DOES POLITICAL POLARIZATION LEAD TO A RISE IN GOVERNMENT DEBT?

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Does Political Polarization Lead to a Rise in Government Debt?

Abstract: Existing politico-economic theories offer two mutually conflicting predictions on whether an increase in the degree of political polarization entails a rise or a decline in government debt. This article estimates the effect of political polarization on government debt, utilizing panel data of the OECD countries from 1962 to 2015. The empirical analysis finds that an increase in the degree of political polarization leads to an increase in government debt, which provides supportive evidence for Alesina and Tabellini (1990) and the like. This finding remains the same across different estimation models, without and with instrumenting the explanatory variable of political polarization.

Keywords: political polarization, government debt, government spending.
JEL: H63, E62, D78

1. Introduction

In the recent decades, rapidly rising government debt of advanced economies ignited various policy debates about the government debt (e.g., Olivella, 2020) raising the importance of understanding government debt behavior. Reflecting the fact that government debt is determined by politicians, *not* by a benevolent social planner, politico-economic approach is widely taken to explain government debt behavior of developed economies. Various politico-economic theories on government debt commonly identify political polarization as a fundamental determinant of government debt; nonetheless, they yield mutually conflicting predictions on the effect of political polarization on government debt. Some theories (Persson and Svensson, 1989; Alesina and Tabellini, 1990; Alesina and Drazen, 1991; Dziuda and Loeper, 2016) argue that an increase in the degree of political polarization raises government debt, while others (Piguillem and Riboni, 2015; Melki and Pickering, 2014) claim the opposite. To investigate which one of these two mutually contradictory predictions is accordance with real data provides valuable implications for fiscal policy decision making as well as is necessary for making a meaningful progress of positive theories on government debt. In spite of its importance, so far, whether an increase in the degree of political polarization actually leads to a rise or a decline in government debt is not yet rigorously tested with real data. In this light, by estimating the effect of political polarization on government debt with panel data of advanced economies, this paper makes the contribution of testing the mutually conflicting hypotheses about the effect put forth by the existing theories.

  This paper is organized as follows. Section 2 critically reviews the related literature and clarifies how this paper is related to and different from the existing studies on political polarization and government debt. Section 3 elaborates on the strategy for identifying the effect

of political polarization on government debt. Section 4 introduces the data sets. Section 5 present

s the estimation results. Section 6 concludes the paper.

2. Review of Related Literature

As traditional theories of government debt, led by Barro (1979), assumed that a benevolent social

planner decides government debt, they failed to explain observed rapid rises in the government

debts of developed economies after the middle 1980s.[1] Because a benevolent social planner does

not actually exist and scholars such as Roubini and Sachs (1989) and Woo (2003) showed that

government debt is affected by political factors, politico-economic theories on government debt

have emerged.[2]One of the most influential politico-economic theories on government debt is

Alesina and Tabellini (1990) that highlighted political polarization as a fundamental factor for

explaining government debt behavior. Although Persson and Svensson (1989) suggested that

political polarization plays an important role in understanding rises in the government debt

before Alesina and Tabellini (1990), it is Alesina and Tabellini (1990) that drew substantive

attentions on the factor of political polarization.[3] Both argued that an increase in the degree of

political polarization (i.e., disagreement of political preferences) leads to a rise in government

debt. Intuitively, as each policymaker who represents different political preferences of voters can

be elected to implement policy that he (she) prefers the most, an increase in the degree of

political polarization makes the incumbent policymaker strategically issue government debt more

to leave less room for fiscal policy choices of the succeeding one who can represent opposite

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[1] Numerous empirical studies (e.g., Kremers, 1989; Bizer and Durlauf, 1990; Corsetti and Roubini, 1991, and etc.) have shown that actual behavior of government debt in many developed economies after the middle of 1980s is not consistent with the prediction of traditional theories following Barro (1979) that government debt behaves counter-cyclically (instead of growing even during booms which begot the observed rises in government debt).

[2] For an overview of various politico-economic theories on government debt, see Alesina and Passalacqua (2016).

[3] Specifically, unlike Alesina and Tabellini (1990), Persson and Svensson (1989) imposed the restrictive assumptions as follows: (i) utility function is *linear* in consumption; (ii) interest rate is zero; and (iii) there are only two periods. Moreover, while Alesina and Tabellini (1990) employed an explicit parameter for the degree of political polarization, Persson and Svensson (1989) did not.

political preference. Although both Alesina and Tabellini (1990) and Persson and Svensson (1989) reached the same testable prediction about the effect of political polarization on government debt, the mechanisms of their models are similar but not exactly identical. While the two political parties in the model of Alesina and Tabellini (1990) disagree on the items of government spending, those of Persson and Svensson (1989) disagree on the amount of government spending. Furthermore, Alesina and Tabellini (1990) showed that when the probability that the incumbent policymaker is re-elected decreases, an increase in the degree of political polarization leads to more increases in government debt. On the other hand, Persson and Svensson (1989) did not offer any theoretical prediction about the re-election probability and government debt.

Since Persson and Svensson (1989) and Alesina and Tabellini (1990), the effect of political polarization has been studied extensively by numerous theoretical analyses which yielded contradictory predictions on whether political polarization affects government debt positively or negatively. While some of them such as Alesina and Drazen (1991) and Dziuda and Loeper (2016) corroborated the argument of the positive effect of political polarization on government debt, others like Piguillem and Riboni (2015) and Melki and Pickering (2014) claimed the opposite that the effect is negative. Sharing the underlying intuition with Persson and Svensson (1989) and Alesina and Tabellini (1990), Alesina and Drazen (1991) and Dziuda and Loeper (2016) showed that an increase in the degree of political polarization makes policymakers fail to promptly stabilize rising government debt. In contrast, however, Piguillem and Riboni (2015) and Melki and Pickering (2014) introduced present-bias to the utility function of voters and policymakers. Piguillem and Riboni (2015) showed that if discount factor of policymakers is low, then an increase in the degree of political polarization reduces government debt. Melki and

Pickering (2014) claimed that if voters are more myopic than policymakers, government debt is decreased by an increase in the degree of political polarization. The present-bias condition of Piguillem and Riboni (2015) or Melki and Pickering (2014) is not directly testable since data of the degree of present bias of voters and policymakers is not feasible to obtain. Nevertheless, Piguillem and Riboni (2015) and Melki and Pickering (2014) alike provided a directly testable hypothesis that an increase in the degree of political polarization leads to a decline in government debt, which is the opposite to the hypothesis of Persson and Svensson (1989), Alesina and Tabellini (1990), Alesina and Drazen (1991), Dziuda and Loeper (2016).

