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Decentralisation or patronage: What determines government's allocation of development spending in a unitary country? Evidence from Bangladesh

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ABSTRACT

This paper contributes to the decentralisation and distributive politics literature by empirically investigating the determinants of public expenditure at the sub-national level in Bangladesh. We argue that fragmentation in a unitary developing country may not channel higher resources to local areas. Political motives may instead play a significant role in the allocation process. Using panel data methods and a novel dataset on government's district-wise allocation of annual development expenditure in Bangladesh covering the period from 2005 to 2009, the analysis focuses on the impact of local government fragmentation and tests key political distribution models (the *core voter hypothesis*, the *swing voter hypothesis*, and the *political alignment theory*). The results show that local government fragmentation does not have any significant impact on public spending at the district level. However, the core vote share, local elected representative's political alignment with the ruling party, and the raw number of ministers from a district are all significantly associated with higher expenditure allocation. No evidence was found in support of the swing voter hypothesis. Overall, the findings suggest that political motives matter and that the allocation of developing spending is significantly influenced by political patronage. This may be a signficant obstacle to SDGs progress, as development spending may not be governed by resource delivery mechanisms that effectively target the poor.

1. Introduction

What determines the allocation of public spending? Traditional public finance theories suggest that the principles of efficiency, equity, and stabilisation decide the allocation pattern, where the central government plays a 'benevolent role' and tries to maximise social welfare (Rodríguez-Pose et al., 2016). Conversely, political distribution and political settlement theories argue that, as politicians are the ultimate policymakers, political motives play a major role in influencing the growth of aggregate and different categories of public spending (Golden and Min, 2013; Persson, 2007). This paper contributes to this debate by investigating the determinants of public spending allocation at the subnational level for a unitary developing country: Bangladesh. We analyse the impact of various type of local government fragmentation, a particular aspect of local decentralisation, and distributive politics on government's district-wise

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allocation of total development expenditure. This is especially relevant to the context of developing economies, as the empirical literature analysing the impact of various types of fragmentation and political patronage on total public spending at the subnational level of developing unitary countries is rather thin. In particular, to the best of our knowledge, no previous studies empirically investigated the core voter versus swing voter debate or the impact of local government fragmentation on national government's spatial allocation of total development spending focussing on Bangladesh.

Bangladesh represents a very interesting case to study both the impact of fragmentation and distributive politics on public spending. The country has made remarkable progress in a number of development outcomes. Yet, what explain its progress is still unclear (Asadullah et al., 2014; Sen, 2016). Undestanding Bangladesh's progress requires also a closer look at decentralisation, as it has become a central feature of the country's development programme adopted during its period of success. In the country, both political and administrative decentralisation is promoted in the form of political fragmentation of local government (LG) units, with the scope to create local participation and representation (Faguet and Ali, 2009). Therefore, understanding whether local government decentralisation or political motive determines the geographical allocation of public spending in Bangladesh can feed into the national effort to pursue the Sustainable Development Goals (SDGs). In particular, SDGs 16 and 17 have emphasised the need for developing effective, accountable, and transparent institutions to ensure responsive, inclusive, and participatory decision making and strengthening domestics resource mobilisation at all levels (UN, 2015). Investigating the impact of fragmentation on government's development expenditure allocation will help us to understand how much the fiscal authority of the local units of Bangladesh contribute to the SDGs.

Existing literature suggests that all the theories that explains the determinants of public spending growth can be classified into three groups: *demand models* (in which, citizens' preference is reflected in the size of the spending), *supply models* (in which, politicians and bureaucrats are seen as having power to impose their interests over the citizens interest), and *constitutional models* (in which constitutional design and rules constraints the state from using its power in a discretionary manner) (Facchini, 2018; Mueller, 2003). The *demand models* are historically the most discussed and empirically tested theories, focussing on determinants capturing the broad demographic and socio-economic condition, ethnic diversity, and political ideology of the population. A growing body of literature investigates *supply models*, focussing especially on distributive politics. Conversely, *constitutional* explanations have seen less discussion, although have been present in very recent literate (Facchini, 2018). In this study, by taking *demand models* variables as controls, we investigate the impact of distributive politics (a supply model factor) and local government fragmentation (a constitutional model factor, as it can create constitutional obligations and constraints) on public spending. This is important, as whether fragmentation favours or disfavours a more efficient and balanced spatial pattern of public spending is still unclear and, moreover, fragmentation itself can create scope for political patronage in resource allocation (Gottlieb et al., 2019; Lessmann, 2012; Livert et al., 2019). Therefore, one should take patronage and fragmentation together, as in this empirical study.

Regarding the relationship between decentralisation and the size of public spending, there is a long-standing theoretical disagreement. The "Decentralisation theory" argues that decentralisation can increase budgetary growth because local demands will be better served (Oates, 1972). Conversely, the "Leviathan theory" suggests that with decentralisation, the size of the total government spending declines as greater competition enhances efficiency and restricts expenditure growth (Brennan and Buchannan, 1980). Testing these theories, empirical studies have provided conflicting results and eventually concluded that the relationship is conditional to specific contexts (Hendrick et al., 2011; Qiao et al., 2019; Choudhury and Shau, 2022). However, the literature is biased towards federal countries, and has paid little attention to the impact of decentralisation on resource allocation in the context of unitary developing countries (Faguet, 2014; Bardhan and Mookherjee, 2010). Besides, studies have often failed to measure decentralisation properly, as they have concentrated only at the national level, whereas most of the unitary countries have implemented horizontal dispersion dimension of decentralisation at the subnational level rather than the vertical dispersion dimension (Boex and Edwards, 2016; Bardhan and Mookherjee, 2012). Furthermore, most of the comparative studies have heavily relied on the conventional indicators of fiscal decentralisation which captures decentralisation partially as unitary countries have shown more affinity towards implementing political and administrative decentralisation (Smoke, 2013). Besides, the comparative studies have the limitation of not capturing the difference in the institutional settings (e.g., the type, objective, or design of the programme) across countries (Bardhan and Mookherjee, 2010). Therefore, more empirical investigations, using appropriate indicators, should be carried out in the developing country context.[2]

Similarly, the literature has offered several theories of distributive politics. It has been suggested that politicians may target the core voters (Cox and McCubbins, 1986), swing voters (Dixit and Londregan, 1996), core (or swing) constituencies rather than voters (Cox, 2010), voter turnout (Nichter, 2008; Casas, 2018), opposition abstention voters (Kaba, 2022), marginally winning constituencies (Persson et al., 2000), opposition strongholds (Casas, 2020), politically aligned constituencies or leaders (Wong, 2022; Baron, 1993), or hometown favouritism (Kung and Zhou, 2021). A vast body of research has provided empirical evidence supporting these theories. Review of the literature, however, confirms that most of the empirical studies are confined to the OECD and Latin American countries with few exceptions, e.g. Callen et al. (2020) on Pakistan, Das and Maiorano (2019) and Bardhan and Mookherjee (2012) on India, and Kung and Zhou (2021), Wong (2022) and Jiang and Zhang (2020) on China. Furthermore, these studies have mainly focused on electorally relevant aspects of taxes and transfers (Golden and Min, 2013). Analyses of the impact of distributive politics on total public spending in the context of a developing country are relatively scarce and often not based on a robust research design (Manacorda et al., 2011). Such investigations are also challenging to conduct as targeting certain areas with certain political features does not necessarily

[2] This study used local government fragmentation indicators to measure local decentralisation following the study of Stansel (2005, 2006). These indicators can capture administrative, political, and fiscal decentralisation, simultaneously (for details see Lewis, 2017; Stansel, 2006; Feld et al., 2010).

confirm politically motived spending, rather it can be an attempt to mitigate the interregional inequality (Banful, 2011). On the econometric front, one faces challenges due to the possibility of reverse causality (between allocation and voting behaviour) and omitted variable bias (caused by not considering regional heterogeneity), which are often not carefully addressed. In addition, studies have used a wide range of variables as a proxy to test the conventional models of distributive politics It is, therefore, important to test them in different settings. Overall, the literature would benefit from more country specific and methodologically sound empirical analysis and the present papers contributes to fill this gap. To our knowledge, this is the first attempt to empirically investigate the impact of distributive politics and fragmentation on government's total development spending at the subnational level of a unitary developing country, offering panel data evidence.

We construct a unique panel dataset on public spending at the district level, using Bangladesh government's district-wise allocation of the Annual Development Plan (ADP) funds over the period 2005–2009. We include a range of local government fragmentation and distributive politics measures. Our regression specification includes a large set of controls (including socio-economic and demographic variables) and, for robustness, uses a range of panel methods accounting for unobserved heterogeneity and dynamic effects. The results suggest that local government fragmentation (either total, horizontal, or vertical) does not have any significant impact on the per capita development expenditure allocated by the government at the subnational level in Bangladesh. Conversely, distributive politics plays a significant determining role, as the study found that a district's share of core vote for the ruling party, number of ministers, and the political alignment of the local representative with the ruling party have a significant positive impact on the per capita development expenditure. This suggest that the allocation of developing spending is significantly influenced by political patronage. And this may be a signficant obstacle to SDGs progress, as development spending may not be governed by resource delivery mechanisms that effectively target the poor.

The rest of the paper is organised as follows: Section 2 reviews the literature on fragmentation and distributive politics; Section 3 describes the methodology of the empirical analysis; Sections 4 and 5 present and discuss the results. Section 6 concludes.

2. Review of the literature

This section offers a brief survey of the literature on the impact of fragmentation and distributive politics on government's allocation of public spending at the local level. We argue that neither the empirical literature on fragmentation nor the one on distributive politics have produced persuasive evidence on developing economies. Finally, we end this review section by presenting a discussion on the nature of public spending in Bangladesh.

