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Fiscal Federalism and Regional Disparities: Evidence from Mexico

Sonia Araujo, David Bartolini, Agustin Redonda[1]

Abstract

This paper investigates the relationship between fiscal federalism and regional disparities across Mexican States. Regional asymmetries in GDP per capita and productivity are large and persistent, reflecting very different standards of living and of opportunities across Mexican States. While fiscal decentralization reforms have intended to promote regional convergence, via fiscal equalisation and spending decentralization, differences in output per capita across Mexican States still persist. This paper investigates fiscal relations between the federal and state governments to shed light on their contribution in mitigating wide geographical disparities. Results from panel data analysis over the period 1990 - 2017 show that increasing revenue decentralization to finance State-level expenditures and reducing the large vertical fiscal gap would boost GDP per capita in Mexican States. We also investigate the link between fiscal decentralization and public investment and find that increasing States responsibility to finance local spending raises State-level investment. Finally, fiscal decentralization is also associated with convergence of GDP per capita across Mexican states (beta-convergence), but the evidence is less robust – indeed there is no convergence over the period under analysis.

JEL Classification Codes: D63, H10, H70, H77, H71, H73, I38.

Keywords: Fiscal federalism, intergovernmental transfers, tax autonomy, regional inequality, regional convergence, Mexico.

[1] Sonia Araujo is the Head of the Mexico and Costa Rica desk at the OECD Economics Department, David Bartolini worked as a Senior Economist at the OECD, and Agustin Redonda is Fellow at CEP – Council on Economic Studies (Zurich, Switzerland). The views in this paper are entirely those of the authors and do not necessarily represent the views of the OECD, its executive directors and the countries they represent.

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1. Introduction

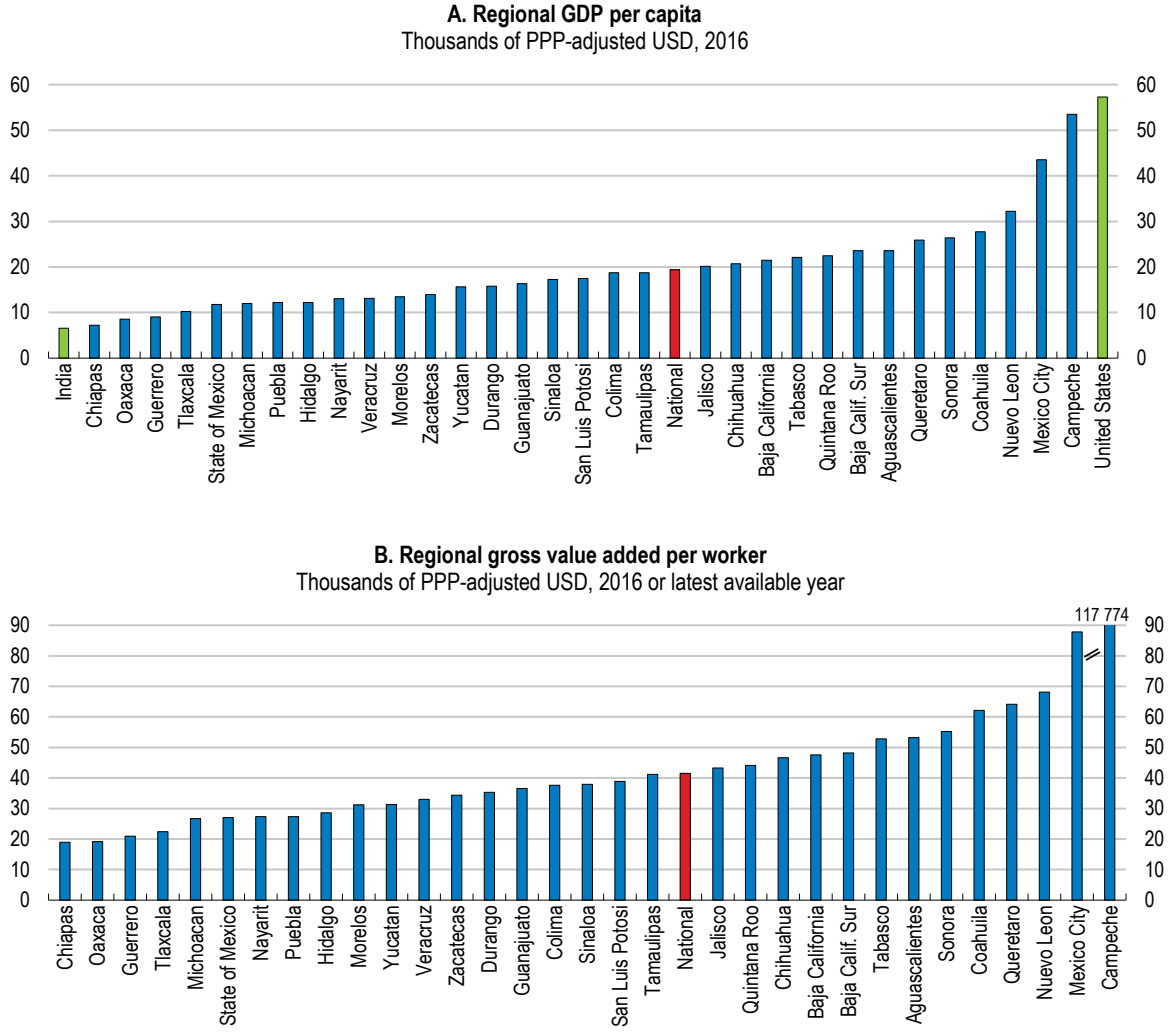
As a federal state, subnational governments are key economic actors in Mexico. Starting in the 1980s, Mexico embarked in fiscal decentralization reforms, which were strengthened in the latter half of the 1990s and beginning of 2000s. Like in other countries at that time, fiscal decentralization reforms intended to reduce poverty and inequality and stimulate the convergence of the lagging regions by improving the provision of public services (Giugalde and Webb, 2000). Reforms in Mexico increased the spending role of the states in key sectors for growth and well-being such as education and health, for which the national government provides transfers. As these reforms aimed at fiscal equalisation across states, resources are gathered at the federal level and then distributed to states and municipal governments to deliver a similar level of local public goods across the territory. Today, subnational governments are responsible for about 52% of total public expenditure and 80% of total public investment for which Mexican States account for the bulk of subnational investment (around 57%). The fiscal imbalance generated by the current intergovernmental fiscal arrangement - i.e., the difference between own resources and spending responsibilities – is large, compared with both the OECD and LAC. Mexico is the OECD country with the largest dependence of subnational government on intergovernmental transfers. On average, in 2014, transfers from the central government comprised 83% of the overall revenues of subnational governments, while local taxes and revenues only accounted for 9%.[2] Across the OECD, grants and subsidies account for about 37% of subnational government revenues while the figure drops to 21% in OECD federal states.

The literature is not conclusive. Some argue that federal transfers, by equalising fiscal capacity across regions, are essential for lagging regions to catch up with the frontier, without which regional divergences with only be reinforced (Prud'homme, 1995; Besley and Ghatak, 2003). Others argue that fiscal autonomy induces a better match between public services delivery and citizens' preferences and willingness to pay, incentivizing transparency and accountability, thus increasing efficiency (Oates, 1972). As lagging regions have a great scope for efficiency gains, fiscal decentralization could act as a pull, catch-up mechanism towards the efficiency frontier (Rodriguez-Pose and Ezcurra, 2010).

