Two to Tango: A Private-Public Approach to Productivity

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This paper offers an alternative explanation for regional productivity differences and the lack of convergence across regions, integrating concepts from managerial economics, development economics and political economy. It goes beyond traditional factors like physical capital, labor, and human capital. Utilizing data from a survey of 28,709 Mexican firms and governance and administrative data from 2,458 local governments, the study applies Bloom et al.'s (2017) concept of management as technology. It presents an empirical model linking firm productivity to internal and external factors, including firm and government management practices, measured using the World Management Survey (WMS) scoring grid, and argue that the government management score indicates the quality of public goods. Findings show that both firm and government management practices significantly impact productivity, measured as total factor productivity (TFP) and value added per worker. For example, one standard deviation increase in a firm's management score results in a 0.4%-0.6% in TFP or 7.4%-8.1% in value-added per worker. Similarly, one standard deviation increase in the government's management score leads to an increase in 1.2%-1.4% in TFP or 27.1%-37.1% in value-added per worker. The study addresses potential endogeneity between firms' internal management practices and quality of public goods, considering network or spillover effects intrinsic to technology, finding a strong positive connection between private management practices and public goods quality. The estimation strategy uses exogenous variation in state capacities using geo-distances from royal treasuries in the Viceroyalty of the New Spain (XVI-XIX centuries), where highly talented bureaucracy was nurtured to maximize tax revenues, and developed managerial capacities to optimize tax collection within their respective area of influence. Using data from Colegio de Mexico on distance to Royal Treasuries as instruments to current state capacity we find that closeness to royal treasuries during the Spanish colony explains government practices today measured by the government management scores.

Keywords – Management, technology, public good, productivity, spillovers, persistence, Mexico

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I. Introduction

Lack of income convergence and interregional differences have been subject to extensive study in growth theory and development economics. Mexico is a good case study; its export oriented economic model has successfully increased its competitiveness, promoted production diversification, and shifted the economy toward more complex industries (Padilla-Perez and Villarreal 2017; World Bank 2019). Structural economic and political reforms such as the autonomy of the Mexican Central Bank and the National Electoral Institute, the implementation of the North American Free Trade Agreement, and the end of the Institutional Revolutionary Party (PRI) hegemony in the 1990s, effectively improved macroeconomic stability, reduced inflation rates, attracted foreign capital, and paved the way to a maturing democratic system. However, it has not been sufficient to sustain robust economic growth. Since 1990, GDP growth has averaged only 2.3 percent annually, and GDP per capita relative to the United States has decreased from nearly 30 percent in 1990 to less than 20 percent in 2019.

In 2022 the World Bank published the report "Productivity Growth in Mexico, Understanding Main Dynamics and Key Drivers" that analyzes three decades of Mexico's low economic performance between 1990 and 2019, the World Bank concludes that during Mexico's meager economic performance has been driven mainly by labor force growth, due to a young population actively participating in the labor market -demographic dividend-, and also, by capital investment such as machinery, equipment and infrastructure. Moreover, GDP per worker (in constant US dollars calculated at purchasing power parity) increased at a annual rate of only 0.1 percent between 1991 and 2020, well below the growth comparable economies, such as the Republic of Korea (3.3 percent) and the Czech Republic (2 percent), or even OECD and Latin American averages of 1.1 and 0.8 percent, respectively. When decomposing the average annual contribution to growth of Mexico in comparison to other similar economies, the study found wide differences of TFP contribution to growth across the sample of comparable countries. Romania is at the top of TFP's contribution, explaining around 4% of average annual growth, while Mexico's and Brazil's TFP contribution has been negative, meaning that the factor accumulation of labor and capital has been offset by negative productivity growth. In fact, average labor productivity did not improve between 1990 and 2019, or even worsened marginally.

Countries heterogeneity in productivity is also present across states, sectors, and firms, especially in developing countries where diversity of decision patterns and outcomes are palpable (Hsieh and Klenow, 2009), and decisions are especially sensitive for owners who are reactive to fears and beliefs, mainly for major management decisions. Evidence of productive firms in developing countries like India, China, and Mexico show that they do not expand as rapidly as their US counterparts due to a mix of financial -specially for smaller firms- and organizational factors -mainly in larger firms- (Bartelsman, et al., 2009, Hsieh and Klenow, 2009). Other factors which exhibit considerable variation such as formalization (Assenova and Sorenson, 2017; Sine et al, 2005; Jiang and Bansal, 2003); investment and financing decisions, market expansions, product innovation, and location, may also play a role in the diversity observed. For the Mexican case, the gap between the highest and lowest productivity performers is substantial, with states like Nuevo León exhibiting productivity levels akin to those of Korea, while others such as Chiapas or Oaxaca

possess productive capacities comparable to Honduras. These disparities in regional GDP per capita and productivity within Mexico exceed those observed in any other OECD country.

Understanding Mexico's overall productivity requires analyzing this heterogeneity across- and within regions and sectors. One recurred explanation in the Mexican case is the growing informal sector, since informal enterprises have low productivity by nature due to its small size, lack of access to credit, ineffective management skills and practices, limited capacity for innovation and adoption of advanced technology, and vulnerability to crime among other explanations. Yet, heterogeneity in productivity is also very present in formal firms.

The World Bank report (2022) raised a new set of questions on whether there are frictions that could generate misallocation of resources or inefficiencies within the firm, explaining the spread of firms' productivity as well as low productivity itself. In fact, Bloom et al. (2022) found strong correlation between Mexican firm's size-management relation -an indicator of misallocation- and variables that reflect weaker governmental institutions such as contract enforcement, crime, and corruption. Along the same lines, Acemoglu and Dell (2010) showed preliminary evidence on the importance of local public goods and institutions within countries in the Americas, which are especially divergent in countries with federal systems, such as Mexico and Brazil, where states and municipalities have significant authonomy in resources allocation, de jure institutions, and de facto institutions. They show that differences in access to paved roads are highly correlated with individual incomes, connecting "public goods and economic prosperity to specific local institutions".