2.1. Local government fragmentation and size of the public sector

Literature suggests that local government fragmentation reallocates the government's fiscal, personnel, and administrative resources, and can potentially help develop the area (Faguet, 2014; Grossman et al., 2017). The theoretical connection between fragmentation and public spending or size of the public sector is mainly established by two different theories which contain contrasting views–the *Decentralisation Theory* and the *Leviathan Theory*. The *Decentralisation Theory* (Oates, 1972, 1985) claims that a decentralised system of public output delivery will be more welfare-enhancing than the centralised system (if there is no cost advantage associated in the centralised provision) as it is more capable of reflecting the differences in demand for the public good across jurisdictions. Therefore, from a purely budgetary perspective, increased decentralisation will cause a higher level of government spending. A contrasting argument is provided by *Leviathan Theory* (Brennan and Buchannan, 1980) which asserts that higher competition and higher mobility of residents among the local units caused by decentralisation increases the efficiency of the local bureaucracies which in turn constricts to total government spending (Schneider, 1989). However, this theory also added that if the degree of revenue decentralisation is smaller than expenditure decentralisation such constraining effect will disappear.

Empirical studies testing the relationship between decentralisation and size of public sector have provided conflicting results. Several studies (e.g., Boyne, 1992; Grisorio and Prota, 2015; Prohl and Schneider, 2009) claimed that higher level of decentralisation reduces the size of public sector. Contrarily, another strand of studies (e.g., Berry, 2008; Forbes and Zampelli, 1989) have found a positive relationship. Besides, few studies, e.g. Campbell (2004) and Stansel (2006) also found mixed results. Contemporary literature, investigating the reason for such conflicting evidence, suggest that the impact of fragmentation on public spending is conditional upon multiple factors, e.g. the type of fragmentation (i.e., horizontal, vertical, or total), type of the local government unit (general or special purpose), 'spending relationship' between different units (Hendrick et al., 2011), level of democracy (Qiao et al., 2019), and ethnic heterogeneity (Choudhury and Shau, 2022).[3] For instance, horizontal fragmentation creates more competitiveness among the units of the same tier making them more efficient and cost-effective in providing public goods. As a result, the size of the public sector shrinks. Conversely, vertical fragmentation creates a complementary relationship among units of different tiers and therefore, increases both local and total public spending (Campbell, 2004; Turnbull and Djoundourian, 1993).

Horizontal fragmentation, however, does not always create competitiveness. Fragmentation of general-purpose units will enhance competition among themselves, and eventually reduce the size of public spending. The opposite will happen in the case of special purpose units as they rather have a complementary relationship among themselves (Goodman, 2015; Stansel, 2006; Zax, 1989). Studies have also investigated the relationship between total fragmentation and government expenditure and provided conflicting

[3] Due to limited scope and data unavailability, this study could not investigate the impact of democracy and ethnic heterogeneity on the size of public spending.

evidence. For instance, Campbell (2004) and Craw (2015) found that with a higher level of total fragmentation per capita expenditure in a local area decrease. Conversely, Feld et al. (2010) and Goodman (2015) have found the opposite impact.

Empirical studies on unitary countries are scarce. Among the few exceptions, Faguet (2004, 2014) on Bolivia and Bangladesh; Rondinelli et al. (1983) on Papua New Guines; Manor (1999) on Philippines and Corte d'Ivoire; and Kis-Katos and Sjahrir (2017) on Indonesia found that local decentralisation has a positive impact on public expenditure and social services in rural areas. Contrarily, Akin et al. (2005) found that the government's total expenditure rather decreased with decentralisation in Uganda. However, most of these studies are either descriptive or sector and context specific, or did not measure local decentralisation at the subnational level in a comprehensive manner.[4] Overall, the evidence on how fragmentation impacts public spending allocation in unitary countries is relatively scarse and inconclusive, and to our knowledge, no earlier study has empirically investigated this relationship in the context of Bangladesh.

2.2. Political distribution theories of resource allocation

Theories of distributive politics suggest that as government spending decision is ultimately determined through a political process, political parties in power often allocate public funds based on electoral motive and without the efficiency or equity consideration (Besley et al., 2004; Bardhan and Mookherjee, 2012; Gervasoni, 2010). Numerous studies have investigated the impact of electoral competition and political motive on private and public resource distribution and developed several theories on distributive politics. However, this paper mainly focuses on the core voter hypothesis, swing voter hypothesis, and partisan alignment theory and tests these theories in the Bangladesh context. A brief description of these theories with supporting empirical evidence is presented in this section.

The debate between the core voter hypothesis and swing voter hypothesis gained wide attention from the political scientists over the years. Core voter hypothesis asserts that politicians tend to spend more in the areas that contain a larger percentage of their core support (Cox and McCubbins, 1986). The main argument here is that political parties know core supporter's preference and desire, therefore, it is the most cost-effective way of vote-buying whereas, other options are riskier (Diaz-Cayeros et al., 2016). A large body of studies has found supporting evidence in favour of this hypothesis (e.g., Das and Maiorano, 2019; Arulampalam et al., 2009; Calvo and Murillo, 2004; Larcinese et al., 2013; Luca and Rodríguez-Pose, 2015).

Contrarily, the *swing voter hypothesis* claims that more resource should be allocated to the groups or regions that contain a large percentage of voters who are ideologically indifferent between political parties, known as "swing voters" (Lindbeck and Weibull, 1987). The argument in favour of this hypothesis is that politicians should not waste their effort in voters who will vote for them no matter what. Thus targeting the swing voters, the reward can make the difference between supporting and opposing them (Stokes, 2005). Again several empirical studies, e.g. Lindbeck and Weibull (1987), Nichter (2008), Snyder (1989), Strömberg (2008), and Stokes (2005 found supporting empirical evidence. These two alternative hypotheses, however, are not incompatible to each other as evidence suggest that parties, in the long term, maintain their electoral coalition with the core voters but in the short run, during the election years, try to expand their electoral base by targeting the swing voters (Ahmad, 2021; Calvo and Murillo, 2004; Stokes, 2005). Moreover, political parties can diversify their electoral investment in both core and swing voters by using cash transfers (which is a quicker and easier method) to target swing voters and use public goods (which are long term and slow moving investment) to target core voters (Tribin, 2020).

Conversely, the *partisan alignment theory* asserts that upper-tier government allocates more funds to lower-tier governments or to constituencies which they control, i.e., which are aligned with the upper-tier government (Arulampalam et al., 2009; Strömberg, 2008). In opposition, the argument is if citizens have a special social preference for a particular political party, independent of whether the incumbent political party in power has helped them or not, then the redistribution policy may not show any evidence of partisan alignment (Kartik and McAfee, 2007; Dey and Sen, 2016). Empirical studies have, however, provided inconsistent results. For instance, Livert et al. (2019), Ansolabehere et al. (2002), Knight (2002), Solé-Ollé, Sorribas-Navarro (2008), and Wong (2022) found supporting evidence, whereas, Callen et al. (2020), Erikson et al. (1989), and Plotnick and Winters (1985) failed to find any unambiguous effect of partisan alignment on resource allocation or voter welfare.

2.3. The nature of development spending in Bangladesh

In this sub-section, we give an overview of Bangladesh government's development spending, relating it to the hypotheses are going to test. Existing reserach indicates that the development spending process in Bangladesh is centrally controlled and biased towards non-poor and advanced regions. Regarding the fiscal authority of the local units, the literature argues that the LGIs are highly dependent on the central allocation but the share of the public spending they receive is very nominal.

Bangladesh government's annual development spending is organised through the Annual Development Plan or ADP which is a list of projects and allocations in various sectors for a year out of a five-year plan period (MoF, 2022).[5] The major share of the ADP is

[4] The early studies (e.g., Manor, 1999; Rondinelli, 1983) were mostly descriptive in nature.; several studies are sector specific (e.g., Akin et al., 2005; Kis-Katos and Sjahrir, 2017; and Faguet 2014). Faguet (2004) 's study on Bolivia used dummy variable to indicate post and pre decentralisation era. Therefore, the level of decentralisation is not directly captured.

[5] The public expenditure data does not come in the form of regional disaggregation. The list shows sectoral and project-wise allocations which cannot be disaggregated at the local level properly. The Ministry of Finance, however, published the district and division-wise disaggregation of the public expenditure data for some years which is used in this current study.

channeled through vertically driven sector programmes and projects that are implemented by ministries and their line agencies (17 agencies of 12 ministries operate at the local level). Only a minor share of the ADP is channeled through block allocations, of which even a smaller portion is assigned to Local Government Institutes (LGIs) through transfers. Hence, the amount of transfer is very nominal compared to the public expenditure incurred at the same level through separate government agencies (Kabir, 2015; Aminuzzaman, 2010; Ahmed et al., 2014). Recent budget data confirms that in the year 2022, total ADP allocation for the Local Government and Rural Development Ministry (which consists of Local Government Division-LGD, Rural Development and Cooperative Division, and Ministry of Chattogram Hill Tracts Affairs) was only 15% out of the total development spending (MoF, 2022). The local government units (i.e., city corporations, municipalities, district councils, sub-district councils, and union councils) are under LGD and LGD's budget for the LGIs is also comparatively small, around 13%–15% (MoF, 2022; Kabir, 2015). During our study period, the budget share was even lower, around 2.5%–6.5% (BBS, 2015; Fox and Menon, 2008). The urban LGIs (city corporations and municipalities) usually receive a relatively higher allocation. However, all city corporations together received 553 crore taka in 2007–08, which was only 2.45% of the year's total ADP allocation (BBS, 2015).

Investigating the nature of government's development spending, several studies have claimed that the development spending is biased towards advanced regions and the non-poor (e.g., Chowdhury and Sen, 1998; World Bank, 2010; Khondker and Mahzab, 2015; Sen and Ali, 2009). Studies have also found that public spending funded by foreign grants mostly finances non-productive civil expenditure whereas, foreign loans are generally utilized for human capital-building programmes (Quazi, 2005). Literature further claims that the LGIs of Bangladesh possess a poor level of fiscal authority on the resource mobilisation channels. The LGIs are highly dependent on central transfers which, however, are determined by ad hoc decisions within the ministry of finance and the local representatives almost have no involvement in the design or implementation of the development projects (Talukdar, 2019; Sarker, 2006; Fox and Mennon, 2008; Panday, 2014). Government also exercises a considerable degree of control by increasing or decreasing the allocation or by making the release subject to the fulfilment of certain conditions (Siddique, 2005). Furthermore, different functions and legal rights of the LGIs are determined by the act of parliament, and through the acts, the central government still holds a dominant position and legal provision to control the LGIs (Ehsan, 2020; Panday, 2011). Besides, at each tier of the local government system, the central government has appointed an administrator and the LGIs are accountable to those field officers through different legal procedures and requirements for approval. For instance, the budget of Union council (lowest tier LG unit) requires final approval from the Union Nirbahi Officers or UNOs. UNOs are also the chief executive of the Upazila or subdistrict. Similarly, Sub-district councils (the middle-tier LG units) have to plan local development in consultation with the local MP and the advice often turns into an executive order. The CG can also remove the elected representatives of any LGI from his/her office on certain grounds (Ehsan, 2020; Haque and Panday, 2018; Ahmed, 2015).

