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MEXICO

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October 17, 2019

Approved By
Western Hemisphere Department

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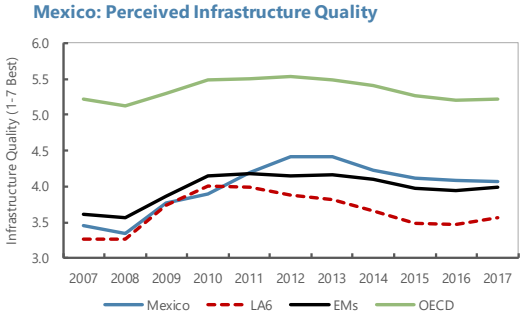
ROAD CONSTRUCTION AND FIRM PRODUCTIVITY[1]

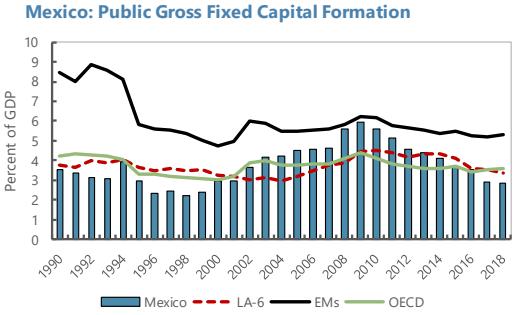
Low productivity growth is a critical challenge for Mexico. This note shows that upgrading basic public infrastructure, and in particular road infrastructure, raises productivity among firms, not only for large companies but also for Mexico's large number of small and micro firms. This finding suggests that greater government spending on road infrastructure will support efforts to raise productivity and growth over the medium-term.

A. Introduction

1. Mexico's infrastructure quality has been on a steady decline. World Economic Forum indicators of perceived infrastructure quality show Mexico broadly in line with—or even outperforming—its emerging market and regional peers. However, there is still a significant gap to the average OECD country, and Cerra et al (2016) show that Mexico compares unfavorably with its main export competitors.[2] At the same time, the data show a clear downward trend in infrastructure quality perceptions since around 2013.



Source: Global Competitiveness Index. World Economic Forum.
LA-6: Argentina, Brasil, Chile, Colombia, Mexico and Peru.
EMs: ARG, BRA, CHL, CHN, COL, EGY, HUN, IND, IDN. MYS, MEX, PER, PHL, POL, ROM, RUS, ZAF, THA, TUN, TUR.



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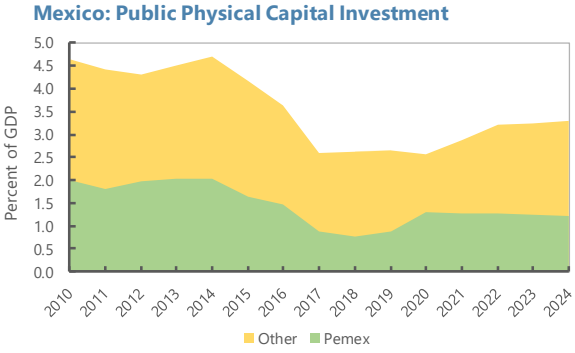
2. Infrastructure quality and access are likely to weaken further at current investment rates. Public gross fixed capital formation declined to 3 percent of GDP in 2018, from a peak of 6 percent in 2009, and compared to an average of 4.2 percent since 2000. It also compares unfavorably to average investment ratios of 5.3 percent and 3.4 percent in 2018 in emerging market and regional peers. Going forward, the authorities project a modest increase in the overall envelope for physical capital spending over the medium term. Within



Source: Authorities' data and staff calculations

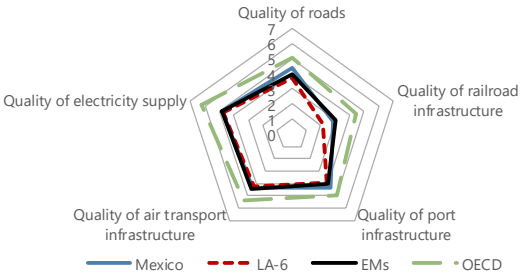
[1] Prepared based on a forthcoming FAD Working Paper authored by Laura Jaramillo, Tomas Martinez, Florian Misch and Christian Saborowski.

[2] See Cerra, Valerie, Alfredo Cuevas, Carlos Goes, Izabela Karpowicz, Troy Matheson, Issouf Samake and Svetlana Vtyurina (2016), "Highways to Heaven: Infrastructure Determinants and Trends in Latin America and the Caribbean," IMF Working Paper 16/185.

this envelope, the share of basic non-energy infrastructure investment is unlikely to increase for two reasons: first, there has been a shift toward Pemex investments starting with the 2019 budget; and second, the envelope will need to account for the administration's large priority infrastructure projects such as the Maya train and the Trans-Isthmus Railway.

3. Spending trends compare particularly poorly to investment needs in the case of roads investment. According to the Global Competitiveness Index, the perceived quality of Mexico's transportation infrastructure is broadly in line with peers. However, 26 percent of firms in Mexico consider transportation—both quality and access—a major constraint according to the most recent World Bank enterprise survey for Mexico from 2010, compared to 23 percent in Latin America and the Caribbean and 20 percent globally. The Global Infrastructure Hub calculates that Mexico's current infrastructure spending trends fall particularly short of investment needs in the case of roads investment.[3]

Mexico: Global Competitiveness Index 2017-2018
Transport Infrastructure Index 1-7 (best)



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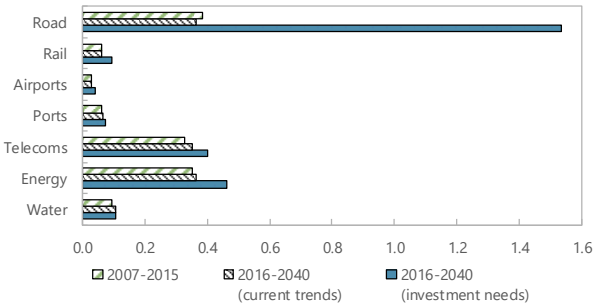
Mexico: Infrastructure Investment Needs



Source: Global Infrastructure Hub. Global Infrastructure Outlook Data.

B. Empirical Approach

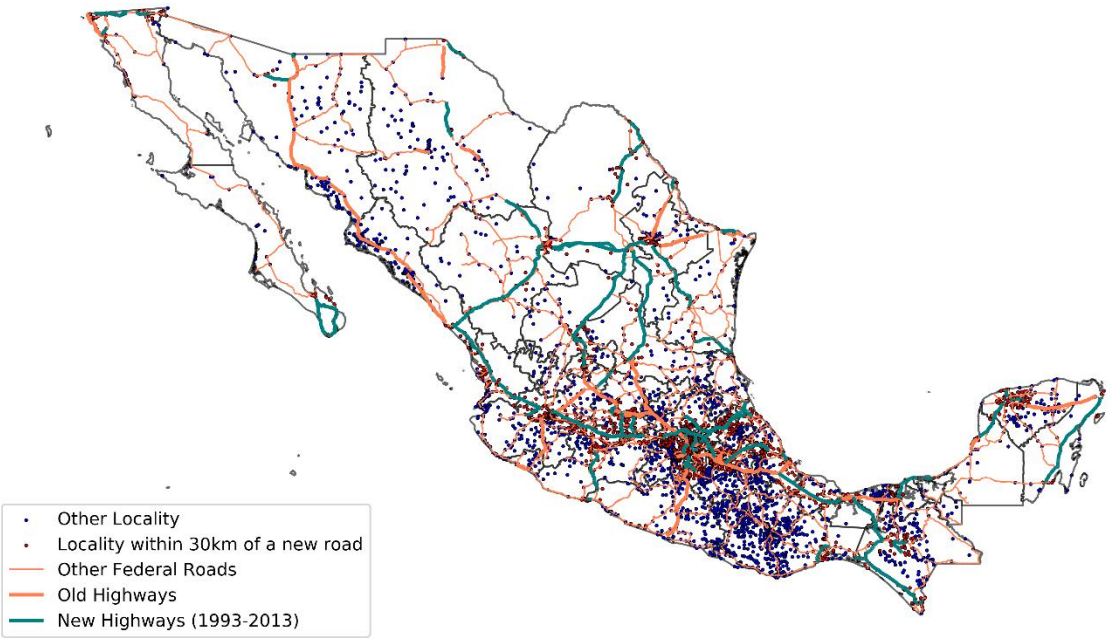
4. Against this background, the note provides evidence of the role of infrastructure investment in boosting productivity. In particular, we estimate the effect of investment in road construction on firm level productivity. We put together a novel data set that allows estimating the relationship while addressing potential reverse causality challenges in an innovative way.

5. We construct longitudinal firm level data on productivity and other firm characteristics. We make use of the Mexican Economic Census which provides firm level data on the universe of Mexican non-agricultural firms with fixed establishments. The sample period ranges from 1993 to 2013 in five-year intervals. We complement this data with the work of Busso and others (2018)—expanded in coverage by INEGI staff—to identify individual firms across waves. We apply a standard cleaning procedure and concentrate on manufacturing firms, which leaves us with

[3] The investment need forecast is developed based on a panel data approach that predicts the level of investment that would materialize if Mexico invested as much as its peers with the highest investment ratios, after controlling for country characteristics.

398,382 firm-year observations.[4] The definitions and sources for the variables we construct are described in Appendix Table 1.

Figure 1. Mexico: Expressway Network



Source: Authorities' data

6. We combine this firm-level dataset with a novel dataset on reductions in travel times within Mexico due to road investment. A detailed description of the approach we take can be found in Box 1. In short, we calculate the distance between each locality and each major metropolitan area in Mexico at the end of our sample period based on the road network in place at that time. We complement this data with information on travel speeds to obtain a measure of travel times between each locality in Mexico and each metropolitan area. We then use data on road construction and improvement to determine how much travel distances, and thus travel times, changed from one 5-year period to the next. Importantly, the changes in travel times between any firm's locality and Mexico's major cities over time are thus entirely driven by road construction and improvement.

[4] First, we drop both extreme productivity values and extreme productivity changes, namely the top and lowest 1 percent of observations in the sample. Second, we drop firms that report birth years that differ by more than 3 years across waves as an additional check on the firm identifier methodology. Finally, we drop localities, state-sector pairs and state-sector-year pairs that have only one observation.

Box 1. Calculating a Measure of Travel Times Based on Geo-Coding
(with Time Variation Solely due to Road Construction and Improvement)

We use geo-coding to create time varying estimates of travel times between firms' localities and major Mexican metropolitan areas in each 5-year interval during our sample period 1993-2013.

The first step involves producing cross-sectional variation on travel times between localities at the end of our sample period. To do so, the calculation makes use of the 2014 digital GIS road network provided by INEGI. We combine the road network with data on average truck speeds on selected federal and state roads from the Mexican Secretary of Communications and Transportation (SCT). For federal and state roads without speed information, we predict their average truck speed by fitting a regression of average speeds on road characteristics. For non-federal and non-state roads with limited information on their characteristics, we assume their average truck speed is equal to 90 percent of the statutory speed limit. Once the entire road network has an assigned truck speed, the time distance on each road section is calculated using its distance and speed. Finally, we employ Dijkstra's optimal route algorithm to compute the shortest time distance between all Mexican localities and the largest metropolitan areas (Appendix Table 2).

The second step involves geo-coding information on road construction and improvement to calculate travel times from each locality to each metropolitan area in earlier years. We geocode information on expressway construction since 1993 obtained from the SCT work reports (Informe de Labores) available from 2003 to 2013. We supplement this information with physical (non-digital) maps of the expressway network for 1989, 1995 and 2000 contained in the National Highway Program. We then reconstruct the network in place during each 5-year period, To do this, we start from the network in place in 2014 and then eliminate roads that were only built after the period under consideration and attribute a speed penalty to roads that were improved after the period under consideration. Importantly, this implies that we hold the average truck speed constant and vary only the length and quality of the federal road network. Once the entire road network has an assigned truck speed, the optimal route algorithm is reapplied to calculate the travel times between the localities and the major metropolitan areas for each 5-year period.