This study proposes a novel approach that amalgamates management and new institutional theories to explain persistent low productivity and its heterogeneity across- and within- regions based on technology adoption. It shows that expanding the concept of management as technology to the public sector, formally presented by Bloom et al. (2017), adds significant information to explain differences in productivity by considering the quality of public goods provision as an explanatory variable to total factor productivity (TFP) and value added per worker (VA). Also, this paper explores the complex interaction of firms and governments *together*, providing an additional version of low productivity persistence, enlightening the discussion on low-productivity traps that certain economies experience.

To reach its goals, this paper faces several challenges. First, measuring the quality of public goods, which is solved using as reference the management score developed by Bloom et al. (2017) for the private sector, among other alternatives empirical techniques. Second, providing a valid connection between private and public sector practices tested empirically by exploiting exogenous sources of variations at local level using microdata. Third, developing a reasonable foundation for such interactions to explain how they affect productivity.

The remainder of this paper is organized as follows. Section 2 reviews existing literature on productivity differentials in developing countries. Section 3 discusses the role of state capacity in the value creation process that motivates the research agenda of this paper, and portrays the basic empirical model used. Section 4 describes the microdata of firms

and the local governments data used in Section 5, where I propose a measurement of government management managements practices as a proxy of quality of local public goods. Section 6 displays the empirical results using different strategies to measure the impact of private and public management practices in TFP and VA of Mexican firms, including exogenous sources of variations at local level caused by institutional factors, and the technology adoption channel as reinforcement mechanism. Section 6 concludes.

II. About heterogeneity and lack of convergence

Scholarship addressing productivity heterogeneity and persistence predominantly concentrates on technological variances within individual firms. Notably, Howitt (2000) and Klenow and Rodríguez-Clare (2005) illustrate how substantial TFP gaps can arise due to sluggish technology diffusion from advanced to other nations. These frameworks depict inefficiencies within firms, with the degree of inefficiency varying across different countries.

Acemoglu and Dell (2010) identified considerable variations in incomes within countries and across municipalities in the Americas that are unaccounted for by observable levels of human capital, as depicted in the residual labor income. They hypothesize a linkage between the origins of within-country and between-country disparities, and present a basic model that integrates variances in technological adoption and expertise among countries and variances in productive efficiency within countries. Their model allows within-country inequalities in equilibirum, originated from regional differences business conditions, public goods, and a skilled workforce, directly reducing the country's income (because some regions are poorer) and indirectly reducing it (because technology adoption at the national level becomes less profitable).

A model proposed and estimated by Acemoglu et al. (2015) study the effect of state capacity of Colombian municipalities on public goods provision and its impact on prosperity considering spillover effects. They conceptualize "state capacity" as the presence of state functionaries and agencies since local state capacity determined at the local level, for instance, services to businesses (notary offices, deed registry offices and tax collection offices), health services (health centers and posts), education services (schools and libraries), public safety services (fire stations and jails). In their model, local and national state capacity are a network game in which each municipality invests in local state capacity, where spillovers created by other municipalities and the decisions of the national government generated. Their estimates indicate that the spillover effect of public good provision is considerable, explaining almost half of the overall impact on economic prosperity, and offering a new rationale on why regional disparities' origin and prevalence.

Bloom et al (2022) explore the misallocation hypothesis comparing management practices of firms' in Mexico and the United States. They found that management practices are closely linked with heightened levels of productivity, growth, trade, and innovation. One indication of higher misallocation in Mexico is the diminished correlation between firm size and effective management, particularly evident in the heavily distorted Mexican service sector. Additionally,

the relationship between size and management quality is less pronounced in smaller markets, as evidenced by proximity to the US for manufacturing enterprises and population density for service-oriented businesses. Finally, they found something particularly relevant for our purposes: in municipalities with weaker institutional frameworks, as gauged by factors such as contract enforcement, crime rates, and corruption, there is a weaker connection between firm size and management effectiveness. Namely, there is higher heterogeneity of TFP. Moreover, the authors found that in recent years, productivity disparities have widened further since low-productivity states are not experiencing rapid enough growth, and high-productivity states continue to augment their levels of value added per worker. These findings align with the notion that impediments dampening overall management quality and productivity are at play.

Regarding income convergence, Eric Bartelsman, John Haltiwanger and Stefano Scarpetta (2009) and Chang-Tai Hsieh and Peter Klenow (2009) showed that productive firms in developing countries like India and China do not expand as rapidly as their US counterparts is due to a mix of financial factors (particularly for smaller firms) and organizational factors (particularly for larger firms). For the Mexican case, Esquivel and Messmacher (2002) found that convergence has not realized, while Chiquiar (2005) and Rodríguez and Sánchez (2002) argued that the economic liberalization of the 1990s halted the convergence process among Mexican regions and exacerbated dispersion, suggesting that trade reforms had adverse effects on poorer regions, as they were unable to leverage the new growth opportunities presented by international trade.

When focusing on (mis)management as potential explanation of such diversity of productivity across- and within-regions I could identify several alternative transmission channels documented by researchers: (a) the role of top-management as studied by Pérez-González (2006), Bennedsen et al (2007), and Bennedsen et al(2020); (b) applicable management practices as found by Bloom et al (2013) and Bloom et al (2022), and (b) other type of "technology" as explained by Bloom, Sadun and van Reenen (2017). The relevance of differentiating the channels of transmission of (mis)management is central for understanding low and heterogeneous productivity in emerging countries where individuals and context have a key importance.

III. Productivity, Firm's Managements and Public Goods

If across- and within-regions differences could be explained by the discrepancy in access to technology, it is worth deepening our understanding on *what "technology" is and how affects productivity*. Bloom, Sadun & van Reenen (2017) expanded the "technology" concept to include management practices, claiming there is evidence that they are technology (in spite of capital) because there are *contagious*, meaning, they are easily learned, adopted and transmited. Furthermre, the authors found that difference in management practices explain around 30% of total differences in TFP between countries and firms. If such is the case in firms, one could image that management practices in governments could also affect aggregate productivity and growth through various channels. Exploring this line of thought motivates this research trying to answer the following questions: *What are the internal and external root causes behind TFP differentials? If firm's management affect productivity by determining allocation efficiency internally, does the context*

such as quality of public goods also impact allocation efficiency though external channels? Are these private (internal) and public (external) channels interrelated?