So far, almost none of empirical analyses have examined the effect of political polarization on government debt, in contrast to numerous theoretical analyses on the effect. To provide evidence for their own theoretical argument that political polarization negatively affects government debt, Melki and Pickering (2014) estimated the effect of political polarization on government debt with panel data of 22 developed countries and found that the effect is negative. However, the estimation of Melki and Pickering (2014) is not rigorous enough for its results to be fully convincing for the following reasons. Firstly, Melki and Pickering (2014) ran OLS (ordinary least squares) regressions of government debt level (% of GDP) that is shown to be non-stationary by various previous studies (e.g., Kremers, 1989; Bizer and Durlauf, 1990; Antonini, Lee and Pires, 2013). It is a well-known fact that regressions with non-stationary data do not give us a reliable estimate.[4] Secondly, Melki and Pickering (2014) adopted standard deviation[5] as the measurement of political polarization, while the degree of political polarization in their model is

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[4] Basically, the underlying (unknown) distribution of a non-stationary variable is varying over time not converging to a (time-invariant) distribution, which disables us from applying Central Limit Theorem that is fundamentally necessary for a valid regression analysis.

[5] The theoretical model of Melki and Pickering (2014) assumed that there are only *two* political parties which take turns deciding government debt and indicated the degree of political polarization with the distance between the two parties' ideological stances. On the contrary, in their empirical analysis part to test their theory, Melki and Pickering (2014) measured the degree of political polarization of a country by standard deviation, which is inconsistent with their theoretical model.

indicated by the distance between political parties' ideological stances that represent their political preferences, not by the standard deviation of the political preferences. However, Esteban and Ray (1994) proved that standard deviation[6] is not an accurate measurement of polarization; hence, the estimation results of Melki and Pickering (2014) are biased with measurement errors. Thirdly, the instrumental variables that Melki and Pickering (2014) used are not highly qualified. Melki and Pickering (2014) adopted a binary indicator for year 1989 (Fall of the Berlin Wall) and the total number of owned television sets in the population as their instrumental variables for the degree of political polarization; but, their two instrumental variables have no apparent relevancy with the degree of political polarization. Moreover, the p-value of the Sargan test of their instrumental variables is just 0.103, which is not sufficiently high to be undoubtedly qualified instrumental variables. Above all, even if their instrumental variables could have been highly qualified, they still would not be able to effectively fix the bias problems from the non-stationarity. Furthermore, the total number of the panel data observations for their 2SLS is just 66 (i.e., only three time points of 22 countries), which is not large enough (or long enough).

Being differentiated from Melki and Pickering (2014), this paper estimates the effect of political polarization on government with resolving the problems of the estimation of Melki and Pickering (2014) as follows. First, this paper utilizes a much larger number of observations of advanced economies (1105) than Melki and Pickering (2014) did, to identify the effect of political polarization on government debt. In particular, for the identification, this paper uses panel data of the 32 OECD (Organisation for Economic Co-operation and Development) countries from 1962 to 2015. Second, to be consistent with the aforementioned politico-

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[6] Although standard deviation is not supported by Statistical science as a proper measurement of polarization, Political science studies like Dalton (2008) and Lindqvist and Östling (2010) used standard deviation for measuring political polarization.

economic theories that this paper aims to test, the degree of political polarization of a country is measured by the distance between ideological stances of the two largest political parties of the country, based on policies that each political party supports. For addressing the potential concern that the number of political parties is actually greater than two, unlike the theoretical models, although OECD countries all have two leading political parties dominantly greater than the other political parties, we also utilize polarization index that Esteban and Ray (1994) developed axiomatically for accurately measuring the degree of political polarization with more than two political parties.

   In addition to this carefully chosen measurement of the degree of political polarization, third, this paper is also different from Melki and Pickering (2014) in that this paper carefully addresses the non-stationarity problem. By conducting unit root tests, we find that the data of government debt level (% of GDP) and the degree of political polarization are non-stationary while their first differences are stationary. Thus, first differences in government debt and the degree of political polarization, both of which are stationary, are used for the regressions of this paper. Fourth, this paper adopted highly qualified instrumental variables. Addressing the potential endogeneity problem, this paper instruments the degree of political polarization according to the instrumental variable method of Hausman and Taylor (1981). With our panel data, the Hausman-Taylor instrumental variables sufficiently pass the statistical tests on the IV qualifications. Furthermore, for robustness, fixed effect model is used as well. The regression analysis of this paper robustly finds that an increase in the degree of political polarization leads to an increase in government debt, without and with the instrumental variables. This is, the empirical finding of this paper provides supportive evidence for Alesina and Tabellini (1990), Persson and Svensson (1989), Alesina and Drazen (1991), Dziuda and Loeper (2016) as opposite to that of Melki and Pickering

(2014).

3. Identification Strategy

To estimate the effect of political polarization on government debt, panel data of OECD countries is utilized, because it provides richer information for identifying the effect than time-series data or cross-sectional data can provide. For an unbiased identification of the effect, it is necessary to begin with understanding the time-series nature of panel data of government debt. To this end, unit root tests on our panel data of OECD countries are conducted and indicate that our data of government debt (% of GDP) and the degree of political polarization are non-stationary. Obviously, any regression of non-stationary variable(s) will be misleading and biased even when its error term is independent of all the right-hand-side variables.[7] To stationarize our data, first-differences of government debt and the degree of political polarization are obtained; and, unit root tests on the obtained first-differences find that the first-differences of these two key variables are stationary.

Basically, the regression equation for identifying the effect of political polarization on government debt is stated as follows.

$$GovDebt_{i,t} = \beta_1 + \beta_2 PoliPolar_{i,t} + \mathbf{X}_{i,t}\beta_3 + u_i + v_{i,t} \tag{1}$$

where $GovDebt_{i,t}$ is government debt of country i in period t; $PoliPolar_{i,t}$ is the degree of political polarization of country i in period t; $\mathbf{X}_{i,t}$ is a vector of other relevant factors such as growth rate of GDP, GDP per capita, and total population of country i in period t and the like. To distill out the potential effects of other relevant factors, $\mathbf{X}_{i,t}$ are included in the right-hand-side of (1). Admittedly, no matter how many control variables are included in $\mathbf{X}_{i,t}$ as relevant

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[7] As mentioned above, by failing to apply Central Limit Theorem, *time-variant* underlying unknown distribution of a non-stationary variable disables standard regressions from obtaining a valid estimate even if the error terms are independent of all the right-hand-side variables.

characteristics of country i, it is possible that there still exists individual heterogeneity of country i that cannot be observed or properly measured, such as unobservable cultural trait of country i which may exert some influence on its government debt behavior. To allow for this possibility, u_i is unobservable uniqueness of country i and $v_{i,t}$ is independent idiosyncratic error. The unobserved variable of u_i may or may not be related to the right-hand-side variables of (1). If it is not related, in the presence of unobserved individual heterogeneity of country i, consistent estimates are obtained by random-effect model (RE). If it is related, consistent estimates are obtained by fixed-effect model (FE). Unlike simple ordinary least squares (OLS) that assume *no* existence of the unobserved uniqueness of country i, u_i, for an unbiased estimation, RE and FE accommodate the existence of the unobserved u_i that affects the dependent variable of government debt.

