Decision-making of Voters' Election Behavior: A new perspective based on Peak-end rule

Abstract:

This paper introduces the peak-end rule to economic voting, finding that voters focus on peak and end economic growth when evaluating incumbents. Cross-national data from 595 elections in 70 countries (1960-2020) shows that the average of the highest GDP growth rate during the term and the growth rate in the election year positively impacts incumbent vote share, with peak growth having a stronger effect. Instrumental variable analysis addresses endogeneity. Heterogeneity analysis reveals that less-educated voters rely more on the peak-end rule. The findings contribute to understanding voters' behavioral patterns and improving democratic accountability.

Keywords: Economic Voting, Peak-end rule, Voter rationality， Myopic, Cross-National

1 Introduction

Voting is the cornerstone of democracy, and understanding how voters evaluate and respond to the performance of incumbent governments is crucial for both political science and economics. A large body of literature on economic voting has shown that voters tend to reward or punish incumbent governments based on their economic performance (Lewis-Beck & Stegmaier, 2000; Nannestad & Paldam, 1994). However, there remains a long-standing debate about the time horizon over which voters evaluate economic performance. Some studies argue that voters are rational and forward-looking, basing their decisions on the overall economic performance

throughout the incumbent's term (Brender & Drazen, 2008; Aytac, 2018; Ferris & Voia, 2020; Hibbs, 2006), while others suggest that voters are myopic and focus disproportionately on economic conditions in the period leading up to the election (Kramer, 1971; Healy & Lenz, 2014; Dassonneiville and Lewis-Beck 2014). However, existing studies have paid insufficient attention to how voters respond to the temporal dynamics of economic conditions. Moreover, they face considerable challenges in identifying exogenous variations in economic conditions, which limits the credibility of causal inference.

We argue that this debate can be reconciled by drawing on insights from behavioral economics, particularly the peak-end rule. This rule, first proposed by Kahneman et al. (1997), posits that people's retrospective evaluations of experiences are disproportionately influenced by the most intense points (peaks) and the final moments (ends), rather than the average of the entire experience. The peak-end rule reflects a memory bias in which people tend to overweight the most emotionally salient and recent experiences when evaluating the past (Fredrickson & Kahneman, 1993). The peak-end rule has been widely documented in various domains, such as perception psychology (Schreiber & Kahneman, 2000), affective and cognitive psychology (Fredrickson & Kahneman, 1993), media psychology or consumer behavior research (Hands & Avons, 2001), food and nutrition psychology (Robinson et al., 2011) and medical psychology or patient behavior research (Redelmeier & Kahneman, 1996), its implications for economic voting have yet to be fully explored.

Recent research in political science and psychology suggests that voters may not

evaluate incumbents' performance in a fully rational manner, but rather rely on heuristics or cognitive shortcuts that can lead to biased decisions. For instance, Healy and Lenz (2014) provide experimental evidence that voters intend to reward politicians based on cumulative growth over their tenure, but are disproportionately swayed by the economic performance in the final year before the election. They argue that this "end heuristic" arises because the election-year economy serves as a salient and accessible information shortcut for voters to evaluate the incumbent's overall performance. Similarly, Huber, Hill, and Lenz (2012) conducted a series of experiments to understand whether biases observed in real-world elections, such as overweighting recent events, could be replicated in a controlled setting. They found that participants indeed outweighed recent performance, were influenced by irrelevant information, and were susceptible to rhetorical framing when evaluating incumbents.

These findings suggest that voters face inherent cognitive limitations in making informed decisions based on incumbents' performance, and highlight the need to consider how the temporal dynamics of economic conditions shape electoral choices. However, while the "end heuristic" emphasizes the importance of the final period, it does not fully capture the potential role of other salient or intense periods, such as economic booms or recessions, in shaping voters' evaluations. This raises the question of whether the peak-end rule may provide a more complete account of how voters respond to the temporal dynamics of economic performance.

The most direct evidence for the applicability of the peak-end rule to economic voting comes from a recent field experiment by Galiani et al. (2019). By manipulating

the timing and size of conditional cash transfers to poor households in Honduras before the 2013 presidential election, they found that larger transfers in the peak and end periods significantly boost voter turnout and support for the incumbent party, regardless of the cumulative amount transferred. While this study provides compelling micro-level evidence for the peak-end rule in a specific context, it remains unclear whether the findings generalize to other countries and policy domains, or more aggregate measures of economic performance.

Our paper aims to address these gaps by providing the first comprehensive test of the peak-end rule in economic voting using cross-national observational data. Specifically, we construct a large panel dataset covering 595 democratic elections in 70 countries from 1960 to 2020 and measure the peak and end economic growth within each incumbent government's term. By leveraging both within-country variation in economic growth patterns and cross-country variation in political institutions, we can estimate the causal effect of peak and end growth on incumbents' electoral performance, while accounting for potential confounding factors at the country and year level. This approach allows us to test the generalizability of the peak-end effect across diverse institutional and cultural contexts, extending the external validity of previous experimental studies. To further address endogeneity concerns, we employ an instrumental variable strategy that exploits exogenous shocks to countries' economic growth stemming from fluctuations in global oil prices and U.S. interest rates. This approach allows us to isolate the causal effect of peak and end growth on voting outcomes, providing a more credible test of the peak-end rule

compared to previous observational studies.

Our findings provide strong evidence that voters follow the peak-end rule when evaluating incumbents' economic performance. Specifically, we find that a one percentage point increase in the average of peak and end growth rates leads to a 1.5 percentage point increase in the incumbent party's vote share, controlling for the overall economic performance during the term. Moreover, we find that the effect of peak growth is significantly stronger than that of end growth, suggesting that voters are more attentive to extremely positive outcomes than to recent conditions. Finally, we show that the peak-end effect is more pronounced in countries with lower levels of education, consistent with the idea that less informed voters are more susceptible to behavioral biases.

Our paper makes several contributions to the literature. First, we introduce the peak-end rule to the study of economic voting, thereby shedding light on the pivotal role of peak economic growth within a leader's term in influencing electoral outcomes. While Galiani et al. (2019) provide micro-level experimental evidence for the peak-end rule in the context of a specific cash transfer program, our study is the first to test this theory using comprehensive cross-national data on election outcomes and economic performance. Compared to the extant literature, which predominantly relies on country-specific studies and focuses on the significance of economic growth in the election year (Arel-Bundock et al., 2019; Dassonneiville and Lewis-Beck 2014; Powell & Whitten, 1993), our paper propels the discourse forward by examining the peak-end rule across a wide range of institutional and economic contexts. Furthermore,

our study builds upon and extends the work of Healy et al. (2014) and other researchers who have investigated the role of election-year economic growth in shaping voters' evaluations of incumbents. While these studies have highlighted the importance of recent economic conditions, our paper reveals that voters are not only swayed by the final year but also by the most extreme positive economic outcomes experienced at any point during the incumbent's tenure. By directly measuring the peak and end of economic growth within each leader's term, we provide a more precise and comprehensive test of the peak-end rule, demonstrating that the peak component plays a particularly crucial role in influencing electoral outcomes.