7. The econometric specification for our analysis takes the following form:

$$\ln(Prod_{ft}) = \alpha_f + \alpha_l + \alpha_{stsecy} + \beta_1 \ln(TTimeM_{ft}) + \gamma X_{ft} + \epsilon_{ft} \quad (1)$$

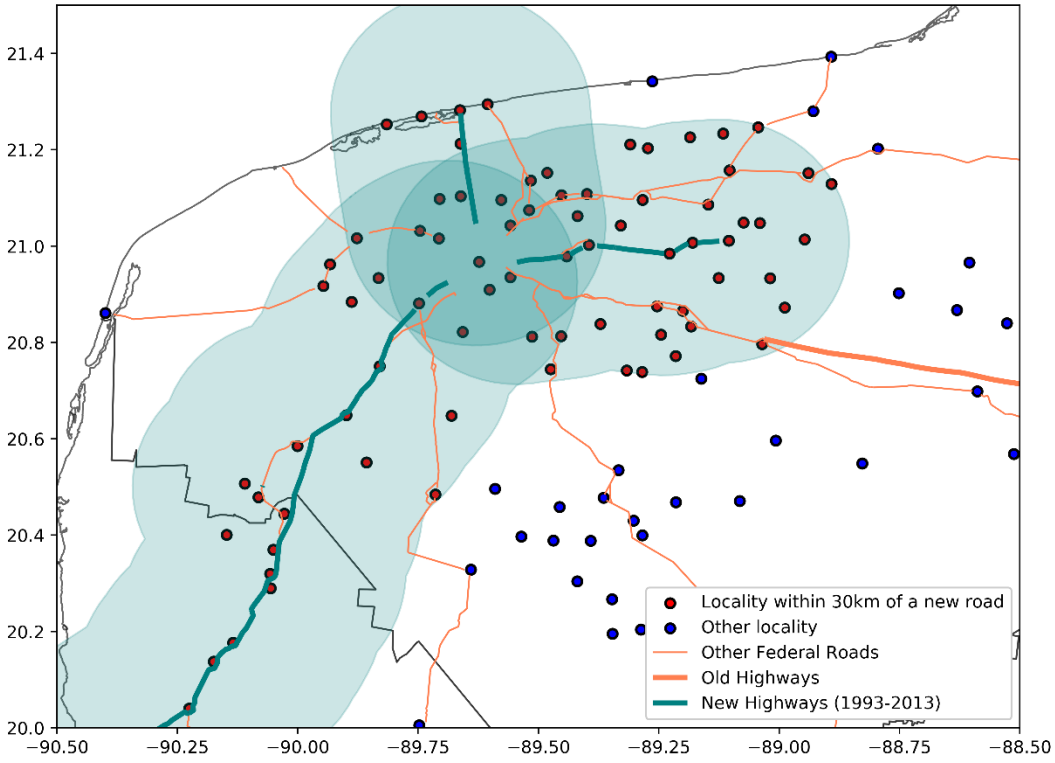
$$\ln(Prod_{ft}) = \alpha_f + \alpha_l + \alpha_{stsecy} + \beta_1 \ln(TTimeM_{ft}) + \beta_2 \ln(TTimeM_{ft}) X_{ft} + \gamma X_{ft} + \epsilon_{ft} \quad (2)$$

where $\ln(Prod_{ft})$ is the productivity of firm *f* at time *t* as measured by the ratio of value added over the number of workers employed by the firm (in logs); $\ln(TTimeM_{ft})$ is our main explanatory variable, namely the average travel time between a firm's locality and the *M* largest metropolitan areas in Mexico (in logs); X_{ft} includes several firm characteristics as control variables and $\ln(TTimeM_{ft}) X_{ft}$ are interaction terms included in some of the regressions to identify whether our main explanatory variable of interest has a different effect on productivity depending on firm characteristics. We also include unobserved effects in all of our regressions: α_f is a set of firm fixed effects, α_l is a set of locality fixed effects and α_{stsecy} is a set of fixed

effects at the state-industry-year level (industry is defined at the 4 digit level). The firm and locality fixed effects imply that we control for all firm and locality characteristics that are time-invariant, so that the effect of our *TTime* variable on *Prod* is identified purely based on time- rather than cross-sectional information. The state-industry-year fixed effects, in turn, imply that the effect of changes in *TTime* on changes in *Prod* are isolated from any such effect that is common to firms in a given 4-digit industry in a given state in a given year.

8. Our innovative identification strategy addresses endogeneity concerns. The concern is that new roads may be built precisely in areas in which an economic expansion is expected which, if unaddressed, would lead to a negative bias between our dependent variable $\ln(Prod_{ft})$ and our main explanatory variable of interest $\ln(TTimeM_{ft})$. If roads were indeed built with the objective of better connecting specific firms with a high growth potential, these would be the ones located near the new or improved road. If that is true, then the endogeneity problem would be solved by not including these firms in our sample. We make use of the fact that we know the precise coordinates both of all the firms in the sample and of the roads constructed or improved in Mexico throughout our sample period 1993-2013. We exclude firms from the baseline sample that were located within a certain radius (ranging from 3 to 30 km) around the newly built or improved road to deal with the endogeneity concern.

Figure 2. Mexico: Illustrating the Identification Strategy



Source: Authors calculations.

C. Results

9. Regression 1 in Table 1 shows the baseline results of estimating Equation 1. The control variables we include are the logged age of the firm in a given period, a dummy indicating whether or not a firm has multiple establishments, a variable measuring the extent to which a firm employs formal labor—as measured by the share of social security contributions in the overall wage bill—and a dummy indicating whether the firm is a small firm (10 or less employees). The definitions and sources of all variables included in our regressions are included in Appendix Table 1. As mentioned above, the firm fixed effects imply that the coefficients on the explanatory variables are estimated strictly based on time variation and thus explain productivity changes in a given firm over time.

10. Our findings show that road investment boosts firm productivity. The main variable of interest in our regressions is $\ln(TTimeM_{ft})$, the average distance between a firm's locality and the M largest metropolitan areas in Mexico (see Appendix Table 2). For the baseline, we set $M = 20$. The variable is highly significant in Regression 1, with a coefficient of about 1.3. This suggests that, if road construction reduces the average travel time from a firm's locality to the 20 largest metropolitan areas in the country by 1 percent, the productivity of that firm goes up by 1.3 percent.[5]

Table 1. Mexico: Baseline and Identification

	All Firms	Drop Firms in 3km Radius	Drop Firms in 5km Radius	Drop Firms in 10km Radius	Drop Firms in 20km Radius	Drop Firms in 30km Radius
TTime20, Logged	-1.267***	-1.213**	-1.236***	-1.217**	-1.208*	-1.159***
	[0.449]	[0.495]	[0.407]	[0.478]	[0.618]	[0.392]
Age, Logged	0.241***	0.240***	0.238***	0.233***	0.238***	0.237***
	[0.023]	[0.025]	[0.025]	[0.027]	[0.031]	[0.034]
Multi-Establishment Firm Dummy	0.009	0.014	0.018	0.004	0.011	0.005
	[0.020]	[0.017]	[0.020]	[0.019]	[0.035]	[0.035]
Formality	0.008***	0.008***	0.008***	0.008***	0.007***	0.007***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.002]	[0.003]
Small and Micro Firm Dummy (<10 Workers)	0.037	0.031	0.029	0.036	0.043	0.055
	[0.036]	[0.038]	[0.038]	[0.042]	[0.059]	[0.064]
Observations	398,382	364,792	352,124	286,799	220,156	180,519
R-squared	0.767	0.770	0.772	0.779	0.779	0.786

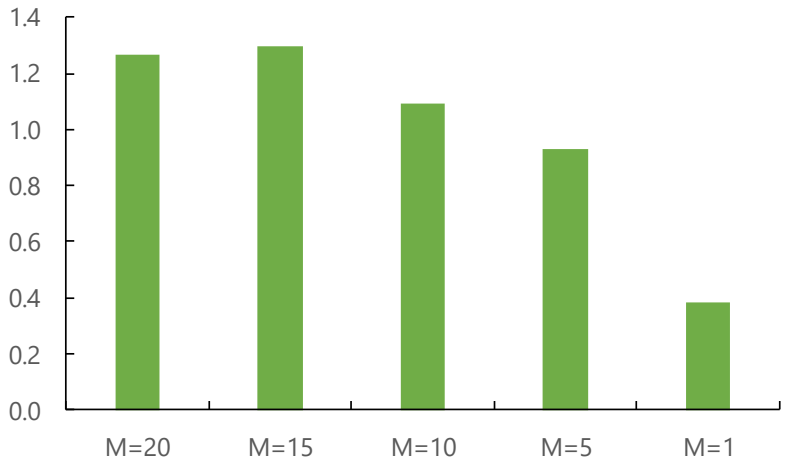
Clustered standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1
Source: Author's calculations

[5] The control variables generally carry the expected coefficients. The age control variable is highly significant with a positive coefficient, signaling that firms tend to be more productive as they age. The multi-establishment dummy carries a positive coefficient but is not significant. One may expect that firms that move from a single to multiple establishments would become more productive or open additional establishments precisely because they are more productive. The insignificance of the variable may be due to the fact that there is a very small number of firms in our sample that indeed move from one to multiple establishments during our sample period. The formality variable carries a positive coefficient and is highly significant as expected. It appears that firms that formalize their operations indeed become more productive, probably in part because they have a stronger incentive to invest in their employees and have an easier time accessing financial services. Finally, the dummy identifying small firms is not significant. One would perhaps expect smaller firms to be less productive in the full sample of firms in Mexico. The fact that we do not find evidence of such a relationship is likely due to the fact that we control for both labor informality and cross-sectional variation in the regression.

11. Our identification strategy suggests that the link running from road investment to firm productivity is causal. Regressions 2-6 of Table 1 are dedicated to our identification strategy. As discussed above, the main reason why we may have a reverse causality problem in our regressions is that new roads might have been built precisely in areas in which an economic expansion was expected. In order to mitigate this possibility, Regressions 2-6 exclude all firms that are situated in localities within a certain radius around any of the newly built or improved roads. In Regression 2, the radius is 3 kilometers, in Regression 3 it is 5 kilometers, in Regression 4 it is 10 kilometers, in Regression 5 it is 20 kilometers and in Regression 6 it is 30 kilometers. Note that the number of observations in the regressions gradually decreases from 398,382 under the baseline in Regression 1 to 180,519 in Regression 6. This amounts to a decline of some 55 percent in the number of observations. Nevertheless, we find that the travel time variable is highly significant in all regressions in the table, and its coefficient is remarkably stable, fluctuating between 1.16 and 1.27. We take this as reasonably strong evidence that we are indeed identifying a causal relationship.

12. Our results are qualitatively robust to different definitions of our travel time variable. We alter the definition of the *TTimeM* variable by varying the number of metropolitan areas *M* based on which the variable is calculated. In particular, we re-run Regression 1 in Table 1 four times, each time defining the variable based on less metropolitan areas (M=15, M=10, M=5 and M=1). In each regression, *TTimeM* remains highly significant. Figure 1 shows the coefficient estimates obtained in each regression, illustrating that the magnitude of the coefficient decreases as *M* falls. In particular, decreasing the time distance to Mexico's largest metropolitan area (Mexico City) for a given firm by 1 percent increases that firm's productivity by about 0.4 percent. This compares to an increase of 1.3 percent if we base the definition of the dependent variable on the 20 largest metropolitan areas in the baseline (see also Regression 1 in Table 1). The smaller coefficient is sensible given that it would, for example, take more road building for a firm located between 20 of the largest metropolitan areas to reduce travel time to all of them by 1 percent rather than to just one of them.

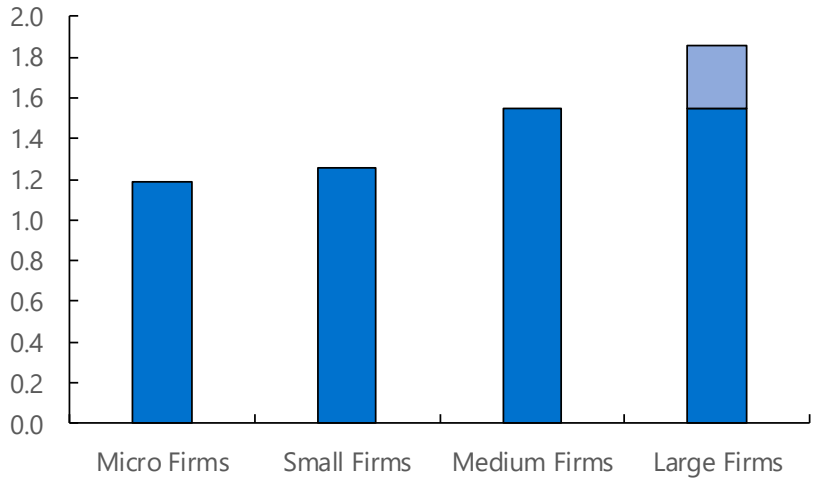
Figure 3. Mexico: Predicted Productivity Impact of 1 Percent Average Decline in Travel Time to the M Largest Metro Areas



Source: Author's calculations

13. Importantly, we find that road investment also increases productivity of micro and small firms. To do so, we include interaction terms between $TTime20_{ft}$ and dummies identifying micro (0 to 3 employees), small (4-10 employees), medium (11-50 employees) and large (>50 employees) in Regression 1 in Table 1 (medium is the omitted category). All interaction terms other than the one based on the dummy for large firms are highly significant in the regressions. Taking all coefficients at face value, Figure 2 illustrates the impact of a 1 percent decline in travel times to the largest 20 metropolitan areas for micro, small, medium and large firms (the light blue illustrates the coefficient on the insignificant dummy for large firms). It appears that firms benefit more from road investment if they are larger. Nevertheless, it is striking that even small and micro firms see significant benefits: a one percent reduction in travel times boosts productivity in large firms by some 1.8 percent while micro firms benefit to the tune of some 1.2 percent.

Figure 4. Mexico: Predicted Productivity Impact of 1 Percent Average Decline in Travel Time to 20 Largest Metro Areas



Source: Authors' calculations

Appendix I

Appendix Table 1. Mexico: Variable Definitions and Sources

Variable	Definition	Source
Productivity	Value added divided by number of employees	Economic Census; authors' calculations
Travel time	Average travel time from locality a firm is located in to the M largest metropolitan areas	
Age	The age of the firm in years	Economic Census; authors' calculations
Multiple Establishments	Dummy taking the value zero when a firm has multiple establishments	Economic Census; authors' calculations
Formality	Share of social security contributions in the firm's overall wage bill	Economic Census; authors' calculations
Firm size dummies	Based on the number of employees of each firm	Economic Census; authors' calculations

Appendix Table 2. Mexico: Largest Cities Based on 2010 Census

1	Mexico City	11	San Luis Potosi
2	Guadalajara	12	Merida
3	Monterrey	13	Mexicali
4	Puebla-Tlaxcala	14	Aguascalientes
5	Toluca	15	Cuernavaca
6	Tijuana	16	Acapulco
7	Leon	17	Tampico
8	Juarez and El Paso	18	Chihuahua
9	La Laguna	19	Morelia
10	Queretaro	20	Saltillo

BUDGETARY SPENDING PRESSURES[1]

This note discusses trends in Mexico's public spending and its composition, assesses the quality of past and planned fiscal adjustments, and studies options for efficiency improvements in social spending, including in health and education expenditure. The analysis shows that Mexico's limited and rigid programmable spending envelope has been cut from 19.6 to 17.3 percent of GDP since the global financial crisis. Moreover, the composition of spending has shifted away from capital spending and, based on functions of government, out of health, education, housing and community services. The planned fiscal adjustment under the authorities' medium-term fiscal framework would reinforce both trends by shrinking programmable spending within the same spending items. This raises questions about the quality and sustainability of the adjustment and, even more so, about scope for further cuts in these areas. The note further underscores that sizable and durable expenditure savings can best be achieved by reforms and efficiency improvements and highlights such options for social spending.

