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MEXICO

SELECTED ISSUES

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Approved By
Western Hemisphere Department

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FORMALITY AND EQUITY—LABOR MARKET CHALLENGES IN MEXICO[1]

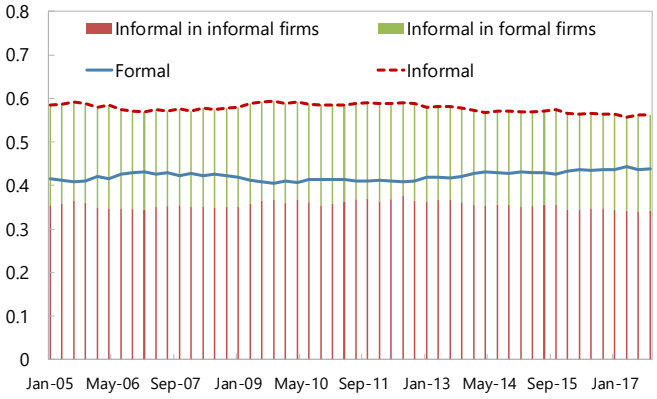
This note documents the composition, trends, and labor market implications of informality using data from the National Employment Survey (ENOE). Over half of the employed population has informal contractual relationships in Mexico both at formal and informal firms. Informality is found to be associated with lower levels of pay –even when accounting for worker composition differences– and lower wage growth over the life cycle. Policy drivers of this market duality, including minimum wage policy, are discussed.

A. Stylized Facts

1. Informality in Mexico takes many forms. Using data from the National Employment Survey (ENOE) from 2005 to 2017, this paper focuses on informality as defined from the perspective of the worker. Following criteria from INEGI, the definition of informal workers includes those at non-agricultural informal firms, self-employed agricultural workers, unpaid workers, non-salaried workers (at both formal and informal firms), and workers without access to social security health services in both formal and informal firms. None of the workers in this definition have access to Mexican Social Security Institute (IMSS) benefits. All other workers are defined as formal in the discussion that follows.

2. Labor market informality in Mexico remains stubbornly high. The growth of formal jobs has outpaced the growth of overall employment in recent years. However, from a medium-term perspective, formality has only slightly increased from 42 percent in 2005 to 44 percent by the end of 2017.

Formality in Mexico
(Share of employment)



Sources: ENOE and staff calculations

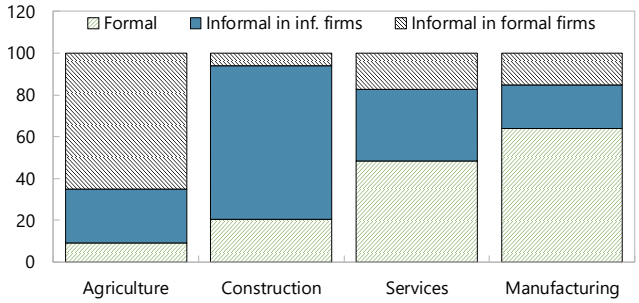
3. An important feature of Mexican informality is that a substantial share of informal workers is employed in firms that can be classified as formal. The definition of informal firms in this context includes subsistence agriculture, domestic work, and firms classified as informal by INEGI based on reported name, family ownership, and accounting practices. All other firms are classified as formal. Under this definition, around 22 percent of workers work at formal firms, but are not salaried or do not have access to full benefits. That is, there is a significant number of informal workers at formal firms under a variety of contractual

[1] Prepared by Jorge Alvarez (WHD).

relationships, from unpaid work to non-salaried contracts, without access to formal benefits. The variety of contractual relationships within formal firms provides an additional degree of freedom in hiring and firing decisions.

4. Formalization levels vary significantly across sectors. Agriculture and construction are the two sectors with the lowest rates of formalization with rates of 9 and 20 percent, respectively. Formalization is higher in other services (48 percent) and highest in manufacturing (64 percent) where formal salaried contract relationships are more common. There is also substantial variation in the type of firms that employ informal workers in different sectors. While only 8 percent of informal workers in the construction sector work at formal firms, 33 percent of informal workers in other services and 42 percent of informal workers do so.

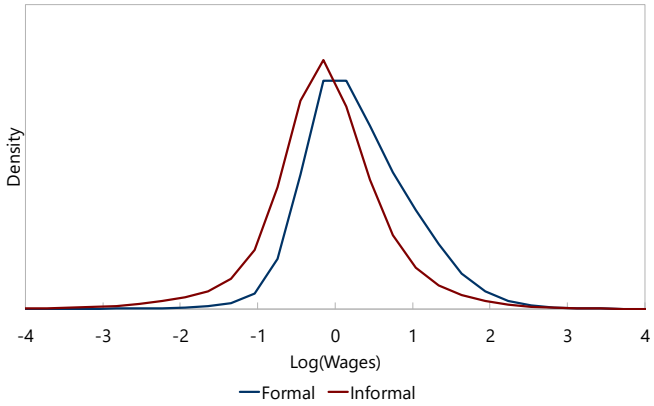
Formality by sector
(Percentage of employed)



Sources: ENOE; and staff calculations.
Note: 2017 data. Informal firms include subsistence agriculture, self-employed and domestic workers without access to IMSS, and firms classified as informal by INEGI. Informal workers in formal firms are those who do not have access to IMSS.

5. Moreover, informality is not only a feature of labor markets among the poorest. There is substantial inequality in both the formal and informal sectors, with variance of log wages[2] of .74 and .65 respectively. Importantly, there is substantial overlap in the distribution of wages in both sectors, as informality is prevalent both among low and high paying jobs as well as across levels of education. The prevalence of informality across sectors and income strata at both formal and informal firms are indicative of a market duality that permeates the Mexican economy.

Distribution of wages



Sources: ENOE; and staff calculations.

B. Labor Market Implications of Informality

6. Informality has important productivity and labor market implications. Formal jobs are better paid by 49 percent on average. Part of this is the effect of payroll and income taxes that are only faced by formal salaried workers. These costs to formality are only partially offset by net benefits received from contributory social security programs[3], which are moderately higher when

[2] Wages are calculated as the ratio of total labor cash income over worked hours reported.

[3] See Levy (2008), Antón, Hernández, and Levy (2012), and Levy (2018) for a more detailed discussion.

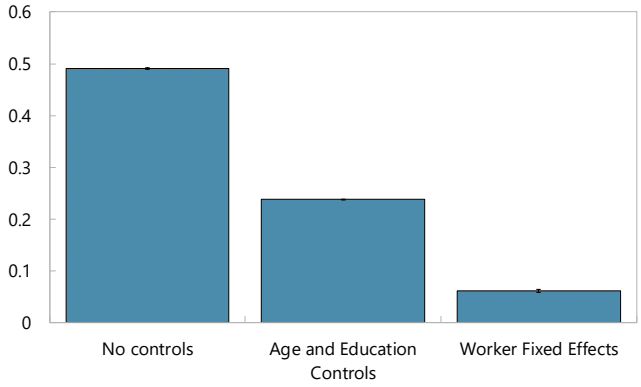
compared with non-contributory ones. To the extent that these differences in pay reflect labor productivity differences, the duality of formal and informal work can have aggregate productivity implications.

7. Much of the difference in pay between formal and informal workers stems from differences in worker composition. Informal workers are on average younger and less educated than formal ones, which explain part, but not all, of the gap in pay. To quantify the contribution of worker composition in this pay gap, wage premiums are estimated as follows:

$$wage_{it} = \alpha + \beta X_{it} + \psi_t + \theta_i + \varepsilon_{it}$$

where $wage_{it}$ is the log of the wage of worker i at time t, α is the wage premium, X_{it} is a vector of observable worker characteristics including age and education, and ψ_t are time fixed effects. Since the ENOE is designed as a five-quarter rotational panel, specifications controlling for worker fixed effects, θ_i, are also estimated.

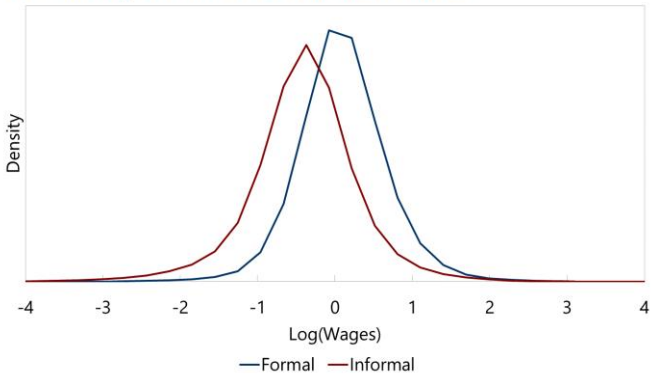
Formality wage premiums
(Premiums in log points)



Sources: ENOE; and staff calculations.

8. Differences in education and demographics account for about half of the overall gap in wages. Once education and demographic differences between informal and formal workers are controlled for, the residual gap is reduced from 49 to 24 percent. This implies that differences in these observable characteristics account for 51 percent of the overall wage gap. There is also substantial variation of wages within formal and informal groups even after accounting for differences in observable demographics (including age and education). Altogether, observable demographics do not account fully for neither the wage gap between formal and informal workers nor the dispersion of wages within each group.