Second, this paper employs an instrumental variable strategy to address the endogeneity problem, a critical issue that has been identified but scarcely addressed in economic voting studies. The economic performance of countries with close economic ties may exert influence on both the economic and electoral outcomes within a nation (Freitas et al., 2020; Aytac, 2018), which leads to the endogeneity problem. While Galiani et al. (2019) use an experimental design to establish causality, their approach is not feasible for large-scale observational studies like ours. To tackle this issue, we introduce two instrumental variables: the global oil price and the U.S. federal funds rate. By exploiting the exogenous variation in economic growth induced by these global economic factors, we can estimate the causal effect of peak-end economic performance on electoral outcomes more credibly than previous observational studies.

Third, our findings have important implications for the accountability of

democratic governments and the design of electoral institutions. The peak-end rule suggests that voters may not always reward or punish incumbents based on their overall performance, but rather focus disproportionately on extreme and recent economic conditions. This behavioral bias could potentially undermine the effectiveness of elections as a mechanism for holding governments accountable, as it may lead to the selection of leaders based on factors beyond their control. Our research thus highlights the need for electoral reforms that could help mitigate the impact of cognitive biases on voting decisions, such as providing voters with more comprehensive and balanced information about the incumbent's performance over their entire term.

In the next section, the datasets will be described in detail, as well as the empirical strategy. In Section 3, the baseline result will be presented. Section 4 also presents robustness checks. Heterogeneity analysis will also be studied in Section 5. Finally, Section 6 concludes.

2 Data and empirical strategy

2.1 Data and variables

This study constructs a comprehensive cross-national dataset covering 70 countries from 1960 to 2020, focusing on election years with a positive democracy level. The democracy level data is obtained from the Polity IV dataset provided by the University of Maryland. We obtain the economic variable, the annual percentage growth rate of GDP at market prices based on constant local currency, from the World Bank. Political information, including political structure, is acquired from the

Database of Political Institutions, also maintained by the World Bank. Election results from 1990 to 2020 are gathered from the International Foundation for Electoral Systems, while data from 1960 to 1990 are collected from election data handbooks (Nohlen et al., 2004). Furthermore, information on the term of each government leader is obtained from Zarate's Political Collections.

The incumbent party is defined as the party to which the head of government belongs at the beginning of the election, having governed for more than two years. If the head of government resigns within 12 months prior to the election, their party is still considered the incumbent party, as they are held accountable for the economic performance during their term. In parliamentary democracies, the vote share is calculated as the ratio of seats won by the incumbent party to the total number of seats in the legislature after the election. In presidential systems, the vote share is the percentage of votes won by the incumbent party in the final round of the upcoming election. Data on vote share and parliamentary seats are collected from the Database of Political Institutions and the Parliament and Government Composition Database (Döring & Manow, 2012).

Based on the concept of remembered utility (Kahneman et al., 1997), this study employs the average of the peak and end economic performance to represent voters' impressions. Additionally, it incorporates military expenditure, trade openness, and corruption as control variables. Military expenditure, expressed as a percentage of GDP, is obtained from the Stockholm International Peace Research Institute. Trade openness is calculated as the ratio of the sum of import and export values to GDP,

with raw data sourced from the CEIC Database, International Monetary Fund, and World Bank. Corruption data, specifically the extent of political corruption, is derived from the Varieties of Democracy Project. The data sources are summarized in Table 1.

Table1

Source of data

Election data	Database of Political Institutions	The World Bank
	Electionguide.org	International foundation for Electoral systems
	World Political Leaders	Zarate's Political Collections
	Parliament and government composition database	Doring&Manow(2012)
	Elections in Africa: A Data Handbook	Nolhen, Grotz, Hartmann(2004)
	Elections in Asia and Pacific: A Data Handbook, vol. I	Nolhen, Grotz, Hartmann(2004)
	Elections in Asia and Pacific: A Data Handbook, vol. II	Nolhen, Grotz, Hartmann(2004)
	Elections in the Americas: A Data Handbook, vol I	Nolhen, Grotz, Hartmann(2004)
	Elections in the Americas: A Data Handbook, vol II	Nolhen, Grotz, Hartmann(2004)
Political system	Database of Political Institutions	The World Bank
GDP growth rate		The World Bank
Mining activities	usgs.gov/centers/nmic/data-tools	National Mineral Information Centre
Military expenditure		Stockholm International Peace Research Institute
Trade openness		CEIC Data International Monetary Foundation World Bank

Corruption		
Energy	eia.gov	U.S. Energy Information Administration
Interest Rate		Federal Reserve Bank

2.2 Empirical strategy

Galiani et al. (2019) suggest that the peak-end rule may play a significant role in shaping voters' evaluations of incumbents' economic performance. They propose two potential mechanisms through which the peak-end rule might operate in the context of economic voting. First, voters may simply rely on peak-end heuristics as a cognitive shortcut, given the inherent difficulty of recalling and aggregating economic information over an entire electoral term. Second, voters may deliberately focus on peak and end economic conditions as the most informative signals of incumbents' competence or preferences, particularly in the period leading up to an election.

Building upon these insights, we argue that the peak-end rule can provide a useful framework for understanding voters' retrospective evaluations of incumbents' economic performance in a cross-national context. When making retrospective economic voting decisions, voters may evaluate the peak and end moments of the incumbent party's economic performance throughout their term. If voters are satisfied with both the peak and end economic performance, they will vote for the incumbent party; otherwise, they will choose other parties.

This behavior can be attributed to two factors, which extend the mechanisms proposed by Galiani et al. (2019) to a macro-level context. Firstly, impressive economic events, often accompanied by extremely high or low GDP growth, tend to capture voters' attention. These salient episodes may serve as heuristic devices that

voters use to evaluate the incumbent's overall performance, even if they do not reflect the average economic conditions during the term.

Secondly, economic performance close to the election is more salient compared to the rest of the term, as it is more easily retrievable from memory. Voters may interpret strong economic performance just before an election as a signal of the incumbent's competence or future policy intentions, making it particularly influential in shaping their voting decisions. In contrast, earlier economic performance may be discounted or forgotten, even if it was relatively strong.

Consequently, these peak and end moments are expected to have a critical impact on the election outcome, as predicted by the peak-end rule. Based on this discussion, the empirical model can be specified as follows:

$$: VoteShare_{it} = \delta_i + \gamma_t + \beta_1 peakend_{it} + X + \varepsilon_i \quad (1)$$

$$VoteShare_{it} = \delta_i + \gamma_t + \beta_1 peak_{it} + \beta_2 end_{it} + X + \varepsilon_i \quad (2)$$

Our empirical analysis is based on a panel dataset covering 70 countries over the period 1960-2020. The dataset is structured at the country-election year level, meaning that each observation represents a unique combination of country i and election year t. Therefore, the subscripts i and t in equations (1) and (2) denote countries and election years, respectively. The dependent variable $VoteShare_{it}$ represents the percentage of the vote share received by the incumbent party in the election held in country i and year t. It is important to note that this variable is only observed in election years, while the economic growth variables on the right-hand side of equations (1) and (2) are measured over the entire term of the incumbent party.