[2] The remaining 8% of resources come either from positive balances from previous years or debt.

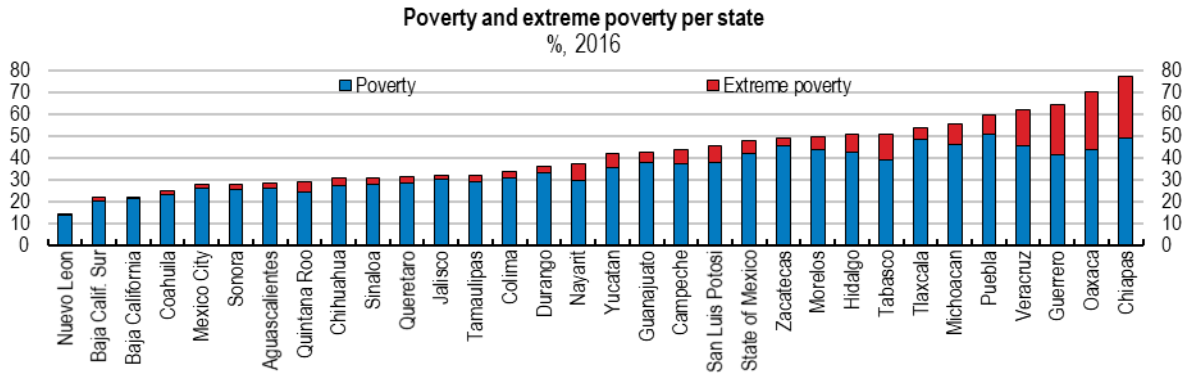
In the case of Mexico, fiscal equalisation does not seem to have achieved the desired results. Regional disparities in GDP per capita and productivity remain markedly large (Figure 1). Mexico is actually the OECD country with the largest inter-regional disparities. Moreover, as we show later in the paper, the gap with the richest region, Mexico City, has increased for all States. Poverty rates also differ greatly across Mexican States (Figure 2). While in Nuevo León less than 1% of the population lives in extreme poverty and less than 15% are poor, in nine other States, particularly in the south, more than 50% of the population live in poverty or extreme poverty. *Prima facie*, it seems that Mexico's fiscal federalism arrangement has not promoted regional convergence nor has it reduced inequality.

Figure 1. Regional differences in GDP per capita and productivity are large in Mexico



Source: OECD Regional Statistics and Productivity databases.

Figure 2. Poverty rates differ greatly across States



Note: CONEVAL's multi-dimensional poverty measure considers income plus six social dimensions of well-being (as presented in Panel B). The population in extreme poverty is the group whose income cannot ensure adequate nutrition and who is deprived in at least three of the six social indicators. The population in poverty includes those whose income cannot ensure adequate access to nutrition and basic services and who are deprived in at least one of the social indicators.

Source: OECD, Income Distribution and Poverty database; CONEVAL (Consejo Nacional de Evaluación de la Política de Desarrollo Social).

This paper contributes to the ongoing debate on the role of fiscal decentralization in promoting regional growth and convergence by looking into the specific case of Mexico. Mexico is an interesting case due to the specific characteristics of its fiscal federal framework: whereas almost all revenue is collected by the federal government, expenditures are highly decentralized and States finance most of their obligations to deliver public services via transfer from the central government (a mix of conditional and unconditional transfers). At the same time, Mexico's economic performance remains below its potential and convergence towards higher living standards has not occurred (OECD, 2019). Inequality across States have also not been reduced. We take que question of whether the current federal fiscal arrangement in Mexico contributes to regional growth and convergence to the data. We gather data on state level growth and convergence and construct several indicators of fiscal decentralization between 1990 and 2017, a long time series of almost three decades and a period marked by increased fiscal decentralization of expenditures.

The main findings of this paper are:

- An increase in revenue decentralization, measured by an increased ability of States to finance their own (State-) level expenditures boosts GDP per capita.
- A reduction of the large vertical fiscal gap is also associated with an increase in GDP per capita.

- We also shed light on the one possible specific channel through which fiscal decentralization leads to higher GDP per capital and find that an increase in the responsibility of States to finance local spending increases the share of State-level investment.
- Fiscal decentralization is also associated with convergence in GDP per capita (beta-convergence) but the evidence is the less robust. However, the somewhat weaker results are possibility a consequence of the fact that no regional convergence is observed in the period under analysis and also given the large vertical fiscal gap across States.

The reminder of the paper is structured as follows. Section 2 puts forward the theoretical arguments linking fiscal decentralization to regional growth and convergence and describes the empirical evidence on the relationship between fiscal federalism and regional disparities. Section 3 characterizes the federal fiscal arrangements in Mexico, describes main reforms and discusses how these can potentially affect regional-state level growth and convergence.[3] Section 4 describes the dataset and the presents the indicators of fiscal decentralization considered in the analysis. Section 5 motivates for the empirical strategy used to estimate the effect of fiscal decentralization on regional growth and catch-up. Section 6 presents the results and section 7 suggests some avenues for future research.

2. Fiscal decentralization and regional disparities: theoretical framework and empirical evidence

2.1. Theoretical framework

Fiscal relations across different levels of government are a key determinant component of the institutional framework that can affect regional convergence and inequality across territories. The distribution of taxing and spending powers between central and local governments affects the implementation of economic policies and ultimately their outcome in terms of growth and regional inequality.

From a theoretical point of view, a larger role for sub-central governments incentivises a better match of policies and service delivery with citizens' preferences (Oates, 1972), transparency, accountability and thus efficiency. It has also been argued that fiscal decentralization, defined both in terms of revenue collection and spending decisions of that revenue, can act as a mechanism promoting regional convergence. The underlying idea is that fiscal decentralization creates greater incentives for

[3] In this paper, regions and States are used interchangeably. Banxico follows a similar approach in its trimestral analysis of regional performance in Mexico ("Reporte sobre las Economías Regionales"). In particular, the report presents regional trends and analysis by grouping States in larger geographic regions.

an efficient use of local resources for growth, as spending and taxation decisions are closer to tax payers and beneficiaries and there is more scope for improvements of resource allocation decisions and governance practices in lagging regions than in those already at the efficiency frontier (Rodriguez-Posé and Ezcurra, 2010). Baldwin and Krugman (2004) also argue that fiscal autonomy can act as a powerful instrument against agglomeration forces as it introduces mechanisms for peripheral jurisdictions to compete with the "center".

Others argue that fiscal decentralization could increase disparity across local governments since some regions may be better endowed (including in the public sector, in terms of skills, technical equipment and IT) and able to take advantage of autonomy than others. Greater autonomy may also lead to a zero-sum game across local governments competing for mobile factors of production, with poorer regions being more likely to "lose", thus increasing regional disparity (Wilson, 2015). Finally, fiscal decentralization could reduce the scope for redistribution through intra-regional transfers, which is one of the main objectives of fiscal federal systems, e.g. through equalization schemes (Prud'homme, 1995).