In fact, governments are at the center of value generation in all economies. They protect property rights, resolve market failures - such as monopolies and externalities - and promote productive investment. They are the providers of public goods par excellence, for example, infrastructure on transportation and energy, education and health services, public safety, economic competition, and the fight against inflation, which could not be enjoyed without the taxes they collect and spend. These public goods and services influence the decisions made by firms affecting their productivity through different channels: investment and financing decisions, market expansions, product innovation, location, among others. To increase value creation through public goods and access to technology, states should be capable of delivering their goods and services.

Consider governmental interventions, such as legislation bolstering union influence, potentially hindering firms from adopting new technologies that could impact labor conditions. These technologies might encompass computer integration in daily operations, mandatory training in innovative production methods, revised promotion criteria like performance-based incentives, or the recent exploration of artificial intelligence applications for specific tasks. Additionally, governmental actions like trade barriers, ostensibly erected to safeguard domestic industries, can further impede access to foreign technologies, exacerbating TFP disparities.

Public management is as complex as private. Mosqueira and Alessandro (2023) studied the public management challenges in addressing societal problems such as inequality and climate change in LAC that showed limited improvements, despite increased resources applied to address them. They refer these challenges as "wicked" because are not linear, have complex-cause-effect relationships, present a high degree of uncertainty, combine several connected subsets or overlapping problems, involve many stakeholders, and generate spillover effects that create or reinforce other social problems. Therefore, logical frameworks and project management methodologies may not work because "complex systems demand an approach that emphasizes collaboration among multiple actors, experimentation, learning, and continuous adjustment. For instance, the development of fiscal rules or the design of pension systems is complicated, but not complex. By contrast, a child's development, which is affected by multiple case-specific environmental, social, health, educational, and household factors, is a complex matter (Kamensky, 2011; Diamond, 2021)."

Including the role of the public sector in the value generation process could also explain such heterogeneity through at least three different channels: (i) governments structures, meaning sectoral agencies with rigid normative frameworks that are based on linear actions plans where a determined input could produce very different outcomes; (ii) vertical implementation of policies and rigidity of regulatory frameworks hinder interagency collaboration, innovation, and experimentation, which may explain diversity of outcomes (and why complex human development

problems have not been solved regardless increasing public budgets); and (iii) public top-management, whose knowledge, beliefs and fears influence the decision-making process.

A Simple Model on Productivity and Quality of Public Goods

Let's start with a simple linear model to conceptualize what is the role of government's and firms' management practices in productivity, and expand our understanding of between and within-regions differences. Bloom et al (2017) developed a survey methodology known as the World Management Survey (WMS) that uses an interview-based evaluation tool that defines 18 basic management practices and scores them from one ("worst practice") to five ("best practice") on a scoring grid. The management score of each individual practice is the average across all questions form their questionnaire on managerial practices, and z-scored this average so the management index has a standard deviation of unity. The simple linear regression model form, derived from the classic Cobb-Douglas function, is

$$lnQ_{it} = \alpha_M M_{it} + \alpha_L lnL_{it} + \alpha_K lnK_{it} + \alpha_X X_{it} + u_{it}, \quad (1)$$

where M_{it} is the empirical management score, x_{it} is a vector of other controls such as the proportion of employees with a college degree, firm age, noise controls (e.g. interviewer dummies), country and three-digit SIC industry dummies and u_{it} is an error term. Notice that the empirical measure of management here, M_{it}, corresponds to the log of the managerial capital stock (lnM_{it}) in the theory. To measure firm performance they used company accounts data, estimating Q_{it} as TFP and alternatively as the value added per worker of firm i at time t. X_{it} are a set of controls at firm's level.

This functional form does not allow to differentiate internal factors, such as firm's managerial practices, and external factors like business conditions and quality of public goods, that directly affect the level of production and influence onf the profitability of technology adoption.

The straightforward linear model extended from Bloom et al (2017) would be:

$$lnQ_{ijt} = \beta_M M_{ijt} + \beta_G G_{jt} + \beta_L lnL_{ijt} + \beta_K lnK_{ijt} + \beta_X X_{ijt} + \beta_Z Z_{jt} + \varepsilon_{ijt}, \quad (2)$$

where G_{jt} is a measure of quality of public goods in jurisdiction j in time t where firm i locates. β_G is the parameter of interest. X_{ijt} are the same firm's level control variables, and Z_{jt} are other municipal control variables included to better identify the parameter of interest, such as geographical coordinates and municipal budget. Nevertheless, there are certain complexities than need to be resolved to identify it properly. The challenge to incorporate external factors such as the quality of public goods is twofold: (i) We should be able to understand what determines quality, and (i) how to measure it properly.

State Capacity, Quality of Public Goods and Government Management Practices

One approach is using Acemoglu et al. (2015) concept of "state capacity" as the presence of state functionaries and agencies since local state capacity are determined at the local level, for instance, services to businesses (notary offices, deed registry offices and tax collection offices), health services (health centers and posts), education services (schools and libraries), and public safety services (fire stations and jails). They estimate this public presence's direct and indirect impact on diverse prosperity indicators: life quality, public utilities coverage rate, fraction of population above poverty line, primary and secondary enrollment rate, and vaccination coverage rate.

But state capacity is a concept that should incorporate both *quantity* and *quality* of public goods. We could conceive it as an outcome of the complex non-linear system behind public administrations (Mosqueira and Alessandro, 2023). I opt to measure government managerial practices using the World Management Survey methodology based on the logic that managerial practices are catalyzers of productivity due to their impact in the efficient use of scarce resources either through sound leadership, problem-solving capacity, systematic performance monitoring, target setting, or providing incentives for good performance, among others.

