

ANALYSIS

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Mexico's Productivity Puzzle: What the State Economies Can Tell Us

Introduction

Mexico is fast emerging as a global industrial power, but recent growth in manufacturing has not translated into broad-based economic gains. Though factory output, employment and exports are chasing new highs, Mexico's economy remains stuck in low gear. Stagnant labor productivity—the value of goods produced on an hourly or per-worker basis—has kept the economy from attaining larger gains. Even though Mexico's factories are rapidly growing in sophistication, Mexican workers are barely more productive than they were a decade ago, in contrast to their South and East Asian peers.

Mexico's Productivity Puzzle: What the State Economies Can Tell Us

BY JESSE ROGERS AND ABHILASHA SINGH

Mexico is fast emerging as a global industrial power, but recent growth in manufacturing has not translated into broad-based economic gains. Though factory output, employment and exports are chasing new highs, Mexico's economy remains stuck in low gear. Stagnant labor productivity—the value of goods produced on an hourly or per-worker basis—has kept the economy from attaining larger gains. Even though Mexico's factories are rapidly growing in sophistication, Mexican workers are barely more productive than they were a decade ago, in contrast to their South and East Asian peers.

In this article, we attempt to understand Mexico's productivity puzzle by comparing the industrial structure, economic performance, and labor market dynamics of Mexico's state economies. In particular, we find that the high degree of labor market informality and low level of educational attainment characteristic of Mexico's less developed states are all too present in the better-performing states of Mexico's industrial north and center. These structural shortcomings play a key role in undercutting productivity growth across Mexican states.

Despite recent improvement, Mexico's state economies are not creating enough formal-sector jobs to absorb growth in the labor force. Because of the shortage of formal-sector jobs, informal work arrangements, which are generally characterized by low-skilled labor and a scarcity of capital, predominate even in Mexico's fastest-growing states. The low educational attainment of Mexico's labor force, which limits opportunities for employment in the formal sector, poses an additional barrier to productivity growth.

Mexico's fading demographic dividend only heightens the productivity imperative. As fertility rates decline and Mexico's

labor force growth slows, the country's state economies will face additional speed bumps on the path to long-run growth should productivity growth remain slow.

Mexico top to bottom

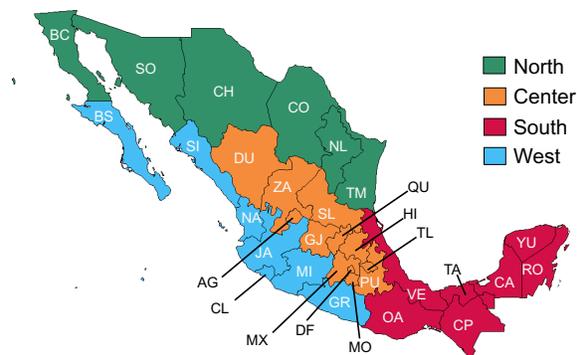
To better understand the structure and performance of Mexico's state economies, we divide them into four regions: North, Center, South and West (see Chart 1 and Table 1). The four regions are bound by geographical proximity as well as industrial structure. Economic drivers are diverse across regions, from manufacturing and logistics in the North and Center to resource extraction in the South, and agriculture and tourism in the South and West.

Though Mexico's National Institute of Statistics and Geography does not publish official regional aggregates, the regional classification we propose aligns closely with other

studies of Mexico's state economies, including the Bank of Mexico's closely watched quarterly survey of Mexico's state economies. However, our approach differs slightly from that of the central bank in that we separate Pacific coast states from their more industrial counterparts inland (see Chart 2).

Mexico's northern states are its most dynamic. Though home to just a fifth of the country's population, the North produces almost half of the country's exports and captures more than a third of its foreign direct investment. Manufacturing's importance is broad-based across the North's states, and its share of out-

Chart 1: Moody's Analytics Regional Aggregates



Sources: INEGI, Moody's Analytics

Table 1: State Abbreviations

North	
BC	Baja California
CH	Chihuahua
CO	Coahuila
NL	Nuevo Leon
SO	Sonora
TM	Tamaulipas
Center	
AG	Aguascalientes
DF	Federal District
DU	Durango
GJ	Guanajuato
HI	Hidalgo
MX	State of Mexico
MO	Morelos
PU	Puebla
QU	Queretaro
SL	San Luis Potosi
TL	Tlaxcala
ZA	Zacatecas
South	
CA	Campeche
CP	Chiapas
OA	Oaxaca
RO	Quintana Roo
TA	Tabasco
VE	Veracruz
YU	Yucatan
West	
BS	Baja California Sur
CL	Colima
GR	Guerrero
JA	Jalisco
MI	Michoacan
NA	Nayarit
SI	Sinaloa

Source: Moody's Analytics

put and employment has increased in recent years as rising labor costs in China and East Asia and demand for shorter shipping times to Western Hemisphere markets increase the attractiveness of producing in Mexico.

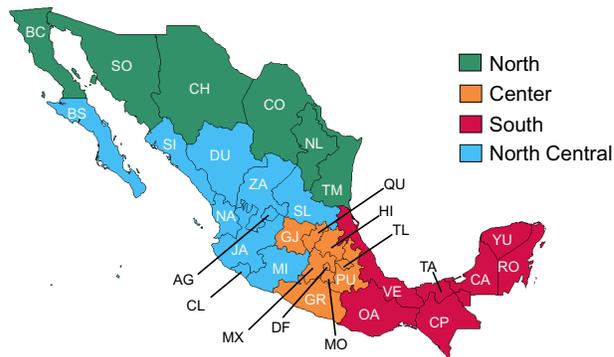
Trade, transportation and demographic links tether the North to the U.S., and sensitivity to economic shocks north of the border—both positive and negative—has made for a more volatile pattern of expansion. Of Mexico's four regions, the North is linked most closely to the U.S. economy, as evidenced by the high correlation coefficient between output growth in the North and the U.S. (see Chart 3). The North grew rapidly following the ratification of the North Ameri-

can Free Trade Agreement in 1994, which drove increased trade and investment flows from U.S. firms. However, the 2001 tech bust and emergence of China as a low-cost manufacturing hub in the early 2000s sent the economy into a deep funk. The region's total output had barely recovered its prior peak when the housing crisis led to the Great Recession in the U.S. from December 2007 to June 2009 (see Tables 2 and 3).

Though the Great Recession sent Mexico's northern states back into recession, the lengthy U.S. recovery and the rising competitiveness of Mexican labor vis-à-vis China have elevated demand for Mexican manufactures. In the six years since 2010, the value of Mexican auto and consumer electronics exports has increased by close to a third, to the benefit of automotive and electronics strongholds Sonora, Chihuahua and Coahuila. The nascent aerospace, medical device and pharmaceuticals hubs of Nuevo Leon and Baja California were quick to benefit as well as more U.S. firms shifted work back from Asia or moved existing manufacturing operations south from the U.S.

However, though northern factories are rapidly growing in sophistication, gains in manufacturing have not spilled over to the rest of the economy, which has failed to recapture the dynamism of the post-NAFTA boom in the late 1990s. As a result, growth in the North has downshifted and its lead over other regions has narrowed (see Chart 4).

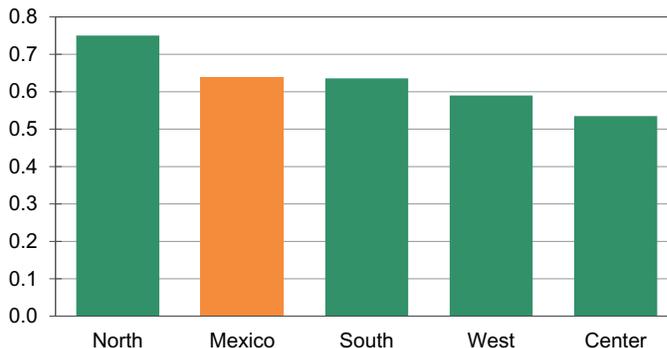
Chart 2: Bank of Mexico Regional Aggregates



Sources: INEGI, Bank of Mexico, Moody's Analytics

Chart 3: North Is Most Reliant on U.S.

Correlation coefficient, % change in real GDP, 1994 to 2016



Sources: INEGI, Moody's Analytics

The Center also boasts a formidable manufacturing base but is divided between the small, export-oriented economies of Aguascalientes, Guanajuato, Queretaro, and San Luis Potosi, which lie closer to the North, and the densely populated states surrounding the Federal District, the largest of which are Puebla, Hidalgo, and the State of Mexico (see Chart 5).¹ Though these three states and the state of Tlaxcala were quick to benefit in the 1990s as foreign firms—specifically automotive and consumer electronics producers—battled to corner Mexico's domestic market and to expand exports to the U.S., anemic growth in domestic demand has halted their ascent.

¹ Chart 5 compares the concentration of manufacturing gross value added by state using location quotients. An LQ of 1 indicates that the industry concentration is equal to the national average; an LQ greater than one indicates that local industry concentration exceeds that of the nation.