Nevertheless, several studies have argued that despite having limitations, the local units have played a positive role in local development by ensuring local representation and participation, enhancing the efficiency of public service provision (especially in health and education), expanding government's social assistance programmes as they are implemented through the local units (Galasso and Ravallion, 2005; Faguet, 2017). It has been observed that, if the local unit representatives are aligned with the ruling political party, higher fiscal and administrative resources are mobilised to the local area (Panday, 2014; Lewis and Hossain, 2017). Therefore, fragmentation or local unit creation may ensure higher resource mobilisation through indirect channels.

However, empirical studies testing the distributive political models on public resource allocation are limited. Among the handful ones, Mahmoud et al. (2008) found that local MP's affiliation with the ruling party plays a significant role in attracting more public investment (i.e., supporting the political alignment theory). The study, however, was able to disaggregate ADP expenditure partially (about 40%–60%) and did not cover the whole country. Similarly, Lewis and Hossain (2017) and Panday (2014)'s qualitative investigation at sub-district level claimed that the central government allocates more grants to those local bodies which are administrated by party allies (i.e., supporting the partisan alignment theory). Although, the findings of these descriptive studies are yet to be empirically tested. In particular, to the best of our knowledge, no previous study has investigated the core voter and swing voter hypothesis on public spending in the context of Bangladesh, which can be a very interesting issue to explore. Furthermore, over the years, government has promoted local government decentralisation by horizontally increasing the number of local units at each tier, therefore, its overall impact on the resource delivery mechanism needs to be investigated in a systematic manner.

Overall, review of the literature shows that most of the studies on fragmentation and distributive politics were conducted on either federal countries or examined the allocation of only specific grants and transfers. Investigation on whether the electoral motive is also evident in total public spending in the context of unitary developing countries is still limited. Moreover, methodological issues, e.g. reverse causality between spending and voting behaviour and the omitted variable bias caused by spatial heterogeneity are often not properly considered. Besides, a wide range of political variables is used in empirical studies to proxy the theoretical variables while testing those distributive theories, and it is, therefore, important to test them in different settings. For such reasons, more empirical investigations are required to explore the key determinants of public spending. Hence, this study examines three dominant theories of distributive politics (i.e., the core voter hypothesis, swing voter hypothesis, and alignment theory) in the context of Bangladesh to find out whether central government's development spending is influenced by political motives.[6]

Informed by the foregoing discussion on fragmentation and distributive politics, we test a set of four hypotheses:

[6] There is a vast literature examining different forms of vote-buying (e.g., Diaz-Cayeros et al., 2016; Bardhan and Mookherjee, 2016). As this study deals with the total development expenditure allocation of the government and detailed knowledge about the type of expenditure is not available, the study does not bring the issue of different forms of vote-buying and their impact in this current analysis. Besides, data unavailability at the local level has been a major constraint in selecting the distributive models to test.

- *Hypothesis 1: Fragmentation has a significant impact on central government (CG)'s annual development expenditure allocation at the subnational level.* We expect that total fragmentation, vertical fragmentation, and horizontal fragmentation of special purpose unit will have a positive impact on public spending, whereas horizontal fragmentation of general-purpose units will have the opposite effect.
- *Hypothesis II: A higher share of core vote for the ruling party has a positive impact on CG's annual development expenditure allocation at the subnational level.*
- *Hypothesis III: A higher share of swing vote has a positive impact on CG's annual development expenditure allocation at the subnational level.*
- *Hypothesis IV: local elected representative's political alignment with the ruling party in the government has a positive impact on CG's annual development expenditure allocation at the subnational level.*

While the first hypothesis is on fragmentation, *Hypothesis II* and *III* are a test of the *Core voter* and *Swing voter hypothesis,* respectively. *Hypothesis IV* is on *partisan alignment* in resource allocation.

3. Methodology and data

3.1. Data and variables

We construct a unique dataset, which is a balanced panel of 61 districts[7] (out of total 64 districts) covering the period from 2005 to 2009. This period cover three different political regimes and district boundaries remained fixed over these years. Our dependent variable is the district-wise allocation of per capita Annual Development Plan or ADP spending. This data is provided by the Ministry of Finance of Bangladesh Government (see MoF, 2008; 2010). We use a range of fragmentation indicators and the political variables as key independent variables.

To capture different types of fragmentation, we construct five indicators. *Total units per density* is the number of total local government (LG) units (i.e., aggregate of the number of Union Councils, Municipalities, Sub-district Councils, and District Councils) in a district per population density. It is constructed to capture the degree of total fragmentation, following Campbell (2004) and Oates (1993). *Local self-govt. Units per density* measures horizontal fragmentation. It is the number of local self-government units at the lowest tier of the LG structure. The number of Union Councils and Municipalities of a district are added to construct this indicator as only they can be considered as self-government units of Bangladesh (Siddique, 2005; Panday, 2011). Furthermore, as general and special purpose local units have different influence on public spending, separate indicators are constructed (following the study of Hendrick et al., 2011; Stansel, 2006). In Bangladesh, Unions can be labelled as general-purpose units and Municipalities can be labelled as special-purpose units (Ahmed, 2015). Therefore, in this study, horizontal fragmentation of general-purpose unit is measured by the indicator *Unions per density* which show the number of Union Councils (UPs) in a district.[8] Horizontal fragmentation of special-purpose government is measured by the indicator *Municipalities per density* which display the number of Municipalities in a district. Finally, following the study of Boyne (1992) and Goodman (2015), the indicator *Vertical fragmentation* is constructed. It shows the share (%) of local government units at the lowest tier (total number of unions and municipalities) out of the total number of units (considering all the three tiers) in the district. All the fragmentation indicators are standardised by the population density of the district .[9]

We constructed the political variables using national election results of 2008, 2001, 1996, and 1991. Constituency-based election results are aggregated to make them representative at the district level following the study of Asfaw et al. (2008) and Imai and Sato (2012) .[10] Literature shows that using the short-run indicator to test the impact of voting on the government's spending decision suffers from endogeneity problem (Larcinese et al., 2013). Moreover, core or swing voter measurement should not be based on the vote returns of a single election as core supports are those voters who show partisan loyalty over a long period (Diaz-Cayeros et al., 2016). To tackle this issue, this paper has constructed the core vote and swing vote indicators using the previous three election results. The timespan of this investigation covers three different political regimes: the year 2005 and 2006 falls into Bangladesh Nationalist Party (BNP) government regime; during 2007 and 2008, the country was under the state of emergency. The national election was held in 2008, and the last year 2009 falls under Awami League (AL) government regime. Therefore, for the first two years of the panel, the national election results of 2001, 1996, and 1991 are used to construct the political variables. For the last year (2009), the election results of 2008, 2001, and 1996 are considered. For the middle two years (2007 and 2008), as the country was under the state of emergency, zero value is assigned to the core and swing voter indicator.

[7] Three hill districts - Rangamati, Bandarban, and Khagrachari, are not included as they are under the Special Affairs Division with separate local government act and land administrative law.

[8] Upazila or subdistrict Council (at the middle tier) and Zila or district Councils (at the top tier of the local government system of Bangladesh) did not have elected representatives during the entire study period. Therefore, they are not included as self-government unit.

[9] Land area and population are often used for standardisation purpose (e.g., Stansel, 2006; Zax, 1989). However, population density incorporates the effect of both land and population and also helps to downsize the impact of population on the value of the indicator in an effective way. Population density is calculated by dividing the district population with district land area and expressed in 1000 square kilometre of land area.

[10] The local elections (union and subdistrict) were without party banners and irregular which does not allow us to construct the political variables at that level. Besides, as the ADP data does not come in the form of spatial disaggregation (except few interim years), we had to rely on constituency-based election results and conducted the study at district level.

To test the *core* and *swing voter hypothesis*, core and swing vote share of each district is measured following Larcinese et al. (2006, 2013). The variable *Vote share_long* is the share of core vote in a district for the ruling party considering past three national elections. The variable is constructed as follows. First, for each constituency, the vote share for the ruling party (core vote) is obtained from the election result. Then to make the variable representative at the district level, a weighted average of all the constituency core vote share in a district is computed, and the new variable is denoted as *District vote_share*. Each constituency's vote share out of total vote cast in the district is considered as the weight. Finally, the indicator *Vote share_long* is constructed by computing the average of last three election's *District vote_ share* for the ruling party. Therefore, *District vote _share* $= \sum_{i=1}^{n} w_i \times$ constituency vote share for the ruling party; where, w_i = total vote cast in a constituency/total vote cast in the district, and i = 1, 2, 3 … …., is the number of constituencies in a district. Thus, *Vote share _long* $= \sum_{t=1}^{3}$ *District vote _ share*/3; where, t = the number of elections. The 2nd indicator, *Swing Vote_long,* represents the share of the swing vote for the ruling party in a district. This variable is constructed by computing the standard deviation of the last three election's *District vote _ share*. A higher value of the indicator, i.e., a higher standard deviation of core vote shows more swing votes in the district.

We use two separate variables to test the partisan alignment theory. *Partisanship* is the share of elected representatives from the ruling party out of total elected representatives of a district (following Arulampalam et al., 2009). If all the constituency representatives of a district are from the ruling party, the variable takes the value '1' and '0' if none of them is from the ruling party. For the caretaker-government period (2007 and 2008), the study has assigned the value '0' to this variable as the advisors of the caretaker government were neither elected nor form any political party[11]. The second variable, *Number of Ministers,* is constructed (following Golden and Picci, 2008) by taking the number of elected representatives from a district who served in the government as a Minister/State or Deputy Minister/Special advisors of the Prime Minister (enjoying the status of a Minister). For the caretaker period, the number of advisors (equivalent to Ministers) from each district is considered.

