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# Wage bargaining structure and political budget cycles: A policy game approach

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## ABSTRACT

Utilizing a panel dataset from OECD countries, this study unveils new evidence suggesting that the centralization of wage bargaining plays a significant role in mitigating Political Budget Cycles. To explain this empirical finding, the paper introduces a political economy model based on a policy game framework, encompassing three key agents: (i) an opportunistic government that decides on the level of budget deficits with the objective of enhancing its reelection prospects, (ii) workers/voters who decide on their sectoral affiliations, and (iii) unions that independently negotiate wages with firms. In this model, the opportunistic government has an incentive to run a budget deficit to favor the median voter, who is affiliated with non-tradable sectors. The mechanism emerges from the impact of debt-financed public spending on relative prices, and consequently, on relative wages between non-tradable and tradable sectors. Wage centralization mitigates the political incentive of opportunistic governments by attenuating the responsiveness of sectoral wages to sectoral prices, thereby pushing down budget deficits towards a socially more optimal level.

## 1. Introduction

In recent years, global public debt levels have reached unprecedented heights, driven by often necessary fiscal measures during the COVID-19 pandemic and by ambitious industrial policies. The resulting high debt levels, coupled with high interest rates and challenges posed by an aging population, raise concerns about long-term debt sustainability. In this context, it becomes crucial to ensure that government deficits are not exploited for short-term political gains. This underscores the importance of understanding the dynamics of political budget cycles (PBCs), where incumbent governments might be tempted to engage in extensive, and potentially sub-optimal, expenditures and tax reductions to boost their reelection prospects.

Previous empirical studies have provided extensive evidence of PBCs in both developed and developing economies.[1] These empirical findings are often explained through theoretical models based on opportunistic pre-electoral manipulations, as originally proposed by Nordhaus (1975), and models of partisan policymakers, pioneered by Hibbs (1977). A significant body of research has focused on examining how various political and institutional factors influence the intensity of PBCs.[2] The present paper instead argues and explains how the centralization of wage bargaining interacts with PBCs.

The motivation emerges from stylized facts that can be observed in the panel of OECD countries. Using the difference in the primary budget balance between election years and the average of the preceding and subsequent years as a proxy for PBCs, Fig. 1 compares the average of this measure between countries with relatively more centralized and less centralized wage bargaining

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[1] See, for example, Shi and Svensson (2002b,a).

[2] See, for example, Alesina and Roubini (1992); Rogoff and Sibert (1988); Shi and Svensson (2006); Persson and Tabellini (2003); Akhmedov and Zhuravskaya (2004); Brender and Drazen (2005).
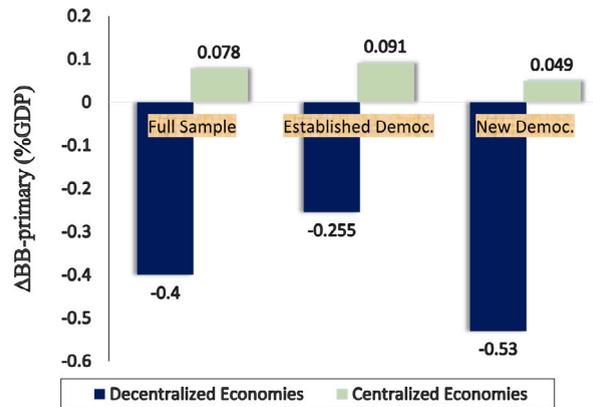
**Fig. 1.** The vertical axis shows (the average of) the change in primary budget balance (%GDP) in election years compared to the preceding and the subsequent years. Dark bars indicate the average of this value for countries with relatively decentralized wage bargaining ($mean(Bargcent) < 2$) and the light bars represent the average in countries with centralized wage bargaining ($mean(Bargcent) > 2$). The comparison is made for the full sample, the sample of established democracies, and the sample of new democracies. See Section 3 for details on *Bargcent*. For the list of established and new democracies, refer to Table A.2.

systems in a sample of OECD countries from 1990 to 2018.[3] The figure also distinguishes between new democracies and established ones. The figure indicates that in countries characterized by less centralized wage bargaining systems, the primary budget deficit in election years tends to be 0.4 percentage points higher than the average of deficits in the preceding and subsequent years. Conversely, in countries with more centralized wage bargaining systems, the primary deficits are even lower in election years, by less than 0.1 percentage points. This observed relationship holds for both established and new democracies.[4]

The three scatter plots in Fig. A.2 depict the relationship between the average (from 1990 to 2018) of the same proxy for PBCs and the average of wage centralization within OECD countries, distinguishing between established and new democracies. The figure consistently suggests that primary deficits tend to be higher in election years only in countries characterized by less centralized wage bargaining systems, both in established and new democracies. In Panel (a) of Fig. A.3, a simple binscatter plot illustrates the relationship between the same two measures, indicating the same conclusion that PBCs are more likely to exist when wage bargaining is more decentralized.

The above-mentioned association between wage centralization and PBCs may be influenced by other country-specific factors, including distinct political and institutional arrangements present in countries with varying wage bargaining systems. To address this concern, Panels (b) to (d) of Fig. A.3 utilize binscatter plots where I control for a suite of economic and political variables, alongside country- and time-fixed effects.[5] This refined analysis not only underscores the association between PBCs and wage centralization but also accentuates its significance, particularly within the set of established democracies.

The binscatter plots in Figs. A.4 and A.5, respectively, examine how primary government expenditure (%GDP) and government revenue (% GDP) are affected by election times and by centralization of wage bargaining. The two figures suggest that the observed relationship between political budget cycles and wage centralization is mainly due to political cycles in government expenditure, and not government revenues.

Even though these stylized facts are motivating, more detailed econometric analyses are needed to truly examine the relationship between political budget cycles and centralization of wage bargaining. Section 3 serves for this aim, incorporating a sample of OECD countries from 1990 to 2018. The baseline empirical results suggest that at the lowest level of wage centralization in our sample, budget deficits (%GDP) tend to be 0.56 percentage points higher in election years. However, an increase in the level of wage centralization by 1 sample standard deviation reduces this effect of election times on budget deficits to 0.22 percentage points. The effect is even larger in the subsample of established democracies, where at the lowest level of wage centralization, budget deficits tend to increase by 0.73 percentage points in election years and the effect is diminished to 0.34 percentage points when wage bargaining increases by one sample standard deviation. Another observation from this section is that wage centralization has no significant association with budget balance outside of election years, suggesting that the association between the two variables stems from a political economy perspective. It is important to mention that this association between wage centralization and PBCs is mainly driven by within-country variations in wage centralization.

As the main contribution of this paper, Section 4 provides a political economy model that explains how the centralization of wage bargaining interacts with PBCs. In this model, the government's incentive to increase deficits during election times arises from the impact of deficits on inter-sectoral relative wages. In OECD countries, characterized by relatively independent central

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[3] For details on how countries are divided based on their level of wage centralization, refer to Section 3.

[4] Brender and Drazen (2005) argue that PBCs are prevalent in new democracies, not in established ones. In contrast, this paper finds strong evidence of PBCs even in established OECD democracies with relatively decentralized wage bargaining systems.

[5] Refer to Section 3.1 for details on the economic and political control variables.

banks, governments face limited options for financing deficits through money printing. Consequently, they resort to issuing bonds. Given the extensive integration of financial markets in these countries, bond issuance leads to capital inflow as foreign investors purchase these bonds. If workers cannot immediately switch sectors, the capital inflow triggers an appreciation of the real exchange rate, i.e. an increase in the relative price of non-tradeable sector products, resulting in an uptick in relative wages for non-tradable sectors (hereinafter, N-sector) compared to tradable sectors (hereinafter, T-sector). This means that such an increase in budget deficits favors workers/voters who are affiliated with N-sectors.

The aforementioned sectoral effects of fiscal policy are well-established within the literature on international macroeconomics. This body of work consistently demonstrates that a shock in government spending is associated with increases in the relative price, relative wages, employment share, and value-added share of non-tradable sectors. For instance, Cardi et al. (2020), utilizing VAR analysis across sixteen OECD countries, discovers that a shock to government consumption by 1% of GDP is associated with a 0.35 percentage point increase in the value added share of the non-tradable sector (see Section 2 for a more detailed review of this literature). In Section 3.4, I explore the sectoral effects of discretionary fiscal policy using a 2SLS approach, where political economy variables serve as instruments for budget deficits. The results indicate that an increase in the deficit by 1% of GDP leads to a 0.335 percentage point increase in the value-added share of the non-tradable sector.

Even though these sectoral effects of fiscal policy are well known in the international macroeconomics literature, their implications for the political economy of fiscal policy have not been studied. Such a distributional effect can create a political incentive to run deficits if policymakers are biased toward non-tradable sectors. This paper argues that such a bias exists, as the vast majority of workers are affiliated with these sectors, as shown by previous literature. For example, Cardi et al. (2020), using a panel of 16 OECD countries from 1970 to 2007, estimates that the non-tradable sector constitutes 67% of total employment and accounts for 63% of total output. Furthermore, using a panel of 18 OECD countries from 1970 to 2015, Cardi and Restout (2023) estimates that the labor share in non-tradable sectors is 62%, while their contribution to GDP is 64%.[6]

I conduct my own calculations for the sample of countries used in the empirical part of this paper. Similarly to the previous literature (see, for example, De Gregorio et al. (1994) and Bradford and Klettzer (2005)), I find that the three sectors (i) 'Manufacturing', (ii) 'Agriculture; forestry and fishing', and (iii) 'Mining and quarrying' (hereinafter, **MAM** sectors) are the most exposed to international trade (where exposure to trade of each sector is measured by the ratio of total international trade to the total value added in that sector). On average, these sectors account for 78.2% of international trade within the sample, while constituting only 21.6% of total employment and 22.1% of total value added.[7] In some countries of the sample, the two sectors, 'Financial and insurance activities' and 'Information and communication' also represent a significant share of international trade, even though the ratio of trade to value-added in these sectors is much lower than the same ratio in the aforementioned three sectors. On average, these two sectors together contribute to 10.5% of international trade, 6% of total employment, and 10.4% of total value added. Collectively, these five sectors (hereinafter, **MAMFI** sectors) account for 88.7% of total trade, 32.5% of total value added, and 28% of total employment in our sample.[8] Fig. 2 illustrates the trend of these averages across the sample countries, while Fig. A.1 displays the time-averaged shares for each individual country.[9] It is noteworthy that Section 3.4 shows that sectoral value-added shares decrease solely in the MAM sectors in response to discretionary budget deficits. This finding, when contextualized within prior research, suggests that only the MAM sectors (which account for an average labor share of only 21.6%) are sufficiently exposed to international trade to be negatively impacted by such deficits. In line with the aforementioned literature, these stylized facts strongly indicate that the majority of workers, affiliated with sectors having low exposure to international trade, may actually benefit from budget deficits and their associated capital inflows.

Given that the majority of workers are affiliated with relatively non-tradable sectors, the distributional impact of budget deficits generates a political motivation for opportunistic incumbent governments to issue bonds and increase budget deficits during election periods, thereby favoring the majority of workers. In the model, this political incentive is embodied by the assumption that the median voter is linked to non-tradable sectors.

Wage centralization interacts with this political incentive by dampening the distributional effect of budget deficits. It achieves this by reducing the responsiveness of sectoral real wages to changes in relative prices, specifically variations in the real exchange rate. This reduction in wage responsiveness arises from what is known as "sectoral wage interdependency", a concept well-established in both theoretical and empirical literature.[10] In essence, wage centralization diminishes the link between sectoral wages and sectoral prices (and other sector- and firm-specific conditions). Instead, wages become more reliant on conditions in other sectors.[11] In the

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[6] See also Boug et al. (2023) and Bradford and Klettzer (2005) for the estimation of labor share of tradable versus non-tradable sectors in Norway and the US, respectively.

[7] The source of data for international trade is the ATLAS Economic Complexity Database, provided by the Growth Lab at Harvard University. Sectoral value added shares are computed using dataset from OECD database. For sectoral employment shares, I used International Labour Organization (ILO) database, completed with OECD database.

[8] It is important to note that the trade share of these sectors could potentially be higher, as some portions of the trade data in the ATLAS Economic Complexity Database are marked as unspecified and may belong to one of the MAMFI sectors.

[9] My estimate for the labor share of tradable sectors is slightly lower than those by Cardi et al. (2020), Cardi and Restout (2023) (28% compared to 33% and 38%). This might be due to the declining trend in labor share, as their samples include years before 1990, when the labor share was higher.

[10] For comprehensive reviews of this relationship, refer to De la Croix (1994) and Kaufman (2002).

[11] For example, Holmlund and Zetterberg (1991) found that in the USA, where wage bargaining is highly decentralized, industry wages were highly responsive to sectoral price and productivity changes. In contrast, in Nordic countries with centralized wage bargaining structures, industry wages were less affected by sectoral conditions. Similar results are evident in cross-country studies, including research by Rycx (2002), Kahn (1998), Blau and Kahn (1996, 1999), Edin and Zetterberg (1992), and Teulings and Hartog (1998), among others. Gürtzgen (2009) also found that in Germany, establishments subject to industry-level wage bargaining had wages that were less responsive to variations in their associated firm's profits, compared to uncovered establishments.
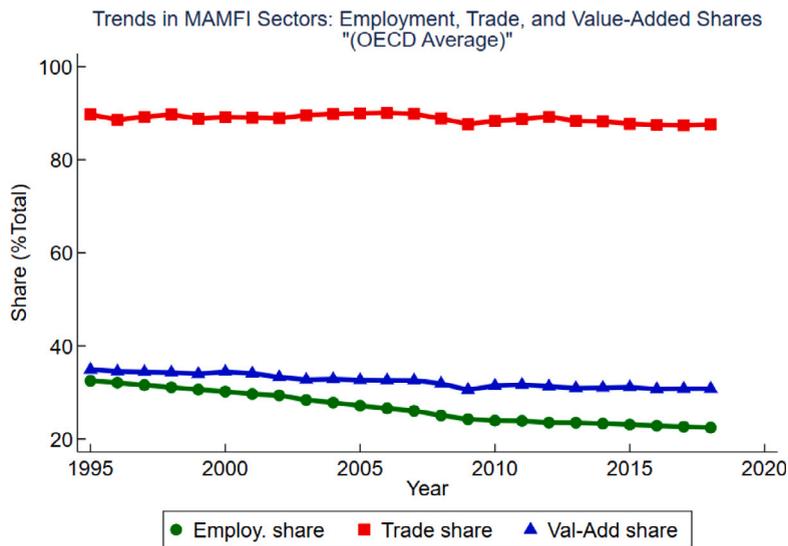
**Fig. 2.** This figure displays the trends in the average shares of the MAMFI sectors in total employment, value added, and trade across the 36 OECD countries included in the sample. While the average shares of trade and value added in MAMFI sectors have remained relatively constant, the average employment share of these sectors has been declining. MAMFI sectors refer to (i) 'Manufacturing', (ii) 'Agriculture; forestry and fishing', (iii) 'Mining and quarrying', (iv) 'Financial and insurance activities', and (v) 'Information and communication'.

context of this paper, this inter-sectoral wage dependency implies that wage centralization mitigates the incumbent government's political incentive to run excessive budget deficits during election periods.

It is noteworthy that the first generations of literature on opportunistic PBCs often hinge on the assumption that households/voters are irrationally myopic (the pioneer paper in this literature is Nordhaus (1975)). This means that when they vote, they do not consider the future costs associated with deficits. Such an assumption suggests that opportunistic governments can systematically manipulate voters, leading to criticism of this literature as being rooted in a *fiscal illusion*.[12] To ensure that the present model avoids the same criticism, it operates within a two-period framework. The first period represents the time leading up to an election, while the second period reflects the post-election phase when the government must repay the debt accumulated in the first period. Importantly, in this model, households, including the median voter, are rational and possess perfect foresight. This means that once the election occurs at the end of the first period, the median voter takes into account that the government is obligated to repay its debt during the second period.

The model features a small open economy with two sectors: (i) tradeable and (ii) non-tradeable, each representing the extremes of exposure to international trade. It comprises three types of agents: (i) households/workers who supply labor to either of these sectors, (ii) an opportunistic government that provides public goods, funded through lump-sum taxes and bond (debt) issuance, to maximize its reelection prospects, and (iii) unions that negotiate wages with firms independently. As detailed in Section 4, the temporal sequence within each period is crucial. Households determine their sectoral affiliation at the beginning of each period. Subsequently, the government decides on the level of public goods provision and, implicitly, the extent of its deficits. Finally, following these decisions, firms and unions engage in wage negotiations.

The model features a two-period game between atomistic and rational workers, who make choices about their sectoral affiliations, and an opportunistic government, which decides the level of budget deficits strategically to maximize its reelection chances. Wage centralization interacts with the strategy of the opportunistic government, as it alters the payoffs of its strategy. The model illustrates that the incumbent's opportunistic incentives create a wedge between the chosen level of budget deficit and the socially optimal level, leading to reduced welfare for all households, including that of the median voter. In other words, all households would be better off if the government committed to the socially optimal level of budget deficit. However, such a commitment suffers from the lack of credibility and from time-inconsistency problems, due to the incumbent's opportunistic motives. In this framework, the centralization of wage bargaining, by diminishing the sensitivity of sectoral wages to the budget deficit, lessens the government's opportunistic incentives. This results in a reduction of the budget deficit in election times, bringing it closer to the socially optimal level. The policy game approach incorporated in the model is inspired by the seminal work of Kydland and Prescott (1977) and adapts it to the context of PBCs.