With conducting unit root tests on the data of all the variables, a non-stationary variable, if any, is stationarized because non-stationary variables are not suitable for the unbiased estimation of β_2 in (1). The unit root tests find that our data of government debt and the degree of political polarization are non-stationary, while first-differences of government debt and the degree of political polarization are stationary. Hence, estimating with the level variables of government debt and the degree of political polarization themselves are not suitable for testing the theoretical predictions regarding the effect of political polarization on government debt, while first-differences of government debt and the degree of political polarization are suitable. Obviously, first-differing the variables of government debt and the degree of political polarization is only for making these variables stationary to correctly estimate the parameter β_2 in (1).

If the unobserved u_i of (1) is related to the variable of political polarization, endogeneity

problem may arise. If so, as the correlation between the variable of political polarization and $u_i + v_{i,t}$ becomes non-zero, the estimate for our key parameter β_2 of (1) would be biased. This endogeneity issue can be resolved by two different estimation models. First, fixed effect model (FE) cancels the unobserved variable of u_i out to obtain an unbiased estimate. Second, as an alternative to fixed effect model that purges u_i out, Hausman-Talyor model solves the endogeneity problem basically by instrumenting the variable of political polarization with the distance from its mean (Hausman and Taylor, 1981). Because differencing the variable of political polarization from its mean (the internal IV) removes the unobserved variable of u_i, the correlation between the variable of political polarization and $u_i + v_{i,t}$ becomes zero, meeting the exogeneity condition for a proper instrument variable (IV). At the same time, it is obvious that the instrumented variable (the degree of political polarization) is certainly related to the instrumental variable (distance from the mean degree of political polarization), satisfying the relevance condition for a proper IV. Thus, this internal IV of Hausman-Talyor model (HT)[8] meets all the qualification conditions for a proper IV. Furthermore, statistical tests on these two qualification conditions are conducted in a way robust to heteroscedasticity. Firstly, Hansen over-identification test is conducted for checking whether the post-estimation error term is correlated with the right-hand-side variables of (1) with the Hausman-Talyor IV or not. Secondly, to verify whether the relevance condition is met or not, Lagrange multiplier rank test of Kleibergen and Paap (2006) is conducted. While adoption of instrumental variables may make estimation less efficient, it will address of the concern of potential bias in our key estimate. Acknowledging this trade-off, the estimation results from both Hausman-Talyor model and fixed

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[8] In addition, Hausman-Talyor model utilizes de-meaned time-variant right-hand-side variables as well as time-invariant right-hand-side variable as instrumental variables too. For details, see Hausman and Taylor (1981).

effect model are reported.

One may consider including the variables of number of political parties, type of government and the like that are crucial characteristic of political institute f a country. Although data for these variables are available, because number of political parties and government type are time-invariant, it is not possible to obtain the coefficients for these variables in the regressions according to Hausman-Talyor model or fixed effect model. Because both Hausman-Talyor model and fixed effect model involve demeaning process, any time-invariant variables are dropped in the middle of estimation, regardless of whether they are observable or not. Nonetheless, no matter how many variables are included as right-hand-side control variables of the regression to capture the uniqueness of a country, because it is still possible that we miss out unobservable relevant variables, we need to address the potential bias concern using Hausman-Talyor model and fixed effect model. Obviously, this paper is not about estimating the effect of number of political parties (or type of the government) on government debt and the politico-economic theories that this paper aims test do not regard these variables relevant factor. Moreover, there is no empirical study that showed importance of these variables in explaining government debt. Hence, it is not necessary to get the estimated coefficient for the variables of number of political parties and type of the government from the regressions. Rather, to control time-variant characteristic of political institute f a country, the variables of total number of congressmen and the incumbent's re-election probability are included in the regression as right-hand-side control variables.

The aforementioned theoretical studies (Persson and Svensson, 1989; Alesina and Tabellini, 1990; Alesina and Drazen, 1991; Melki and Pickering, 2014; Piguillem and Riboni, 2015; Dziuda and Loeper, 2016) derived their predictions from investigating whether an increase in the

degree of political polarization causes an increase or a decrease in government debt in an economy where all terms are real and not subject to monetary policy changes. Thus, like many other empirical studies on government debt (e.g., Kremers, 1989; Bizer and Durlauf, 1990; Antonini, Lee, and Pires, 2013; Melki and Pickering, 2014) the size of government debt is measured as % of GDP.

Notably, the above-noted politico-economic theories on government debt (Persson and Svensson, 1989; Alesina and Tabellini, 1990; Alesina and Drazen, 1991; Melki and Pickering, 2014; Piguillem and Riboni, 2015; Dziuda and Loeper, 2016) defined political polarization as one-dimensional difference (disagreement) in the political preferences of voters or policymakers that voters elect, since they assumed that there exist *two* political parties for policy decision making. Furthermore, according to these studies, political preference (ideological stance) of the voters or policymakers for a political party is revealed[9] by policy proposals that the political party manifests and supports. In practice, difference (disagreement) in the political preference of various political parties can be measured in terms of their left vs. right wing stance that is reflected in their policy proposals. Thus, to be consistent with the above-noted politico-economic theories on government debt, in the present empirical analysis of testing these theories, the degree of political polarization of a country is defined as difference in the ideological stances between the two largest political parties of the country. That is,

$$PoliPolar_{i,t} = \left\| rl_{i,t}^{1st} - rl_{i,t}^{2nd} \right\| \tag{2}$$

where $rl_{i,t}^{1st}$ is political preference for right-wing stance of the largest political party of country i which wins the largest share of votes in period t, and $rl_{i,t}^{2nd}$ is political preference for right-wing

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[9] One might concern that strategic (dishonest) voting may distort channel through which political preference of voters is revealed by their vote for a political party. However, the aforementioned politico-economic theories on government debt behavior assumed honest voting. To be consistent with these politico-economic theories, this paper also views that voters cast their vote to a political party which they prefer the most.

stance of the second largest political party of country *i* which wins the second largest share of votes in period *t*. Specifically, political preference for right-wing stance takes a positive value, while that for left-wing stance takes a negative value.