2.2. Evidence from the empirical literature

Theory highlight different channels through which fiscal decentralization may impact on growth and regional inequalities. The results from the empirical literature highlights that the effect depends on country-specific institutions and economic features, as well as making a distinction between decentralization of taxing powers from decentralization of expenditure responsibilities. Lessmann (2006) considers a series of indicators of tax and expenditure decentralization for a panel of 17 OECD countries showing that, over the 1980-2001 period, all indicators of fiscal decentralization significantly reduced regional disparities in term of GDP per capita. These results are confirmed by Ezcurra and Pascual (2008) who restrict the analysis to a panel of institutionally homogenous countries (12 EU countries) while focusing on the level of expenditure responsibilities. More recently, Bartolini et al. (2016) show the importance of a balanced fiscal structure at the subnational level, where local spending is mainly financed with local tax revenue. The authors show that countries in which local governments are responsible to finance most of their spending experience lower regional inequality. The greater autonomy of local administrators results in a powerful incentive to expand the tax base at the local level, through growth-enhancing policies. This is particularly relevant for lagging regions where resources are less likely to be exploited and inefficiencies in the system are larger. Bartolini et al. (2018) find that subnational governments that rely on own resources, rather than transfers from the central government, tend to allocate more spending to economic rather than social areas (i.e., local policies related to investment and the business environment). Similarly, Kappeler et al. (2013) show that higher tax decentralization is associated with a shift of local spending towards investment in infrastructure and education.

These empirical findings are important steps towards a better understanding of the impact of fiscal relations across tiers of governments on growth and regional convergence. They however represent an average effect that may mask the impact of country-specific institutional settings. For instance, Kyriacou et al. (2013) consider a panel of 24 OECD countries showing that fiscal decentralization reduces regional disparities, measured by GDP per capita, only in countries with a high government quality.[4] Indeed, improving the transparency and efficiency of the regulatory framework is also important to attract investments from outside the region and mobilise local resources. This argument is particularly important for the current analysis as it suggests that the impact of decentralization may depend on the level of corruption, low enforcement and, in general, on the quality of the public administration.

Unlike most of previous studies that focus on advanced economies, Rodriguez-Pose and Ezcurra (2010) (partially) look at low income countries. The authors use a panel of 26 countries (19 high income and 7 low income), finding a different effect of expenditure decentralization among the two group of countries. Whereas in low income economies fiscal decentralization tends to increase regional disparity, the opposite is observed among high-income economies. Lessman (2012) confirms the importance of the level of economic development showing that the interaction between fiscal decentralization and GDP per capita has a negative impact on regional disparities.

To sum up, the empirical evidence suggests that, under some conditions (e.g., quality of institutions, tax autonomy, etc.), fiscal decentralization can reduce regional inequality. However, results are mainly based on panels of advanced countries. Furthermore, the starting level of inequality differences across regions is mostly overlooked. The present work addresses these issues by explicitly considering regional inequality in an emerging economy – namely, Mexico – and using on several measures of regional autonomy.

3. Fiscal decentralization in Mexico: main features and recent trends

Mexico is a federal presidential state with a three-tier government structure. At the sub-national level Mexico has 32 States and Ciudad de Mexico, the capital, which is granted a particular status. The constitution defines that the states of the Federation are free, sovereign, autonomous and independent from one another. Mexican states have their own constitutions and can enact their own laws as long as

[4] Governance and the quality of government is measured using perception-based indicators of corruption, rule of law, and general effectiveness of the public administration. The authors used indicators provided in the International Country Risk Guide (ICRG), a publication of the PRS Group (available at https://www.prsgroup.com/explore-our-products/international-country-risk-guide/).

they do not contradict the national Constitution and laws. States have their own civil and penal codes as well as judiciary branch. Mexico has 2438 municipalities.

Mexico has been in practice quite centralized from a political and fiscal standpoint, until de 1980s, when the decentralization process was initiated with the objective of reducing poverty, inequality and improve the provision of public services and accountability (OECD, 2017; Giugalde and Webb, 2000). In 1980, VAT collection was centralized, and the National System of Fiscal Coordination (SNCF, Sistema Nacional de Coordinación Fiscal) was created with the objective of clarifying the rules around fiscal transfers, and avoiding double or triple taxation. The Constitution was subsequently amended in 1983, to decentralize public functions to states and municipalities while allowing for subnational governments to collect their own revenues. The responsibility to provide health and education services was transferred to States between 1995 and 1998. Important responsibilities in social programmes destined to alleviate poverty have also been passed to States.

As a result of the decentralization process the share of States and municipalities in public spending increased steadily and subnational governments are now responsible for 52% of total public expenditure and 80% of total public investment. States do most of the decentralized spending.

The decentralization of spending was not matched by an increase in subnational tax revenues but by greater federal earmarked transfers instead, in an effort to attain fiscal equalization across States. The main idea behind this arrangement was to promote the harmonization of public service delivery and promote regional convergence. Resources are gathered at the federal level and then distributed to states and municipal governments to implement a similar level of local public goods in all states and municipalities. In fact, between 1980 and 1990 most taxing powers were returned from subnational governments to the federal government.

An important reform carried out in 2007 sought to give sub-national entities more taxing powers and incentives to use them and improve transparency in public spending. States and municipalities have autonomy to set their own taxes rates and /or bases over the payroll tax (nómina), motor vehicle use and ownership taxes (tenencia), property (predial) taxes and user taxes. Also, specific formulas to allocate funds to States were also modified, in some cases with the aim to strengthen incentives to increase local tax efforts and local economic activity (eg. The *Fondo General de Participaciones*), in others to increase the redistributive features of the system (such as the modified formula of the fund earmarked for education, the FAEB, the largest earmarked transfer). Overall, the system of transfers, is overly complex, with many dispersed funds and complex formulas used by the different transfer mechanisms (World Bank, 2016).

The 2007 reforms have also not resolved the vertical fiscal gap, the largest among OECD countries. State own revenues to total revenues has declined over time, from 32% in 1990 of their total resources on average to less than 10%. Mexican States are therefore very far from fully self-financing their spending. It has been argued that large federal transfers do not incentivize the collection of taxes at the State and municipal level given its political cost and the resources needed to administer them (OECD, 2013; OECD, 2017; OECD, 2018; World Bank, 2016). For instance, revenues from property taxes amount to only 0.3% of GDP against the OECD average of 1.9%. Still, there are large differences in the ability to collect revenues across States. While own resources in the Nuevo León account for more than 20% of total revenues, these are less 3% in Tlaxcala.

While the large fiscal gap eliminates one channel identified in the literature through which fiscal federalism may stimulate regional growth and convergence, the large historical inequalities of income in Mexico, production structures and thereby ability to collect taxes, may justify the centralization of revenues for subsequent redistribution to stimulate regional growth and promote catch-up. We take this question to the data. We construct several indicators of fiscal decentralization to investigate its effect on income inequality and catch up among Mexican regions.

4. Regional growth and convergence

We gather yearly data from 1997 to 2017 for the 32 *Entidades Federativas*, i.e., the 31 States plus Mexico City. Most data come from Mexico's National Institute of Statistics and Geography (INEGI), which collects a significant amount of information at the State, and for some series, at the local level.[5] This section presents some stylized facts about the level and trend of regional disparities and the measures of fiscal decentralization used in the paper.

The main dependent variable of interest is State-level GDP per capita, $GDP\_pc_{i,t}$, collected in constant Mexican pesos (2013 base year) for each year t.[6] Throughout the sample period, the average national GDP per capita in Mexico is 117,810 pesos (about 5,970 USD). There is a high heterogeneity across States, with GDP per capita ranging from a minimum 52,133 pesos (2,716 USD) in Chiapas to a maximum of 345,896 pesos (18,019 USD) in Mexico City. The State of Campeche also stands out. The large oil sector accounts for about 80% of the State GDP and the Index of Economic Specialization in the oil industry is, by far, the highest across all Mexican states (CESOP, 2017). Moreover, the State's

[5] For more details, see INEGI's website: https://www.inegi.org.mx/datos/.

