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RESEARCH ARTICLE

Competing to lose: FDI, investment incentives, and taxation capacity under fiscal federalism

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Abstract

This article examines how subnational fiscal competition over foreign direct investment affects both the siting of new projects and the ability of local governments to raise tax revenue for social spending. We leverage a quasi-natural experiment, an unexpected declaration by the Brazilian Supreme Court in 2017 that reduced states' ability to offer investors differentiated tax subsidies. Our results show that disadvantaged regions did not see a major shift in investment patterns after the change in investment law. We do not find a consistent relationship between the incentive law change and state revenue generation, but we do find that incentives are associated with less revenue. The results are consistent with arguments that investment incentives exacerbate inequality by reducing states' capacity to collect revenue while doing little to affect investment location. Our results illustrate that economic agglomeration is difficult to reverse through tax policy and that fiscal federalism often cannot provide strong enough inducements to drive investment into less advantaged regions.

Keywords: Foreign direct investment (FDI); investment incentives; fiscal policy; tax policy; federalism; decentralization; Global South; Brazil; natural experiment; Bayesian methods

Introduction

What are the trade-offs associated with governments' attempts to use a variety of incentives—such as tax holidays, subsidies, or grants—to attempt to fulfill national developmental strategies and to foster localized economic development? Previous research finds that governments use investment incentives to try to achieve manufacturing upgrading,[1] induce local research and development activities,[2] and to compensate globally mobile firms for political risk.[3] At the same time, such strategies are widely seen as highly inefficient. Political leaders can also use such tools to pander to constituents for votes[4] and to direct public resources toward politically powerful geographies.[5] Understanding the opportunity costs of incentives is important because of the size of such programs: for example, local and state governments in the US spend between $45 and $90 billion per year on incentives.[6] Emerging market economies also make substantial use of investment incentives; as a notable example, Brazil spends five percent of gross domestic product (GDP) annually on such inducements.[7]

Incentive competition among governments for globally mobile investments may be particularly strong in systems characterized by fiscal federalism. When subnational units can use their authority to set—or strategically lower—local tax rates, they may competitively bid for multinational corporations

[1]Bauerle Danzman and Slaski (2021a).
[2]Wellhausen (2013).
[3]Li (2006, 2016); Plumper et al. (2009).
[4]Jensen and Malesky (2018); Jensen et al. (2015); Owen (2019).
[5]Rickard (2018).
[6]Bartik (2017).
[7](IMF 2017, 24).

(MNCs) to site projects in their jurisdictions, rather than elsewhere in the country. While *countries* may compete with each other for investment as well, competition among *subnational units* raises specific questions about general welfare and redistribution choices since such contests may dramatically reduce local governments' ability to collect tax receipts. Intuitively, citizens should be better off if governments prevented such intrastate competition and used increased tax revenue to redistribute resources to subnational regions that failed to attract investment.

In this paper, we take advantage of an unexpected legal ruling in Brazil that limited states' ability to provide differentiated investment incentive packages so that we can evaluate the effect of fiscal federalism on two outcomes of interest: patterns of realized investment and subnational fiscal capacity. Using deal-level data on Greenfield investment and incentive packages, we model the effect of the removal of state-level fiscal autonomy on the patterns of investment into Brazilian states. We also evaluate states' ability to collect revenue and engage in spending pre- and post-rule change.

We find that patterns of investment shifted only minimally after the change in investment law. While there is some weak evidence that agglomeration hastened after disadvantaged states lost the ability to offer differentiated tax incentives, the changes are substantively small and in some models reversed. Taken as a whole, the alteration in investment patterns is less than one would expect if the goal of large outlays on incentives was to redirect large amounts of investment towards disadvantaged states. Moreover, while we do not find direct evidence that states receive a substantial increase in revenue when differentiated incentives are no longer permitted, we do demonstrate that incentives are negatively associated with revenue at the state level. These findings indicate that any discrete investment that tax incentives facilitate comes at a fiscal cost to host states, but without proving effective at overcoming structural and geographic factors that determine investment location.

Our research helps to resolve an outstanding question in the literature about the opportunity costs of competing for investment through tax incentives. Our empirical analysis indicate that, at most, there was a less than a 2 percent increase in additional investment flowed to agglomeration hubs after the decision. In some models, agglomeration states received *less* investment after the ruling. Our quasi-experimental approach allows us to more precisely evaluate how changes in legal capacity to engage in intrastate tax competition affect outcomes of interest. This is an important improvement over previous studies that have largely relied on cross-national differences in fiscal authority to study the effect of fiscal federalism on tax incentive policy and outcomes.

More broadly, our findings speak to a growing literature at the intersection of economic geography, industrial policy, and popular challenges to globalization. Many scholars have emphasized the confluence of economic grievance, rising inequality, declining trust in institutions, and the rise of anti-democratic populist movements globally. Brazilian public opinion reflects these global trends: in the 2020 Latinobarometer survey, 58 percent of respondents said they had little or no trust in MNCs and 25 percent indicated that foreign investment was *harmful* to the country.[8]

Scholars as well as policymakers are increasingly considering whether and how industrial policy and targeted locational incentives may help to compensate the historical losers from globalization and aid in spreading the economic benefits of trade and open economies across a wider, geographically bound, segment of society.[9] Our findings caution against optimism here. Tax incentives are, on the whole, a very weak tool against incredibly strong forces of clustering economic activity into geographically centralized engines of innovation and growth. Moreover, there is some evidence that their use reduces governments' capacity to raise revenue that can be used for other forms of redistribution, compensation, and public goods that are more closely associated with economic growth and opportunity. Therefore, investment incentives are unlikely to be a highly effective policy tool for redistributing economic opportunities outside of core economic clusters.

The remainder of the paper is organized as follows. First, we review the existing research and associated debates about the role of incentives in attracting foreign direct investment (FDI) and develop hypotheses to test. Second, we discuss the case of Brazil, outlining how it fulfills the conditions for a

[8]Latinobarometer 2020 - Brazil. pp. 37, 70.

[9]Broz et al. (2021); Rickard (2018); Schonfeld (2021).

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quasi-natural experiment. Third, we present our data and methodological approach, highlighting our findings that investment flows to disadvantaged regions were not higher during the period in which Brazil's federal states were allowed to offer differentiated incentives. Finally, we conclude by discussing the implications of our findings for broader debates about the power dynamics between states and globally mobile firms and suggest avenues future research.