δ_i is the country fixed effect, and γ_t is the year fixed effect. In Equation (1), $peakend_{it}$ is calculated as the arithmetic average of the highest GDP growth rate during the term of incumbent party and the GDP growth rate in the final year of that term, as the peak-end rule theory predicted. The term is defined as starting from the date the political party took office and ending on the date of the election.

To calculate, we first identify the highest GDP growth rate achieved during the incumbent party's term and the GDP growth rate in the final year before the election. These two values are then averaged to obtain $peakend_{it}$. It is worth noting that the determination of which years are included in the incumbent party's term depends on the timing of the election. Specifically, if the election is held before June 30th, the economic performance of the election year itself is not considered part of the current term but will be included in the calculation for the next term. Conversely, if the election is held after June 30th, the election year's economic performance is considered part of the current term but will not be included in the calculation for the next term.

Prior studies have shown that economic performance in the final year of an incumbent's term plays a critical role in election outcomes (Dassonneville & Lewis-Beck, 2014). Consequently, it is plausible that the average of peak and end GDP growth rates may significantly influence election results due to the incorporation of the final year's GDP growth. However, it is also possible that only the final year's economic performance, not the peak GDP growth throughout the term, contributes to this impact. To address this potential ambiguity and ensure a clear understanding of

the separate influences of peak and end GDP growth rates, this study decomposes the peak-end GDP growth into two distinct components, as demonstrated in Equation (2). In Equation (2), $peak_{it}$ represents the highest GDP growth in the term, and the end_{it} represents the GDP growth in the final year of the term. $\mathbf{X}$ are the control variables, including military expenditure, trade openness and corruption index. Military expenditure is measured as a percentage of GDP. Trade openness is measured by the ratio of the sum of the import and export values to the GDP. The corruption index measures the pervasiveness of political corruption, with a higher value indicating a higher level of corruption. ε_i is the error term.

To obtain causal estimates of the impact of peak and end-period GDP growth rates on election outcomes, we employ an identification strategy that addresses two types of endogeneity concerns within our model. The first arises from omitted variables that may affect both economic growth and election results. The second stems from the potential correlation between peak-end growth and cumulative growth over the incumbent's term.

To tackle the first type of endogeneity, we use an instrumental variable approach. We employ two instruments: the change in global oil prices and the U.S. federal funds effective rate interacted with a country's degree of financial integration. The change in international oil prices, weighted by each country's average share of oil production in GDP, has been discussed in detail in previous studies (Acemoglu et al., 2013; Brückner & Grüner, 2019). As an important energy source, oil price fluctuations critically impact economic growth, especially in countries with a large petroleum

industry, while being plausibly exogenous to election outcomes due to the presence of OPEC.

Furthermore, we introduce the U.S. federal funds effective rate as a novel instrument. We instrument peak-end growth with the average federal funds rate during the same two years used to calculate peak-end growth. Previous papers have studied the spillover effects of the federal funds rate on the global economy (Georgiadis, 2015; Iacoviello & Navarro, 2018). Importantly, the Federal Reserve has prioritized domestic monetary policy over international financial stability since 1973, making it unlikely that the Fed would directly influence foreign elections (Eichengreen, 2013). To account for heterogeneous responses to changes in the federal funds rate, we interact it with each country's degree of financial integration, measured by its external assets and foreign reserves (Lane and Milesi-Ferretti, 2017).

The validity of our instruments relies on their relevance and exogeneity. We argue that both instruments satisfy the relevance condition as important drivers of economic fluctuations. While difficult to prove definitively, we contend that they are plausibly exogenous to election outcomes, being determined by factors largely outside the control of any single country.

However, addressing the endogeneity of economic growth does not directly tackle the endogeneity of peak-end growth. As argued by Healy and Lenz (2014), cumulative economic growth over the incumbent's entire term may influence election outcomes in addition to peak-end growth. The endogeneity of peak-end growth arises because it is likely correlated with cumulative growth, which is not fully captured by

the instruments.

Directly controlling for cumulative growth would lead to high multicollinearity with peak-end growth, as the latter is a component of the former. Multicollinearity can inflate the standard errors of the estimated coefficients, making it difficult to interpret the individual effects of peak-end and cumulative growth. By using the average of economic growth rates in non-peak and non-end years as a proxy for cumulative growth, we circumvent this issue and obtain more precise estimates of the peak-end effect. This approach effectively separates the effects of peak-end growth from growth in other years, allowing us to control for the influence of cumulative growth without introducing multicollinearity issues. By decomposing cumulative growth into peak-end and non-peak-end components, we can isolate the causal effect of peak-end growth on election outcomes while accounting for the overall economic performance during the incumbent's term.

By addressing both types of endogeneity concern, namely the endogeneity of economic growth and the endogeneity of peak-end growth, our identification strategy provides credible causal estimates of the impact of peak and end-period economic growth on election outcomes.

The main variables and descriptive statistics are shown in Table 2.

Table 2

Descriptive statistics

Variable	Mean	SD	Obs
Dependent Variable			
Vote_share	36.829	18.739	595
Reelection	0.421	0.494	595
Independent Variable			

Peak	5.357	3.213	595
End	3.332	3.229	595
Min	0.762	3.500	595
R_average	2.909	2.728	350
World_GDP_growth	3.296	0.982	595
Control Variable			
Military_expenditure	0.022	0.022	562
Trade_openness	0.303	0.657	393
Corruption_index	0.235	0.253	562
Instrument Variable			
Interest_rate	4.918	3.585	483
Reserve	22439.12	82134.94	483
Assets	517335.6	1966855	483
Oil_price	30.32	28.904	547
Oil_rents	1.273	3.49	547

3 Empirical Results

3.1 Baseline estimates

Table 3 presents the empirical results of the impact of peak-end economic growth on election outcomes. Column (1) shows that peak GDP growth is positive and statistically significant at the 1% level, with a larger coefficient than that of end GDP growth. This result implies that peak GDP growth has a greater influence on election outcomes compared to end GDP growth. Column (2) considers both peak and end GDP growth jointly, as predicted by the peak-end rule theory. The coefficient is positive (1.186) and statistically significant at the 1% level, indicating that a 1 percent increase in the average of peak and end GDP growth leads to a 1.186 percent increase in the vote share of the incumbent party. Notably, the coefficient of peak-end GDP growth in column (2) is larger than the coefficient of peak GDP growth in column (1). This suggests that end GDP growth may also influence election outcomes, although

its coefficient is relatively small and not statistically significant.