The remainder of the paper is organized as follows: Section 2 reviews the relevant literature. Section 3 focuses on empirical research regarding the association between centralization of wage bargaining and PBCs. Section 4 presents a political economy model that elucidates the empirical findings. Finally, Section 5 offers a discussion of the model and concludes.

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[12] Critiques of this perspective can be found in works such as Rogoff and Sibert (1988), Drazen (2000), and Alesina and Perotti (1995).

## 2. Contribution to the literature

The present paper is related to the extensive literature on Political Budget Cycles (PBCs). The empirical studies of this literature have provided extensive evidence of PBCs in both developed and developing economies (See, for example, Shi and Svensson (2002b,a)). These empirical findings are often explained through theoretical models based on opportunistic pre-electoral manipulations, as originally proposed by Nordhaus (1975), and models of partisan policymakers, pioneered by Hibbs (1977). Most of this literature has focused on examining how various political and institutional factors influence the intensity of PBCs (e.g. Alesina and Roubini, 1992; Rogoff and Sibert, 1988; Shi and Svensson, 2006; Persson and Tabellini, 2003; Akhmedov and Zhuravskaya, 2004; Brender and Drazen, 2005.) The present paper brings a new contribution to this literature by exploring how wage bargaining structures interacts with PBCs.

This paper is also related to the international macroeconomic literature that studies sectoral effects of discretionary budget deficits. The seminal theoretical contribution dates back to Rødseth (1979). This body of work consistently demonstrates that a shock in government spending is associated with increases in the relative price, relative wages, employment share, and value-added share of non-tradable sectors. For instance, Cardi et al. (2020), utilizing VAR analysis across sixteen OECD countries, discovers that a shock to government consumption by 1% of GDP raises the value added share of non-tradables by 0.35 percentage points. Additionally, Boug et al. (2023) demonstrates that expansionary fiscal policy increases the value added in the non-traded goods sector at the expense of the traded goods sector. Bénétrix and Lane (2010) Using a panel of EMU member countries, they find that fiscal shocks lead to an increase in the relative size of the non-traded sector. (also see Bénétrix and Lane, 2010; Cardi and Restout, 2023; Monacelli and Perotti, 2008 as other references for this literature). The contribution of my paper to this literature is twofold. First, it examines the implications of the sectoral effects of fiscal deficits, as discussed in this literature, for political budget cycles. This approach bridges the gap between this literature and PBCs literature, offering new insights into how sectoral shifts influence political incentives. Second, while most prior empirical work on the sectoral effects of fiscal policy in this literature has relied on VAR analysis to address potential endogeneity issues, the political economy framework of this paper facilitates the use of a 2SLS approach. This method is enabled by incorporating political and institutional variables that explain budget deficits as exogenous and relevant instruments for fiscal policy, as detailed in Section 3.4. The findings closely align with those of the aforementioned literature, indicating that an increase in the deficit by 1% of GDP results in a 0.335 percentage point increase in the value-added share of the non-tradable sectors.

In addition to the literature on PBCs and on sectoral effects of fiscal policies, the paper is also related to the vast literature that studies macroeconomic impacts of wage bargaining centralization (see, for example, Mauro et al., 2023; Daniels et al., 2006). The literature on how wage bargaining centralization affects budget deficits is rather limited. Arabzadeh (2022), utilizing the pooled-mean-group (PMG) ARDL methodology, identifies a long-term negative association between wage centralization and budget deficits in a sample of OECD countries. While the findings of that paper align with the results of this study in terms of the direction of the association between wage centralization and budget deficits, the present paper distinguishes itself by focusing on the interaction between election times and wage centralization. This focus yields the novel empirical result that wage centralization predominantly impacts deficits only during election periods, suggesting that the observed association primarily emerges from a political economy perspective.

Another relevant study is Roubini and Sachs (1989), suggesting a U-shaped relationship between wage centralization and budget surplus. Theoretically, this results is based on the "hump-shaped" hypothesis proposed by Calmfors and Driffill (1988). The hump-shaped hypothesis posits that extensive wage indexation is prevalent in countries with labor markets characterized by numerous powerful unions bargaining non-cooperatively at an intermediate level, and less prevalent in countries with either highly decentralized, thus weaker unions, or in countries with **corporatist** wage bargaining structures (where unions negotiate at the national level). The rationale behind the hump-shaped hypothesis is that in national-level wage bargaining, highly centralized unions coordinate and internalize the macroeconomic consequences of wage increases on unemployment. Conversely, in highly decentralized economies (bargaining at the firm level), unions are too weak to demand significant wage increases. Therefore, wages are lower in both extremes compared to the intermediate level of bargaining, where unions are sufficiently large and powerful to demand higher wages but lack sufficient centralization for coordination.[13] Roubini and Sachs (1989) argue that this "hump-shaped" hypothesis translates into a U-shaped relationship between wage centralization and budget surplus, reasoning that government spending programs are the fiscal counterpart to wage indexation schemes. Consequently, the political demand for government transfer programs is larger in countries with an intermediate level of wage bargaining and lower in countries with either highly decentralized or corporatist wage bargaining structures. The humped-shaped relationship between wage centralization and budget deficits as proposed by Roubini and Sachs (1989), however, is not consistent with the empirical findings of the present paper, notably, the empirical results of my paper suggests that the attenuating effect of wage bargaining centralization on PBCs is not driven by extreme cases of wage bargaining centralization (i.e. corporatist wage bargaining) and PBCs are smaller in the intermediate level of wage centralization as compared to very decentralized cases of wage bargaining structures.[14]

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[13] Based on this influential paper of Calmfors and Driffill (1988), other studies also find non-monotonic and humped-shaped relationship between wage bargaining centralization and macroeconomic variables (see, for example, Iversen, 1999; Daniels et al., 2006).

[14] Arabzadeh (2022) also shows that the empirical relation between budget deficits and wage centralization is linear once one controls for country-fixed effects.

## 3. Empirical analysis

This section introduces new evidence regarding the interaction between the centralization of wage bargaining and political budget cycles. The analysis focuses on a panel of OECD countries spanning the years 1990 to 2018. The selection of this time frame is due to the democratization of several OECD countries in the late 1980s or early 1990s. The baseline regression model employed is as follows:

$$BB\_prim_{it} = \beta_0 + \beta_1\, election_{it} + \beta_2\, cent_{it} + \beta_3\, election_{it} \cdot cent_{it} + Z_{it}\,\beta + \gamma_t + \eta_i + \varepsilon_{it}, \tag{1}$$

where $BB\_prim$ represents the primary budget balance as a percentage of GDP. The variable $election$ serves as an electoral dummy, while $cent$ denotes a measure of wage centralization, details of which will be discussed later. $Z$ constitutes a vector of control variables. The terms $\gamma_t$ and $\eta_i$ are included to capture time-fixed effects and country-fixed effects, respectively. The error terms are represented by $\varepsilon_{it}$. A key focus of this analysis is the coefficient $\beta_3$, which captures how centralization of wage bargaining interacts with political budget cycles, i.e., with the impact of $election$ on the budget balance.

### 3.1. Variables and source of data

#### 3.1.1. Centralization of wage bargaining (cent)

To measure the centralization of wage bargaining, denoted as $cent$, I utilize the ICTWSS database (Visser, 2019). This database offers two key variables as indicators of wage centralization. The first, referred to here as $Barglevel$, indicates the predominant level of wage bargaining.[15] $Barglevel$ is assigned the following values:

- $Barglevel = 5$: Bargaining predominantly occurs at the central- or cross-industry level, with centrally determined binding norms or ceilings guiding agreements negotiated at lower levels.
- $Barglevel = 4$: Intermediate, alternating between central- and industry-level bargaining.
- $Barglevel = 3$: Bargaining predominantly occurs at the sector- or industry-level.
- $Barglevel = 2$: Intermediate, alternating between sector- and company-level bargaining.
- $Barglevel = 1$: Bargaining predominantly occurs at the local- or company-level.

A bargaining level is *predominant* if it accounts for at least two-thirds of the total bargaining coverage rate in a given year and country. If it accounts for less, but for more than one-third of the coverage rate, we have a mixed or intermediate situation, between two levels. A mixed situation also occurs when bargaining levels alternate and/or it is impossible to assess which of the two contributes more to the actual regulation of employment relations.

In the ICTWSS database, $Bargcent$ is identified as the comprehensive measure of wage bargaining centralization. This continuous variable extends beyond $Barglevel$ - the predominant level of wage bargaining - by incorporating three additional dimensions: (i) the prevalence and regulatory oversight of subsidiary bargaining at the enterprise level, (ii) the degree to which central or sectoral agreements accommodate subsidiary bargaining, and (iii) the adaptability of agreements via *opening clauses*.[16] The integration of these elements renders $Bargcent$ a more nuanced measure of wage centralization. However, its utilization is constrained by limited data availability for some countries, resulting in narrower coverage compared to $Barglevel$. In this study, $Bargcent$ is utilized as the primary measure, with $Barglevel$ being employed for robustness checks.[17]

It is noteworthy that the within-country variations of these two variables are considerably smaller compared to their between-country counterparts.[18] Remarkably, in 10 of the 36 countries in the sample, $Bargcent$ remains unchanged. Additionally, once a change in this variable occurs, it tends to remain stable for several years. These patterns reflect the inherent nature of wage bargaining as a structural variable. Crucially, for the purposes of this analysis, it seems implausible that governments could significantly alter the structure of wage bargaining during election periods. This supports the assumption that this variable is exogenous to political budget cycles.

#### 3.1.2. Dummy variable for election

I employ the Database of Political Institutions (DPI) to construct a dummy variable that indicates election periods (Scartascini et al., 2021). The DPI offers comprehensive data on both legislative and executive election dates, inclusive of the specific months when these elections occur. For each country $i$, the dummy variable $election_{it}$ is assigned a value of 1 if an election is held during the second, third, or final quarter of year $t$, or in the first quarter of the following year, $t+1$. This approach is based on the premise that if an election is scheduled early in the year, any budget deficits associated with political budget cycles are more likely to occur in the preceding year. In Section 3.2, I conduct various robustness checks to examine the influence of this definition of $election$ on the study's results.

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[15] In the ICTWSS database, this variable is labeled **Level**.

[16] For detailed information, see Visser (2019).

[17] Table A.1 presents the summary statistics for these two variables.

[18] The average within-country standard deviation of $Bargcent$ is 0.32, in contrast to its overall standard deviation of 1.03 in the sample. For more detailed information, refer to Table A.1.

Within the OECD country sample, DPI categorizes democratic systems into three types based on the election method of chief executives: (i) Parliamentary, (ii) Assembly-Elected President, and (iii) Presidential.[19] For baseline regressions, executive elections in Presidential systems and legislative elections in Parliamentary and Assembly-Elected President systems are considered. In Section 3.2, I analyze the sensitivity of the results to this specific definition of *election*.

### 3.1.3. Control variables

I consider two sets of control variables: (i) economics control variables and (ii) political/institutional control variables. Following previous literature (see for example, Brender and Drazen, 2005 and Persson and Tabellini, 2003), the first set includes the following variables:

- *age_dep:* that sums the fraction of the population aged 15–64 and that of the population older than 65+. Higher age dependency implies limited tax bases and more public spending for retirements, public education, etc. Therefore, the coefficients of this variable is expected to be negative.[20]
- *NR:* which is the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents, normalized by the GDP. Higher natural resource rents provide governments with higher revenue, reducing pressure on governments' budgets.
- *interest* which is governments' interest payments on their accumulated debts (% GDP). Higher interest payments increases the cost side of the budget. Since our dependent variable is the primary budget balance, the level of these payments is not likely to directly affect the dependent variable. However, debts become more discretionary when they become large. As a result, it is expected that governments with very high levels of debts and interest payments face more difficulty to issue bonds and run deficits.
- *L_GDPpc*: which is the natural logarithm of the real GDP per-capita (based on constant 2015 US$).
- *trade*: trade openness, which is the sum of imports and exports in goods and services normalized by the GDP.

The set of political/institutional variables includes:

- *Herfindahl:* this is the Herfindahl index, which measures the extent of governments' cohesion or fragmentation.
- *ideology:* which is a categorical variable and measures the executive party's orientation with respect to economic policy. This variable takes values of 1, 2, 3 for executive party defined as Right, Center, and Left, respectively. This variable equals 0 for all those cases that party's platform does not focus on economic issues (not defined in the previous categories), or there are competing wings, or no information is available.[21]
- *plurality:* is a dummy variable that equals to 1 in cases of *plurality* systems, and 0 otherwise.
- *system:* which takes 0 for Parliamentary systems, 1 for Assembly-Elected President systems, and 2 for Presidential systems.
- *Fiscal Rule:* is a dummy variable that equals 1 if the central government is subject to fiscal rules limiting its budget deficits. This includes EU countries following the establishment of the Stability and Growth Pact (SGP) in 1997 and Switzerland following the implementation of the 'debt brake' rule in 2003.

The sources for the data of each variable are detailed in Table A.3.

### 3.2. Regression results

Table 1 presents baseline results. The first column represents a simple model that examines the existence of political budget cycles in the sample of OECD countries, without incorporating the measure of wage centralization and control variables. Although the coefficient of *election* is negative, it is not statistically significant. Similar results are obtained when either or both sets of control variables are included in the model.[22]

In column (2), I introduce the baseline measure of wage centralization (*Bargcent*) and its interaction with *election*. Now, the coefficient of *election* is not only negative but also highly significant, while the coefficient of the interaction term is significantly positive. This suggests that political budget cycles exist for low levels of wage centralization, but the centralization of wage bargaining tends to mitigate political budget cycles. It is important to note that the minimum level of *Bargcent* in our sample is 0.8. The estimated coefficients imply that at the minimum level of wage bargaining centralization, budget deficits tend to be 0.56 percentage points higher in election times, consistent with political budget cycles. However, an increase in the level of wage centralization by 1 sample standard deviation (1.03) reduces this effect of election times on budget deficits to 0.22 percentage points.

Table 1 also reports the impact of election times on budget deficits across different levels of wage bargaining centralization. For instance, at the 25th percentile of *Bargcent* (with a value of 1), the estimated coefficients reveal that at this level of wage centralization, budget balances (%GDP) are significantly higher during election times by $-0.82 + 0.325 = -0.495$ percentage points,

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[19] For detailed definitions of each system, refer to Scartascini et al. (2021).

[20] As a robustness check, I consider old and young age dependency as two separate variables. The results are not sensitive to this different consideration.

[21] See Scartascini et al. (2021), for more information.

[22] The corresponding results for the regression without the measure of wage centralization but with control variables are not reported, but can be provided upon request.

**Table 1**
Baseline regressions.

| Dependent variable | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| | BB_prim | BB_prim | BB_prim | BB_prim | BB_prim | BB_prim | BB_prim |
| *election* | −0.054 | −0.820** | −0.874*** | −0.742** | −0.806** | −0.809*** | −0.945** |
| | (0.171) | (0.306) | (0.310) | (0.300) | (0.304) | (0.307) | (0.381) |
| *Bargcent* | | −0.129 | −0.020 | −0.122 | −0.057 | −0.104 | −0.453 |
| | | (0.786) | (0.881) | (0.832) | (0.902) | (0.748) | (0.583) |
| *election × Bargcent* | | 0.325*** | 0.331*** | 0.307*** | 0.309*** | 0.302*** | 0.357*** |
| | | (0.109) | (0.114) | (0.107) | (0.110) | (0.111) | (0.130) |
| **Marginal effect of *election* at different percentiles of wage centralization** | | | | | | | |
| *Bargcent* = 1 (25th pctle) | | −0.495** | −0.544** | −0.436** | −0.498** | −0.508** | −0.588** |
| *Bargcent* = 1.8 (50th pctle) | | −0.235 | −0.279* | −0.190 | −0.251* | −0.266* | −0.302* |
| *Bargcent* = 2.5 (75th pctle) | | −0.00697 | −0.0477 | 0.0243 | −0.0348 | −0.0547 | −0.0525 |
| *Bargcent* = 3.5 (90th pctle) | | 0.318* | 0.283* | 0.331** | 0.274* | 0.247 | 0.305* |
| Observations | 991 | 956 | 911 | 950 | 906 | 906 | 906 |
| R-squared | 0.260 | 0.269 | 0.346 | 0.287 | 0.360 | 0.42 | 0.71 |
| Number of countries | 36 | 35 | 33 | 35 | 33 | 33 | 33 |
| **Included controls:** | | | | | | | |
| Economic Control Variables | No | No | Yes | No | Yes | Yes | Yes |
| Political Control Variables | No | No | No | Yes | Yes | Yes | Yes |
| Count. FE | Yes | Yes | Yes | Yes | Yes | No | Yes |
| Time FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Country spec. trends | No | No | No | No | No | No | Yes |

– For all columns, the dependent variable is the primary budget balance.
– The second part of the table reports the effect of *election* on primary budget balance at different percentiles of wage centralization.
– ICTWSS does not provide data on *Bargcent* for Iceland. Data on *interest* is missing for Latvia and Lithuania.
– Robust standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

consistent with the PBCs. At the median level of wage centralization (*Bargcent* = 1.8), the effect of *election* on the primary budget balance shows a reduction of just −0.235 percentage points. In contrast, at the 90th percentile (*Bargcent* = 3.5), budget deficits tend to be even 0.32 percentage points lower in election times than in non-election periods. This result might be due to the assumption that wage centralization *linearly* interacts with political budget cycles.[23] Alternatively, it could also reflect the opposing view in the literature that voters in developed countries are "fiscally conservative", typically penalizing rather than rewarding fiscal manipulation.[24]

One important observation from column (2) is that the coefficient of wage centralization is negative but insignificant. This implies that centralization of wage bargaining has an impact on the budget balance only in election times, suggesting that the association between wage centralization and budget deficits arises from a political economy perspective.