Capital mobility, investment incentives, and shaping firms' locational choices

Many governments, in an effort to spur employment and economic growth, attempt to attract global pools of investment using a variety of fiscal policies. Such tools are closely related to, and overlap with, industrial policy. We define industrial policy as state-driven efforts to encourage the domestic development of particular industries and business activities, often by investing in "national champions."[10] Scholarship on the developmental state has closely examined why governments make specific strategic choices over how to shape their countries' economic development trajectory, the political-economic causes and effects of such strategies, and the ultimate outcome of these interventions on social welfare. Fiscal investment incentives in the form of tax holidays are one of the most widely used industrial policy tools, especially among lower income countries, in part because such interventions do not require upfront government fiscal expenditure but rather relinquish future tax claims against enterprise revenue in order to induce firms to locate—and generate employment—within the government's jurisdiction.[11]

Scholarly interest in investment incentives—and particularly incentives aimed at FDI rather than domestic investment—often places analytic focus on how capital mobility affects firm-government bargaining dynamics and the welfare effects of these dynamics. Accordingly, political economy-oriented study of investment incentives specifically, rather than industrial policy and developmentalism broadly, provides a particular window into studying the power dynamics between states (to tax capital) and firms (to avoid taxation) in the context of international capital mobility.

Research in this vein often addresses a persistent puzzle: why do governments offer such incentives, given that formal modeling exercises and econometric assessments routinely show that incentives are inefficient? Indeed, a large literature finds such incentives routinely fail to achieve their stated objectives of increasing FDI and employment,[12] including fostering particularly desirable business activities such as research and development.[13] There is also no consistent evidence that incentives fundamentally shape firms' site selection,[14] while economic development bureaucrats with business backgrounds are more likely to view incentives as marginal to site selection.[15]

Scholars generally point to three dynamics that may explain persistent use of costly investment incentives, despite limited evidence of their effectiveness. First, incentives may reflect the structural power of firms to demand concessions in the context of global capital mobility,[16] however deal-level analysis in Latin America suggests that firm embeddedness and alignment with governments' industrial policy goals, rather than firm mobility, better explain patterns of which foreign investors receive incentive packages.[17] Instead of reflecting case-specific bargaining dynamics between governments and mobile investors, investment incentives may act as compensatory tools that aim to make investments commercial viable despite costly problems of geography, limited human capital, and weak rule of law and domestic institutional quality.[18] Governments may especially feel compelled to provide

[10]Rickard (2018); Osgood et al. (2017).
[11]UNCTAD (2022).
[12]Baccini et al. (2014); Jensen (2017); Thomas (2011); Ghauri and Oxelheim (2004); Johnson et al. (2013).
[13]Wellhausen (2013).
[14]James (2013); Jensen (2012); UNIDO (2011).
[15]Bauerle Danzman and Slaski (2021b).
[16]Lindblom (1977); Frieden (1991); Strange (1996).
[17]Bauerle Danzman and Slaski (2021a).
[18]Bellak and Leibrecht (2009); Blonigen and Davies (2004); Egger et al. (2009); Mutti and Grubert (2004); Li and Resnick (2003); Egan (2010); Li (2006).

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increasingly large tax holidays when other localities offer similar packages, creating competitive dynamics in which localities attempt to outbid each other.[19]

For this reason, investment incentives may be particularly susceptible to "race-to-the-bottom" dynamics both across and within countries, especially in situations where fiscal federalism empowers local politicians to negotiate investment deals.[20] Fiscal federalism may strengthen mobile capital's structural power over states, limiting the optimal tax rate governments can impose before such firms will exercise their option to exit.[21] Because tax incentives are usually offered at the local rather than the national level, and because such packages often do not require legislative approval, governments may face less resistance to reducing firms' tax burdens through tax holidays than through changes to statutory rates.[22] Moreover, because incentive packages are negotiated ad hoc between firms and local government officials, they are not stymied by political veto players in the ways that other forms of legislation might be, making them an "easy to use" policy tool that is unlikely to be blocked.[23]

A second argument suggests investment incentives exist not because they attract investment, but because of private benefits politicians can accrue from offering these inducements. Politicians can use such announcement to claim credit for economic development and thereby generate voter approval.[24] Rickard (2018) argues that these political incentives, along with institutional features to channel voter preferences and business interests, also explain patterns of economic subsidies across geographies and industries. Incentives may also be a way to reward politically connected businesses[25] and build clientelist networks.[26] Relatedly, incentives may represent the "quiet politics" that constitute regulatory capture by firms.[27]

A final argument is that investment incentives may only rarely attract "additional" projects—meaning investment that would not have otherwise occurred—but the long-term payoff to attracting even one project could be high enough to justify the policy costs. This argument rests heavily on the concept of agglomeration economies and resulting path dependence. Due to increasing returns to scale and geographically specific positive externalities, productive firms and industries tend to concentrate in consolidated areas.[28] The "clumpiness" of investment holds not just for domestic activity but also for FDI, creating increased inequality across economic geographies.[29] At the most extreme, the competition for investment can become "winner take all" wherein single regions or cities attract the vast majority of investment.[30] These locations have advantages such as ports or other favorable geographic features, improved infrastructure, an educated workforce, attractive policies, or simply luck that allowed them to develop a lead in investment flows. In this context, incentives may not drive locational choices, but could provide localized benefits through upward pressure on wages, community benefit agreements that require developers to contribute to local civic needs, and by increasing projects' capital intensity.[31]

It is this insight—that governments may be willing to pursue enormously costly investments as a bid to develop a new investment cluster—on which we focus. However, as the proceeding section makes clear, rather than justifying seemingly inefficient tax policy to attract "anchor" investments, agglomeration dynamics themselves may further prevent investment incentives from achieve governments' policy objectives.

[19]Rodriguez-Pose and Arbix (2001).
[20]Owen (2019); Baccini et al. (2018); Jensen and Malesky (2018); Li (2016); Baccini et al. (2014).
[21]Hirschman (1970); Rodden (2002); Weingast (1995).
[22]Shin (2017).
[23]Basinger and Hallerberg (2004).
[24]Jensen (2008); Jensen et al. (2015); Jensen and Malesky (2018).
[25]Baccini et al. (2018).
[26]Cai and Treisman (2005).
[27]Culpepper (2011).
[28]Krugman (1991).
[29]Jordaan (2005).
[30]Moretti (2013).
[31]Slattery and Zidar (2020); Tavares-Lehmann et al. (2016).