Distribution of wages - Residual after accounting for differences in observables



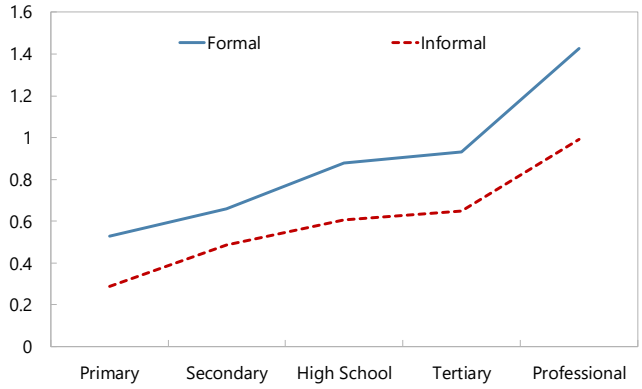
Sources: ENOE; and staff calculations.

9. The gap is significant reduced if observable and unobservable characteristics are accounted for. Wage premiums estimated after controlling for individual fixed effects is significantly lower at 6 percent. This implies that differences in worker composition as controlled by observable and fixed unobservable characteristics account for 88 percent of the overall wage gap. It is important, however, to qualify this statement as the latter wage premiums are only estimated using workers who switch across sectors. These switchers do not form a representative sample of the

population; therefore, it might still be the case that gains from formalization are greater for workers who do not switch across sector. In addition, given that the panel structure of the dataset follows a worker for only five quarters, wage premiums are exclusively affected by short-term gains from transitioning across sectors. This implies that, although estimated short-term wage premiums are relatively small, long-term gains from formalizations might still significant.

10. Informality can also lead to depressed human capital accumulation, with potential long-term productivity costs. Returns to education (relative to no education) are lower for informal workers than for formal ones, particularly for workers with completed high school and professional degrees. To the extent that lower returns are an intrinsic feature of informality, this can decrease the incentives for schooling for workers and potentially lead to substantial human capital lags.

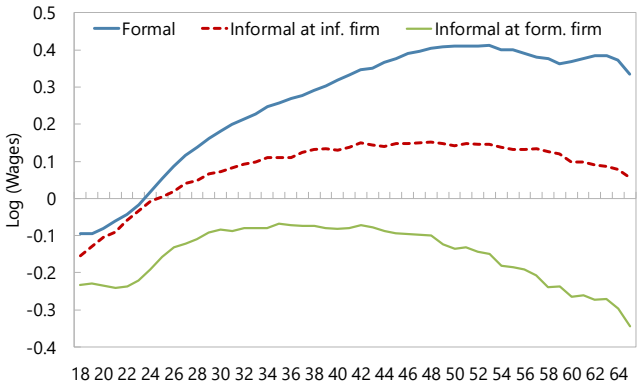
Returns to education
(Premiums in log points)



Sources: ENOE; and staff calculations.

11. Beyond schooling, informality can also depress on-the job human capital accumulation. Returns to experience —as depicted by conditional wage growth profiles[4] over the life cycle— are significantly lower for informal workers. This is consistent with research highlighting limited on-the job training outside of formal jobs in Mexico.[5] Interestingly, informal workers at formal firms —which include non-salaried workers without health benefits—appear to exhibit lower wage growth than informal workers at formal firms—which include the self-employed.

Wage growth over life cycle



Sources: ENOE; and staff calculations.

While formal workers peak wages arrive around age 50, the peaks occur before the mid-40s for informal workers. These flatter wage pattern among informal workers occurs at both small informal firms as well as large formal ones. To the extent that wage levels reflect productivity differences across age groups, the flatter informal wage growth profiles can be indicative of poor on-the-job human capital accumulation. Altogether, the evidence suggests a human capital channel —through both schooling and experience—connecting informality to poor long-term labor productivity.

[4] Reported age and education returns estimated after controlling for worker observables, location, and time fixed effects.

[5] See Alaimo et al. (2015).

C. Regulatory Drivers of Informality

12. Regulation that treats differentially formal and informal workers and firms hinders the formalization process in Mexico. Formal firms that employ salaried workers face social insurance contributions, taxes, and hiring/firing costs that do not apply to non-salaried workers both at formal and informal firms. Most prominently, formal firms must enroll salaried workers in the social security registry (IMSS) and pay a contribution proportional to worker's wages in a scale that contains a regressive fixed cost component. Non-compliance is subject to monetary fines in the rage of 20–350 daily minimum wages per non-registered workers.[6] Formal salaried workers also face state payroll taxes that do not applied to non-salaried informal workers, and the fact that federal income taxes are withheld while non-salaried ones are filed directly has led to greater tax evasion among the later.

13. Formal firms hiring salaried workers can also be sued for unfair dismissals, implying a contingent liability for hiring formal salaried workers at formal firms. Labor lawsuits arising from this regulation often leads to long legal dispute processes that, in the past, led to an accumulation of payments owed by firms directly linked to the length of the dispute.[7] The 2017 labor reform has limited these firing costs and has allowed for processes aimed at facilitating dispute resolution processes. The regulation needed to fully implement this reform, however, is yet to be passed.

14. There is now extensive research suggesting that these and other barriers create a dual incentive system that induces high informality rates and provides an implicit subsidy to small unproductive informal firms. Adding to the measures discussed, the literature has also emphasized the role of non-contributory benefits in discouraging formality,[8] the limited value of contributory benefits,[9] and the effect of size-specific tax regimes such as Repeco[10] and enforcement policies[11] in inducing labor and capital misallocation towards the informal sector. Levy (2018) provides a relevant summary and expanded discussion of this research and concludes that formalization frictions lead to significant aggregate TFP losses in Mexico.

15. Policy changes in Mexico over the last two decades have likely worsened market duality. Two main policy trends have likely have widened the incentive gap preventing

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[6] Bobba et al. (2017).

[7] Heckman and Pages (2004) estimate significant costs associated by severance pay regulations in the order of 3 percent of wages. Da-Rocha, Tavares, and Restuccia (2016) show that this type of regulations can have large negative effects on TFP.

[8] See Bosch, Cobacho, and Pagés (2014) for a meta-analysis of these studies.

[9] Levy (2009) document the value of contributory programs relative to required contributions and conclude that net benefits are limited for the average worker. Most workers who can opt in but are not mandated to enroll in these programs do not do so.

[10] Special regime for small enterprises.

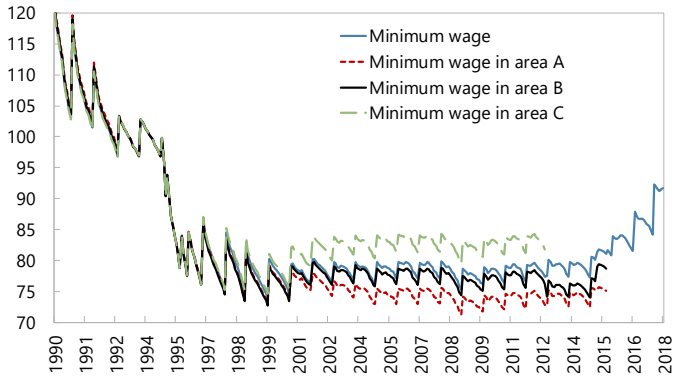
[11] See Leal (2014).

formalization. On the one hand, there has been significant increases in the collection of payroll taxes that are only applicable to salaried workers.[12] On the other hand, non-contributory programs, such as non-contributory health and pension programs have expanded their coverage and size in Mexico,[13] which has lowered the relative benefits of contributory programs enjoyed by formal workers. In this context, proposed minimum wage increases by the incoming administration would likely contribute to this incentive gap. We turn to this latter aspect of labor policy next.

D. Minimum Wage Policy and Informality

16. After an extended period of stability, minimum wages have only recently started to increase. Real minimum wages collapsed in the 1990s, remained relatively stable in the 2000s, and started rising significantly in the past three years, when minimum wages went from 37 to 40 percent of median wages. According to comparable OECD data, the ratio of minimum to median wages in Mexico remains below OECD peers and other Latin American economies.

Real minimum wages
(index, 1994=100)



Sources: Banxico; and staff calculations.

17. The effects of minimum wage hikes on inequality and formality are however hard to assess. This is challenging due to limited exogenous policy variation in Mexico. Nonetheless, using 2005–2017 data from ENOE, we can document how past changes in minimum to median wage ratios have been *associated* with changes in both formality and inequality and the municipal level. Policy variation comes from two sources. First, minimum wages levels are periodically updated creating significant variation across time. Second, Mexico has reformed its minimum wages system from a multi-zoned system to a single federal minimum wage inducing policy variation across regions. Using this variation, the following models are estimated:

$$Percentile_{mt} = \gamma\, Min\_Wage_{mt} + \beta X_{mt} + \psi_t + \theta_m + \varepsilon_{mt}$$

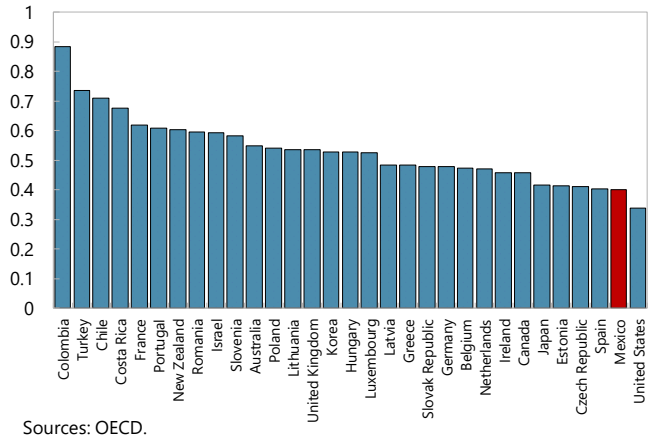
$$Formality_{mt} = \gamma\, Min\_Wage_{mt} + \beta X_{mt} + \psi_t + \theta_m + \varepsilon_{mt}$$

[12] Levy (2018) estimates that there was an increase of 1.9 percent of GDP in the collection of income and payroll taxes collected from formal workers.