IV. Data

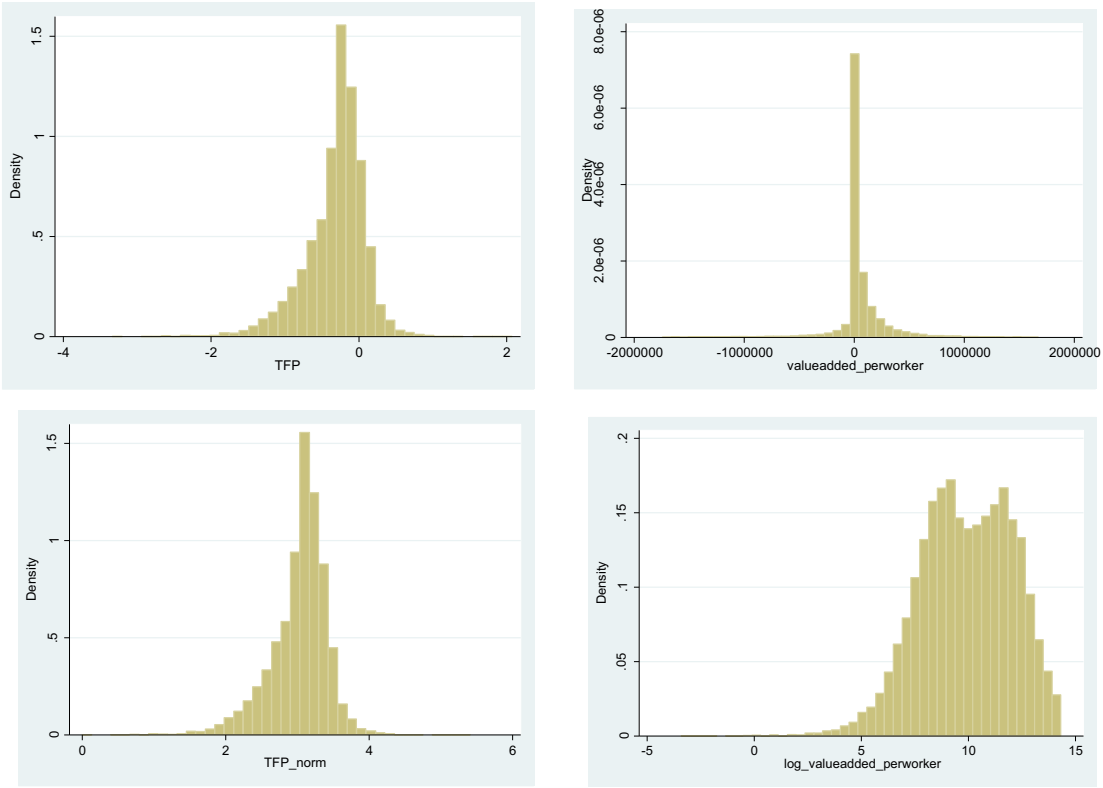
I use two surveys to obtain information to measure management practices and state capacity. For the former I used sectorial data obtained from the National Survey on Productivity and Competitiveness of Micro, Small, Medium and Large Firms (ENAPROCE), which provides national information on management and entrepreneurship skills, as well as the government support they receive, to contribute to the promotion of business culture in our country. It contains 16 questions on Management Quality that reflect three main dimensions on managerial decision-processes: (i) design and use of indicators to measure performance, (ii) decision-making process in production, and (iii) employee's compensation and promotion mechanisms. The first wave was conducted in 2013 and the second in 2018, obtaining data from 16,353 and 15,321 small, medium, and large firms, respectively. These survey waves provide valuable data on the productivity and competitiveness of companies in Mexico at different times, helping to understand trends and changes in the country's business environment.

For state capacity and government practices I use the National Census of Municipal Governments and Territorial Jurisdictions of Mexico City (CNGMD) performed to all 2,458 municipalities every two years. Its objective is to generate statistical and geographical information on the management and performance of the institutions that make up the Public Administration of each municipality and jurisdiction of Mexico City, specifically in the functions of government, public security, civic justice, drinking water, sanitation, urban solid waste and the environment, with the purpose of linking it with the government's work within the process of design, implementation, monitoring and evaluation of public policies of national scope on the aforementioned topics[3]. It includes valuable information such as

[3] Censo Nacional de Gobiernos Municipales y Demarcaciones Territoriales in Spanish. https://www.inegi.org.mx/programas/cngmd/2023/

education attainment of municipal personnel, number of procedures and services processed per employee, use of electronic tools in procedures and services, institutional mechanisms for public procurement, quantification of water extracted, garbage collection, activities carried out in the Municipal in terms of property taxing, or training and certifications of police forces. Thus, the CNGDM allows to test which public and private *institutions* affect productivity, and how they may relate to each other.

Figure 1: Total Factor Productivity and Value Added per Worker of Small, Medium and Large Formal Mexican Firms in 2015 and 2018



Variable	No. Obs.	Mean	Std. Dev.	Min	Max
TFP					
TFP normalized	28,709	11.42824	8.150062	2.042612	20.01432
Log (TFP normalized)	28,709	2.059987	0.933218	.7142294	2.996448
VA/Worker	28,709	47,616.32	28,4296.3	-1,744,666	1,673,722
VA/Worker normalized					
Log (VA/worked normalized)	23,456	9.894597	2.18149	-3.401197	14.33056

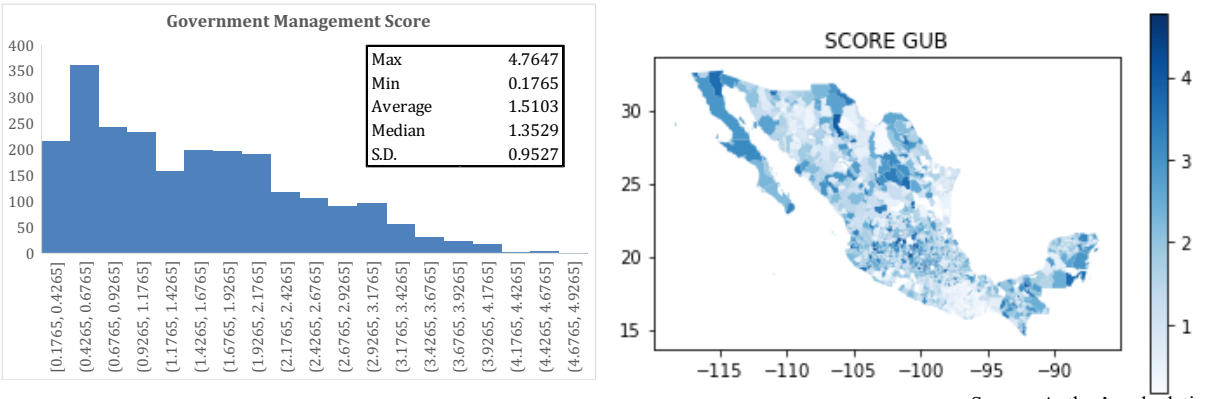
Source: Author's calculations using ENAPROCE 2015 and 2018 using 28,710 (TFP) and 23,456 (VA) firms.