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The clash of fiscal federalism and agglomeration

We consider how investment agglomeration may erode any benefit local governments might seek through competition for capital through fiscal federalism and related tax incentive programs. The tendency for investment to cluster may encourage politicians to offer ever-increasing incentives to attract an initial firm, as a way of developing an industrial center. However, the very fact that investment tends to agglomerate may render such attempts fruitless. Here, we follow a deep literature in economics and regional development that identifies agglomeration—defined as positive externalities that arise from locating productive capabilities proximate to each other—as a primary driver of FDI location.[32] There exist multiple channels through which agglomeration can generate positive externalities including the sharing of suppliers or pools of labor, the increased ability to match specialized inputs or labor when suppliers and workers are geographically proximate, and the ways in which closeness can facilitate knowledge and learning spillovers.[33]

Our central premise is that if investors' siting decisions are primarily determined by the benefits of co-locating productive activities where clusters of activity are already active, then investment incentives are unlikely to shift locational choices. This dynamics makes fiscal competition generated through political decentralization unlikely to affect investment patterns, despite politicians' best efforts.[34] However, politicians are still likely to offer and investors are likely to accept tax incentive packages for projects that would occur at the chosen site regardless of whether the tax holiday was offered. This happens for two reasons. First, political officials cannot directly observe if a firm requires a tax incentive to invest, so they have limited options for constraining such packages only when they will be decisive to a locational decision. Second, since firms know that politicians cannot distinguish between incentives necessary to induce investment and superfluous incentives, they will claim the incentive is necessary to the deal and take the incentive.

This dynamic empowers firms to avoid local taxation and diminishes the government's capacity to collect such revenues. Accordingly, when fiscal federalism is present—that is, when subnational governments can compete with each other on local tax rates—FDI will continue to accrue mostly along agglomeration patterns but local governments will be less able to collect tax receipts and therefore have less revenue to spend on a variety of other priorities, including social spending. In such circumstances, competition for investment through fiscal federalism will result in more inequality, even if the original objective of the fiscal competition was to reduce inequality by drawing productive investment out of economic centers and to disadvantaged areas.

These insights, then, suggest the following two hypotheses:

Hypothesis 1: *FDI will be no more likely to occur in outlying areas (non-Agglomeration Centers) when subnational governments are allowed to compete through fiscal packages than when they are prevented from offering locational tax incentives (Incentive competition does not overcome agglomeration dynamics).*

Hypothesis 2: *Subnational governments are able to collect more tax revenue when they are prevented from offering locational tax incentives than when they are allowed to offer such incentives (Incentive competition reduces governments' revenue generation capacity).*

Brazil's "fiscal wars" and subnational investment competition

Because it is often difficult to obtain systematic data on investment incentives, the literature on incentives has largely relied on observational studies, small case studies, and survey experiments, which creates challenges for causal inference.[35] These data limitations have made it difficult to adjudicate

[32]Jones and Temouri (2016); Jordaan (2005).

[33]Duranton and Puga (2004); Krugman (1991).

[34]Li (2016).

[35]One notable exception is that of Jensen and Malesky (2018) with an experiment on whether sub-national leaders in Vietnam are more willing to offer incentives when they are up for promotion; however, this experiment largely focused on the political motives and rewards to offer incentives, rather than their effect on investment decisions.

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between institutional and firm-level effects, particularly beyond the US context, where data availability issues are less pronounced and existing research is more developed.[36] Moreover, the existing literature has focused on the developed world, with less focus on middle- and low-income economies; to the extent that developing countries have been studied, research has focused on electoral incentives of politicians, rather than the effectiveness of the incentives themselves.[37] Finally, little research has looked at both changes in incentives and investment flows simultaneously, to more plausibly test the role of incentives in creating patterns of investment, particularly in the Global South.

Our ultimate outcome of interest is firm investment decisions, and in particular whether and how these decisions change in response to incentive policy. We examine this question in the context of Brazil, the world's ninth largest economy. Brazil routinely ranks in the top ten developing country recipients of FDI, and its highly diversified economy attracts FDI across a range of sectors. Due in part to its complex and decentralized tax system, Brazil is frequently considered the canonical emerging market case of "fiscal wars," in which states outbid each other for investment through tax incentives.[38] Brazil also has an extremely high level of subnational inequality: the federal district has a per capita income approximately 6.5 times that of the state with the lowest per capita income, Maranhão.[39] The state of São Paulo has an economy 185 times larger than that of the Brazilian state with the smallest economy, Roraima.[40]

The Brazilian federal government has several incentive programs aimed at attracting foreign and domestic investment in priority sectors such as infrastructure and manufacturing; other programs, including free trade and export processing zones in Manaus and Bahia, focus on drawing investment to disadvantaged areas in the Northeast and Amazon regions. Within the context of these programs, concerns about competition within a federal system have been substantial, especially given that corruption and subnational inequality are high in Brazil. Brazil has offered more incentives than any other country in Latin America, a fact often attributed to the competitive dynamics that fiscal federalism allows. (In)famously, Ford received a 1.4 billion dollar investment incentive to locate in the state of Bahia.[41] More broadly, Brazil's automotive industry, which compromises approximately 10 percent of GDP, has been the subject of case studies on the inefficiency of incentives in subnational competition for investment.[42] Thus, we consider Brazil to be a "most likely" case of subnational tax competition driving firm locational decisions.

Conditions for quasi-natural experiment

In this section, we review the complex tax structure in Brazil, including the conditions before and after the change in investment law, in order to establish the conditions for a quasi-natural experiment. Brazilian states and municipalities have long enjoyed substantial fiscal autonomy and have used this authority over specific sales taxes to extend incentive packages to investors on a case-by-case basis. Brazil levels a variety of state and regional taxes, the most important of which are value-added or indirect taxes, and specifically the Imposto Sobre Circulação de Mercadorias e Serviços (ICMS) which taxes the circulation of goods and transportation and communication services. Brazilian states' capacity for incentivizing investment stems mainly from their ability to offer reductions on these taxes.