In columns (3) and (4), I separately add the two sets of economic and political/institutional control variables to the model, respectively. In column (5), I include both sets of control variables simultaneously. The results remain similar to those in column (2), both quantitatively and qualitatively. In column (6), I omit controlling for country-fixed effects. The results remain very similar, suggesting that most of the findings in columns (2)-(5) stem from within-country variations in wage centralization.

Another concern addresses possible pre-trends in both wage centralization and PBCs. To account for this possibility, in column (7), I control for country-specific trends. The results, with these adjustments, are consistent with those in previous columns.

### 3.2.1. Robustness checks

In this subsection, I provide various robustness checks for the previous findings.

*Corporatist behavior of unions:.* One important question is whether the association between wage centralization and PBCs is influenced by extreme cases of wage bargaining centralization, i.e. corporatist wage bargaining, where bargaining occurs at the national- or cross-industry levels with the possibility of government involvement in the wage bargaining process. In instances of such corporatist wage bargaining, the association between wage bargaining and PBCs might emerge through the direct influence of the government or through cooperative behavior of unions that results in internalizing potential externalities (similar to the argument provided by Roubini and Sachs (1989)). It is noteworthy that cases of such extreme cases of wage bargaining were more prevalent in, for example, Nordic countries before 90's. Since 90's, with the trends toward wage bargaining decentralization that started in 80's, those extreme cases of wage bargaining have not been prevalent anymore in OECD countries.

To explore more deeply whether the association between wage centralization and PBCs are driven by corporatis behavior of unions in highly centralized wage bargaining cases, in columns (1) and (2) of Table A.4, I exclude cases where *Bargcent* ≥ 4

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[23] The results in columns (1)-(2) of Table A.4 suggest that the attenuating impact of wage centralization on PBCs diminishes as the degree of centralization increases.

[24] See Peltzman (1992), Besley and Case (1995), Alesina et al. (1998), Brender (2003).

(i.e. cases with important influence of national-level or cross-industry-level bargaining), without and with the two sets of control variables, respectively. The coefficient of the interaction term remain qualitatively similar to those in columns (2) and (5) in Table 1, but are quantitatively larger. This finding suggests that the results from the previous columns are not attributable to the cooperative behavior of wage setters nor to the influence of the government on the wage-setting process. Furthermore, it indicates that the attenuating impact of wage centralization on PBCs might even diminish as the degree of centralization increases.

*Established versus new democracies:.* Brender and Drazen (2005) argue that PBCs are more prevalent in new democracies than in established ones. In light of this argument, in columns (3) and (4) of Table A.4, I split the sample into two subsamples of established and new democracies, respectively.[25] The findings are consistent with previous results across both subsamples.[26]

*Alternative measure of wage centralization.* In columns (5) and (6) of Table A.4, I employ *Barglevel* as an alternative measure of wage centralization. The benefit lies in its broader coverage compared to *Bargcent*.[27] However, as mentioned earlier, this choice comes with a trade-off: crucial aspects of wage centralization, such as the incidence of and control over additional bargaining at the enterprise level, are not captured in the definition of *Barglevel*. These elements contribute to higher variations in *Bargcent* compared to *Barglevel*.

The corresponding in columns (5) and (6) of Table A.4 mirror the model specifications in Columns (2) and (5) of Table 1 (model specifications without and with the two sets of control variables, respectively). Importantly, the key findings persist. Specifically, the coefficient of *election* remains significantly negative, and that of the interaction term is significantly positive across the two model specifications. Additionally, the coefficient of *Barglevel* remains statistically insignificant in both columns.

*Pre-determined versus endogenous elections:.* One concern regarding the validity of the empirical results is that elections can be endogenous in some countries.[28] This can lead to endogeneity bias due to reverse causation or from shocks that simultaneously influence the election date and the fiscal balance. To address this issue, I focus on elections with pre-determined timings. Following Brender and Drazen (2005), this is achieved by examining the constitutionally set election intervals and considering as pre-determined those elections held either at the fixed interval or within the expected year of the constitutionally fixed term.

The corresponding results are reported in columns (1)-(3) of Table A.5. In columns (1) and (2), only the dummy for pre-determined elections (and its interaction with wage centralization) are considered, first without and then with the two sets of control variables. In column (3), I also include the dummy for endogenous elections and its interaction with *Bargcent*. Across these columns, the coefficients of pre-determined *elections* and their interaction with *Bargcent* are consistent with previous results and are statistically significant. Quantitatively, these coefficients are even larger in absolute terms when compared with columns (2) and (5) of Table 1. The coefficients for the dummy of endogenous elections and its interaction display consistent signs, yet they are not statistically significant.[29]

*Alternative measures of election.* For robustness check, I explore two alternative measures of *election*. First, I redefine *election* such that $election_{it} = 1$ if and only if there is an election in the *last two quarters* of year $t$ or the *first two quarters* of year $t+1$. Consistent with the baseline, for Parliamentary and Assembly-Elected President systems, I consider legislative elections, while for Presidential systems, I consider executive elections. This definition is labeled as $election^{def2}$. The corresponding results are reported in columns (4) and (5) of Table A.5, replicating the same model specifications found in columns (2), (5) of Table 1, respectively.

In the second approach, I redefine *election* to encompass both legislative and executive elections, independent of *system*. This is denoted as $election^{def3}$. The results are presented in Columns (5)-(6) of Table A.5, where these columns mirror the model specifications of Columns (2), (5) of Table 1, respectively. Across the columns of this table, the previous results regarding the sign and significance of the main coefficients of interest remain consistent.

### 3.3. Government expenditures versus tax

In this subsection, I investigate the impact of election times on changes in primary government expenditure and revenue, exploring whether this relationship is contingent upon the centralization of wage bargaining. I utilize the baseline measures of wage centralization (*Bargcent*) and *election*. The results are reported in Table A.6.

The first four columns of the table focus on the dependent variable, primary government expenditure (%GDP). The initial column omits control variables, while the second column incorporates both economic and political controls. The third column introduces controls for country-specific linear trends, and the last column narrows the focus to established democracies.

The results reveal that the coefficient of *Gov. Exp.* is significantly positive, indicating that governments tend to increase their primary expenditure during election times, consistent with PBCs. Notably, the coefficient of the interaction term is significantly negative, suggesting that when wage bargaining is more centralized, governments have less incentive to increase their expenditure

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[25] Established democracies are identified as countries that transitioned to democratic governance before 1970, thus having a democratic history of at least 20 years before the beginning of the sample period.

[26] It is noteworthy that both the effect of the election and the interaction term appear smaller and less significant in the new democracies subsample. This may be attributed to the smaller number of observations in this group.

[27] Notably, the ICTWSS database lacks *Bargcent* data for Iceland, whereas it includes *Barglevel* data for this country.

[28] For example, Heckelman and Berument (1998) finds that election dates in Japan and the UK are endogenous.

[29] The lack of significance may be due to the low variance of the variable.

during election times. Consistent with previous findings, the coefficient of *Bargcent* is not significant, indicating that wage bargaining centralization does not affect government expenditure outside of election times.

In Columns (5)-(8) of Table A.6, the dependent variable is government revenue (% GDP). These columns replicate the same model specifications as Columns (1)-(4), respectively. The results indicate that neither the coefficient of *election* nor that of the interaction term are statistically significant. Furthermore, their signs change across the columns. This suggests that in our sample, there is no evidence that governments manipulate elections by altering taxes.

To summarize, the empirical findings from this section indicate that in the OECD countries sample, governments tend to increase budget deficits during election times, primarily through expanded expenditure. Additionally, the centralization of wage bargaining appears to mitigate this tendency

### 3.4. Sectoral effects of budget deficits

As explained in Section 2, a large body of research has focused on understanding the sectoral effects of discretionary fiscal policies, particularly how these policies impact the relative employment, value added, wages and prices of tradable versus non-tradable sectors. For the empirical part, these studies have typically employed VAR analysis to address potential endogeneity problems, as budget deficits and their components can be endogenous and influenced by various macroeconomic variables. This section, guided by the empirical results of the previous subsections, uses political and institutional variables as exogenous instruments for fiscal deficits. This approach is important not only because it offers a new method for examining the sectoral effects of budget deficits (and, thereby, bridging the gap between the PBCs and international macroeconomics literature), but also because these sectoral effects are central to the theoretical mechanism that I will explain in the next section.

I will focus on the value added share of tradable versus non-tradable sectors. In the sample, the three sectors (i) 'Manufacturing', (ii) 'Agriculture; forestry and fishing', and (iii) 'Mining and quarrying' (**MAM** sectors) are the most exposed to international trade (where exposure to trade of each sector is measured by the ratio of total international trade to the total value added in that sector). This is in line with the findings of previous literature (see, for example, De Gregorio et al. (1994) and Bradford and Klettzer (2005)). On average, these sectors account for 78.2% of international trade within the sample, while constituting only 21.6% of total employment and 22.1% of total value added.[30] In some countries of the sample, the two sectors, 'Financial and insurance activities' and 'Information and communication' also represent a significant share of international trade, even though the ratio of trade to value-added in these sectors is much lower than the same ratio in the aforementioned three sectors.[31] On average, these two sectors together contribute to 10.5% of international trade, 6% of total employment, and 10.4% of total value added. Collectively, these five sectors (**MAMFI** sectors) account for 88.7% of total trade, 32.5% of total value added, and 26.7% of total employment in our sample. Therefore, I interpret these five sectors as tradable sectors.

The OLS specification of the empirical model is:

$$Sectoral\,Shares_{it} = \beta_0 + \beta_1\,BD\_prim_{it} + Z_{it}\,\beta + \gamma_t + \eta_i \cdot year + \varepsilon_{it}, \tag{2}$$

where $BDprim$ stands for primary budget deficits (%GDP) and $Z_{it}$ is the set of *economic* control variables as descried in Section 3.1.3. $\gamma_t$ is time fixed effects and $\eta_i \cdot year$ captures country-specific trends.[32] Obviously, the OLS regression of Eq. (2) might suffer from endogeneity problems as both sectoral shares and budget deficits could be influenced by other macroeconomic shocks. Guided by the findings of the previous subsections, I employ a 2SLS approach, using the dummy for *predetermined elections* and its interaction with other political/institutional variables as exogenous instruments for primary budget deficits.[33] This implies that the second stage of the 2SLS approach measures the sectoral effect of deficits generated solely by the political incentives of incumbent governments.

The results are reported in Table 2. The first column presents a simple fixed-effects OLS regression of Eq. (2), conducted without the use of exogenous instruments. The dependent variable is the value-added share of MAMFI sectors. The results show that an increase in the primary budget deficit by 1% of GDP is significantly associated with a decline in the value-added share of MAMFI sectors, consistent with previous literature. In the second column, I employ the aforementioned 2SLS approach. Here, the coefficient of $BD\_prim$ is much larger in absolute terms. This more appropriate approach suggests that a politically induced budget deficit of 1% of GDP is associated with a 0.335 percentage point decline in the value-added share of MAMFI sectors. This represents almost a 1% decline in this share compared to its sample mean of 32.5%. This result is very close to the findings of Cardi et al. (2020) that use VAR analysis for sixteen OECD countries.

In columns (3)-(7) of Table 2, I explore how primary budget deficits affect the value-added share of the five tradable sectors individually. The results show that the effect of budget deficits on sectoral value-added share is significant only for 'Manufacturing',

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[30] The source of data for international trade is the ATLAS Economic Complexity Database, provided by the Growth Lab at Harvard University. Sectoral value added shares are computed using dataset from OECD database. For sectoral employment shares, I used International Labour Organization (ILO) database, completed with OECD database.

[31] The exposure to trade for other sectors is lower than these five sectors.

[32] In most countries within the sample, there are observable trends in sectoral value-added shares. Therefore, controlling for country-specific trends is crucial. Nevertheless, the signs and significance of the results remain robust, even when these trends are not accounted for.

[33] $L\_GDPpc$ and *trade* might cause an endogeneity problem in the first stage of the 2SLS approach. As a robustness check, I removed these two variables from the regression model. Also, to get stronger instruments for $BD_p rim$, as a robustness check, I included only those political/institutional variables that have a significant association with budget deficits (i.e., wage centralization, *ideology*, *Fiscal Rule*, *Herfindahl*) and their interaction with predetermined *election*. The results are robust to these robustness checks. The corresponding results are not reported but are available upon request.

**Table 2**
Effects of budget deficits on sectoral value added shares.

| Dep. Var. Included Sectors | (1) VA-Share MAMFI | (2) VA-Share MAMFI | (3) VA-Share Manufac. | (4) VA-Share Agri. | (5) VA-Share Mining | (6) VA-Share Info&Commun. | (7) VA-Share Fina&Insur. |
|---|---|---|---|---|---|---|---|
| BD-prim | −0.145*** | −0.335*** | −0.266*** | −0.116** | −0.091* | 0.013 | 0.125 |
| | (0.041) | (0.088) | (0.095) | (0.047) | (0.055) | (0.072) | (0.078) |
| age_dep | 0.170** | 0.179*** | −0.057 | 0.051* | 0.063** | 0.062 | 0.060 |
| | (0.067) | (0.061) | (0.061) | (0.029) | (0.031) | (0.041) | (0.057) |
| L_GDPpc | 5.641 | 4.217 | 8.213* | −2.791** | −0.803 | −0.020 | −0.382 |
| | (4.289) | (3.101) | (4.489) | (1.393) | (1.206) | (0.995) | (2.079) |
| trade | 0.080*** | 0.065** | 0.071** | −0.001 | −0.005 | 0.007 | −0.007 |
| | (0.029) | (0.028) | (0.029) | (0.005) | (0.005) | (0.005) | (0.010) |
| NR | 0.793*** | 0.628*** | −0.198 | −0.132 | 1.100*** | −0.049 | −0.092 |
| | (0.127) | (0.115) | (0.215) | (0.091) | (0.233) | (0.064) | (0.096) |
| interest | 0.255 | 0.223 | 0.457* | −0.011 | −0.090 | 0.114 | −0.247 |
| | (0.182) | (0.210) | (0.262) | (0.117) | (0.108) | (0.104) | (0.159) |
| interest (squared) | 0.012* | 0.012 | −0.011 | −0.001 | 0.004 | −0.006 | 0.026*** |
| | (0.008) | (0.008) | (0.009) | (0.004) | (0.004) | (0.004) | (0.006) |
| Sample mean of the dependent variable (% total value added): | | | | | | | |
| | 32.5 | 32.5 | 17.3 | 3.1 | 1.7 | 4.5 | 5.9 |
| Observations | 781 | 750 | 750 | 750 | 750 | 750 | 750 |
| # of country | 33 | 31 | 31 | 31 | 31 | 31 | 31 |
| Method | OLS | 2SLS | 2SLS | 2SLS | 2SLS | 2SLS | 2SLS |
| Country FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Country spec. trend | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

–MAMFI sectors refers to the following ISIC Rev.4 sectors: "Manufacturing", "Agriculture, forestry and fishing", "Mining and quarrying", "Financial and insurance activities", "Information and communication".
– In the 2SLS method, the *predetermined election* and its interactions with other political/institutional variables are used as exogenous instruments for the primary budget deficit (BD-prim ).
– Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

'Agriculture, forestry, and fishing', and 'Mining and quarrying', i.e. the sectors with the highest exposure to international trade. For the other two sectors, the coefficient of the primary budget deficit is positive but statistically insignificant. The same exercise has been conducted for all the first and most general divisions of ISIC Rev.4 sectors. The coefficient of $BD\_prim$ is either significantly positive or insignificant when other sectors are considered (The corresponding results are not included in the paper but are available upon request). In light of the theory, this result suggests that even the 'Financial and insurance activities' and 'Information and communication' sectors are not sufficiently exposed to trade to be negatively affected by budget deficits.

## 4. Theoretical model

This section provides a theoretical model to elucidate the empirical results outlined in the preceding section. Specifically, the model posits that governments exhibit diminished political incentives to increase deficits during election times when wage bargaining is more centralized. The model features a small open economy with two sectors: (i) tradeable and (ii) non-tradeable, representing the extremes of exposure to foreign competition. Spanning two periods, the first period signifies the run-up to an election, while the second period encompasses the post-election periods.

The model comprises three types of agents: (i) households/workers who supply labor to one of two sectors, (ii) an opportunistic government that provides public goods funded through lump-sum taxes and bond (debt) issuance, aiming to maximize its reelection prospects, and (iii) unions that independently negotiate wages with firms. As detailed in the following subsections, the temporal sequence within the model is crucial: Households decide on their sectoral affiliation at the beginning of each period. This is followed by the government's determination of the level of public goods provision, which implicitly sets the extent of its deficits. Finally, after these decisions are made, firms and unions proceed with wage negotiations

Section 4.1 introduces the main features of the economy and demonstrates how an increase in budget deficits, financed through debt, leads to a rise in the relative price of non-tradeable goods. This dynamic is contingent upon workers being unable to switch their sectoral affiliations following the realization of the budget deficit. Section 4.2 focuses on the introduction of unions and the conceptualization of wage centralization. Drawing on existing literature in this field, it elucidates how wage bargaining centralization diminishes the sensitivity of sectoral wages to fluctuations in sectoral prices. Together, these two subsections propose that wage centralization mitigates the impact of budget deficits on the relative wages between sectors.