V. Measuring Government Management Practices

As stated above, I developed a method to measure government management practices covering monitoring, targets and incentives, emulating the World Management Survey (WMS) that uses an interview-based evaluation tool with 18 basic management practices that are scored from one ("worst practice") to five ("best practice") on a scoring grid. Although the original score is aimed to measure firms' management quality, I used the same criteria apply for governments with proper adjustments, assuming that they are equally valuable in the public sector.

Considering the basic management practices evaluated by the WMS, I selected 18 questions from CNGMD that reflect practices on leadership management -council meetings-, talent management -monitoring and training-, operation management -procedures and tools, applicable mostly to police forces-, and moniroting and evaluation -use of indicators, statistics, registers and georreferenciation-. I z-scored each individual practice, average across all questions, and z-scored this average for each of the 2,458 Mexican municipalities using the CNGMD, as the management score of Bloom et al (2017). I use the government management score as a measure of state capacity assuming that *higher* values positively affect the *quality* of public goods delivered by the municipality (see Appendix 2 for maps per individual government indicators).

Figure 2: Distribution and Map of Municipal Government Management Scores
2,458 Mexican municipalities (2017)



Source: Author's calculations

VI. Private-Public Managements at Play

To estimate equation (2) I calculated firms' management score and estimated TPF and VA following the method detailed in Bloom et al (2020). Then, I replicated the estimation of the influence of the management score on TPF and VA using equation (1), to confirm that sense of estimates are consistent with previous findings using ENAPROCE datasets. My estimates are smaller than those in Bloom et al (2022) possibly explained by the sample difference (my

sample is larger with more heterogeneity), yet statistical significance and robustness of estimates are in line with the study.

The estimates obtained confirm previous findings, the firm's (private) management score has a significant and consistent influence on productivity measured as TFP and VA. The rest of estimates of labor, fixed capital, and human capital are also consistent with the literature. Firm's management estimates differ according to the sector (manufacturing or other) but are stable across years (2015 vs 2018), as in Bloom et al (2022). When including the local government's (public) management score the original estimates do not vary. The results suggest that increasing firm's management score one standard deviation increases value added per worker in the services sector by 13.2% services sector, and TFP by 1.2%. An increase of one standard deviation of the government's management score relates to an increase of 37.1% of the value added in the services sector and 1.3% of TFP in manufacturing. Parameters are significant in most cases and robust across multiple specifications and subsamples, reflecting an incidence of local public practices -quality of local public goods- disregarding the size of the municipal budget, geographical and demographic characteristics (See Appendix 3).

Table 1: Productivity, Firm's Management and Quality of Public Goods

	1	2	3	4	5	6	7	8
	Pooled Regressions, All Sectors							
Dependent Variable	Log Value Added per Worker				Log TFP			
Firm's management score	-0.0803	0.0406	0.391***	0.301***	0.0499***	0.0459***	0.0266***	0.0301***
	(0.0500)	(0.0575)	(0.0543)	(0.0545)	(0.00232)	(0.00268)	(0.00276)	(0.00277)
Government's management score	0.130**	0.230***	0.382***	0.329***	0.00701***	0.000274	0.000820	0.00311
	(0.0552)	(0.0585)	(0.0536)	(0.0535)	(0.00256)	(0.00272)	(0.00272)	(0.00272)
Firm's management score*manufacture		-0.289***	0.122	0.141		0.00669	-0.0116**	-0.0122***
		(0.1000)	(0.0922)	(0.0918)		(0.00459)	(0.00460)	(0.00459)
Government's management score*manufacture		-0.266***	-0.367***	-0.300***		0.0185***	0.0161***	0.0133***
		(0.0661)	(0.0604)	(0.0603)		(0.00305)	(0.00304)	(0.00304)
log(capital)			0.246***	0.246***			0.00461***	0.00466***
			(0.00539)	(0.00536)			(0.000273)	(0.000272)
log(employees)			-0.688***	-0.676***			0.00852***	0.00802***
			(0.0114)	(0.0114)			(0.000572)	(0.000573)
Percentage of employees with college degree				0.561***				-0.0243***
				(0.0408)				(0.00210)
Observations	20,506	20,506	20,155	20,155	25,132	25,132	24,747	24,747
R-squared	0.509	0.513	0.597	0.601	0.993	0.993	0.993	0.993

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Notes: Robust standard errors clustered at firm level. Constant and time dummy included in all regressions. TFP constructed using a Törnqvist index approach.

A Persistence Mechanism: Private-Public Management Interrelation

One of the main concerns of productivity differences are persistence. One hypothesis is that firms' management -private measured as management score- and quality of public goods – measured as the public managament score- are interrelated based in the "contagious" property of management, claimed by Bloom et all (2017), and the "spillover" effects between local governments modelled and estimated by Acemoglu et al (2015). If there are indeed spillovers *among* firms and governments, one case conceive that there are spillovers *between* firms and governments also. If so, there could be a strong correlation between firms' and governments' scores (see Figures 3 and 4).

Initial exploration confirms there is a small yet robust relationship between these two measures, meaning that doubling municipal government management score increases around 10% of all firms' management score in that municipality. But the size and sense of this relationship could be biased if spillovers go from firms' to governments' and vicecersa, confounding the hypothetical relationship found between management score in firms' productivity. To explore that potential endogeneity and better estimate the relationship, I use an exogenous *quality schock* explained below.