Finally, we use a set of control variables on the demographic and socio-economic features of the district (i.e., the *demand model* variables) that are widely used in the literature. District population (as a proxy of district size to capture the scale effect), population growth rate (to capture the change effect), district's GDP, share of the school-going population, extreme poverty level (incidence, headcount), and the unemployment rate is incorporated as governments usually have an equalising objective in their expenditure programme. In addition to this, access to paved road (length of paved road as a % of total) and access to electricity (% of households having the access) are included to capture the level of infrastructural development, which also determines public investment decision. Table 1 presents the descriptive statistics for all the variables described above. Besides a detail description regarding the construction method and sources of the variables is presented in Appendix Table A1.

3.2. Empirical strategy

The estimation strategy involves two steps. First, this study designs the following static linear panel model to test the hypotheses:

$$ln\_Exp_{it} = \alpha F_{it} + \beta P_{it} + \delta X_{it} + \mu_t + \gamma_i + u_{it} \quad (1)$$

Where, ln_Exp_{it} is the log of per capita development expenditure of the central government allocated to district *i* in year *t*; F_{it} is a vector of fragmentation indicators and P_{it} is the vector of political variables .[12] The vector X_{it} represents control variables; γ_i denotes the district-specific time-invariant fixed effect and μ_t is the time effect, and u_{it} is the idiosyncratic error term. Following Arulampalam et al. (2009), Hauk and Wacziarg (2007), and Livert et al. (2019), we specify a log-linear model.[13]

In the next step, a dynamic panel model is constructed by including the lag of the dependent variable on the right side of equation (1). The dynamic model corresponds to the typical specification of empirical models found in the existing political distribution literature. The rationale for considering the autoregressive model is to capture the incremental nature of government's development spending. Former allocations usually have a substantial impact on current allocation as governments accumulate experience from the past. Moreover, if allocations are administrated through formulas or government shows limited responsiveness to different changing characteristics of the country, inertia in the budgetary allocation are observed (Larcinese et al., 2013). To incorporate these issues, and to control the presence of a first-order autoregressive process in the panel, the study constructed this dynamic model following the specification used by Larcinese et al. (2013) and Hauk and Wacziarg (2007). Besides, estimating both static and dynamic panel model

[11] For further confirmation, this study has tested all the hypotheses excluding these years from the panel and compared the outcomes with the original results as a part of a robustness check.

[12] Political and fragmentation variables are incorporated together in a single model specification though there is a high correlation among them. As various hypotheses regarding these variables are not logically incompatible with each other, regressing separately at a time might cause omitted variable bias (Larcinese et al., 2013). Moreover, incorporating the variables together, it is possible to examine whether any of these variables offset the effects of the other variables in determining or influencing the development spending allocation. However, all the indicators are also separately regressed against the dependent variable, and results are analysed as a part of robustness check.

[13] As the study used a log-linear model, the slope coefficient measures the relative change in per capita development spending for a given absolute change in the value of the regressor.

Table 1
Descriptive statistics.

Variable	Obs.	Mean	Std. Dev.	Min	Max
Per capita total development expenditure*	305	1.396902	0.5756836	0.467	4.37
Fragmentation indicators					
Total units per density	305	92.84803	43.39401	15.02996	214.5772
Local self-govt. Units per density	305	83.6966	39.30866	12.96291	190.1934
Unions per density	305	78.47316	37.59966	11.62695	182.8783
Municipalities per density	305	5.255726	2.767083	0.5761295	14.14711
Vertical fragmentation	305	89.69323	3.72958	65.69343	96.15384
Political variables					
Vote share long	305	0.234614	0.2086297	0	0.8989944
Swing vote _long	305	0.051791	0.0553214	0	0.3483487
Number of ministers	305	0.606557	1.077257	0	6
Partisanship	305	0.45773	0.4448158	0	1
Controls					
Population	305	2181752	1417206	619915	9498383
Growth in log of population	305	1.256263	0.6249336	−0.1639787	1.567708
Growth in log of per capita Nominal GDP	305	0.085974	0.3941987	−1.486533	0.7364016
Share of school going population (%)	305	2.189597	0.3761045	1.315572	3.204907
Unemployment rate (%)	305	4.137082	3.056841	0.4504505	23.10797
Extreme poverty (%)	305	22.00407	10.70516	−2.26	55
Access to electricity (%)	305	44.87336	18.84913	7.44	98.69
Access to paved roads (%)	305	77.35321	14.35828	33.69026	100

(T = 5, n = 61).
*Note: The per capita development expenditure is in nominal term. During our study period, the variable showed a fluctuating trend. Using the national CPI, we have converted the variable into real term. We find that the mean per capita real development expenditure was 0.019 thousand taka during our study period and it also had a fluctuating trend, However, as regional CPI is not available and we are only interested in the spatial inequality, we have refrained from using the real per capita spending in our investigation.

is useful as the impact of the political variables can significantly vary over time. Therefore, by analysing the static and dynamic panel estimates, we can identify such variations as the former shows the long-term impact, and the latter shows the short-term impact on the dependent variable.

Regarding the estimation strategy, for the static panel model, this study relies on two–way fixed effect (FE) estimation[14] with district and year time effect, as it has the advantage of controlling all the time-invariant variables that are idiosyncratic to the districts (Greene, 2003). To control serial and spatial correlation, robust standard errors were estimated clustering them at the district level .[15] For the dynamic panel, the study applied bootstrap based bias-corrected fixed effect estimation technique. Econometric literature suggests that if the cross-sectional variation is larger than the within variation in the panel, which is the case in our investigation, bias-corrected fixed effect estimation technique provides better estimates than the GMM estimators in terms of accuracy and efficiency (Everaert and Pozzi, 2007; Kotschy and Sunde, 2017; De Vos, Everaert, and Ruyssen, 2015).[16] However, several alternative techniques were also applied and compared with the main results as a part of the robustness test. The Bootstrap-based bias-corrected FE estimation is conducted by using *xtbcfe* command in STATA.

4. Results

In this section, we discuss the econometric results obtained from both the static and dynamic panel model estimation. The Fixed Effects estimates of the static panel model is reported in Table 2. Fragmentation and political variables are separately regressed against the dependent variable as a baseline model, and the results are shown in column 1 and 2, respectively. Finally, in column 3, the full specification model is used. For every specification, linear restriction test was applied to the explanatory variables and reported in each column.

Table 2 confirms that none of the fragmentation indicators (except *Local units per density*) show any statistically significant association with the dependent variable both in the baseline and full specification model. The indicator *Local units per density* showed a week association with the dependent variables in the baseline specification, however it turned insignificant in the full specification. Linear restriction test applied on all the specification confirms that the fragmentation variables are not significantly different from zero. Therefore, the fixed effect result rejects the hypothesis that fragmentation (either total, horizontal, or vertical fragmentation) has

[14] Pre-diagnostic test - Pesaran test (Pesaran, 2021) confirms that there is no cross-sectional dependence in the panel dataset which rejects the need to conduct spatial econometric analysis. Hausman test (Hausman, 1978) and Brusch Pagan LM test (Brusch Pagan, 1979) were applied to identify the appropriate estimator. Tests confirm that the estimates provided by the fixed effect estimation are preferable compared to random effect and Pooled OLS.

[15] Modified Wald test (Baum, 2000) confirms the presence of group-wise heteroscedasticity. Wooldridge test (2002) confirms the presence of serial correlation of AR (1) in the dataset.

[16] A detailed discussion regarding the selection of the dynamic estimation technique is provided in the appendix (see Note A1).

Table 2
Determinants of development expenditure: Fixed Effects estimates.

Variables	Dependent variable: Log of per capita development expenditure		
	(1)	(2)	(3)
Fragmentation indicators			
Total units per density	−0.0225		−0.0247
	(0.0260)		(0.0213)
Local self-govt. Units per density	0.0939*		0.0175
	(0.0560)		(0.0473)
Unions per density	−0.0627		0.0382
	(0.0490)		(0.0436)
Municipalities per density	0.0727		0.0850
	(0.0864)		(0.0674)
Vertical fragmentation	−0.01793		−0.0255
	(0.0265)		(0.0217)
Political variables			
Vote share_ long		0.793***	0.747***
		(0.297)	(0.273)
Swing vote _long		−1.298**	−1.564***
		(0.627)	(0.550)
Number of Ministers		0.0681***	0.0694***
		(0.0172)	(0.0165)
Partisanship		0.190*	0.234**
		(0.111)	(0.105)
Controls	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
District dummies	Yes	Yes	Yes
Constant	1.909	0.0748	−0.466
	(3.009)	(1.147)	(2.428)
Observations	305	305	305
R-squared	0.514	0.651	0.668
Number of districts	61	61	61
Linear restriction test*	1.22	20.46	14.13
(p-value)	(0.3121)	(0.000)	(0.000)

Note: Robust standard errors in parentheses.
***p < 0.01, **p < 0.05, *p < 0.1.

a significant impact on central government's annual development expenditure allocation at the subnational level.

Among the political variables, the coefficient of *Vote share_long* is positive and statistically significant. This indicates that the district's core vote share for the ruling party in government ensures a higher development expenditure allocation in the area, which goes in line with the core vote hypothesis. However, the coefficient of *Swing vote_long* is negative and statistically significant, which rejects the swing voter hypothesis as it indicates that higher share of swing vote will lower the allocation of development expenditure.

The other two variables- *Number of Ministers* and *Partisanship* were constructed to test partisanship alignment in the resource allocation process. *Number of Ministers* holds a positive and statistically significant association with the dependent variable, indicating that a higher number of ministers from a district ensures a higher development expenditure allocation. The variable *Partisanship* does not show statistically significant association in the baseline estimation (column 1), although in the full specification model, the coefficient of the variable turns statistically significant. Therefore, the fixed effect results confirm our hypothesis that local elected representative's political alignment with the ruling party in the government has a positive impact on CG's annual development expenditure allocation at the subnational level. Linear restriction test applied on all the specification also confirms that the political variables are significantly different from zero. Further investigation is conducted to see whether the political variables are individually significant in the robustness checks section.

