUCATION AS MOST IMPORTANT PROBLEM

Notes: Data source: Politbarometer (Forschungsgruppe Wahlen 2019). The y-axis reports the share of respondents that indicated education as the most or second most important problem in Germany. The x-axis reports the distance (in years) from the “PISA-shock”, which occurred on the 4th of December 2001. Data are aggregated into six-month bins.

The share of respondents who regarded education as the most or second most important problem in Germany increased dramatically after the “PISA-shock”. In the two years prior to the “PISA-shock”, only 2.7% of respondents indicated education as the most or second most important problem in Germany on average. This share more than doubled after the “PISA-shock”: on average, 5.7% of respondents indicated education as the most or second most important problem in Germany in the seven years after the “PISA-shock”. It is also interesting to note that the “PISA-shock” triggered an upward trend in the importance of education, as it never reverted to its pre-shock level in the seven years after the shock.

A similar pattern emerges when looking at parliamentary debates. In Figure 3, I report the share of speeches about education and the number of times that “PISA” was mentioned in parliamentary debates in Figure 2. This figure clearly depicts the “tsunami-like” impact of the release of the first PISA results on the political debate about education. The share of speeches about education increased by 1.8 percentage points after the “PISA-shock”. This effect translates into a 22% increase with respect to

the pre-shock share of 7.3% and is statistically significant (see Table A3). In the first six months after the “PISA-shock”, the term “PISA” was mentioned more than 2,000 times in parliamentary debates. Overall, “PISA” was mentioned almost 11,000 times after the “PISA-shock”. These figures substantiate the claim that the salience of education increased dramatically because of the “PISA-Shock”. The impact of this exogenously induced increase in salience of education on the political debate will be analyzed in the Section 4.

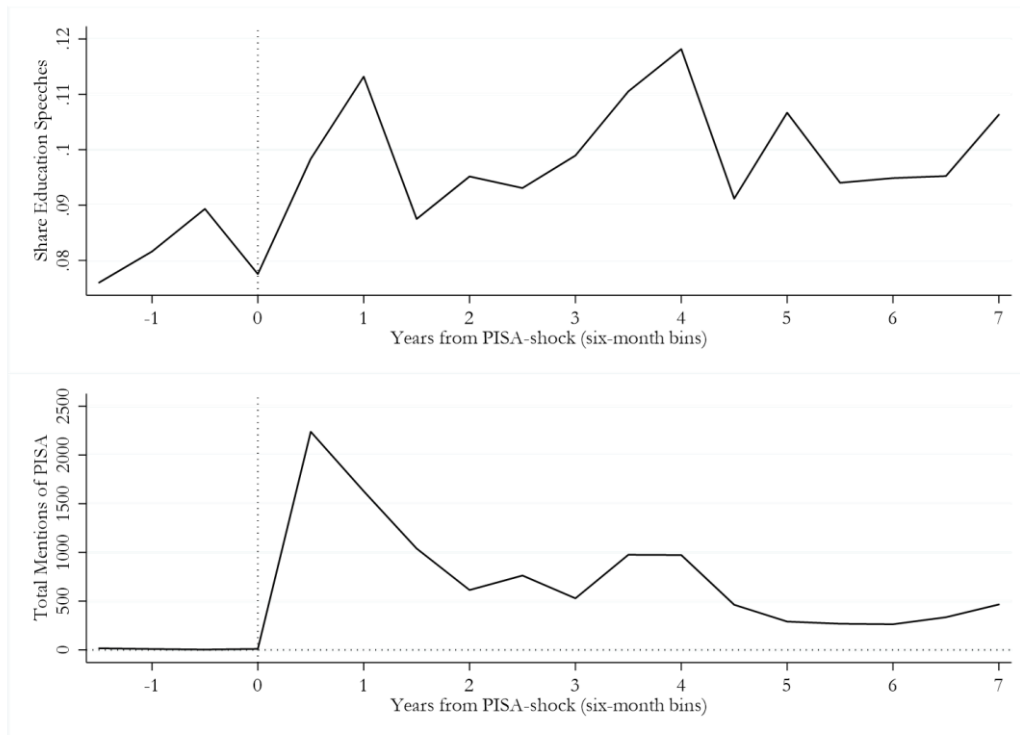


FIGURE 2. THE “TSUNAMI”-LIKE IMPACT OF “PISA”