[13] See Anton (2016) for a documentation of the increase of non-contributory benefit spending in Mexico.

where Min_Wage_{mt} is the ration of minimum to median wages in municipality m at time t, X_{mt} is a vector containing the demographic characteristics of the municipality (including mean age and education levels), ψ_t are time fixed effects, and θ_m are municipality fixed effects. For robustness, linear municipality-specific time trends are also included in some specifications. The model is estimated with the 10th, 25th, 50th, 75th and 90th percentiles as dependent variables as well as the share of formal workers over total employed.

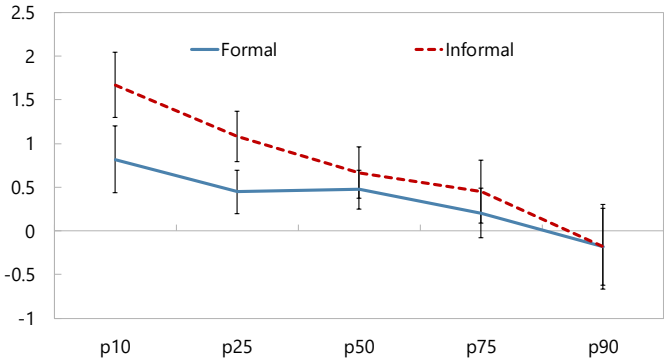
Minimum wage relative to median



Sources: OECD.

18. Past increases in minimum wages were associated with significant changes in the wage distribution among both formal and informal workers. Coefficients on minimum-to-median wage ratios from percentile regressions are plotted in the figure for formal and informal workers separately. Past minimum wage increases were associated with larger increases among the lowest percentiles of the distribution of both formal and informal workers. The pattern document is consistent with spillover effects from minimum wages discussed in the structural labor literature.[14]

Minimum wage rises and wage percentiles



Sources: ENOE; and staff calculations.
Note: Coefficients on minimum to median wage ratio from municipality-level fixed effect percentile regressions.

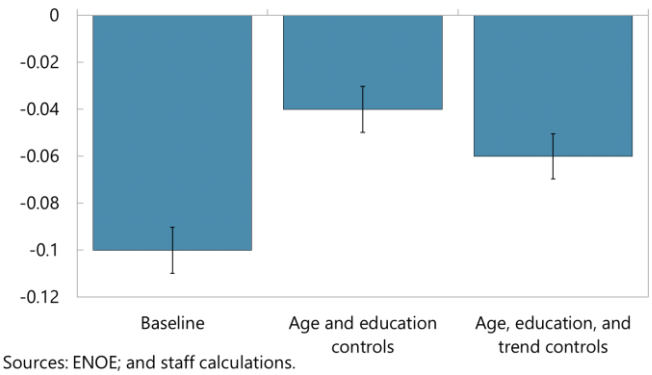
19. However, past increases in minimum to median wage ratios were also associated with increasing informality.[15] Coefficients on minimum-to-median wages using formality as the dependent variable show significant negative coefficients with and without a vector of controls. The results document a pattern where informality increased the most in municipalities that experienced the greatest increases in minimum-to-median wages. These effects appear to be driven by both

[14] See Burdett and Mortensen (1998), Bontemps et al. (1999), and more recently Engbom and Moser (2018).

[15] The patterns documented for Mexico are consistent with moderate negative effects on employment as summarized in Card and Krueger (1995) and Neumark and Wascher (2008).

movements from formal to informal firms as well as by the movement from formal to informal contractual arrangements within formal firms.

Formality changes associated to minimum wage increases



Sources: ENOE; and staff calculations.
Note: Coefficients on minimum to median wage ratio from municipality-level fixed effect regressions with time effects and formality as a dependent variable.

20. Overall, past correlations suggest that minimum wage increases, while potentially inequality-reducing, risk increasing informality. There are important caveats to this statement, however. First, the patterns documented reflect associations that do not prove a causal relationship between minimum wages and both distributional and formality outcomes. Second, past minimum wage changes over the period of study (2005–17) have been relatively smooth and may not be informative of non-linear effects that might occur from larger abrupt policy changes.

E. Conclusions

21. The results suggest that informality tends to select workers with lower earnings potential and limits their development. Informality indeed tends to be more prevalent among younger and less educated workers, for which better paid jobs are harder to come by. Moreover, it appears to lead workers towards a path of limited earnings and perhaps skill growth potential. These gaps in earnings growth and potential resonate with firm-data evidence documenting lower output levels and growth in informal firms[16] and highlight a channel linking labor market duality and aggregate productivity.

22. Future labor market reforms should take a holistic approach that addresses both distributional concerns and formality barriers. One alternative is to reduce dependence on payroll taxes that are biased towards formal salaried workers while transitioning towards a social insurance system that provides good-quality services for all, irrespective of their salaried/non-salaried status. Another is easing firing and hiring restrictions of salaried workers while increasing protections to the unemployed through a more universal unemployment insurance scheme. This type of profound long-term transformations should, of course, only be implemented after careful review of policy alternatives guided by experiences in other countries and detailed impact analysis.

23. Short-term reforms should build towards a system where the non-exclusive targets of boosting social protection and removing distortionary restrictions are achieved. Policy proposals, such as hikes in the minimum wage, should be gradual, viewed in the context of other distortionary polices, and carefully weigh equity benefits against the potential displacement of labor towards unproductive informality.

[16] See Chapter 2 of this paper; and Busso, Fazio, and Levy (2012) and Levy (2018) for firm-level evidence on productivity differences.

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CONSTRAINTS TO FIRM INVESTMENT AND GROWTH—A LIFE CYCLE ANALYSIS[1]

This paper highlights growth over a firm's life cycle as a key factor behind Mexico's weak productivity growth. It confirms that the average Mexican firm stagnates after some 10-15 years of age at less than twice its initial size. The few industries with stronger life cycles tend to be located close to the US border and related to the North American supply chain. While NAFTA appears to have boosted life cycle growth only for initial cohorts of firms in some sectors (e.g. transportation), this does not appear to be the case across the board. The analysis also uncovers important distortions that explain weak life cycle growth. These include the prevalence of informality, highlighting that informal firms do not grow while formal firms experience solid and continuous growth. Moreover, stronger firm growth appears to be associated with less concentrated industries that are less likely to be subject to the undue use of market power. Firms are also less likely to invest and grow if they are far away from population centers and do not have access to good financial and internet services.

A. Motivation

1. Mexico implemented sweeping structural reforms during the mid-1990s following a series of economic and financial crises. The reforms succeeded in achieving macroeconomic stability, opened the economy up to trade and foreign investment, and boosted educational attainment.

2. Against this backdrop, Mexico's negative productivity growth in recent decades remains a puzzle (Levy and Rodrik, 2017). Previous work (e.g. Levy, 2018; Misch and Saborowski, 2018) has shown that productivity in Mexico is low in part because the allocation of capital and labor is inefficient. A complementary explanation would be that individual firms are simply not productive enough.

3. One explanation for low firm productivity could be insufficient investment due to the prevalence of distortions that discourage firm growth. Hsieh and Klenow (2014) argue that the lack of investment constrains productivity both directly in incumbent firms and by reducing competition for new entrants. In this context, their finding that manufacturing plants in Mexico grow far less than firms in the United States as they age is an important concern.

4. The aim of this paper is to understand why firms in Mexico do not invest more and thus remain relatively small and unproductive. We make use of several waves of the Mexican Economic Census and other subnational data sources to calculate firm growth over firms' life-cycles.

[1] Prepared by Florian Misch (FAD) and Christian Saborowski (WHD).

We then decompose life cycle dynamics to understand regularities and attempt to identify distortions that explain the lack of firm growth.

B. Methodology and Data

5. Estimating firm life cycles is challenging. A firm's life cycle measures the evolution of size over its lifetime. The ideal research setting would thus be one in which the researcher could simply aggregate observed firm-level life cycles for all firms in the economy. In reality, however, longitudinal data on firm growth is typically not available for all types of firms.

6. Firm life cycle dynamics have been calculated using different approaches, each associated with important shortcomings. Two of the more well-known papers on this topic are Hsieh and Klenow (2014) and Eslava and Haltiwanger (2017). Hsieh and Klenow (2014) calculate firm life cycles based on a specific wave of the Mexican Economic Census by calculating the average firm size in a given 6-digit industry for a series of age groups. By combining average firm sizes across age groups into a representative life cycle, the approach faces two main problems: first, it does not follow the same firms over time and, second, it is likely associated with attrition bias since earlier age-groups will include a larger number of unproductive and, crucially, relatively small, firms that do not make it to the older ages.[2] Eslava and Haltiwanger (2017) avoid both problems by focusing on longitudinal firm-level data for Colombia, but their data is incomplete in that it does not include the full universe of firms as small and informal firms are underrepresented.

7. We make use of several waves of the Mexican Economic Census to calculate life cycles for Mexican firms. As is standard in the literature, we measure firm size as the number of employees. We use the same data source as Hsieh and Klenow (2014) but makes use of a larger number of waves of the Economic Census to ensure that we can follow the same firms over time. Specifically, we define age groups in five-year intervals (0–4 years, 5–9, 10–14, 15–19, 20–24). We then compare the average firm size in age group 0-4 in industry i and state s in the 1993 wave to the average size of firms in age-group 5–10 in the same industry and state in the 1998 wave. This gives us the average growth rate of firms in industry i and state s from age group 0–4 to age group 5–10. We continue this process until the 2013 wave which gives us the full life cycle of firms in industry i and state s born in the 1993 wave from ages 0-4 to ages 20–24. We label these firms the 1993 cohort.