Table 3 reports the regression results of (bootstrap-based) bias-corrected fixed effects estimation technique applied to the dynamic panel model. The similar specification is used in the estimation method except including the lag of the dependent variable in the model. Results again confirm that the fragmentation indicators do not have any significant association with the per capita development expenditure. Among the political variables, the variable *Vote share_long* shows a positive and statistically significant association with the dependent variable in all the specifications. However, rest of the political variables- *Swing vote long, Partisanship*, and *Number of ministers* failed to show any significant association with the dependent variable (see column 2 and 3). This might have occurred because the variable *Vote share_long* is either capturing the effect of the other political variable or those political variables do not have any short run impact on the dependent variable. This is an issue which the study will further investigate in the robustness checks section.

Linear restriction test again confirms that all the fragmentation variables are not different from zero, whereas the political variables are jointly significantly different from zero. Table 3 also displays that the coefficient of the lagged dependent variable is positive and statistically significant, which confirms that the previous year's allocation has a significant impact on the current year's development spending.

For further illustration, the study makes a comparison between the static panel estimates (of Table 2) and dynamic panel estimates (of Table 3). However, the estimated coefficients of the dynamic panel regression are short-run multipliers. Therefore, we have

Table 3
Determinants of development expenditure: dynamic Fixed Effects estimates.

Variables	Dependent variable: log of per capita development expenditure		
	(1)	(2)	(3)
Lagged Y	0.687***	0.632***	0.447***
	(0.115)	(0.0920)	(0.121)
Fragmentation indicators			
Total units per density	−0.0505		−0.0334
	(0.0798)		(0.0711
Local self-govt. Units per density	0.0944		−0.0516
	(220.5)		(0.220)
Unions per density	−0.0293		0.122
	(220.5)		(0.236)
Municipalities per density	0.186		0.222
	(220.5)		(0.284)
Vertical fragmentation	−0.0946		−0.0623
	(0.0774)		(0.0691)
Political factors			
Vote share_ long		0.853***	0.812***
		(0.317)	(0.271)
Swing vote _long		−0.835	−1.258*
		(0.664)	(0.638)
Num. of Ministers		0.0331	0.0463*
		(0.0220)	(0.0240)
Partisanship		0.0555	0.143
		(0.113)	(0.108)
Controls	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
Observations	244	244	244
Number of districts	61	61	61
Linear restriction test	0.95	11.89	11.02
p-value	0.4488	0.00000	0.00000

Note: Robust standard errors in parentheses.
***p < 0.01, **p < 0.05, *p < 0.1.

calculated the long-run multipliers by dividing each short-run multiplier with (1 – α) where α is the coefficient of the lag dependent variable. Table 4 shows the long-run effects of all fragmentation and political variables on per capita development expenditure.

Table 4 reveals that a variation is observed in the direction and magnitude of the coefficients of some of the fragmentation variables. However, in both the alternative techniques, none of the fragmentation indicators showed any significant association with the dependent variable. Contrarily, both the estimation techniques have produced similar estimates of the long-run effects of the political variables. The only difference is that in dynamic panel estimations, the partisanship variables (i.e., *number of ministers* and *partisanship*) and *swing vote* variable showed no significant association with the dependent variable although the sign and magnitude more or less are the same.

4.1. Robustness checks

A series of robustness checks were applied to explore the sensitivity of both the static and dynamic panel regression results. The first set of robustness checks replicates the original analysis but using alternative estimation techniques and then compares the estimates.

Table 4
A comparison of the long run effects: static and dynamic panel estimates.

	Dependent variable: log of per capita development expenditure	
	Static model estimation (FE results)	Dynamic model estimation (Bias-corrected FE results)
Fragmentation indicators		
Total units per density	−0.0247	−0.0604
Local units per density	0.0175	−0.0933
Unions per density	0.0382	0.2206
Municipalities per density	0.0850	0.4014
Vertical fragmentation	0.0255	−0.1127
Political factors		
Vote share _long	0.747***	1.4684**
Swing vote _long	−1.564***	−2.2749*
Number of ministers	0.0694***	0.0837*
Partisanship	0.234**	0.273

Note: ***p < 0.01, **p < 0.05, *p < 0.1.

We applied the random effect, 1st difference, and pooled OLS estimation methods to the static panel model, and bias-corrected Least Square Dummy Variable estimators (i.e., LSDV internalising Anderson-Hsiao, Arellano-Bond, and Blundell Bond) and IV-GMM (two-step difference GMM and system GMM) estimators to the dynamic panel model. The results are provided in the appendix Table A2. Most of the alternative estimation techniques confirm our main results (except for 1st difference and Pooled OLS estimates in the static panel estimation and System GMM estimates in the dynamic panel).[17] All the alternative techniques (except the difference GMM estimation)[18] validate that the previous year's allocation has a significant impact on current year's development spending.

Next, the study applies an alternative specification to the model. The study constructs separate specifications for each variable to avoid the issue of correlation among the variables and investigate how they are associated with the dependent variable individually. Table A3 in appendix shows the fixed effect regression results of the alternative specification. Again, results validate the main fixed effect results (of Table 2) except for the variable *swing vote_long,* which now fails to show any significant association with the dependent variable (see column 7 of Table A3). The same process was repeated for the dynamic panel model, and similar result was obtained (results can be provided on request). Therefore, results indicate that swing vote share does not have any significant association with the dependent variable. However, for further confirmation, we have constructed an interaction term between *swing vote_long* and *core vote_long* to check whether the impact of core vote share on the dependent variable varies with the different level of swing vote share. This will give us a robust confirmation regarding the impact of swing vote. The static and dynamic panel estimates are provided in Table A4 in the appendix. Results shows that the coefficient of the interaction term (*vote share*swing vote*) is negative but not statistically significant. This confirms that the impact of vote share (i.e. core vote share) on the dependent variable does not vary with the level of the swing vote share of the district.

In the third set of robustness checks, the study uses different measures of the fragmentation and political variables. As an alternative, all fragmentation indicators are standardised in terms of district land area (i.e., units per 1000 sq.km. of land area of the district) instead of population density, following the study of Stansel (2005, 2006), and Zax (1989). For vertical fragmentation (VF), following the study of Hendrick et al. (2011), the study constructs a new indicator which shows the number of special-purpose units per general purpose unit (i.e., the number of Municipalities per Union for Bangladesh context). Regarding political variables, *vote share_short* is constructed which shows the share of core vote for the ruling party in the last national election (rather than considering the average of the previous three elections). Using the same technique, *swing vote_short* is constructed. Finally, the new variable *Num_minister* is constructed by assigning value '0' for the year 2007 and 2008. During this period, the country was under a caretaker government and a state of emergency. Therefore, by assigning value '0', the study holds the assumption that caretaker government advisors showed no element of partisanship as they had no political intention to be elected in the next election.

Both the static and dynamic panel estimates are reported in appendix Table A5 Fixed effect estimates (column 1) are similar to our main results of Table 2. In the dynamic panel model (column 2), a similar result is obtained (compared to Table 3) except for the variable *total units per 1000 sq. km of land*, which now shows significant association with the dependent variable. However, separately regressing against the dependent variable the coefficient again turns insignificant (result can be shown on request), therefore, confirming no robust association with the dependent variable.

Next, it is often argued that caretaker or interim governments usually follow the previous government's allocation pattern and restrain themselves from implementing any radical change. Therefore, the previous government's share of the core vote and swing vote may also influence the caretaker government's allocation pattern. The study conducts further robustness test by assigning the previous government's core and swing vote share value for the year 2007 and 2008 to address this issue (instead of assigning 'zero' to those variables). Regression results are provided in appendix Table A6. Fixed effect regression results again confirm the initial results of Table 2. Dynamic panel estimates were also consistent with the results of Table 3 which is not shown here (Results can be provided on request).

Besides, we have also tested the hypotheses on different sets of data as it can be claimed that districts with metropolitan cities and city-corporation might drag more public resources towards them. Therefore, we have run the regression on two separate sets of data-first, only considering the districts that have city corporations (Dhaka, Chittagong, Comilla, Barishal, Khulna, Mymensing, Rajshahi, Rangpur, Sylhet, Gazipur, and Narayanganj - all these eleven districts have a city corporation, except Dhaka, which has two city corporations), and secondly, taking rest of the districts. The fixed effect regression results are presented in Table A7 in the appendix. Results again confirm that in both cases, fragmentation does not have any robust impact on the ADP allocation. For further confirmation, we have regressed the fragmentation variables separately against the dependent variable and found a similar result. Contrarily, among the political variables, only *Number of ministers* and *Partisanship* shows significant association with development allocation in those selected districts (see column 1). However, considering rest of the districts, *Core vote share* also shows significant association with the dependent variable along with *Number of ministers* and *Partisanship* (see column 2). Dynamic panel estimation offers the same conclusion (results can be provided on request).

[17] Pooled OLS and 1st difference are weaker techniques among all the alternatives as pooled OLS fails to capture the unobserved time-invariant heterogeneity across the districts and in 1st difference, the degrees of freedom reduced significantly. In the system GMM estimation, the coefficient of *core vote_share* is statistically insignificant (see column 8, Table A2 in appendix). However, some restrictive measure was taken in that system GMM estimation, which yielded such outcome. Relaxing them, the coefficient again becomes significant at 5% level of significance. For details, see the note attached to Table A2.

[18] The coefficient of the lag dependent variable in difference GMM in statistically insignificant (see column 7, Table A2 in appendix). However, literature suggests that IV estimates (applied in GMM) of the autoregressive coefficients are often unreliable as the method is sensitive to the presence of unobservable heterogeneity and serially correlated errors where the instruments become invalid (Dang et al., 2015).

The last set of robustness check is conducted to investigate whether the impact of distributive politics on the dependent variable varies according to the level of fragmentation. We have investigated such possibility by including some interaction variables in the model. Fist, five new variables were created by interacting the variable *vote share_long* with all the fragmentation indicators to test whether the impact of core vote share varies with the level of fragmentation. Results of Table A8 in appendix confirms that the impact of core vote share on the dependent variables does not vary with the level of fragmentation, as in none of the cases, the coefficients of the interaction terms are statistically significant (see column 2–6 of Table A8). Similar techniques were repeated for the other political variables, and the regression results again confirm that the impact of *swing vote-long, number of ministers,* and *partisanship* also does not vary with the level of fragmentation (regression results can be provided on request).