A. Introduction

1. The authorities are shifting the composition of spending toward new priority areas. These include several large public infrastructure projects (e.g., railways and ports); supporting PEMEX to increase oil production and refining capacity (including via tax reductions and capital injections); doubling old-age pensions; programs for the youth (i.e., more student scholarships and the apprentice program "Youths Building the Future"); and expanding and unifying healthcare.[2]

2. This shift is happening within a tight budgetary envelope and against the backdrop of declining oil revenues and a slowing economy. The authorities have reiterated that they are not planning to raise taxes at least until 2021 or to finance these programs by increasing public debt. Shrinking revenues are particularly worrisome as Mexico already has the lowest tax-to-GDP ratio among OECD countries, and one of the lowest among Latin American economies. Consequently, fiscal pressures are emerging, and staff sees the need for 1.5 percent of GDP in measures to meet the authorities' medium-term fiscal targets. While there is significant scope to raise revenues to close the gap, this note focuses on the potential for spending measures to contribute to filling the fiscal gap while making the spending mix more growth friendly and inclusive.

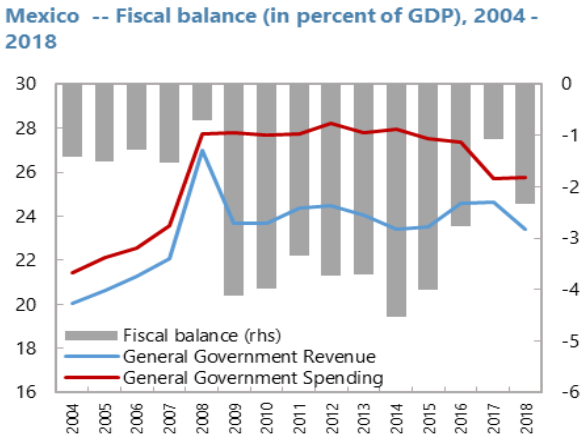
B. Spending Trends Prior to the Current Government

3. The post-GFC period saw a significant increase in public debt that was arrested only in 2016 through both an increase in non-oil revenues and cuts in spending. The counter-cyclical policy response during the global financial crisis expanded the overall deficit to an average of 4 percent in 2009-10 and increased budgetary spending from 20.1 percent of GDP in 2000-2007 to

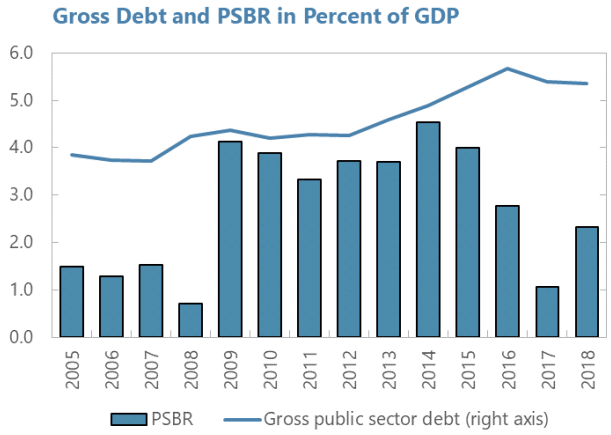
[1] Prepared by Mehdi Raissi and Christian Saborowski

[2] The profit-sharing duty is expected to decrease from 65 percent in 2019 to 58 percent in 2020 and to 54 percent in 2021—equivalent to a forgone tax revenue of $2.3 billion in 2020 and $4.3 billion in 2021 (0.2 and 0.3 percent of GDP, respectively). The government will also provide direct capital injections of $7.3 billion (about 0.7 percent of GDP) over three years.

24.5 percent in 2008-10. This policy response was warranted by the magnitude of the shock facing Mexico at the time and was broadly in line with the size of fiscal expansions in Mexico's regional and emerging market peers (see Annex V). However, the deficit remained at around 4 percent of GDP for several years, leading to an increase of almost 20 percentage points in the public debt to GDP ratio between 2007 and 2016. The increase in debt was only arrested after 2016, following a reform in 2013-14 that raised tax revenues to offset the decline in oil revenues. At the same time, budgetary expenditures were cut by almost 2.8 percentage points of GDP between 2016 and 2018 while the decline in programmable budgetary spending amounted to 3.4 percentage points of GDP.



Source: IMF FAD Expenditure Assessment Tool (EAT), World Economic Outlook.



4. A decomposition of programmable budgetary spending raises questions about the quality of the post-GFC shift in spending composition. Table 1 compares average programmable expenditure as a percent of GDP in 2008-2017 with spending in 2018 across both economic and functional classifications. Decomposing by economic classification indicates that the decline in programable spending of 2.3 percentage points can largely be explained by a reduction in capital expenditure, and, to a lesser extent, by a fall in wages and salaries as well as a decline in subsidies and transfers, mostly in education, health and housing and community services (Table 1).[3] Areas in which spending increased include pensions and interest payments. Moving to a functional classification of spending—also shown in Table 1—expenditure is higher than its historical average only in social protection. The size of the increase is equal to the rise in pensions in the economic classification, implying that it is due mainly to increases in social pensions while other social assistance expenditure and non-social pensions remained broadly unchanged.

[3] As discussed in Section D, a shift away from current expenditure within education spending could be justified.

Table 1. Mexico: Public Spending, Average 2008–2017, and 2018

(Percent of GDP)

Economic Classification	Total Programmable Expenditure		General Public Services		Defense		Public Order and Safety		Economic Affairs		Environmental Protection		Housing and Community Services		Health		Rec/Culture		Education		Social Protection		Other (incl Stabilization Funds)	
	Functional Classification																							
Total Programmable Expenditure	19.6	17.3	1.0	0.9	0.5	0.5	0.3	0.2	6.4	5.1	0.2	0.1	1.5	1.0	2.5	2.4	0.1	0.1	3.5	3.0	3.4	3.8	0.3	0.2
Wages and Salaries	5.7	5.2	0.6	0.5	0.3	0.3	0.1	0.1	0.9	0.8	0.0	0.0	0.0	0.0	1.4	1.3	0.0	0.0	2.3	2.0	0.1	0.1	0.1	0.1
Subsidies & Transfers	3.3	2.7	0.0	0.1	0.0	0.0	0.1	0.0	0.6	0.6	0.0	0.0	0.4	0.2	0.6	0.6	0.0	0.0	1.0	0.9	0.5	0.4	0.0	-0.1
Pensions	2.9	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	3.3	0.0	0.0
Other Current Expenditure	2.8	2.8	0.2	0.3	0.1	0.1	0.1	0.1	1.6	1.6	0.0	0.0	0.0	0.0	0.6	0.5	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
Physical Capital	4.0	2.6	0.1	0.0	0.1	0.1	0.0	0.0	2.5	1.6	0.1	0.0	1.1	0.7	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.1	0.0	-0.1
Other	0.9	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Interest	2.1	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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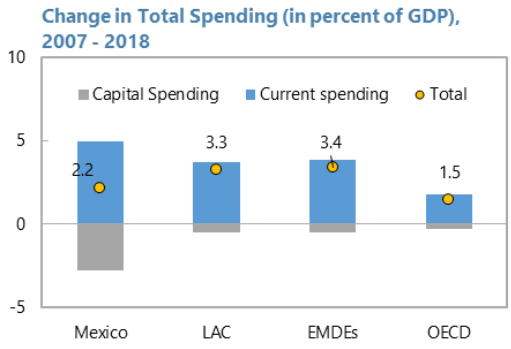
Source: Authorities' data and authors' calculations

Note: Assessment of the quality of adjustment (yellow versus green) is based on staff's judgement.

C. Projected Spending Trends Under the Current Fiscal Plans

5. The ongoing fiscal adjustment under the current administration appears to reinforce these trends. Tables 2 and 3 show the economic and functional breakdowns of spending, respectively, in 2019 and 2020 compared to 2018 and the 2008-2017 average. Total programable expenditure is projected to decline by another ¾ percent of GDP from 2018 to 2020. While pension spending is expected to continue increasing significantly, non-PEMEX related physical capital spending is set to decline further. Moreover, cuts of 0.7 percent of GDP are envisaged in other current spending, implying a decline by a quarter. From a functional perspective, spending cuts are envisaged in education, and housing and community services, which are areas in which spending ratios to GDP had already contracted in prior years.

6. The fact that the planned spending cuts fall on similar expenditure items as in previous years raises questions about the sustainability of the adjustment. Given that legally-mandated expenditures represent 2/3 of the budget, while another 20 percent is comprised of technically discretionary but inflexible expenditures, spending cuts continue to focus on a small share of effectively discretionary expenditures—including vital capital investments. Moreover, while social protection spending is on the rise, spending in areas such as education, health and housing and community services is declining. Cutting other current expenditure by a full quarter, from an already low level within a year or two also raises sustainability concerns. Achieving a more growth-friendly and inclusive spending mix, while making space for the authorities' medium-term objectives would require reallocating expenditure toward capital spending



Source: IMF FAD Expenditure Assessment Tool (EAT), World Economic Outlook.

and education, while also making efficiency improvements in all areas. One area in which such improvements appear feasible is social spending which is the subject of the subsequent section.

Table 2. Mexico: Projected Public Spending in 2019–2020 (Economic Classification)
(Percent of GDP)

		Total Programmable Expenditure			
		Average (2008-2017)	2018	2019	2020
Economic Classification	Total Programmable Expenditure	19.6	17.3	16.7	16.6
	Wages and Salaries	5.7	5.2	5.0	5.0
	Subsidies & Transfers	3.3	2.7	2.7	2.7
	Pensions	2.9	3.3	3.6	3.7
	Other Current Expenditure	2.8	2.8	2.7	2.4
	Physical Capital	4.0	2.6	2.6	2.5
	Other	0.9	0.7	0.2	0.2
	Interest	2.1	2.6	2.7	2.6

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Long-term average (2008-2017)	

Note: Authorities' data and authors' calculations.

Table 3. Mexico: Projected Public Spending in 2019–2020 (Functional Classification)
(Percent of GDP)

		Total Programmable Expenditure			
		Average (2008-2017)	2018	2019	2020
Functional Classification	Total Programmable Expenditure	19.6	17.3	16.6	16.7
	General Public Services	1.0	0.9	0.9	0.9
	Defense	0.5	0.5	0.4	0.4
	Public Order and Safety	0.3	0.2	0.2	0.2
	Economic Affairs	6.4	5.1	4.6	4.6
	Environmental Protection	0.2	0.1	0.1	0.1
	Housing and Community Services	1.5	1.0	1.0	0.9
	Health	2.5	2.4	2.4	2.4
	Rec/Culture	0.1	0.1	0.1	0.1
	Education	3.5	3.0	2.9	2.9
	Social Protection	3.4	3.8	4.2	4.3
	Other (incl Stabilization Funds)	0.3	0.2	0.1	0.0

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> 10%	
Long-term average (2008-2017)	

Source: Authorities' data and authors' calculations

7. A focus on outturns for 2019 suggests large declines in capital spending while social protection spending grew at above 10 percent in real terms. Tables 4 and 5 compare the expenditure outturns in the first eight months of 2019 with the same period in 2018 based on economic and functional classifications in real terms. The calculations suggest that physical capital

spending declined by 14.6 percent while health and education expenditure also declined notably by 4.2 percent and 5.3 percent, respectively. Nevertheless, spending on other categories such as public order and safety, environmental protection, recreation and culture, general public services and economic affairs declined even more dramatically, while social protection spending grew significantly at 10.3 percent.

Table 4. Mexico: Spending Outturns in 2019 (Economic Classification)

		Total Programmable Expenditure(Billion pesos)		
		January-August 2018	January-August 2019	Real % growth
Economic Classification	Total Programmable Expenditure	2609	2590	-4.6
	Wages and Salaries	735	729	-4.6
	Subsidies & Transfers	497	480	-7.0
	Pensions	528	573	4.4
	Other Current Expenditure	374	385	2.9
	Physical Capital	476	423	-14.6
	Interest	389	424	4.9

Source: Authorities' data and authors' calculations

Table 5. Mexico: Spending Outturns in 2019 (Functional Classification)

		Total Programmable Expenditure (Billion pesos)		
		January-August 2018	January-August 2019	Real % growth
Functional Classification	Total Programmable Expenditure	2609	2590	-4.6
	General Public Services	139	112	-18.1
	Defense	68	68	-4.1
	Public Order and Safety	35	26	-28.3
	Economic Affairs	792	720	-12.5
	Environmental Protection	13	10	-24.9
	Housing and Community Services	159	168	1.2
	Health	343	342	-4.2
	Rec/Culture	13	11	-14.2
	Education	441	434	-5.3
	Social Protection	592	679	10.3

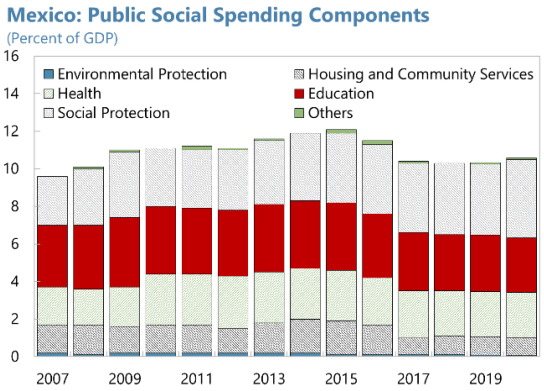
Source: Authorities' data and authors' calculations

D. Benchmarking Social Spending (Functional Classification)

8. Current trends in social spending will determine the structural increase in public expenditure over the long term. We define social spending to include education, health, social

protection, housing and community services, and environmental protection. Spending trends in these areas will be shaped by the government's policy goals of boosting social assistance and achieving universal secondary education and universal access to basic health insurance as well as by rising healthcare and social protection spending related to an aging population.