The statutory ICMS varies by state and can be quite high; in 2024 the state of São Paulo had a rate of 18 percent, although the rate for individual products can be as high as 25 percent.[43] In 2010, the ICMS

[36]Hines (1996).

[37]A notable exception comes in the literature on special economic zones (SEZs) and export processing zones (EPZs) (Schrank 2001; Moberg 2015).

[38]Thomas (2011).

[39]For comparison, the wealthiest US state (Massachusetts) has approximately a per capita income double that of the poorest US state (Mississippi).

[40]For reference, this is approximately double the difference in size between the size of the largest US state economy (California) and that of the smallest US state economy (Vermont).

[41]Jensen and Malesky (2018).

[42]Rodriguez-Pose and Arbix (2001).

[43]PriceWaterhouseCooper (2021).

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accounted for over 20 percent of all Brazilian tax receipts, or eight percent of GDP (Melo et al. 2010, 68). Brazil also has a process of tax substitution by which taxes are collected at the initial stage rather than at other points along the supply chain, resulting in tax shifting to lower tax locations, making differences in interstate rates more extreme. Tax substitution of the ICMS is common, with additional taxes being applied at the initial production site and credited later in the supply chain, rather than being charged at each step of the value chain that adds value to the product. This process creates a way to shift taxes to jurisdictions with lower rates.[44] While by law Brazilian States were not permitted to compete through offering ICMS tax holidays, in practice they have.[45] For decades, less developed Brazilian states have used changes in the ICMS rate, alongside other methods such as Free Trade Zones, to incentivize investment.

In March 2017, the Brazilian Supreme Court ruled that states could no longer provide these incentives.[46] This was followed by a Brazilian Congressional ruling in July 2017, wherein the Congress approved all the ICMS tax incentives currently granted and the passing of law (Complementary Law (CL) No. 160/2017) in August 2017 which required that states publish all existing incentives, disallowing future incentives and permitted states to match any existing incentive.[47] This law was explicitly designed to level the playing field on the "fiscal wars" by banning state differentiation in investment incentives. All states were required to list their ICMS tax incentives publicly, in accordance with CL No. 160/2017 and CONFAZ Agreement 190/2017. Effectively, the Supreme Court decision and subsequent change in the tax law reduced the ability of disadvantaged states to offer differentiated investment incentives.

Importantly, this change in law did not eliminate the ability of local governments to provide investment incentives. Instead, it reduced their ability to offer *differential* ICMS rates on interstate commerce by applying a flat ICMS rate across states and prevented states from providing project-specific relief from this standard rate. Because companies had unsuccessfully lobbied for many years, and brought the case before the Supreme Court multiple times without success, we argue that this decision (and subsequent change in the law) were not anticipated by investors and thus did not factor into investment decisions before the announcement.

This change in fiscal authority forms the basis of our quasi-experiment. We evaluate whether investment patterns and subnational tax revenue collection changed after the Brazilian government curtailed states' ability to compete for investment through differential tax incentives. Importantly, by looking only subnationally, we control for domestic institutions that may mediate the choice of investment location.[48] We are thus able to focus on whether companies are willing to invest in more or less disadvantaged regions in the same country. We also argue that our findings about competition between locations for investment, while based on a subnational experiment, should have implications for cross-national investment flows and the effectiveness of investment incentives for disadvantaged locations.

Modeling approach

We use a regression discontinuity design to test whether the change in law described above altered patterns of foreign investment and revenue in "agglomeration centers" versus disadvantaged Brazilian states. The unit of analysis is the state-sector-month; monthly data allow us to measure the shifts in foreign investment flows immediately before and after the announced change in the law.

Data

In our main models, we examine two dependent variables: FDI projects and State Revenue. To test hypothesis 1, our main model use the count of monthly *FDI Projects* from the fDiMarkets database,

[44]Seppala et al. (2014); Rezende (2013); Poulsen (2020).
[45]Cubas (2018).
[46]Ernst and Global (2018).
[47]Melo et al. (2010); Kher and Kusek (2020).
[48]Mosley (2003); Rudra (2008).

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aggregated to the state level.[49] We choose counts rather than total deal value to provide a conservative test of our theory, as smaller states are likely to receive fewer large investments that could skew the results even more towards what we call "agglomeration centers," or the few states that are the most highly developed. Investments into poorer states are, on average, smaller than investments into wealthier city centers. By focusing on deal counts rather than deal size, we allow for the possibility that smaller states may attract a large number of small deals.[50] However, in the appendix, we report models that use *Investment Size* as the dependent variable and find similar results (A29).

There are a total of 5209 projects in the time period from January 2010 to July 2021. Table 1 provides summary statistics for FDI projects across states.[51] We also have access to announced investment incentive data through IncentivesFlow.[52] We could use incentives rather than FDI inflows as our main dependent variable. We choose not do to so due to concerns that announced incentives data may display substantial missingness, especially for poorer regions. In robustness checks, we use incentives as our dependent variable and also find no change in distribution of incentives post ruling, once state-level variables are included in the analysis (A25).[53] We are primarily interested in foreign investment, especially because foreign investors have a more credible threat of exit than do domestic projects. However, our findings are also robust to models that include incentives to domestic firms (A28).

To test hypothesis 2, we model *State Revenue* which we obtain from the Brazilian Institute of Geography and Statistics (IBGE).[54]

Our key explanatory variables include *Post Investment Law*, an indicator equal to 1 in the time period after the 2017 law change, and *Agglomeration Center*. In our primary models, we measure agglomeration in two ways. First, we use a simple indicator variable equal to one for the Brazilian states with the largest economies, measured by GDP.[55] However, this approach requires us to arbitrarily set a cutoff point. To address this and other potential bias in how we qualitatively define agglomeration, we supplement this analysis by using a Bayesian sparse modeling technique called LASSOplus that essentially assesses the state-level variables listed below to inductively find the variables that best capture investment pooling.[56] These models then include interactions between the relevant state-level variables and *Post Investment Law*. The coefficient estimates for this interaction capture the relationship between these agglomeration proxies and investment flows after the change in the incentive law. Since our theory predicts that the change in law will not affect investment flows, we anticipate that there will be no or minimal differences in the effect of agglomeration measures on investment flows pre- and post the law change.