Table 2: Gross Value Added*Compound annual growth rate*

State	1996-2000	Rank	2000-2005	Rank	2005-2010	Rank	2010-2015	Rank
North	6.8		2.3		2.2		3.7	
Baja California	8.5	1	1.0	24	0.6	31	3.3	14
Chihuahua	7.8	3	1.7	18	1.4	28	4.2	5
Coahuila	5.1	14	2.4	10	1.9	23	4.1	6
Nuevo Leon	7.0	5	3.2	4	3.5	6	4.0	7
Sonora	5.6	10	1.4	21	2.8	11	3.9	8
Tamaulipas	6.4	7	3.0	6	1.3	29	2.1	27
Center	5.4		1.4		2.5		3.2	
Aguascalientes	7.3	4	3.1	5	4.0	4	5.4	2
Federal District	5.1	15	0.9	26	2.1	22	2.6	24
Durango	2.8	27	2.4	9	1.6	27	2.4	25
Guanajuato	5.0	18	2.1	12	2.5	14	5.4	3
Hidalgo	4.6	19	0.7	27	1.7	25	3.4	12
State of Mexico	5.8	8	1.3	22	3.0	9	2.4	26
Morelos	5.0	16	1.9	14	1.7	26	2.9	18
Puebla	7.0	6	1.7	16	2.1	21	2.8	20
Queretaro	7.9	2	2.7	7	4.4	3	6.3	1
San Luis Potosi	5.0	17	2.7	8	2.6	12	3.9	9
Tlaxcala	5.2	12	-0.3	32	2.5	16	2.7	22
Zacatecas	2.6	29	3.5	3	6.2	1	2.8	21
South	2.8		1.8		0.3		0.8	
Campeche	2.3	31	1.9	15	-5.6	32	-2.7	32
Chiapas	3.7	22	0.2	30	2.5	15	0.6	31
Oaxaca	2.8	26	0.6	29	1.1	30	2.9	17
Quintana Roo	5.2	13	4.7	2	3.5	7	5.0	4
Tabasco	2.8	28	2.0	13	4.6	2	1.5	28
Veracruz	2.1	32	1.7	17	3.0	8	1.3	30
Yucatan	5.6	9	2.4	11	2.8	10	3.0	15
West	4.3		1.2		2.3		3.2	
Baja California Sur	3.4	23	5.9	1	3.7	5	2.9	16
Colima	3.8	21	0.1	31	2.3	17	3.8	11
Guerrero	2.5	30	1.2	23	2.2	20	1.4	29
Jalisco	5.4	11	1.0	25	2.2	19	3.8	10
Michoacan	4.2	20	0.7	28	1.7	24	2.8	19
Nayarit	3.3	24	1.6	19	2.6	13	3.3	13
Sinaloa	3.1	25	1.5	20	2.3	18	2.6	23
National	4.9		1.7		1.9		2.8	

Rank is out of 32 states

Sources: INEGI, Moody's Analytics

Table 3: Total Employment*Compound annual growth rate*

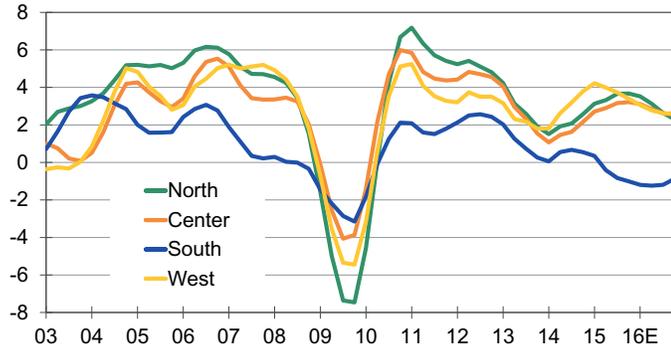
State	1996-2000	Rank	2000-2005	Rank	2005-2010	Rank	2010-2015	Rank
North	3.5		2.1		1.7		2.6	
Baja California	5.4	2	2.8	8	2.2	12	2.8	8
Chihuahua	3.8	12	1.7	23	0.3	31	3.3	4
Coahuila	2.7	19	0.8	28	2.1	14	2.8	7
Nuevo Leon	3.3	17	2.7	9	2.4	10	1.5	23
Sonora	2.4	24	2.2	16	1.5	22	4.2	2
Tamaulipas	3.3	16	2.1	18	1.4	25	2.1	16
Center	3.1		2.1		1.6		2.0	
Aguascalientes	4.5	6	2.5	13	2.8	6	2.3	12
Federal District	2.4	21	0.8	27	0.3	32	0.9	28
Durango	2.5	20	0.7	29	1.5	23	3.5	3
Guanajuato	2.4	23	2.0	20	1.8	19	2.4	11
Hidalgo	0.7	31	4.0	3	1.1	29	3.2	5
State of Mexico	3.9	10	2.5	12	2.6	8	2.5	10
Morelos	3.8	11	2.2	15	2.4	9	0.5	31
Puebla	3.7	13	2.7	10	1.5	24	1.9	19
Queretaro	5.3	4	3.1	5	1.3	27	1.9	20
San Luis Potosi	4.0	9	2.9	7	1.5	21	2.0	18
Tlaxcala	3.5	14	2.1	19	1.6	20	3.2	6
Zacatecas	0.5	32	1.1	26	1.8	18	1.2	26
South	3.2		0.9		2.2		1.1	
Campeche	3.2	18	4.0	2	2.0	17	2.0	17
Chiapas	4.3	8	-0.7	32	2.3	11	0.9	27
Oaxaca	2.3	27	1.2	25	1.4	26	0.8	29
Quintana Roo	7.0	1	7.2	1	4.7	1	2.7	9
Tabasco	2.3	25	2.1	17	2.2	13	1.4	24
Veracruz	2.4	22	-0.4	31	2.1	16	0.7	30
Yucatan	5.1	5	2.2	14	2.7	7	1.6	21
West	2.7		1.6		2.1		1.6	
Baja California Sur	5.3	3	3.9	4	4.4	2	4.4	1
Colima	4.5	7	2.5	11	3.2	5	2.3	13
Guerrero	2.0	29	-0.2	30	3.5	3	0.2	32
Jalisco	3.4	15	1.8	22	2.1	15	1.5	22
Michoacan	1.8	30	1.3	24	1.0	30	2.2	14
Nayarit	2.2	28	1.9	21	3.2	4	2.2	15
Sinaloa	2.3	26	3.0	6	1.2	28	1.4	25
National	3.2		1.8		1.9		1.9	

Rank is out of 32 states

Sources: INEGI, Moody's Analytics

Chart 4: North Maintains Lead, but Gap Narrows

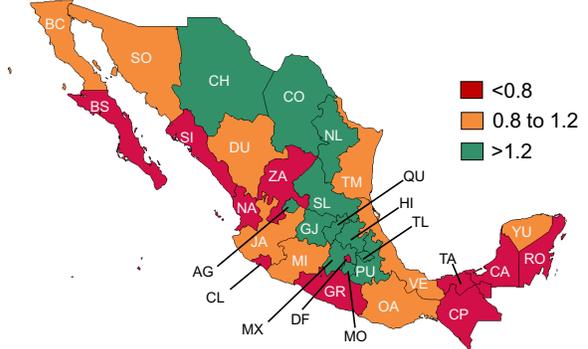
Gross value added, 2008MXN, % change yr ago, 4-qtr MA



Sources: INEGI, Moody's Analytics

Chart 5: Manufacturing Reigns in North, Center

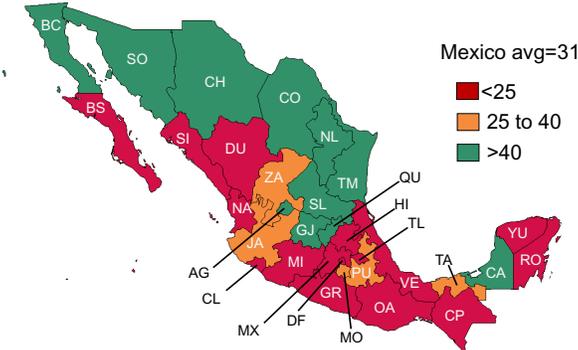
Location quotient, Mexico=1, manufacturing GVA, 2015



Sources: INEGI, Moody's Analytics

Chart 6: Center Rivals North for Exports...

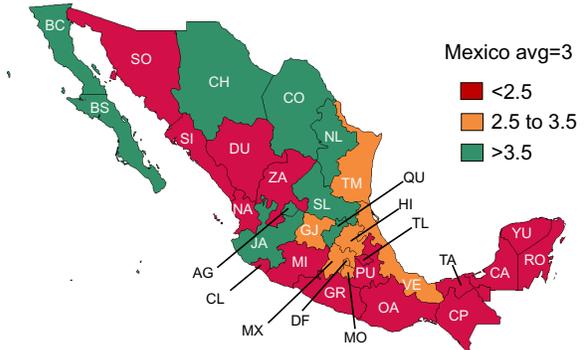
Total exports, % of nominal GVA by state, 2015



Sources: INEGI, Moody's Analytics

Chart 7: ...As Well as Foreign Investment

Foreign direct investment, % of nominal GVA by state, 2015



Sources: INEGI, Moody's Analytics

In contrast, the Center's smaller, export-oriented economies have prospered as large investments from global automakers, medical device manufacturers, and pharmaceutical and aerospace firms increase factory capacity and employment. Thanks to favorable tax incentives and easy access to rail and highway transport, the states of Aguascalientes, Guanajuato, Queretaro, and San Luis Potosi now rival those in the North for new manufacturing investment, as evidenced by their rising concentration of FDI and exports (see Charts 6 and 7).