Source: OECD (2016).



Sources: SHCP and staff calculations.

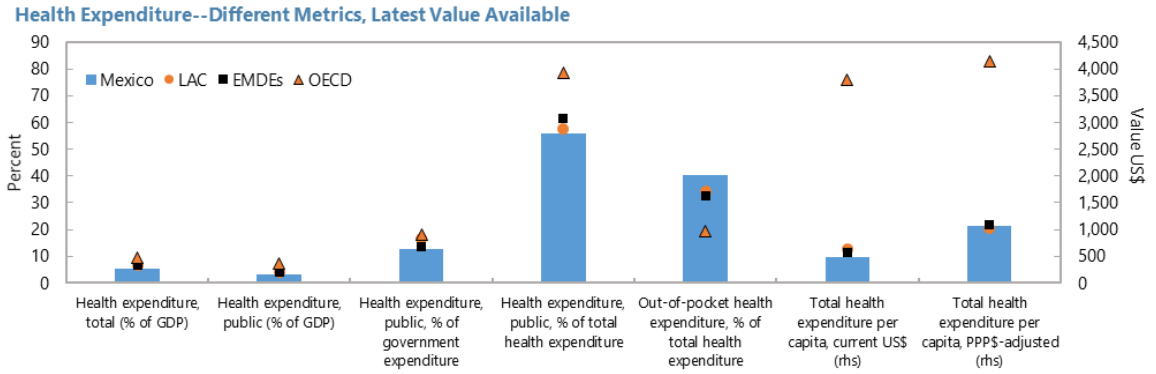
9. We track the evolution of social spending in Mexico over time and benchmark its current level against peers. In addition to social protection spending (defined below), social spending includes education and health expenditure—reflecting the critical importance of such spending for promoting inclusive growth. Social spending as a share of GDP increased by 2.5 percent of GDP from 2007 to 2015, reaching a maximum of 12.1 percent of GDP, before shrinking to 10.3 percent in 2018. Social protection and education spending together absorb more than 60 percent of the total, while health expenditure amounts to close to a fourth. From a cross-country perspective, Mexico currently has one of the lowest levels of social spending, partly reflecting its low tax to GDP ratio, but such spending is set to increase over time.

10. We also estimate the level of spending required to reach satisfactory progress towards the Sustainable Development Goals (SDGs) in the health and education sectors. We follow the input-output methodology of Gaspar and others (2019) in three steps: (i) identifying key inputs and their associated unit cost in the health and education sectors; (ii) benchmarking the input costs in Mexico to countries with comparable GDP per capita levels but higher social outcomes today; and (iii) estimating the spending levels needed to achieve those high-quality outcomes, given Mexico's GDP per capita and population growth. Estimates are reported for 2030 in percent of GDP.

Health

11. Mexico's healthcare system is fragmented, service delivery is unequal, and administrative costs are high. Mexico's spending on healthcare is comparable to countries with similar GDP per capita levels. However, the multiplicity of insurance schemes (each with its own parallel provider network, funding and administrative structures), and the lack of coordination between them increase the administrative and insurance costs of health services and contribute to unequal service delivery. Administrative costs account for almost 10 percent of total health spending and insurance premiums are high. Aligning the administrative and insurance costs with the OECD

average of 3 percent would generate savings of at least 0.15 percent of GDP (World Bank, 2016). Spending also remains concentrated in the richest states, resulting in disparities in care quality and access. Finally, there are significant beneficiary overlaps and inconsistencies across insurance schemes which, if eliminated, would lead to further fiscal savings (more than 0.1 percent of GDP).



Source: IMF FAD Expenditure Assessment Tool (EAT), World Bank, World Health Organization.

12. The costing exercise suggests that health spending will have to increase if SDG for health is to be reached by 2030. Mexico could aim to increase the share of doctors in the population as well as their wages while containing the number of other health professionals (Table 4). Overall, by 2030, Mexico could face an increase of more than 0.5 percent of GDP in total health expenditure to meet the SDGs. Fiscal pressures would be higher if the share of public sector in total health-care provision increases. All these trends necessitate seeking efficiency gains in the interim period, otherwise the spending required to reach the SDGs would be significantly larger.

Table 6. Mexico: Cost Estimates for Health

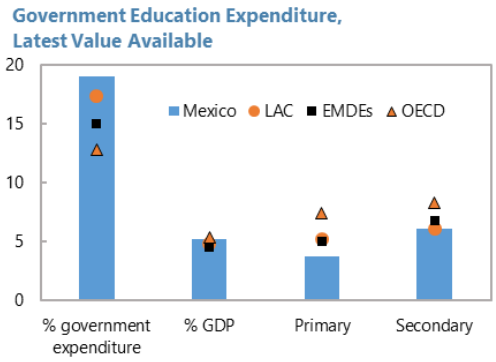
	GDP per capita $6000-$15000			Mexico	
	All	Low performance	High performance	2016 (or latest)	2030
GDP per capita	8,909.5	8,115.8	12,623.2	8,814.9	10,234.4
Main factors					
Doctors per 1,000 population	2.0	1.9	2.7	2.2	2.7
Other medical personnel per 1,000 population	6.4	6.3	7.7	9.6	7.7
Doctor wages (ratio to GDP per capita)	4.1	4.2	4.0	3.5	4.0
Other current and capital spending (% total spending)	59.8	60.9	59.8	58.5	58.5
Private share (% total spending)	39.5	47.8	31.6	47.8	31.6
Results					
Health spending (percent of GDP)	6.4	5.9	7.1	5.9	**6.4**
Public	3.9	3.1	4.9	3.1	4.4
Private	2.5	2.8	2.3	2.8	2.0
Per capita spending (USD 2018)	570.4	482.3	899.5	523.8	653.6
SDG3 index	80.1	78.2	85.8	81.9	>84

Source: Staff calculations using "IMF SDG Costing Tools".

Education

13. Enhancing the quality of education spending is not only important for fiscal sustainability, but also critical for growth and competitiveness. Given the projected demographic trends in Mexico and the constitutional mandate to universalize secondary education, the coming years will likely see a large expansion in education services and a sector-wide shift towards secondary and tertiary levels (to supply the human capital needed for the new economy). These factors are expected to generate significant structural fiscal pressures, thus, underscoring the need to enhance value for money in education spending.

14. Improving transparency and accountability in the education payroll, along with a rebalancing of spending towards investment in equipment and facilities would result in efficiency gains. The share of current spending in total education expenditure is very high, potentially crowding out investment in equipment, facilities, information technology and modern infrastructure necessary to improve education quality and keep pace with the evolving labor demands of a growing economy (World Bank 2016). Shifting the composition of education expenditures toward capital spending is therefore warranted. Improving the quality of early-childhood education, access to education in low-coverage regions and for disadvantaged-background children would also lead to better outcomes.



Source: IMF FAD Expenditure Assessment Tool (EAT), World Bank.

15. Seeking efficincy gains is particularly important as there will be additional education spending pressures in the long term if SDGs in education are to be achieved. Additional spending needs are estimated at 0.5 percent of GDP by 2030. To improve outcomes and consistent with the discussion above, the SDGs costing exercise in the education sector suggests that Mexico should recalibrate the mix of salaries and personnel to emulate the levels observed in high performing countries, which tend to have lower teacher wages (in percent of GDP) but also smaller classes (lower student to teacher ratios). Enrollment rates should also be increased.

Table 7. Mexico: Cost Estimates for Education

	GDP per capita 6000-15000			Mexico	
	All	Low performance	High performance	2018 (or latest)	2030
GDP per capita	9,169.5	8,408.5	12,390.3	8,814.5	10,234.4
Main factors					
Students per teacher ratio	14.3	18.3	11.3	19.2	11.3
Teacher wages (ratio to GDP per capita)	1.7	2.3	1.6	2.9	1.6
Other current and capital spending (% total spending)	45.8	43.3	46.6	28.7	46.6
Other					
Student age population (% total population)	35.7	40.2	23.2	42.0	30.0
Enrollment rate (preprimary to tertiary)	77.5	72.3	85.6	72.2	80.2
Private share (% of total spending)	12.8	20.7	10.1	16.8	10.1
Results					
Education spending (percent of GDP)	6.1	6.5	5.4	6.1	**6.6**
Public	5.3	5.1	4.9	5.3	5.9
Private	0.8	1.3	0.5	0.8	0.7
Spending per student (USD 2018)	2,019.6	1,872.9	3,380.4	1,768.7	2,792.2
SDG4 index	82.7	78.0	88.5	92.6	>84

Source: Staff calculations using "IMF SDG Costing Tools".

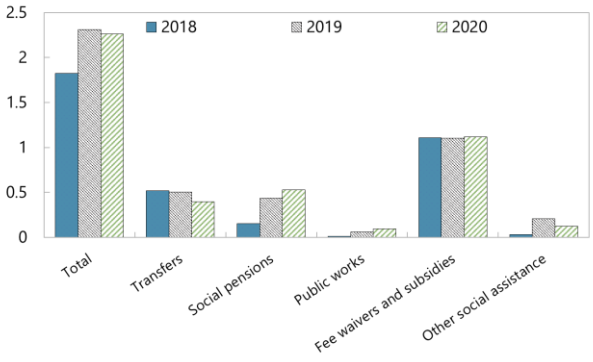
Social protection

16. The IMF defines social protection spending to comprise social insurance and social assistance programs. Social insurance aims at protecting households from shocks that can adversely impact their incomes and welfare and is typically financed by contributions or payroll taxes. Social assistance aims at protecting households from poverty and is financed by general government revenue. The terms social assistance and social safety net are used interchangeably.

17. Mexico's social protection programs are fragmented and there is much potential for efficiency gains. Existing social assistance and insurance programs should be carefully reviewed, and the process of rationalization should continue. There are more than 8,000 programs at the federal, state and municipal levels. This multiplicity has resulted in a significant degree of duplication, redundancy and fragmentation—reducing the effectiveness and efficiency of the social protection system. Some programs suffer from significant leakages to higher-income groups or other unintended beneficiaries. A few programs were eliminated or scaled down in January 2019, but others were newly established or scaled. To improve targeting, the authorities conducted a social census covering about 20 million households (out of a total of 30 million households) to identify those in need. If possible, this census should be used to clean an existing beneficiary database—the Sistema de Información Social Integral (SISI)—which collects data from social programs at all levels of government. Matching SISI with the social census to create a single registry of beneficiaries would improve the overall targeting efficiency. It could also reduce errors of inclusion and exclusion, beneficiary overlaps, and program duplications.

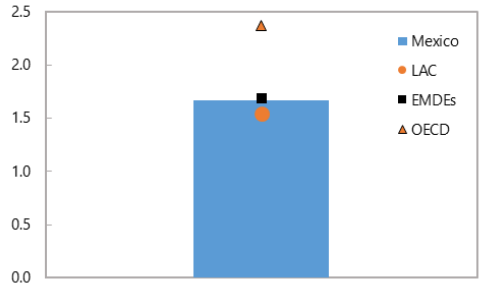
18. The overall envelope for social assistance—which is part of social protection—is comparable in size to Mexico's peers, but is likely to grow. The administration spent about 1.8 percent of GDP on social assistance programs in 2018 (text chart). This level is comparable to other Latin American countries and EMDEs but is lower than the OECD average. In the medium- to long-term, Mexico's aging population will put increasing pressure on different elements of the social protection system, including social assistance. The main schemes included: cash, food and in-kind transfers; fee waivers and subsidies, and social pensions to the elderly (PAM).[4] Transfers and PAM represented about 40 percent of the total social assistance received by an average household in Mexico and mostly benefit households at the bottom of the income distribution. However, other social assistance programs are less well targeted and suffer from inefficiencies (IMF Country Report 18/308). The 2019 and 2020 budgets increased the size of social assistance spending by about 0.5 percent of GDP and changed its composition—with a significant increase in social and disability pensions and a modest decrease in transfers. The conditional cash transfer program Prospera has been canceled and its resources have been distributed to other priority areas. To reduce exclusion errors, the authorities are targeting indigenous groups, elderly, and people with disabilities.