Table 3

Peak-end GDP growth and election outcome (Baseline: OLS)

	(1)	(2)	(3)	(4)	(5)	(6)
Peak	0.951***		1.231***		1.054**	
	(0.315)		(0.465)		(0.473)	
End	0.238		0.197		0.384	
	(0.302)		(0.421)		(0.414)	
Peak_end		1.186***		1.358***		1.418***
		(0.279)		(0.317)		(0.374)
Country fixed effect	No	No	Yes	Yes	Yes	Yes
Year fixed effect	No	No	No	No	Yes	Yes
R^2	0.0363	0.0333	0.3902	0.3851	0.4577	0.4560
Observations	595	595	595	595	595	595

Note:Standard errors clustered at the country-level are in parentheses.

*, ** and *** are significant at the levels of 10%, 5% and 1%, respectively.

Columns (3) and (4) introduce country fixed effects, which absorb cross-country differences in election systems and other institutional characteristics, capturing both time-invariant and cross-country variation in election outcomes. After adding country fixed effects, the coefficients of peak GDP growth and peak-end GDP growth remain positive and statistically significant at the 1% level, with larger magnitudes compared to the previous estimates.

Time fixed effects are included in columns (5) and (6). Initially, time fixed effects were not included due to potential multicollinearity between the end-year dummy and end-year GDP growth, which may render end-year GDP growth statistically insignificant. However, time fixed effects are important as they capture the impact of major global events. After presenting the results without time fixed effects, the specification is updated to include them. The results show that the coefficients of both peak GDP growth and end GDP growth are greater than the estimates in column (1),

while the significance of peak GDP growth declines to the 5% level. Consequently, the coefficient of peak-end GDP growth is found to be larger than the previous estimates.

In reality, various factors can simultaneously influence both election outcomes and economic growth. For example, tense diplomatic relations can increase defense spending, promoting economic growth while dissatisfying some voters. Corruption can impede long-term economic growth and undermine trust in the incumbent party. Trade openness can benefit local consumers while harming local producers, potentially causing the incumbent party to lose support from local producers.

Table 4

Peak-end GDP growth and election outcome (Baseline: Adding control variables)

	(7)	(8)	(9)	(10)	(11)	(12)
Peak	1.467***		1.441***		1.371***	
	(0.375)		(0.630)		(0.481)	
End	0.128		0.121		0.246	
	(0.362)		(0.358)		(0.501)	
Peak_end		1.539***		1.501***		1.544***
		(0.428)		(0.001)		(0.516)
military	93.306	101.064	86.974	93.549	193.813	193.984
	(81.942)	(78.830)	(82.411)	(79.679)	(155.329)	(154.842)
corruption			11.281	13.152	13.605	16.384
			(23.341)	(23.749)	(33.135)	(33.0545)
trade					-3.068***	-3.254***
					(0.673)	(0.648)
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.475	0.469	0.476	0.4703	0.5630	0.5591
Observations	562	562	562	562	371	371

Note:Standard errors clustered at the country-level are in parentheses.

*, ** and *** are significant at the levels of 10%, 5% and 1%, respectively.

Table 4 presents the results of the model with additional control variables, such as military expenditure, corruption index, and trade openness, as well as country and

time fixed effects. In columns (7), (9), and (11), the coefficient of peak GDP growth is greater than the baseline estimates and remains statistically significant at the 1% level, while the coefficient of end GDP growth is smaller than the baseline estimates. The coefficients of peak-end GDP growth in columns (8), (10), and (12) are larger than the baseline estimates and statistically significant at the 1% level. These results suggest that the baseline estimation may underestimate the coefficients of peak GDP growth and peak-end GDP growth, implying that their coefficients may be larger when more control variables are included in the specification. This finding lends further credence to the importance of the peak-end rule in shaping voters' evaluations of incumbents, as documented by Galiani et al. (2019) in a field experiment setting.

3.2 Endogenous problem

In this section, we address the potential endogeneity concerns in our model by employing a comprehensive two-step approach. First, we use an instrumental variable strategy to tackle endogeneity in the effect of economic growth on election outcomes, which may arise due to omitted variables. Second, we control for the influence of economic growth in non-peak and non-end years to isolate the causal effect of peak-end growth on election results, addressing the endogeneity stemming from the correlation between peak-end growth and cumulative growth.

As Graham et al. (2020) point out, many seemingly random and irrelevant events, such as natural disasters, sporting events, and lottery results, can impact election outcomes. Therefore, the model presented above may suffer from endogeneity problems, as many factors can simultaneously influence economic growth and

election results. To address this issue, we adopt an instrumental variable strategy.

Table 5 presents the estimation results using different instrumental variables. Initially, we considered three instrumental variables to estimate GDP growth rates: the federal funds effective rate weighted by foreign reserves and external assets, changes in global mineral prices weighted by countries' share of mineral production in GDP, and changes in global oil prices weighted by countries' share of oil production in GDP.

However, in the instrumental variable estimations, only the federal funds rate and changes in global oil prices were used, as mineral price changes exhibited a weak instrument problem. Detailed information on the instrumental variable estimation using mineral price changes can be found in Appendix A.

Although the original data (including instrumental variables and economic growth data for 70 countries from 1960-2020) showed a strong relationship between the instrumental variables and economic growth, this relationship weakened after matching election results with peak and end-period GDP growth rates within each term. This led to a reduction in the sample size to 595 observations. Furthermore, the years with the highest economic growth and election years differ from other years, indicating that the sample selection is non-random after the matching process, further weakening the relationship. As a result of these issues, weak instrument problems may arise when separately matching instrumental variables for peak and end-period GDP growth rates in the estimation. We find that the F-statistic decreases when the instrumental variables for peak and end-period GDP growth rates are jointly included

in the first-stage estimates. To avoid this problem, only the peak-end GDP growth rate is included in the instrumental variable estimations.

In column (13), the federal funds effective rate weighted by foreign reserves and external assets is set as the instrumental variable. The coefficient of the peak-end GDP growth rate is positive (3.3) and statistically significant at the 1% level, suggesting that a 1% increase in the average of peak and end-period GDP growth rates will increase the incumbent party's vote share by 3.3%. In column (14), oil price changes weighted by countries' share of oil production in GDP are used as the instrumental variable. The coefficient of the peak-end GDP growth rate remains positive (5.072) and statistically significant at the 1% level. Considering that OPEC countries, whose income largely depends on oil exports, may strategically adjust oil production to influence prices and boost GDP growth rates for re-election purposes, we exclude Venezuela, an OPEC country, from the sample in column (14). The coefficient of the peak-end GDP growth rate increases, while its statistical significance remains unchanged. This coefficient is larger than the baseline estimates, indicating that the true effect of the peak-end GDP growth rate may be greater than previously estimated. The larger coefficients on peak-end GDP growth in the instrumental variable estimations (Table 5) compared to the baseline estimates (Table 3) are consistent with the findings of Galiani et al. (2019). The Hausman test is significant in columns (14) and (15), suggesting the presence of endogeneity in the baseline estimates.