In reality, countries have more than two political parties, unlike the above-noted politico-economic theories on government debt that this empirical analysis seeks to test. Even the US has more than two political parties, although the US presidential election at the final stage involves only two parties. In the countries of our data, the two leading political parties are much more dominant and exert greater influences on making policy decisions than any other political parties. While the measurement of (2) is consistent with the above-noted politico-economic theories, it does not completely accommodate the reality that there are more than two political parties in a country. When we consider more than two parties together, then how much polarized the distribution of political preferences is might not always be captured by the distance of the two major parties' political preferences. In this regard, for allowing the number of political parties to be larger than two, studies like Melki and Pickering (2014), Dalton (2008), and Lindqvist and Östling (2010) adopted standard deviation as the measurement of political polarization, without a proper basis of Statistics science. In fact, Esteban and Ray (1994) showed that standard deviation [10] is not an accurate measurement of polarization. To demonstrate why standard deviation is improper measurement of political polarization, consider following two countries: one country has political preferences of (10, 1) distributed as ($\frac{1}{2}$, $\frac{1}{2}$), while the other country has political preferences of (10, 9, 8, 7, 6, 5, 4, 3, 2) that are uniformly distributed (i.e., $\frac{1}{9}$ for each). Obviously, the former country is more politically polarized than the latter country.

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[10] Although standard deviation is not supported by Statistical science as a proper measurement of polarization, Political science studies like Dalton (2008) and Lindqvist and Östling (2010) used standard deviation for measuring political polarization.

However, standard deviation of political preferences *wrongfully* indicates that the latter is more polarized politically than the former, as the standard deviation is larger for the latter country (5.333) than the former country (4.500). To recognize the inaccuracy of standard deviation for measuring the degree of polarization, Esteban and Ray (1994) axiomatically developed polarization index. Hence, to complement the estimation with (1), for accommodating the cases of more than two political parties, we also measure the degree of political polarization using the polarization index of Esteban and Ray (1994) as follows.

$$PoliPolar_{i,t} = \sum_{j=1}^{n_{i,t}} \sum_{k=1}^{n_{i,t}} s_{i,t,j}^{1+\alpha} s_{i,t,k} \left\| rl_{i,t,j} - rl_{i,t,k} \right\| \tag{3}$$

where $\alpha \in [1,1.6)$ is parameter for the degree of sensitivity to polarization; $n_{i,t}$ is total number of political parties of country i in period t; $s_{i,t,k}$ is vote share for political party k of country i in period t; and, $rl_{i,t,k}$ is political preference for right-wing stance that political party k of country i takes in period t. In the present analysis, α is set to 1.5 (highly sensitive to polarization. With theoretically solid basis, the Esteban-Ray index of (3) rigorously measures the degree of political polarization with more than two political parties. Thus, for the robustness check of the estimation with (2), we re-run the same regression with (3) to allow the influence of more than two political parties on the degree of political polarization, although the above-noted politico-economic theories assumed that only two political parties exist in an economy.

4. Data Overview

For estimating the effect of political polarization on government debt, political and economic data of 32 OECD member countries, all of which are developed economy with democratic political system, are collected from the year when each country officially obtained the

membership.[11] For the detailed list of the 32 OECD member countries in the sample, refer to Appendix. The data of gross general government debt is secured from International Monetary Fund Historical Public Debt Database (Abbas et al. 2010) from IMF Government Finance Statistics database. The data of vote share and right (left) wing stance of political parties of the OECD countries are secured from Manifesto Project Database of WZB Berlin Social Science Center (Volkens et al. 2017). In this dataset, right (left) wing stances of political parties are consistently assessed according to the established criteria of Budge and Laver (1992), based on policies that the political parties manifest (propose) in a nationwide general election, in terms of constitutionalism, use of military power, importance of individual freedom and human right, political authority, free market economy, business-oriented policies, opening market, economic orthodoxy, social welfare expenditure, nationalism, traditional morality, law and order, internationalism, education expansion, and the like. Specifically, the maximum value[12] of 100 is assigned for the most extreme right-wing stance, whereas the minimum value of -100 is for the most extreme left-wing stance. For non-election years, the value of the degree of political polarization is obtained by linear interpolation.

In the Manifesto Project Database, the right (left) wing stance of a political party can take different values over time, reflecting the reality that exact ideological stance of a political party of a country varies over time with different policy proposals. Moreover, the right (left) wing stance of the Manifesto Project Database is not self-reported but assessed consistently by objective criteria (Budge and Laver, 1992); so, it can accurately compare ideological stance of one country's right-wing political party from that of another country's right-wing political party.

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[11] There are 33 OECD member countries in total. Among them, it is not possible to obtain the data of change in the degree of political polarization for Slovenia.

[12] For an example to give more concrete sense of this measure of right (left) wing stance, the Manifesto Project Database assigns -6.4 for the set of policy proposals from Democratic Party in the United States presidential election of 2012, while it assigns 28 for the opponent Republican Party.

Thus, the Manifesto Project Database is much more suitable than other popularly used datasets like Database of Political Institutions (DPI) and World Values Survey (WVS). Although DPI also provides a measure of the right (left) wing stance of four major political parties of a country based on name or description of the four parties, the measure of DPI can take only three values (left, center, and right), according to the relative stance within a country. Thus, the right (left) wing stance measure of DPI cannot accurately compare ideological stance of one country's right-wing political party *from* that of another country's right-wing political party or *from* that of the same political party in the past. In fact, the right (left) wing stance measure of DPI exhibits almost no variation in the degree of political polarization. Furthermore, DPI provides no information on vote share for each political party which is necessary to identify the largest and the second largest political parties. On the other hand, WVS also provides a measure of the right (left) wing stance. However, the right (left) wing stance measure of WVS is not about a political party but about survey respondents themselves; and it is subjective self-assessment of 1000 respondents (per country), disabling objective cross-country comparisons.

To control potential effect of relevant factors $\mathbf{X}_{i,t}$ other than political polarization, firstly, the variable for the probability that the incumbent policymaker is re-elected is included, as Alesina and Tabellini (1990) as well as Aghion and Bolton (1990) showed that the re-election probability also affects the government debt choice of the incumbent policymaker. Specifically, the re-election probability of the current incumbent policymaker of a country is approximated by the vote share of the current incumbent policymaker in the *next* election of the country. The data on the vote shares of the political parties of a country in each nationwide general election is secured from the Manifesto Project Database and the value for non-election years is linearly interpolated. Furthermore, by conducting unit root tests, we find that the data of the re-election probability of

the incumbent policymaker is not stationary, while its first difference is stationary. Thus, for the regressions, the first difference of the re-election probability is utilized. In addition, the total number of congressmen (i.e., total number of seats in parliament), whose data is also from the Manifesto Project Database, is included in $\mathbf{X}_{i,t}$ as well. Because war may raise government debt regardless of political polarization, a binary indicator for inter-state war involvement is also included in the regression. The data for this indicator is obtained from Uppsala Conflict Data Program (UCDP) and International Peace Research Institute, Oslo (PRIO) Armed Conflict Dataset.[13]

Moreover, relevant economic factors are also included in $\mathbf{X}_{i,t}$ as well. To this end, the data of GDP growth rate and exchange rate (national currency per US dollars, annual average) are secured from World Bank database; and, the data of GDP per capita (PPP, 2011 international dollars) is from World Economics database and World Bank database.[14] As currency crisis can trigger an increase in government debt, part of which is issued in foreign currency, a binary indicator for currency crisis is also included as a right-hand-side control variable with data from Reinhart and Rogoff (2011).[15] In addition, as Tabellini (1991) and Song, Storesletten, and Zilibotti (2012) claimed that population aging is an important factor of government debt,[16] we attempt to use the data of the population share of the elderly (those whose age is 65 and above). However, unit root tests reveal that the elderly population itself and its first difference alike are non-stationary. Thus, alternatively, the population share of prime-age workers (those whose age

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[13] The data set is of version 17.2 and is downloaded at https://www.prio.org/Data/Armed-Conflict/.