8. We calculate life cycles for four cohorts of firms per industry and state. We follow the same process as described in the previous paragraph for the cohorts of firms born in the 1998, 2003 and 2008 waves, except that the life cycles we calculate for these firms are progressively shorter. For example, we can draw out the evolution of firms in the Bakery and Tortillas sector in Aguascalientes that were 0–4 years of age in 1993 until they were 20–24 years old. But we can only observe the

[2] In a slight variation to this approach, the authors calculate life cycles based on two waves of the Mexican Economic Census by comparing the average size of a given age group in the first wave to the average size of five-year older firms in the same sector in the second wave. This somewhat attenuates the first shortcoming but does not alleviate the selection bias.

cohort of firms in the same industry and state that was 0–4 years old in 1998 up to age 15–19. Throughout our analysis, we include only cohorts that we can observe at birth. So, for instance, we do not include the cohort of firms that was 5–9 years old in 1993. This leaves four cohorts per industry-state pair whose life-cycles we observe. Table 1 illustrates the structure of the resulting data set for better exposition. Note that firm sizes are normalized to one at birth to allow better aggregating the data across states and sectors.

Table 1. Mexico: Stylized Example of Data Set

Industry	State	Cohort	Year	Age Group	Size
1	1	1993	1993	1	1
1	1	1993	1998	2	…
1	1	1993	2003	3	…
1	1	1993	2008	4	…
1	1	1993	2013	5	…
1	1	1998	1998	1	1
1	1	1998	2003	2	…
1	1	1998	2008	3	…
1	1	1998	2013	4	…
1	1	2003	2003	1	1
1	1	2003	2008	2	…
1	1	2003	2013	3	…
1	1	2008	2008	1	1
1	1	2008	2013	2	…

9. Our approach improves upon the methodology used by Hsieh and Klenow (2014) and covers a broader sample of firms than Eslava and Haltiwanger (2017). While we are, like Hsieh and Klenow (2014), not able to work with longitudinal firm level data, we do follow the same cohort of firms over time. We also make an effort to directly control for the problem that cohorts may get smaller over time because small and unproductive firms exit disproportionately (attrition bias).[3] In contrast to Eslava and Haltiwanger (2017), in turn, our data set includes the full universe of non-agricultural firms in Mexico, including small and informal ones. Moreover, we distinguish life cycles not only at the level of the 6-digit industry but also by state, allowing us to run regressions that include state and industry as well as wave fixed effects.

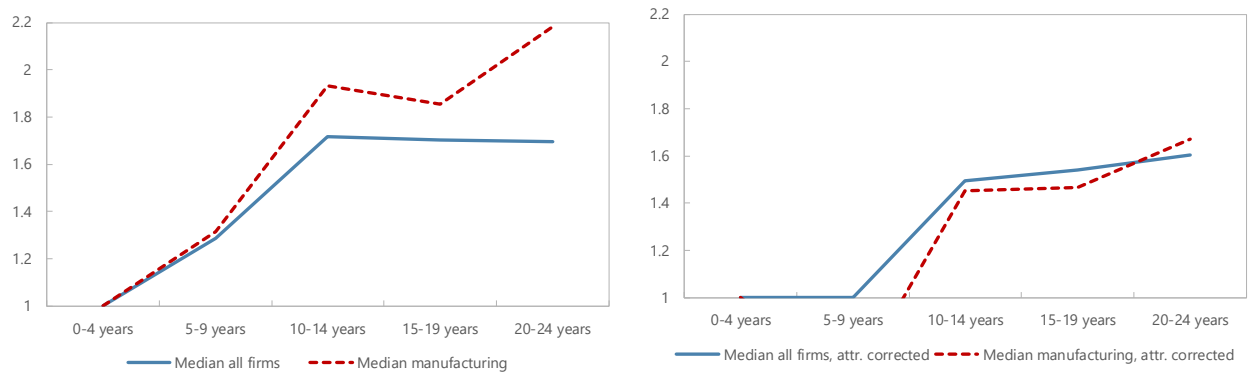
C. Descriptive Analysis

10. Mexican firms no longer grow after some 10-15 years of age. We focus on the 1993 cohort of firms to illustrate life cycle dynamics in Mexico. When we aggregate the life cycles of all industry state pairs across states, and then across industries by taking medians, we find that the

[3] We do so by running a regression of life-cycle levels on the share of firms in a cohort that survived until a given point in the life cycle. We then calculate the corrected life cycle as error term in the regression.

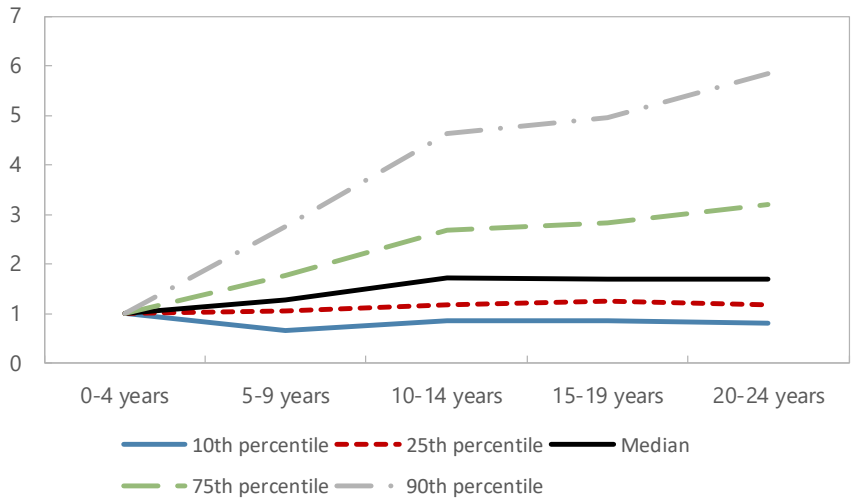
median sector in Mexico sees firms less than double in size before stagnating after 10-15 years of age (Figure 1, left chart). The picture looks even more bleak when we correct for a potential attrition bias (Figure 1, right chart). We see somewhat more and more continues growth in the manufacturing sector, but the sector does not look much different when correcting for attrition bias. This finding is broadly in line with Hsieh and Klenow (2014) who estimate that manufacturing firms in Mexico stagnate after reaching around two times their initial size around age 20. The authors find that US firms, by contrast, continue growing throughout their lifetimes to more than seven times their initial size.

Figure 1. Mexico: Aggregate Life Cycle Dynamics Across Industries



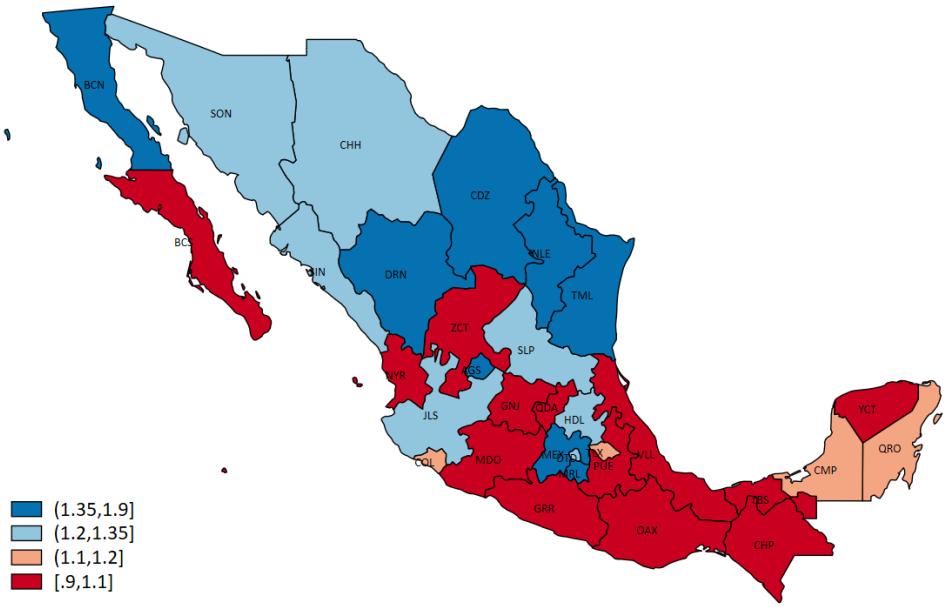
11. Only a small share of firms experiences significant growth in higher ages. Figure 2 illustrates the distribution of industry life cycles. As can be seen only a very small share of Mexican firms grows to high multiples of their initial size, with even the 90th percentile remaining far below Hsieh and Klenow's (2014) results for the US economy.

Figure 2. Mexico: Distribution of Life Cycles Across Industries



12. Firms with stronger life cycles appear to be clustered along the US border and in industries related to the North American supply chain. A closer look at the manufacturing sector suggests that many of the sectors related to the North American supply chain are among those that experience the highest growth over their life cycles (e.g., transportation, food and basic metals). However, there also appears to be notable regional variation suggesting that, beyond industry composition there may be an important role for structural rigidities in determining life cycles. Figure 3 illustrates that life-cycles in the manufacturing sector are weakest in Mexico's less developed South and stronger closer to the border with the US.

Figure 3. Mexico: Median Manufacturing Life Cycle Growth by State[1]



1/ The map shows the growth the average firm in the state experiences over its life cycle. Specifically, the underlying figures reflect the median across all 6-digit industries in the state.