Our state-level variables measure concepts that the literature on FDI flows has identified as important for locational attractiveness.[57] We include *Population*, *Income*, measured by gross regional product per capita, *State Spending*, log transformed, and *Education*, measured as the percent of students age 11 to 14 years in the final stages of elementary education. For models that use *FDI Inflows* as the outcome variable, we also include *Log of State Revenue* as a explanatory variable. We also include data from the Instituto Brasileiro de Geografia e Estatística on the share of each state's economy in a range of

[49]These data are collected and maintained by the Financial Times and are available through a commercial license. The dataset includes green field cross-border investment, including expansion projects as long as they are associated with new capital investment or employment [?].

[50]We test for stationary in our dependent variable using a Dickey-Fuller test and yield a value of −21.812, with a p-value = 0.01, rejecting the null hypothesis that the data is nonstationary.

[51]The small number of total FDI projects in several states, while a reality of the natural experiment framework, raises power concerns. We caution readers against over interpreting our findings.

[52]This proprietary dataset is also maintained by the Financial Times. It tracks announced fiscal incentives for domestic and cross-border investment projects. See [?].

[53]A Dickey-Fuller test for non-stationarity returned a value of −44.484 and a p-value of 0.01, indicating this variable is also stationary.

[54]https://www.ibge.gov.br/english/IBGE. Diretoria de Pesquisas, Coordenação de População e Indicadores Sociais. State revenue also passes Dickey-Fuller tests for non-stationarity, with a p-value of 0.01.

[55]These states include: São Paulo, Rio de Janeiro, Minas Gerais, Rio Grande do Sul, Parana, and Bahia.

[56]We use the R package sparsereg to implement this analysis. See Ratkovic and Tingley (2017) for documentation.

[57]All Brazilian State data are from IGBE.

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Table 1. Number of Greenfield FDI projects by state

Destination state	Number of FDI projects
Acre	2
Alagoas	10
Amapa	8
Amazonas	98
Bahia	145
Ceara	58
Espirito Santo	42
Federal District	47
Goias	49
Maranhao	19
Mato Grosso	31
Mato Grosso do Sul	20
Minas Gerais	262
Para	35
Paraiba	15
Parana	197
Pernambuco	114
Piaui	18
Rio de Janeiro	541
Rio Grande do Norte	43
Rio Grande do Sul	158
Rondonia	6
Roraima	1
Santa Catarina	98
Sao Paulo	2,208
Sergipe	5
Tocantins	9
Not specified	970

sectors, to capture whether investments are more likely to flow to places where other investments in that sector already exist. Summary statistics are included in the appendix (A1).

As an additional control, we also include a count of investment *Incentives* for each state-month-sector. These data come from IncentivesFlow (formerly Incentives Monitor). There are a total of 1660 investment incentives over the time period of analysis. A table of the number of projects in each state and each year is included in the appendix (A2). Data include information not only on count of projects, but also on jobs and capital associated with each investment. We include this measure to address concerns that, despite the Supreme Court ruling reducing states' ability to provide differential incentives, the ruling did not eliminate all incentives. Including incentives is therefore a very conservative modeling strategy. However, in robustness checks, we remove incentives as a explanator (A26). Our results do not substantively change.

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Modeling specifications

To test Hypothesis 1, we estimate a series of equations that take the following basic form:

$$FDIFlows_{ims} = \alpha + \beta_1 PostInvLaw_m + \beta_2 AgglomerationCenter_i + \beta 3 AgglomerationCenter_i * PostInvLaw_{im} + \beta_4 Incentives_{ims} + \beta_5 HostStateCharaterstics_{im} + \beta_6 Sector_{ims} + \epsilon_{ims}$$

where *FDIFlows* are the count of investments in that state (i)-sector (s)-month (m), α represents the intercept and ϵ is the error term. In models that measure agglomeration through sparse modeling techniques instead of through an indicator variable, our basic equation takes the following form:

$$FDIFlows_{ims} = \alpha + \beta_1 PostInvLaw_m + \beta_2 HostStateCharaterstics * PostInvLaw_{im} + \beta_3 Incentives_{ims} + \beta_4 HostStateCharaterstics_{im} + \beta_6 Sector_{ims} + \epsilon_{ims}$$

and where *HostStateCharaterstics* includes a vector of state-level controls as described in the previous section, which capture the characteristics associated with either disadvantaged states or agglomeration hubs.[58] To test Hypothesis 2, we use similar equations, substituting $LogofStateRevenue_{im}$ for $FDIFlows_{ims}$ as the explanatory variable.

Results

Our results include both main models and a series of robustness checks, designed to capture the effect of the natural experiment on investment flows. The goal is to measure the factors that affected investment flows and whether the change in investment law impacted those flows.

We begin with a visual comparison of the investment before and after the change in investment law. Figure 1 presents the number of projects per state in 2016 and 2018; the results are similar, with São Paulo continuing to receive the vast majority of investment, with little change in investment flows to the rest of the country. This provides preliminary visual evidence that the fiscal war period was ineffective in incentivizing investment into disadvantaged states. Figure 2 provides a visual representation of investment flows over time.[59] Again there appears to be little shift in investment before and after the change in investment law.

The number of investment projects in Brazil in 2016 and 2018, before and after the change in investment law. The light state represents São Paulo.

We here briefly provide a note on how to interpret the LASSOPlus results, as some readers may be unfamiliar with how to interpret such results, although such approaches are becoming increasingly popular in political science. As in all Bayesian methodologies, the results are the posterior distribution of the model once fitted to the data. In addition, LASSOPlus is a form of sparse distribution that makes the analysis less sensitive to model selection and selects only the most relevant results. When interpreting the results of Bayesian models, do we not assume that there is a "true" distribution; instead, the posterior distribution is the most likely one given the available data. The posterior distribution estimates are similar to point estimates and the credible intervals can be interpreted in a way similar to frequentist confidence intervals.

Hypothesis 1

In Table 2, we first present results for the models that measure agglomeration through an indicator variable. In models that exclude state-level controls, we see that agglomeration centers receive statistically significant more FDI projects before the Supreme Court ruling, and that they receive less FDI after the ruling. However, these findings disappear with the inclusion of state-level controls (models 4 and 5). Most importantly, the coefficient estimate for the interaction term (here, since both

[58]Note that the state data is only partially available for 2020 and 2021, resulting in a reduced sample size.

[59]São Paulo omitted to ease visual interpretation. The same figure, including São Paulo is available in the appendix.