[14] The World Bank database also provides the data of GDP per capita in constant 2011 international dollars, it is only from 1990, while the World Economics database provides much longer span of data (from 1960), which is publicly available at https://www.worldeconomics.com/GrossDomesticProduct/. Nevertheless, as the World Economics database does not have GDP per capita of Iceland and Luxembourg, GDP per capita of these two countries inevitably is only from the World Bank database.

[15] This data is provided only up to 2010. Thus, more recent data is manually updated with exchange rate data, according to the definition of the currency crisis of Reinhart and Rogoff (2011).

[16] However, Tabellini (1991) and Song, Storesletten, and Zilibotti (2012) did not agree on whether the effect of population aging on government debt is positive or not.

is between 15 and 64) and total population, both of which are found to be stationary, are included in $\mathbf{X}_{i,t}$ with data from World Bank database.

Taken together, the total number of the observations used in the regressions is 1150 with the earliest year being 1962 and the latest year being 2015. The summary statistics of the variables for the main regressions are displayed in **Table 1**. Probably, one may well think that there would be little variation in the ideological distance between the two largest political parties of a country over time. On the contrary, as a matter of fact, the within-country standard deviation of the first-difference in the degree of political polarization is 5.94 while the between-country standard deviation is 1.51, to get the overall standard deviation as 5.98. On the other hand, as shown in **Table 1**, on average, the two largest political parties hold more than the majority share of the total votes, which suggests that our data of the OECD countries are suitable for testing the predictions from the two-party models of the aforementioned politico-economic theories.

To verify whether the variables used for the regression are stationary or not, Fisher-type Dickey-Fuller unit root tests for panel data are conducted. The unit root test results, which are reported in **Table 2**, indicate that the government debt data is non-stationary, which resonates with previous empirical studies on government debt (e.g., Kremers, 1989; Bizer and Durlauf, 1990; Antonini, Lee, and Pires, 2013). Similarly, the two variables of the degree of political polarization and the re-election probability of the current incumbent policymaker are not stationary either. However, **Table 2** also shows that the first differences of these three non-stationary variables are stationary, as all the other right-hand-side variables themselves.

To provide additional overview of our data for identifying the effect of political polarization on government debt, the first-differences of the degree of political polarization and government debt, which are stationary and thus used for the regression (1), are averaged over the OECD

countries for each year. As illustrated in **Figure 1**, most of the cases when the first-difference in the degree of political polarization goes upward (downward), the first-difference in government debt moves upward (downward) as well. Although these two key variables do not always perfectly go hand in hand with each other, their co-movement over time, depicted in **Figure 1**, is consistent with the positive correlation between the two key variables (which is 0.048).

On the other hand, by averaging over time, instead of the countries, **Figure 2** plots average first-difference in government debt against average first-difference in the degree of political polarization. Unlike **Figure 1**, it is not readily clear whether these two average variables move in the same direction or not. While there is an outlier (Israel), its influence on the actual association between these two average variables is quite limited because Israel joined OECD in 2010 and has much smaller number of observations than the other OECD countries in our data. Even after excluding this uninfluential outlier, the association between average first-differences in the degree of political polarization and in government debt in **Figure 2** is not as apparent as **Figure 1**. After all, notice that **Figure 1** and **2** for themselves cannot constitute a reliable evidence to prove a positive or negative effect of political polarization on government debt, as they neither distill out potential effects of the relevant political and economic factors nor address the potential endogeneity issues.

5. Estimation Results

Before reporting the estimation results, testing suitability of the estimation models is conducted with all the variables that are summarized in **Table 1**. As shown in the first two rows of **Table 3** that presents the test outcomes, OLS is clearly dominated by both fixed effect model (FE) and random effect model (RE), which suggests the need to deal with unobserved uniqueness of individual country, u_i in the regression equation of (1). In contrast, however, the Hausman test

statistic fails to clearly indicate whether FE or RE is better, as it takes a negative value (which violates the asymptotic assumption of the Hausman test).[17] On the other hand, Baltagi test result (Baltagi, Bresson, and Pirotte, 2003) indicates that Hausman-Talyor model (HT) is better than fixed effect model (FE), which means that instrumenting the variable of the degree of political polarization (HT) is better than FE. This still cannot inform us about whether HT is better than RE or not, because Baltagi test just compares HT and FE. Although we do not have test statistics indicating that FE is strictly better than RE, we adopt FE instead of RE because perfect independence between u_i and the right-hand-side variables of (1) is less realistic than some correlation between them.

To begin, **Table 4** reports the results of estimating the effect of political polarization on government debt under fixed effect model with differently measured degree of political polarization, according to (2) and (3) in Section 2. Across the four columns[18] of **Table 4**, the estimated β_2 of (1) with FE remains positive with statistical significance, regardless of including the variable of the re-election probability of the incumbent and changing to alternative measurement of the degree of political polarization. In fact, the univariate OLS regression of the degree of political polarization measured by (2) on the degree measured by the Esteban-Ray index of (3) yields the coefficient of 24.004 with standard error of 10.71, suggesting statistically significant positive correlation between the two measurements of the degree of political polarization. Also, notice from **Table 4** that the estimated coefficients of all the other statistically significant right-hand-side variables (re-election probability, GDP growth rate and currency crisis indicator) remain unchanged when we change the measurement of political polarization from (2)

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[17] As a matter of fact, it is not unusual that the calculated Hausman test statistics fail to take a positive value.

[18] Since the variable of 'Two Largest Political Parties' Vote Share' does not vary over time for a given country, its coefficient is not feasible to estimate under the fixed effect model due to multicollinearity. Thus, the estimate for the coefficient is not available for **Table 4**.

to (3).