[6] Unless otherwise specified, all variables are measured in constant Mexican Pesos (pesos) throughout the paper.

low population inflates the State's GDP per capita, which could bias our results. We have therefore excluded Campeche from the analysis.[7]

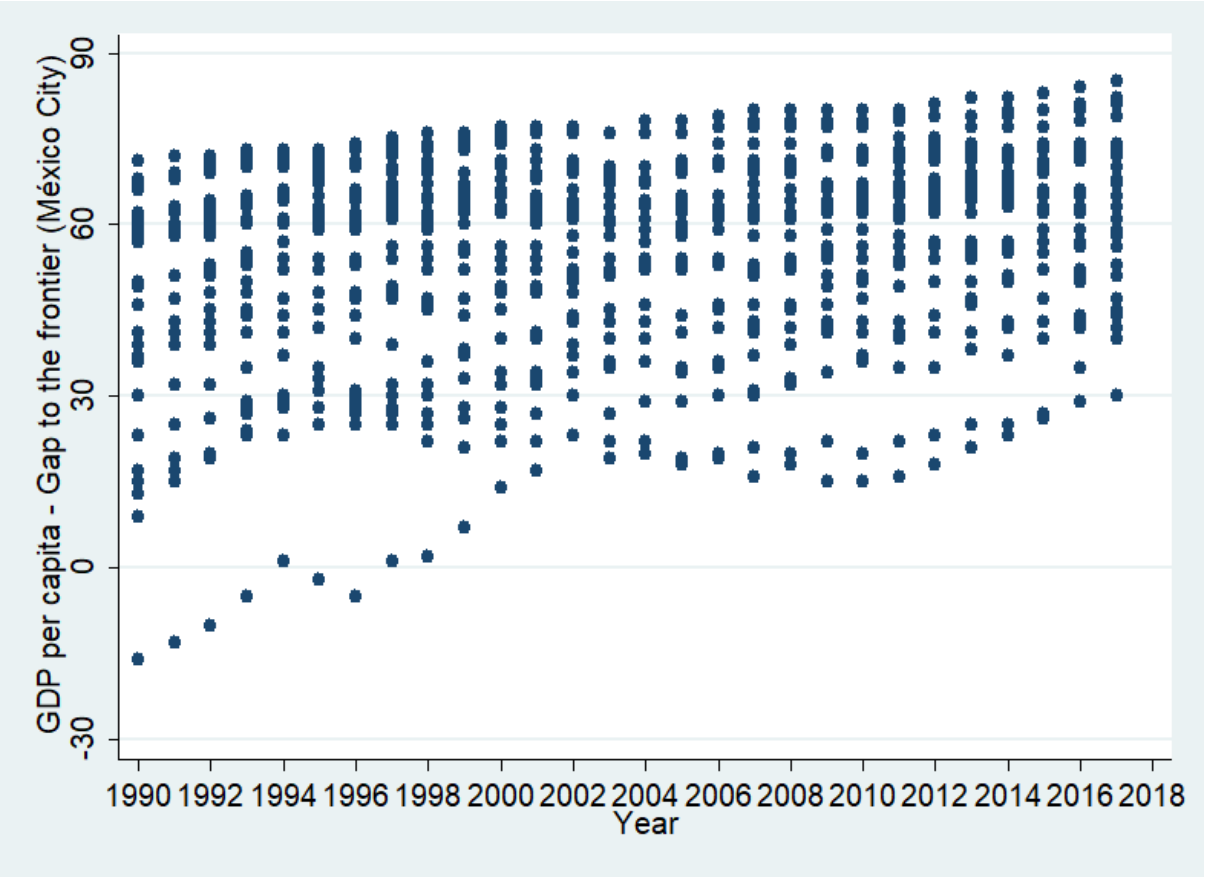
We are also interested in understanding the role played by fiscal decentralization in promoting regional convergence. We measure convergence in terms of the relative distance to the frontier (beta-convergence). With this purpose, we compute an index, $Gap_{i,t}$ which measures the distance of each State GDP per capita to the State with the highest GDP per capita level in each year. This State is invariability Mexico City throughout the sample period. Mexican states are then ranked according to their distance to Mexico City, which is normalized to 100.

This specification provides an even clearer picture of the high heterogeneity in output per capita across the Mexican territory. One advantage of using the gap rather than GDP per capita as dependent variable is that the first specification mitigates the bias that Mexico City could introduce in our baseline model, as most of the states lag significantly behind Mexico City. The GDP per capita in most States is less than half of the GDP per capita in Mexico City (Figure 3). At the extreme, GDP per capita in Chiapas is just 25% of the GDP per capita in Mexico City.

Beyond the huge heterogeneity in income per capita, a more worrisome trend is observed. Instead of poorer states catching-up, there is an ongoing process of divergence in income per capital levels process with respect to Mexico City. Figure 4 nicely illustrates this. States are ranked with respect to their gap to the frontier (Mexico City) at the beginning (1990) and the end (2017) of the period covered by our study. All states have performed worse than México City and, hence, their respective gaps to the frontier have increased when comparing the two extremes of our time series. Even Tabasco which, at the beginning of our sample, had a larger GDP per capita than Mexico City (hence, a negative index) has performed significantly worse than Mexico City and, in 2017, lagged 40% behind the frontier. It is interesting to note that there has been quite a significant change in the ranking of States with respect to their distance to the frontier, i.e. some States have been diverging faster than others with respect to Mexico City. For instance, Quintana Roo, State with the level of GDP per capita closet to Mexico City in 1990, significantly increased its gap from 9 to 53 and, hence, was outperformed by Nuevo León, Coahuila, Querétaro, Sonora, Baja California Sur and Aguascalientes, all States with smaller gaps than Quintana Roo in 2017.

[7] We re-estimated the models including the non-oil GDP for Campeche. Results do not vary significantly and are available upon request.

Figure 3. Income Gap to the frontier, by year

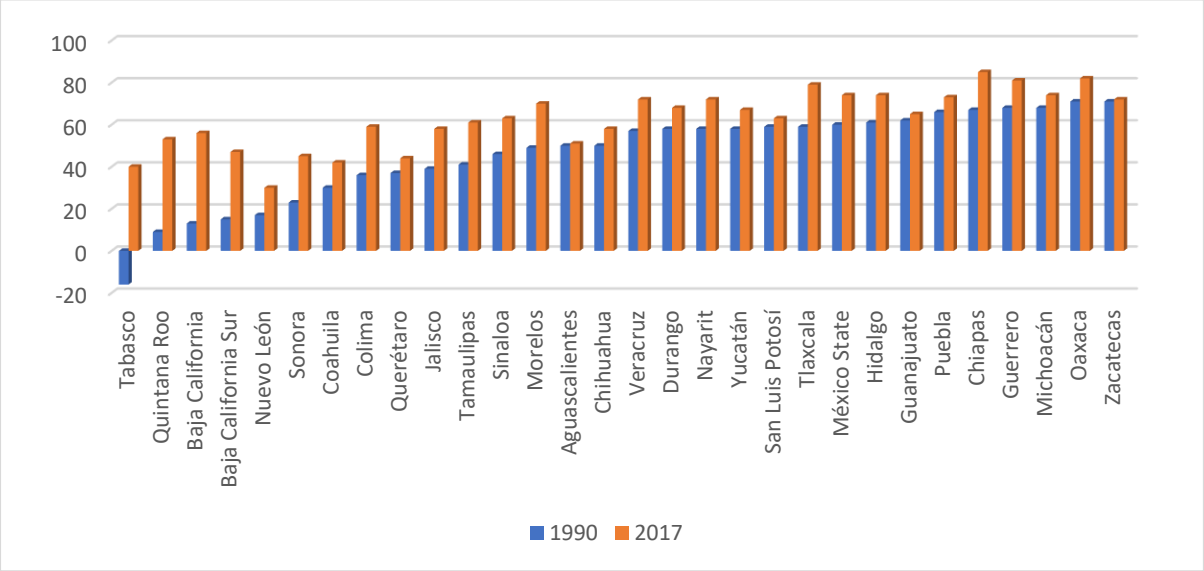


Source: Authors' calculations.