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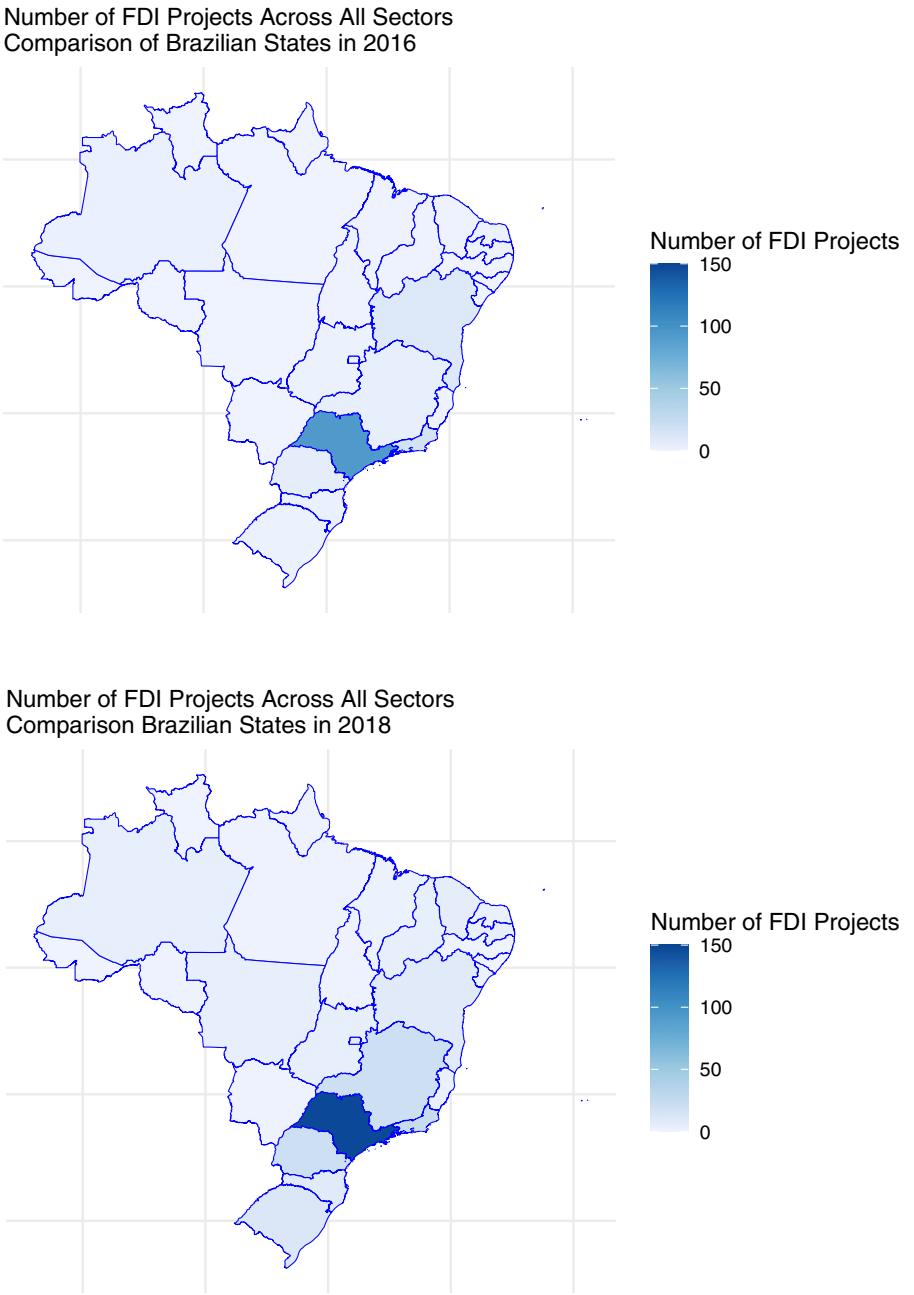

Figure 1. Investment projects in Brazil before the change in investment law.

variables are indicators, meaning when a state is both an agglomeration center and in the post-court ruling time period) is statistically insignificant as is the stand alone coefficient estimate for the post-court ruling time period (which estimates the effect of the law change in states that are not agglomeration centers). These findings are consistent with Hypothesis 1's expectation that the law change would not affect patterns of investment. In other words, we find that within both agglomeration centers and within non-agglomeration centers, the law change had no statistically significant effect on their ability to attract investment projects.

In robustness checks (A27), we rerun analysis dropping state revenues and state spending because these variables may be post-treatment variables if the change in allowable incentives affected states'

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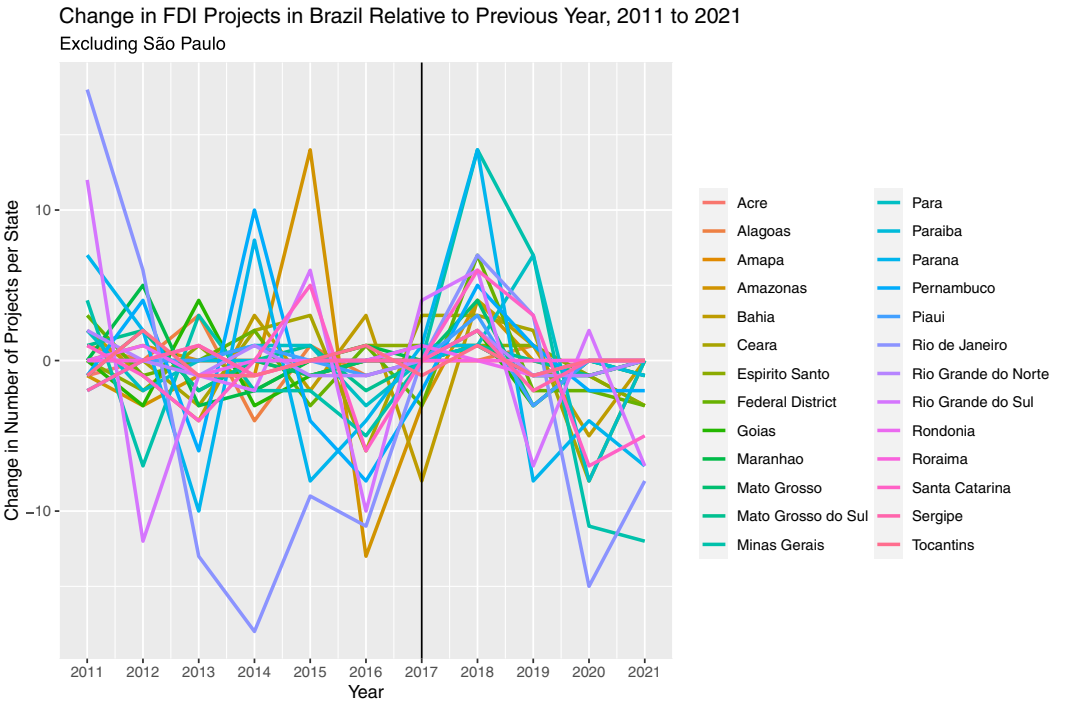