Figure 3: Firms Management Score by state (2015 and 2018)

HERE

Source: World Bank (2022)

Figure 4. Municipal Governments Managements Scores
Aggregated by State (2017)*

HERE

*State average score weighted by population

Source: Author's calculations

Table 2: Firm's Management and Municipal Government's Scores Relationship

	1	2	3	4	5	6	7	8
	Pooled Regressions				2015			
Dependent Variable	Log (Firm's Management Score)				Log (Firm's Management Score)			
log(Government management score)	0.0893***	0.0897***	0.0970***	0.0884***	0.0550***	0.0538***	0.0740***	0.0694***
	(0.0119)	(0.0120)	(0.0153)	(0.0161)	(0.0166)	(0.0167)	(0.0209)	(0.0219)
Latitude		0.00754***	0.0104***	0.00988***		0.00724***	0.00922***	0.00891***
		(0.00177)	(0.00192)	(0.00195)		(0.00238)	(0.00259)	(0.00263)
Longitude		0.00113	0.00281**	0.00265**		-0.000406	0.00104	0.000962
		(0.00127)	(0.00134)	(0.00134)		(0.00172)	(0.00181)	(0.00181)
log(public budget)			0.0387***	0.00903			0.0237	0.00765
			(0.0126)	(0.0214)			(0.0176)	(0.0291)
log(population)				0.0188*				0.0104
				(0.0109)				(0.0150)
Observations	24,149	24,149	21,335	21,335	12,402	12,402	10,944	10,944
R-squared	0.003	0.004	0.006	0.006	0.001	0.002	0.004	0.004

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Notes: Robust standard errors clustered at firm level. Constant and time dummy included in all regressions.

	9	10	11	12	13	14	15	16
	2018				Non-Manufacturing			
Dependent Variable	Log (Firm's Management Score)				Log (Firm's Management Score)			
log(Government management score)	0.121***	0.122***	0.119***	0.107***	0.109***	0.109***	0.103***	0.0902***
	(0.0171)	(0.0172)	(0.0224)	(0.0236)	(0.0142)	(0.0142)	(0.0179)	(0.0189)
Latitude		0.00785***	0.0117***	0.0110***		0.00265	0.00451**	0.00364
		(0.00264)	(0.00285)	(0.00288)		(0.00210)	(0.00228)	(0.00231)
Longitude		0.00266	0.00455**	0.00432**		0.000501	0.00159	0.00136
		(0.00188)	(0.00197)	(0.00198)		(0.00144)	(0.00151)	(0.00151)
log(public budget)			0.0505***	0.00989			0.0496***	0.00699
			(0.0181)	(0.0315)			(0.0153)	(0.0250)
log(population)				0.0252				0.0278**
				(0.0160)				(0.0129)
Observations	11,747	11,747	10,391	10,391	17,162	17,162	15,155	15,155
R-squared	0.004	0.005	0.007	0.008	0.005	0.005	0.007	0.007

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Notes: Robust standard errors clustered at firm level. Constant and time dummy included in all regressions.

	17	18	19	20
	Manufacturing			
Dependent Variable	Log (Firm's Management Score)			
log(Government management score)	0.0231	0.0229	0.0464	0.0507
	(0.0219)	(0.0222)	(0.0297)	(0.0309)
Latitude		0.0173***	0.0224***	0.0227***
		(0.00335)	(0.00365)	(0.00369)
Longitude		0.00249	0.00620**	0.00631**
		(0.00273)	(0.00292)	(0.00292)
log(public budget)			0.0259	0.0437
			(0.0223)	(0.0414)
log(population)				-0.0105
				(0.0206)
Observations	6,987	6,987	6,180	6,180
R-squared	0.000	0.006	0.009	0.009

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Notes: Robust standard errors clustered at firm level. Constant and time dummy included in all regressions.

Exogenous variation in State Capacity: Distance to Royal Treasuries during the Viceroyalty of the New Spain

The estimation strategy uses exogenous variation in state capacities using geo-distances from royal treasuries in the Viceroyalty of the New Spain (XVI-XIX centuries), where highly talented bureaucracy was nurtured to maximize tax revenues, and developed managerial capacities to optimize tax collection within their respective area of influence. Using data from Colegio de Mexico on distance to Royal Treasuries as instruments to current state capacity we find that closeness to royal treasuries during the Spanish colony explains government practices today measured by the government management scores. The main hypothesis we test is that closeness to royal treasuries determined local government practices, and that these practices endured. We use as instruments the geo-distance to the most important royal treasuries during the Colony: Mexico City, the capital; Veracruz, as the main port for trading with Spain, and Arizona, as the top point at the North were there was a royal treasury.

Figure 5: Royal Treasuries during the Viceroyalty of the New Spain (XVI-XIX centuries)

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Our instrumental variables approach to state capacity using historical data indicates that the local government managerial practices could be explained by historical factors and that the relationship to firm's productivity is higher in magnitude than using the government management score, indicating that there is persistence of local government capacities inherited from the XVI-XIX centuries.