Figure 5 provides a more complete picture. It shows the time evolution of $Gap_{i,t}$ for all states during the almost 3 decades covered by this study. Again, although some states show short periods of catch-up *vis-à-vis* México City (e.g. Coahuila went down from 37 in 1994 to 27 in 1998), no state has reduced the distance to the frontier over the entire 1990-2017 period.

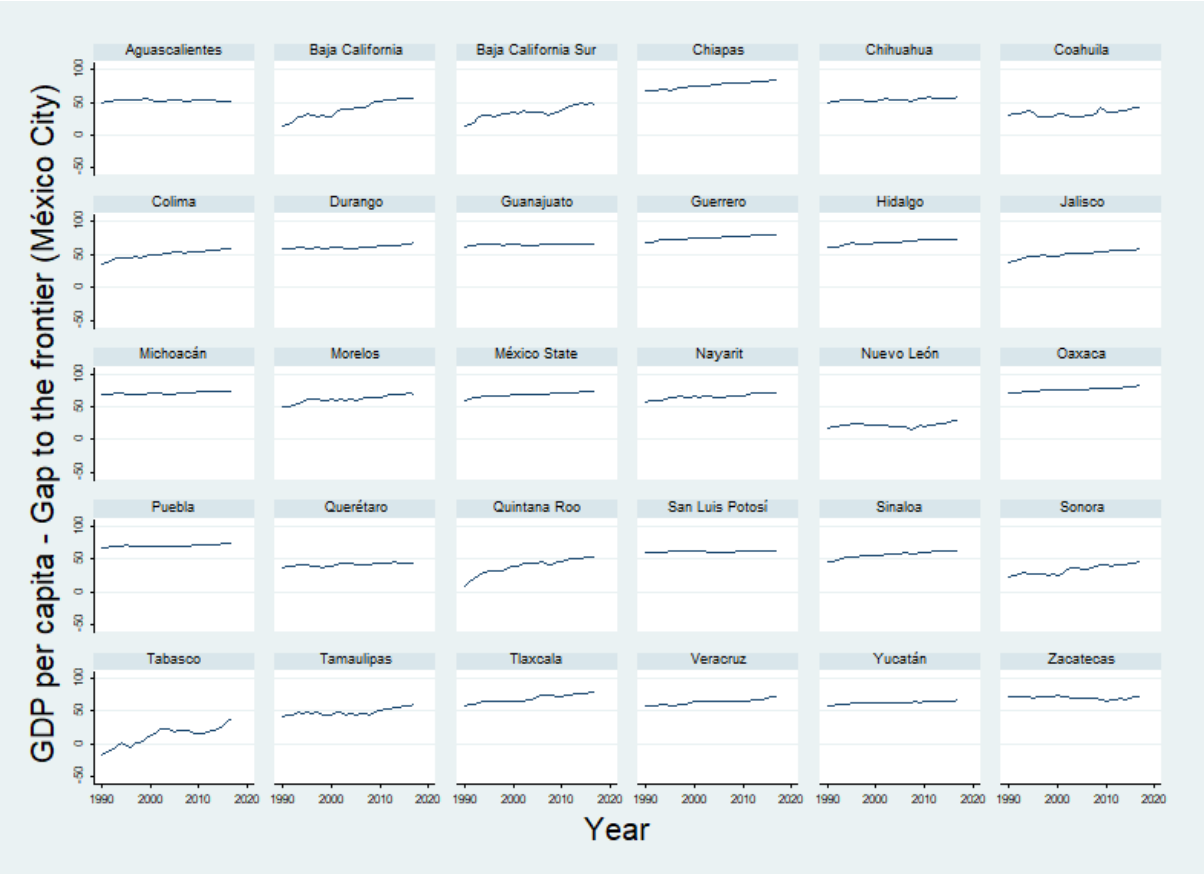
Figure 6 offers another look into the diverging income levels across Mexico. The figure plots the time evolution of GDP per capita for the states with the minimum (Chiapas), maximum (Mexico City), median (San Luis Potosí) and closest to the mean (Chihuahua) GDP per capita over the sample period. Figure 6 highlights the nature of the regional divergence dynamics in motion is Mexico, which is driven by the growth of Mexico City's GDP per capita and the (nearly) economic stagnation of other regions, including the poorest State, Chiapas.

Figure 4. Gap to the frontier (1990 and 2017), sorted by distance to the frontier in 1990



Source: Authors' calculations.

Figure 5. Time evolution of the Gap to the frontier, by State



Source: Authors' calculations.

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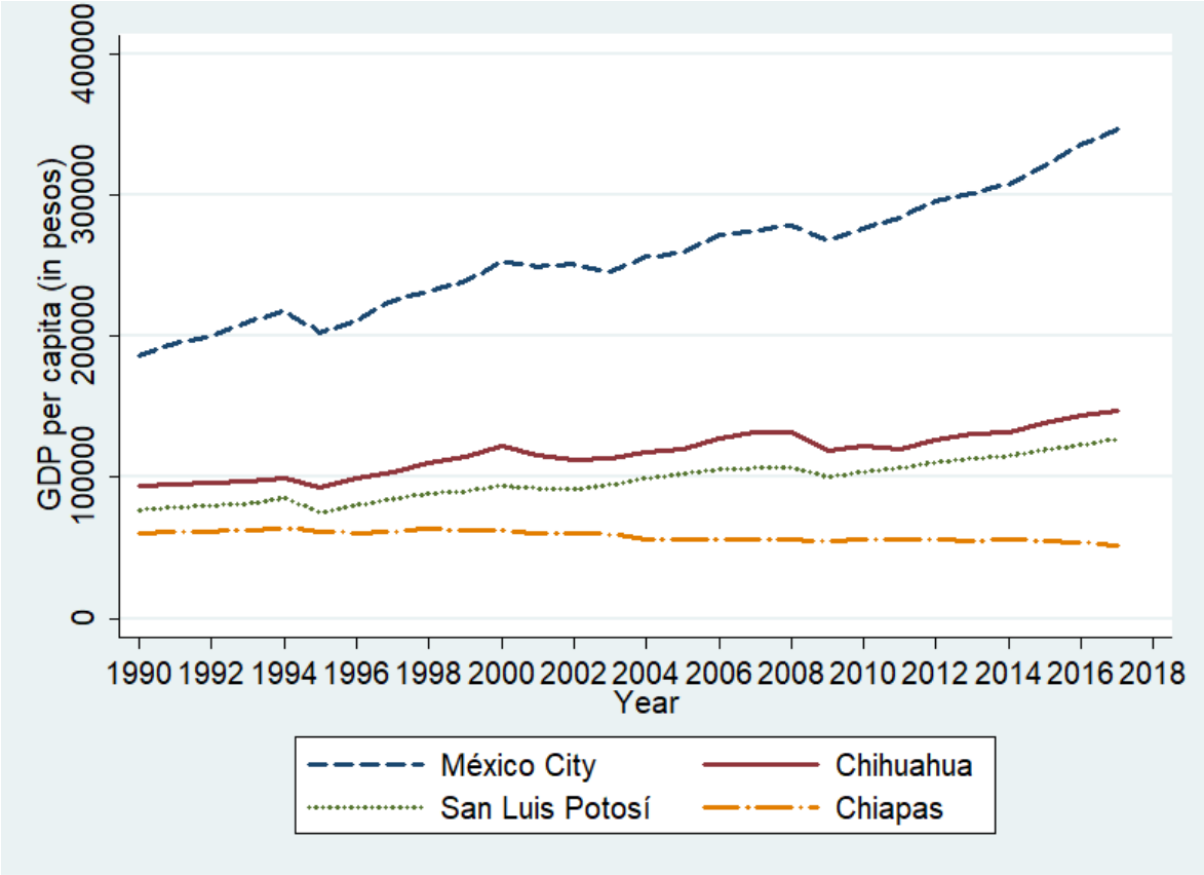
Figure 6. Time evolution of the Gap per capita in selected States