13. The benefits from NAFTA appear to have been restricted to earlier cohorts of firms in some industries. An interesting question is whether cohorts that were the first to benefit from NAFTA (e.g., the 1993 and 1998 cohorts), some of which broke into new markets for Mexican firms, experienced stronger life cycles than those who came later. Looking at the transportation sector, the answer appears to be that initial cohorts indeed experienced more growth over their lifetimes than later cohorts (Figure 4). For example, firms in the 1993 cohort in the motor manufacturing sector grew in size by a factor of 44 by the time they were 5–10 years of age while the 1998 and 2008 cohorts experienced 10 and 1.3-fold growth, respectively. A potential explanation might be that NAFTA had a sort of level effect on firm growth in that firms initially grew fast until global car producers were saturated in the share of production they would be interested in bringing to Mexico. An alternative explanation is that firms in later cohorts came in with larger initial investments than the initial cohorts.

Figure 4. Mexico: Life Cycles in the Transportation Sector

1993 Cohort	336210 Bodies and Trailers	336310 Motors	336320 Electronics	336330 Navigation and suspension	336340 Brakes	336350 Transmission	336360 Seats/interior	336370 Metal parts	336390 Other car parts	336410 Aerospace	336510 Railway	336610 Boats
AG												
1	1.0	1.0	1.0		1.0							
2	1.5	44.1	2.0		1.1							
3	2.7	78.3	2.4		2.1							
4	2.1	110.7	2.6		4.3							
5	3.5	100.4	2.8		8.2							
1998 Cohort												
AG												
1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0			
2	1.8	9.8	1.4	9.2	6.8	0.7	10.1	1.7	4.9			
3	2.4	5.4	1.3	15.5	11.5	76.2	7.3	4.6	11.6			
4	2.9	6.3	2.0	18.6	5.8	35.9	8.9	6.7	16.7			
2003 Cohort												
AG												
1	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		1.0
2	3.4		1.6	4.0	4.7	37.7	2.4	2.1	1.6	1.8		8.9
3	2.3		2.7	12.6	6.9	38.0	3.3	5.2	4.0	3.9		11.8
2008 Cohort												
AG												
1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2	1.4	1.3	1.6	1.4	2.5	2.1	5.9	3.6	1.8	2.8	1.5	0.3

14. However, this finding cannot be generalized to all fast-growing manufacturing sectors. The basic metals sector is a case in point in which life cycles weakened over time in some industries while they strengthened in others (Figure 5). This may suggest that, in contrast to a sector like the transportation sector that is dominated by a relatively small number of large firms, in other sectors the benefits from NAFTA may have survived.

Figure 5. Mexico: Life Cycles in Basic Metals Sector

1993 Cohort	331210 Iron and steel pipes	331220 Other iron and steel	331310 Aluminum	331419 Other nonferrous metals smelting and refining	331420 Secondary lamination of copper	331490 Secondary lamination of nonferrous metals	331510 Iron and steel parts molding by casting	331520 Nonferrous metallic parts molding by casting
AG								
1							1.0	
2							0.8	
3							2.1	
4							5.0	
5							8.6	
1998 Cohort								
AG								
1	1.0	1.0	1.0				1.0	1.0
2	1.3	1.3	8.3				1.8	1.1
3	2.0	2.0	13.1				3.7	6.1
4	0.8	0.8	14.7				9.7	9.3
2003 Cohort								
AG								
1	1.0	1.0	1.0		1.0		1.0	1.0
2	17.3	1.6	2.8		0.1		2.1	3.7
3	6.2	1.8	6.0		0.4		6.2	12.9
2008 Cohort								
AG								
1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2	0.6	3.6	2.0	1.4	13.8	0.1	3.7	2.9

D. Econometric Analysis

15. In this section, we aim to better understand the determinants of firm growth over the life cycle in Mexico. Our econometric specification takes the form

$$Q_{i,s,t,c} = \alpha_i + \alpha_s + \alpha_w + \sum_{AG=2}^{5}(\beta_{AG}D_{AG} + \gamma_{AG}D_{AG}X_{i,s,t}) + X_{i,s,t} + \varepsilon_{i,s,t,c}$$

where $Q_{i,s,t,c}$ is the growth the average firm experienced between birth and wave t in industry i and state s in cohort c (e.g. the cohort that was 0-4 years old in 1993 would be c=1993). All regressions include fixed effects for each 6-digit industry i, state s and wave t. They further include age group dummies D_{AG} for each industry-state pair which are intended to capture average life-cycle dynamics. The set of fundamentals $X_{i,s,t}$ can vary by industry, state and wave (year). The latter are computed based both on data from the Mexican Economic Census and the SIMBAD database which includes a range of socioeconomic indicators with variation at the municipal level (which, by matching these indicators with locational information for firms in the Economic Census, allows creating regressors that do not drop from the regression even in the presence of industry and state fixed effects). Finally, we also allow for interactions $D_{AG}X_{i,s,t}$ between age group dummies and the fundamentals to allow computing average life cycles conditional on fundamentals.

16. The regressions make use of up to 56,800 observations. All regressions include the three sets of fixed effects which are omitted in the tables. Regression 1 in Table 2 includes only the age group dummies in addition to the fixed effects in the regression. With life cycles normalized to 1 in the initial age group, the coefficients suggest that the average industry sees firms grow to some 2.4 (1+1.4) times their initial size after 20–24 years of age once fixed effects are controlled for. While this suggests a somewhat stronger average life-cycle than in the descriptive results, the results are closer to the initial findings (at 1.5–1.6 times the initial size) once outliers (the largest and smallest 1 percent realizations of the dependent variable) are dropped in Regression 2. Importantly, the R^2 rises from 0.07 to 0.22 once these outliers are dropped.

17. We control both for the initial average firm size as well as for a potential attrition bias in the regressions. Regression 3 additionally includes two control variables to correct for potential biases. The initial average size of firms in the sector is meant to even the playing field between industries with initially very large and industries with initially very small firms. As can be expected, it appears that life cycle growth is somewhat weaker when firms are large from the outset. The variable measuring the share of the initial cohort that survived until the given age group is our control for potential attrition bias. As expected, it appears that firm growth is higher in sectors in which a smaller share of the initial population of firms survives as it is likely small and unproductive firms that do not make it to the higher ages.

Table 2. Mexico: Regression Table

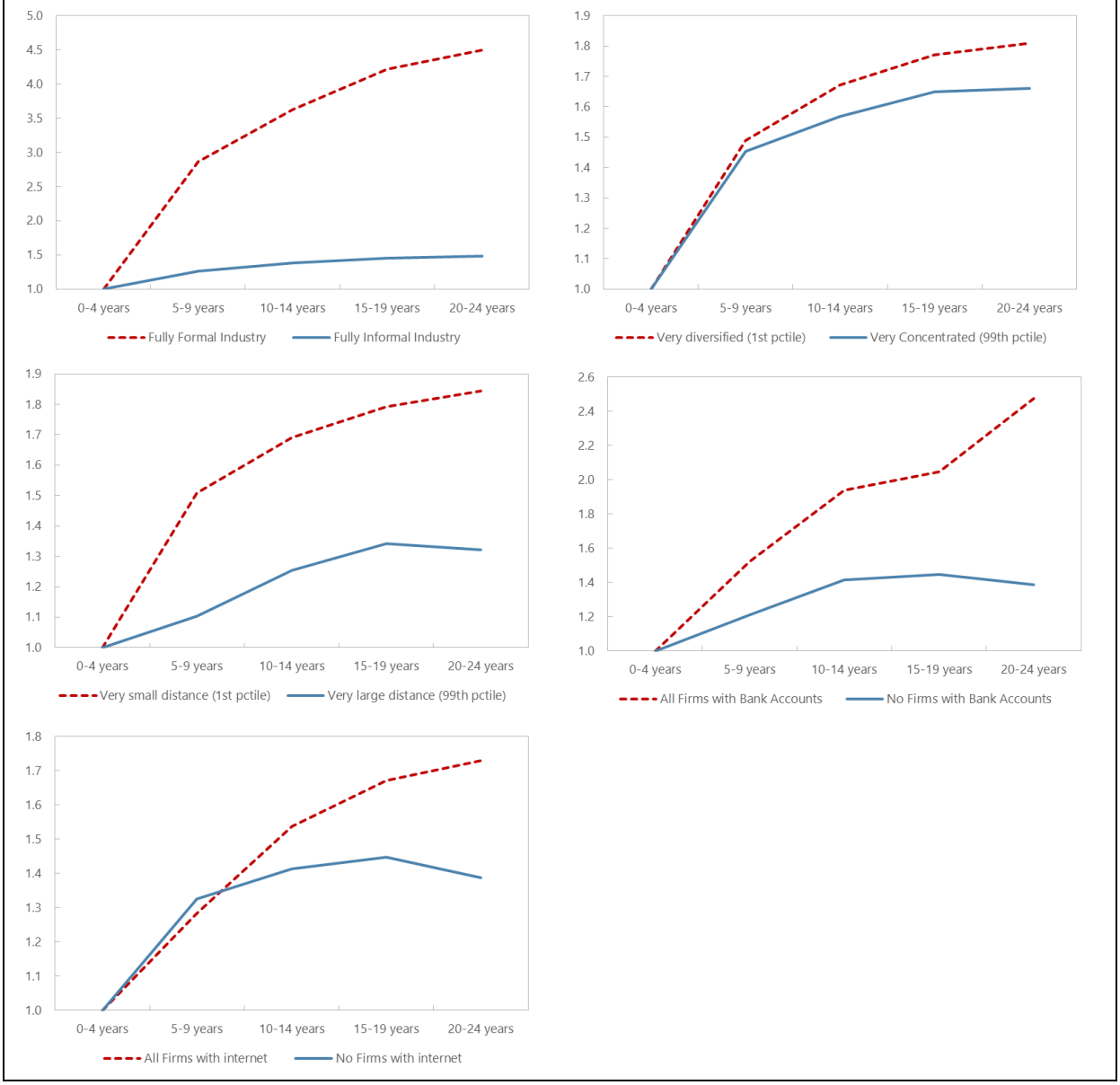
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dummy 5-9 years	0.634***	0.478***	0.452***	0.445***	0.412***	0.363***	0.422***
	[0.030]	[0.007]	[0.008]	[0.008]	[0.011]	[0.010]	[0.012]
Dummy 10-14 years	0.969***	0.667***	0.629***	0.619***	0.619***	0.569***	0.638***
	[0.040]	[0.009]	[0.010]	[0.010]	[0.013]	[0.013]	[0.014]
Dummy 15-19 years	1.177***	0.777***	0.726***	0.715***	0.713***	0.660***	0.740***
	[0.057]	[0.012]	[0.013]	[0.013]	[0.015]	[0.015]	[0.017]
Dummy 20-24 years	1.373***	0.810***	0.756***	0.749***	0.711***	0.624***	0.704***
	[0.146]	[0.020]	[0.020]	[0.021]	[0.021]	[0.020]	[0.021]
Log of initial size			-0.248***	-0.282***	-0.405***	-0.387***	-0.379***
			[0.011]	[0.011]	[0.017]	[0.017]	[0.018]
Share of initial cohort surviving			-0.041***	-0.048***	-0.040***	-0.038***	-0.030***
			[0.008]	[0.009]	[0.010]	[0.010]	[0.010]
Informality, share				-1.379***	-1.048***	-1.242***	-1.325***
				[0.062]	[0.098]	[0.098]	[0.109]
Market concentration, Herfindahl				-0.203***	-0.377***	-0.610***	-1.047***
				[0.052]	[0.118]	[0.119]	[0.201]
Distance from large city, 100 km				-0.964***	-0.939***	-0.873***	-0.494
				[0.182]	[0.297]	[0.300]	[0.347]
Illiteracy, share				-0.018***	0.006	0.064***	0.102***
				[0.003]	[0.012]	[0.012]	[0.016]
Share of firms with bank account					0.458***		
					[0.019]		
Share of firms with bank credit						0.204***	
						[0.021]	
Share of firms with internet access							0.129***
							[0.022]
Observations	56,804	55,660	55,660	53,117	29,390	29,390	25,248
R-squared	0.071	0.220	0.239	0.253	0.264	0.253	0.250