Table 3: Instrumental Variables Estimation: Distance to Royal Treasuries

Instrumental Variables			Kms to Mexico City				Kms to Mexico City, Latitude and Longitude			
Dependent Variable	OLS		Log VA per Worker		Log TFP		Log VA per Worker		Log TFP	
	Log VA per Worker	Log TFP								
Firm's management score	0.301***	0.0301***	0.376***	0.438***	0.0297***	0.0286***	0.375***	0.440***	0.0296***	0.0287***
	(0.0545)	(0.00277)	(0.0463)	(0.0477)	(0.00233)	(0.00243)	(0.0463)	(0.0477)	(0.00232)	(0.00243)
Firm's management score*manufacture	0.329***	0.00311		9.686**		0.0689		3.639**		0.0433
	(0.0535)	(0.00272)		(4.017)		(0.142)		(1.506)		(0.0603)
Government's management score	0.141	-0.0122***	-0.412	1.663	0.0786	0.0884	1.014***	1.504***	0.0709***	0.0720***
	(0.0918)	(0.00459)	(1.260)	(1.417)	(0.0607)	(0.0738)	(0.366)	(0.391)	(0.0196)	(0.0214)
Government's management score*manufacture	-0.300***	0.0133***		-15.86**		-0.103		-6.195***		-0.0631
	(0.0603)	(0.00304)		(6.402)		(0.227)		(2.388)		(0.0956)
log(capital)	0.246***	0.00466***	0.230***	0.234***	0.00469***	0.00463***	0.229***	0.233***	0.00466***	0.00461***
	(0.00536)	(0.000272)	(0.00569)	(0.00575)	(0.000254)	(0.000257)	(0.00569)	(0.00577)	(0.000254)	(0.000256)
log(employees)	-0.676***	0.00802***	-0.679***	-0.673***	0.00813***	0.00799***	-0.679***	-0.671***	0.00809***	0.00798***
	(0.0114)	(0.000573)	(0.0136)	(0.0139)	(0.000517)	(0.000523)	(0.0136)	(0.0139)	(0.000517)	(0.000521)
Percentage of employees with college degree	0.561***	-0.0243***	0.690***	0.658***	-0.0233***	-0.0229***	0.687***	0.654***	-0.0233***	-0.0229***
	(0.0408)	(0.00210)	(0.0364)	(0.0369)	(0.00215)	(0.00219)	(0.0364)	(0.0369)	(0.00214)	(0.00218)
Observations	20,155	24,747	23,025	23,025	28,239	28,239	23,025	23,025	28,239	28,239
R-squared	0.601	0.993	0.595	0.595	0.993	0.993	0.595	0.595	0.993	0.993

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

Instrumental Variables			Kms to Veracruz				Kms to Veracruz, Latitude and Longitude			
Dependent Variable	OLS Log VA per Worker	Log TFP	Log VA per Worker		Log TFP		Log VA per Worker		Log TFP	
Firm's management score	0.301***	0.0301***	0.372***	0.436***	0.0296***	0.0285***	0.377***	0.439***	0.0296***	0.0286***
	(0.0545)	(0.00277)	(0.0463)	(0.0476)	(0.00233)	(0.00243)	(0.0464)	(0.0477)	(0.00233)	(0.00243)
Firm's management score*manufacture	0.329***	0.00311		-4.401		0.115		3.167*		0.0298
	(0.0535)	(0.00272)		(3.613)		(0.129)		(1.789)		(0.0650)
Government's management score	0.141	-0.0122***	3.685***	3.213***	0.0843	0.1000	-0.575	-0.106	0.0593**	0.0606**
	(0.0918)	(0.00459)	(1.067)	(1.171)	(0.0537)	(0.0632)	(0.459)	(0.494)	(0.0236)	(0.0263)
Government's management score*manufacture	-0.300***	0.0133***		6.620		-0.177		-5.448*		-0.0411
	(0.0603)	(0.00304)		(5.783)		(0.206)		(2.856)		(0.104)
log(capital)	0.246***	0.00466***	0.230***	0.233***	0.00469***	0.00462***	0.230***	0.232***	0.00469***	0.00464***
	(0.00536)	(0.000272)	(0.00569)	(0.00575)	(0.000254)	(0.000257)	(0.00569)	(0.00577)	(0.000254)	(0.000256)
log(employees)	-0.676***	0.00802***	-0.680***	-0.673***	0.00808***	0.00799***	-0.679***	-0.671***	0.00812***	0.00800***
	(0.0114)	(0.000573)	(0.0136)	(0.0139)	(0.000517)	(0.000524)	(0.0136)	(0.0139)	(0.000516)	(0.000521)
Percentage of employees with college degree	0.561***	-0.0243***	0.696***	0.666***	-0.0230***	-0.0226***	0.689***	0.659***	-0.0232***	-0.0228***
	(0.0408)	(0.00210)	(0.0364)	(0.0369)	(0.00215)	(0.00218)	(0.0364)	(0.0369)	(0.00214)	(0.00217)
Observations	20,155	24,747	23,025	23,025	28,239	28,239	23,025	23,025	28,239	28,239
R-squared	0.601	0.993	0.595	0.595	0.993	0.993	0.595	0.595	0.993	0.993

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

Instrumental Variables			Kms to Arizona				Kms to Arizona, Latitude and Longitude			
Dependent Variable	OLS Log VA per Worker	Log TFP	Log VA per Worker		Log TFP		Log VA per Worker		Log TFP	
Firm's management score	0.301***	0.0301***	0.372***	0.437***	0.0296***	0.0286***	0.378***	0.440***	0.0296***	0.0285***
	(0.0545)	(0.00277)	-0.0463	-0.0476	-0.00233	-0.00243	-0.0464	-0.0477	-0.00233	-0.00243
Firm's management score*manufacture	0.329***	0.00311		-4.805		0.169		1.183		0.0346
	(0.0535)	(0.00272)		-4.165		-0.162		-1.652		-0.0579
Government's management score	0.141	-0.0122***	4.779***	4.583***	0.0715	0.0869	-0.888*	-0.612	0.0647***	0.0685**
	(0.0918)	(0.00459)	-1.118	-1.204	-0.0604	-0.0682	-0.465	-0.508	-0.0232	-0.0268
Government's management score*manufacture	-0.300***	0.0133***		7.253		-0.263		-2.287		-0.0486
	(0.0603)	(0.00304)		-6.66		-0.258		-2.643		-0.0924
log(capital)	0.246***	0.00466***	0.229***	0.232***	0.00468***	0.00461***	0.229***	0.232***	0.00472***	0.00465***
	(0.00536)	(0.000272)	-0.0057	-0.00576	-0.000254	-0.000257	-0.00569	-0.00577	-0.000254	-0.000256
log(employees)	-0.676***	0.00802***	-0.680***	-0.672***	0.00810***	0.00801***	-0.679***	-0.671***	0.00810***	0.00798***
	(0.0114)	(0.000573)	-0.0136	-0.0139	-0.000517	-0.000523	-0.0136	-0.0139	-0.000516	-0.000521
Percentage of employees with college degree	0.561***	-0.0243***	0.693***	0.663***	-0.0231***	-0.0227***	0.688***	0.658***	-0.0231***	-0.0227***
	(0.0408)	(0.00210)	-0.0364	-0.0369	-0.00214	-0.00218	-0.0364	-0.0369	-0.00214	-0.00217
Observations	20,155	24,747	23025	23025	28239	28239	23025	23025	28239	28239
R-squared	0.601	0.993	0.595	0.596	0.993	0.993	0.595	0.595	0.993	0.993