Next, **Table 5** displays the results of estimating the effect of political polarization on government debt under Hausman-Talyor model that addresses the potential endogeneity issue by instrumenting the variable of political polarization. In the bottom of **Table 5**, the post-estimation test statistics indicate that the validity conditions of a proper IV (exogeneity and relevance conditions) are met. As shown in the first column of **Table 5**, after instrumenting the variable of political polarization, which is measured by (2), the estimated effect of political polarization on government debt is positive with statistical significance, which is consistent with the corresponding estimates of **Table 4**. Even when the variable of the re-election probability of the incumbent, which Alesina and Tabellini (1990) uniquely argued as a factor of government debt behavior, is discarded from the regression or included as the instrumented variable, the estimated effect of political polarization on government debt remains positive with statistical significance taking quite similar values.

In addition, embracing the reality that the OECD countries have more than two political parties unlike what the aforementioned politico-economic theories (Persson and Svensson, 1989; Alesina and Tabellini, 1990; Alesina and Drazen, 1991; Melki and Pickering, 2014; Piguillem and Riboni, 2015; Dziuda and Loeper, 2016) assumed, we re-run the same Hausman-Talyor regressions now with measuring the degree of political polarization by the Esteban-Ray index of (3), instead of (2). Because there are some missing data in the voting shares and ideological stances of some minor political parties, the total number of the observations used for the regression is smaller with the measurement of (3) than with the measurement of (2). Unlike the measurement of (2) that needs only the two largest political parties' information, the Esteban-Ray index requires the information and ideological stance of all the political parties. Based on

the Fisher-type Dickey-Fuller unit root tests, we find that the data of the Esteban-Ray index of political polarization itself and its first difference are stationary; nevertheless, its first difference (change) is used for the regression to consistently compare with the main regressions presented in **Table 4**, **5** and **6**. The results of this additional estimation for the robustness check are reported in **Table 6**. Comparing **Table 5** and **Table 6**, even when we take the alternative measurement of political polarization deviating from the two-party assumption of the theories, the effect of political polarization is still positive with statistical significance, with the estimated coefficients of all the other statistically significant right-hand-side variables (re-election probability, GDP growth rate and currency crisis indicator) remaining unchanged.

Obviously, the empirical finding of the positive effect of political polarization on government debt in itself has its own right with important policy implications. In addition, the findings from **Table 4**, **5** and **6** also can provide supportive evidence for only one of the two mutually contradictory predictions of the politico-economic theories on government debt. Above all, with and without the instrumental variables, this paper finds that an increase in the degree of political polarization leads to an increase in government debt. This empirical finding is robust[19] evidence for the *positive* effect of political polarization on government debt, which is consistent with Alesina and Tabellini (1990), Persson and Svensson (1989), Alesina and Drazen (1991), and Dziuda and Loeper (2016). In particular, the negative sign of the estimated coefficient for the re-election probability of the incumbent in **Table 4**, **5** and **6** renders the additional empirical supports for Alesina and Tabellini (1990). In addition, notice from **Table 4**, **5** and **6** that the

[19] In fact, we still find the same result (i.e., statistically significant positive effect of political polarization on government debt) when the fiscal decentralization index is included as one of the right-hand side variables in the regression. Thus, the empirical finding of this paper is robust to adding the variable of the fiscal decentralization. While the coefficient of this variable is not statistically significant, including this variable drastically reduces the total number of observations and the length of the panel data time span. Thus, to maintain the statistical reliability of the estimation results of this paper, the regression results without the decentralization variable are not chosen here.

estimated coefficient for GDP growth rate remains negative, while that for currency crisis stays positive, with statistical significance. These signs of the statistically significant right-hand-side control variables in **Table 4**, **5** and **6** appear to be reasonable.[20] Intuitively, economic downturn (recession) would entail an increase (decrease) in government debt. On the other hand, because part of government debt is issued in foreign currency, currency crisis also may increase government debt as well.

   The finding of this paper that an increase in the degree of political polarization does not decrease but increase government debt is certainly evidence *against* the predictions of the politico-economic theories of Piguillem and Riboni (2015) and Melki and Pickering (2014). Nevertheless, this finding does not necessarily invalidate these politico-economic theories themselves. Rather, it would suggest that the present-bias conditions of Piguillem and Riboni (2015) and Melki and Pickering (2014) are not actually met.

6. Concluding Remarks

In sum, this paper estimates the effect of political polarization on government debt, because political polarization is highlighted as an important determinant of government debt behavior by various existing politico-economic theories (Persson and Svensson, 1989; Alesina and Tabellini, 1990; Alesina and Drazen, 1991; Melki and Pickering, 2014; Piguillem and Riboni, 2015; Dziuda and Loeper, 2016), while these theories yield mutually conflicting predictions on whether political polarization affects government debt positively or negatively. Testing which one of the predictions is consistent with real data, the effect of political polarization on government debt is estimated using panel data of the OECD countries between 1962 and 2015. This paper finds that

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[20] The estimated coefficients for inter-state war involvement in **Table 4** and **Table 5** remain statistically insignificant. All the inter-state wars that any OECD country was involved with during the sample periods (from 1962 and 2015) are limited local warfare, which might not need a discernible increase in government debt.

an increase in the degree of political polarization leads to an increase in government debt. This finding is robust to changes in the estimation models and remains unchanged before and after instrumenting the key explanatory variable of the degree of political polarization as well as changing the measurement of the degree of political polarization. These empirical findings serve supportive evidence for the politico-economic theories that argue the positive effect of political polarization on government debt (Persson and Svensson, 1989; Alesina and Tabellini, 1990; Alesina and Drazen, 1991; Dziuda and Loeper, 2016). Moreover, this paper also finds that the re-election probability of the incumbent political party is negatively associated with government debt, being consistent with Alesina and Tabellini (1990). Although the theories did not factor in currency crisis or GDP growth rate, the regression analyses of this paper also find that currency crisis and a decrease in the GDP growth rate are positively associated with government debt.

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APPENDIX

The 32 OECD countries, whose data are used for the regression analysis, are Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxemburg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States.

Table 1] Descriptive Statistics

	Mean	(SD)
First Difference in Government Debt (% of GDP)	1.05	(4.80)
First Difference in Political Polarization	0.17	(5.98)
First Difference in Re-Election Probability of the Incumbent	−0.19	(2.64)
Total Number of Congressmen	309.62	(179.23)
Involvement in Inter-State War (=1)	0.01	(0.11)
Growth Rate of GDP (%)	3.41	(18.04)
GDP per capita (PPP, 2011 international billion dollars)	1067.28	(2033.69)
Exchange Rate (national currency per US dollars)	74.48	(241.61)
Currency Crisis (=1)	0.11	(0.32)
Population Share of Prime-Age Workers (%)	65.60	(3.11)
Total Population (million)	38.05	(54.76)
Number of Observations	1150	

(a) The variables with (=1) are binary indicators that take the value of one if the statement of the variable name is true and the value of zero otherwise.
(b) First difference in the variables of Government Debt, Political Polarization, and Re-Election Probability of the Incumbent, respectively, is difference in the current-year and previous-year values of these variables.