Figure 2. Annual change in investment projects across Brazilian states, excluding São Paulo.

capacity to collect revenue. Our main findings are robust to these modeling changes—the coefficient estimates for the post-law change indicate that reducing the ability to compete for incentives did not benefit agglomeration centers. In fact, there is some evidence that reducing incentive competition actually disadvantaged agglomeration centers, which is the opposite of what we might expect if incentives were able to attract investment to disadvantaged areas.

Some may worry, however, that the agglomeration may rely on a specific specification of state-level factors, or that non-sparse estimation may be overly sensitive to capturing the effect of incentives. To further validate these findings, we turn to our Bayesian sparse modeling estimation technique. As a reminder, the LASSOPlus framework addresses concern about model sensitivity and multicollinearity by inductively choosing, based on predictive capabilities, which of a series of potential explanatory variables to include in a final model. Additionally, as these models use Bayesian techniques, credible intervals rather than confidence intervals. Model 6 (Table 2) first re-estimates model 1, with substantive results largely replicating. Agglomeration centers receive more investment pre- and post-court ruling, compared to disadvantaged areas. The greater ability to provide incentives prior to the ruling did not push investments away from agglomeration centers and into more disadvantaged regions.

Table A8 presents our main LASSOPlus results with full controls and interactions. The results show, unsurprisingly, that indicators associated with Agglomeration Centers—income, population, revenue, and spending—were associated with increased investment. These interaction term shows a small, statistically significant decrease in investment flows to agglomeration enters after the change in investment law. They also show a small and statistically significant decrease in total investment after the Supreme Court decision. This indicates that the shift in investment law did not substantially impact investment flows, and if anything made it slightly more likely that disadvantage states received more investment after the Supreme Court restricted the use of tax incentives to attract foreign investment. Since the logic of investment incentives is that they help attract investment to otherwise less desirable locations, this finding is the exact opposite of what we would expect if incentives actually operated to help poorer regions compete with agglomeration centers for capital.

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Table 2. Main models: natural experiment of FDI inflows across Brazilian states, 2010–2021

	Dependent variable:				
	FDI Count				
	(1)	(2)	(3)	(4)	(5)
Agglomeration Center	0.067 ***	0.067 ***	0.067 ***	−0.028 ***	−0.029 ***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Period Post-Supreme Court	−0.005 ***	−0.005 ***	−0.005 ***	0.003	0.004
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Agglomeration Center × Period Post-Supreme Court	−0.017 ***	−0.017 ***	−0.017 ***	0.003	0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.005)
Incentives Count		−0.001	−0.0004	0.006 **	0.012 **
		(0.003)	(0.003)	(0.003)	(0.006)
Population				0.000 ***	0.000 ***
				(0.000)	(0.000)
Per Capita Income				0.00002 ***	0.00003 ***
				(0.00000)	(0.00000)
Education Score (IDEB)				0.0001	−0.004 *
				(0.002)	(0.002)
State Revenue (logged)				0.003 ***	0.003 ***
				(0.0004)	(0.0004)
State Spending (logged)				−0.033 ***	−0.039 ***
				(0.002)	(0.002)
Constant	0.014 ***	0.014 ***	0.002	0.619 ***	0.764 ***
	(0.001)	(0.001)	(0.003)	(0.034)	(0.042)
Sector Controls			X	X	X
Matching Sector Percent					X
Observations	161,240	161,240	161,240	83,520	64,368
R^2	0.015	0.015	0.039	0.096	0.102

Note: $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$.

Hypothesis 2

Hypothesis 2 predicted that incentive competition reduces governments' revenue generation capacity. To test this expectation, we run a series of models that use revenue as the outcome variable rather than investment projects. Table 3 provides results for ordinary least squares (OLS) models and Table A14 reports results for LASSOplus specifications. Our findings across these estimation strategies are inconsistent. In both specifications, we find a baseline decrease in revenue after the Supreme Court decision overall. However, in LASSOplus specifications, when factoring in population, income, and education, we find a net increase in revenue, particularly to agglomeration centers that have higher populations, income, and education levels. In OLS models, we find that non-agglomeration centers collected less revenue post Supreme Court ruling but the revenue generation capability of agglomeration states did not change. However, in fully specified models, we find evidence that counts of investment incentives are negatively associated with state revenue, which supports our broader claim that investment incentives are costly to governments and generate revenue and spending

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Table 3. Models predicting revenue

	Dependent variable:				
	Log Revenue				
	(1)	(2)	(3)	(4)	(5)
Agglomeration Center	1.673 ***	1.673 ***	1.673 ***	0.698 ***	0.638 ***
	(0.014)	(0.014)	(0.014)	(0.021)	(0.025)
Period Post-Supreme Court	−0.693 ***	−0.693 ***	−0.693 ***	−0.655 ***	−0.625 ***
	(0.011)	(0.011)	(0.011)	(0.015)	(0.021)
Incentives Count		0.003	0.003	0.002	−0.203 ***
		(0.022)	(0.022)	(0.023)	(0.053)
Population				0.00000 ***	0.00000 ***
				(0.000)	(0.000)
Per Capita Income				−0.0002 ***	−0.0002 ***
				(0.00001)	(0.00001)
Education Score (IDEB)				−0.041 ***	−0.170 ***
				(0.014)	(0.017)
Agglomeration Center × Period Post-Supreme Court	−0.075 ***	−0.075 ***	−0.075 ***	−0.040	−0.019
	(0.024)	(0.024)	(0.024)	(0.028)	(0.042)
Constant	24.278 ***	24.278 ***	24.278 ***	24.547 ***	24.800 ***
	(0.007)	(0.007)	(0.030)	(0.060)	(0.071)
Sector Controls			X	X	X
Matching Sector Percent					X
Observations	103,200	103,200	103,200	83,520	64,368
R^2	0.202	0.202	0.202	0.235	0.215

constraints. In other words, we have inconsistent evidence and therefore cannot make strong claims to the effect of the rule change on revenue.