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

18. Informality is a key determinant of the strength of firm life cycles. Regression 4 includes all those fundamentals that we are able to observe in all years associated with the waves in the sample. Additional variables that we are only able to compute for later years are included in Regressions 5–7 as they would otherwise reduce the number of observations in the baseline regressions. A crucial determinant of life cycles appears to be the degree of informality in a given sector-state pair. Informality here is calculated as the share of firms that pays neither social security contributions nor VAT (and is thus unlikely to be registered at either tax authority). It appears that industries with a higher prevalence of informality experience sharply weaker life-cycles. This result is unsurprising since informal firms are not only less likely to invest and grow themselves (e.g. to remain under the radar of tax authorities or due to lack of access to bank credit) but also may depress investment in more productive formal firms that cannot compete due to the unfair cost advantages enjoyed by informal firms.

19. Informal firms grow only marginally over their lifetimes while formal firms experience solid and continuous growth. When including not only the informality term itself but also its interaction with the age group dummies $D_{AG}X_{i,s,t}$ in the regression (not shown in the table), we can draw a set of life cycles as predicted by the regression for fully informal and fully formal industry state pairs. As shown in Figure 6 (top left chart), informal firms on average hardly grow at all after the age of 4 years over their life cycles when controlling for other explanatory variables. Formal firms, in contrast, not only do not stagnate but grow to some 4.5 times their size by the age of 20–25.

Figure 6. Mexico: Predicted Life Cycles Conditional on Regressors



20. Market concentration also weakens firm growth, likely due to the undue use of market power that discourages investment in the majority of firms. Using interaction terms between the age group dummies and the concentration variable, we find evidence of a close association between life cycle growth and market concentration (defined as the Herfindahl index calculated based on the 20 largest firms in the sector state pair), suggesting that firms invest and grow more in markets that are less concentrated and thus perhaps less subject to the undue use of market power. The top right chart in Figure 6 shows that firms in very concentrated industries (99th percentile of the distribution of the Herfindahl index) have notably weaker life cycles than those in very diversified industries (1st percentile of the distribution).

21. Another interesting relationship arises between life cycle growth and the average geographical distance of firms from major markets (defined as the distance from the closest city with more than 500,000 inhabitants). It appears that more remotely located firms do not experience as much growth as firms closer to not only customers but also competitors and suppliers. Once again using interaction terms in the regressions, the middle left chart in Figure 6 shows how much stronger life cycles are in municipalities located very closely to large cities as opposed to municipalities located very far from large cities.

22. Firms also appear to have stronger life cycles when they have access to financial and internet services. Intuitively, financial and internet services may discourage investment into firm growth. The middle right and bottom left charts in Figure 6 show how life cycles in industries with full coverage of financial and internet services, respectively, compare to those with zero coverage according to the predictions of our baseline regression augmented by interaction terms.

E. Conclusions

23. This note finds that firm life cycle growth in Mexico is significantly lower than in more advanced economies such as the US. The underlying driver, namely the failure to invest, may explain part of the productivity slowdown the Mexican economy has experienced in recent decades. In particular, the average Mexican firm appears to no longer grow after some 15 years of age and to stagnate at less than double its initial size.

24. We also find that several of the few industries with stronger life cycles are those located in Mexico's North, close to the US border. While NAFTA appears to have delivered only a temporary boost to life cycles in some sectors (e.g., transportation), this does not appear to be the case across the board.

25. The analysis also uncovered important distortions that appear to be associated with weaker firm investment and growth. These include the prevalence of informality, highlighting that informal firms do not appear to grow much over their life cycles while formal firms experience solid and continuous growth. Moreover, stronger firm growth appears to be associated with less concentrated industries that are presumably less likely to be subject to the undue use of market

power. Firms are also less likely to invest and grow if they are far away from population centers and do not have access to good financial and internet services.

26. These findings highlight the importance of pushing ahead with the important structural reform agenda begun with the Pacto por Mexico in 2012. This includes the fight against informality, strengthening competition in the Mexican economy as well as access to financial and telecommunication services. Furthermore, targeted infrastructure investments could help better connect the more remote regions to the major markets of the country.

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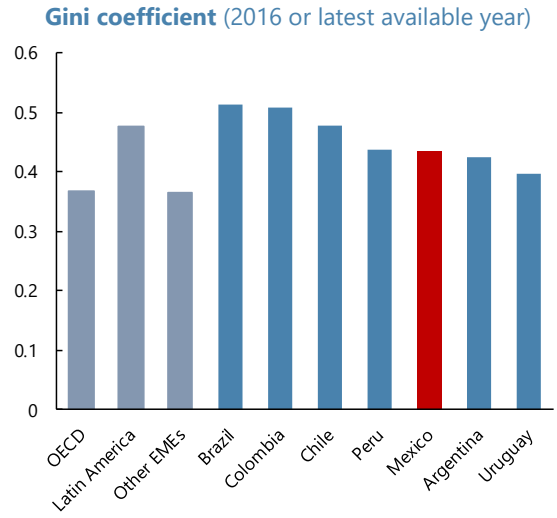
INEQUALITY AND SOCIAL POLICIES[1]

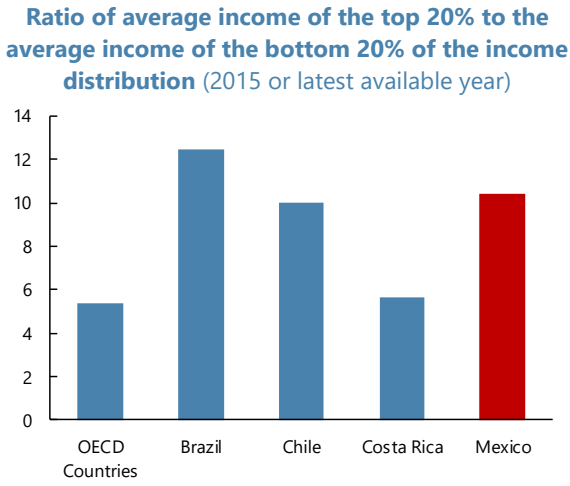
This note summarizes the results of an analysis of income inequalities and government transfers using microdata from Mexico's survey on household income and expenditures (ENIGH). It highlights the positive role played by government transfers in reducing inequalities over 2004-2016 and suggests that there is scope for better targeting existing social programs.

A. Income Inequality in Mexico

1. Mexico has a high level of income inequality compared to other OECD countries. The Gini coefficient[2] in Mexico far exceeds the OECD average and is just equal to the Latin American average. Similarly, the ratio of average income of the top 20 percent to the average income of the bottom 20 percent of the income distribution is twice as high in Mexico than in other OECD countries (Figure 1).

Figure 1. Mexico: Inequality in Mexico and Regional and Income Peers





Note: OECD, Latin America and Other EMEs averages are weighted by each country's population. Latin America includes Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Paraguay Peru, El Salvador, and Uruguay.

Sources: World Bank, World Development Indicators database; and staff calculations.

Source: OECD Income Distribution Database.

2. Inequality has only slightly declined over the last decade. In contrast, the average Gini coefficient in Latin American countries has fallen substantially (Figure 2). The commodity price boom, which increased demand for low skilled labor, played a significant role in that fall (IMF, 2018).