Section 4.3 elucidates the determination process of budget deficits within the model. The outcome is derived from a two-period game involving atomistic and rational workers who make decisions about their sectoral affiliations and an opportunistic government

that strategically sets the level of budget deficits to enhance its reelection prospects. Wage centralization interacts with the strategy of the opportunistic government, as it alters the payoffs of its strategy. In this model, adhering to the median voter theorem, the opportunistic government aims to maximize the discounted utility of a representative worker affiliated with the non-tradeable sector. This assumption is based on the empirical observation that the majority of workers in OECD countries are affiliated with this sector, which forms the basis for the model's political dynamics.[34]

### 4.1. General framework

#### 4.1.1. Households

In the beginning of each period, each worker decides on her/his sectoral affiliation, where s/he supplies one unit of labor inelastically.[35] The total population of households is normalized to unity. Therefore, $n_{Tt} = 1 - n_{Nt}$, where $n_{it}$ is the labor in sector $i$ at period $t$ (hereafter, subscripts $T$ and $N$ refer to tradeable and non-tradeable sectors, respectively). The instantaneous utility of a representative household affiliated to sector $i$ is a function of the household's private consumption ($c_{it}$) and public goods provision ($G_t$), with an additively separable representation:

$$U(c_{it}, G_t) = u(c_{it}) + v(G_t) \quad i \in \{T, N\}, \tag{3}$$

with $u'(.) > 0$, $v'(.) > 0$, and $v''(.) < 0$.

For the sake of simplicity and to elucidate the primary mechanism of the model, I assume that households are non-Ricardian, meaning they do not engage in asset trading and instead consume all of their disposable income.[36] Each household in sector $i$ receives a wage ($w_{it}$) and pays an exogenously determined lump-sum tax ($T_t$).[37] In addition, households, owning equal shares in all firms, receive equal dividends or profits ($\pi_t$). It is important to note that $\pi_t$, $w_{it}$, and $T_t$ are expressed in terms of the aggregate domestic price level. Therefore, the consumption of a representative household in sector $i$ at period $t$ is determined as follows:

$$c_{it} = w_{it} + \pi_t - T_t \quad i \in \{T, N\}. \tag{4}$$

Baskets of private consumption and public goods in the model are both formulated as Cobb–Douglas aggregations of traded and non-traded final goods.

$$\bar{C}_t(\bar{C}_{Tt}, \bar{C}_{Nt}) = \bar{C}_{Tt}^\gamma \bar{C}_{Nt}^{1-\gamma} \tag{5}$$

$$G_t(G_{Tt}, G_{Nt}) = G_{Tt}^\gamma G_{Nt}^{1-\gamma}, \tag{6}$$

where $\bar{C}_t$ is aggregate consumption; $\bar{C}_{Tt}$ and $\bar{C}_{Nt}$ represent aggregate consumption of traded and non-traded goods, respectively. $G_{Tt}$ and $G_{Nt}$ are traded and non-traded goods embodied in the basket of public goods ($G_t$), respectively. Note that in Eqs. (5) and (6), it is assumed that the share of tradable goods ($\gamma$) is the same in both private and public expenditures. However, previous literature finds that government spending is more intensive in non-tradables.[38] The higher the proportion of public spending allocated to non-tradables, the greater the impact on the demand for, and consequently on the relative price of, non-tradables. This suggests that if government spending is more heavily biased towards non-tradables, it would amplify the effects outlined in the current model.

The price of traded goods which is internationally fixed is set as numeraire ($p_T = 1$). $p_N$ therefore represents the inverse of the real exchange rate.[39] For a given level of $p_N$, the government and households allocate their respective budgets between the final goods of the two sectors in order to maximize their baskets subject to their budget constraints. The corresponding static maximization problems lead to the following relation between demands and relative prices of the two sectors[40]:

$$p_{Nt} = \frac{(1-\gamma)}{\gamma} \frac{\bar{C}_{Tt} + G_{Tt}}{\bar{C}_{Nt} + G_{Nt}}. \tag{7}$$

Consequently, the aggregate price level is[41]:

$$\bar{P}_t(p_{Nt}) = \frac{1}{\gamma^\gamma (1-\gamma)^{1-\gamma}} p_{Nt}^{1-\gamma}. \tag{8}$$

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[34] Refer to the discussion provided in the introduction and to Figs. 2 and A.1.

[35] Throughout the paper, I use "worker" and "household" interchangeably.

[36] The assumption of non-Ricardian workers simplifies the model. However, the results are not contingent upon this assumption.

[37] The paper yields qualitatively similar results with an endogenous lump-sum tax and an exogenously fixed public goods provision. Having both policy instruments as endogenous would violate the unidimensionality required by the median voter theorem. In line with the empirical findings in the previous section, it is assumed that for its political objectives, the government manipulates the provision of public goods rather than its revenue sources.

[38] For example, Cardi et al. (2020), using a sample of 16 OECD countries, estimate that on average 90% of government spending is allocated to non-tradables. See also Cardi and Restout (2023).

[39] In other words, an increase in $p_N$ implies an appreciation of the real exchange rate.

[40] See Appendix A.1 for the proof.

[41] See Appendix A.2 for the proof.

### 4.1.2. Government

The government finances the first-period budget deficit ($G_1 - T_1$) by issuing bonds in the international financial markets and repays its debts in the second period:

$$G_1 = T_1 + \frac{B}{\bar{P}_1} \tag{9}$$

$$G_2 = T_2 - \frac{(1+r)B}{\bar{P}_2}, \tag{10}$$

Where $r$ represents the international interest rate and $B$ denotes the first-period budget deficit (expressed in terms of the price of traded goods). Given that households cannot save or borrow in this model, the budget deficit is equal to the trade deficit.

Since taxes are exogenous, the government's decision on its first-period budget deficit ($B$), which is the primary policy variable of interest, dictates the provision of public goods in both periods.

### 4.1.3. Production and market clearing

In each sector, firms use labor as a single productive input, with a constant returns to scale production function as follows:

$$Y_{it} = a_i n_{it} \qquad i \in \{T, N\}, \tag{11}$$

where $a_i$ is productivity (exogenous parameters) in sector $i$. Market clearing in the first period implies that aggregate private consumption ($\bar{C}$) plus government expenditure (G) are equal to aggregate production plus the budget deficit:

$$(\bar{C}_1 + G_1)\bar{P}_1 = Y_{N,1}p_{N,1} + Y_{T,1} + B \tag{12}$$

and in the second period:

$$(\bar{C}_2 + G_2)\bar{P}_2 = Y_{N,2}p_{N,2} + Y_{T,2} - (1+r)B. \tag{13}$$

Using the definition of being non-tradable goods, we have: $\bar{C}_{Nt} + G_{Nt} = Y_{Nt}$. Consequently, we have: $\bar{C}_{T,1} + G_{T,1} = Y_{T,1} + B$ and $\bar{C}_{T,2} + G_{T,2} = Y_{T,2} - (1+r)B$. Combining these results with Eq. (7), we get[42]:

$$p_{N,1} = \frac{(1-\gamma)(Y_{T,1} + B)}{\gamma Y_{N,1}} \tag{14}$$

$$p_{N,2} = \frac{(1-\gamma)\left(Y_{T,2} - (1+r)B\right)}{\gamma Y_{N,2}}. \tag{15}$$

Eqs. (14) and (15) imply that *for a given allocation of labor* between the two sectors, an increase in the first period budget deficit leads to an appreciation of the real exchange rate in the first period and to a depreciation in the second period.

### 4.2. Wage setting and wage centralization

Following Iversen (1999), the level of wage centralization, represented by parameter $\sigma$, indicates the share of workers belonging to /covered by each union. For the sake of simplicity, I assume that all unions have the same share of workers. Consequently, by symmetry across unions, $1/\sigma$ is the number of unions. Therefore, a higher level of wage centralization (higher $\sigma$) implies that wage bargaining is conducted by fewer, but larger unions and vice versa. For example, firm-level wage bargaining implies a decentralized wage bargaining system, where there exists a large number of small unions. Besides, I assume that workers who belong to the same union are also affiliated with the same sector.

The mechanism of this model is based on sectoral wage interdependency, which emerges from wage centralization. Following the existing theoretical literature (see, for example, De la Croix, 1994 and Gylfason and Lindbeck, 1984), I model wage interdependency through the *envy effect*, inside the unions' utility function, i.e. by assuming that the utility of unions depends not only on their members' real wage but also on wages received by members of other unions. Note that the specific form of this utility function is not crucial for the results. However, it is crucial that unions' preferences negatively depend on wages received by members of other unions, since otherwise wage inter-dependency cannot be generated. Among different options, I assume the following utility function:

$$\mathcal{U}_{j,t} = w_{j,t} + \phi(w_{j,t} - \bar{w}_{-j,t}) = (1+\phi)w_{j,t} - \phi\bar{w}_{-j,t}, \tag{16}$$

where $\mathcal{U}_{j,t}$, $w_{j,t}$ and $\bar{w}_{-j,t}$ represent the utility function of union $j$, the wage in this union, and the average of wages received by workers in other unions, respectively. $\phi > 0$ is the relative intensity of unions' envy in their preferences. As is shown below, the larger this parameter is, the higher the wage inter-dependency between unions is.

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[42] Note that $\bar{C}_{T,1} + G_{T,1} = Y_{T,1} + B$ represents the balance of payments equation in the first period. Here, $B > 0 (< 0)$ indicates capital inflow (outflow), i.e., the purchase of government bonds by foreigners and $\bar{C}_{T,1} + G_{T,1} - Y_{T,1}$ represents net imports or the trade deficits. The same holds for the second period.

The wage is the outcome of Nash bargaining between unions and firms. The profit that a representative firm in sector $i$ obtains by hiring a worker who is covered by union $j$ is: $\Pi_{j,i,t} = (a_{it}p_{it})/\bar{P}_t - w_{j,i,t}$. As a result, the wage bargained between union $j$ and a firm in sector $i$ is the outcome of the following maximization problem:

$$\max_{w_{j,i,t}} \mathcal{U}_{j,i,t}^{\eta} \Pi_{j,i,t}^{1-\eta}, \tag{17}$$

where $\eta$ is the bargaining power of unions. This maximization problem leads to the following wage equation (See Appendix A.3 for the proof):

$$w_{j,i,t} = \frac{\eta(1+\phi) - \eta\phi \frac{\partial \bar{w}_{-j,t}}{\partial w_{j,i,t}}}{1+\phi - \eta\phi \frac{\partial \bar{w}_{-j,t}}{\partial w_{j,i,t}}} \frac{a_i p_{it}}{\bar{P}_t} + \frac{(1-\eta)\phi}{1+\phi - \eta\phi \frac{\partial \bar{w}_{-j,t}}{\partial w_{j,i,t}}} \bar{w}_{-j,t}. \tag{18}$$

$\frac{\partial \bar{w}_{-j,t}}{\partial w_{j,i,t}}$ in Eq. (18) represents the, ceteris paribus, average wage-reaction of other unions to a one unit wage increase in union $j$. This term captures sectoral wage interdependency.[43] Note that, in the absence of the envy effect ($\phi = 0$), the wage would be a constant share of match-specific value added, i.e. $w_{j,i,t} = \eta \cdot (a_i p_{it}/\bar{P}_t)$, and there would be no wage interdependency (i.e. if $\phi = 0 \Rightarrow (\partial \bar{w}_{-j,t})/(\partial w_{j,i,t}) = 0$ and $(\partial w_{j,i,t})/(\partial \bar{w}_{-j,t}) = 0$). Moreover, it is easy to show that, if $\phi > 0$, wage interdependency is increasing in the level of wage centralization, i.e. $(\partial(\partial \bar{w}_{-j,t}/\partial w_{j,i,t}))/(\partial \sigma) > 0$ (see Appendix A.4 for the proof). In the extreme case of a highly decentralized wage bargaining system, where there is a large number of small unions, a wage rise in union $j$ does not have any aggregate effect and, hence, does not generate reactions from other unions (i.e. if $\sigma \to 0 \Rightarrow (\partial \bar{w}_{-j,t})/(\partial w_{j,i,t}) \to 0$).[44]

Moreover, note that the coefficient of $a_i p_{it}/\bar{P}_t$ in the first term of the RHS of Eq. (18) is strictly decreasing in $(\partial \bar{w}_{-j,t})/(\partial w_{j,i,t})$ and, thus, strictly decreasing in $\sigma$. This captures the well-established fact that wage centralization and its associated wage interdependency lowers the responsiveness of sectoral real wages w.r.t. variations in sector specific conditions, particularly relative sectoral prices. Consequently, one can immediately see that the wage rise (decline) of workers in the non-tradeable (tradeable) sector as a response to an appreciation of the real exchange rate is lower if wage bargaining is more centralized, i.e. if $\sigma$ and, thus, $(\partial \bar{w}_{-j,t})/(\partial w_{j,i,t})$ are higher.[45]

Note that households' income depends not only on their wage, but also on the profit they receive. Profit is equal to GDP minus the aggregate wage level, which can be found by aggregating Eq. (18) across all unions. Doing so, one can find households' disposable income and consumption that depend on the real exchange rate as well as on the level of wage centralization (the derivation of profit and income equation is shown in Appendix A.5):

$$c_{Nt} = \Gamma_N(p_{Nt}; \sigma) := \psi(\sigma) \frac{a_{Nt} p_{Nt}}{\bar{P}_t} + (1 - \psi(\sigma))\bar{Y}_t - T_t, \tag{19}$$

$$c_{Tt} = \Gamma_T(p_{Nt}; \sigma) := \psi(\sigma) \frac{a_{Tt}}{\bar{P}_t} + (1 - \psi(\sigma))\bar{Y}_t - T_t, \tag{20}$$

where:

$$\psi(\sigma) = \frac{\eta(1+\phi) - \eta\phi \frac{\partial \bar{w}_{-j,t}}{\partial w_{j,i,t}}}{1+\phi - \eta\phi \frac{\partial \bar{w}_{-j,t}}{\partial w_{j,i,t}} + \frac{\sigma}{1-\sigma}(1-\eta)\phi}, \tag{21}$$

and $\bar{Y}_t := (n_{Nt} a_{Nt} p_{Nt} + n_{Tt} a_{Tt})/\bar{P}_t$ is the GDP in terms of the aggregate domestic price level. Note that $\psi(\sigma)$ is decreasing in $(\partial \bar{w}_{-j,t})/(\partial w_{j,i,t})$ and, thus, it is a decreasing function of wage centralization: $\psi'(\sigma) < 0$ (See Appendix A.6 for the proof).[46] As $\psi(\sigma)$ is decreasing in $\sigma$, one can show that centralization of wage bargaining reduces the responsiveness of workers' income (and, hence, that of consumption) with respect to variations in the relative price of the sector to which they are affiliated. This is despite the fact that variations in sectoral prices affect aggregate output.[47] This leads to the following lemma:

**Lemma 1.** *Wage centralization attenuates the marginal effect of real exchange rate appreciation on the consumption/disposable income of non-traded sector workers (positive effect) and traded sector workers (negative effect). Formally:*

$$\frac{\partial^2 c_{Nt}}{\partial p_{Nt}.\partial \sigma} = \frac{\partial \Gamma'_{Nt}(p_{Nt}; \sigma)}{\partial \sigma} < 0, \tag{22}$$

$$\frac{\partial^2 c_{Tt}}{\partial p_{Nt}.\partial \sigma} = \frac{\partial \Gamma'_{Tt}(p_{Nt}; \sigma)}{\partial \sigma} > 0, \tag{23}$$

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[43] Note that, consistent with the empirical results discussed in column (7) of Table 1, in this model, sectoral wage interdependency arises from *non-cooperative* wage bargaining, where unions independently negotiate wages with employers.

[44] The same holds if wage bargaining is between firms and non-unionized individual workers.

[45] An increase in the real exchange rate ($p_N$) increases $p_{Nt}/\bar{P}_t$ and lowers $p_{Tt}/\bar{P}_t = 1/\bar{P}_t$.

[46] Also, in the absence of the envy effect ($\phi = 0$) and/or when wage setting is highly decentralized ($\sigma \to 0$), $\psi(\sigma) = \eta$. In that case, private consumption of workers would be a constant fraction of the net of tax of their match-specific value added plus the profit, which would be $1 - \eta$ share of aggregate output.

[47] See Appendix A.7 for the proof.

where $\Gamma'_{it}(p_{Nt}; \sigma)$  $i \in \{N, T\}$ *represents the marginal effect of real exchange rate appreciation on the disposable income/consumption of a representative household in sector $i$.*

See Appendix A.7 *for the proof.*  □

As will be demonstrated in Section 4.3, this lemma is pivotal in determining the budget deficit. It should be noted that the model, as presented thus far, establishes the full equilibrium for a specified level of budget deficit, $B$, and for given labor allocations in the two periods, $n_{it}$ ($i \in T, N, t \in 1, 2$).[48] Labor allocation is decided by the individual choices of rational and atomistic workers regarding their sectoral affiliations. Each worker's strategy involves selecting the sector that offers the highest expected wage/income.[49] The first-period budget deficit, $B$, is the policy variable controlled by the opportunistic government, aiming to maximize the discounted utility of the median voter, who is affiliated with the non-tradeable sector.