Mexico: Social Assistance Spending
(Percent of GDP)



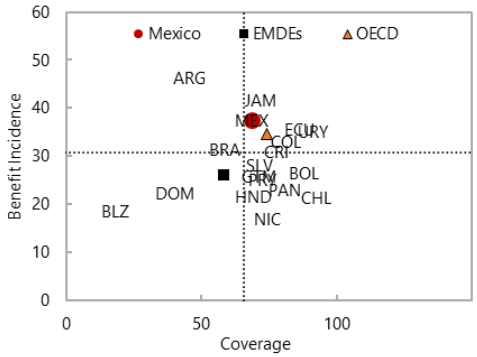
Source: SHCP

Social Assistance Spending (in percent of GDP), Latest Value Available



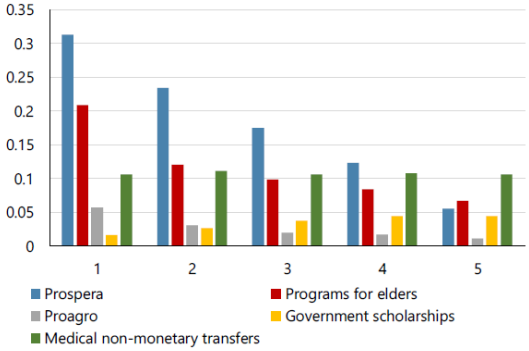
Sources: IMF FAD Expenditure Assessment Tool (EAT), World Economic Outlook, ASPIRE, and IMF Pension Indicators.

Social Assistance Coverage and Benefit Share of Poorest 20 percent (in percent), Latest Value Available 1/ 2/



Sources: IMF FAD Expenditure Assessment Tool (EAT), World Economic Outlook, ASPIRE, and IMF Pension Indicators.

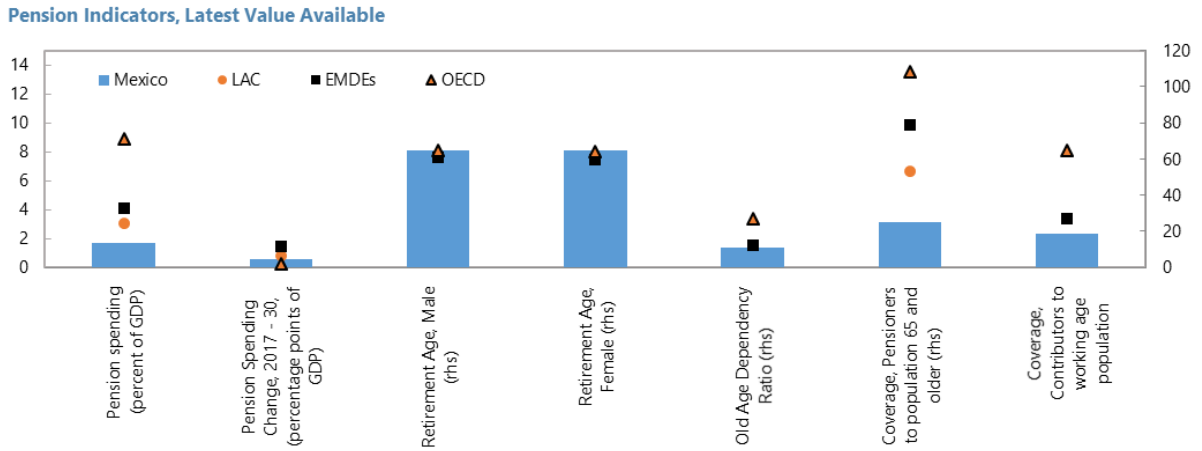
Coverage of government transfer programs by household income quintile (2016)



Note: Coverage is computed at the household level.
Sources: INEGI; IMF staff calculations.

[4] The PAM benefits about 8 million individuals; 60 percent of those aged 65+, and 100 percent of those aged 68+.

19. A need for old age social assistance—and other non-contributory social pensions—has arisen amid a pension system that has limited coverage and low contribution rates. Multiple pension systems cover private sector employees, different categories of civil servants at different government levels, SOEs, public universities and military personnel. The poverty rate among people over 65 is very high, at more than 30 percent, in part due to insufficient benefits from the contributary Pension system. This increases the need for social pension spending (and social assistance spending in general). The average contribution rate of 6.5 percent in IMSS for the DC scheme is very low and may at best lead to a replacement rate of 26 percent for a full career average earner, the second lowest replacement rate among OECD countries (OECD 2019). Increasing the contribution rate would improve adequacy and could in part be offset by reducing the rate of contribution from wages to the housing fund (Infonavit). Further adjustments could include increasing the effective retirement age by linking the statutory retirement age to gains in life expectancy; tightening early-retirement schemes; increasing the contribution period required for a full pension in the old public-sector DB scheme; and increasing the age limit to get a full pension in the public sector faster (OECD 2015).



Sources: IMF FAD Expenditure Assessment Tool (EAT), World Economic Outlook, ASPIRE, and IMF Pension Indicators.

E. Conclusions

20. Low levels of discretionary spending imply that raising revenues will be indispensable in putting public debt on a downward path. There is substantial room for tax policy and revenue administration reforms to raise revenues and ensure that public debt remains on a downward path.

21. Spending efficiency should be strengthened to make additional room for priority expenditures. The burden of the fiscal adjustment in recent years has continuously fallen on a small number of discretionary spending items such as capital spending, health and education, thus hurting inclusive growth. Spending adjustments should concentrate on boosting spending efficiency, including in social spending. Enhancing value for money in social spending is particularly important given the additional spending needs to meet the SDGs in education and health.

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PEMEX'S TAXATION REGIME[1]

Using the IMF Fiscal Analysis for Resource Industries (FARI) project-level cashflow modeling methodology, this note evaluates key characteristics of the current tax regime for PEMEX, and compares it to both recently announced reform plans, as well as the production sharing regime which applies to contracts awarded in recent licensing rounds. The analysis suggests that in the short-term, an increase in the cost cap and a reduction in the profit-sharing rate will not only reduce the overall tax burden for Pemex but also the regressivity of the regime, and by increasing the return to PEMEX, may release funds for further investment. However, the analysis shows that even with the increased cost cap and reduced profit-sharing rate, the regime does not contain sufficient progressive instruments to allow the government to share in the upside from new developments, a desirable characteristic of petroleum fiscal regimes. In the longer term, migration of entitlement assets to the newer more balanced contractual regimes would be beneficial.

A. Introduction

1. The administration is implementing reforms of the petroleum fiscal regime applicable to PEMEX, the state- owned oil company.[2] The discussion is based on the premise that the company's upstream petroleum activities are taxed too heavily, constraining its ability to invest in exploration and production, and intend to release funds for additional investment. Ratings agencies and financial research have also noted the heavy tax burden as a constraint on the company's ability to finance its capital expenditure program.[3]

2. This year's reforms involve both a loosening of cost deduction caps as well as a reduction in the profit-sharing rate. In February 2019, the SHCP announced plans to ease the tax burden by loosening the cost deduction caps under PEMEX's 'entitlement' fiscal regime, aligning them with the cost recovery limits of production sharing contracts concluded under licensing rounds held in 2015-18, and PEMEX's Ek Balam area which recently transitioned from the entitlement regime to a production sharing contractual scheme. Furthermore, the PEMEX business plan presented in July 2019 announced the government's plans to reduce the profit-sharing rate from 65 percent to 58 and 54 percent in 2020 and 2021, respectively.

B. Background

3. The petroleum sector in Mexico has a long history of public ownership, with only recent private sector participation. The oil industry was nationalized in 1938 and the state-owned oil company PEMEX was founded, with exclusive rights over exploration, extraction, refining, and commercialization of oil in Mexico. This arrangement lasted until 2013-14, when a wide-reaching

[1] Prepared by Alpa Shah.

[2] SHCP Boletín 009-2019, 'Acciones para fortalecer la capacidad productiva de Petroleos Mexicano', Ciudad de México, 28 de enero de 2019.

[3] Barclays Credit Research, 'Petróleos Mexicanos (PEMEX): Crude Awakening; Initiating at Underweight, January 11, 2019.

Mexican energy reform opened the petroleum sector to private companies, allowing the state to enter into a range of risk-sharing contracts with the private sector. However, under the 'Round Zero' process of the reform, SENER granted PEMEX rights over 83 percent of proven and probable reserves and 21 percent of Mexico's prospective reserves. As such, most of the current petroleum production and the associated revenue is still generated through PEMEX's operations.

4. As oil production declined PEMEX has faced growing difficulties. Mexico experienced falling crude oil and natural gas production, with crude oil production declining on a sustained basis from its peak in 2004 of 3.4 mbpd. PEMEX had a difficult time fully replacing petroleum reserves. The decline in production and reserve levels was mainly a consequence of the depletion of Mexico's principal oil field (Cantarell), PEMEX's lack of the financing and technical capacity required to explore for and develop the majority of its potential resources located in offshore Gulf of Mexico, and the restrictions on private sector participation.

5. While private sector exploration is now increasing, PEMEX is still struggling to undertake capital investment. Since the reform, about 70 companies are now conducting exploration and production in Mexico. Petroleum exploration activity is progressing, with a few significant recent discoveries, and increased production is anticipated over the medium term. However, PEMEX, which still controls a large portion of reserves, is struggling to finance new investment in the sector, blamed in large part to the onerous fiscal regime. PEMEX's oil production has continued to decline, reaching 1.6 million barrels per day in 2018, less than half of its 2004 peak.

C. Fiscal Regime Reform: Key Design Issues

6. A key challenge in designing a fiscal regime is securing an appropriate level of revenue for the government, while also maintaining incentives for companies to invest in the sector. This must be achieved in the face of uncertain petroleum production, prices or costs across a variety of potential project outturns. Critical to achieving this balance is the composition of the fiscal regime—that is, the balance between production and profit-based instruments. Production-based instruments such as royalties can provide revenues from the start of production but given their regressive nature should be set at a moderate level so as not to deter investment in less profitable projects. Progressive profit-based instruments capture a rising share of cashflows as profitability increases, playing an important role in offsetting the impact of regressive instruments and allowing the government to maintain an appropriate government take across a variety of projects outturns.

7. Progressive instruments commonly feature in modern petroleum fiscal regimes. In recent decades, recognizing the potential for large economic rents in the resource sectors, many petroleum-producing countries in the region and internationally have introduced a range of resource rent taxes, profit-based production sharing and additional profits tax mechanisms to capture additional resource rent as project profitability increases.

8. The appropriate design of PEMEX's fiscal regime has long been a concern of the Mexican authorities. As a state-owned monopoly, PEMEX has not been subject to the same market discipline as its private sector counterparts. In such an environment, policies must seek to provide an

appropriate balance between limiting the operational inefficiencies and cost overruns characteristic of many state-owned corporations, and the risk of creating unwarranted distortions through an overly burdensome tax regime and strict controls which limit the company's ability to behave as a profit maximizing company. In particular, the design of the fiscal regime has reflected the government's concerns around the weak incentives for cost containment by PEMEX. Analysis of PEMEX's regime has been the subject of earlier FAD Technical Assistance reports, most recently in 2012, the findings of which are summarized in Box 1.

Box 1. Summary of Findings from 2012 Report

The report assessed the fiscal regime in place at the time, which comprised of three main instruments: (i) the Stabilization Fund Duty (DSHFE), a 10 percent royalty applicable when oil prices exceeded $31 per barrel; (iii) the Extraordinary Export Duty, a 13.1 percent royalty, creditable against the DSHFE, applied to the difference between the actual and the budget oil price, and (iii) the ordinary duty, a 71.5 percent income tax, subject to a cost cap of $6.50/bbl. It also analyzed a special regime applicable to activities in Chicontepec and in deep water fields.

Assuming an oil price at prevailing 2012 levels of $115 per barrel, and industry benchmark costs of $7.5 per barrel, the report's analysis concluded that the 2012 fiscal regime generated average effective tax rates (AETR) in the range 70-80 percent, comparable with other countries in the region (and presenting an improvement over the pre-2005 regime which implied a much higher AETR). The AETR was notably higher when assumed costs are in line with PEMEX's costs of $17/barrel.

However, the report also acknowledged the regressivity of the regime in terms of both cost and (in the case of the ordinary regime) price, driven largely by the limits on deductibility of costs, which were set at low levels, and in absolute terms, not indexed by inflation. It also presented sensitivity analysis which illustrated that over a $50-80 price range, the ordinary regime generated AETR of over 100 percent, rendering representative projects unviable at both industry benchmark and PEMEX cost levels.

It concluded that in the long run, the cost cap should be eliminated and the fiscal regime aligned with normal IOC taxation. In preparation for this transition, emphasis was placed on the narrowing of the gap between PEMEX and industry benchmark costs, and strengthening of audit controls and independent oversight. It also suggested that interim adjustments to the cap could be considered to reduced its distortionary effects.

Source: Cheasty et al, 2012, 'Mexico: Is PEMEX Taxed Too Much?, IMF Technical Assistance Report

D. The Mexican Fiscal Regime

9. Exploration and extraction activities in Mexico are carried out either through 'entitlements' held by PEMEX, or 'contracts' with private companies. While much of PEMEX's activities are carried out under entitlements, PEMEX now has the option to migrate any existing entitlement to the new contractual regime. Incentives to move to the new regime include less onerous and more progressive fiscal terms, and the possibility to 'farm out' or partner with private sector partners. Indeed, one of the ideas behind the reform was to gradually transition PEMEX's operations to the new contractual regime. In order to make such a transition, PEMEX is required to demonstrate that this will be of benefit to the nation. The contract type and the technical terms are

determined by SENER and the fiscal terms are established by the SHCP. In the case of a farm out, PEMEX's joint venture partners are determined through a public tender process.

E. Entitlements

10. An entitlement is a contract through which the Ministry of Energy (SENER) can grant PEMEX (or another state productive enterprise) the right to explore and produce hydrocarbons. The entitlement holder can then conclude service contracts with private companies for exploration and extraction activities. There are currently 428 entitlement agreements in place between SENER and PEMEX.

11. The entitlements granted to PEMEX are subject to a specific fiscal regime, composed of production and area-based instruments, along with the corporate income tax. This regime is comprised of the following principal components, also detailed in Table 1. These terms reflect the regime prior to the changes contemplated by the SHCP this year.