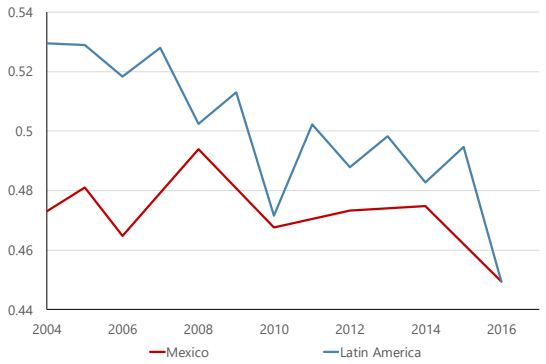
[1] Prepared by Frederic Lambert and Hyunmin Park (WHD).

[2] The Gini coefficient takes values between zero and one. The closer the Gini coefficient is to zero, the more equally distributed is income (or consumption, or wealth); the closer it is to one, the higher the inequality.

However, that boom did not affect Mexico much, as its economy is more diversified and as it exports mostly manufacturing products. Still, the average annual growth of household income over the period 2004–16 decreased nearly monotonically across income deciles.

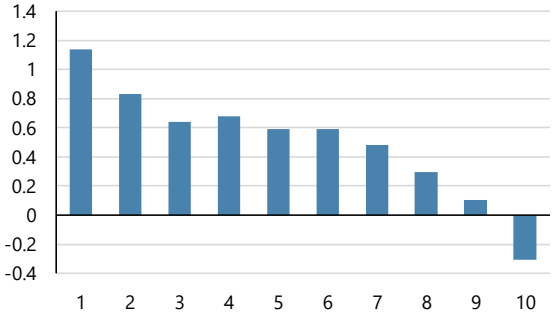
Figure 2. Mexico: Recent Trends

Gini coefficient trends



Sources: World Bank, World Development Indicators database; INEGI (Mexico); and staff calculations.

Average annual growth in household income, by income decile (2004-2016, in percent)



Source: INEGI; staff calculations.

3. Despite significant differences in average income levels, inequalities between states represent less than 10 percent of total inequality (Figure 3). An alternative measure of inequality, the Theil index, can be decomposed into "between" and "within" inequality.[3] This decomposition shows that the "within" inequality amounts to at least 55 percent of overall inequality. Inequalities between states, rural and urban areas, industries, and formal and informal sectors each account for less than 10 percent of overall inequality. However, inequality between different education levels is sizable and accounts for around 20 percent of total inequality, but its importance has decreased between 2004 and 2016, as returns to schooling have declined.[4]

[3] The Theil index is defined as the weighted average of the log of the ratio of individual income to average income:

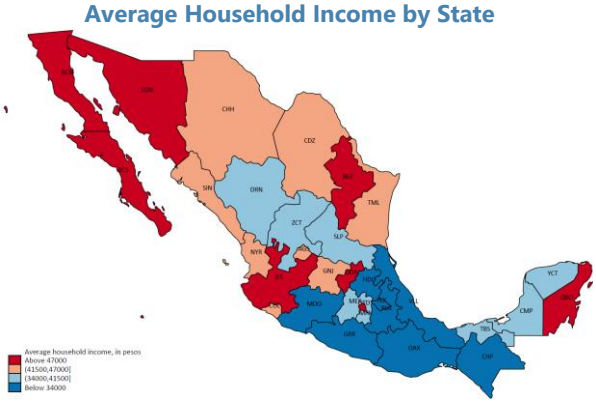
$$T = \frac{1}{n}\sum_{i=1}^{n}\left[\frac{y_i}{\bar{y}}\log\frac{y_i}{\bar{y}}\right],$$

where n denotes the total number of individuals, y_i is the income of individual i, and $\bar{y}$ is the average income in the population.

[4] The decline in returns to education has been attributed to the increase in the supply of skilled labor and the misallocation of resources (Levy and Lopez-Calva, 2016).

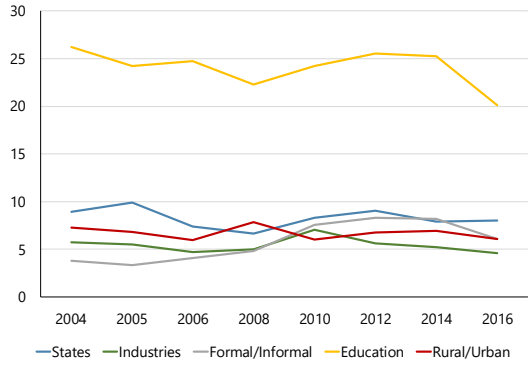
Figure 3. Mexico: "Between" and "Within" Inequality

Average Household Income by State



Sources: INEGI; IMF staff calculations.

Between-group inequality as a share of the overall Theil index (in percent)

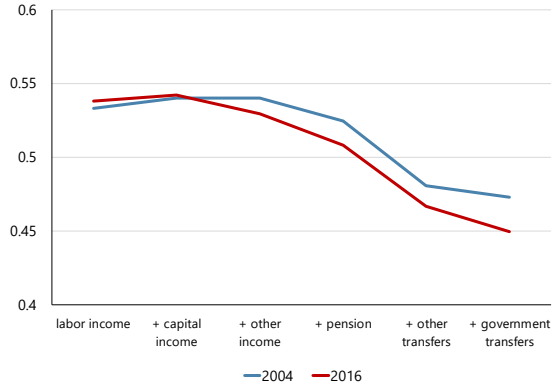


Sources: INEGI; IMF staff calculations.

4. Labor income remains the main source of income inequality. The Gini coefficient based on labor income only (wages and self-employment income) was close to 0.54 in 2016. Capital income tends to compound labor income inequalities, which on the contrary, public and private transfers contribute to reduce.[5] A Shapley decomposition of the change in the Gini coefficient between 2004 and 2016 shows that labor income contributed to a small increase in inequality over the period, which was more than offset by government transfers. This attests to the significant redistributive role of public transfers in Mexico, although that role remains much smaller than in peer countries.

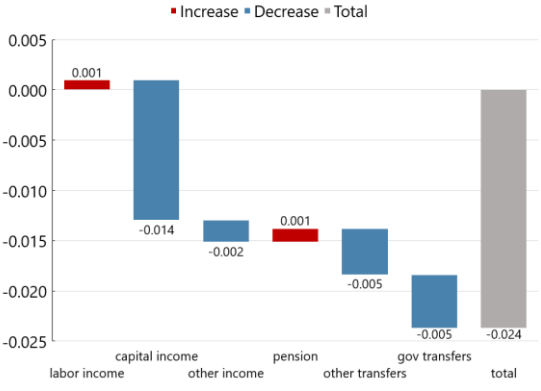
Figure 4. Mexico: Sources of Income Inequality

Changes in the Gini coefficient by income component



Sources: INEGI; IMF staff calculations.

Shapley decomposition of the change in the Gini coefficient between 2004 and 2016



Sources: INEGI; IMF staff calculations.

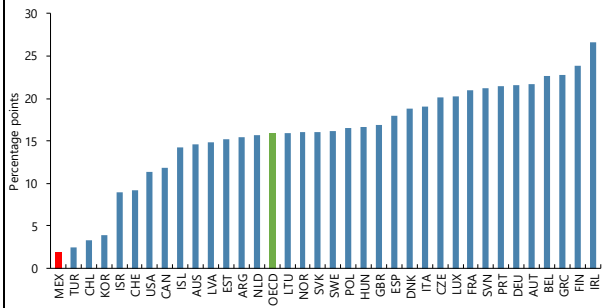
[5] Capital income tends to be under-reported in ENIGH and a comparison of ENIGH data with national accounts suggests this under-reporting may have increased over time (del Castillo Negrete Rovira, 2017).

B. The Role of Government Transfers

5. Transfers and taxes play a much more limited role in alleviating inequalities in Mexico than in other OECD countries. The Gini reduction effect of transfers and taxes is lower in Mexico than in all OECD countries. This limited redistributive role of fiscal policies in Mexico may result from a tax system that is insufficiently progressive. It also reflects the low level of public social spending as a share of GDP, in particular on non-contributory cash transfers targeted at the poorest households.

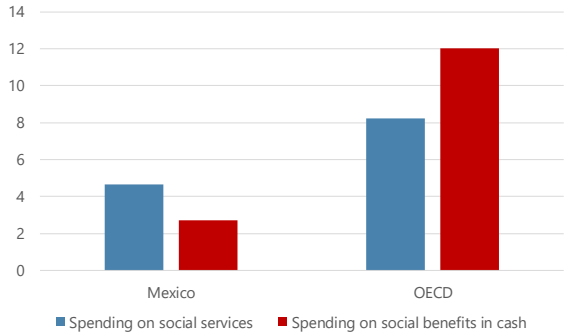
Figure 5. Mexico: Redistributive Role of Transfers and Taxes

Gini reduction effect of transfers and taxes (circa 2010-2015, in percent)



Source: OECD.

Spending on social services and social benefits as a share of GDP (2011, in percent)



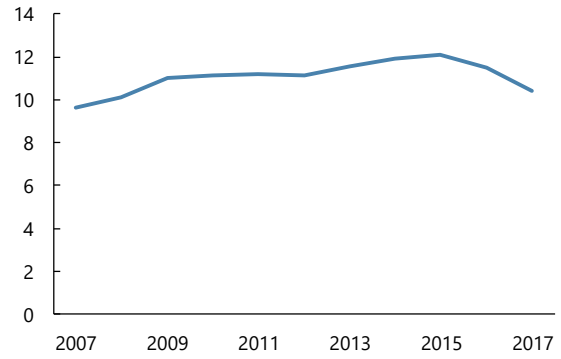
Note: Social services refer to care and accommodation for the elderly and disabled, disability services, health, childcare, housing assistance and other social services. Social benefits in cash refer to old age and survivor pensions, disability benefits, family cash benefits, unemployment and other social assistance categories.