Given that both labor allocation and budget deficit affect the real exchange rate and, consequently, sectoral payoffs, there is an interaction between workers' choices of sectoral affiliations and the opportunistic government's decision on the level of the budget deficit ($B$). This sets the stage for a non-cooperative game between atomistic and rational workers on one hand and the opportunistic government on the other hand. The following subsection describes the outcome of this game and its contingency on the level of wage bargaining centralization.

### 4.3. Equilibrium: a policy game approach

#### 4.3.1. No-arbitrage condition

As mentioned earlier, a crucial assumption of the model is the presence of frictions in the sectoral reallocation of labor. This means that within each period, the sectoral allocation of labor cannot be modified after the realization of the budget deficit. However, to ease the understanding of the model, it is helpful to explore how the model's equilibrium would be determined if workers could freely update their sectoral affiliation after the realization of government expenditure/deficit. In this counter-factual scenario, for any given realization of the budget deficit, workers would opt for the sector offering a higher payoff. In equilibrium, a *no-arbitrage condition* must be satisfied, meaning that equilibrium wages are equal across sectors ($w_T^{na} = w_N^{na}$).[50] From Eq. (18), the no-arbitrage condition implies $a_N p_N = a_T$. Consequently, the no-arbitrage values of the real exchange rate and the aggregate price are: $p_N^{na} := \frac{a_T}{a_N}$ and $\bar{P}^{na} := \frac{(a_T/a_N)^{1-\gamma}}{\gamma^\gamma (1-\gamma)^{1-\gamma}}$ (from Eq. (8)). Note that the no-arbitrage values of relative and aggregate prices depend solely on parameters and are, in particular, independent of the budget deficit. Therefore, according to Eqs. (19) and (20), the no-arbitrage values of households' disposable income (and, hence, their private consumption) would be equal across the two sectors and depend only on the exogenous parameters.

$$c_i^{na} = c^{na} := \frac{a_T}{\bar{P}^{na}} - T = \gamma^\gamma (1-\gamma)^{1-\gamma} a_T^\gamma a_N^{1-\gamma} - T \quad \text{for:} \quad i \in \{T, N\}. \tag{24}$$

In other words, if workers could adjust their labor affiliations after the realization of budget deficit, an increase in the deficit would prompt more workers to opt for the N-sector. This shift would increase the supply of N-sector products, lowering their relative price until sectoral prices and wages reach their no-arbitrage values. Appendix B.1 provides more details on the equilibrium level of budget deficits in the counterfactual scenario where inter-sectoral labor reallocation is frictionless.

#### 4.3.2. Determination of the budget deficit

Considering sector-specific human capital and other types of labor market frictions (including search and matching frictions), it is more plausible to consider that workers cannot immediately change their sectoral affiliations in response to variations in the sectoral relative prices.[51] Correspondingly, in the model, it is assumed that within each period, the allocation of labor across sectors is determined before the realization of the budget deficit, i.e. within each period, workers cannot update their sectoral affiliation after the realization of budget deficits. Therefore, the sequence of the game in each period is as follows: At the beginning of each period, atomistic households decide on their sectoral affiliations. Once the labor allocation is realized, the government then decides on its expenditure and consequently on the deficit level. Finally, wages are set through negotiations between unions and firms.

Households cast their votes at the **end of the first period**, basing their decision on the welfare (i.e., discounted utility) they perceive at that time. By this point, workers' wages and consequently their consumption for the first period have been realized. Given that voters are rational and possess perfect foresight, they are also aware of how deficits in the first period will impact their utility in the second period. This awareness means the government cannot systematically manipulate voters. Since the only difference among households lies in their sectoral affiliations, the opportunistic government aims to maximize the discounted utility of the median voter as it will be realized at the end of the first period. Notably, since the median voter is affiliated with the non-tradable sector, the government's objective specifically focuses on maximizing the discounted utility of a representative worker in the N-sector.

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[48] Eq. (11) determines sectoral production for given allocations of labor in the two periods. Then, with those labor allocations, and for a specified level of budget deficit, Eqs. (14) and (15) ascertain the real exchange rate for the two periods. Finally, Eqs. (18), (19), and (20) establish the prevailing wages and private consumption for workers in different sectors.

[49] Since labor allocation across sectors affects relative prices and, consequently, sectoral wages, individual decisions regarding sectoral affiliations constitute a non-cooperative game among workers.

[50] The superscript *na* denotes equilibrium values in the no-arbitrage condition.

[51] Cardi et al. (2020) also show how imperfect mobility of labor across tradable and non-tradable sectors is essential to explain empirical evidence on the sectoral effect of government spending.

The equilibrium of the model can be found by backward induction: In the second period, the government is passive and should repay its debts accumulated from the first period. At the beginning of the second period, workers, who know the amount of public debt, choose their sectoral affiliations. The strategy of atomistic workers is to choose a sector with higher payoffs. As there is no uncertainty in the model, this implies that the no arbitrage condition holds in the equilibrium of the second period: $p_{N,2} = p_N^{na} := \frac{a_T}{a_N}$ and $\bar{P}_2 = \bar{P}^{na} := \frac{(a_T/a_N)^{1-\gamma}}{\gamma^\gamma (1-\gamma)^{1-\gamma}}$. As a result, second-period wages and private consumptions are equal across the two sectors and are independent of the first-period budget deficit. Using Eq. (24), private consumption is: $c_{i,2} = c^{na}$ (for $i \in \{N, T\}$).

For a given labor allocation in the first period, the government decides on its deficits ($B$) in order to maximize the discounted utility of a representative non-tradeable sector worker (the median voter), given that its decision cannot affect the second-period median voter's income. Consequently, the maximization problem of the government is:

$$\max_{B, G_1, G_2, p_{N,1}, c_{N,1}} u(c_{N,1}) + v(G_1) + \beta(u(c_{N,2}) + v(G_2))$$

$$\text{s.t.} \begin{cases} (9), (10), (14), (19). \\ c_{N,2} = c^{na} \quad , \quad \bar{P}_2 = \bar{P}^{na} \end{cases}$$

Note that the constraints of this maximization problem dictate that the budget deficit ($B$) influences the median voter's first-period private consumption as well as the provision of public goods in both periods (Eqs. (19), (9), and (10)), but it does not affect the median voter's income in the second period ($c_{N,2} = c^{na}$). This maximization problem yields the opportunistic government's best response function (BRF) with respect to a given first-period labor allocation ($n_{N,1}$).[52]

$$\frac{1-\gamma}{\gamma} \frac{1}{a_N n_{N,1}} \Gamma'_N(p_{N,1}; \sigma) u'(c_{N,1}) + (1 - (1-\gamma)\frac{B}{B + a_T(1 - n_{N,1})})\frac{1}{\bar{P}_1} v'(G_1)$$
$$- \frac{\beta(1+r)}{\bar{P}^{na}} v'(G_2) = 0. \tag{25}$$

Eq. (25) is an implicit function that determines the level of budget deficit ($B^*$) chosen by the opportunistic government for any given labor allocation ($n_{N,1}$).[53] If the first term on the left-hand side (LHS) of Eq. (25) were zero, this equation would correspond to the maximization of the discounted value of public goods. The first term on the LHS of Eq. (25) represents the marginal effect of the budget deficit on the median voter's utility from first-period private consumption, thereby reflecting the government's political incentive to favor the median voter through the budget deficit's distributional effect. The second and third terms denote the marginal effect of the budget deficit on the discounted value of public goods provision. As a result, the first term creates a wedge between the budget deficit level chosen by the opportunistic government and the level that would maximize the discounted value of public goods provision

Households accurately predict this strategy and accordingly choose their sectoral affiliations, leading to the establishment of a no-arbitrage condition in the first period. Consequently, prices and households' consumption align with their no-arbitrage values ($c_{i,1} = c^{na}, p_{N,1} = p_N^{na}, \bar{P}1 = \bar{P}^{na}$). Under these conditions, the best response function of households can be characterized by the following relationship between labor allocation ($n_N, 1$) and the budget deficit, $B^*$ (the proof of which is provided in Appendix A.9):

$$n_{N,1}^* = (1-\gamma)(1 + \frac{B^*}{a_T}). \tag{26}$$

Eq. (26) depicts a positive relationship between $n_{N,1}$ and $B$: an anticipated higher budget deficit renders the non-tradeable sector more appealing to households.[54]

To find the Nash equilibrium of this game, note that in the equilibrium $p_{N,1} = p_N^{na}$ and $\bar{P}^* = \bar{P}^{na}$ and, thus, $G_1^* = T_1 + \frac{B^*}{\bar{P}^{na}}$ and $G_2^* = T_2 - \frac{(1+r)B^*}{\bar{P}^{na}}$. Substituting these values in Eq. (25), we have:

$$\frac{1-\gamma}{\gamma} \frac{1}{(a_N n_{N,1}^*)} \Gamma'_N(p_N^{na}; \sigma) u'(c^{na}) + (1 - (1-\gamma)\frac{B^*}{B^* + a_T(1 - n_{N,1}^*)})\frac{1}{\bar{P}^{na}} v'(T_1 + \frac{B^*}{\bar{P}^{na}})$$
$$- \frac{\beta(1+r)}{\bar{P}^{na}} v'(T_2 - \frac{(1+r)B^*}{\bar{P}^{na}}) = 0. \tag{27}$$

Knowing from Eq. (26) that $n_{N,1}^*$ is increasing with $B^*$, it is straightforward that the LHS of Eq. (27) is strictly decreasing in $B^*$. Consequently, Eq. (27), which integrates the BRFs of both the households and the opportunistic government, yields a unique solution for $B^*$.

### 4.3.3. Effect of wage centralization

As $n_{N,1}^*$ is strictly increasing with $B^*$, the LHS of Eq. (27) is strictly decreasing in $B^*$. Remember from Lemma 1 that $\Gamma'_N(P_N^{na}; \sigma)$ is strictly decreasing with wage centralization ($\sigma$). Consequently, it is mathematically evident that an increase in $\sigma$ results in a lower

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[52] The proof of this is provided in Appendix A.8.

[53] Note that for a given level of $n_{N,1}$, the other endogenous variables in Eq. (25), namely $G_1$, $G_2$, $p_{N,1}$, and $\bar{P}_1$, are uniquely determined by $B$.

[54] Note that under the no-arbitrage condition, $a_T(= a_N p_N^{na})$ represents the GDP in terms of international prices. Therefore, this equation implies that a 1% increase in the budget deficit relative to the GDP results in a $(1-\gamma)$ percentage points increase in the labor share of the non-tradeable sector.

budget deficit ($B^*$). The interpretation is that higher wage centralization diminishes the distributional effect of the budget deficit, thereby rendering it less appealing for the opportunistic government.[55] This result is encapsulated in Proposition 1.

**Proposition 1.** *The opportunistic government chooses a lower level of budget deficit if wage bargaining is more centralized.*

$$\frac{\partial B^*}{\partial \sigma} < 0. \tag{28}$$

*4.3.4. Welfare effect, commitment, and the time inconsistency problem*

The political incentive of the opportunistic government to favor the median voter through the distributional effect of the budget deficit, as indicated by the first term on the LHS of Eq. (25), generates a wedge between the level of budget deficit chosen by the opportunistic government and the level that would maximize the discounted value of public goods provision. To elucidate this further, consider the equilibrium that would result if the opportunistic government were replaced by a non-opportunistic one. This hypothetical government is defined as one whose sole objective is to maximize the discounted value of public goods provision. Consequently, the level of the budget deficit chosen by the non-opportunistic government ($B^{n.o.}$) for a given labor allocation ($n_{N,1}$) can be derived as the solution to the following maximization problem[56]:

$$\max_{B,G_1,G_2,p_{N,1}} \upsilon(G_1) + \beta \upsilon(G_2)$$
$$\text{s.t.} \quad (9), (10), (14).$$

Households, fully cognizant of the strategy employed by the non-opportunistic government, select their sectoral affiliations in a way that ensures the no-arbitrage condition is met in equilibrium: $p_{N,1}^{n.o.} = p_N^{na}$ and $\bar{P}_1^{n.o.} = \bar{P}^{na}$. When the solution of the aforementioned maximization problem is combined with these no-arbitrage price values, it leads to:

$$\left(1 - (1-\gamma)\frac{B^{n.o.}}{B^{n.o.} + a_T(1-n_{N,1}^{n.o.})}\right)\frac{1}{\bar{P}^{na}}\upsilon'(T_1 + \frac{B^{n.o.}}{\bar{P}^{na}})$$
$$- \frac{\beta(1+r)}{\bar{P}^{na}}\upsilon'(T_2 - \frac{(1+r)B^{n.o.}}{\bar{P}^{na}}) = 0, \tag{29}$$

Where, $n_{N,1}^{n.o.} = (1-\gamma)(1 + B^{n.o.}/a_T)$ represents the labor allocation that satisfies the no-arbitrage condition for $B^{n.o.}$. It is important to note that if the first term on the left-hand side (LHS) of Eq. (27) were zero, Eqs. (27) and (29) would be identical. However, if this term is positive, then $B^{n.o.}$ would be less than $B^*$.[57] Consequently, the political incentive of the opportunistic government results in a first-period budget deficit that is higher than the level that maximizes the discounted utility of public goods provision.

Households' private consumption, including that of the median voter, remains constant and equal to the no-arbitrage value ($c^{na}$), regardless of whether the government is opportunistic or non-opportunistic. Consequently, the opportunistic government's political incentive ultimately reduces the welfare of all households, including that of the median voter. This implies that even the median voter would prefer a non-opportunistic government(i.e. a government that does not prioritize the median voter's welfare) or would prefer that the opportunistic government commits to the level of budget deficit that maximizes the discounted value of public goods provision (i.e., to $B^{n.o.}$). However, such a commitment by the opportunistic government suffers from the time inconsistency problem: If households believe the government's commitment to $B^{n.o.}$ ($< B^*$), then the labor allocation would adjust to $n_{N,1}^{n.o.}$ ($=(1-\gamma)(1 + \frac{B^{n.o.}}{a_T}) < n_{N,1}^*$). After the realization of labor allocation, the opportunistic government will have an incentive to deviate from its commitment by implementing a higher budget deficit ($B^{cheating} > B^{n.o.}$). Thus, such a commitment would not be credible initially, and the equilibrium would be characterized by $B^*$ and $n_{N,1}^*$ as long as the government remains opportunistic.

This game-theoretic setup is, to some extent, similar to and inspired by the literature on the 'monetary policy game', following the lead of Kydland and Prescott (1977) and Barro and Gordon (1983). To borrow expressions from that literature, the outcome of the aforementioned game leads to a *'budgetary bias'* (i.e., a suboptimal budget balance) and 'no bias' in relative wages. In other words, the government fails to favor the median voter with a higher wage and, simultaneously, provides a sub-optimal level of public goods.

As previously described, the centralization of wage bargaining, by introducing sectoral wage interdependency, diminishes the distributional effect of budget deficits. This reduction weakens the opportunistic government's incentive to employ fiscal policy as a political tool to disproportionately favor workers in the non-tradeable sector through excessively high budget deficits. Consequently, wage centralization aligns the level of budget deficits more closely with what a non-opportunistic government would choose. This alignment implies that the centralization of wage bargaining enhances the discounted value of public goods provision and improves households' welfare overall.

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[55] Furthermore, based on Eq. (26), it can be deduced that, ceteris paribus, higher wage centralization correlates with a lower labor share in the non-tradeable sector.

[56] The superscript *n.o.* denotes the equilibrium of the model under a non-opportunistic government.

[57] The LHS of Eq. (29) corresponds to the second and third terms in the LHS of Eq. (27). Since the first term in Eq. (27) is positive and the second and third terms are both strictly decreasing in $B^*$ (as $\upsilon''(.) < 0$), it follows that $B^* > B^{n.o.}$.

## 5. Discussion and concluding remarks

Using a panel of OECD countries, this paper presents new evidence that centralization of wage bargaining mitigates Political Budget Cycles. The paper provides a political economy model to explain this finding. This model is based on a policy game approach and shows that wage centralization interacts with and reduces the opportunistic incentive of the incumbent government to run excessive budget deficits in election times.

The theoretical model employed in this study is based on the median voter theorem. A potential concern might arise regarding the median voter's capacity to comprehend and consider the intricate mechanisms underlying the model. However, it is important to notice that the median voter's electoral choice is based on its discounted utility, and this decision is made at the end of the first period, by which time the first-period wage, the level of public goods provision, and public debt levels have been realized. This implies that the median voter, at the point of voting, does not require detailed knowledge of the wage bargaining process or the strategic behavior of the government or other voters. Additionally, it is worth noting that in reality, households' decisions regarding their sectoral affiliations are typically based on observable wage signals from the market, rather than on an understanding of the incumbent's strategies or the specifics of wage bargaining.

Another important point is that the empirical findings of this paper indicate that in economies with highly centralized wage bargaining systems, incumbents may even reduce budget deficits during election times. While this is not the primary focus of the paper, a brief remarking point might be noteworthy. This observation might be a manifestation of the opposing perspective in the literature that voters in developed countries are 'fiscally conservative', tending to penalize rather than reward fiscal manipulation. The current model could be extended to encompass this concept by incorporating a concave function of budget surplus within the median voter's utility function. Consequently, the median voter's utility would be influenced not only by private consumption and public goods provision but also by the budget balance, positively affected by surpluses and negatively by deficits. Such an extension could imply deficits during election times in economies with highly decentralized wage bargaining, and conversely, budget surpluses in those with highly centralized bargaining systems.