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

Instrumental Variables			If Royal Treasury in the locality, Kms to Veracruz, Mexico City and Arizona, Latitude and Longitude				Kms to Closest Royal Treasury, Kms to Veracruz, Mexico City and Arizona, , Latitude and Longitude			
Dependent Variable	OLS Log VA per Worker	Log TFP	Log VA per Worker		Log TFP		Log VA per Worker		Log TFP	
Firm's management score	0.301***	0.0301***	0.373***	0.438***	0.0295***	0.0286***	0.374***	0.437***	0.0294***	0.0285***
	(0.0545)	(0.00277)	(0.0463)	(0.0477)	(0.00232)	(0.00243)	(0.0464)	(0.0477)	(0.00232)	(0.00243)
Firm's management score*manufacture	0.329***	0.00311		1.289		0.0410		1.315**		0.0496**
	(0.0535)	(0.00272)		(0.823)		(0.0314)		(0.590)		(0.0233)
Government's management score	0.141	-0.0122***	1.093***	1.323***	0.0551***	0.0587***	0.218	0.497***	0.0370***	0.0428***
	(0.0918)	(0.00459)	(0.212)	(0.228)	(0.0114)	(0.0128)	(0.170)	(0.186)	(0.00897)	(0.0104)
Government's management score*manufacture	-0.300***	0.0133***		-2.449*		-0.0589		-2.471***		-0.0724**
	(0.0603)	(0.00304)		(1.296)		(0.0494)		(0.925)		(0.0366)
log(capital)	0.246***	0.00466***	0.230***	0.234***	0.00472***	0.00467***	0.230***	0.233***	0.00471***	0.00466***
	(0.00536)	(0.000272)	(0.00569)	(0.00577)	(0.000254)	(0.000256)	(0.00569)	(0.00577)	(0.000254)	(0.000256)
log(employees)	-0.676***	0.00802***	-0.682***	-0.674***	0.00797***	0.00786***	-0.679***	-0.672***	0.00801***	0.00790***
	(0.0114)	(0.000573)	(0.0137)	(0.0139)	(0.000517)	(0.000521)	(0.0137)	(0.0139)	(0.000517)	(0.000521)
Percentage of employees with college degree	0.561***	-0.0243***	0.680***	0.646***	-0.0236***	-0.0232***	0.688***	0.655***	-0.0233***	-0.0230***
	(0.0408)	(0.00210)	(0.0363)	(0.0368)	(0.00214)	(0.00218)	(0.0364)	(0.0369)	(0.00214)	(0.00217)
Observations	20,155	24,747	23,025	23,025	28,239	28,239	23,025	23,025	28,239	28,239
R-squared	0.601	0.993	0.595	0.596	0.993	0.993	0.595	0.595	0.993	0.993

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

VII. Conclusions

This document aims to deepen our understanding of the causes of productivity heterogeneity and the lack of convergence, topics extensively studied in growth theory and development economics. By using Mexico as a case study, it combines concepts from managerial economics and political economy to explain phenomena that cannot be accounted for by physical capital, labor, and human capital alone.

Applying the concept of management as technology, as presented by Bloom et al. (2017), this paper develops an empirical model that links firms' productivity to internal and external factors, specifically, firms' management practices and the quality of public goods. The findings indicate that both factors significantly impact productivity, measured as total factor productivity (TFP) and value added per worker. The analysis uses Mexican microdata on the management practices of 28,709 firms and the practices of 2,458 local governments from official surveys.

The paper explores the interrelationship between internal and external factors, considering network or spillover effects intrinsic to technology. It concludes that there is a robust connection between private and public management practices. Our instrumental variable approach that exploits exogenous variation in state capacities using geo-distances from royal treasuries in the Viceroyalty of the New Spain (XVI-XIX centuries), shows that closeness to royal treasuries during the Spanish colony explains government practices today measured by the government management scores, indicating that there is persistence of local government capacities inherited from colonial times.

The results suggest that management practices and the quality of public goods affect firms' productivity both directly and indirectly, explaining a significant portion of productivity heterogeneity. This paper initiates a broader effort to explain the interdependence between public and private sectors beyond conventional wisdom, highlighting their dual impact on economic performance and the persistence of heterogeneous (and low) productivity over time. A theoretical model depicting these mechanisms could greatly benefit further research.

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Appendix 1

Variables construction

Performance

Value added/worker: Value added is calculated by subtracting the consumption of materials (Mi) and energy (Ei), which consists of electricity and fuels, from the gross value of production of the firm Qi , following Bloom et al. (2018b):

$$VAi = Qi - Mi - Ei$$

Where Qi is calculated as the sum of sales and inventories change. Value added is then divided by the total number of employees in the firm.

Total Factor Productivity (TFPR): To construct our measure of TFP, I followed Aw et al. (2000), and we calculate a Törnqvist index as follows:

$$lnTFP_i = \ln(Y_i) - \ln(\bar{Y}) - \frac{1}{2}\left[\sum_{j=1}^{k}(S_{ij} + \bar{S}_j)(\ln(X_{ij}) - \ln(\bar{X}_j))\right]$$

Where

$TFP_i = TFP_i\ index$

$Y_i = Revenue\ of\ firm\ i$

$Y = Revenue\ of\ average\ firm$

$S_{ij} = Revenue\ share\ of\ input\ j\ for\ firm\ i$

$\bar{S} = Average\ revenue\ share\ of\ input\ j$

$j = Labor, capital, and\ materials\ expenses\ (raw\ materials, fuel, electricity, etc.)$

$X_{ij} = Value\ of\ input\ j\ at\ firm\ i$

$\bar{X} = Average\ value\ of\ input\ j$

Appendix 2: Maps of Indicators that form the Government Management Score, 2016-2017

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Source: Author's calculations

Appendix 3

Firm's Productivity and Management Score before including Quality of Public Goods

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Appendix 4

Robustness Check of Productivity, Firm's Management and Quality of Public Goods

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