Besides, the above tests, the study also performs some additional robustness tests, e.g. modifying the panel dataset by including all the 64 districts in the analysis, excluding the caretaker government period (2007 and 2008) from the panel, and using an alternative dependent variable-expenditure share of each district (following the study of Ansolabehere et al., 2002). In all the cases, results were similar to our main findings. The results can be provided on request.

5. Discussion

The empirical findings can be summarised as follows. First, fragmentation of local government unit (either total, horizontal, or vertical fragmentation) does not have any significant impact on government's per capita development expenditure allocated at the subnational level in Bangladesh. Second, distributive politics play a significant determining role in the allocation of development expenditure, as results show that the share of the core vote for the ruling party has a positive impact on the per capita development expenditure in the district. Results, however, cancel out the swing voter hypothesis. Contrarily, both the 'partisan alignment' variables - *number of ministers* and *partisanship* - show a significant positive association with the dependent variable in the static panel regression. In the dynamic regression, however, they do not show any significant association. This indicates that, in the short run, the impact of these political variables is rather captured by the *vote share_long* variable, which implies, government mainly concentrates on core vote share. However, in the long run, the number of ministers and % of representatives aligned with the ruling party also influences the spending allocation. Finally, the impact of the political variables on public spending does not vary with the level of fragmentation.

The bias-corrected fixed effects estimates (of Table 4) show that a one standard deviation increase in the share of core vote for the ruling party within a district (i.e., over the time) will increase the growth of the per capita development expenditure by 30.63%, other factors remaining the same (where one standard deviation increase within a district is equivalent to a 20.86% increase of the core vote share). To put this in perspective, consider two representative districts: Faridpur and Kurigram (as they are close to the fitted regression line), which had an average per capita development expenditure of 1.4208 thousand BDT and 1.2108 thousand BDT, respectively, during the study period. The estimates suggest that the per capita development expenditure would have grown by an extra 503.25 taka per capita for Faridpur and 415 BDT per capita for Kurigram, if core vote share increased by one standard deviation. The coefficient of *partisanship* shows that one standard deviation increase in the share of an elected local representative coming from the ruling party (standard deviation is 0.444) within a district contributes a 3.72% increase in the growth rate of per capita development expenditure. This would have resulted in the per capita expenditure for Faridpur and Kurigram to increase by an extra 61.12 BDT and 50.46 BDT, respectively. Regarding the variable *Number of ministers,* the study finds that one standard deviation increase in this variable (standard deviation is 1.077) within a district would have caused the per capita growth to increase by 29.4%. This implies that, for Faridpur, per capita expenditure would have increased by an extra 483.04 BDT, and for Kurigram the amount stands to 398 BDT. Therefore, this study confirms that partisanship variables play a vital role in influencing the development expenditure allocation though their impact is partially reduced by the district's share of the core vote.

It is challenging to compare these results with past studies as distributive politics and fragmentation theories have hardly been empirically tested in Bangladesh, especially at the subnational level. Mahmoud et al. (2008) show that political alignment (using the same variable *partisanship*) plays a significant impact on the development expenditure in the transportation sector. Several descriptive studies have also suggested that public resource allocation has become more vulnerable to patronage and political division in Bangladesh (Lewis and Hossain, 2017; World Bank, 2010; Rahman, 2013). Therefore, the findings of this current study are in line with the descriptive literature. Comparing these results with the studies conducted on similar settings can also provide some validation. For instance, Besley et al. (2004)'s study on Indian villages is more or less on a similar socio-economic and political background. The study claims that public good allocation is higher in Gram Panchayat pradhan's (head of a village council) village. Rodden and Wilkinson (2004) 's study on India claimed that political parties in power, has targeted resources to its core supporters and directed resources away from those states where the opposition controls state government. Besides, findings of our study are consistent with the current political distributive literature: e.g. Larcinese et al. (2013) on the US; Bracco et al. (2015) and Golden and Picci (2008) on Italy; Rodriguez-Pose et al. (2016) on Greece; Livert et al. (2019) on Chile. This investigation found no robust evidence in favour of the *swing voter hypothesis*. However, the literature argues that the swing voter hypothesis is prevalently observed in mature democratic voting behaviour (Lindberg and Morrison, 2005). In Bangladesh, therefore, one can speculate that swing voters mechanisms may not be prevalent.

Regarding the impact of fragmentation, the literature suggests that for developing country context, the standard arguments and theories regarding the relationship between fragmentation and public sector size may not hold as the functions of the local units are hardly well defined, and in most cases, the local units are not fully devolved (Mohammed, 2016). In the context of Bangladesh, country-level studies have claimed that, from fiscal decentralisation perspective, Bangladesh is a highly centralised country. The central government usually channels the major share of the ADP allocations through various vertically driven sector programmes which are implemented directly by ministries and their line agencies (Fox and Menon, 2008; World Bank, 2010; CPD, 2013).

Therefore, even though the number of Unions and Municipality has increased rapidly across the country, findings show that they have failed to attract more resource from the central government. Overall, limited expenditure and revenue authority and the absence of any significant spending relationship among the local units (Ahmed, 2015; Sarker, 2006) are the plausible explanation behind why horizontal fragmentation (of general or special purpose units) and vertical fragmentation failed to display any significant impact on public resource allocation.

6. Conclusion

This study has investigated the impact of local government fragmentation and distributive politics on the central government's per capita development spending at the district level in Bangladesh. We conducted a panel data analysis, covering the period from 2005 to 2009, constructing multiple fragmentation indicators to capture the potential impact of different aspects of local government fragmentation (total, horizontal, and vertical) on development spending. To investigate the possible role of political or electoral motive in resource allocation, we empirically tested the core voter hypothesis, the swing voter hypothesis, and political partisanship or alignment theory.

The findings suggest that fragmentation (either total, horizontal, or vertical) of semi-devolved local government units in Bangladesh may not influence the allocation of public spending. This may suggest that local participation may be a missing element of the resource delivery meachanism, as the resources are generally delivered through the centre-controlled government agents. This "institutional vacuum" at the local level may divert the resources that are meant for the poor (Choudhury and Sen, 1998). Therefore, it may be an obstacle to developing effective, inclusive, and participatory decision-making at all levels, as prescribed by Sustainable Development Goal 16. Moreover, this also indicates that the resource mobilisation channel of decentralisation may not work here, therefore other transmission channels of decentralisation should be considered to further understand its impact on different socio-economic variables.

Second, this study has provided new evidence on the "core vs. swing voter hypothesis" debate, by testing both hyptheses on a unitary developing country's total annual development spending. The findings show that ruling parties target the district's core vote share, rather than swing vote share, when allocating development spending. This is in line with Tribin (2020), Das and Maiorano (2019), Rodriguez-Pose et al. (2016), Larcinese et al. (2013), Arulampalam et al. (2009), and Calvo and Murillo (2004). The spending growth rate, however, is not significantly associated with the share of a district's swing vote, which seems to reject the swing voter hypothesis. The literature argues that politicians use public goods to target core voters and cash transfers to target swing voters (Tribin, 2020). In Bangladesh, a major share of the development spending is utilized to provide public goods and this might be the possible reason behind the significant association between core vote share and development spending.

Third, we find that elected representative's political alignment with the ruling party (i.e., if the local Member of Parliament is politically aligned with the party in government) and the number of ministers from a district both play a significant role in ensuring a higher per capita development expenditure allocation in the district. This provides evidence in favour of the partisan alignment theory and again aligns with previous studies, e.g. Wong (2022); Ansolabehere et al. (2002), Banful (2011), Livert et al. (2019), Solé-Ollé and Sorribas-Navarro (2008).

Fourth, dynamic panel estimates confirm that, in the short run, political parties in power put more emphasis on core vote share than the other political factors in the spending decision, as we found that the core vote share partially offsets the impact of other political variables. However, in the long run, along with core vote share, partisan alignment also starts to play a role as shown by the static panel estimates. Finally, as a part of a robustness check, this paper also investigated whether the impact of the political variables varies with the level of fragmentation by constructing multiple interaction variables between political and fragmentation indicators. The results, however, confirm that the impact of core vote share and partisan alignment on the resource allocation does not vary with the level of fragmentation at the district level.

Overall, the findings of this paper suggest that political motives tend to divert development spending allocation in Bangladesh. Past studies have claimed that the development expenditure is biased towards non-poor and developed districts, despite the fact that several districts of the country are lagging behind in terms of poverty reduction and other socio-economic indicators (Zohir, 2011; Sen and Ali, 2009; Chowdhury and Sen 1998). This paper, however, provides empirical evidence that the allocation of developing spending is significantly influenced by political patronage. This may be a signficant obstacle to poverty reduction, as resource mobilisation mechanisms may not effectively target and reach the poor.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ejpoleco.2023.102385.