To evaluate the relevance and validity of the instrumental variables, Panels A and B of Table 5 report various test statistics and the first-stage estimates of the excluded

instruments, respectively. In every column of Table 5, the p-values from the Kleibergen-Paap LM test are smaller than 0.1, rejecting the null hypothesis that the endogenous regressors are unidentified. The first-stage Kleibergen-Paap F-statistic is above 10 in all three columns of Table 3. According to Stock and Yogo (2005), for the first-stage Kleibergen-Paap F-statistics of the 2SLS estimations in Table 5, the hypothesis that the maximum IV bias is larger than 10% can be rejected at the 5% significance level. In all three columns of Table 5, the p-values from the Hansen J-test exceed 0.1. Thus, the Hansen J-test fails to reject the assumption that the instruments are valid.

Panel B reports the first-stage estimates of the excluded instruments. The coefficients of all instruments, except for the current federal funds effective rate weighted by external assets, are statistically significant at the 5% level. The negative coefficient for the federal funds rate can be explained by the fact that higher rates may hinder economic growth, particularly in countries with larger foreign reserves and external assets. In columns (14) and (15), the coefficient of oil price changes weighted by countries' share of oil production in GDP is also positive and significant at the 1% level. This is consistent with the expectation that higher oil prices and a larger proportion of oil production in GDP will lead to greater economic growth resulting from rising global oil prices.

Table 5

Peak-end GDP growth and election outcome (Robustness: Instrumental variables estimation)

	(13)	(14)	(15)
Panel A: Second stage estimates			
Peak_end	3.310***	5.072***	5.421***

	(1.283)	(1.254)	(1.946)
Kleibergen-Paap rk LM test, p-value	0.0511	0.0259	0.0291
Kleibergen-Paap rk F statistic	10.761	30.375	12.815
Hansen J test, p-value	0.393		
Endogeneity test, p-value	0.2786	0.0062	0.0439
Panel B: First stage estimates			
*Interest_rate*Reserves*	2.60e-06***		
	(9.64e-07)		
*Interest_rate, t-1*Reserves*	-2.98e-06***		
	(8.674-07)		
*Interest_rate*Assets*	1.44e-07		
	(1.25e-07)		
*Interest_rate, t-1*Assets*	-2.35e-07**		
	(1.21e-07)		
*Oil_price_change*Oil_rent*		86.695***	83.783***
		(15.836)	(23.403)
Controls and Observations in panels A and B			
Country fixed effect	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes
Observations	483	547	542

Note:Standard errors clustered at the country-level are in parentheses.

*, ** and *** are significant at the levels of 10%, 5% and 1%, respectively.

While the instrumental variable approach addresses the endogeneity of economic growth, it does not directly tackle the endogeneity of peak-end growth. As argued by Healy and Lenz (2014), cumulative economic growth over the incumbent's entire term may also influence election outcomes, in addition to peak-end growth. The endogeneity of peak-end growth arises because it is likely correlated with cumulative growth, which is not fully captured by the instruments.

To address this second type of endogeneity, we construct a variable capturing the average of economic growth rates in non-peak and non-end years within the term,

denoted as R_average, and include it as a control variable in the model. This approach effectively separates the effects of peak-end growth from growth in other years, allowing us to control for the influence of cumulative growth without introducing multicollinearity issues. By decomposing cumulative growth into peak-end and non-peak-end components, we can isolate the causal effect of peak-end growth on election outcomes while accounting for the overall economic performance during the incumbent's term.

Table 6 presents the results of this approach.[1] In column (16), we include both the peak GDP growth rate and R_average in the specification. The coefficient of the peak GDP growth rate remains positive and statistically significant at the 1% level, while the coefficient of R_average is not statistically significant and smaller than that of the peak GDP growth rate. This result suggests that the peak GDP growth rate plays a more critical role in election outcomes than economic growth in other years. Similarly, in column (17), the coefficient of the peak-end GDP growth rate remains positive and statistically significant at the 1% level when R_average is included, further supporting the importance of peak-end growth in driving election results.

Column (18) presents the result of instrumental variable estimation using global oil price as instruments when controlling for R_average. The coefficient of the peak GDP growth rate increases and remains statistically significant at the 1% level, while the coefficient of R_average remains insignificant. The Kleibergen-Paap LM test and F-statistic indicate that the instruments are relevant, and the endogeneity test suggests

[1] It's worth noting that the sample size reduced to 350 since there are 245 samples which only have two years in the term.

the presence of endogeneity, justifying the use of the instrumental variable approach.

Table 6

Peak-end GDP growth and election outcome (Robustness: Other years in term)

	(16) OLS	(17) OLS	(18) 2SLS
Peak	2.011***		6.382***
	(0.697)		(2.065)
End	0.534		
	(0.551)		
Peak_end		2.335***	
		(0.627)	
R_average	0.568	0.722	-0.677
	(0.642)	(0.628)	(0.922)
Kleibergen-Paap LM test, p-value			0.0734
Kleibergen-Paap F statistic			16.458
Endogeneity test, p-value			0.0630
Country fixed effect	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes
R^2	0.580	0.574	0.501
Observations	350	350	325

Note:Standard errors clustered at the country-level are in parentheses.

*, ** and *** are significant at the levels of 10%, 5% and 1%, respectively.

The robust coefficient on peak-end GDP growth after controlling for economic growth in non-peak and non-end years (Table 6) indicates that the effect of peak-end growth is distinct from that of overall economic performance during the incumbent's term. This finding echoes the analysis of Galiani et al. (2019), who separately examine the impact of peak-end cash transfers and cumulative transfers on voting behavior. Our results confirm that the peak-end rule has an independent effect on election outcomes, over and above the influence of total economic growth.

4 Robustness

4.1 Other possible explanation

This paper has considered various potential explanations that could bias our estimates of peak-end GDP growth in the baseline and IV estimates, including the possibility that only peak or end effect on the election outcome, the negative peak, and sub-sample regression.

4.1.1 Peak or end alone

To determine whether the peak or end GDP growth alone can significantly influence election outcomes, we conducted separate analyses. First, columns (19) and (21) in Table 7 examine the possibility that the impact of peak GDP growth on election outcomes might be attenuated when end GDP growth is not controlled for. However, our results suggest that even when end GDP growth is not included in the specification, peak GDP growth still has a large and significant impact on the election outcome. The coefficient of peak GDP growth remains positive and significant at the 1% level in both OLS and IV estimates. This finding demonstrates that peak GDP growth is a robust predictor of election outcomes, regardless of whether end GDP growth is accounted for. The finding that peak GDP growth has a significant impact on election outcomes, even when end GDP growth is not controlled for, is consistent with the results of Galiani et al. (2019). In their study, the effect of peak cash transfers on voting behavior remains significant and substantial, regardless of whether end cash transfers are accounted for.