Rising manufacturing output in these four states has powered superior growth. Not only have they surpassed the rest of the Center in total output growth, but their economies have outpaced the North since the start of Mexico's recovery in 2010 (see Chart 8). In particular, synergies with Mexico's top private universities have helped Queretaro carve out a niche in the

aerospace industry. Queretaro's aerospace employment and output are growing quickly and could soon rival Mexico's larger aerospace cluster in the state of Baja California.

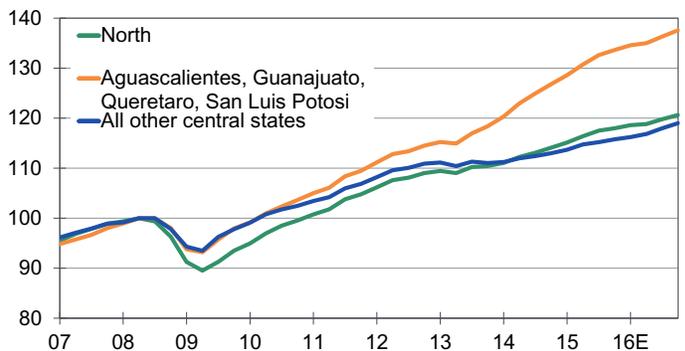
The Center's northernmost states—Zacatecas and Durango—are home to rich mineral deposits and rely less on manufacturing than other central states. More recently, several large auto parts makers have planted roots in Durango in a bid to take advantage of low land and labor costs. However, although the nascent auto parts cluster has boosted factory output and investment, manu-

facturing still accounts for a small share of Durango's total output and employment.

The South is the seat of Mexico's oil industry, but its fortunes have faded amid the fall in oil prices and the secular decline in Mexican oil production over the past two decades. Though rising oil prices in the

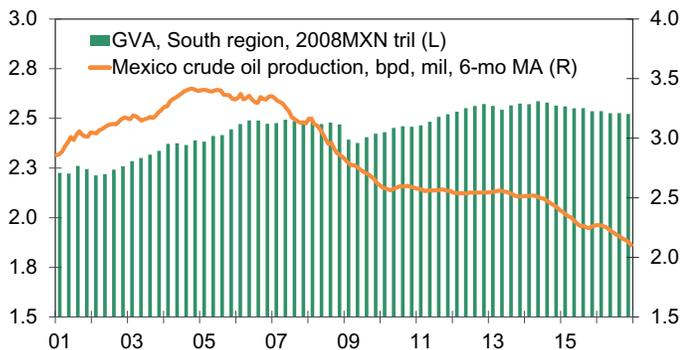
Chart 8: Center's All-Stars Break Away

Gross value added, 2008MXN, 2008Q2=100



Sources: INEGI, Moody's Analytics

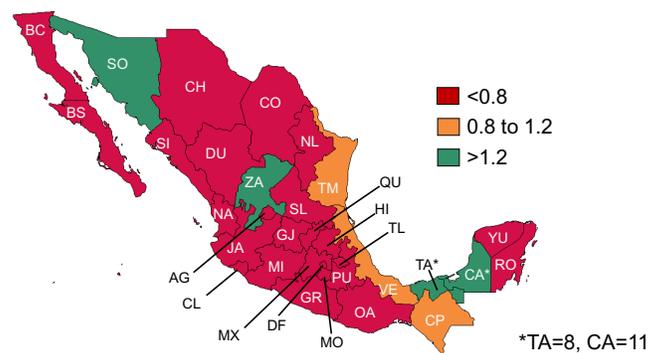
Chart 9: Falling Oil Production Pummels South



Sources: INEGI, IEA, Moody's Analytics

Chart 10: Oil Production Drives Gulf States

Location quotient, Mexico=1, mining and quarrying GVA, 2015



Sources: INEGI, Moody's Analytics

mid-2000s hoisted the value of Mexican oil exports and sheltered the region from trade shocks emanating from the U.S., the combination of falling production and declining prices has brought the South to a standstill (see Chart 9). Oil production has fallen by a third from its 2005 peak, depressing output and employment in the oil-producing states of Veracruz, Tabasco and Campeche. Though Mexico's recent oil reform opened the industry to foreign investment, few bidders have come to the table given the considerable sums necessary to revive production in the large, conventional fields along Mexico's Gulf coast (see Chart 10).

Not all southern economies are performing poorly. Quintana Roo, which lacks significant oil deposits, has emerged as a national standout in output and employment growth thanks to its growing tourist industry. The industry's share of total output now rivals that in traditional tourist hubs on Mexico's Pacific coast (see Chart 11). Home to longtime tourist havens Cancun and Playa del Carmen, the state has made considerable strides in attracting higher-income visitors through the promotion of Mayan archeological sites in and around Mexico's Caribbean coast. The state's favorable location and large international airport have also stirred growth in business services, helping to diversify its industrial base. These forces have reshaped the economy of neighboring Yucatan, albeit to a lesser degree. Yucatan is beginning to attract greater tourist visits, but its economy remains largely dependent on low-value agriculture.

Chiapas and Oaxaca round out the South. The two also are tourism-reliant economies that have bucked the larger slowdown in the region, but they attract fewer high-income visitors and have proved less successful in diversifying their industrial base. The two states are among Mexico's least well-off in per capita income and poverty rate, and a lack of robust drivers outside of tourism and agriculture keeps output and employment gains well below the national average.

The West region, comprising the Pacific coast states north of Oaxaca, also relies heavily on tourism, but a more dynamic, export-oriented agriculture industry has powered stronger output gains. As with the North and Center, trade links to the U.S.—primarily through agriculture and tourism—are a source of strength, but they also heighten volatility. The West experienced significant recessions in 2001 and 2009, surpassed in severity only by those in the North. However, in recent years, the strong U.S. economy has boosted tourist visits to western states, helping to propel growth in line with that in the North and Center. The combination of export-oriented agriculture and international tourism has played out particularly favorably

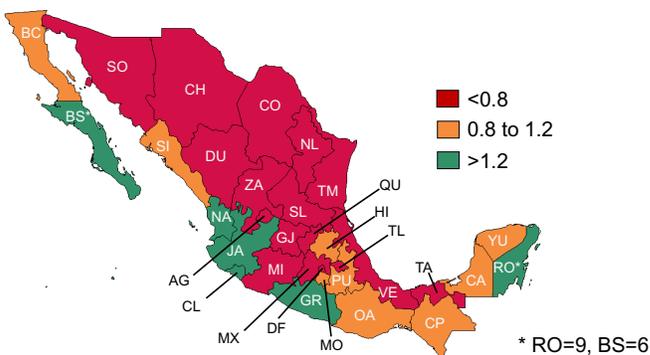
in Baja California Sur, where international hotels and boutique resorts are expanding with vigor.

Because of its large manufacturing base and geographic proximity to Mexico's Center and North, Jalisco is a regional exception. Though its coastal and crop-growing regions bear similarities to other western states, its capital city of Guadalajara is home to Mexico's largest cluster of software and information technology firms. Because economic activity outside of Guadalajara revolves around manufacturing, tourism and agriculture, the total share of state output in scientific and professional services falls short of that of rivals Nuevo Leon and the Federal District (see Chart 12). However, the budding IT cluster in Guadalajara confers an important comparative advantage in high-value services.

Despite efforts by northern and central states to promote foreign investment in high-value research and design fields, these remain

Chart 11: Tourism Thrives Along Coasts

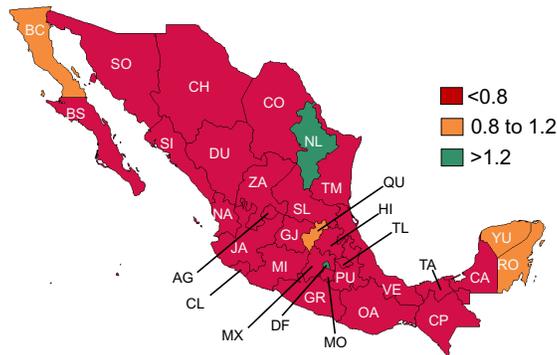
Location quotient, Mexico=1, recreation, hospitality GVA, 2015



Sources: INEGI, Moody's Analytics

Chart 12: Tech Concentrated in Urban Centers

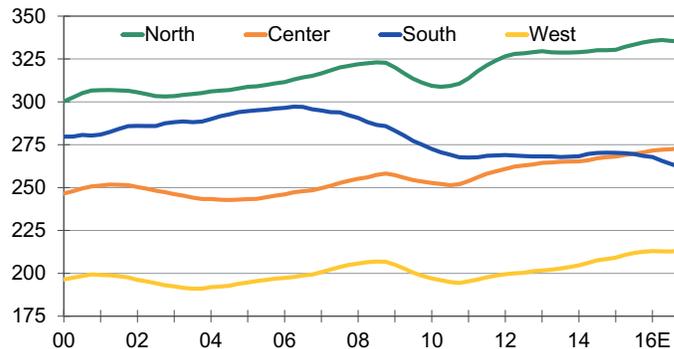
Location quotient, Mexico=1, scientific and prof. svcs., GVA, 2015



Sources: INEGI, Moody's Analytics

Chart 13: Productivity Highest in North, Center...