Source: Authors' calculations.

5. Empirical strategy

5.1. The econometric model and the data

To assess the impact of fiscal federalism on regional disparities among Mexican states we follow Bartolini et al. (2016), who study the role played by intergovernmental fiscal frameworks in shaping development between and within 30 OECD countries, and estimate the following baseline model:

$$Y_{i,t} = \beta_0 + \beta_1 FD_{i,t} + \beta \boldsymbol{X}_{i,t} + \delta_i + \gamma_t + \varepsilon_{i;t}, \qquad (1)$$

where $Y_{i,t}$ represents (the log of) GDP per capita in State *i* at year *t* and $FD_{i,t}$ denotes the specific measures of decentralization used in this study and described above. The matrix $\boldsymbol{X}_{i,t}$ denotes the set of control variables listed in Table 1. It includes socioeconomic variables and structural characteristics of Mexican States, such as the presence of the oil sector and the share of informality. Finally, δ_i and γ_t are the State and year fixed effects, and $\varepsilon_{i;t}$ is the error term.

However Bartolini et al. (2016) focus on OECD countries, with results mainly driven by fiscal relations in advanced economies. Focusing on Mexico will provide results that are better tailored to an emerging economy. Empirical studies of the effects of fiscal decentralization on inequality in low income and emerging economies are relatively scarce. For instance, Savitri (2012) assesses the impact of fiscal decentralization on income inequality in 30 Indonesian provinces finding a positive and significant effect. Likewise, Liu et al. (2016) use a nationwide county-level panel dataset for the 1995–2009 year to assess the impact of fiscal decentralization and fiscal equalization (both measured at the sub-provincial level) on intra-provincial inequality in China. The authors find that, while fiscal decentralization at the sub-provincial level in China leads to larger intra-provincial inequality, fiscal equalization tends to mitigate such an effect.

Our dataset consists of yearly observations over the period 1990-2017, for 32 Mexican *Entidades Federativas*, i.e. 31 States plus Mexico City. The State of Campeche is not included because its high GDP per capital reflects the presence of the large oil industry. We have re-estimated the models including the non-oil GDP of the State as a robustness check. Results do not change significantly and are available upon request.

The regressor of interest is $FD_{i,t}$. In the baseline model we consider three indicators of fiscal decentralization, (FD) which capture main features of revenue allocation: i) total revenue in state *i* at year *t*, measured in per capita terms ($Rev\_Tot_{i,t}$); ii) tax revenue as share of the state GDP ($Tax\_GDP_{i,t}$); iii) the dependency ratio ($Dep\_ratio_{i,t}$), which captures the share of federal transfers in total State revenues– both earmarked (*aportaciones)* and non-earmarked (*participaciones).* This three fiscal decentralization indicators are introduced one at a time, to avoid concerns of multicollinearity. However, the bi-lateral correlation between these indicators is not very large (Table 2).

In addition to the fiscal indicators, we include a set of State-specific socio-economic control variables such as population ($Pop_{i,t}$), share of employment ($Empl_{i,t}$), share of informal employment ($Empl\_Inf_{i,t}$) and $Educ\_H_{i,t}$ - which captures the share of population with at least secondary education attainment.[8] Whereas informality is often associated with higher levels of inequality, the opposite is

[8] In order to get a larger number of observations of $Pop_{i,t}$, we merged two different datasets provided by INEGI. Whereas one provides yearly data from 1990 to 2010, the other is based on the business census, which is run every 5 years. Hence, to complete the yearly time series for the latter, we filled-in the missing years between

true for the level of education. The inclusion of the state population is particularly relevant since our dependent variable also depends on the size of the population. In other words, by controlling for population size, we rule out the mechanical effect that the size of the population could have on our dependent variable, $GDP\_pc_{i,t}$, e.g. through migration. Finally, we include a dummy ($Oil_{i,t}$) that equals 1 for the 8 oil and gas producing States and 0 for the other States.[9] Oil revenues tend to be concentrated in few firms, while significantly contributing to the state GDP level, therefore it would bias upward the GDP per capita indicator, in particular when it comes to small States such as Tamaulipas.

Table 1 presents the summary statistics and table 2 the correlation matrix.

Table 1. Summary statistics

Variable	Units	N	Mean	Std. Dev.	Min	Max
GDP per capita	1,000	868	117.81	50.32	52.13	345.90
Gap to frontier	0-100	868	53.51	19.75	-16	85
Total revenue per capita	1,000	868	7.92	6.08	0.16	29.39
Tax-to-GDP ratio	%	868	0.22	0.25	0.01	1.77
Dependency ratio	%	868	81.59	14.91	19.58	97.72
Free revenue ratio	%	868	45.71	17.87	14.45	97.76
Capital spending ratio	%	868	8.99	6.59	0	57.25
Population	100,000	868	32.96	27.85	3.18	174.55
Employment	100,000	403	15.33	12.76	2.42	74.50
Informal	%	403	58.14	12.55	35.22	83.42
High education	%	403	52.53	8.99	27.44	71.02
Oil	Dummy	868	0.26	0.44	0	1

Table 2. Correlation matrix

	GDP pc	Gap	Total	Tax-to-GDP	Dependency	Free Rev	Capital	Population	Employment	Informal	High Educ	Oil
GDP per capita	1.0000											
Gap to frontier	-0.9758	1.0000										
Total revenue per capita	0.3277	-0.1727	1.0000									
Tax-to-GDP	0.3664	-0.2363	0.5832	1.0000								
Dependency ratio	-0.5163	0.4898	-0.3627	-0.5037	1.0000							
Free revenue	0.7163	-0.7082	-0.0601	0.3833	-0.2541	1.0000						
Capital spending ratio	-0.1100	0.0301	-0.2481	-0.3138	0.0275	-0.2454	1.0000					
Population	0.0070	0.0084	-0.1281	0.3547	-0.3866	0.3196	-0.1591	1.0000				
Employment	0.0625	-0.0447	-0.1099	0.3927	-0.4230	0.3657	-0.1723	0.9958	1.0000			
Informal	-0.6996	0.6884	-0.1494	-0.1899	0.4309	-0.4442	-0.0532	0.0780	0.0373	1.0000		
High education	0.6500	-0.5551	0.5713	0.5129	-0.4867	0.4158	-0.1561	0.0040	0.0536	-0.6539	1.0000	
Oil	0.1587	-0.1601	-0.0203	-0.1411	0.0360	0.0374	0.0023	0.1208	0.0957	0.0348	-0.0895	1.0000

the census waves by assuming that the variation was linear. Since from 2005 until 2010 we have data from both sources, we were able to check the consistency of this strategy and hence are confident about the results.