## CRediT authorship contribution statement

**Hamzeh Arabzadeh:** Writing – original draft, Software, Methodology, Formal analysis.

## Declaration of competing interest

I, Hamzeh Arabzadeh, declare that I have no relevant or material financial interests that relate to the research described in this paper.

## Data availability

Data will be made available on request.

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## Appendix A. Mathematical proofs

### A.1. Proof for Eq. (7)

The static maximization problem of a representative household in sector $i$ is:

$$\max_{c_{i,T,t}, c_{i,N,t}} c_{it} = c_{i,T,t}^{\gamma} c_{i,N,t}^{1-\gamma} \tag{A.1}$$

$$s.t. \quad p_{Nt} c_{i,N,t} + c_{i,T,t} = \bar{P}_t c_{it}. \tag{A.2}$$

This maximization problem leads to: $c_{i,T,t} = \frac{\gamma}{1-\gamma} p_{Nt} c_{i,N,t}$. By aggregating over the total population we have:

$$\bar{C}_{Tt} = \sum_i c_{i,T,t} = \frac{\gamma}{1-\gamma} p_{Nt} \bar{C}_{Nt}. \tag{A.3}$$

The static maximization problem of the government is:

$$\max_{G_{Tt}, G_{Nt}} G_t = G_{Tt}^{\gamma} G_{Nt}^{1-\gamma} \tag{A.4}$$

$$s.t. \quad p_{Nt}G_{Nt} + G_{Tt} = \bar{P}_t G_t. \tag{A.5}$$

This maximization problem implies that:

$$G_{Tt} = \frac{\gamma}{1-\gamma} p_{Nt} G_{Nt}. \tag{A.6}$$

Combining Eqs. (A.3) and (A.6), we have:

$$G_{Tt} + \bar{C}_{Tt} = \frac{\gamma}{1-\gamma} p_{Nt} (\bar{C}_{Nt} + G_{Nt}) \tag{A.7}$$

$$\Rightarrow p_{Nt} = \frac{(1-\gamma)}{\gamma} \frac{\bar{C}_{Tt} + G_{Tt}}{\bar{C}_{Nt} + G_{Nt}}. \tag{A.8}$$

### A.2. Proof for Eq. (8)

By substituting for $G_{Tt}$ from Eq. (A.6) into the government's budget constraint, we have:

$$p_{Nt}G_{Nt} = (1-\gamma)\bar{P}_t G_t = (1-\gamma)G_{Tt}^{\gamma} G_{Nt}^{1-\gamma} \tag{A.9}$$

$$\Rightarrow \bar{P}_t = \frac{1}{1-\gamma}(\frac{G_{Nt}}{G_{Tt}})^{\gamma} p_{Nt} = \frac{1}{1-\gamma}(\frac{1-\gamma}{\gamma}\frac{1}{p_{Nt}})^{\gamma} p_{Nt} = \frac{1}{(1-\gamma)^{1-\gamma}\gamma^{\gamma}} p_{Nt}^{1-\gamma}. \tag{A.10}$$

### A.3. Proof for the wage equation (eq. (18))

$$\max_{w_i} \mathcal{U}_i^{\eta} \Pi_i^{1-\eta} \tag{A.11}$$

$$s.t. \quad \begin{cases} \mathcal{U}_i = (1+\phi)w_i - \phi\bar{w}_{-i} \\ \Pi_i = \frac{a_i p_i}{\bar{P}} - w_i. \end{cases} \tag{A.12}$$

F.O.C. implies that:

$$\eta[(1+\phi) - \eta\phi\frac{\partial\bar{w}_{-i}}{\partial w_i}]\mathcal{U}^{\eta-1}(\frac{a_i p_i}{\bar{P}} - w_i)^{1-\eta} = (1-\eta)\mathcal{U}^{\eta}(\frac{a_i p_i}{\bar{P}} - w_i)^{-\eta} \tag{A.13}$$

$$\Rightarrow \eta[(1+\phi) - \eta\phi\frac{\partial\bar{w}_{-i}}{\partial w_i}](\frac{a_i p_i}{\bar{P}} - w_i) = (1-\eta)((1+\phi)w_i - \phi\bar{w}_{-i}) \tag{A.14}$$

$$\Rightarrow w_{it} = \frac{\eta(1+\phi) - \eta\phi\frac{\partial\bar{w}_{-i}}{\partial w_i}}{1+\phi - \eta\phi\frac{\partial\bar{w}_{-i}}{\partial w_i}}\frac{a_i p_i}{\bar{P}} + \frac{(1-\eta)\phi}{1+\phi - \eta\phi\frac{\partial\bar{w}_{-i}}{\partial w_i}}\bar{w}_{-i}. \quad \Box \tag{A.15}$$

### A.4. Proof for $\frac{\partial(\frac{\partial\bar{w}_{-i}}{\partial w_i})}{\partial\sigma} > 0$

First, we find the reaction of union i to an increase in wages by union j. This is the derivative of Eq. (A.15) with respect to $w_j$:

$$\frac{\partial w_{it}}{\partial w_{j,t}} = \frac{(1-\eta)\phi}{1+\phi - \eta\phi\frac{\partial\bar{w}_{-i}}{\partial w_i}}\frac{\partial\bar{w}_{-i}}{\partial w_j}. \tag{A.16}$$

Note that $\bar{w}_{-i} = \frac{\sigma w_j + (1-2\sigma)w_k}{1-\sigma}$ (for: $k \neq \{i, j\}$). Therefore, the last term in Eq. (A.16) is:

$$\frac{\partial\bar{w}_{-i}}{\partial w_j} = \frac{\sigma + (1-2\sigma)\frac{\partial w_{it}}{\partial w_{j,t}}}{1-\sigma}. \tag{A.17}$$

Inserting Eq. (A.17), into Eq. (A.16), we get:

$$\frac{\partial w_{it}}{\partial w_{j,t}} = \frac{(1-\eta)\phi}{1+\phi - \eta\phi\frac{\partial\bar{w}_{-i}}{\partial w_i}}\frac{\sigma + (1-2\sigma)\frac{\partial w_{it}}{\partial w_{j,t}}}{1-\sigma}. \tag{A.18}$$

Again, symmetry implies that: $\frac{\partial w_{it}}{\partial w_{j,t}} = \frac{\partial w_{j,t}}{\partial w_{it}} = \frac{\partial\bar{w}_{-i}}{\partial w_i}$. Therefore, Eq. (A.18) can be written as:

$$\frac{\partial\bar{w}_{-i}}{\partial w_i} = \frac{(1-\eta)\phi}{1+\phi - \eta\phi\frac{\partial\bar{w}_{-i}}{\partial w_i}}\frac{\sigma + (1-2\sigma)\frac{\partial\bar{w}_{-i}}{\partial w_i}}{1-\sigma} \tag{A.19}$$

$$\Rightarrow -\eta\phi(1-\sigma)(\frac{\partial\bar{w}_{-i}}{\partial w_i})^2 + [(1-\sigma)(1+\phi) - (1-\eta)(1-2\sigma)\phi](\frac{\partial\bar{w}_{-i}}{\partial w_i}) \tag{A.20}$$

$$- (1-\eta)\phi\sigma = 0.$$

We can show that Eq. (A.20) leads to two positive values for $\frac{\partial \bar{w}_{-i}}{\partial w_i}$, one smaller than and the other larger than 1. Also, it is easy to show that both of them are increasing in $\sigma$. Note that only the value lower than one implies a stable reaction function. Therefore, the only stable solution will be: $0 < \frac{\partial \bar{w}_{-i}}{\partial w_i} < 1$ and, moreover, $\frac{\partial \left( \frac{\partial \bar{w}_{-i}}{\partial w_i} \right)}{\partial \sigma} > 0$. $\quad \square$

### A.5. Proof for the consumption equation

To find the profit ($\pi_t$), first we need to find the aggregate/average wage received by workers. For this aim, we rewrite Eq. (18) in terms of aggregate/average wage level: Having symmetry across unions of the same sector and knowing that the aggregate wage level is $\bar{w}_t = (1 - \sigma)\bar{w}_{-j,t} + \sigma w_{j,i,t}$, we can rewrite Eq. (18) in the following form:

$$w_{j,i,t} = \psi(\sigma)\frac{a_i p_{it}}{\bar{P}} + \xi(\sigma)\bar{w}_t \quad , \tag{A.21}$$

where:

$$\psi(\sigma) = \frac{\eta(1 + \phi) - \eta\phi\frac{\partial \bar{w}_{-j,t}}{\partial w_{j,i,t}}}{1 + \phi - \eta\phi\frac{\partial \bar{w}_{-j,t}}{\partial w_{j,i,t}} + \frac{\sigma}{1-\sigma}(1 - \eta)\phi}, \tag{A.22}$$

$$\xi(\sigma) = \frac{(1 - \eta)\phi}{(1 - \sigma)(1 + \phi - \eta\phi\frac{\partial \bar{w}_{-j,t}}{\partial w_{j,i,t}}) + \sigma(1 - \eta)\phi}. \tag{A.23}$$

By aggregating (A.21) over the whole economy, we can find $\bar{w}$:

$$\bar{w}_t = \frac{\psi(\sigma)}{1 - \xi(\sigma)} \frac{n_{Nt}a_{Nt}p_{Nt} + n_{Tt}a_{Tt}}{\bar{P}_t} = \frac{\psi(\sigma)}{1 - \xi(\sigma)} \bar{Y}_t, \tag{A.24}$$

where $\bar{Y}_t := (n_{Nt}a_{Nt}p_{Nt} + n_{Tt}a_{Tt})/\bar{P}_t$ is the GDP in terms of aggregate domestic price level. Consequently, the aggregate/average profit is:

$$\pi_t = \bar{Y}_t - \bar{w}_t = \frac{1 - \xi(\sigma) - \psi(\sigma)}{1 - \xi(\sigma)} \bar{Y}_t, \tag{A.25}$$

Note that households have the same share of all firms. As a result, $\pi_t$ is the profit that each worker receives. Substituting wage and profit from Eqs. (A.21), (A.24), and (A.25) into Eq. (4), we find income ($\Gamma_i(p_N; \sigma)$) and consumption $c_{it}$:

$$c_{Nt} = \Gamma_N(p_{Nt}; \sigma) := \psi(\sigma)\frac{a_{Nt}p_{Nt}}{\bar{P}_t} + (1 - \psi(\sigma))\bar{Y}_t - T_t \tag{A.26}$$

$$c_{Tt} = \Gamma_T(p_{Nt}; \sigma) := \psi(\sigma)\frac{a_{Tt}}{\bar{P}_t} + (1 - \psi(\sigma))\bar{Y}_t - T_t. \quad \square \tag{A.27}$$

### A.6. Proof for $\psi'(\sigma) < 0$

$$\psi(\sigma) = \frac{\eta(1 + \phi) - \eta\phi\frac{\partial \bar{w}_{-i}}{\partial w_i}}{1 + \phi - \eta\phi\frac{\partial \bar{w}_{-i}}{\partial w_i} + \frac{\sigma}{1-\sigma}(1 - \eta)\phi}. \tag{A.28}$$

Remember that $\frac{\partial \left( \frac{\partial \bar{w}_{-i}}{\partial w_i} \right)}{\partial \sigma} > 0$. For simplicity, let us define $\chi = \frac{\partial \bar{w}_{-i}}{\partial w_i}$ and $\chi' = \frac{\partial \left( \frac{\partial \bar{w}_{-i}}{\partial w_i} \right)}{\partial \sigma} > 0$.
Making a derivative of $\psi(\sigma)$ w.r.t. $\sigma$ in Eq. (A.28), we have:

$$\psi'(\sigma) = \frac{-(1 - \eta)\phi\left((1 + \phi) + \eta\phi\frac{\sigma}{1-\sigma}\right)\chi' - \frac{1}{(1-\sigma)^2}(1 - \eta)\eta\phi\overbrace{\left((1 + \phi) - \phi\chi\right)}^{>0}}{(1 + \phi - \eta\phi\frac{\partial \bar{w}_{-i}}{\partial w_i} + \frac{\sigma}{1-\sigma}(1 - \eta)\phi)^2} < 0. \quad \square \tag{A.29}$$

### A.7. Proof for Lemma 1

For the N-sector, we have:

$$c_N = \Gamma_N(p_N; \sigma) := \psi(\sigma)\frac{a_N p_N}{\bar{P}} + (1 - \psi(\sigma))\bar{Y} - T \tag{A.30}$$

$$c_N = \Gamma_N(p_N; \sigma) := \psi(\sigma)\frac{a_N p_N}{\bar{P}} + (1 - \psi(\sigma))(\frac{n_N a_N p_N + n_T a_T}{\bar{P}}) - T \tag{A.31}$$

$$c_N = \Gamma_N(p_N; \sigma) := \psi(\sigma)\left((1 - n_N)\frac{a_N p_N}{\bar{P}} - n_T\frac{a_T}{\bar{P}}\right) + (\frac{n_N a_N p_N + n_T a_T}{\bar{P}}) - T \tag{A.32}$$

$$\Rightarrow \frac{\partial^2 c_N}{\partial p_N \cdot \partial \sigma} = \left( (1 - n_N) a_N \overbrace{\frac{\partial (\frac{p_N}{\bar{P}})}{\partial p_N}}^{>0} - a_T n_T \overbrace{\frac{\partial \frac{1}{\bar{P}}}{\partial p_N}}^{<0} \right) \overbrace{\frac{\partial \psi(\sigma)}{\partial \sigma}}^{<0} < 0 \qquad (A.33)$$

And, for the T-sector, we have:

$$c_T = \Gamma_T(p_N; \sigma) := \psi(\sigma) \frac{a_T}{\bar{P}} + (1 - \psi(\sigma)) \bar{Y} - T \qquad (A.34)$$

$$c_T = \Gamma_T(p_N; \sigma) := \psi(\sigma) \frac{a_N}{\bar{P}} + (1 - \psi(\sigma))(\frac{n_N a_N p_N + n_T a_T}{\bar{P}}) - T \qquad (A.35)$$

$$c_T = \Gamma_T(p_N; \sigma) := \psi(\sigma)\left( (1 - n_T) \frac{a_T}{\bar{P}} - n_N \frac{a_N p_N}{\bar{P}} \right) + (\frac{n_N a_N p_N + n_T a_T}{\bar{P}}) - T \qquad (A.36)$$

$$\Rightarrow \frac{\partial^2 c_T}{\partial p_N \cdot \partial \sigma} = \left( (1 - n_T) a_T \overbrace{\frac{\partial (\frac{1}{\bar{P}})}{\partial p_N}}^{<0} - a_N n_N \overbrace{\frac{\partial \frac{p_N}{\bar{P}}}{\partial p_N}}^{>0} \right) \overbrace{\frac{\partial \psi(\sigma)}{\partial \sigma}}^{<0} > 0. \quad \square \qquad (A.37)$$

### A.8. Proof for Eq. (25)

The maximization problem of the government for a given labor allocation in the first period is:

$$\max_{B, G_1, G_2, p_{N,1}, c_{N,1}} u(c_{N,1}) + v(G_1) + \beta(u(c_{N,2}) + v(G_2)) \qquad (A.38)$$

$$\text{s.t.} \qquad (A.39)$$

$$(\lambda_{c_{N,1}}): \quad c_N = \Gamma_N(p_{N,1}; \sigma) \qquad (A.40)$$

$$(\lambda_{G_1}): \quad G_1 = T + \frac{B}{\bar{P}_1} \qquad (A.41)$$

$$(\lambda_{G_2}): \quad G_2 = T - \frac{(1 + r)B}{\bar{P}_2} \qquad (A.42)$$

$$(\lambda_{p_{N,1}}): \quad p_{N,1} = \frac{(1 - \gamma)(Y_{T,1} + B)}{\gamma Y_{N,1}}, \qquad (A.43)$$

where $\{\lambda_{c_{N,1}}, \lambda_{G_1}, \lambda_{G_2}, \lambda_{p_{N,1}}\}$ are the corresponding Lagrangian multipliers. The F.O.C.s with respect to each variable are:

$$\frac{\partial \mathcal{L}}{\partial c_{N,1}} = 0 \Rightarrow \lambda_{c_{N,1}} = u'(c_{N,1}) \qquad (A.44)$$

$$\frac{\partial \mathcal{L}}{\partial p_{N,1}} = 0 \Rightarrow \lambda_{p_{N,1}} = \Gamma_N'(p_{N,1}; \sigma) \lambda_{c_{N,1}} - (1 - \gamma) \frac{B}{p_{N,1} \bar{P}(p_{N,1})} \lambda_{G_1} \qquad (A.45)$$

$$\frac{\partial \mathcal{L}}{\partial B} = 0 \Rightarrow \frac{1 - \gamma}{\gamma} \frac{1}{Y_{N,1}} \lambda_{p_{N,1}} + \frac{1}{\bar{P}(p_{N,1})} \lambda_{G_1} = \frac{1 + r}{\bar{P}^{na}} \lambda_{G_2} \qquad (A.46)$$

$$\frac{\partial \mathcal{L}}{\partial G_1} = 0 \Rightarrow \lambda_{G_1} = V'(G_1) \qquad (A.47)$$

$$\frac{\partial \mathcal{L}}{\partial G_2} = 0 \Rightarrow \lambda_{G_2} = \beta V'(G_2). \qquad (A.48)$$