- Profit Sharing Fee of 65 percent of production value less cost deductions, which are subject to an annual cost cap.
- Hydrocarbons Extraction Fee, essentially a price linked ad-valorem royalty
- Corporate Income Tax at 30 percent of taxable income.

The entitlement regime also includes two annual fixed surface area fees, the Hydrocarbon Exploration Fee, and the Tax on Hydrocarbon Exploration and Extraction Activity. The profit-sharing fee and hydrocarbons fees are deductible expenses for the calculation of corporate income tax.

Table 1. Mexico: Entitlement Fiscal Regime

Fiscal Term	
Production Sharing Fee (percent of value of hydrocarbons)	
Rate	65 percent
Cost Deductions	100 percent expensing of exploration costs, 4 year straight-line depreciation of development costs
Cap on Cost Deductions (percent of value of Hydrocarbons):	
Onshore Oil	12.50 percent
Offshore Oil Shallow	12.50 percent
Offshore Oil Deep	60 percent
Natural Gas	80 percent
Chicontepec	60 percent
Hydrocarbon Extraction Fee (percent of value of hydrocarbons)	When oil price is less than $48 per barrel, 7.5 percent. When oil price greater than or equal to $48 per barrel, (12.5 percent*Petroleum price) + 1.5 percent
Corporate Income Tax	
Rate	30 percent
Depreciation	100 percent immediate expensing of exploration costs, 4 year straight-line depreciation of development Costs

Source: Hydrocarbons Revenue Law

Cost Caps

12. The cost caps associated with the profit-sharing fee reflect an effort to try and contain costs. Prior to the 2014 reform, cost caps were calculated annually in absolute monetary terms, from agreed annual portfolio–wide expenditures by PEMEX divided by the number of barrels expected to be produced in the year. The reforms saw the introduction of caps expressed as a percentage of revenue in the Hydrocarbons Revenue Law, ranging from 12.5 percent to 80 percent depending on the location of the activity (onshore or offshore) and the type of hydrocarbon being extracted (oil or gas). The relatively low level of the cost caps appear to be driven by both the low operating costs associated with the Cantarell field, as well as the government's experience of cost inflation issues in PEMEX.

13. An important determinant of the fiscal regime's impact on marginal or less profitable projects is the minimum government share of project revenues, or the 'effective royalty rate'. Under the entitlement regime, this minimum share results from the Hydrocarbon Extraction Fee and the effect of the cost cap limit combined with the profit-sharing fee. The cap on cost deductions,

just like a royalty, secures up-front revenues to the government as soon as production starts by ensuring that there is always a minimum quantity of production revenue subject to the profit-sharing fee. The combination of these instruments provides a floor for the government share of project revenues, regardless of project profitability, offering host countries a form of revenue protection by ensuring that the government collects revenue as long as there is production. However, a high minimum government share of project revenues will increase the risk perceived by an investor: the recovery or payback period will be longer due to the lower amount of petroleum available for cost recovery, with an increased risk that not all costs will be recovered over the project life.

Table 2. Mexico: Minimum Government Revenue
(percent of project revenues)

	Onshore	Offshore Shallow Water	Offshore Deepwater	Natural Gas	Chicontepec Paleochannel	Proposed Reform
Minimum Royalty (percent of Production Revenue)	7.5	7.5	7.5	7.5	7.5	7.5
Cost Cap (percent of Production Revenue	12.5	12.5	60	80	60	60
Profit Sharing Fee (percent of Production Revenue-Costs)	65	65	65	65	65	54
Effective Royalty Rate (percent)	**60.1**	**60.1**	**31.6**	**19.5**	**31.6**	**27.5**

Source: Hydrocarbons Revenue Law and Staff Estimates
Note: This calculation assumes that the royalty is deductible from the base of the profit sharing fee. The formula for the effective royalty rate is therefore 'Royalty Rate+(1-Royalty Rate) *(1-Cost Cap Rate)*Profit Sharing Fee'. Note also that at current price levels of approximately $60/barrel, the royalty rate would be higher than the minimum rate, at around 9 percent ((0.125*60)+1.5). On July 3, 2019, the Mexican basket price was $59.33 per barrel.

14. For onshore and shallow water offshore oil operations, the profit-sharing fee and associated cost cap have a highly regressive impact. Since Mexico is predominantly an oil producer, these terms are highly relevant to PEMEX's current and future operations. The combined impact of the royalty and profit-sharing fee has the effect of a royalty of 60.1 percent (Table 2). Royalty instruments are regressive in their fiscal impact, falling most heavily on less profitable projects. Thus, while the regime might appear to generate a high level of government revenue at lower levels of profitability, it raises the risk of discouraging investment altogether. In the context of a state-owned sector, this regressive burden of taxation may have simply represented a transfer of revenue from PEMEX to the state. However, given the intention to allow PEMEX to operate on a level

playing field with private operators, this regime may be too regressive to allow for investment to be undertaken on commercial terms. This issue is explored further in Section IV.

15. Internationally, effective royalty rates or minimum government share of revenue levels vary significantly from country to country. However, Mexico's effective royalty rate for oil under the entitlement regime is far above international norms. The median effective rate in a sample of 56 countries surveyed is approximately 20 percent.

16. SHCP's proposal to increase the cost cap and lower the profit-sharing rate would reduce the regressive impact for onshore and shallow water offshore oil projects. Indeed, low cost caps combined with high profit shares increase the risk perceived by an investor as the recovery period will take longer. Therefore, increasing the cost cap and lowering the profit-sharing rate, and thereby reducing the minimum government share of revenue to 27.5 percent may help to facilitate investment on commercial terms.

Ringfencing

17. Fiscal payments made by PEMEX under the entitlement regime are ringfenced by 'region'. Under the Hydrocarbons Revenue Law, payments under the entitlement regime as well as for income tax are ringfenced accordingly to five 'regional' classifications: onshore, shallow water and deep-water areas, extraction of non-associated natural gas, as well as extraction in the Chicontepec Paleochannel, where exploration for unconventional hydrocarbons is taking place. This 'regional ringfence' also applies for income tax.

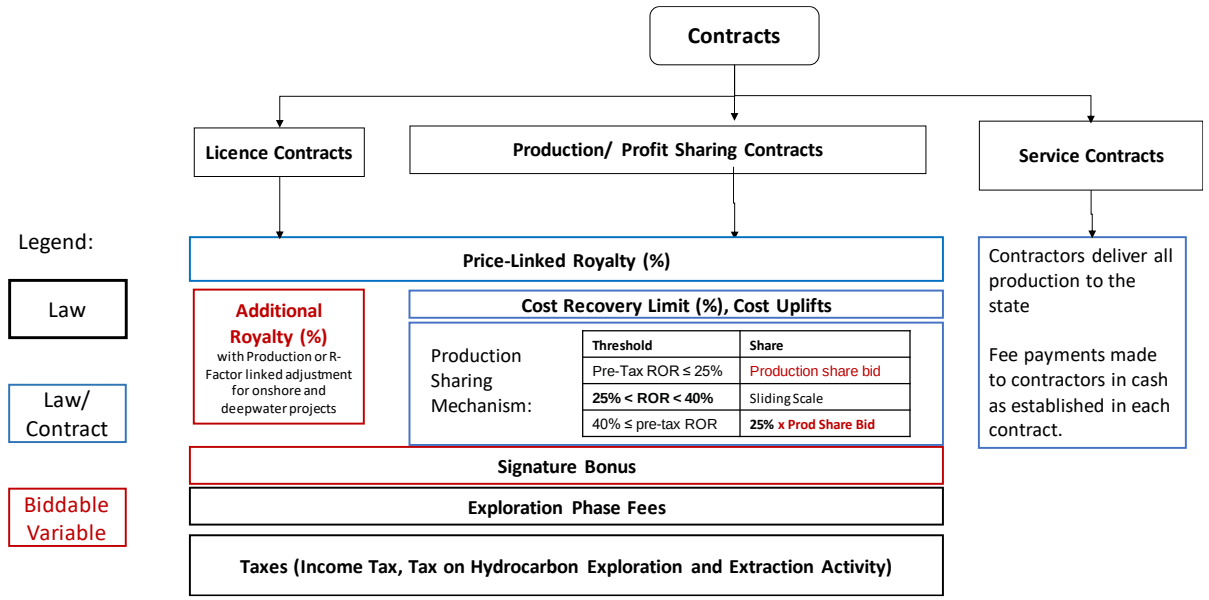
18. Ringfencing at a regional level rather than a licence or asset level may reduce the impact of the cost caps and will defer government revenue. Without reasonably tight ring-fencing at a licence or contract level, PEMEX can deduct exploration or development costs for each new project against the income of producing projects (if they are not also constrained by the cost cap). New investments will therefore result in an immediate reduction of taxable income on existing operations, and government revenue due from profit-based instruments such as the corporate income tax, or the profit sharing fee from producing areas will likely be delayed.

F. Contractual Regimes

19. Following the recent reform, the legal framework provides for a number of different contract types (license contracts, production-sharing contracts, profit-sharing contracts and service contracts), each implying different fiscal regimes. For each contract type, some of the terms are determined under the Hydrocarbons Revenue Law and specified in further detail in model contracts issued for each licensing round, and others are specified as biddable variables to be determined during the tendering process. Contract regimes appear to have a more balanced structure than the entitlement regime, comprising both production and profit-based instruments. The structure of each contract type is detailed in Figure 1.

20. The principal sources of variation in terms across contract areas are the choice of contract and the bid variable. The government has the flexibility to choose the fiscal system for each area tendered and the associated fiscal biddable variables. A natural consequence of this design is that each contract awarded is subject to a slightly different fiscal regime. To date, license contracts have been awarded for onshore and deep-water areas, and production sharing contracts have been concluded for shallow water areas.

Figure 1. Mexico: Structure of Contractual Regimes



Source: IMF Mexico Fiscal Transparency Evaluation 2018

21. The Secretaría de Hacienda y Crédito Público (SHCP) is looking to align the PEMEX cost caps with the cost recovery limits of recently signed production sharing contracts (PSC). Given the focus on alignment with cost recovery limits of PSCs, licence contracts are not analyzed further in this note, but could be the subject of further analysis and technical assistance. The cost recovery limit under these production sharing contracts was set at 60 percent for oil contracts and 80 percent for gas, which align with the natural gas and deep-water oil cost caps for entitlements (Table 3). The cost recovery under the recently migrated Ek-Balam contract[4], which was specifically referenced in the SHCP circular is also set at 60 percent. Therefore it appears that the onshore and shallow water offshore entitlement regimes and associated cost caps are the primary focus of the SHCP's recent announcement.

22. The plan to lower the profit-sharing rate aligns it more closely with the minimum profit share levels under recent PSCs. Analysis of the results of bidding rounds 1, 2 and 3 suggests that the average first tier (government) profit share bid was 54 percent for shallow water oil PSCs—this aligns with the proposed profit-sharing rate in 2021. This average for the minimum government

[4] https://www.gob.mx/cms/uploads/attachment/file/283510/Contrato_.pdf

profit share will be used in the fiscal modeling analysis of the PSC regime in Section V. However, the bids appear to have varied widely and further analysis of specific terms under signed contracts should be the subject of future analysis.[5]

Table 3. Mexico: Fiscal Terms – Production Sharing Contracts

Fiscal Term		
Cost Recovery Limit	60 percent (oil), 80 percent (gas)	
Cost Uplift	25 percent (on both exploration and development)[1]	
Production Sharing Mechanism	**Threshold**	**Government Production Share**
	Pre-Tax ROR ≤ 25 percent	(1-Contractor Production Share (Bid)
	25 percent < pre-tax ROR < 40 percent	Sliding scale
	40 percent ≤ pre-tax ROR	(1-25 percent × Contractor Production Share (Bid))
Hydrocarbon Extraction Fee (percent of value of hydrocarbons)	When oil price is less than $48 per barrel, 7.5 percent. When oil price greater than or equal to $48 per barrel, (12.5 percent*Petroleum price) + 1.5 percent	
Corporate Income Tax		
Rate	30 percent	
Depreciation	100 percent immediate expensing of exploration Costs, 4-year straight-line depreciation of development Costs	

Source: Staff calculations.

G. The Mexican Fiscal Regime

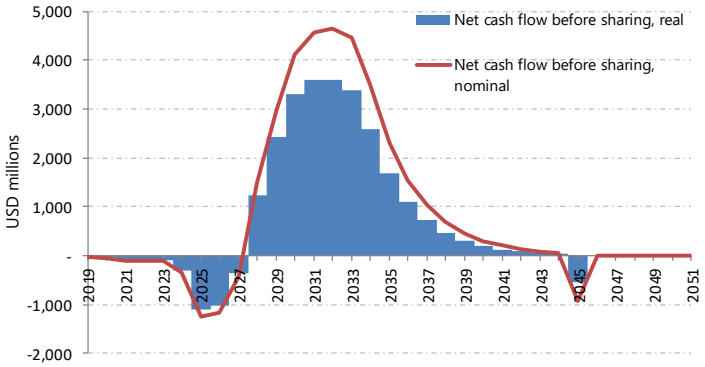
23. Economic modeling was undertaken using FAD's FARI modeling framework and a stylized offshore oil field example. The project example is stylized for illustrative purposes, although it is intended to reflect the broad cost structure of prospects that might be anticipated in the shallow water offshore Mexican waters. It reflects the broad scale of the shallow water Ek-Balam project, and the capital and operating costs reflect the levels reported in a PEMEX investor presentation published in November 2018.[6] However, there may be significant variation in the cost structures and project economics of PEMEX's current and future projects in Mexico, and as such the analysis which follows considers a number of possible variations in price and cost which might alter the ultimate project economics. With more detailed information on the economics of current and future PEMEX projects (including for natural gas), the analysis could be refined further.