Appendix

Table A1
Variables

Variable	Variables description, measurement and sources
*ln_pc_exp**	Log of per capita annual total development expenditure of the central government allocated to a district. The variable is in nominal term. Data source: Comparative Statement of per capita expenditure (Districts & Divisions), Ministry of Finance's website (www.mof.gov.bd), Government of Bangladesh.
Total units per density	Total number of local government units per population density in a district. The total number is obtained by summing the number of unions, municipalities and city corporation, sub-district councils and district councils that exists in a district. The indicator is standardised by the population density of the district. Population density is expressed in terms of district population per1000 square kilometre of district land area. Data source: Statistical Year Book (2001,2005,2010,2015), Bangladesh Bureau of Statistics (www.bbs.gob.bd).
Local self-govt. Units per density	Number of local govt. Units (Unions + Municipalities) at the lowest tier of the local government structure per population density. Data source: Statistical Yearbook, BBS (multiple years)
Unions per density	Number of Union councils per population density. Data source: Statistical Year Book, BBS
Municipalities per density	Number of Municipalities per population density. Data source: Statistical Year Book, BBS
Vertical Fragmentation	Share of local government units (Unions and Municipalities) at the lowest tier out of total units (considering all tiers) in a district. Data source: Statistical Year Book, BBS (multiple years)
Vote share _long	Share of vote for the ruling party considering the last 3 national elections. Constituency election results are aggregated (taking the weighted average of the vote share where total share of vote of each constituency out of total vote casted in the district is used as the weight) and presented at district level. The national election result of 1991, 1996 and 2001 is used for the first two waves of the panel (2005 and 2006) and election result of 1996, 2001 and 2008 is used for the last wave of the panel (year 2009). The middle two years were under caretaker period (2007 and 2008). For these two waves the variable is assigned value '0' as the country was in state of immergence. Data source: National Election Report of several years. Obtained from Election Commission's website (www.ecs.gov.bd).
Swing vote _long	The ruling party's swing vote share considering the previous 3 national elections. Constituency election results are be aggregated (taking the weighted average of the vote share where total share of vote of each constituency out of total vote cased in the district is used as the weight) to calculate the vote share of the ruling party and present it at district level. Finally, standard deviation of the vote share is computed to construct this variable. The variable is assigned value '0' for the caretaker govt. period (2007 & 2008). Data source: National Election Report of several years. Obtained from Election Commission's website (www.ecs.gov.bd).
Number of ministers	Raw number of ministers from a district. The list of ministers was obtained from cabinet division's website then election report was used to track down which constituency they represented in the last election (it is also in most cases their home district). For caretaker government period advisor's home district was used to construct the variable. Data source: Cabinet division (government of Bangladesh) 's website.
Partisanship	% Of constituencies with representatives from the ruling party. The variable is constructed by identifying from which party the elected representatives were nominated. Data source: National Election Report of several years. Obtained from Election Commission's website: http://www.ecs.gov.bd//?lang=en
Population	Total population of the district. Data source: Census data of 2001 and 2011 is used to project each year's population. Census data is obtained from Statistical Year Book of BBS, 2010 and 2015
Growth in log *of population*	Growth in log of population. Own construction using district population data. Data source: Statistical Year Book, BBS.
Growth in log *of pc N.GDP**	Average annual growth rate per capita nominal GDP of the district. The study has constructed the variable by dividing the nominal GDP with district population. Then the natural log of the variable is taken, and the average annual growth is calculated. Real GDP data is not available at district level of Bangladesh. Data source: Nominal GDP data is obtained from Statistical Year Book of 2005 and Planning Commission's background study report of 7th Five Year Plan (2015).
Unemployment rate	Unemployment rate data of 2005 and 2010 (for 2009) is used directly. Unemployment rate for the middle years were obtained by calculating the average annual growth rate using the data from 2005 to 2010. Data source: 2005 (planning commission); Labour Force Survey, 2010.
Incidence of poverty	Incidence of extreme poverty. It shows % of people living below extreme poverty line. Data is obtained from -a) Poverty Mapping report provided by WB and BBS (2005 & 2010). Poverty data for the middle years are predicted by calculation the average growth rate of poverty from 2001 to 2010. Source: https://openknowledge.worldbank.org/handle/10986/20785, b) Loal estimation of poverty and malnutrition in Bangladesh (2004). BBS in collaboration with UNWFP. Available at https://documents.wfp.org/stellent/groups/public/documents/ena/wfp033309.pdf?iframe=
Share of School going population	Share of school going population (5–19) in each district. School going population is divided by district population. Data for the middle years are predicted using the annual average growth rate of 2001–2010 period. Data source: Integrated Public Use Micro-Data Series (IPUMS) international dataset.
Access to electricity	% Of household out of access to electricity. Data source: Sample Vital Registration System (SVRS) report (published by BBS) of 2005–2010. Source: www.bbs.gov.bd/vital-Statistics
Access to paved road	% Of unpaved roads out of total (in length) in a district. Data source: Statistical Year Book, BBS.

*Note: Both per capita development expenditure and district GDP is in nominal term therefore, expected to be affected by inflation rate. During our study period (2005–2009), the average inflation rate was 7.45% with a fluctuating trend. As district or regional CPI data is not available in Bangladesh, one cannot accurately account for how these nominal variables at district level are affected by inflation. One way is to use National CPI to convert them in real term. However, in such a case, all the district level values of the variables will be similarly affected by the inflation rate. As we are only interested in the spatial inequality of development spending across the districts rather than the temporal trend, we have not adjusted those two nominal variables with the inflation rate.

Table A2
Alternative estimation methods applied to static and dynamic panel regressions

	Dependent Variable: log of per capita development expenditure							
	Static Panel Estimates			Dynamic Panel Estimates				
	Random Effects	1st difference	Pooled OLS	LSDV (Anderson -Hsiao)	LSDV (Arellano-Bond)	LSDV (Blundell-Bond)	Difference GMM (two step)	System GMM
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lagged Y	–	–	–	0.463***	0.408***	0.501***	0.0345	0.686***
				(0.112)	(0.104)	(0.0876)	(0.154)	(0.174)
Fragmentation indicators								
Total units per density	−0.00902	0.000844	−0.00195	−0.0501	−0.0487	−0.0428	−0.0603	−0.0757
	(0.0168)	(0.0216)	(0.0147)	(0.0490)	(0.0465)	(0.0469)	(0.0738)	(0.0588)
Local units per density	0.0311	−0.000718	0.0999*	0.0337	0.0213	0.0456	−0.0122	0.216**
	(0.0216)	(0.0471)	(0.0577)	(0.115)	(0.109)	(0.111)	(0.126)	(0.0822)
Unions per density	−0.0201	0.0159	−0.0972*	0.0471	0.0617	0.0241	0.120	−0.132*
	(0.0205)	(0.0408)	(0.0581)	(0.103)	(0.0974)	(0.0991)	(0.0992)	(0.0771)
Muni. per density	−0.00200	0.0226	−0.0710	0.169	0.179	0.135	0.116	−0.127*
	(0.0215)	(0.0544)	(0.0572)	(0.123)	(0.116)	(0.120)	(0.136)	(0.0704)
Vertical Frag.1	−0.0229	−0.00342	−0.0237**	−0.0781	−0.080*	−0.071	−0.0884	−0.0546
	(0.0144)	(0.0248)	(0.0112)	(0.0496)	(0.0469)	(0.0469)	(0.0774)	(0.0471)
Political variables								
Vote share_ long	0.630**	0.446	0.524	0.856***	0.870***	0.861***	0.782**	0.792
	(0.285)	(0.289)	(0.422)	(0.303)	(0.287)	(0.325)	(0.389)	(0.549)
Swing vote _long	−1.013*	−0.809	0.0482	−0.963*	−0.982*	−0.861	−1.540**	−0.232
	(0.548)	(0.743)	(0.455)	(0.543)	(0.511)	(0.588)	(0.586)	(0.828)
Num. of Ministers	0.0575***	0.0402**	0.0737***	0.0321	0.0339	0.0346	0.0417	−0.0276
	(0.0170)	(0.0192)	(0.0211)	(0.0220)	(0.0208)	(0.0232)	(0.0292)	(0.0529)
Partisanship	0.150	0.145	0.0559	0.0759	0.0831	0.0629	0.224	0.0501
	(0.107)	(0.118)	(0.127)	(0.0994)	(0.0942)	(0.106)	(0.136)	(0.187)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	2.559*	244	3.007**					
	(1.408)	0.578	(1.357)					
Observations	305	5.48	305	244	244	244	183	244
Number of districts	61	0.000	0.522	61	61	61	61	61
Instruments							52	39
AR (2) p-value							0.621	0.733
Hansen p-value							0.588	0.529
Linear restriction test	65.13	5.48	8.43	39.90	47.74	35.26	52	39
p value	0.000	0.000	0.000	0.000	0.000	0.0001	0.621	0.733

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

Note: Both in difference-GMM (column 7) and system GMM (column 8), to control the number of instruments "collapse" command was applied which creates one instrument for each variable and lag distance, rather than one for each time period, variable, and lag distance. Moreover, in system GMM (column 8), to control the number of instruments, sub-option 'equation (level)' command was included in the iv-style variables. Equation (level) specifies which IVs to use. Also, lag (2 2) was applied to the gmm variables. STATA command *xtabond2* was applied in the GMM estimations, which makes available a finite-sample correction to the two-step covariance matrix derived by Windmeijer (2005). The row for the Hansen J-test reports the p-values for the null hypothesis of the validity of the over-identifying restrictions. The null hypothesis cannot be rejected, which validates the instruments. AR (2) p-value confirms no evidence for significant second-order autocorrelation.

Table A3
Fixed Effect estimates: alternative specifications

Variables	Dependent variable: log of per capita development expenditure								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Total units per density	0.007								
	(0.007)								
Local units per density		0.014							
		(0.011)							

(*continued on next page*)

Table A3 (*continued*)

Variables	Dependent variable: log of per capita development expenditure								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Unions per density			0.011						
			(0.011)						
Muni. per density				0.116					
				(0.072)					
Vertical fragmentation					0.002				
					(0.014)				
Political variables									
Vote share_ long						1.360***			
						(0.218)			
Swing vote _long							−0.654		
							(0.727)		
Num. of Ministers								0.114***	
								(0.0199)	
Partisanship									0.358***
									(0.076)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	1.052	0.393	0.731	1.027	1.485	0.538	1.323	0.578	2.285*
	(1.496)	(1.547)	(1.511)	(1.479)	(2.068)	(1.213)	(1.500)	(1.244)	(1.279)
Observations	305	305	305	305	305	305	305	305	305
R-squared	0.506	0.507	0.506	0.510	0.504	0.610	0.509	0.568	0.575
Number of districts	61	61	61	61	61	61	61	61	61

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

Table A4
FE and Bias Corrected FE estimates: introducing interaction terms

VARIABLES	Dep var.: Log of per capita development expenditure	
	Static panel estimation (Fixed Effect)	Dynamic panel estimation (Bias-corrected FE)
	(1)	(2)
Lagged Y		0.641***
		(0.0760)
Vote share_long	0.969**	0.923**
	(0.369)	(0.439)
Swing vote_long	−0.215	−0.212
	(1.863)	(1.964)
Vote share*swing vote	−2.646	−1.561
	(4.487)	(4.933)
Number of ministers	0.0677***	0.0352*
	(0.0175)	(0.0206)
Partisanship	0.185*	0.0610
	(0.107)	(0.107)
Controls	Yes	Yes
Year dummies	Yes	Yes
District dummies	Yes	Yes
Constant	−0.165	
	(1.152)	
Observations	305	244
R-squared	0.652	
Number of code	61	61