Notes: The figure reports the share of education speeches in parliamentary debates in the upper panel and the total number of mentions of the term “PISA” in parliamentary debates in the lower panel. The x-axis reports the distance (in years) from the “PISA-shock”, which occurred on the 4th of December 2001. Data are aggregated into six-month bins.

4. Empirical Strategy

To establish a causal link between the salience of a topic and polarization in political debates, one would need exogenous variation in the salience of a topic. The largely unexpected low performance of Germany in the PISA study, which resulted in the “PISA-shock”, thus makes the setting of this study is suitable for this analysis.

I develop a differences-in-differences strategy that controls for topic-invariant time-trends in the polarization of political debates. I exploit the fact that the “PISA-shock”

was largely about a single topic: education. The counterfactual group consists of speeches in topics that were not affected by the “PISA-shock”.. I therefore estimate the impact of topic salience on polarization using the following equation:

$$y_{islt,p \neq b} = \alpha_0 + \alpha_1 PostPISA_t + \beta PostPISA \times Ed_{st} + \gamma' X_{islt,p \neq b} + \tau_s + \sigma_l + \varepsilon_{islt,p \neq b} \quad 1$$

The outcome variable $y_{islt,p \neq b}$ denotes the polarization between speech i by member of party p and all the speeches of benchmark party $p = b$ in topic s and state-legislative period cell l at time t . Speeches from the benchmark parties are therefore omitted from the analysis. The dummy variable $PostPISA_t$ takes value one if speech occurred after the “PISA-shock” (4th December 2001). The interaction term, $PostPISA \times Ed_{st}$ takes value one if a speech occurred after the “PISA-shock” and if it is about education. The parameter of interest, β , is thus estimated net of underlying time-trends in the polarization of the political debates. $X_{islt,p \neq b}$ is a vector of speech, state, and time specific controls, such as the length of the speech i , the shares of the two main parties, CDU/CSU and SPD, at time t in state s , whether the speech i is given by a member of a governing party, is given by a minister, and distance from the next election in state s at time t . τ_s, σ_l denote topic and state-legislative period fixed effects, respectively; $\varepsilon_{islt,p \neq b}$ is the idiosyncratic error. This approach, however, comes at the cost of imposing a parallel-trend assumption of the treated and untreated units. I provide evidence on the validity of this assumption in the next Section.

5. Results

5.1. Main Results

I report evidence of the validity of the parallel-trends assumption using an event-study design in Figure 3. The figure does not show diverging trends in the period prior to the “PISA-shock”, and I cannot reject the null hypothesis of pre-event effects being zero, thus suggesting that polarization in political debates about education and other topics were following the same trend before the shock. Conversely, the test of post-event effects being jointly null is largely rejected. It can also be noted that the impact of the “PISA-shock” on polarization seemingly fades out over time and that polarization reverts to its pre-shock level only 6 years after the shock.