Gross value added per worker, ths, 2008MXN, 8-qtr MA



Sources: INEGI, Moody's Analytics

concentrated in Nuevo Leon and the Federal District. Bolstered by numerous universities and research and development centers in its capital city of Monterrey, Nuevo Leon is Mexico's largest hub for engineering, design, biotech and medical research. The Federal District boasts an even higher concentration of output and employment in professional services. While mostly a function of the high concentration of corporate and financial headquarters, Mexico's capital is also home to a growing software and IT cluster, as well as dozens of biotech and medical research firms.

Outside of the Federal District and Nuevo Leon, only Queretaro has cultivated a sizable scientific and professional services cluster. The swift expansion of the state aerospace industry has stimulated growth in engineering and design, with local engineering firms beginning to play a larger role in product research and development.

Mexico's productivity puzzle

Since the ratification of NAFTA in 1994, Mexico's economy has grown by a paltry 2.6% per annum, surprising even the staunchest critics of the trade pact's capacity to boost growth. Despite a surge in foreign investment over the past two decades, the economy has failed to recapture its dynamism of the 1960s and 1970s, when state-led industrialization and urbanization drives hoisted productivity by an average annual rate of 4%. These gains came to a halt during the large and lingering debt crisis of the 1980s. After a brief rebound in the second half of the 1990s, productivity

growth resumed its downward course, averaging just less than 0.8% per year in the past decade.

Measured on an output per-worker basis, productivity is considerably higher in the industrial economies of the North and Center than in the less developed West and South (see Chart 13). However, even within these regions, large disparities exist. For example, productivity in the Center is far greater in the export-oriented economies of Aguascalientes, San Luis Potosi and Queretaro than in the central states of Puebla, Tlaxcala, and the State of Mexico, which produce goods primarily for the domestic market. And in the South and West, respectively, productivity in Quintana Roo and Jalisco trounces that of nearly every other state (see Table 4).

These trends have largely held over time, with the exception of the South. Though productivity in the South exceeded that in Mexico's central states as late as 2014, this gap has reversed as large oil-reliant states grapple with falling oil prices and production. In Veracruz, Tabasco and Campeche—large oil-producing states that collectively make up two-thirds of the region's total output—layoffs in the oil industry have not been nearly as severe

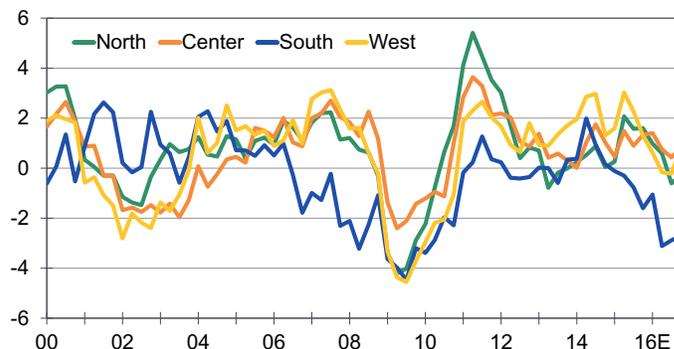
as the decline in production. As a result, per-worker output has shriveled.

Even though the North and Center command a considerable lead in output per worker, productivity growth has slowed recently in line with that in Mexico's other regions (see Chart 14). Indeed, productivity growth in the North, which has traditionally led all other regions, fell below the national average in the most recent decade and is a far cry from rates sustained by regional rival Chile as well as emerging industrial powers in Asia. Though productivity growth for Mexico as a whole did increase in the most recent five-year period, this measure is biased by the slow jobs recovery from the Great Recession, during which output gains led job additions.

Mexico's productivity slump is all the more puzzling given rising trade and investment flows that have raised the value added of its manufacturing exports and have el-

Chart 14: ...But Growth Has Skidded to a Halt

Gross value added per worker, % change annualized, 8-qtr MA



Sources: INEGI, Moody's Analytics

Table 4: Productivity
Compound annual growth rate

State	1996-2000	Rank	2000-2005	Rank	2005-2010	Rank	2010-2015	Rank
North	3.2		0.2		0.5		1.0	
Baja California	2.9	7	-1.8	27	-1.6	31	0.5	22
Chihuahua	3.9	2	0.0	14	1.1	9	0.9	18
Coahuila	2.3	13	1.6	5	-0.2	23	1.2	15
Nuevo Leon	3.6	3	0.5	10	1.1	10	2.5	4
Sonora	3.2	5	-0.8	22	1.2	5	-0.3	28
Tamaulipas	3.0	6	0.9	8	0.0	22	0.0	25
Center	2.2		-0.7		0.9		1.1	
Aguascalientes	2.6	8	0.6	9	1.1	6	3.0	2
Federal District	2.6	9	0.1	13	1.8	4	1.7	10
Durango	0.3	26	1.7	4	0.1	21	-1.1	30
Guanajuato	2.6	10	0.1	12	0.8	13	3.0	3
Hidalgo	3.9	1	-3.1	32	0.6	16	0.2	23
State of Mexico	1.8	16	-1.2	25	0.4	17	-0.1	26
Morelos	1.2	18	-0.3	17	-0.7	27	2.4	5
Puebla	3.2	4	-1.0	24	0.7	15	0.9	19
Queretaro	2.5	11	-0.4	19	3.1	2	4.3	1
San Luis Potosi	0.9	20	-0.3	16	1.1	8	1.9	9
Tlaxcala	1.7	17	-2.3	30	0.9	11	-0.5	29
Zacatecas	2.1	14	2.3	1	4.3	1	1.6	11
South	-0.4		0.9		-1.9		-0.3	
Campeche	-0.9	30	-2.1	28	-7.4	32	-4.6	32
Chiapas	-0.6	28	0.9	7	0.2	18	-0.3	27
Oaxaca	0.5	23	-0.6	20	-0.3	24	2.1	8
Quintana Roo	-1.7	31	-2.3	29	-1.2	30	2.2	7
Tabasco	0.4	25	-0.2	15	2.4	3	0.0	24
Veracruz	-0.2	27	2.1	2	0.9	12	0.6	20
Yucatan	0.5	22	0.1	11	0.1	20	1.3	13
West	1.5		-0.4		0.1		1.5	
Baja California Sur	-1.9	32	1.9	3	-0.7	26	-1.5	31
Colima	-0.7	29	-2.4	31	-0.8	28	1.5	12
Guerrero	0.5	24	1.4	6	-1.2	29	1.3	14
Jalisco	1.9	15	-0.8	23	0.1	19	2.3	6
Michoacan	2.4	12	-0.7	21	0.7	14	0.6	21
Nayarit	1.0	19	-0.3	18	-0.6	25	1.1	17
Sinaloa	0.7	21	-1.5	26	1.1	7	1.2	16
National	1.6		-0.1		0.1		0.9	

Rank is out of 32 states

Sources: INEGI, Moody's Analytics

evated their share of GDP.² At approximately 36%, merchandise exports' share of GDP has increased by more than two-thirds in the past two decades and is among the highest of Latin America's large economies.

Like its Latin American peers, Mexico has struggled in recent years to increase domestic fixed investment. However, rising inflows of foreign direct investment into higher-value industries such as aerospace, pharmaceuticals, consumer electronics and autos have transformed Mexico's exporting firms into globally competitive producers of high-value manufactured goods. Not only have exports of autos and consumer electronics nearly doubled in the past decade, placing Mexico among the top 10 global producers of light vehicles, flat-screen televisions and computers, but nontraditional exports such as aerospace products and parts have staked large gains as well. And while North America remains the primary destination for Mexican manufactures, domestic auto and electronics makers have also made inroads in European, South American and Asian markets.

The experience of Mexico's regional economies defies most academic accounts of development, which hold that increased export competitiveness elevates the productivity of firms up and down the supply chain.³ Despite tangible signs of technology diffusion in the export-oriented northern and central states, where most of the country's manufacturing exports are produced, productivity gains in manufacturing have failed to take hold in the broader economy.

Evidence from Mexico's economic census—a near-complete count of establishment employment and revenues—suggests that the predominance of small, mostly informal firms plays a central role in stifling productivity growth. According to the most

recent census, in 2014, firms with 10 or fewer workers account for more than 95% of all establishments. However, most do not register their workers with the Mexican Social Security Institute, as required by law. Indeed, there is a broad overlap between firm size and workers' legal

status. On average, firms with 250 workers or greater are largely compliant with tax and labor laws, while firms with fewer than 10 or even 50 workers are not.⁴ This owes in part to the greater tax scrutiny faced by larger firms, as well as their greater profitability, which reduces the cost of complying with tax and labor regulations that require firms to enroll their workers in social security and pension programs.