Sources: OECD, Social Expenditure database.

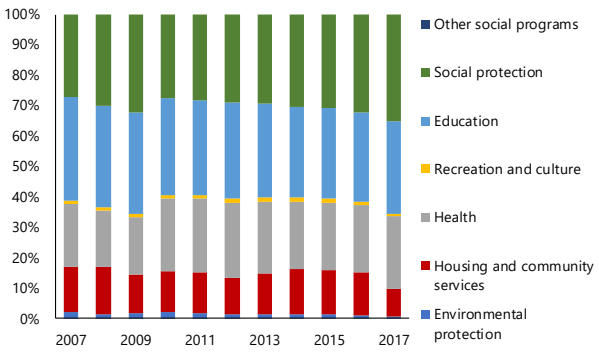
6. After a modest increase over 2007-2015, public social spending as a share of GDP has fallen in the last two years.[6] Public social spending increased by 2.5 percent of GDP from 2007 to 2015, reaching a maximum of 12.1 percent of GDP, before shrinking to 10.4 percent in 2017. Social assistance and education, the first two components of public social spending, absorb together more than 60 percent of the total, while health expenditures amount to close to a fourth.

[6] Scott, de la Rosa and Aranda (2017) argue that this decline in social spending after 2015 was compounded by a significant reduction in indirect subsidies, in particular on gasoline. The latter is not addressed in the analysis presented here.

Figure 6. Mexico: Public Social Spending in Mexico



Sources: SHCP; WEO; and staff calculations.



Sources: SHCP; WEO; and staff calculations.

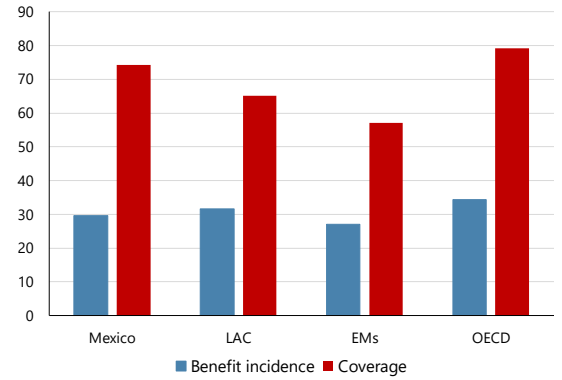
7. Mexico's social assistance programs cover well households at the bottom of the income distribution. 31 percent of the households in the bottom income quintile benefit from Mexico's conditional cash transfer program *Prospera* (formerly known as *Oportunidades* and initially launched as *Progresa*), which has served as a model for many countries around the world (Parker and Todd, 2017). Similarly, the share of households benefiting from old-age social assistance is three times higher in the first income quintile than in the fifth one. *Prospera* and old-age social assistance programs account for about ¾ of the decline in the Gini coefficient coming from government transfers, while they represent about half of the total government transfer amount received by an average household.

8. Other social benefits are less well targeted. Individuals in the bottom income quintile receive less than 30 percent of total social transfers, a smaller share than in other Latin American and OECD countries (Figure 7, top left panel). The farmland subsidies program *Proagro* (formally *Procampo*) benefits a greater share of households in the bottom income quintile than in any other quintile, but the average amount received by household in the top quintile is only marginally lower than the average transfer amount to households in the bottom quintile and higher than in the middle three quintiles.

9. Non-monetary government transfers covering medical expenses benefit the same proportion of households in all five income quintiles. However, the transfer amounts increase with income, following the growth of healthcare expenditures with income and resulting in richer households getting a higher share of their health expenditures covered by the government (Figure 7, middle right panel).

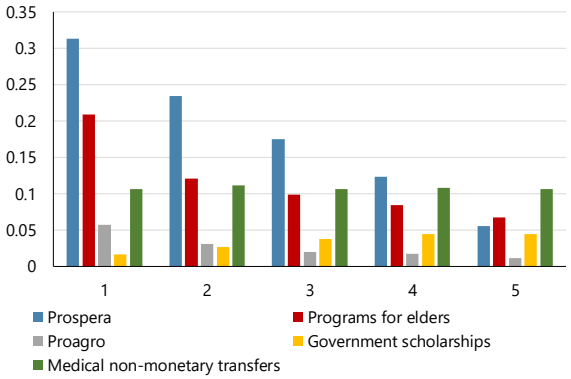
Figure 7. Mexico: Social Benefits

Coverage and benefit incidence of social assistance programs, Bottom income quintile



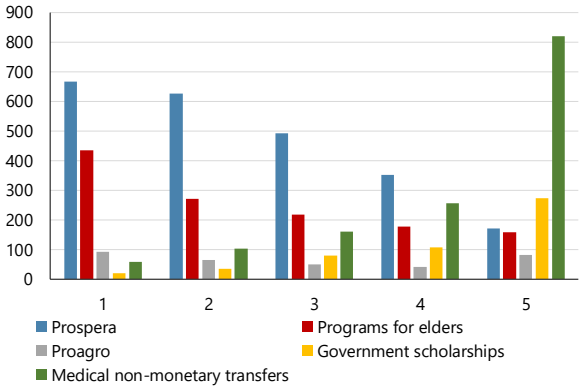
Note: Benefit incidence = (sum of all transfers received by all individuals in the quintile)/(sum of all transfers received by all individuals in the population).
Coverage = (number of individuals in the quintile who live in a household where at least one member receives the transfer)/(number of individuals in the quintile).
Sources: IMF; World Bank ASPIRE database.

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



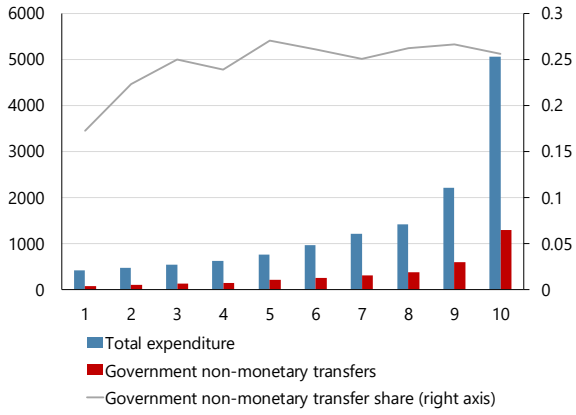
Note: Coverage is computed at the household level.
Sources: INEGI; IMF staff calculations.

Government transfer amount by household income quintile (2016)



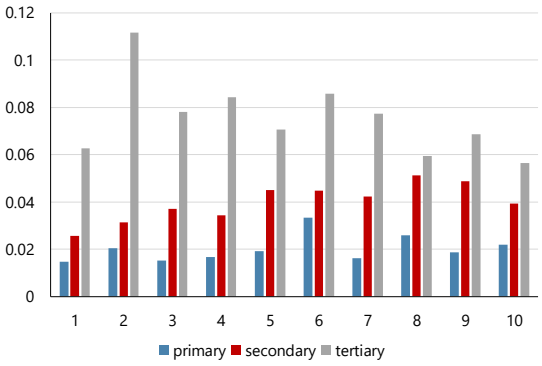
Sources: INEGI; IMF staff calculations.

Healthcare spending by household income decile (2016)



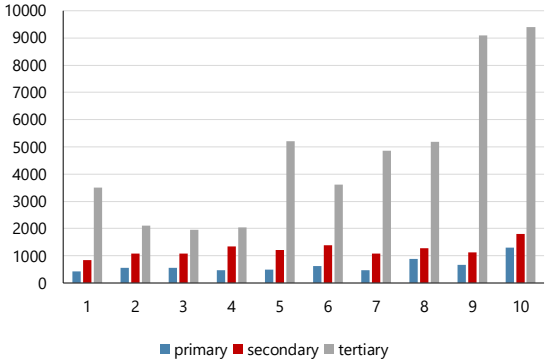
Sources: INEGI; IMF staff calculations.

Probability of receiving a government scholarship conditional on enrollment by household income decile (2016)



Sources: INEGI; IMF staff calculations.

Average government scholarship amount conditional on receiving a government scholarship (2016, in pesos)

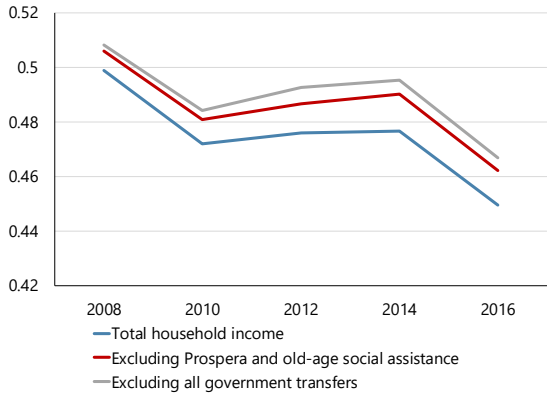


Sources: INEGI; IMF staff calculations.

10. Government scholarships for secondary education accrue more frequently to households in the top half of the income distribution, while scholarships for primary and tertiary education are more evenly distributed (Figure 7, bottom left panel). In addition, the scholarship amounts are much higher for students enrolled in tertiary education institutions, which are more likely to belong to top income deciles. Government scholarships thus increase inequalities.

11. A comparison of the effect of various government transfer programs on inequality confirms the predominant role played by *Prospera* and old-age social assistance programs. Those programs account for 74 percent of the reduction in the Gini coefficient achieved by government transfers (Figure 8).

Figure 8. Mexico: Gini Coefficient With and Without Government Transfers



Sources: INEGI; IMF staff calculations.

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