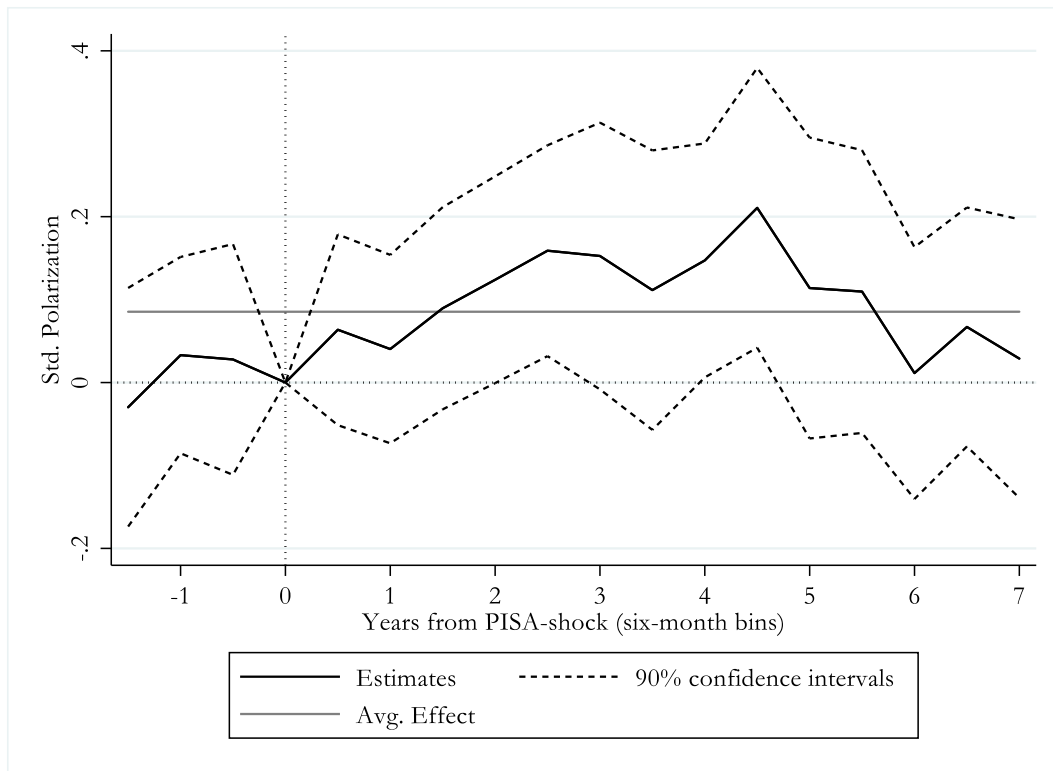


FIGURE 3. THE IMPACT OF THE PISA-SHOCK ON POLARIZATION IN EDUCATION DEBATES: EVENT-STUDY GRAPH

Notes: Coefficients from a non-parametric event-study regressions and their 95 percent confidence intervals. The dependent variable is the standardized cosine similarity between each speech and all speeches from the governing parties in each state and election period. Data have been aggregated in six-month bins. The x-axis reports the distance (in years) from the “PISA-shock”, which occurred on the 4th of December 2001. The 6 months prior to the PISA-Shock is the excluded category. Standard errors are clustered at the state level. The *p-values* of the joint hypothesis tests of zero pre- and post-event effects are 0.646 and 0.000, respectively.

The validity of the assumption allows to interpret the estimated parameters in a causal way. I report the estimates of Equation 1 in Table 2. The magnitude of the impact varies between 10.7 and 8.5% SD. All coefficients are statistically significant at the five

percent level. The preferred estimate is the one in Column 3, where I control for state-legislative, party and year fixed effects and additional control variables. The estimated coefficient implies an increase in polarization of 8.5% SD. This impact translates into an increase in polarization which is roughly equivalent to 21% of the polarization between the main center-right and center-left parties.¹¹ Overall, these results show that the “PISA-shock” had a substantial and persistent impact on the political debates about education.