Table 2] Unit Root Test Results

	Unit Root Test Statistic
Government Debt (% of GDP)	72.983
First Difference in Government Debt (% of GDP)	470.433[***]
Political Polarization	58.984
First Difference in Political Polarization	338.530[***]
Re-Election Probability of the Incumbent	67.522
First Difference in Re-Election Probability of the Incumbent	300.129[***]
Total Number of Congressmen	92.225[**]
Involvement in Inter-State War	131.911[***]
Growth Rate of GDP	502.440[***]
GDP per capita	79.845[*]
Exchange Rate	120.553[***]
Currency Crisis	843.692[***]
Population Share of Prime-Age Workers	237.451[***]
Total Population	188.161[***]

(a) The standardized χ^2 statistic from Fisher-type Dickey-Fuller unit-root test with no lag is reported and the null hypothesis of the test is that a time-series data of the countries in the panel data contains a unit root.
(b) The notations of *, **, and *** refer to being statistically significant at 10%, 5%, and 1% levels, respectively.

Figure 1] Trend of First Differences in Government Debt and Political Polarization
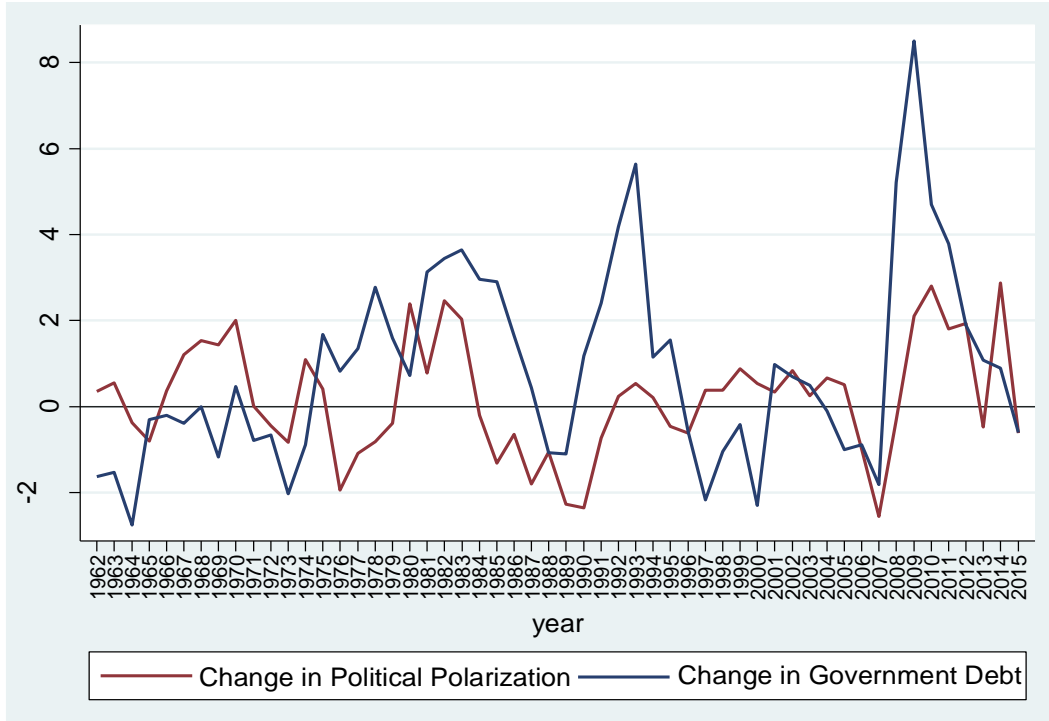
Note: Each year, changes (i.e., first differences) in the degree of political polarization and in government debt (% of GDP), respectively, are averaged over the OECD countries.

Figure 2] Scatterplot of First Differences in Government Debt and Political Polarization
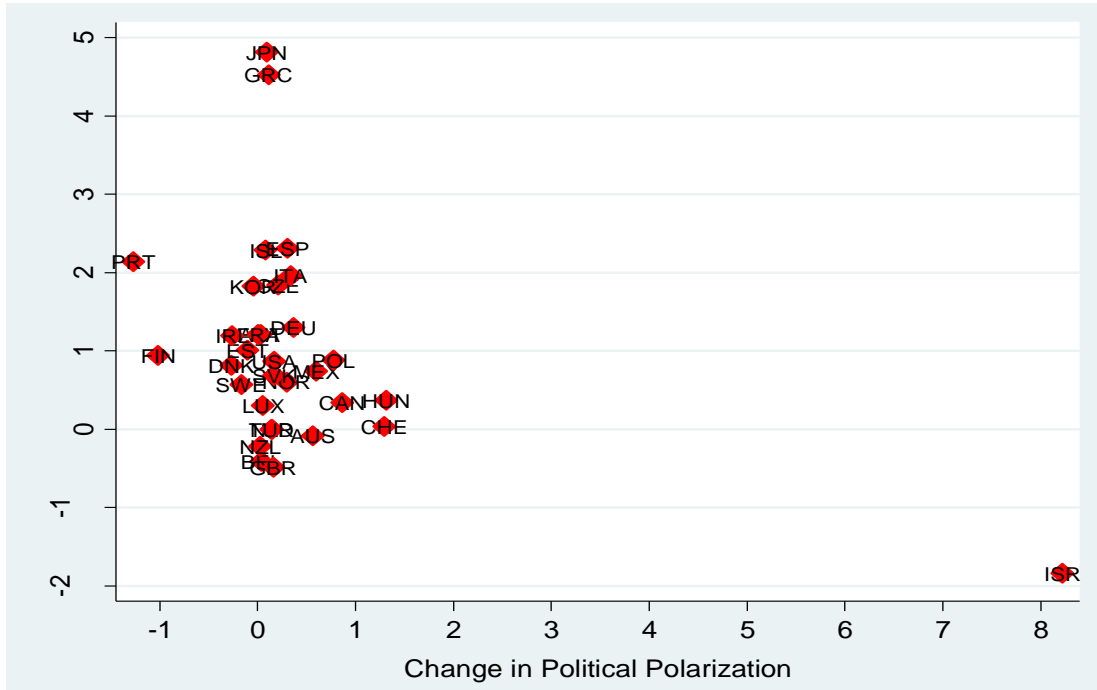
Note: For each OECD country, notated according to ISO 3-letter code, changes (i.e., first differences) in the degree of political polarization and in government debt (% of GDP), respectively, are averaged over the sample periods.