Table 7

Peak-end GDP growth and election outcome (Robustness: other potential explanation)

	(19)	(20)	(21)	(22)	(23)	(24)
	OLS	OLS	2SLS	2SLS	OLS	OLS

Peak	1.275***		5.225***		2.02***	
	(0.356)		(1.994)		(0.548)	
End		0.930***		4.01***	0.673	0.679***
		(0.336)		(1.373)	(0.534)	(0.047)
Peak_end						
min						0.636**
						(0.344)
Kleibergen-Paap LM test, p-value			0.0491	0.0415		
Kleibergen-Paap F statistic			12.535	10.615		
Endogeneity test, p-value			0.0169	0.0922		
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.455	0.445	0.2371	0.2751	0.5604	0.4525
Observations	595	595	547	547	387	595

Note:Standard errors clustered at the country-level are in parentheses.

*, ** and *** are significant at the levels of 10%, 5% and 1%, respectively.

We also investigated the potential reasons behind the insignificance of end GDP growth in the baseline estimates. One possibility is that the end growth might not be statistically significant when regressed individually, leading to its insignificance when peak GDP growth is included in the specification. To test this, we conducted separate OLS and IV estimates for end GDP growth, as shown in columns (20) and (22) of Table 7. Surprisingly, the results reveal that end GDP growth is positive and statistically significant at the 1% level when considered alone. This finding is consistent with the results reported in previous literature, implying that end GDP growth does indeed affect election outcomes when analyzed independently.

The decision to examine peak and end GDP growth separately stems from the need to gain a clearer understanding of their individual effects on election outcomes.

By isolating each component, we can determine whether the insignificance of end GDP growth in the baseline estimates is due to the presence of peak GDP growth or other factors. Furthermore, this approach allows us to assess the robustness of peak GDP growth's impact on election outcomes and compare our findings with those of previous studies focusing on end GDP growth alone.

4.1.2 The negative peak

In previous behavioral economics studies (Kahneman et al., 1993; Redelmeier & Kahneman, 1996), the term "peak" referred to both positive and negative outcomes. To investigate whether negative economic peaks have a similar effect on election outcomes as positive peaks, we replace the highest GDP growth in the term with the lowest GDP growth, denoted as "min" in column (24) of Table 7. The coefficient of "min" is positive and statistically significant at the 1% level, indicating that the lowest GDP growth in the term also influences election outcomes. However, the coefficient of the lowest GDP growth is much lower than that of the peak GDP growth, suggesting that voters may be more sensitive to positive economic peaks than negative ones.

Another interesting finding is that the coefficient of end GDP growth becomes statistically significant when peak GDP growth is replaced by the lowest GDP growth. This result may imply that the positive impact of end GDP growth on election outcomes largely depends on the presence of a positive economic peak earlier in the term. In other words, voters may attribute more importance to end GDP growth when there is no significant positive peak to overshadow it.

The decision to examine the effect of negative economic peaks on election outcomes stems from the need to gain a more comprehensive understanding of how voters respond to different types of economic extremes. By comparing the coefficients of the highest and lowest GDP growth, we can determine whether voters place equal emphasis on positive and negative economic events or if they exhibit asymmetric reactions. This analysis also helps to clarify the relationship between peak and end GDP growth in shaping election outcomes, as the significance of end GDP growth may vary depending on the presence and nature of economic peaks.

4.1.3 Sub-sample regression

Brender & Drazen (2008) found that the impact of GDP growth on election outcomes is greater in developing countries than in developed countries. A possible explanation for this might be that economic growth is more important to voters in developing countries due to their lower income per capita. To investigate whether there is a difference in the impact of peak-end GDP growth between developing and developed countries, we divide our sample into two groups, as shown in Table 8. In columns (25) and (26), the coefficient of peak GDP growth is the same for both developing and developed countries, suggesting that the importance of peak economic performance is consistent across different levels of economic development.

Table 8

Peak-end GDP growth in developing country and developed country

	(25)	(26)	(27)	(28)
	Developed	Developing	Developed	Developing
Peak	1.408***	1.403**		
	(0.446)	(0.658)		
End	-0.198	0.660		
	(0.463)	(0.711)		

Peak_end			1.191***	2.012***
			(0.404)	(0.658)
Country fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
R^2	0.571	0.5256	0.5631	0.5237
Observations	324	271	324	271

Note:Standard errors clustered at the country-level are in parentheses.

*, ** and *** are significant at the levels of 10%, 5% and 1%, respectively.

However, there is a considerable difference in the coefficient of end GDP growth between developing and developed countries, although both are not statistically significant. This result suggests that the impact of end GDP growth in developed countries is smaller than in developing countries. We propose that this difference could be due to the presence of political business cycles (PBC) in these two types of countries. According to the PBC literature, political budget cycles exist primarily in low-income countries or new democracies (Janků & Libich, 2019). This implies that incumbent parties in developed countries have less incentive to increase government expenditure before an election because voters in these countries place less emphasis on end-year GDP growth when making economic voting decisions.

Consequently, the coefficient of peak-end GDP growth is positive and statistically significant at the 1% level in both developing and developed countries, but the size of the coefficient differs considerably in Columns (27) and (28). The results in columns (27) and (28) suggest that this difference can be explained by the varying influence of end-year GDP growth rather than voters' preferences for economic growth. If the difference were due to different demands for economic growth in different countries, the coefficient of peak GDP growth would not be the same in developing and developed countries.

Table 9

The peak-end GDP growth and the election outcome in different periods

	(29) 1960-1990	(30) 1990-2020	(31) 1960-1990	(32) 1990-2020	(33) 1960-1990
Peak	0.357	1.490***			
	(0.816)	(0.480)			
End	0.892	0.025			0.394
	(0.975)	(0.504)			(0.706)
Min					2.022**
					(0.923)
Peak_end			1.239**	1.461***	
			(0.562)	(0.485)	
Country fixed effect	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes
R^2	0.623	0.4558	0.623	0.449	0.658
Observations	198	397	198	397	198

Note:Standard errors clustered at the country-level are in parentheses.

*, ** and *** are significant at the levels of 10%, 5% and 1%, respectively.

To further explore the temporal dynamics of the peak-end effect, we divide our observations into two periods: 1960-1990 and 1990-2020, as shown in Table 9. In columns (30) and (32), the results show that in the more recent period, both peak GDP growth and peak-end GDP growth are positive and statistically significant at the 1% level. However, in the earlier period, the coefficient of peak GDP growth is not statistically significant, while the coefficient of end GDP growth is larger, as shown in column (29).

We offer several explanations for this discrepancy. One possibility is that the reduced sample size of the earlier period may have led to biased estimates. However, the coefficient of peak-end GDP growth remains positive and statistically significant in column (31), implying that there are other explanations. Another possibility is that there are more instances of peak GDP growth occurring in election years between

1960 and 1990, leading to a smaller and insignificant coefficient for peak GDP growth. However, only 73 of the 198 observations exhibit this phenomenon, which is similar to the ratio in the full sample.