TABLE 2—PISA-SHOCK AND POLITICAL POLARIZATION IN EDUCATION DEBATES -DIFFERENCES-IN-DIFFERENCES

	(1)	(2)	(3)
PISA-Shock × Education	0.107** (0.041)	0.114** (0.042)	0.085** (0.038)
State-Legislative Period FE	No	Yes	Yes
Party, Year FE	No	Yes	Yes
Controls	No	No	Yes
R-squared	0.007	0.223	0.628
Observations	137,775	137,775	137,775

Note: Differences-in-differences estimate of the impact of the “PISA-Shock” on the polarization. The dependent variable is the standardized polarization with CDU/CSU as the benchmark party. All regressions include topic fixed effects. Controls include the length of a speech, the distance from the next election and a dummy variable for each topic. The data include all education from January 2000 till September 2008. Standard errors (in parentheses) have been clustered at the state level. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

5.2. State-Specific Heterogeneities

The initial “PISA-shock”, which occurred on 4th of December 2001, was followed by a state-specific “PISA-shock”, which occurred on the 26th of June 2002. On this date, German state-specific results were released and revealed large heterogeneities in the performance of German states (reported in Table A2). I therefore investigate whether the impact of the “PISA-shock” differed with respect to the actual performance of each state. To this purpose, I first create an additional treatment variable (*PISA-shock (State)*) to capture whether a speech occurred after the 26th of June 2002. First, I interact this variable with a dummy indicating whether the state-specific results were published at all, since for two states, Berlin and Hamburg, they were not published. Second, I interact the dummy *PISA-shock (State)* with a set of dummies that capture whether each state’s performance was in the lower, middle, or upper tercile of the distribution of

¹¹ The figure is obtained by dividing the estimated coefficient (0.085) by the difference between the polarization measure for the CDU/CSU and the SPD when the CDU/CSU is used as the benchmark party (0.41), which can be found in Table A1 (Column 1).

performance of German states. I further explore this hypothesis by interaction the *PISA-shock (State)* treatment with the actual performance of each German state. Results can be found in Table 3. Surprisingly, the table shows that the impact of the “PISA-shock” was rather homogenous not only with respect to whether state specific results were published or not, but also with respect to the actual performance of each German state. This already emerged in Table A3, which did not show any significant heterogeneity of the impact of the “PISA-shock” on the share of education speeches. A possible explanation for these results is that differences in performance across German states were already known to policymakers prior to PISA. Thus, while surprising for the electorate, this information was not new to politicians.¹²

TABLE 3—HETEROGENEITIES BY STATE-SPECIFIC PERFORMANCE

	(1)	(2)	(3)	(4)
PISA-shock (<i>Federal</i>) × Education	0.035 (0.044)	0.044 (0.045)	0.042 (0.036)	0.042 (0.036)
PISA-shock (<i>State</i>) × Education	0.055 (0.043)	0.048 (0.045)	0.054 (0.043)	0.053 (0.044)
PISA-shock (<i>State</i>) × Education × PISA score		0.068 (0.069)		
PISA-shock (<i>State</i>) × Education × Medium			-0.056 (0.091)	
PISA-shock (<i>State</i>) × Education × High Perf.			-0.079 (0.088)	
PISA-shock (<i>State</i>) × Education × PISA Perf. /				-0.098 (0.193)
State-Legisl. Period, Party, Year FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
R-squared	0.628	0.620	0.635	0.635
Observations	137,775	137,775	119,283	119,283

Note: Differences-in-differences estimate of the impact of the “PISA-Shock” on the polarization of education speeches. The dependent variable is the standardized polarization with CDU/CSU as the benchmark party. All regressions include topic fixed effects. The variable, PISA-shock (Federal) is a dummy variable which takes value one if a speech occurred after 4th December 2001. The variable PISA-shock (State) is a dummy variable that takes value one if a speech occurred after 26th June 2002. The medium performance variable takes value one if the performance of the respective state is in the middle tercile, while high performance takes value one if the performance is in the upper tercile. Standard errors (in parentheses) have been clustered at the state level. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

¹²For example, IQ data from 1992 to 1998 collected by the German military service revealed a virtually identical pattern as the one presented by PISA in terms of state-specific heterogeneity (Ebenrett et al. 2003).