[9] In total, there are 9 States that benefit from the FEXHI since Campeche is also part of that group.

5.2. Expected Results

Greater magnitude of total revenue is expected to boost regional GDP per capita, i.e. when $FD_{i,t} = Rev\_Tot_{i,t}$, we expect $\beta_1 > 0$. This indicator is closely related to regional output and is not necessarily informative about the independent policies of the state government *vis-a-vis* the federal government. In order to analyse the impact of fiscal decentralization, it is crucial to determine the source of local resources. For instance, the mobilization of own (State) resources would generate a stream of revenue that is generally more stable and predictable than federal transfers – which are subject to political uncertainty. In addition, financing local spending with own taxes can strengthen the social contract between citizens and their government and thus improve governance. As a consequence, we expect a positive relation of tax-to-GDP ratio with output per capita, i.e., $\beta_1 > 0$. Finally, the overall dependence of the local budget on central government transfers is another indicator of the (in)dependence of the local government. A high dependency on federal transfers is unlikely to provide incentives to maximise spending efficiency or promote economic growth. Therefore, we expect $\beta_1 < 0$ when our fiscal decentralization variable represents dependency of the State budget on federal transfers ($FD_{i,t} = Dep\_ratio_{i,t}$). Table 3 summarizes the expected results for each of our FD indicators.

Table 3. Fiscal decentralization indicators – expected sign of coefficients

Fiscal decentralization indicators ($FD_{i,t}$)	**Expected sign**
$Rev\_Tot_{i,t}$	$\beta_1 > 0$
$Tax\_GDP_{i,t}$	$\beta_1 > 0$
$Dep\_Ratio_{i,t}$	$\beta_1 < 0$

6. Baseline results

All the coefficients estimated in our baseline model present the expected signs (Table 4). Total revenue as well as the share of taxes to total revenue have a positive effect on state-level output per capita (columns 1 and 2, respectively). Yet, whereas the former is statistically significant, the impact of $Tax\_GDP_{i,t}$ is not. Similarly, local governments with a lower dependency on federal transfers tend to have a higher output per capita (column 3). Finally, the inclusion of the time-varying control variables does not have a strong impact on the size of the coefficient, reducing the concern about potential selection bias (Altonji et al., 2005).[10]

[10] Results are not shown, but available under request to the authors.

Table 4. Impact of FD on output per capita, fixed effects estimates

FD variable	Tot rev pc	Tax-to-GDP	Depend ratio
Total revenue per capita	0.0903***		
	[0.0253]		
Population	-0.679***	-0.711***	-0.741***
	[0.116]	[0.113]	[0.117]
Employment	0.263***	0.258***	0.275***
	[0.0892]	[0.0887]	[0.0890]
Informal	-0.00680***	-0.00709***	-0.00695***
	[0.00139]	[0.00143]	[0.00147]
High education	0.00314*	0.00391**	0.00345*
	[0.00179]	[0.00186]	[0.00183]
Oil	0.613***	0.687***	0.696***
	[0.165]	[0.163]	[0.170]
Tax-to-GDP ratio		0.0342	
		[0.0219]	
Dependency ratio			-0.000856**
			[0.000351]
Observations	403	403	403

Note: The dependent variable in all specifications is $GDP\_pc_{i,t}$. Standard errors in brackets. * p<0.10, ** p<0.05, *** p<0.01.

The estimated coefficients for the different fiscal decentralization variables represent the elasticity of GDP per capita with respect to $FD_{i,t}$. For instance, on average, increasing $Rev\_Tot_{i,t}$ by 10 percentage points, increases $GDP\_pc_{i,t}$ by 9%. For the average state in our sample, this implies increasing GDP per capita by roughly 10,638 pesos (554 USD). On the other hand, increasing $Dep\_ratio_{i,t}$ by 10 percentage points, reduces $GDP\_pc_{i,t}$ by 0.1%, which (again, for the average state) implies a reduction in GDP per capita of roughly 106 pesos or 5.5 USD. However, both total revenue and tax-to-GDP ratio could be biased by reverse causality with respect to output per capita. In particular, an increase of output per capita can result in larger total revenue and larger tax revenue at the State level. By contrast, the dependency ratio is less affected by this endogeneity problem, as it is mostly determined by the institutional setting (i.e., the share of subsidies).

6.1. Driving Channels

The results of the baseline model do not say much about the channels through which increasing fiscal decentralization may lead to higher output per capita in Mexican states. In this section we try to identify the channel(s) that drive the results in the previous section. We start by looking at the attitude of local governments towards pro-growth spending. Although current spending could be very well

justified (e.g. when it comes to social spending in poor regions), capital investment is a key determinant of economic growth. We hence explore whether FD has any impact on the share of capital spending ($Exp\_K_{i,t}$) with respect to total spending at the state level.

$$Y_{i,t} = \beta_0 + \beta_1 FD_{i,t} + \beta \boldsymbol{X}_{i,t} + \delta_i + \gamma_t + \varepsilon_{i;t}, \qquad (2)$$

As observed in Table 5, the impact of our three FD variables on capital spending is the expected one, i.e. positive for total revenue (column 1) as well as tax-to-GDP (column 2) and negative for the dependency ratio (column 3), indicating that increasing decentralization is associated with larger share of state budget in capital spending. These results show that more fiscal responsibility at the State level would result in larger output per capital because of larger capital investments.

Table 5. Impact of FD on capital spending

	(1)	(2)	(3)	(4)
	Capital spending			
Total revenue per capita	12.510***			
	(2.418)			
Tax revenue to GDP		4.929**		
		(2.215)		
Dependency ratio			-0.115***	
			(0.039)	
Share of disposable revenue				-0.246***
				(0.070)
Population	2.890	-1.405	-5.610	-11.917
	(10.310)	(10.617)	(10.454)	(10.600)
Employment	1.980	1.232	3.576	5.028
	(7.740)	(8.026)	(7.924)	(7.901)
Informality	0.342***	0.302**	0.320**	0.281**
	(0.127)	(0.131)	(0.131)	(0.130)
High education share	0.156	0.264*	0.199	0.176
	(0.150)	(0.155)	(0.153)	(0.152)
Oil sector	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)
N	403	403	403	403

Note: Standard errors in brackets. * p<0.10, ** p<0.05, *** p<0.01.

Another important factor to consider is the share of federal transfers that can be freely used by the State governments, *participaciones*. Thus we consider an alternative model with the share of revenues that State governments can use without constraint ($Rev\_Free_{i,t}$), i.e. the share of revenues from *participaciones* plus tax revenues and social security contributions, over total revenues. A higher share of disposable transfers is associated with less capital spending, indicating that it is really the responsibility to raise own revenues (such as taxation) that provides the incentive to increase capital investment and thus promote regional growth.