First, using $p_{N,1} = \frac{1-\gamma}{\gamma} \frac{Y_{T,1}+B}{Y_{N,1}}$ and substituting for $\lambda_{c_{N,1}}$ from Eq. (A.44) into Eq. (A.45), and then substituting for $\lambda_{G_1}, \lambda_{G_2}, \lambda_{p_{N,1}}$ from Eqs. (A.45), (A.47) and (A.48), respectively, into Eq. (A.46), we get:

$$\frac{1 - \gamma}{\gamma} \frac{1}{Y_{N,1}} \Gamma_N'(p_{N,1}; \sigma) u'(c_{N,1}) + (1 - (1 - \gamma) \frac{B}{B + Y_{T,1}}) \frac{1}{\bar{P}(p_{N,1})} v'(G_1)$$
$$= \frac{\beta(1 + r)}{\bar{P}^{na}} v'(G_2). \qquad (A.49)$$

Replacing $Y_{N,1}$ and $Y_{T,1}$ from $Y_{N,1} = a_N n_{N,1}$ and $Y_{T,1} = a_T(1 - n_{N,1})$, respectively, we have:

$$\frac{1 - \gamma}{\gamma} \frac{1}{a_N n_{N,1}} \Gamma_N'(p_{N,1}; \sigma) u'(c_{N,1}) + (1 - (1 - \gamma) \frac{B}{B + a_T(1 - n_{N,1})}) \frac{1}{\bar{P}} v'(G_1)$$
$$- \frac{\beta(1 + r)}{\bar{P}^{na}} v'(G_2) = 0. \quad \square \qquad (A.50)$$

### A.9. Proof for Eq. (26)

No-arbitrage condition implies that: $p_{N,1} = \frac{a_T}{a_N}$. Besides, from Eq. (14), we know that: $p_{N,1} = \frac{1-\gamma}{\gamma} \frac{Y_{T,1}+B}{Y_{N,1}}$. Therefore:

$$\frac{a_T}{a_N} = \frac{1 - \gamma}{\gamma} \frac{Y_{T,1} + B}{Y_{N,1}} = \frac{1 - \gamma}{\gamma} \frac{a_T n_{T,1} + B}{a_N n_{N,1}}$$

**Table A.1**
Summary statistics of the two measures of wage centralization.

| Variable | obs | mean | Std Dev. in sample | Std Dev. (within country) | min min | max max |
|---|---|---|---|---|---|---|
| Full sample | | | | | | |
| Bargcent | 997 | 1.94 | 1.03 | 0.32 | 0.8 | 4.7 |
| Barglevel | 1026 | 2.28 | 1.21 | 0.3 | 1 | 5 |
| Established democracies | | | | | | |
| Bargcent | 576 | 2.15 | 0.99 | 0.33 | 0.8 | 4.6 |
| Barglevel | 605 | 2.6 | 1.15 | 0.32 | 1 | 5 |
| New democracies | | | | | | |
| Bargcent | 421 | 1.67 | 1 | 0.3 | 0.8 | 4.7 |
| Barglevel | 421 | 1.82 | 1.14 | 0.27 | 1 | 5 |

$$\Rightarrow \gamma n_{N,1} = (1-\gamma)((1-n_{N,1}) + \frac{B}{a_T}) \Rightarrow n_{N,1} = (1-\gamma)(1 + \frac{B}{a_T}). \quad \square$$

# Appendix B. Further discussions on the model [new section]

## B.1. Budget deficit in a non-frictional labor market

As explained in Section 4.3.1, if the inter-sectoral reallocation of labor is frictionless, then prices and private consumption are the same across sectors and are independent of the level of budget deficits.

Remember that the opportunistic government's objective function is to maximize the discounted utility of the median voter, who is, by assumption, affiliated with the non-tradable sector. Consequently, the level of budget deficit and the provision of public goods in the two periods are the outcomes of the following maximization problem:

$$\max_{B,G_1,G_2} u(c_{N,1}) + v(G_1) + \beta(u(c_{N,2}) + v(G_2)) \tag{B.1}$$

$$\text{s.t.} \begin{cases} (9),(10) \\ \bar{P}_1 = \bar{P}_2 = \bar{P}^{na} \quad \& \quad c_{N,1} = c_{N,2} = c^{na} \end{cases} \tag{B.2}$$

Since $c_{N,1} = c_{N,2} = c^{na}$ and are independent of $B$, this maximization problem can be re-written as the maximization of the discounted value of public goods provision:

$$\max_{B,G_1,G_2} v(G_1) + \beta v(G_2) \tag{B.3}$$

$$\text{s.t.} \begin{cases} G_1 = T_1 + \frac{B}{\bar{P}^{na}} \\ G_2 = T_2 - \frac{(1+r)B}{\bar{P}^{na}}, \end{cases} \tag{B.4}$$

This maximization problem implies that: $v'(T_1 + \frac{B}{\bar{P}^{na}}) = \beta(1+r)v'(T_2 - \frac{(1+r)B}{\bar{P}^{na}})$, which corresponds to smoothing the provision of public goods. For example, if $\beta(1+r) = 1$ and $T_1 = T_2$, then $B^{na} = 0$. This result implies that in the absence of frictions in inter-sectoral labor reallocations, the opportunistic government's strategy would be similar to that of a non-opportunistic government (see Section 4.3.4). This is because, in the current model, the political incentive of the opportunistic government stems only from the the inter-sectoral distributional effect of deficits, and allowing for perfect inter-sectoral mobility of labor eliminates this effect.

This outcome stems from two assumptions of the model: First, households are assumed to have perfect foresight and are therefore aware of the future cost of current increases in budget deficits and in public good provisions. Consequently, the opportunistic government cannot manipulate households by providing higher public goods through issuing bonds. Second, the model abstracts from any kind of nominal rigidities; therefore, the budget deficit does not have any real effect on the economy that could arise when such rigidities are present. $\square$

# Appendix C. Tables

See Tables A.1–A.6.

# Appendix D. Figures

See Figs. A.1–A.5.

**Table A.2**

List of countries with the average of the two measures of wage centralization.

| Country | Bargcent (mean) | Barglevel (mean) | Country | Bargcent (mean) | Barglevel (mean) |
|---|---|---|---|---|---|
| **Australia** | 1.8 | 2.8 | South Korea | 1 | 1 |
| **Austria** | 2.32 | 3.18 | Latvia | 1 | 1 |
| **Belgium** | 4.14 | 4.41 | Lithuania | 1 | 1 |
| **Canada** | 1 | 1 | **Luxembourg** | 1.79 | 2.04 |
| Chile | 1 | 1 | Mexico | 1 | 1 |
| Czech Republic | 2.1 | 2.28 | **Netherlands** | 2.41 | 3.22 |
| **Denmark** | 2.38 | 3.45 | **New Zealand** | 1.12 | 2.02 |
| Estonia | 1 | 1 | **Norway** | 3 | 3.93 |
| **Finland** | 3.15 | 3.69 | Poland | 0.95 | 1 |
| **France** | 2.4 | 3 | Portugal | 2.83 | 3.12 |
| **Germany** | 2.24 | 3 | Slovak Republic | 2.26 | 2.36 |
| Greece | 3.1 | 3.98 | Slovenia | 3.3 | 3.73 |
| Hungary | 1.14 | 1.26 | Spain | 2.46 | 3.36 |
| **Iceland** | – | 3 | **Sweden** | 2.62 | 3.6 |
| **Ireland** | 3.2 | 3.45 | **Switzerland** | 2.31 | 3 |
| **Israel** | 1.45 | 2.29 | Turkey | 1 | 1.12 |
| **Italy** | 2.58 | 3.29 | **United Kingdom** | 0.97 | 1.88 |
| **Japan** | 1 | 1 | **United States** | 1 | 1 |

Average values of two wage centralization measures for sampled countries, 1990–2018. Established democracies (democratic at least since 1970) are highlighted in bold.

**Table A.3**

Variable definitions & sources for panel estimations.

| Variable | Description | Source |
|---|---|---|
| BB_prim | Primary budget balance (%GDP) | Public Finances in Modern History (IMF) |
| Gov. Exp. | Gov. primary expenditure (%GDP) | Public Finances in Modern History (IMF) (completed with OECD data) |
| Gov. Rev. | Gov. Revenue (%GDP) | Public Finances in Modern History (IMF) (completed with OECD data) |
| Bargcent | Index of wage bargaining centralization | ICTWSS Database (Visser, 2019) |
| Barglevel | The predominant level of wage bargaining | ICTWSS Database (Visser, 2019) |
| age_dep | Age dependency | World Bank |
| NR | Natural resource rent measured as sum of the rents from oil, natural gas, coal, mineral, and forest (% of GDP). | World Bank |
| interest | government's interest payments on their accumulated debts | Public Finances in Modern History (IMF) |
| L_GDPpc | Logarithm of GDP per capita (constant 2015 US$) | World Bank |
| trade | Export + import (%GDP) | World Bank |
| Herfindahl | Index for the extent of government fragmentation | Database of Political Institutions (DPI) |
| plurality | dummy variable for plurality system | Database of Political Institutions (DPI) |
| system | categorical variable: Parliamentary syst. (0), Assembly-Elected President syst.(1), Presidential syst.(2) | Database of Political Institutions (DPI) |
| ideology | executive party's orientation for economic policy | Database of Political Institutions (DPI) |

**Table A.4**
Robustness checks.

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| *dep. variable* | BB_prim | BB_prim | BB_prim | BB_prim | BB_prim | BB_prim |
| *measure of wage centralization* | *Bargcent* | *Bargcent* | *Bargcent* | *Bargcent* | *Barglevel* | *Barglevel* |
| **Marginal effect of *election* at different percentiles of wage centralization** | | | | | | |
| *election* | −1.078** | −0.987** | −1.045** | −0.932* | −0.773** | −0.773** |
| | (0.468) | (0.428) | (0.404) | (0.457) | (0.305) | (0.305) |
| *bargaining* | −0.982** | −1.360*** | 0.592 | −0.839* | 0.097 | 0.097 |
| | (0.467) | (0.494) | (0.931) | (0.395) | (0.776) | (0.776) |
| *election × bargaining* | 0.488** | 0.421** | 0.387*** | 0.374* | 0.306*** | 0.306*** |
| | (0.233) | (0.204) | (0.128) | (0.178) | (0.103) | (0.103) |
| *election* | −1.078** | −0.987** | −1.045** | −0.932* | −0.773** | −0.745** |
| | (0.468) | (0.428) | (0.404) | (0.457) | (0.305) | (0.303) |
| *bargaining* | −0.982** | −1.360*** | 0.592 | −0.839* | 0.097 | 0.149 |
| | (0.467) | (0.494) | (0.931) | (0.395) | (0.776) | (0.892) |
| *election × bargaining* | 0.488** | 0.421** | 0.387*** | 0.374* | 0.306*** | 0.274*** |
| | (0.233) | (0.204) | (0.128) | (0.178) | (0.103) | (0.098) |
| ME 25th pctle | −0.590** | −0.565** | −0.657** | −0.558* | −0.468** | −0.471** |
| ME 50th pctle | −0.248 | −0.270 | −0.192 | −0.558* | −0.162 | −0.197 |
| ME 75th pctle | 0.0936 | 0.0247 | −0.0758 | 0.00226 | 0.143 | 0.0762 |
| ME 90th pctle | 0.240 | 0.151 | 0.350 | 0.152 | 0.449* | 0.350* |
| Observations | 895 | 845 | 566 | 340 | 985 | 930 |
| R-squared | 0.283 | 0.412 | 0.434 | 0.450 | 0.264 | 0.350 |
| Number of countries | 35 | 33 | 20 | 13 | 36 | 34 |
| Economic Control Var. | No | Yes | Yes | Yes | No | Yes |
| Political Control Var. | No | Yes | Yes | Yes | No | Yes |
| Count. FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Sample of Countr. | **non-corporatist wage barg.** | **non-corporatist wage barg.** | **Established democracies** | **New democracies** | **Full** OECD | OECD |

– Robust standard errors in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
– Non-corporatist wage bargaining indicates cases where *Bargcent* < 4.
– Data on *interest* is missing for Latvia and Lithuania.
– For the list of Established versus New democracies refer to Table A.2.
– In columns (1)–(4), wage centralization is measured by *Bargcent*, and in columns (5)–(6) with *Barglevel*.

**Table A.5**
Results for Alternative Measures of *election*.

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| | BB_prim | BB_prim | BB_prim | BB_prim | BB_prim | BB_prim | BB_prim |
| *election$^{pred}$* | −1.107** | −1.036*** | −1.080*** | | | | |
| | (0.445) | (0.372) | (0.369) | | | | |
| *election$^{pred}$ × Bargcent* | 0.505*** | 0.486*** | 0.490*** | | | | |
| | (0.192) | (0.158) | (0.154) | | | | |
| *election$^{endog}$* | | | −1.219 | | | | |
| | | | (1.927) | | | | |
| *election$^{endog}$ × Bargcent* | | | 0.060 | | | | |
| | | | (0.618) | | | | |
| *Bargcent* | −0.197 | −0.354 | −0.379 | −0.343 | −0.442 | −0.350 | −0.442 |
| | (0.775) | (0.797) | (0.762) | (0.545) | (0.581) | (0.553) | (0.586) |
| *election* | | | | −0.599* | −0.764** | −0.805** | −0.815** |
| | | | | (0.329) | (0.334) | (0.333) | (0.353) |
| *election × Bargcent* | | | | 0.282** | 0.312*** | 0.288** | 0.286** |
| | | | | (0.126) | (0.116) | (0.125) | (0.129) |
| Marginal effect of *election* at different percentiles of wage centralization | | | | | | | |
| *Bargcent* = 1 (25th pctle) | −0.602** | −0.549** | −0.589*** | −0.316* | −0.452** | −0.517** | −0.529** |
| *Bargcent* = 1.8 (50th pctle) | −0.198 | −0.160 | −0.197 | −0.0906 | −0.203 | −0.286 | −0.301* |
| *Bargcent* = 2.5 (75th pctle) | 0.156 | 0.181 | 0.146 | 0.107 | 0.0155 | −0.0848** | −0.101 |
| *Bargcent* = 3.5 (90th pctle) | 0.661** | 0.667*** | 0.637*** | 0.389** | 0.327** | 0.203 | 0.185 |

**Table A.5** (*continued*).

| Variables | (1) BB_prim | (2) BB_prim | (3) BB_prim | (4) BB_prim | (5) BB_prim | (6) BB_prim | (7) BB_prim |
|---|---|---|---|---|---|---|---|
| R-squared | 0.627 | 0.630 | 0.646 | 0.713 | 0.646 | 0.71 | |
| Observations | 956 | 906 | 906 | 956 | 906 | 956 | 906 |
| Number of id | 35 | 33 | 33 | 35 | 33 | 35 | 33 |
| Economic Control Variables | No | Yes | Yes | No | Yes | No | Yes |
| Political Control Variables | No | Yes | Yes | No | Yes | No | Yes |
| Count. FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Country spec. trends | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

– Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
– ICTWSS does not provide data on *Barglevel* for Iceland. Data on *interest* is missing for Latvia and Lithuania.
– $election^{pred}$ and $election^{endog}$ refer to pre-determined and endogenous elections, respectively.
– In columns (4) and (5), *election* is defined based on $election^{def2}$ (see Section 3.2.1).
– In columns (6) and (7), *election* is defined based on $election^{def3}$ (see Section 3.2.1).
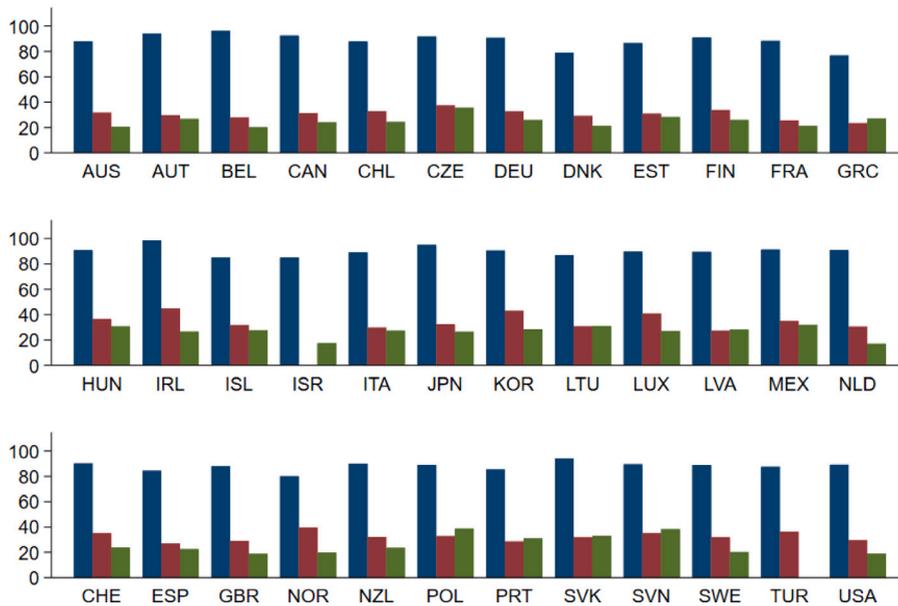


**Fig. A.1.** This figure displays the time-averaged shares of the MAMFI sectors in total employment, value added, and trade across the 36 OECD countries included in the sample. MAMFI sectors refer to (i) 'Manufacturing', (ii) 'Agriculture; forestry and fishing', (iii) 'Mining and quarrying', (iv) 'Financial and insurance activities', and (v) 'Information and communication'.