5.3. Heterogeneity by Party

I explore which parties contributed the most to the increase in polarization in Table 4. It is worth reminding that, since the benchmark party is the CDU/CSU, party interactions capture the polarization of each party with respect to the CDU/CSU. Results show that the increase in polarization is driven by a cleavage between the two main parties, the CDU/CSU and the SPD. In fact, the interaction between treatment dummy and the SPD dummy is positive and statistically significant in Column 5, where all the interactions are included. The pattern for the Green Party, the other main center-left party, is qualitatively the same, although it does not reach any conventional level of statistical significance. Conversely, the liberal party, a center-right party, does not seem to contribute to the increase in polarization. These results are compatible with a cleavage theory framework, where the main center-right and center-left parties exploited the increased salience of education induced by the “PISA-shock” to amplify their ideologically distinctiveness.

TABLE 4—HETEROGENEITIES BY PARTY

	(1)	(2)	(3)	(4)	(5)
PISA-shock × Education	0.087** (0.040)	0.061* (0.033)	0.091* (0.044)	0.085 (0.050)	0.010 (0.071)
PISA-shock × Education × SPD		0.057 (0.044)			0.108** (0.041)
PISA-shock × Education × FDP			-0.024 (0.050)		0.057 (0.079)
PISA-shock × Education × GREENS				0.011 (0.063)	0.085 (0.083)
State-Legisl. Period, Party, Year FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
R-squared	0.620	0.620	0.620	0.620	0.620
Observations	137,775	137,775	137,775	137,775	137,775

Notes: Differences-in-differences estimate of the impact of the “PISA-Shock” on the polarization of education speeches. The independent variable is the standardized cosine similarity between each education speech and all the education speeches given by the members of governing parties in the same state and legislative period. Controls include the length of a speech, distance from the next election, CDU/CSU and SPD share of votes obtained at the latest election. The data include all education from January 2000 till September 2008. Standard errors (in parentheses) have been clustered at the state level. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

5.4. Robustness Checks

In this section, I first check that results are robust the choice of a different party as the benchmark party for the computation of the polarization measure. I report the results in Table 5. Coefficients are qualitatively the same as those shown in Table 2, thus confirming that the results are not driven by the choice of a benchmark party.

TABLE 5—TOPIC SALIENCE AND POLITICAL POLARIZATION (SPD)

	(1)	(2)	(3)
PISA-shock × Education	0.137** (0.032)	0.114** (0.031)	0.078** (0.031)
State-Legisl. Period FE	No	Yes	Yes
Party FE	No	Yes	Yes
Year FE	No	Yes	Yes
Controls	No	No	Yes
R-squared	0.005	0.229	0.632
Observations	152,300	152,300	152,300

Notes: Differences-in-differences estimate of the impact of the “PISA-Shock” on the polarization. The dependent variable is the standardized polarization with CDU/CSU as the benchmark party. Controls include the length of a speech, the distance from the next election and a dummy variable for each topic. The data include all education from January 2000 till September 2008. Standard errors (in parentheses) have been clustered at the state level. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Another concern is that the effect might also be driven by other factors, such as the release of the results of subsequent PISA studies, which occurred at intervals of three years. To mitigate this concern, I shrink the time window of the analysis until 2004, thus excluding subsequent PISA releases. I report results in Table 6, which are almost identical to those reported in Table 2. This corroborates the claim that the increase in polarization occurred as a consequence of the “PISA-shock”.