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

Table A5
FE and Bias Corrected FE estimates (using alternative variables)

Variables	Dependent variable: log of *per capita* development expenditure	
	Static Panel Estimates	Dynamic Panel Estimates
	Fixed effects	Bias corr. Bootstrap-based FE
Lagged Y		0.422***
		(0.108)
Fragmentation indicators		
Total units per 1000 sq.km	0.0192	0.171***

(*continued on next page*)

Table A5 (*continued*)

Variables	Dependent variable: log of *per capita* development expenditure	
	Static Panel Estimates	Dynamic Panel Estimates
	Fixed effects	Bias corr. Bootstrap-based FE
	(0.0231)	(0.0470)
Local units per 1000sq.km	0.0637*	0.0432
	(0.0337)	(2.027)
Unions per area 1000sq.km	−0.0324	−0.169
	(0.0717)	(2.030)
Muni per 1000sq.km	−0.253	0.0612
	(0.285)	(2.326)
Vertical-fragmentation2	0.141	−0.00394
	(0.167)	(0.292)
Political variables		
Vote share _short	1.287***	1.113***
	(0.207)	(0.180)
Swing vote _short	−1.951***	−1.767**
	(0.662)	(0.683)
Num_minister2	0.0499**	0.0348
	(0.0191)	(0.0211)
Controls	Yes	Yes
Year dummies	Yes	Yes
District dummies	Yes	–
Constant	−2.340	Yes
	(2.163)	
Observations	305	244
R-squared	0.653	
Number of districts	61	61

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

Table A6
Fixed effects estimates: New core vote and swing vote share values for caretaker government period

Variables	Dependent variable: log of per capita development expenditure		
	(4)	(5)	(6)
Fragmentation indicators			
Total units per density	−0.0225		−0.0311
	(0.0260)		(0.0223)
Local units per density	0.0939*		0.0653
	(0.0560)		(0.0551)
Unions per density	−0.0627		−0.00594
	(0.0490)		(0.0510)
Municipalities per density	0.0727		0.0776
	(0.0864)		(0.0748)
Vertical fragmentation1	−0.0179		−0.0228
	(0.0265)		(0.0222)
Political variables			
Core_ vote_ new		0.487***	0.450***
		(0.141)	(0.127)
Swing_ vote_ new		−1.478***	−1.897***
		(0.362)	(0.418)
Num. of Ministers		0.0798***	0.0798***
		(0.0161)	(0.0158)
partisanship		0.277***	0.308***
		(0.0747)	(0.0700)
Controls	Yes	Yes	Yes
Year and District FE	Yes	Yes	Yes
Constant	1.909	0.688	−0.121
	(3.009)	(1.120)	(2.437)
Observations	305	305	305
R-squared	0.514	0.636	0.652
Number of districts	61	61	61

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

Table A7
Fixed effects estimates: districts with and without city corporations

VARIABLES	Dep. variable: log of per capita development expenditure	
	Districts with city corporations	Districts without city corporations
	(1)	(2)
Fragmentation indicators		
Total units per density	0.0216	0.0172
	(0.0273)	(0.0407)
Local units per density	0.130	0.0224
	(0.0974)	(0.0550)
Unions per density	−0.00229	−0.0121
	(0.159)	(0.0940)
Municipalities per density*	−0.696*	−0.0217
	(0.354)	(0.478)
Vertical fragmentation	0.369	−0.00186
	(0.223)	(0.187)
Political variables		
Vote share long*	−1.127	0.894***
	(0.717)	(0.289)
Swing vote long	−1.845	−1.482**
	(2.107)	(0.556)
Num of ministers	0.0742***	0.0837***
	(0.0200)	(0.0278)
partisanship	0.526*	0.168
	(0.277)	(0.108)
Controls	Yes	Yes
Constant	−4.156	−0.489
	(3.991)	(3.054)
Year dummies	Yes	Yes
District dummies	Yes	Yes
Observations	55	250
R-squared	0.900	0.654
Number of districts	11	50

Robust standard errors in parentheses.
***p < 0.01, **p < 0.05, *p < 0.1.
*Note: In column 1, the coefficient of *Municipalities per density* is negative and weekly significant. However, if the variable is individually regressed against the dependent variable (with and without including the political variables and controls), the coefficient becomes positive and statistically insignificant (results can be provided on request). Therefore, we refrain to make any robust conclusion here. Similarly, the variable *Core vote share* shows a negative association with the development spending (which contradicts with our main results). Again, if the variable is individually regressed against the dependent variable, the coefficient becomes positive and insignificant. High correlation among the political variables may be behind this.

Table A8
Fixed effects estimates: Introducing interactions between core vote share and fragmentation variables

Variables	Dependent variable: log of per capita dev. expenditure					
	(1)	(2)	(3)	(4)	(5)	(6)
Fragmentation variables						
Total units per density	−0.0182	−0.0182	−0.0183	−0.0183	−0.0188	−0.0186
	(0.0223)	(0.0223)	(0.0222)	(0.0222)	(0.0218)	(0.0224)
Local units per density	0.0718*	0.0720*	0.0722*	0.0720*	0.0756*	0.0731*
	(0.0402)	(0.0404)	(0.0404)	(0.0404)	(0.0397)	(0.0415)
Unions per density	−0.0338	−0.0338	−0.0339	−0.0338	−0.0368	−0.0346
	(0.0350)	(0.0352)	(0.0352)	(0.0351)	(0.0362)	(0.0361)
Municipalities per density	0.0191	0.0193	0.0195	0.0193	0.0223	0.0195
	(0.0765)	(0.0759)	(0.0757)	(0.0759)	(0.0724)	(0.0768)
Vertical fragmentation	−0.0236	−0.0236	−0.0237	−0.0237	−0.0242	−0.0234
	(0.0198)	(0.0198)	(0.0198)	(0.0198)	(0.0195)	(0.0195)
Political variables						
Vote share long	1.387***	1.392***	1.397***	1.394***	1.419***	1.582
	(0.208)	(0.228)	(0.228)	(0.227)	(0.224)	(1.142)
vote share _long × Total units per density		−6.70e-05				
		(0.00105)				
vote share _long × Local units per density			−0.000145			
			(0.00118)			
vote share _long × Unions per density				−0.000110		
				(0.00122)		

(*continued on next page*)

Table A8 (*continued*)

Variables	Dependent variable: log of per capita dev. expenditure					
	(1)	(2)	(3)	(4)	(5)	(6)
vote share _long × Municipality per density					−0.00704	
					(0.0200)	
vote share _long × Vertical frag.						−0.00218
						(0.0130)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
District dummies	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.794	0.788	0.783	0.786	0.786	0.738
	(2.403)	(2.420)	(2.417)	(2.417)	(2.416)	(2.348)
Observations	305	305	305	305	305	305
R-squared	0.620	0.620	0.620	0.620	0.620	0.620
Number of districts	61	61	61	61	61	61

Robust standard errors in parentheses.
***p < 0.01, **p < 0.05, *p < 0.1.
Note A1. Estimation technique for dynamic panel.

Econometric literature suggests that, in dynamic panels, fixed effects (within) are inconsistent and biased when time (T) is fixed (even if the number of cross-sectional units N is very large) (Nickell, 1981; Anderson and Hsiao, 1982). This bias occurs due to the correlation between the lagged dependent variable and the error term (it disappears though when T is large). Two alternative approaches are used to deal with this bias. The 1st approach is using instruments (IVs) for the lagged dependent variables. Various estimation methods apply this approach, e.g. the just identified IV estimator (Anderson and Hsiao, 1982), the 1st difference GMM estimator (Arellano and Bond, 1991), the system GMM estimator (Blundell and Bond, 1998).

Alternatively, a bias correction method (using an analytical approximation formula to capture the bias) is applied in the Least Square Dummy Variable (LSDV) method, developed by Kiviet (1995) and Bruno (2005). Compared to GMM estimators, the bias corrected LSDV estimators display superior small sample properties (Bun and Carree, 2006). The only drawback of the estimation is it holds a strict assumption that all the variables except the lag dependent variable has to be strictly exogenous. To tackle this issue, Bootstrap based bias-corrected fixed effect estimation (proposed by Everaert and Pozzi, 2007) comes as a useful solution. This method does not require any analytical expression for the bias. It takes the original bias estimates of LSDV and searches over the parameter space through an iterative bootstrap method until unbiased estimates of the true population parameters are found. Unbiased estimates are obtained if repeatedly generating data from these estimates produce average LSDV estimates that are equal the original bias LSDV estimates (for details see, Evaraert and Pozzi, 2007). Compared to analytical corrections (i.e., Kiviet's method) this bootstrap-based method provides a better inference in samples with small to moderate T. Moreover, if the cross-sectional variation is larger than the within variation in the panel, bias-corrected fixed effect estimation technique provides better estimates than the GMM estimators in terms of accuracy and efficiency (Everaert and Pozzi, 2007; Kotschy and Sunde, 2017; De Vos, Everaert and Ruyssen, 2015). Overall, the (bootstrap based) bias-corrected fixed effect method appears to be the most conservative and reliable estimator in this current setting (as T is relatively small and N is also not large).

However, the GMM estimators are also applied as a part of robustness checks as they better tackle the endogeneity issue. It can be assumed that both fragmentation and political factors have a simultaneous relationship with development expenditure. The study has constructed the political variables considering the last three national election results which help to avoid the problem of endogeneity (following the study of Larcinese et al., 2013). For fragmentation variables, the endogeneity issue still is a problem. It is difficult to find suitable external instruments for the fragmentation variables. GMM estimators in such a situation are useful in providing consistent results. Therefore, as GMM removes the endogeneity problem by internally transforming the data and by constructing instruments within the model (Roodman, 2009), the study applies IV-GMM estimators and compares the results as a part of robustness check.

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