Table 3] Specification Test Results

	H_0 vs H_a	Test Statistic
F-Test	OLS vs. FE	2.53[***]
Breusch-Pagan Lagrange Multiplier Test	OLS vs. RE	36.88[***]
Hausman Test	RE vs. FE	NA
Baltagi Test after instrumenting 'Political Polarization'	HT vs. FE	2.56
Baltagi Test after instrumenting 'Political Polarization' and 'Re-Election Probability of the Incumbent'	HT vs. FE	2.60

(a) The result of Hausman test that compares RE (random effect model) and FE (fixed effect model) is reported as NA (not available) since the calculated test statistic fails to meet the test's asymptotic assumption by being lower than zero.
(b) Both variables of 'Political Polarization' and 'Re-Election Probability of the Incumbent' are stationarized.
(c) The notations of *, **, and *** refer to being statistically significant at 10%, 5%, and 1% levels, respectively.

Table 4] Regressions of Government Debt under Fixed Effect Models

Dependent Variable:	Polarization Measured by Difference in Ideological Stances		Polarization Measured by Esteban-Ray Index of Ideological Stances	
Government Debt	(1)	(2)	(3)	(4)
Political Polarization	0.040[*]	0.038[*]	30.089[***]	30.348[***]
	(0.023)	(0.023)	(11.157)	(11.167)
Re-Election Probability of the Incumbent	−0.122[**]		−0.093[*]	
	(0.052)		(0.054)	
Total Number of Congressmen	0.004	0.003	−0.001	−0.002
	(0.006)	(0.006)	(0.007)	(0.007)
Involvement in Inter-State War	0.820	0.762	0.923	0.957
	(1.282)	(1.285)	(1.319)	(1.320)
Growth Rate of GDP	−0.025[***]	−0.025[***]	−0.024[***]	−0.024[***]
	(0.008)	(0.008)	(0.007)	(0.007)
GDP per capita	0.0004	0.0004	0.0003	0.0003
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Exchange Rate	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Currency Crisis	1.673[***]	1.693[***]	1.479[***]	1.488[***]
	(0.471)	(0.471)	(0.497)	(0.498)
Population Share of Prime-Age Workers	−0.120	−0.107	−0.148	−0.140
	(0.092)	(0.092)	(0.094)	(0.094)
Total Population	−0.010	−0.012	−0.007	−0.008
	(0.029)	(0.029)	(0.029)	(0.029)
Year Dummy Included?	Yes	Yes	Yes	Yes
Number of Observations	1150	1150	1021	1021

(a) The notations of *, **, and *** refer to being statistically significant at 10%, 5% and 1% levels, respectively.
(b) All the variables in the regression are stationary. In particular, the variables whose levels are not stationary are stationarized by first differencing.

Table 5] Regressions of Government Debt under Hausman-Talyor Model

Instrumented Variable(s):	Political Polarization		Political Polarization & Re-Election Probability of the Incumbent
Dep. Variable: Government Debt	(1)	(2)	(3)
Political Polarization	0.038^*	0.037^*	0.038^*
	(0.023)	(0.023)	(0.023)
Re-Election Probability of the	-0.121^{**}		-0.120^{**}
Incumbent	(0.051)		(0.051)
Two Largest Political Parties' Vote	0.456	0.522	0.545
Share	(2.858)	(2.766)	(2.861)
Total Number of Congressmen	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)
Involvement in Inter-State War	0.339	0.250	0.335
	(1.258)	(1.260)	(1.258)
Growth Rate of GDP	-0.025^{***}	-0.025^{***}	-0.025^{***}
	(0.007)	(0.007)	(0.007)
GDP per capita	0.0004^*	0.0004^*	0.0004^*
	(0.0002)	(0.0002)	(0.0002)
Exchange Rate	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)
Currency Crisis	1.670^{***}	1.687^{***}	1.670^{***}
	(0.463)	(0.464)	(0.463)
Population Share of Prime-Age	-0.045	-0.037	-0.044
Workers	(0.076)	(0.076)	(0.076)
Total Population	-0.012	-0.012	-0.012
	(0.012)	(0.012)	(0.012)
Year Dummy Included?	Yes	Yes	Yes
Hansen test statistic [null: over-identified IV] (its p-value)	12.594 (1.559)	12.652 (0.475)	12.100 (0.5195)
Kleibergen-Paap rank LM test statistic [null: weak IV] (its p-value)	45.34*** (0.0001)	44.40^{***} (0.0001)	43.46^{***} (0.0001)
Number of Observations	1150	1150	1150

(a) The notations of *, **, and *** refer to being statistically significant at 10%, 5% and 1% levels, respectively.
(b) All the variables in the regression are stationary. In particular, the variables whose levels are not stationary are stationarized by first differencing

Table 6] Hausman-Talyor Regressions of Government Debt Change with Alternative Measure of Political Polarization (Esteban-Ray Index)

Instrumented Variable(s):	Political Polarization		Political Polarization & Re-Election Probability of the Incumbent
Dep. Variable: Government Debt	(1)	(2)	(3)
Political Polarization	18.362**	19.005**	18.656**
	(7.705)	(7.883)	(7.833)
Re-Election Probability of the Incumbent	−0.087*		−0.087*
	(0.053)		(0.053)
Two Largest Political Parties' Vote Share	0.940	0.903	0.897
	(3.702)	(3.758)	(3.708)
Total Number of Congressmen	0.0006	0.0005	0.0006
	(0.003)	(0.003)	(0.003)
Involvement in Inter-State War	0.751	0.782	0.751
	(1.300)	(1.300)	(1.300)
Growth Rate of GDP	−0.024***	−0.024***	−0.024***
	(0.007)	(0.007)	(0.007)
GDP per capita	0.0003	0.0003	0.0003
	(0.0002)	(0.0002)	(0.0002)
Exchange Rate	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)
Currency Crisis	1.427***	1.434***	1.427***
	(0.491)	(0.491)	(0.491)
Population Share of Prime-Age Workers	−0.069	−0.068	−0.069
	(0.082)	(0.082)	(0.082)
Total Population	−0.006	−0.006	−0.006
	(0.014)	(0.015)	(0.014)
Year Dummy Included?	Yes	Yes	Yes
Hansen test statistic [null: over-identified IV] (its p-value)	4.655	4.635	4.635
	(1.000)	(0.999)	(1.000)
Kleibergen-Paap rank LM test statistic [null: weak IV] (its p-value)	116.97***	116.95***	173.63***
	(0.0001)	(0.0001)	(0.0003)
Number of Observations	1021	1021	1021

(a) The notations of *, **, and *** refer to being statistically significant at 10%, 5% and 1% levels, respectively.
(b) All the variables in the regression are stationary. In particular, the variables whose levels are not stationary are stationarized by first differencing.