TABLE 6—TOPIC SALIENCE AND POLITICAL POLARIZATION (2000-2004)

	(1)	(2)	(3)
PISA-shock × Education	0.104** (0.046)	0.092** (0.041)	0.088** (0.041)
State-Legisl. Period FE	No	Yes	Yes
Party FE	No	Yes	Yes
Year FE	No	Yes	Yes
Controls	No	No	Yes
R-squared	0.007	0.235	0.637
Observations	72,797	72,797	72,797

Notes: Differences-in-differences estimate of the impact of the “PISA-Shock” on the polarization. The dependent variable is the standardized polarization with CDU/CSU as the benchmark party. Controls include the length of a speech, the distance from the next election and a dummy variable for each topic. The data include all education from January 2000 till December 2004. Standard errors (in parentheses) have been clustered at the state level. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

6. Conclusion and Further Research

The rise of polarization observed in many democracies has fueled a lively debate on the causes on such phenomenon. While research on the determinants of polarization in the electorate abounds, much less is known about what drives polarization in political speech. In this paper, I shed light on topic salience as a possible determinant of polarization in parliamentary debates. I find that the sharp increase in the salience of education induced by the “PISA-shock” in Germany had a strong and long-lasting impact on the polarization of debates about education. Further, I provide evidence that politicians discussed education related issues much more extensively in the aftermath of the “PISA-shock”. These results have important implications for our understanding of the phenomenon of polarization in political debates.

In the next step, I plan to include the following analysis:

- Analyze in which direction the debate about education evolved by further exploiting differences with respect to the content of the speeches of each party
- Exploit party manifesto to tease out heterogeneity with respect to the salience of education in each manifesto before the “PISA-shock”
- Run falsification test to validate the measure of polarization (by randomly assigning a speech to a party)
- Develop further measures of polarization

- Improve the counterfactual by exploiting correlations between topics
- Run robustness checks with respect to different time windows across the shock, different measures of polarization

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Appendix A

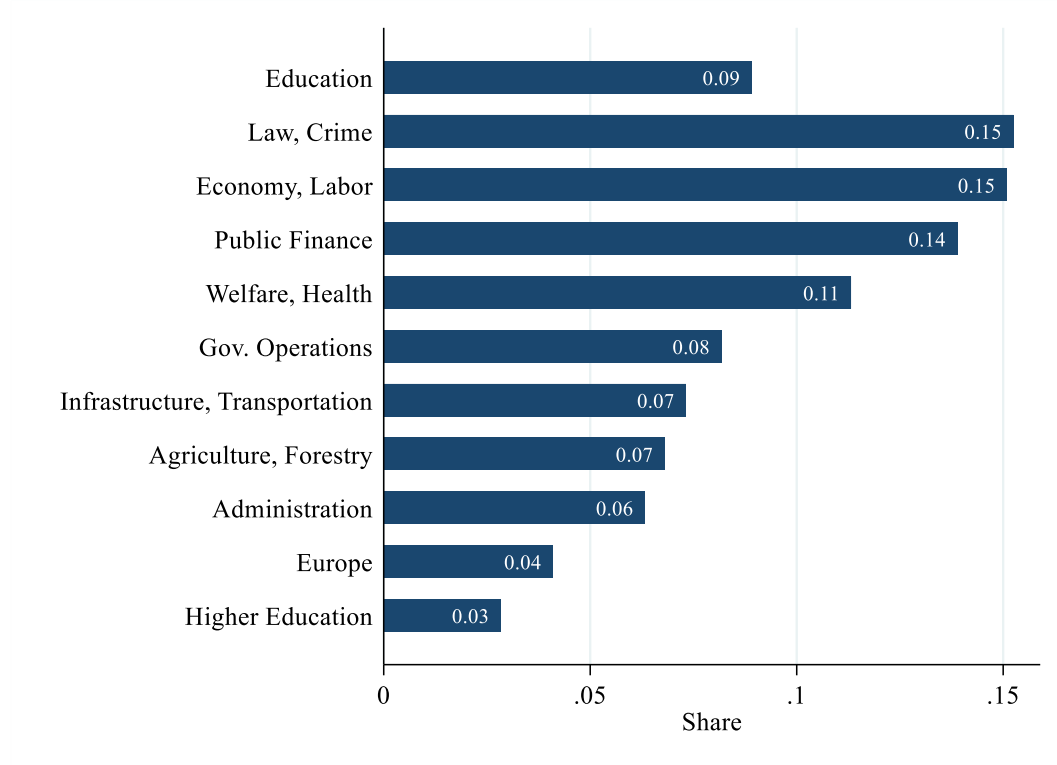


FIGURE A1. SHARE OF CLASSIFIED TOPICS

Notes: I classified the topic “education” with a machine learning algorithm. The remaining topics have been classified using an unsupervised machine learning algorithm, namely topic modelling, and assigning the topic with the highest weight to each speech.