Robustness

We run a series of other robustness checks, which are reported in the appendix, to ensure the results are not sensitive to model specification (although the LASSOPlus implementation should overcome some of these concerns, as it is less sensitive to model selection and variable inclusion). As a whole, our findings survive these alternative specifications.

First, we run the main model but with standard errors clustered at the state level (Table A9). The results are consistent with the main models. Second, we run models dropping the federal district. The federal district is politically distinct from the rest of Brazil—with high levels of education, and an economy highly reliant on the public sector, and thus a potential outlier (Table A10). Again, we see similar result to the main model. Third, it is possible that firms responded to the change in investment law that followed the Supreme Court decision. Using that as the regression discontinuity, the results are shown in (Table A11). Fourth, as measures of project size, we also run models that include the jobs and capital associated with projects (Table A12). Jobs, although not capital, are associated with an increased likelihood of investment before the Supreme Court decision. We then show results for using investment incentives as the dependent variable (Table A13).

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A battery of further alternative model specifications also demonstrate the robustness of our findings. There are a number of projects that have either unspecified states or unspecified projects. We show dropping unspecified states in Table A22, dropping projects with unspecified sectors in A23. In addition, we also use alternate measures of agglomeration. First, we use the share of investment in that sector going to that state (Table A16). We also use the existing investment in that state, with one-, two-, and three-year lags, shown in Tables A18, A19, and A20, respectively. We also run models using an average of those three lags, shown in A17. And, we use the amount of investment in 2010 as a "starting point" (Table A21). Finally, given that we use Amelia II to impute missing data, we run a robustness check using the un-imputed data (Table A24).

Conclusion

In this paper, we engage with the existing scholarship on economic geography: agglomeration hubs have captured increasingly large shares of FDI, leaving the question of whether development policy can reverse that trend. We advance the literature by using a quasi-natural experiment in Brazil that more precisely identifies the causal effect of subnational fiscal competition on FDI patterns. Prior to a 2017 Supreme Court decision, Brazilian states had wide latitude to compete over FDI projects by offering differential tax breaks. This feature of Brazilian fiscal federalism was widely seen to promote "fiscal" wars among states, leading to overbidding for investment in ways that shifting bargaining power toward mobile firms that could pit states against each other. However, the Supreme Court decision, and subsequent legislative change, took this authority away from states. We leverage this change to see if the reversal of fiscal autonomy led to a change in investment patterns. If investment incentives function as compensatory devises to lure multi-national enterprises to underdeveloped regions, we should expect the end of the "fiscal war" period to limit the ability of poorer states to attract investment projects. If, instead, the shift in incentive law did not influence investment patterns, we could conclude that incentives are little more than transfers to firms.

We find that investments patterns were unaltered by this sudden change in tax law, providing a cleanly identified test of the (in)ability of fiscal federalism to influence investment flows through tax incentive competition. We argue that given that, despite the unique features of Brazil, our quasi-experiment remains a valid test of the role of fiscal federalism on investment incentives. Because it has such fierce competition for investment, and because the use of investment incentives is such an important policy strategy, Brazil represents a "mostly likely" case for tax incentive competition structuring investment flows. Therefore, this quasi-experiment provides credible evidence that tax incentives are not effective tools for redistributing investment dollars to economically disadvantaged areas.

Our analysis also provides valuable empirical insight into the effects of investment incentives in emerging markets, which have received relatively little attention in the literature on tax incentives. While we look subnationally, our results have implications for other developing economies. We find that the loss of decentralized fiscal authority does not affect the process of agglomeration. Wealthy regions receive higher levels of investment flows than disadvantaged regions with or without differentiated incentives. Providing subnational units with the statutory authority to compete through incentives does not increase disadvantaged regions' success in attracting investment relative to their wealthier neighbors. These findings suggest that incentives reinforce inequality between investment locations, rather than allow disadvantaged locations to catch up. Although sectoral effects are not significant in models presented here, it is possible that the models simply lack the power to identify significant sectoral effects. Future research should explore these potential heterogeneous treatment effects and also explore how reducing subnational units' abilities to use tax incentives affect their revenues.

Our findings have important implications for policy debates about investment incentives and their usefulness in fostering development. The results bolster arguments that public funds spent on tax incentives are better redirected to other forms of spending – education, health, or infrastructure – that more directly foster development. Our analysis also speaks to the effects of agglomeration economies

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and potential efforts to combat the forces that drive inequality between "have" and "have-not" investment locations. Less developed states are unlikely to find tax incentives to be an effective tool to redirect investment toward economically disadvantaged areas. Instead, other forms of redistribution or coordinated national investment policy that reduces subnational competition may be more effective strategies. Future work should continue to explore how to reduce the inequality between locations, given that investment trends appear to continue to exacerbate these differences.

Our analysis also has broader implications for international political economy and the politics of economic globalization. First, a growing literature is reassessing the politics of openness in the context of a politically influential backlash to economic globalization in advanced industrial economies. Researchers have identified economic geography, and political systems that empower rural interest groups over dynamic metropolitan areas, as an important source of anti-globalization sentiments. Pro-openness coalitions may wish to combat protectionism by reallocating investment and employment to areas that have experienced plant closings and sustained job loss. Our findings suggest that tax incentives are not likely to be effective policy interventions in this regard. Economic revitalization will require other forms of government intervention.

Second, our research speaks to a broader political economy literature related to federalism. Scholars have typically seen subnational authority as either accelerating a race-to-the-bottom in taxation and regulatory standards more generally[60] or as arresting such dynamics.[61] We demonstrate that agglomeration economies render subnational competition relatively powerless, in line with previous formal theory.[62] These findings provide greater support for the notion that the tendency for economic activity to organize into complex, hierarchical networks generates sustained inequality not only in material outcomes but also in political power.[63] Subnational competition often cannot counteract these centripetal forces.

Supplementary material. The supplementary material for this article can be found at https://doi.org/10.1017/bap.2025.10014

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