Not only are larger firms substantially more productive than their smaller counterparts—the value added per worker of firms with 250 employees or greater is about five times higher—but the productivity of smaller firms declined by an average annual rate of 2% from 2004 to 2014, more than sufficient to counter gains at larger enterprises.⁵ Firms with 10 or fewer workers are the norm even in the export-oriented auto and computer and electronics industries, where a few large, modern enterprises rely on a supporting cast of mostly small and informal firms.

These findings gel with the large body of research that points to informality as the primary drag on labor productivity.⁶ According to this view, Mexico's small firms face equipment, manpower and credit con-

Chart 15: Informality Remains Common

IMSS enrollees as share of total employment, %



Sources: INEGI, IMSS, Moody's Analytics

straints that curb their capacity to innovate. In the following sections, we take a closer look at how these dynamics play out at the regional level.

Abnormal informality

According to INEGI, almost two-thirds of Mexican workers are employed informally. This is an improvement over the last decade, when nearly 70% of workers toiled in the informal sector. However, informal employment in Mexico still ranks among the highest of Latin America's large economies and is well above rates reported by the U.S. and Western Europe. Indeed, in its pervasive informality, Mexico's labor market more closely resembles those in the largely underdeveloped countries of Central America.

To assess the extent of informality across states and regions, we compare the number of workers enrolled with the Mexican Social Security Institute, or IMSS, to the total jobs count from the INEGI household survey. Because enrollment with the IMSS is a legal requirement for salaried workers, and because the IMSS automatically deducts social security and income tax payments from enrollees' paychecks, which ensures compliance with tax authorities, we use the count of IMSS enrollees as a proxy for formal employment. According to this measure, the share of formal-sector workers has increased by nearly 10% over the past decade but accounts for just more than a third of total employment (see Chart 15 and Table 5).

There are considerable differences in the share of formal workers across regions,

² According to the OECD, the value added by Mexican exports has increased steadily from 2000 to 2011, the last year for which data are available. While this measure remains below its peak just after the signing of NAFTA, more recent data from INEGI indicate that the value added of Mexican manufacturing exports has continued to rise.

³ See Ricardo A. Lopez, "Trade and Growth: Reconciling the Macroeconomic and Microeconomic Evidence," *Journal of Economic Surveys*, Volume 19, No. 4 (2005) and Ana Cuadros, Vicente Orts, and Maite Alguacil, "Openness and Growth: Re-Examining Foreign Direct Investment, Trade, and Output Linkages in Latin America," *The Journal of Development Studies*, Volume 40, No. 4 (2004)

⁴ Tabulations of INEGI's 2009 Economic Census by Matias Busso, Maria Victoria Fazio, and Santiago Levy in "(In)Formal and (Un)Productive: The Productivity Costs of Excessive Informality in Mexico," Inter-American Development Bank Working Paper 341 (August 2012), 44-45.

⁵ Author tabulations of INEGI's 2004 and 2014 Economic Census.

⁶ See Eduardo Bolio et. al, "A tale of two Mexicos" Growth and prosperity in a two-speed economy," McKinsey Global Institute (March 2014) and Gordon H. Hanson, "Why Isn't Mexico Rich?" NBER Working Paper No. 16470 (October 2010)

Table 5: Formal-Sector Share of Total Employment

%

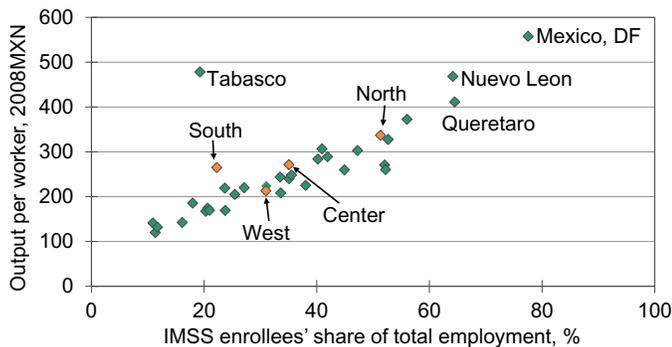
State	2000	Rank	2005	Rank	2010	Rank	2015	Rank
North	53.7		48.7		47.9		51.3	
Baja California	59.5	2	52.6	3	47.4	6	51.6	5
Chihuahua	59.8	1	50.3	5	48.5	4	51.3	7
Coahuila	54.7	5	50.9	4	49.5	3	55.8	4
Nuevo Leon	58.2	4	53.6	2	56.0	2	63.6	2
Sonora	41.8	10	39.3	11	41.0	9	40.3	11
Tamaulipas	46.3	7	43.0	8	41.3	8	41.3	10
Center	32.3		30.0		31.1		35.1	
Aguascalientes	51.1	6	46.8	6	44.7	7	51.4	6
Federal District	58.9	3	58.2	1	63.0	1	75.0	1
Durango	33.2	13	30.0	16	29.8	17	30.8	19
Guanajuato	28.1	18	27.5	19	29.2	18	34.8	16
Hidalgo	18.3	27	15.1	29	15.9	28	17.0	28
State of Mexico	20.6	23	18.7	24	19.0	25	19.9	26
Morelos	24.6	20	22.9	20	22.7	21	25.6	21
Puebla	21.9	21	18.5	25	18.6	27	20.8	25
Queretaro	43.4	9	41.5	10	48.1	5	60.6	3
San Luis Potosi	28.1	19	27.5	18	28.8	19	33.4	17
Tlaxcala	20.4	24	17.3	26	15.0	29	15.7	29
Zacatecas	19.5	26	20.2	23	23.3	20	26.9	20
South	17.8		19.3		20.2		22.3	
Campeche	29.4	17	32.3	14	34.6	13	36.7	13
Chiapas	8.0	32	9.5	32	10.6	30	11.4	31
Oaxaca	9.3	31	9.9	31	10.3	32	11.9	30
Quintana Roo	45.6	8	43.5	7	40.6	10	45.2	8
Tabasco	15.7	29	16.7	27	18.6	26	21.6	24
Veracruz	20.0	25	21.2	22	22.4	23	23.7	22
Yucatan	33.0	14	32.0	15	30.1	16	33.2	18
West	26.7		26.7		28.2		31.0	
Baja California Sur	41.7	11	42.3	9	40.2	11	39.8	12
Colima	32.5	15	33.3	13	33.8	14	35.5	15
Guerrero	10.4	30	11.3	30	10.4	31	11.1	32
Jalisco	38.9	12	37.8	12	39.1	12	44.0	9
Michoacan	15.9	28	16.6	28	19.5	24	19.8	27
Nayarit	21.0	22	22.6	21	22.4	22	23.5	23
Sinaloa	31.0	16	29.2	17	32.8	15	36.5	14
National	32.2		30.8		31.5		35.0	

Rank is out of 32 states

Sources: INEGI, IMSS, Moody's Analytics

Chart 16: Formal Sector Is More Productive...

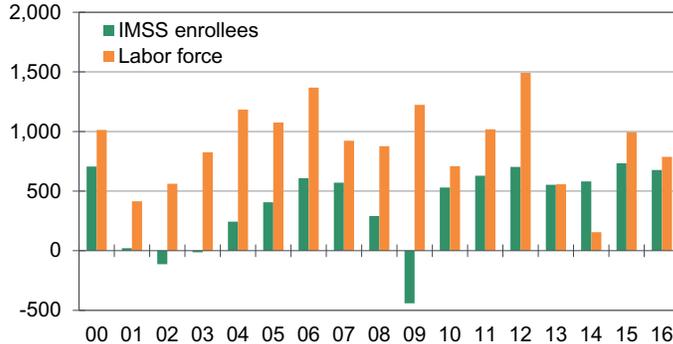
Mexican regions and states ex Campeche, 2016



Sources: INEGI, IMSS, Moody's Analytics

Chart 17: ...But Cannot Absorb the Labor Force

Mexico, annual change, ths



Sources: INEGI, IMSS, Moody's Analytics

but all share a discouraging trend: From the more industrialized North and Center to the less developed South and West, the formal sector is creating too few jobs to absorb the increase in the labor force. This is particularly concerning since we observe a strong positive relationship between the share of formal-sector workers and the level of productivity. On average, output per worker is considerably higher in states that boast a greater share of formal-sector workers (see Charts 16 and 17). States with the highest share of formal-sector workers are largely manufacturing states reliant on exports, such as Nuevo Leon, Queretaro and Aguascalientes. However, the state with the highest share of formal employment boasts little manufacturing at all. The Federal District, where four in five workers are employed in the formal sector, is characterized by high levels of government employment as well as a large concentration of financial, information and scientific professional services.

Mexico's two largest energy-producing states—Tabasco and Campeche—are outliers for another reason entirely. Despite their high levels of productivity, the share of formal-sector employment is very low. The high level of output per worker owes in part to the states' sparse population and small share of employment outside of extractive industries. Though it is well above that in most other states, the level of productivity has fallen substantially over the past decade as oil output declined and the industrial mix shifted to less productive sectors.