[5] It is also understood that the Ek-Balam contract has a much higher minimum government share of 70.5 percent. Further analysis would consider the mechanics of this PSC and the basis on which these terms were determined during the migration process.

[6] See PEMEX Investor Presentation, November 2018, available at http://www.pemex.com/en/investors/investor-tools/Presentaciones%20Archivos/Investor%20presentation_20181106.pdf

Figure 2. Mexico: Economics of Project Example Evaluated

	MMBbl	Years
Total production	500	18
Project costs	**$MM**	**$/Bbl**
Exploration costs	400	0.80
Development costs excluding drilling	2,208	4.42
Drilling costs	1,977	3.96
Operating costs	3,998	8.00
Decommissioning costs	558	1.12
Total costs	9,141	18.3
Oil Price	$60/Bbl	
Pre-tax IRR	35.0 percent	



Note: All figures are in 2019 constant dollars

24. A key variable underpinning the project economics is the oil price. The analysis uses a constant oil price of USD 60 per barrel, based on current price trends and expectations. With these assumptions, the project yields a relatively high pre-tax IRR of 35 percent (Figure 2) i.e., a profitable project on a pre-tax basis.

25. The current fiscal regime applied to PEMEX's shallow water offshore oil operations is compared with SHCP's recent reform proposal and the average terms of production sharing contracts signed following recent bid rounds[7]. Only the principle terms of the regimes, as detailed in Tables 1 and 2 are modeled. Smaller surface area fixed fees are not modeled – these would constitute a fixed fee and have relatively small regressive impact.

26. The regime is analyzed on a project level, and thus the impact of the consolidated ringfencing treatment applicable to PEMEX is not analyzed. As such the benefit to the investor in being able to offset new investment costs against revenue from currently producing fields is not reflected in the results. Further work could consider the impact of the consolidated tax treatment at the 'regional' level.

Revenue Generating Capacity

27. The revenue generating capacity of each fiscal regime was evaluated by estimating the Average Effective Tax Rate (AETR) or "government take". The AETR is defined as the ratio of government revenue from a profitable project to the project's pre-tax net cash flows and is calculated both in undiscounted and discounted terms using a discount rate of 10 percent. At the assumed price and cost levels, the entitlement regime renders the project unviable. Figure 3 shows the AETR of the regimes, while Table 4 shows the key results.

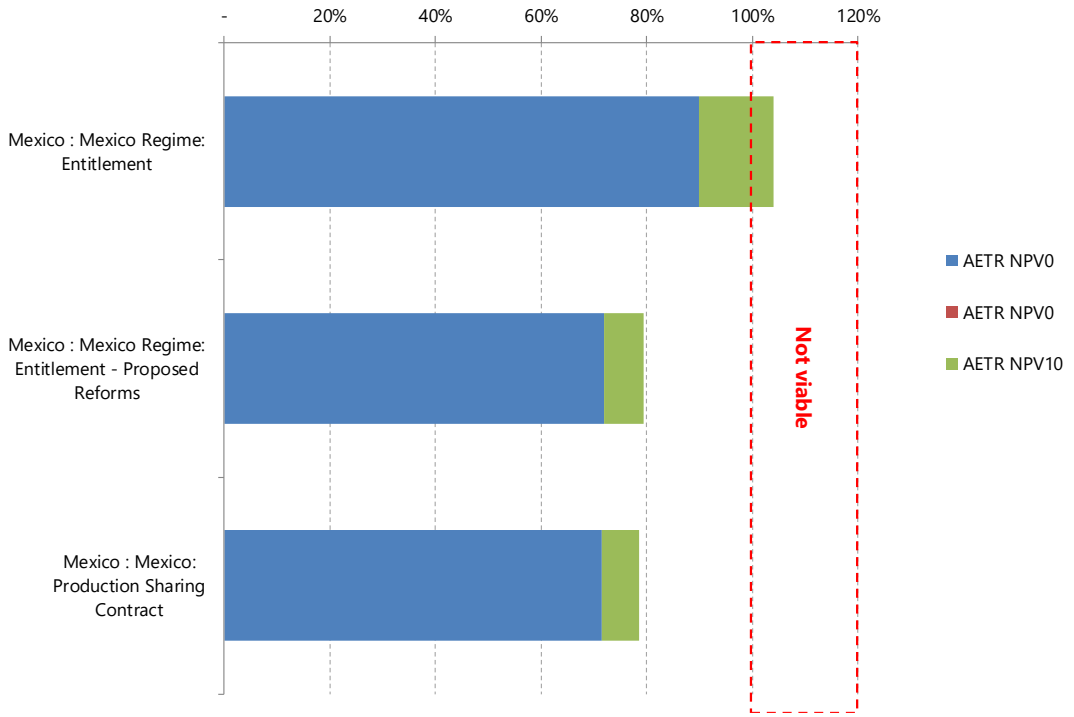
28. Under the entitlement regime with the 12.5 percent cost cap, the project is clearly unviable with an AETR of well over 100 percent, and a 6.8 percent investor IRR. It should be noted that this may be partially ameliorated by the regional ringfencing treatment which would

[7] The PSC regime is assumed to have a minimum government profit petroleum share of 55 percent.

allow these costs to be recoverable from other projects, unless of course they are also constrained by the cost cap.

Figure 3. Mexico: Average Effective Tax Rate - AETR for Selected Regimes

Discount Rate 10.0%



Note: Project Description: Size: 500 MMBbl; Costs: $18.3/Bbl (real); Oil price: $60.7/Bbl (real); IRR pre tax: 35%

Table 4. Mexico: Key Results

Project Fiscal Results *(% or US$ mm real 2019 terms)*	Entitlement Regime	Entitlement Regime - Proposed Reforms	Production Sharing Regime
Pre-Tax project IRR	35.0%	35.0%	35.0%
Post-tax IRR on total funds	6.8%	18.0%	18.5%
Post-tax IRR on equity	9.0%	28.9%	29.6%
Pre-tax NCF undiscounted	20,844	20,844	20,844
Post-tax investor NCF undiscounted	1,944	5,751	5,839
Government Revenue undiscounted	18,779	14,972	14,884
AETR undiscounted	90.1%	71.8%	71.4%
Pre-tax NCF (10% discount)	5,267	5,267	5,267
Post-tax investor NCF (10% discount)	-350	967	1,024
Government revenue (10% discount)	5,510	4,193	4,136
AETR (10% discount)	104.6%	79.6%	78.5%

Source: Staff calculations.

29. The analysis of the entitlement regime might therefore support the notion that the tax burden is constraining PEMEX's ability to invest. For projects comparable to the example analyzed, private sector companies would be unlikely to explore and develop petroleum resources under these fiscal terms. If projects are being undertaken by PEMEX under terms which render them commercially unviable, the fiscal regime may be restricting the possible returns to PEMEX and the availability of capital to reinvest further.

30. Increasing the cost cap and reducing the profit-sharing rate does improve the viability of the project. With the increased cost cap and reduced profit-sharing rate (at 54 percent), the discounted AETR falls significantly to 79.6 percent, with an investor IRR of 18.0 percent.

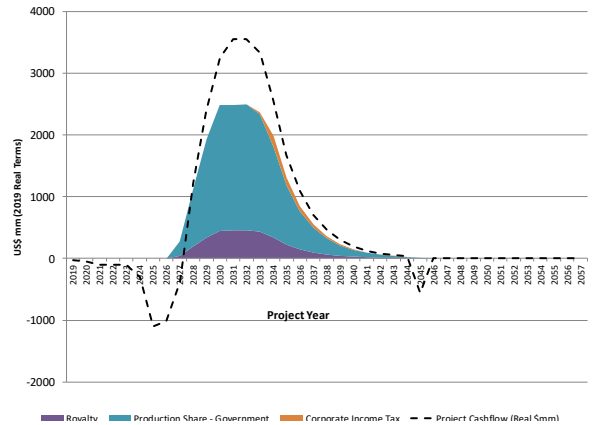
31. The project is also viable under the PSC regime. The PSC regime generates an AETR of 78.5 percent, with a post-tax IRR of 18.5 percent. The slightly lower AETR, compared with the reformed entitlement regime reflects a more generous cost recovery treatment through the application of cost uplifts.

Profile of Government Revenues

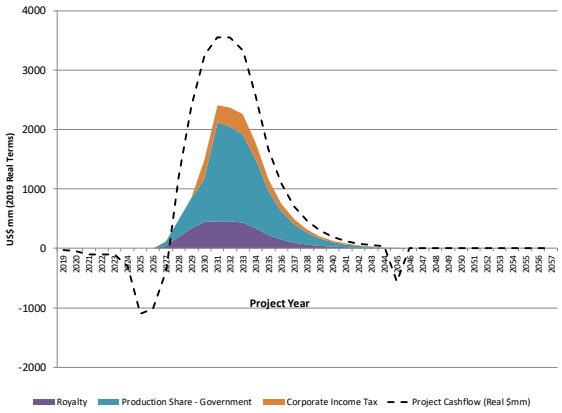
32. Looking at the profile of government revenues, under the entitlement regime, government takes significant revenues from the commencement of production. Figure 4 displays the profile and composition of revenues collected by the government from royalty, profit sharing fee or production sharing and corporate income tax. The profile of government revenue mainly reflects the production profile of the project evaluated. While under all three options the government starts receiving revenue from day one of production (due to the royalty and minimum production share/profit sharing fee), government take from early cashflows is especially high in the case with the 12.5 percent cost caps. Raising the cost cap to 60 percent and lowering the profit sharing rate to 54 percent provides some relief to the investor in the early years of the project while is recovering its investment. This effect is also seen in the case of the production sharing system, where the uplifts on exploration and development costs provide further relief to the investor during the investment recovery period.

Figure 4. Mexico: Government Revenue Profile and Composition

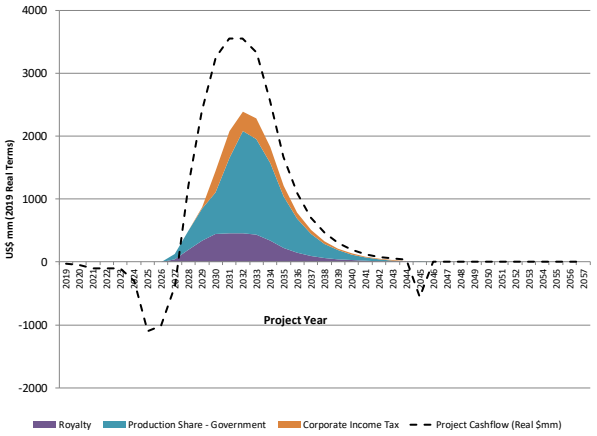
Entitlement Regime



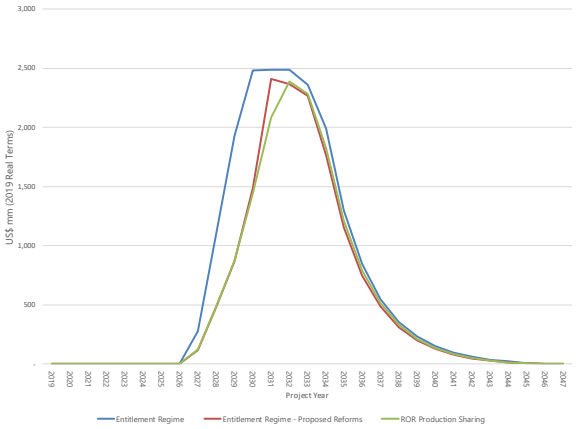
Entitlement Regime – Proposed Reforms



Production Sharing



Regime Comparison



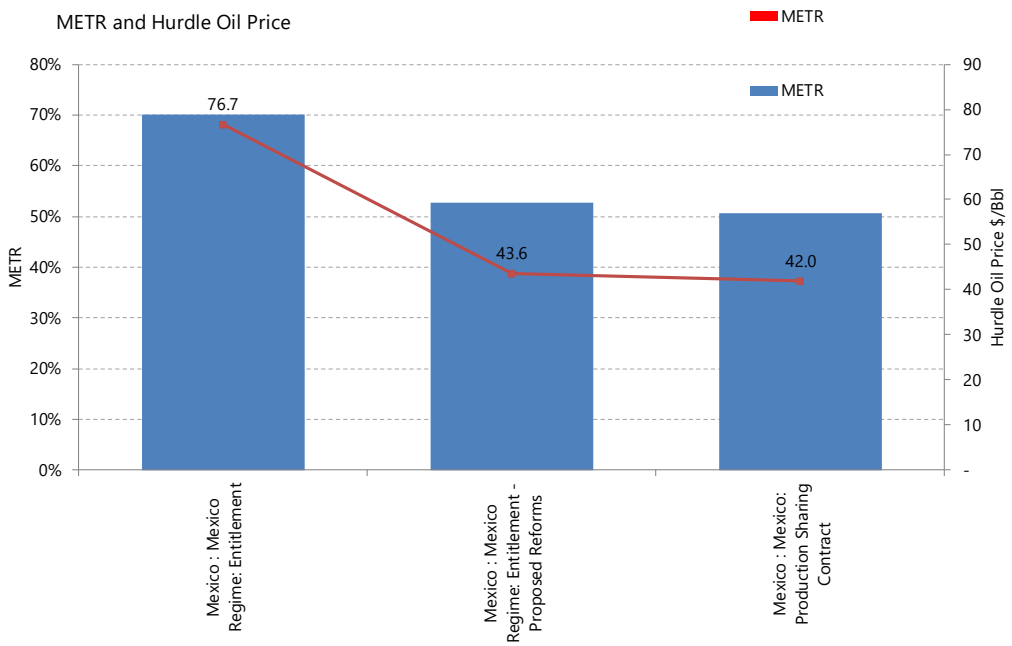
Source: Staff Calculations

Neutrality

33. The analysis also compared the relative burden that the different options would put on a marginal project. A key indicator is the "breakeven price" or the minimum price required to meet the minimum after-tax rate of return required by the investor (assumed in the model to be 12.5 percent in real terms).[8] As expected, for the entitlement regime, driven by its highly regressive nature, the breakeven price is well above current price levels at USD76.7/barrel (Figure 5). In contrast, by reducing the regressive fiscal burden, the entitlement regime with increased cost cap and lower profit-sharing rate, and the production sharing regime display breakeven prices more in line with current market trends and expectations.