TABLE A1—POLARIZATION BY PARTY

Party	Statistics	Benchmark: CDU/CSU	Benchmark: SPD
		(1)	(2)
CDU/CSU	Mean (SD)	-0.30 (1.15)	0.13 (0.95)
SPD	Mean (SD)	0.11 (0.94)	-0.40 (1.15)
GREENS	Mean (SD)	0.15 (0.83)	0.06 (0.88)
FDP	Mean (SD)	0.18 (0.77)	0.21 (0.77)

Notes: The table reports the average polarization measure with respect to a benchmark party by party. The polarization measure consists of the inverse of the standardized cosine similarity between the all the speeches from a benchmark party (CDU/CSU in Column 1 and SPD in Column 2) and all the other speeches in the same topic and legislative period.

TABLE A2—STATE-SPECIFIC RESULTS IN PISA 2000

State	State Score Reading (1)	Deviation from federal mean (2)	Position in interna- tional PISA ranking (3)
Bayern	510	26	11
Baden-Württemberg	500	16	18
Sachsen	491	7	23
Rheinland-Pfalz	485	1	25
Saarland	484	0	27
NRW	482	-2	29
Thuringia	482	-2	30
Schleswig-Holstein	478	-6	33
Hessen	476	-8	34
Niedersachsen.	474	-10	36
Mecklenburg-Vorpommern	467	-17	38
Brandenburg	459	-25	40
Sachsen-Anhalt	455	-29	42
Bremen	448	-36	44

Notes: The table reports the average performance in reading of each German state in Column 1, the distance from the average German performance in Column 2, and position in the international PISA ranking in Column 3. Data have been taken from OECD (2001). Results for Berlin and Hamburg were not made public due to these states not meeting the prescribed threshold of sample size.

TABLE A3—THE EFFECT OF THE “PISA-SHOCK” ON THE SHARE OF EDUCATION SPEECHES

	(1)	(2)	(3)	(4)
PISA-shock (Federal)	0.018*** (0.005)	0.018** (0.007)	0.018** (0.007)	0.018** (0.007)
PISA-shock (State)		-0.006 (0.005)	-0.007 (0.009)	-0.190 (0.123)
PISA-shock (State) × Medium Perf.			-0.004 (0.009)	
PISA-shock (State) × High Perf.			0.015 (0.010)	
PISA-shock (State) × PISA Perf./100				0.038 (0.025)
Mean DV (Pre-shock)		0.073		
State FE	No	Yes	Yes	Yes
Party FE	No	Yes	Yes	Yes
Controls	No	Yes	Yes	Yes
R-squared	0.001	0.009	0.009	0.009
Observations	210,006	210,006	210,006	210,006

Notes: The table report OLS estimate of the impact of the “PISA-shock” on the share of education speeches. The dependent variable is a dummy variable indicating whether a speech is about education. The variable, PISA-shock (Federal) is a dummy variable which takes value one if a speech occurred after 4th December 2001, when the first PISA results were released. The variable PISA-shock (State) is a dummy variable that takes value one if a speech occurred after 26th June 2002, the date on which state specific results were released. The medium performance variable takes value one if the performance of the respective state is in the middle tercile, while high performance takes value one if the performance is in the upper tercile. The PISA Performance variable represents the performance on each state as reported in Table A1 (Column 1). Controls include distance from the next and previous election, the CDU/CSU and SPD share of votes obtained at the latest election *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.