**Table A.6**

Regression Analysis: Government Expenditure and Revenue in Relation to Election Time and Wage Centralization.

| Dep. variable | (1) Gov. Exp. (%GDP) | (2) Gov. Exp. (%GDP) | (3) Gov. Exp. (%GDP) | (4) Gov. Exp. (%GDP) | (5) Gov. Rev. (%GDP) | (6) Gov. Rev. (%GDP) | (7) Gov. Rev. (%GDP) | (8) Gov. Rev. (%GDP) |
|---|---|---|---|---|---|---|---|---|
| *election* | 1.128** | 0.846* | 0.666 | 1.276** | 0.196 | 0.029 | −0.267 | 0.096 |
| | (0.473) | (0.422) | (0.411) | (0.521) | (0.326) | (0.283) | (0.300) | (0.379) |
| *Bargcent* | −0.201 | −0.636 | −0.434 | −1.211 | −0.342 | −0.688 | −0.532 | −1.073 |
| | (0.703) | (0.676) | (0.759) | (1.170) | (1.147) | (1.147) | (0.492) | (0.855) |
| *election × Bargcent* | −0.442** | −0.349** | −0.310* | −0.542** | −0.078 | −0.034 | 0.061 | −0.088 |
| | (0.187) | (0.171) | (0.166) | (0.193) | (0.138) | (0.135) | (0.140) | (0.169) |

(*continued on next page*)

**Table A.6** (*continued*).

| Dep. variable | (1) Gov. Exp. (%GDP) | (2) Gov. Exp. (%GDP) | (3) Gov. Exp. (%GDP) | (4) Gov. Exp. (%GDP) | (5) Gov. Rev. (%GDP) | (6) Gov. Rev. (%GDP) | (7) Gov. Rev. (%GDP) | (8) Gov. Rev. (%GDP) |
|---|---|---|---|---|---|---|---|---|
| Marginal effect of *election* at different percentiles of wage centralization | | | | | | | | |
| *Bargcent* = 1 (25th pctle) | 0.686** | 0.497* | 0.357 | 0.734** | 0.117 | −0.00482 | −0.205 | 0.00809 |
| *Bargcent* = 1.8 (50th pctle) | 0.333 | 0.218 | 0.109 | 0.300 | 0.0551 | −0.0319 | −0.156 | −0.0622 |
| *Bargcent* = 2.5 (75th pctle) | 0.0239 | −0.0270 | −0.108 | −0.0793 | 0.000483 | −0.0555 | −0.113 | −0.124 |
| *Bargcent* = 3.5 (90th pctle) | −0.418 | −0.376 | −0.417* | −0.621** | −0.0775 | −0.0894 | −0.0520 | −0.212 |
| Observations | 964 | 906 | 906 | 566 | 964 | 906 | 906 | 566 |
| R-squared | 0.174 | 0.289 | 0.474 | 0.474 | 0.076 | 0.249 | | 0.544 |
| Number of id | 35 | 33 | 33 | 20 | 35 | 33 | 33 | 20 |
| Economic Control Variables | No | Yes | Yes | Yes | No | Yes | Yes | Yes |
| Political Control Variables | No | Yes | Yes | Yes | No | Yes | Yes | Yes |
| Count. FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Country spec. trends | No | No | Yes | Yes | No | No | Yes | Yes |
| Sample of Countries | Full OECD | Full OECD | Full OECD | **Established democracies** | Full OECD | Full OECD | Full OECD | **Established democracies** |

– Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

– ICTWSS does not provide data on Barglevel for Iceland. Data on *interest* is missing for Latvia and Lithuania.
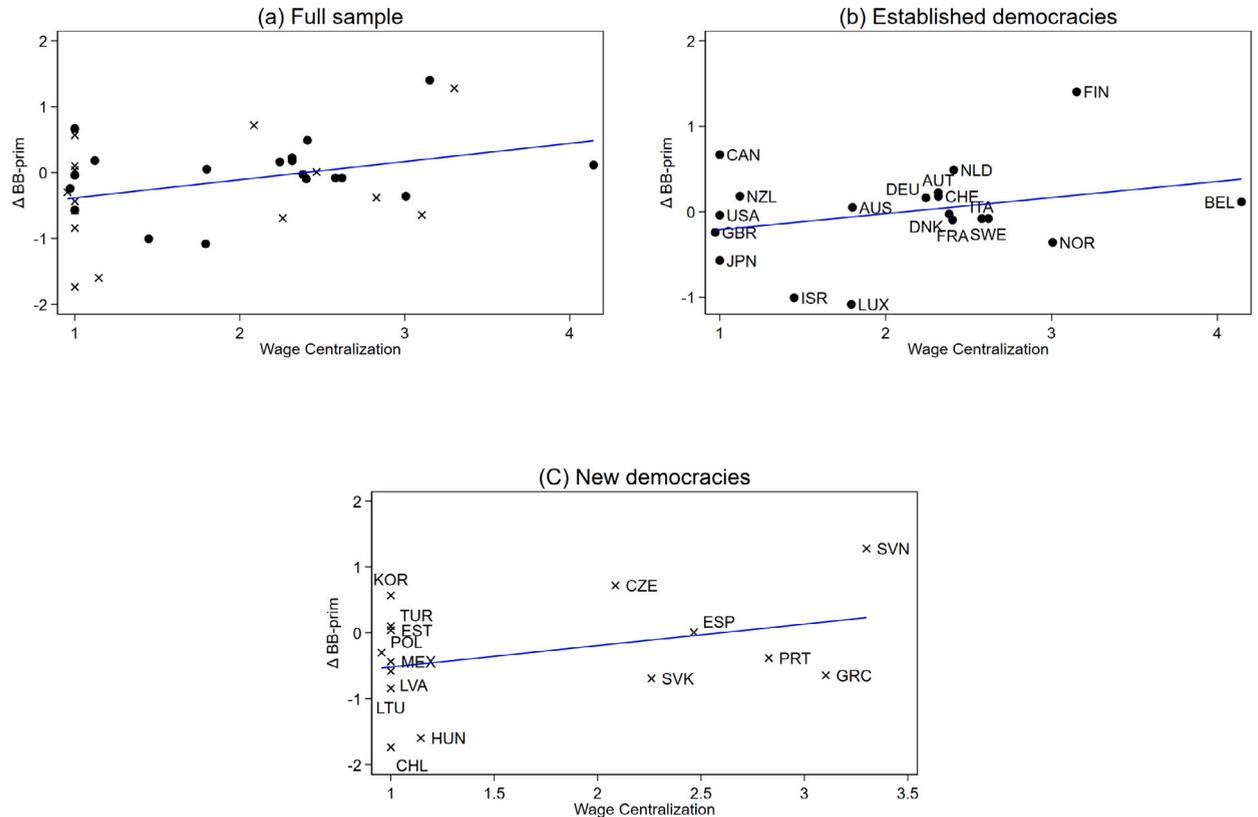


**Fig. A.2.** The vertical axis shows the average of the difference in primary budget balance (%GDP) between election years and the average of the budget balance in the preceding and subsequent years from 1990 to 2018. The horizontal axis is the average of *Bargcent* (a measure for centralization of wage bargaining) in the same period. "×" is used for new democracies and "•" indicates established democracies. See Section 3 for details on *Bargcent*. For the list of established and new democracies, refer to Table A.2.

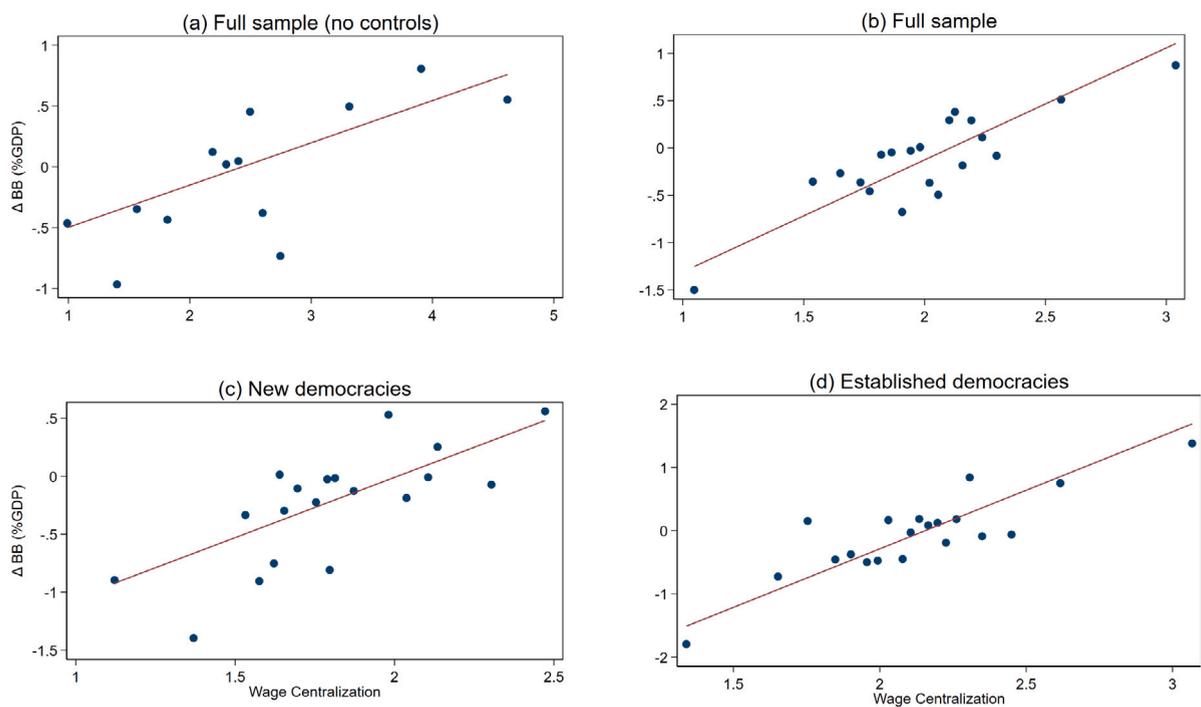## Political Budget Cycles vs Wage Centralization



**Fig. A.3.** The bin-scatter plots show the relationship between political budget cycles and wage centralization (1990–2018). The vertical axis represents the difference in the primary budget balance between the election year and the average of the budget balance in the preceding and subsequent years. The horizontal axis represents a measure of wage centralization ($Bargcent$). Panel (a) exhibits a simple bin-scatter plot without any controls. Panels (b), (c), and (d) include controls for a set of economic and political variables, alongside time and country-fixed effects. Detailed definitions of election years, $Bargcent$, and the set of control variables are provided in Section 3. For the list of established and new democracies, refer to Table A.2.

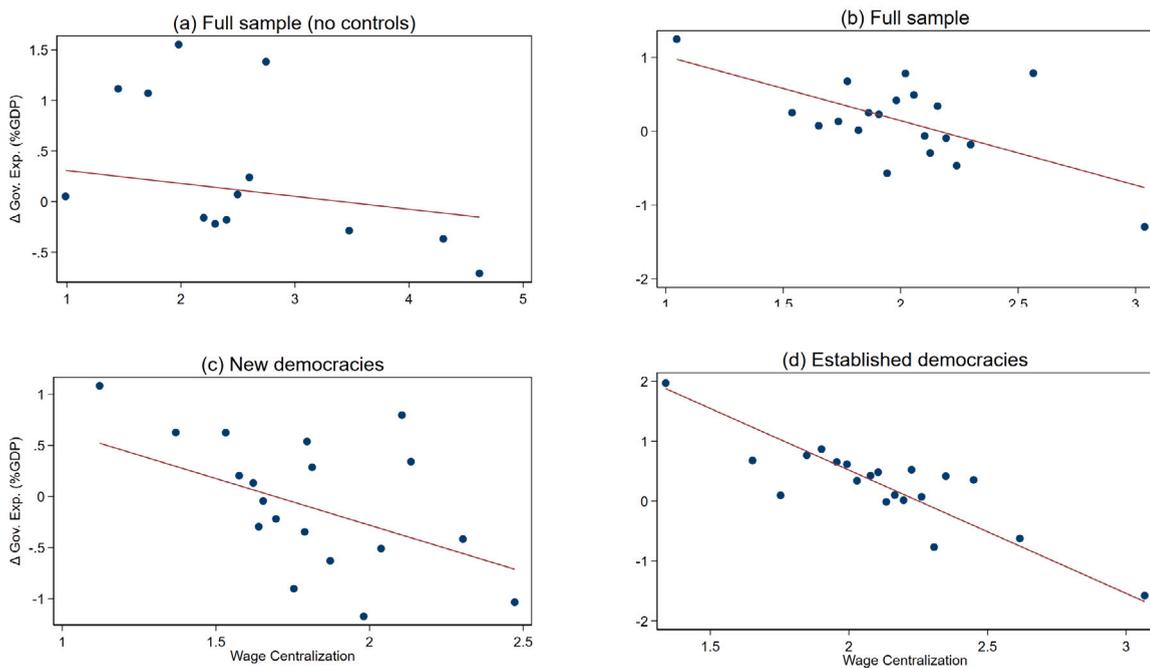## Political Gov. Expenditure Cycles vs Wage Centralization



**Fig. A.4.** The bin-scatter plots show the relationship between political cycles in primary government expenditure (%GDP) and wage centralization (1990–2018). The vertical axis represents the difference in primary government expenditure (%GDP) between the election year and the average of the budget balance in the preceding and subsequent years. The horizontal axis represents a measure of wage centralization (*Bargcent*). Panel (a) exhibits a simple bin-scatter plot without any controls. Panels (b), (c), and (d) include controls for a set of economic and political variables, alongside time and country-fixed effects. Detailed definitions of election years, *Bargcent*, and the set of control variables are provided in Section 3. For the list of established and new democracies, refer to Table A.2.

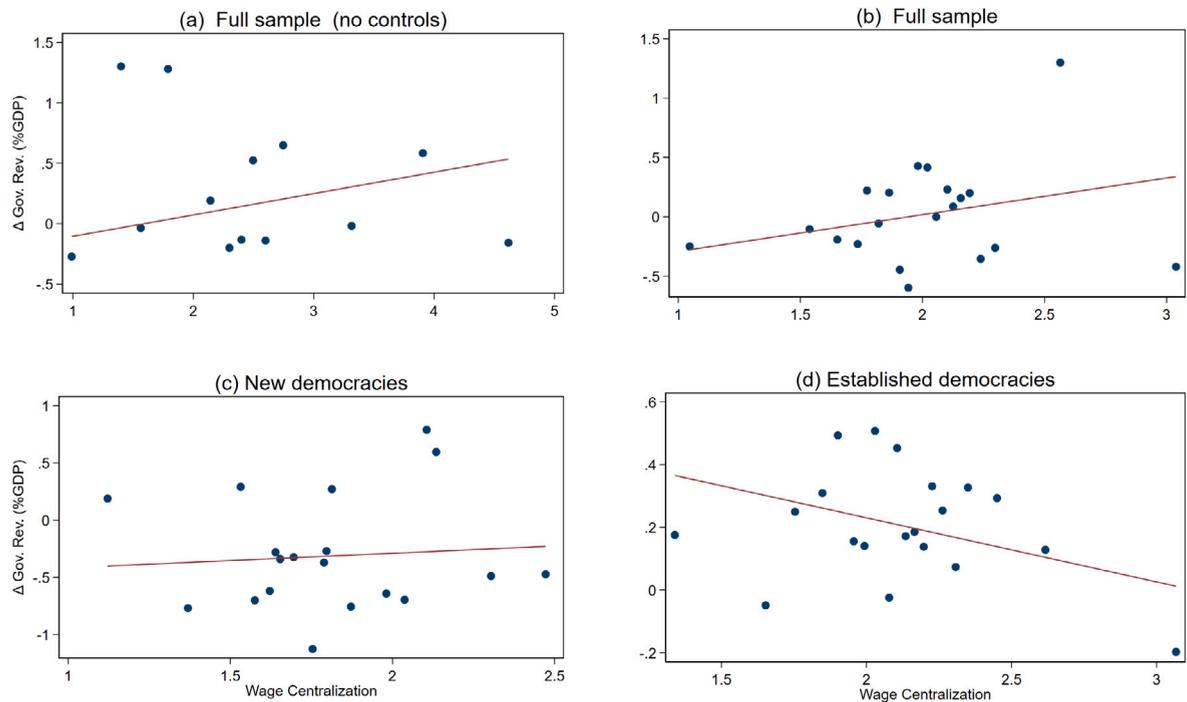# Political Gov. Revenue Cycles vs Wage Centralization



**Fig. A.5.** The bin-scatter plots show the relationship between political cycles in government revenue (%GDP) and wage centralization (1990–2018). The vertical axis represents the difference in government revenue (%GDP) between the election year and the average of the government revenue in the preceding and subsequent years. The horizontal axis represents a measure of wage centralization (*Bargcent*). Panel (a) exhibits a simple bin-scatter plot without any controls. Panels (b), (c), and (d) include controls for a set of economic and political variables, alongside time and country-fixed effects. Panel (b) encompasses all countries in the sample, while Panels (c) and (d) focus exclusively on new democracies and established democracies, respectively. Detailed definitions of election years, *Bargcent*, and the set of control variables are provided in Section 3. For the list of established and new democracies, refer to Table A.2.

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