To further investigate this issue, we analyze the descriptive statistics of the sub-sample and full sample. Table 10 shows little difference between peak and end GDP growth, while the lowest GDP growth is noticeably larger in the sub-sample compared to the full sample. Consequently, we conduct additional analyses that include the lowest GDP growth rate in the 1960-1990 period. Surprisingly, in column (33) of Table 9, the coefficient of the lowest GDP growth is even larger than that of peak GDP growth in the baseline estimates. We speculate that this may be due to voters using international economic performance as a reference point for their economic voting decisions (Aytac, 2018), and that the world GDP growth rate during the earlier period was higher than during the more recent period. This may have led voters to hold the incumbent party to a higher standard, making them less concerned with positive peaks and more concerned with negative peaks.

Table 10

Descriptive statistics of the sub-sample and full sample

	1960-1990 Mean	1960-1990 SD	Observations	Full sample Mean	Full sample SD	Observations
Peak	5.624	3.204	198	5.357	3.212	595
End	3.455	3.285	198	3.332	3.229	595
Min	1.219	3.322	198	0.762	3.500	595
World	3.791	1.249	198	3.296	0.982	595

4.2 Peak-end rule in reference point

In Table 9, the paper finds that when the global economy is prosperous, the highest GDP growth will not be worth noting anymore. Instead, the lowest GDP growth will impress the voters more, leading to dissatisfaction with the incumbent party.

The result suggest that reference points do make sense in the behavior of economic voting. The election outcome may not simply depend on the absolute value of peak GDP growth, but rather on relative value of peak GDP growth compared to the global average GDP growth, which serves as a reference point. In order to ensure the robustness of our benchmark estimation, this paper enter the world average GDP growth is entered into the specification in this part. The model estimation results are shown in Table 11.

Table 11 presents that the world average GDP growth entered the specification through different forms. In columns (34) and (35), Relative peak-end GDP growth is calculated as peak-end GDP growth minus the world average GDP growth, while in column (36) and (37), it is measured as the ratio between peak-end GDP growth and world average GDP growth. Our main results still hold when we considered reference point in our OLS estimation and IV estimation, and we find the coefficient of the peak-end economic performance become more statistically significant.

Table 11

Peak-end rule in reference point

	(34)	(35)	(36)	(37)	(38)	(39)

	OLS	OLS	OLS	OLS	2SLS	2SLS
Relative_peak	1.082**					
	(0.465)					
Relative_end	0.367					
	(0.464)					
Relative_Peak_end		1.419***			5.136***	
		(0.367)			(1.331)	
Peak/World_economy			1.784*			
			(1.062)			
End/World_economy			1.010			
			(0.981)			
Peak_end/World_economy				2.661***		16.348***
				(0.909)		(4.582)
Kleibergen-Paap rk LM test, p-value					0.0264	0.0255
Kleibergen-Paap rk F statistic					29.087	20.406
Hansen J test, p-value					0.0071	0.0017
Endogeneity test, p-value	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect						
R^2	0.444	0.455	0.445	0.444	0.2948	0.0568
Observations	595	595	595	595	547	547

Note:Standard errors clustered at the country-level are in parentheses.

*, ** and *** are significant at the levels of 10%, 5% and 1%, respectively.

4.3 Replacing vote share with reelect

In the previous section, the paper found a significant impact of the peak-end GDP growth on the incumbent party's vote share. However, a higher vote share does not always mean a reelection. Therefore, we replaced the independent variable vote share with the binary variable reelect for two reasons. First, to verify whether the peak-end GDP growth has a critical impact on the reelection. Second, to ensure the robustness of the baseline estimates by using the Probit estimates, which have a non-linear function form. The definition of reelection is largely based on Brender (2008). The binary variable $reelect_{it}$ is 0 if the incumbent party is not reelected, otherwise it is 1.

Reelection is defined as the candidate from the incumbent party becoming the head of government again after the election. Specially, this means that if a new election is held and the incumbent party wins, or if the current prime minister/president is reelected, the $reelect_{it}$ is 1. If the head of government resigns and a new leader from a different party is appointed less than 24 months before the election, or if the country is under a military government or non-party leader, the sample is dropped. If a country became democratic after 1960, samples for that country begin at the second election after democratization. Additionally, this paper excludes samples where the period between two elections is less than 24 months, as this may not provide enough time for significant economic changes to occur.

Table 12 presents the result of the Probit estimates. In columns (40) and (41), this paper find that coefficients of both peak and peak-end GDP growth are positive and statistically significant at the 1% level. However, the coefficient of the end is slightly negative. The result implies that the probability of reelection of the incumbent party increases by 4.6% when the peak GDP growth increases by 1%, and that the impact of the peak-end GDP growth is largely contributed by the peak GDP growth rather than the end GDP growth. It's worth noting that the sample size is reduced to 549 because some countries in our samples only have the result of success in reelection and fail to reelection. To ensure the robustness of our result, we present OLS estimates in column (42) and (43) that remove these samples. Thus, the OLS estimates that remove these samples are presented in columns (42) and (43). Little difference is found between the results in columns (42) and (43) and the baseline

estimates in Table 3.

Table 12

Replacing vote share with reelect or not

	(40) Probit	(41) Probit	(42) OLS	(43) OLS	(44) IV-Probit	(45) IV-Probit
Peak	0.052***		1.042**			
	(0.011)		(0.515)			
End	-0.002		0.495			
	(0.012)		(0.512)			
Peak_end		0.046***		1.531***	0.353***	0.433***
		(0.110)		(0.396)	(0.081)	(0.141)
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Wald test of Exogeneity					0.0362	0.2426
R^2	0.2081	0.4558	0.435	0.4356		
Observations	549	549	549	549	509	406

Note:Standard errors clustered at the country-level are in parentheses.

*, ** and *** are significant at the levels of 10%, 5% and 1%, respectively.

To address the endogeneity problem, this paper use the IV Probit method and use oil price and federal fund rate as instrumental variables in column (44) and column (45) We find that the coefficients of peak-end GDP are both positive and statistically significant at the 1 % level. This result is consistent with the result in OLS estimates and IV estimates in Table 3 and Table 5.

4.4 Jackknife Resampling

To ensure that the empirical results are not driven by a smaller number of countries that have extreme values, this paper re-estimates baseline estimates by leaving out one of the countries at a time. The results are similar to the baseline results, both in terms of the magnitude of the size of the coefficient and its statistically significance.

Several examples of moderate changes in the coefficient and significance are presented here. Dropping some countries makes the coefficient of peak GDP growth smaller than 1 and the coefficient of end GDP growth larger than 0.4, including Chile (0.9611, 0.44), Fiji (0.955, 0.43), South Korea (0.980, 0.41), Peru (0.945, 0.56) and Solomon Islands (0.990, 0.50). Additionally, when Jamaica was removed, the coefficient of peak GDP growth increased to 1.484. However, all of them are statistically significant at the 5% level.