There are large variations in the share of formal employment both across Mexico's regions and within. However, one broad trend stands out. States with greater exposure to export trade, whether in the form of goods or services, tend to boast higher shares of formal-sector employment and higher productivity. One possible explanation is that foreign firms that export a large share of output, whether in the form of goods or services, are both more productive and face greater tax scrutiny by Mexican and international customs authorities.

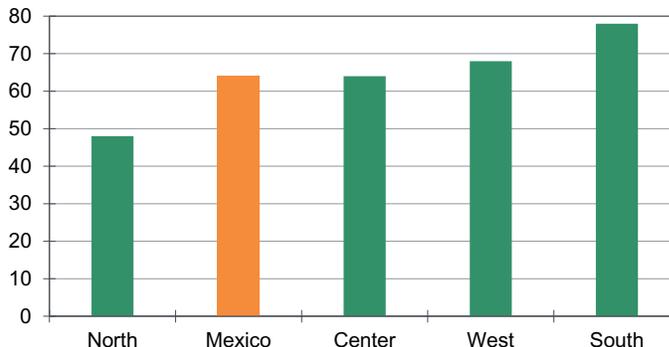
Of Mexico's four regions, informality is highest in the South, where the decline of the oil industry has drained the ranks of large, private sector firms on the hunt for workers (see Chart 18). In the large oil states of Veracruz, Tabasco and Campeche, 20% to 30% of workers are employed formally. This share dwindles to just 11% in Chiapas and Oaxaca, two largely rural states that remain mired in poverty despite recent growth in tourism. As mentioned above, Quintana Roo is a regional exception; formal workers make up nearly 50% of total employment, a share on par with that in most northern states. As in the case of manufacturing in the North, the presence of large, export-

oriented multinational firms—this time in the hospitality industry—may encourage greater compliance with tax and customs authorities. The labor market in tourism-reliant Yucatan resembles that of Caribbean neighbor Quintana Roo; the share of formal-sector workers in the state of Yucatan is about even with the national average but relatively high for the South at approximately 35%.

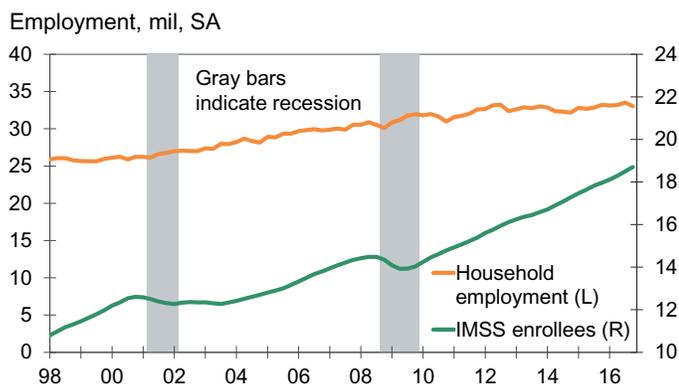
Informality is less of a blight in the West, though large differences exist between Pacific coast states closer to the North, which rely more on exports and tourist visits than states closer to the South. For example, the share of formal workers in export-oriented agriculture states Sinaloa and Baja California Sur is just more than 40%. Meanwhile, Guerrero and Michoacan, poorer agricultural states that ship produce primarily to the domestic market, more closely resemble the South in their share of formal workers: Just 11% of workers in Guerrero work in the

Chart 18: Informality Evident in All Regions

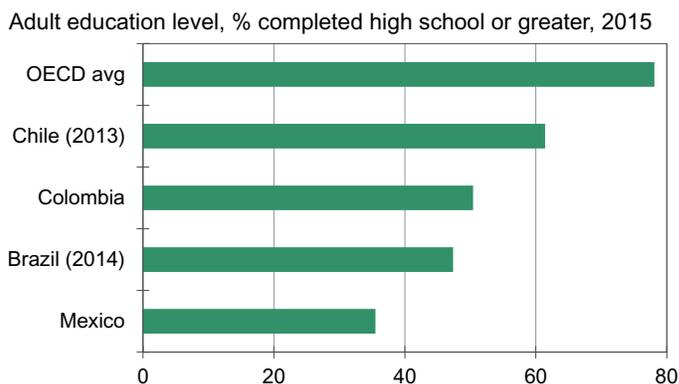
IMSS enrollees as share of total employment, %, 2016



Sources: INEGI, IMSS, Moody's Analytics

Chart 19: Informal Sector Is a Shock Absorber

Sources: INEGI, IMSS, Moody's Analytics

Chart 20: Attainment Trails LatAm Peers'...

Sources: OECD, Moody's Analytics

formal sector; this share is slightly higher in Michoacan. Formal-sector employment is most prevalent in Jalisco, which exports large quantities of agricultural commodities as well as manufactured goods such as autos and consumer electronics.

The share of formal employment in central states also varies with the importance of exports and foreign investment. Formal-sector employment in export powerhouses Aguascalientes and Queretaro is among the highest in the country. In contrast, in industrial states that produce goods primarily for the domestic market—such as Puebla, Hidalgo, the State of Mexico, and Tlaxcala—labor market informality is just as high as in the South's poorest states.

Formal employment is notably higher in the North, a trend going back almost two decades. Border states have long been the seat of Mexico's export-oriented manufacturing industry and their share of high-value manufacturing exports has only grown over time. However, outside of Nuevo Leon, there is still at least one informal-sector worker for every worker employed formally. As a result, labor markets in Mexico's largest states still contend with a large shadow pool of labor that hurts bargaining power and holds down wages. Indeed, if even a small share of informal-sector workers hold the skills necessary to perform in the formal economy, workers at larger, more efficient firms would face large downward wage pressures from this shadow workforce.

A simple time-series comparison of total IMSS enrollees to total household employ-

ment suggests that workers can and do switch between sectors.⁷ Indeed, the ranks of IMSS enrollees at both the state and national levels fall sharply during recessions and rebound when national and regional economies begin to heal. In contrast, total household employment shows little cyclical variation. For total household employment to maintain its upward trajectory even when formal-sector employment contracts, the labor market would need to fully absorb the workers cast aside by formal-sector firms (see Chart 19).

Moreover, there is evidence that flows from the informal sector to the formal sector are characteristic of Mexico's labor market as well. However, these generally occur when the economy is on the upswing. Indeed, during periods of state and national expansion, the ranks of IMSS enrollees swell even though the trajectory of total employment does not appreciably change, suggesting that workers can and do move to the formal sector when economic conditions improve.

Human capital

In Mexico, as in other developing countries, informal-sector employment is not a choice for many workers: Because of low schooling, many workers have few options outside of low-skilled informal work. The average Mexican has only 10 years of formal

education, less than Latin America's other large economies and well below the average for the OECD, the group of largely developed countries that counts Mexico as a member. There is considerable variation in educational outcomes across states as measured in years of schooling, from a low of eight years in Chiapas to a high of almost 12 in the Federal District, according to INEGI. However, by and large, educational attainment is highest in Mexico's northern and central states and lowest in Mexico's less developed South and West, where high school drop-out rates are high and only a small share of students enroll in post-secondary education.

Low educational attainment is just as important a piece of Mexico's productivity puzzle as informality: Educational attainment is highly correlated with the level of productivity across states, and this positive relationship has only strengthened over time. However, although educational attainment has improved considerably over the past 15 years, it remains well below that of Latin America's largest economies such as Brazil and Chile. For example, the share of Mexican adults aged 25 to 64 that held a high school degree or higher is half that of Chile and a quarter below Brazil's share as of 2013, the last year of available data for all three countries (see Chart 20).⁸

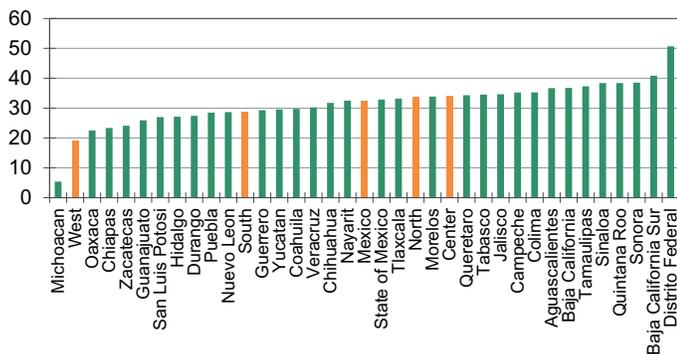
As mentioned above, the share of the population in Mexico's North and Center that holds a high school degree or higher is

⁷ For a comprehensive account of informality and worker mobility in Mexico, see Santiago Levy, "Good Intentions, Bad Outcomes. Social Policy, Informality, and Economic Growth in Mexico," (Washington, DC: Brookings Institution Press, 2008), 85-110.

⁸ Data retrieval from the OECD: Adult education level, accessed 5/11/2017 <https://data.oecd.org/eduatt/adult-education-level.htm#indicator-chart>

Chart 21: ...And Varies Widely Across States

Adult education level, % completed high school or greater, 2016



Sources: INEGI, Moody's Analytics

well above that in Mexico's other regions (see Chart 21 and Table 6). Higher attainment in North and Center states confers a significant comparative advantage. Though the share of the adult population in Baja California and Aguascalientes with a high school degree falls short of that in Latin America's other large economies, it is significantly higher than in western states such as Michoacan or southern states Oaxaca and Chiapas. In addition to high transport costs, low educational attainment may also explain why international manufacturers have hesitated to expand to Mexico's South and West.