[8] This rate would of course vary by country, depending on the risks to be faced in the exploration and development of potential projects in Mexico.

Figure 5. Mexico: Breakeven Price



Source: Staff calculations.

Progressivity

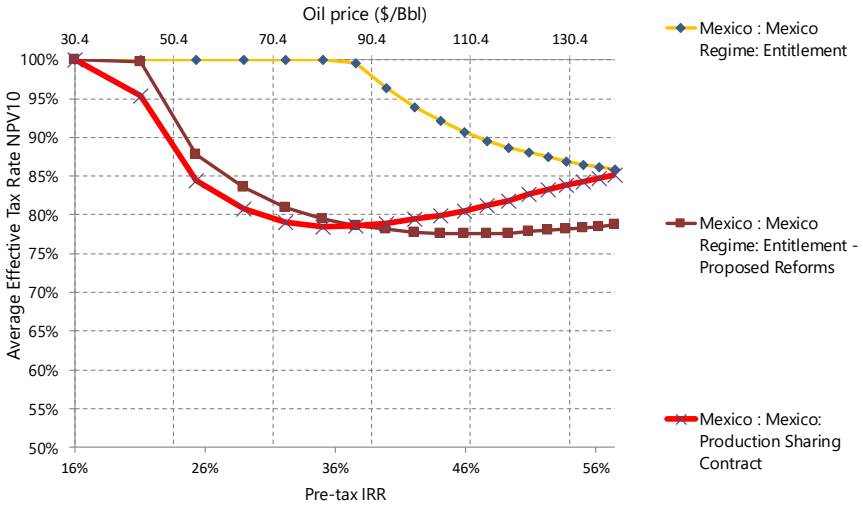
34. The analysis then considered how the AETR varies over a range of project outcomes. Progressive instruments in the fiscal regime would yield a higher share for the government as the profitability of the project increases, offsetting the impact of the regressive instruments. Figure 6 below illustrates the AETR over a range of project pre-tax IRRs. The variation in project pre-tax IRR was obtained by varying oil prices and the unit costs of the projects, respectively.

35. While increasing the cost cap and reducing the profit-sharing rate reduces the regressivity of the entitlement regime, without a substantive progressive component, the AETR falls as profitability increases. In contrast, under the PSC regime, while the AETR initially falls as profitability increases due to the dominance of its regressive components, this effect is counteracted by the progressive components once profitability increases enough to trigger the higher tiers of the production sharing mechanism.

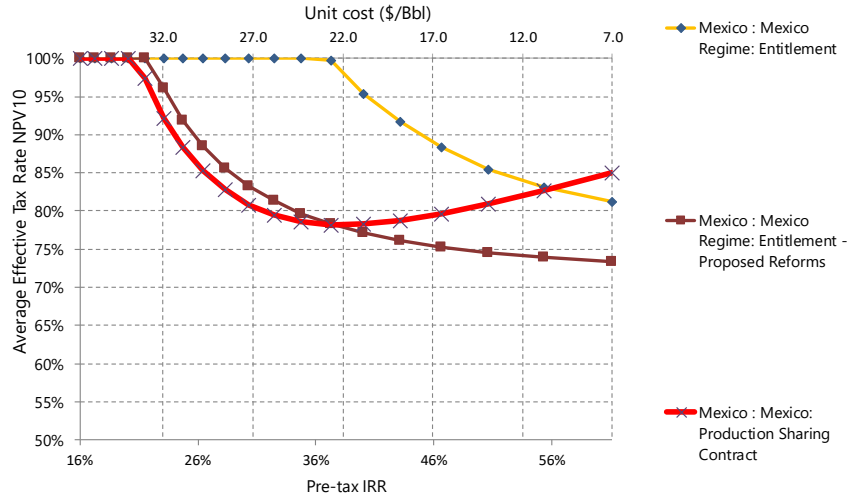
36. The results imply that a wider range of projects could be developed commercially under the reformed entitlement regime and the PSC regime. Although it appears that government take from an individual project would be lower under the PSC than the entitlement regime at lower levels of project profitability, it is important to recall that such projects, if based purely on commercial viability, would not be developed at all under the current entitlement regime, and so no government revenue would be available.

Figure 6. Mexico: Progressivity

Price Sensitivity



Cost Sensitivity



Source: Staff calculations.

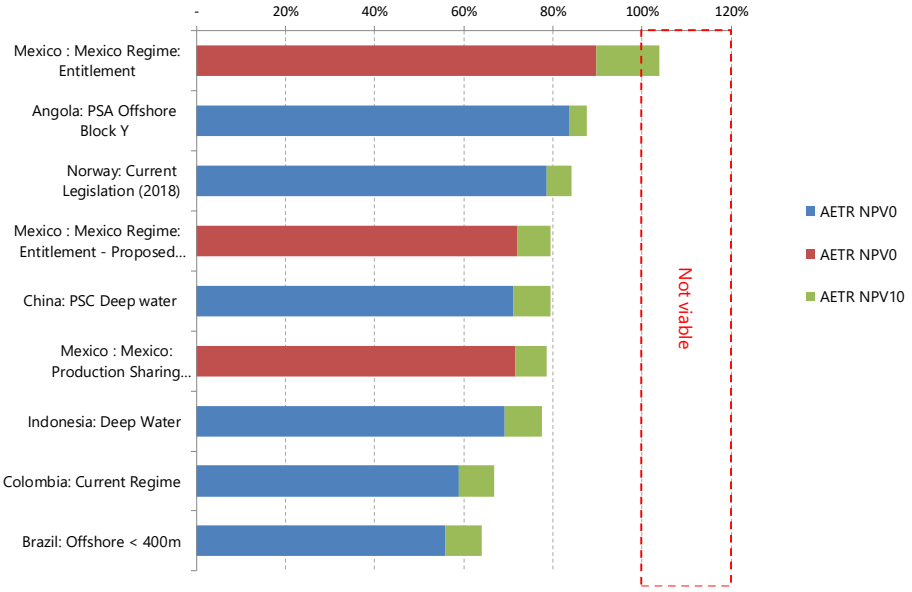
International Comparison

37. The Mexican regimes were compared with fiscal regimes applicable in other petroleum producing countries from the region and globally (Figures 7 and 8). Some of the comparators included in the sample are terms in established producers (Angola, Norway, Indonesia), while others are producers in the region (Colombia, Brazil). Under their fiscal regimes, these comparator countries use a range of production sharing and additional profits tax mechanisms to capture resource rents.

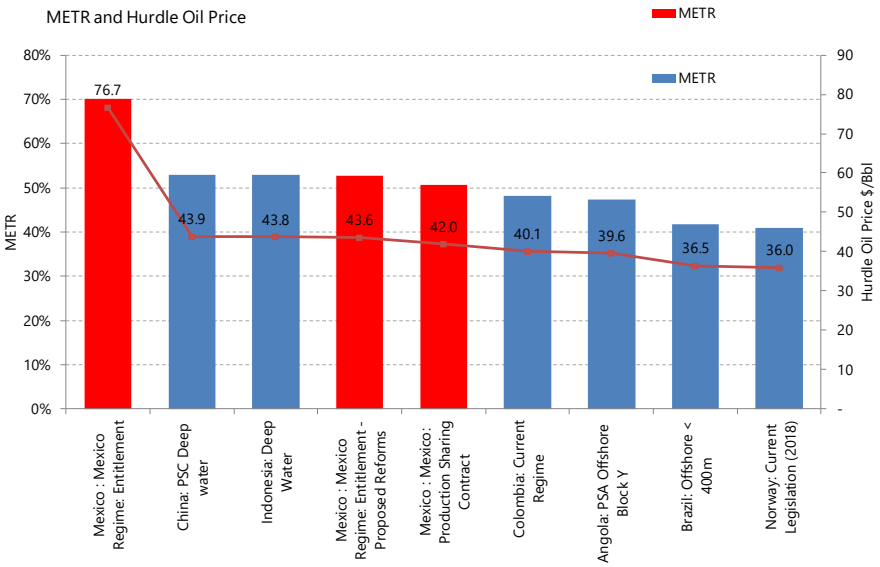
38. The entitlement regimes place a significantly higher burden on projects than the other countries in the sample. In contrast, the PSC and the reformed entitlement regime places Mexico better in line with the sample in terms of neutrality, while still maintaining a comparable government share of revenue. In terms of progressivity, the PSC regime places Mexico in line with other regime with production sharing linked to profitability indicators such as the Angolan rate of return linked production sharing system, or those with additional profit tax mechanisms such as the Norwegian Special Petroleum Tax.

Figure 7. Government Tax and Breakeven Price—International Comparison

Government Revenue and AETR; AETR Selected Regime; Discount Rate 10%



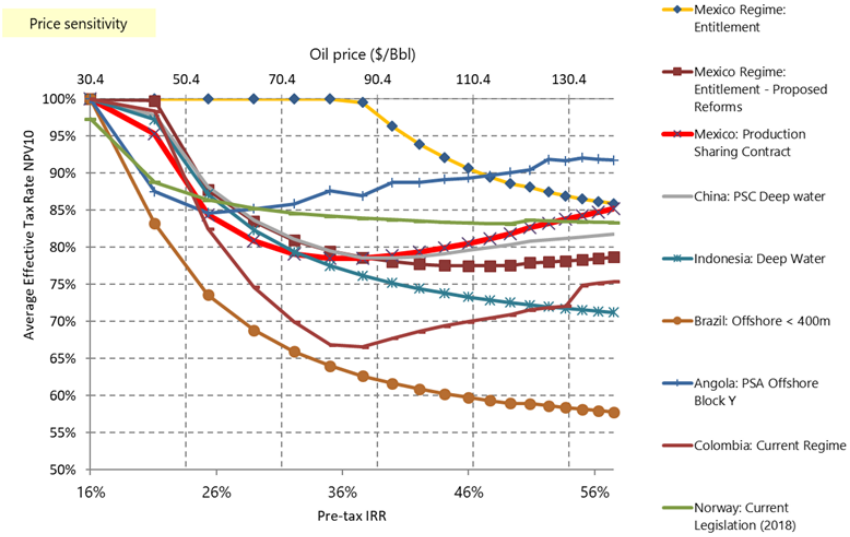
Breakeven Price



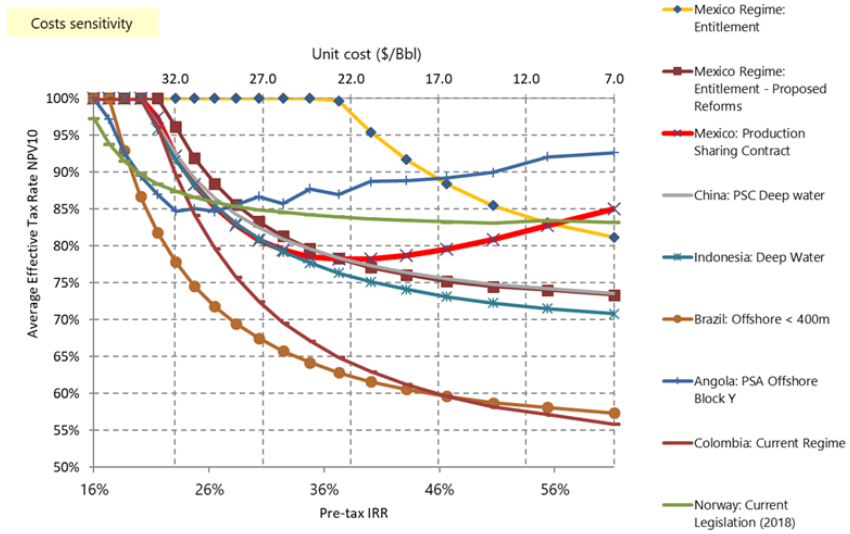
Source: Staff calculations

Figure 8. Progressivity—International Comparison

Price Sensitivity



Cost Sensitivity



Source: Staff calculations

H. Observations

39. The analysis suggests that in the short term, the increase in the cost cap and a reduction in the profit-sharing rate will reduce the regressivity of the regime. By increasing the return to PEMEX, these reforms would improve its ability to undertake new onshore and shallow water oil projects on a commercial basis and increase its available cashflow for additional investment.

40. However, the analysis shows that even with the increased cost cap and reduced profit-sharing rate, the regime does not contain sufficient progressive instruments to allow the government to share in the upside from new developments, a desirable characteristic of petroleum

fiscal regimes. In the longer term, therefore, migration of entitlement assets to the newer more balanced contractual regimes would be beneficial, although this would of course come with some revenue loss to the government.

41. If cost caps are increased, other mechanisms should be put in place to mitigate the risk of cost inflation. These would include: (i) careful screening by CNH of PEMEX's projects, budgets and work plans; (ii) regular high-quality cost and fiscal audits (which should be required by CNH and SAT, the Tax Administration Service); and (iii) competitive, transparent procurement procedures for subcontractor services. Ultimately, through the migration process, private sector participation through farmouts can provide a mechanism for cost oversight and incentivize cost containment.