Dropping some countries does not change the coefficient of the peak-end GDP growth so much. The largest change happens when removing Ireland, when the coefficient increases to 1.631. Still, the coefficient is statistically significant at the 1% level.

5 Heterogeneity analysis

The peak-end rule is a widely used heuristic that allows voters to make quick, informed decisions without incurring the high cost of searching and analyzing economic information. However, the effectiveness of this rule may vary depending on the level of education of the voter. In countries with highly educated voters, the impact of peak-end GDP growth on election outcomes may be weaker due to their stronger analytical ability and capacity to process more complex economic information.

To investigate this hypothesis, we use data from the Educational Attainment Dataset (Barro & Lee, 2013) to classify the countries in our sample into three groups

based on their average years of total schooling. The high education group takes a value of 1 when the country ranks in the top third of average years of total schooling in the full sample; otherwise, it takes a value of 0. Table 13 presents the results of the heterogeneity analysis of the peak-end GDP growth effect.

In column (46), the coefficient of the interaction term between peak-end GDP growth and the high education dummy (Hi_education) is negative and statistically significant at the 10% level. This finding indicates that voters in countries with higher levels of education rely less on peak-end economic performance when making voting decisions. In other words, the impact of peak-end GDP growth on election outcomes is weaker in countries with more educated voters.The finding that voters in countries with higher education levels rely less on peak-end economic performance is consistent with the discussion in Galiani et al. (2019). Although they do not directly test for heterogeneity by education level, they suggest that voters' cognitive sophistication may affect their susceptibility to the peak-end rule. Our results provide empirical support for this idea, showing that more educated voters are indeed less likely to overweight peak and end economic conditions when evaluating incumbents.

Furthermore, in columns (47) and (48), the coefficients of the interaction terms between peak-end GDP growth and the medium education dummy (Med_education) and the low education dummy (Low_education) are positive but not statistically significant. This result suggests that the relationship between peak-end GDP growth and election outcomes does not differ significantly between countries with medium and low levels of education.

Our findings are consistent with those of Janku & Libich (2019), who found that the top third of OECD countries with well-informed voters do not experience political budget cycles. They argue that politicians cannot buy votes by increasing government expenditure during election years when voters can perceive the government's behavior. Our results provide an additional explanation for why well-informed voters do not experience political budget cycles. Informed voters are less likely to rely on the peak-end heuristic when evaluating economic performance, as they have the ability to process more complex information and form their opinions based on a broader set of factors.

Consequently, peak GDP growth and end GDP growth may no longer play a critical role in determining election outcomes in countries with highly educated voters. If politicians attempt to promote economic growth through increased government spending, their vote share may decrease, as informed voters are more likely to recognize and penalize such opportunistic behavior. This, in turn, diminishes politicians' incentives to engage in political budget cycles.

The heterogeneity analysis contributes to our understanding of how voter characteristics, particularly education levels, moderate the relationship between economic performance and electoral success. By highlighting the role of voter education in shaping the effectiveness of the peak-end heuristic, our findings suggest that the impact of economic growth on election outcomes may vary across countries depending on the sophistication of the electorate.

Table 13

Heterogeneity in the peak-end GDP growth

	(46)	(47)	(48)
	OLS	OLS	OLS
Peak_end	2.028***	1.250**	1.224**
	(0.430)	(0.476)	(0.477)
Hi_education	9.533**		
	(4.070)		
Med_education		9.99	
		(4.98)	
Low_education			-18.506***
			(5.405)
*Peak_end*Hi_education*	-1.329*		
	(0.722)		
*Peak_end*Med_education*		0.768	
		(0.718)	
*Peak_end*Low_education*			0.774
			(0.794)
Country fixed effect	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes
R^2	0.447	0.443	0.4435
Observations	584	584	584

Note:Standard errors clustered at the country-level are in parentheses.

*, ** and *** are significant at the levels of 10%, 5% and 1%, respectively.

6 Conclusion

This study contributes to the growing literature on economic voting by introducing the peak-end rule from behavioral economics to analyze voters' decision-making processes. Using a comprehensive cross-national panel dataset covering 595 national elections in 70 countries from 1960 to 2020, we find strong evidence that voters place significant weight on peak and end economic growth when evaluating incumbents' performance. Our empirical strategy addresses endogeneity concerns through a novel two-step approach and an instrumental variable method, ensuring the robustness and credibility of our findings.

The application of the peak-end rule to economic voting research represents a

significant advancement in understanding how voters form their opinions on economic performance. Our empirical results demonstrate that both peak and end GDP growth significantly influence election outcomes, highlighting the importance of considering the temporal dynamics of economic growth in voting behavior. These findings are consistent with the results of Galiani et al. (2019), who found that voters in Honduras responded more strongly to the peak and end cash transfers than to the average amount of transfers received over the incumbent's term. Our study extends their findings to a cross-national context, suggesting that the peak-end rule is a robust phenomenon in economic voting. This finding also contributes to the ongoing debate on the time horizon over which voters evaluate economic performance (Healy & Lenz, 2014).

Another contribution of our study lies in its approach to addressing endogeneity issues, which have been a persistent problem in research on economic growth and electoral outcomes. We employ an instrumental variable strategy, utilizing global oil prices and the U.S. federal funds rate as exogenous instruments to isolate the causal effect of economic growth on election results. This approach allows us to establish a more credible causal link between economic growth and electoral success, addressing a critical gap in the existing literature.

This paper also explores the impact of peak-end GDP growth on election outcomes, demonstrating its significance across a series of robustness checks. First, peak GDP growth, not end GDP growth, is found to have a major impact on election results, even when not controlled for each other. Second, peak GDP growth is found

more influential than the average growth of other years within a term. Third, our results still hold when separating the developed and developing countries and different periods in our samples. Fourthly, we also considers the role of global economic performance as a reference point in voting decisions, while the result do not change our main conclusion. Lastly, replacing vote share with reelection as the dependent variable still confirms the significant impact of peak GDP growth on the probability of reelection.

Another interesting finding that emerged from this study is the role of voter education in shaping the perception of economic growth and, by extension, election outcomes. In countries with higher levels of education, voters demonstrate a stronger ability to analyze the impact of economic growth, thus potentially weakening the influence of peak-end GDP growth on election outcomes. This trend was less apparent in countries with lower education levels.

Overall, this study provides a unique perspective on the complex interplay between political and economic influences, shedding light on the influence of peak-end rule of economic growth on election outcomes and how this influence manifests in different national contexts and time effects. By extending the insights of Galiani et al. (2019) to a cross-national setting and demonstrating the robustness of the peak-end effect across various subsamples and specifications, our findings contribute to a better understanding of the nuances and generalizability of this important behavioral principle in the context of economic voting.

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