Nonetheless, states in the North and Center still face hurdles: On average, less than a third of the adult population holds a high school degree. Larger manufacturing employers often compensate for education and skills gaps with vocational training programs, but this option may be too costly for smaller firms down the supply chain. The extra investment needed to train skilled workers could put smaller manufacturing firms at a competitive disadvantage vis-à-vis foreign suppliers that can draw on a large pool of qualified workers and are thus able to devote more resources toward business equipment spending and research and development.

As Mexican goods-producing and service-providing firms scale the value-added chain, the shortage of qualified workers could become a binding constraint. For example, employers in high-value services such as information technology, medical research, engineering and management regularly re-

port difficulties filling open positions.⁹ Though states with large urban centers such as the Federal District and Nuevo Leon have made considerable progress in raising educational attainment, the share of the adult population with a high school degree is still very low compared with international standards. The shortage of trained workers is especially concerning given the two economies' reliance on information technology and scientific and professional services for growth.

More broadly, low educational attainment could hamper efforts to cultivate research and design clusters in states such as Baja California, San Luis Potosi, and Aguascalientes that could potentially leverage existing

⁹ Surveys by international recruiting firms regularly report a shortage of Mexican workers in high-value service industries such as engineering and medical research. The Manpower Group's 2015 Talent Shortage Survey and the Hays Group's Reporte Laboral Mexico 2014 are just a few examples.

Table 6: Educational Attainment

% of adult population with high school degree or higher

State	2005	Rank	2010	Rank	2015	Rank
North	23.4		27.1		32.2	
Baja California	26.4	4	31.1	5	36.2	5
Chihuahua	22.3	13	24.0	22	29.7	18
Coahuila	21.0	20	25.4	18	29.1	19
Nuevo Leon	20.9	21	24.0	20	27.3	25
Sonora	25.4	5	30.0	6	36.2	4
Tamaulipas	24.8	8	28.8	11	35.9	6
Center	24.0		28.4		32.7	
Aguascalientes	25.2	6	29.0	10	35.7	7
Federal District	37.8	1	43.1	1	48.7	1
Durango	19.7	23	21.7	26	25.8	27
Guanajuato	15.4	29	19.3	30	22.9	28
Hidalgo	17.6	25	20.8	27	28.1	21
State of Mexico	22.4	12	27.2	14	31.5	17
Morelos	32.1	2	37.7	2	33.6	12
Puebla	22.4	12	21.8	25	27.9	22
Queretaro	22.2	14	26.6	17	32.6	15
San Luis Potosi	16.5	27	22.4	24	26.2	26
Tlaxcala	21.1	19	26.9	16	31.7	16
Zacatecas	14.4	30	18.3	31	21.5	31
South	18.3		23.6		27.3	
Campeche	23.0	11	28.2	12	34.9	9
Chiapas	13.8	31	19.6	28	22.9	29
Oaxaca	15.7	28	19.6	29	22.2	30
Quintana Roo	24.2	10	31.7	4	35.2	8
Tabasco	21.5	17	29.4	8	34.0	10
Veracruz	19.7	22	24.0	21	27.4	24
Yucatan	17.8	24	23.6	23	28.6	20
West	13.1		15.6		18.9	
Baja California Sur	27.5	3	34.8	3	39.0	2
Colima	24.7	9	29.3	9	33.5	13
Guerrero	21.6	16	24.4	19	27.5	23
Jalisco	21.4	18	27.1	15	33.9	11
Michoacan	4.2	32	4.9	32	5.7	32
Nayarit	22.1	15	28.0	13	32.9	14
Sinaloa	25.0	7	29.8	7	38.2	3
National	22.1		26.6		31.3	

Rank is out of 32 states

Sources: INEGI, Moody's Analytics

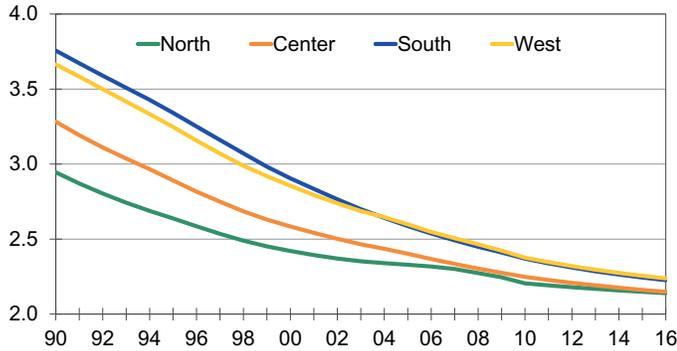
comparative advantages in advanced manufacturing to propel investment in research and design fields.

Population dynamics

The slowdown in productivity growth is all the more pressing because of the broad deceleration in population growth across

Chart 22: Gap in Fertility Rates Has Narrowed...

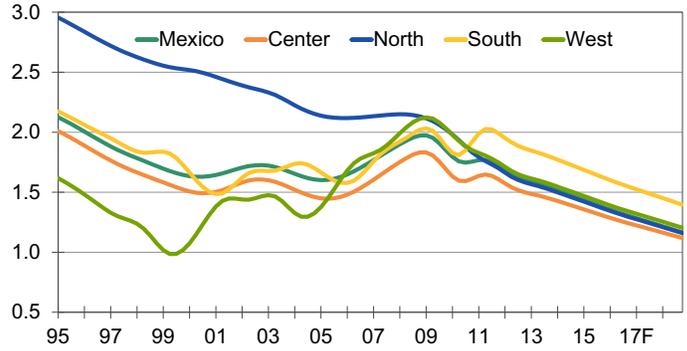
Births per childbearing-age woman



Sources: CONAPO, Moody's Analytics

Chart 23: ...Causing Labor Force Gains to Slow

Population aged 15-64, % change yr ago



Sources: CONAPO, INEGI, Moody's Analytics

states. Over the past few decades, the rapid decline in the fertility rate, or average number of children born per childbearing-age woman, has translated into slower population and labor force growth. This dynamic has played out to a larger degree in the less developed South and West, where fertility rates were a third higher than in the North and Center as late as the mid-1990s, but fell more quickly in the ensuing two decades (see Chart 22).

Population growth in the less developed South and West easily outpaced that of the North and Center well into the 1980s, but the convergence in fertility rates in the subsequent decades has narrowed the gap in population gains. As a result, population and labor force growth have slowed almost uniformly across states (see Chart 23). Over time, slower population increases will tilt the age distribution of Mexico's states toward older cohorts, thinning the ranks of prime-age workers.

The changing pattern of Mexican immigration to the U.S. has also played an important role in reshaping population dynamics. Starting in the mid-1990s, out-migration from northern states to the U.S. began to wane, while states in the South, West and Center began to send ever larger numbers of migrants to the U.S. Along with declining fertility rates, out-migration from the South, West and Center weighed on population growth—so much so that population gains in these regions trailed those in the North in the 1990s and early 2000s (see Table 7).

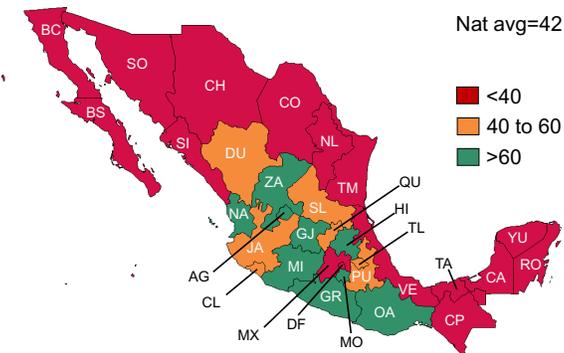
Not all southern and western states experienced net out-migration in the 1990s and early 2000s. In Quintana Roo and Baja California Sur, the growing tourism and hospitality industries attracted large numbers of workers from surrounding states. And in Queretaro and San Luis Potosi, growth in manufacturing kept net outflows very low relative to the total population.

Northern states sent migrants to the U.S. as well, but these flows were dwarfed by large inflows from other states—both temporary and permanent—that kept population growth in the North well above that in the other regions.

As more states in the South, West and Center sent migrants to the U.S., the regional pattern of remittances began to shift as well. Traditionally concentrated in a handful of central and western states, remittances gained importance in the South and West and remained elevated long after out-migration to the U.S. ebbed (see Charts 24 and 25). While data on personal spending at the regional level are sparse, the greater dispersion of remittances has coincided with stronger output gains in local service-providing industries. Indeed, it is precisely these gains that have narrowed the gap in overall economic growth between the North and Mexico's central and western states.

Chart 24: Remittances Highest in Center, West...