6.2. Regional convergence

Although the evidence produces in the previous sections show that fiscal decentralization does increase output per capita in Mexican States, it does not provide any indication about convergence. If the impact is greater in richer states than in the poor ones, fiscal decentralization would actually increase regional inequality. decentralizationTo this effect we consider an alternative dependent variable: the gap, in terms of GDP per capita, of each state with respect to the frontier, i.e. the richest state (Mexico City in our sample). In other words, we estimate the following econometric model:

$$Y_{i,t} = \beta_0 + \beta_1 FD_{i,t} + \beta_2 \boldsymbol{X}_{i,t} + \delta_i + \gamma_t + \varepsilon_{i;t}, \qquad (3)$$

where the dependent variable $Y_{i,t} = Gap_{i,t}$.

A positive impact of FD on economic growth implies a reduction of the gap to the frontier, thus we expect the coefficients associated with the FD indicators to have an opposite sign than in the baseline model. Indeed, the estimation results present the expected signs (Table 6). However, only the coefficient associated with total revenue is statistically significant (column 1). When it comes to the magnitude of the impact, on average, increasing State revenues by 1% decreases the gap by almost 5%. The difference in the robustness of the results might be that, in this specification, estimates are computed over all states but Mexico City (the frontier).

Table 6. Regional convergence

	(1)	(2)	(3)	(4)	(5)	(6)
			Gap to the frontier			
Total revenue per capita	-4.916***			-6.256***		
	(1.272)			(1.290)		
tax revenue over GDP		-1.215			-3.485***	
		(1.153)			(1.332)	
Dependency ratio			0.004			-0.010
			(0.020)			(0.034)

Rich states				-32.114***	-2.780***	-3.263
				(7.517)	(0.984)	(3.644)
interaction w/tot rev				3.249***		
				(0.787)		
interaction w/tax					3.567***	
					(1.184)	
interaction w/dep						0.021
						(0.040)
population	36.836***	39.021***	39.886***	32.821***	35.540***	38.841***
	(5.423)	(5.527)	(5.479)	(5.384)	(5.549)	(5.515)
employment	-8.075**	-8.098*	-8.639**	-8.442**	-7.041*	-8.199**
	(4.071)	(4.178)	(4.153)	(3.983)	(4.132)	(4.161)
informality	0.214***	0.231***	0.232***	0.256***	0.264***	0.220***
	(0.067)	(0.068)	(0.068)	(0.067)	(0.070)	(0.069)
high education	-0.137*	-0.173**	-0.159**	-0.109	-0.151*	-0.170**
	(0.079)	(0.081)	(0.080)	(0.077)	(0.081)	(0.080)
Oil sector	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)
N	403	403	403	403	403	403

Note: The dependent variable in all specifications is $Gap_{i,t}$. Standard errors in brackets. * p<0.10, ** p<0.05, *** p<0.01.

The effect of FD could differ in rich and poor states. The problem is that poor states may lack the capacity to take advantage of fiscal autonomy thus benefitting less than rich states. We interact our fiscal decentralization variables with a dummy capturing whether a state is rich, i.e. GDP per capita larger to the mean of the GDP per capita distribution in our sample.[11],[12] Interestingly in this specification of the model tax revenue becomes statistically significant (column 5), increasing tax revenue reduces the gap with the frontier and the magnitude is lower for rich states (the interaction term is positive, reducing the effect on the gap), thus indicating that FD can promote convergence across Mexican states. The dependency on federal transfers does not have any significant effect on convergence.

[11] For the sake of simplicity, we only show the results for $FD_{i,t} = Rev\_Tot_{i,t}$. The results for the other specifications are available under request.

[12] We performed an independent t-test to compare the means of the two groups, rich and poor States. As expected, the group means are significantly different (at the 1% level). Indeed, the mean GDP per capita for the group of rich States is 127,882 pesos compared to 87,044 pesos for the group of poor States.

6.3. Instrumental variable approach

Establishing a strong causal link is always hard in non-experimental settings. In the case of fiscal decentralization is even harder due to potential reverse causality if GDP affects local revenues and expenditure. However, this is less of a problem when considering the distribution of taxing and spending powers between the centre and the subnational governments.

In addition, one can expect $GDP_{i,t}$ and $FD_{i,t}$ to be correlated but it is less likely that there exists correlation between $GDP_{i,t}$ and $FD_{i,t-1}$ or $FD_{i,t-2}$. Hence, in order to address this potential endogeneity bias, we implement an instrumental variables (IV) approach where we use the one- and two-periods lagged value of our fiscal decentralization variables ($FD_{i,t-1}$ and $FD_{i,t-2}$) as instruments for $FD_{i,t}$.[13]

In Table 7 we turn to the possible endogeneity issues as described in Section 5 and provide FE-2SLS estimates. We use the 1- and 2-periods lagged values of our fiscal decentralization variables as instruments. Our set of instruments performs quite well. We compute a weak identification test following Stock and Yogo (2002) and provide the 1st-stage F-statistic. In all specifications the F-statistic is larger than 10 suggesting that we are not in presence of weak instruments. When it comes to the exogeneity condition, the Sargan Test is also passed in all specifications.

Turning to our main coefficients, the estimates show the same sign than in Table 4. Yet, $Rev\_Tot_{i,t}$ as well as $Tax\_GDP_{i,t}$ are not statistically significant.

Table 7. Instrumental variables

[13] As an alternative, we followed Geys and Sorensen (2016) to instrument our fiscal decentralization variables with oil revenue ($Oil_{i,t}$). Yet, the instrument does not perform well in terms of weak instruments and the coefficients do not show the expected results. We attribute this poor performance to the fact that we have fairly little observations since, unlike Geys and Sorensen (2016) that rely on municipal-level data, only eight states in our sample benefit from the FEXHI. We hence decided not to show these results that are nonetheless available under request.

FD variable variable	Tot Rev pc	Tax-to-GDP	Depend ratio
Total revenue per capita	0.0337		
	[0.0491]		
Population	−0.494***	−0.448**	−0.371**
	[0.173]	[0.175]	[0.180]
Employment	0.501***	0.440**	0.339*
	[0.174]	[0.178]	[0.185]
Informal	−0.0193***	−0.0194***	−0.0179***
	[0.00122]	[0.00115]	[0.00118]
High education	0.0116***	0.0109***	0.0104***
	[0.00212]	[0.00190]	[0.00182]
Oil	0.175***	0.186***	0.187***
	[0.0253]	[0.0257]	[0.0254]
Tax-to-GDP ratio		0.0937	
		[0.0608]	
Dependency ratio			−0.00648**
			[0.00270]
Sargan test	0.660	0.308	0.036
	0.4167	0.5787	0.8490
Weak identif. Test	1315.211	1606.116	122.650
Observations	403	403	403

Note: The dependent variable in all specifications is $GDP\ pc_{i,t}$. $FD_{i,t}$ instrumented using all exogenous regressors plus lagged values of the variable, i.e. $FD_{i,t-1}$ and $FD_{i,t-2}$. Standard errors in brackets. Sargan Test of Overidentifying Restrictions: χ^2 above and P values below. Weak identification test: 1st-stage F-statistic. * p<0.10, ** p<0.05, *** p<0.01.

7. Summary of preliminary findings and future research

[to come].

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