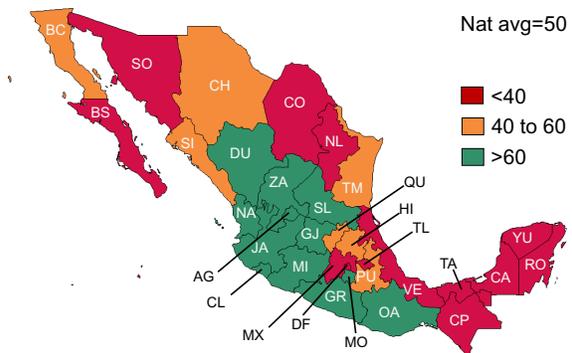
Remittances per capita, 2003, 2009\$



Sources: INEGI, Bank of Mexico, Moody's Analytics

Chart 25: ...And Stay High as Migrants Return

Remittances per capita, 2016, 2009\$



Sources: INEGI, Bank of Mexico, Moody's Analytics

Table 7: Total Population*Compound annual growth rate*

State	1996-2000	Rank	2000-2005	Rank	2005-2010	Rank	2010-2015	Rank
North	2.2		1.9		1.7		1.2	
Baja California	3.4	2	2.6	3	2.0	5	1.4	12
Chihuahua	2.1	7	1.8	8	1.4	17	0.8	27
Coahuila	1.7	14	1.5	15	1.4	18	1.2	19
Nuevo Leon	1.9	12	1.8	6	1.7	11	1.4	11
Sonora	1.9	10	1.8	9	1.7	10	1.3	14
Tamaulipas	2.2	4	1.9	5	1.6	12	1.1	21
Center	1.1		1.1		1.2		1.1	
Aguascalientes	1.8	13	1.7	12	1.8	8	1.5	9
Federal District	0.2	30	0.1	32	-0.1	32	-0.2	32
Durango	0.6	26	0.9	24	1.3	21	1.1	20
Guanajuato	0.7	23	0.6	26	1.0	27	0.9	25
Hidalgo	0.7	24	1.0	23	1.5	16	1.4	13
State of Mexico	2.1	6	1.9	4	1.8	7	1.6	7
Morelos	0.9	21	1.1	21	1.4	20	1.2	18
Puebla	1.3	17	1.1	22	1.2	23	1.1	22
Queretaro	2.0	9	1.7	11	1.8	6	1.6	6
San Luis Potosi	0.6	27	0.7	25	1.1	25	1.1	23
Tlaxcala	1.9	11	1.6	13	1.6	13	1.6	8
Zacatecas	-0.2	32	0.3	31	1.0	26	0.8	28
South	1.3		1.1		1.2		1.2	
Campeche	2.1	8	1.8	7	1.7	9	1.7	5
Chiapas	2.1	5	1.7	10	1.5	14	1.5	10
Oaxaca	0.6	25	0.4	29	0.7	31	0.8	29
Quintana Roo	4.4	1	3.8	1	3.5	1	3.0	2
Tabasco	1.6	15	1.4	17	1.2	22	1.2	16
Veracruz	0.5	28	0.5	27	0.9	29	1.0	24
Yucatan	1.6	16	1.4	16	1.4	19	1.3	15
West	0.8		1.0		1.3		1.1	
Baja California Sur	3.0	3	3.3	2	3.5	2	3.3	1
Colima	1.2	19	1.6	14	2.1	4	1.8	4
Guerrero	0.4	29	0.5	28	0.9	30	0.8	30
Jalisco	1.0	20	1.2	19	1.5	15	1.2	17
Michoacan	0.1	31	0.4	30	0.9	28	0.8	31
Nayarit	0.7	22	1.3	18	2.2	3	1.9	3
Sinaloa	1.2	18	1.2	20	1.2	24	0.9	26
National	1.3		1.2		1.3		1.1	

Rank is out of 32 states

Sources: CONAPO, INEGI, Moody's Analytics

The onset of the U.S. housing crisis and subsequent recession slowed the pace of net outflows from Mexico's South, West and Center and eventually caused net out-migration to reverse. On the one hand, the end of large population losses raised overall population gains in the three regions. However, because of the earlier convergence in fertility rates to the North, the reacceleration of population growth has topped out at the North's rate. Moreover, we expect the convergence in overall population growth to persist over the next few years as fertility rates remain similar and fewer Mexicans undertake the long journey to the U.S. In contrast to previous business cycles, net Mexican out-migration to the U.S. has remained negative despite the relatively robust U.S. recovery, a factor we attribute in earlier work to rising incomes and declining family size.¹⁰

Given improving educational outcomes among Mexican females and the tendency in most states for female labor force participation to rise as fertility rates decline, Mexico's state economies may yet reap the benefits of a better-educated labor force. However, compositional changes are likely to be marginal in the near term. Even in the more developed North, female labor force participation is approximately half that of the male population.

Breaking away

In this paper, we map out the industrial structure of Mexico's state economies by

geographic region. While we note clear differences in the industrial composition of Mexican states that give rise to distinct comparative advantages, they have changed little in the quarter century since the signing of NAFTA and the subsequent cultivation of trade ties with a broad range of countries. Mexico's northern states continue to produce more than half its merchandise exports and attract an outsize share of foreign direct investment, a potent combination that has hoisted growth above that in most other states.

Of the four regions we identify in this paper, only the Center has experienced large-scale change in its industrial composition. The boom in manufacturing investment in recent years has elevated the smaller, export-oriented states of Guanajuato, San Luis Potosi, Aguascalientes, and Queretaro, where manufacturing's share of total output and employment has increased considerably and overall output growth has matched or exceeded that of their northern neighbors. Meanwhile, the Center's large industrial states that produce goods primarily for the domestic economy have expanded at a much slower rate.

Despite a thriving manufacturing base, the economies of the North and Center have not been able to leverage existing comparative advantages in advanced manufacturing to attract investment in high-value research and design. Beyond the Federal District, Nuevo Leon, and Queretaro, information

technology and scientific and professional services make up a minute share of total output and employment.

As evidenced by the outperformance of Quintana Roo, Baja California Sur, and Jalisco, growth in manufacturing is not the only viable driver of output gains. The cultivation of high-income tourism, business services, and in the case of Jalisco, high-tech research and development, has proved both a viable and vigorous growth engine in these states. Meanwhile, rising remittances to Mexico's West, South and Center states have stimulated consumer spending and growth in local services, but it is less clear whether these gains can be sustained given calls for more restrictive immigration policy in the U.S. and ever larger net return flows to Mexican states.

Despite the breakaway performance of Mexico's northern and export-oriented central states, these economies face important structural barriers to growth that will become more imposing over time. High labor market informality and low educational attainment are pervasive in these states and explain why economy-wide gains have disappointed despite a fast-growing manufacturing sector that has learned to innovate. The fading of Mexico's demographic dividend only heightens the productivity imperative. Given slowing labor force gains across all states, economic growth will continue to disappoint should productivity growth falter.

¹⁰ For a thorough discussion of state-level migration patterns, see Jesse Rogers and Adam Ozimek, "Whither Mexican Immigration?" *Regional Financial Review* (September 2016)

Appendix

The measure of labor market informality we employ in this article—the ratio of IMSS enrollees to total employment—is not only helpful in understanding the evolution of Mexico's labor markets over time. It also explains a large share of the variation in productivity growth across states. In a panel regression of the five-year change in productivity on the change in labor market formality and average years of education, we find that states where the share of formal employment has grown have also become more productive (see Table 8). We also find a highly significant relationship between productivity growth and educational attainment. The average years of education is jointly significant with the informal share.

On average, a 1-percentage point increase in the formal share of employment is associated with a 4,000-peso increase per worker in labor productivity in real terms—about 1.5% of the 259,000-peso mean output per worker across the states (excluding Campeche). In other words, formality would have to increase substantially to have any meaningful impact on productivity. The returns to education are higher, but on average, a one-year increase in schooling is associated with just an 8,000-peso gain per worker in productivity. The estimated coefficients of these two variables are small but confirm that sustained improvement in

Table 8: Panel Analysis of Productivity Growth ex Campeche

Dependent variable: Real gross value added per worker
Method: Least squares, random effects
Sample: 2000-2015
Included Observations: 124

Variable	Coefficient	Std. error	t-Statistic	Prob.
Share of formal-sector employment	3.9940	0.0434	9.2131	0.0000
Yrs of education completed	7.0375	2.6223	2.6837	0.0086
		R-squared	0.4820	
		Mean dependent var	6.9378	
		S.D. dependent var	19.4500	

Sources: INEGI, Moody's Analytics

reducing informality and raising educational attainment can raise productivity. This analysis excludes Campeche, where productivity is more than four standard deviations above the mean, a result explained by the highly concentrated oil industry and sparse state population.

The model explains nearly half of the variation in productivity growth since 2000, but there are other important factors outside of education and employment status that may influence productivity, such as low domestic saving and investment, and small firms' relatively limited access to bank lending. Over time, a higher incidence of violent crime in certain states may also impede investment decisions and ultimately, produc-

tivity growth. However, long-term effects on productivity would be difficult to capture over the relatively short period we examine in this paper.

Finally, any analysis of state-level economies may fail to pick up on important trends in industrial structure, economic performance and productivity at the metropolitan area level that can influence productivity growth. The case of Jalisco, where agriculture and manufacturing exports overshadow the large information technology cluster in capital city Guadalajara, is just one example. Understanding the comparative advantages of Mexico's major metro areas could provide fertile ground for future investigation and cast additional light on Mexico's productivity puzzle.

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