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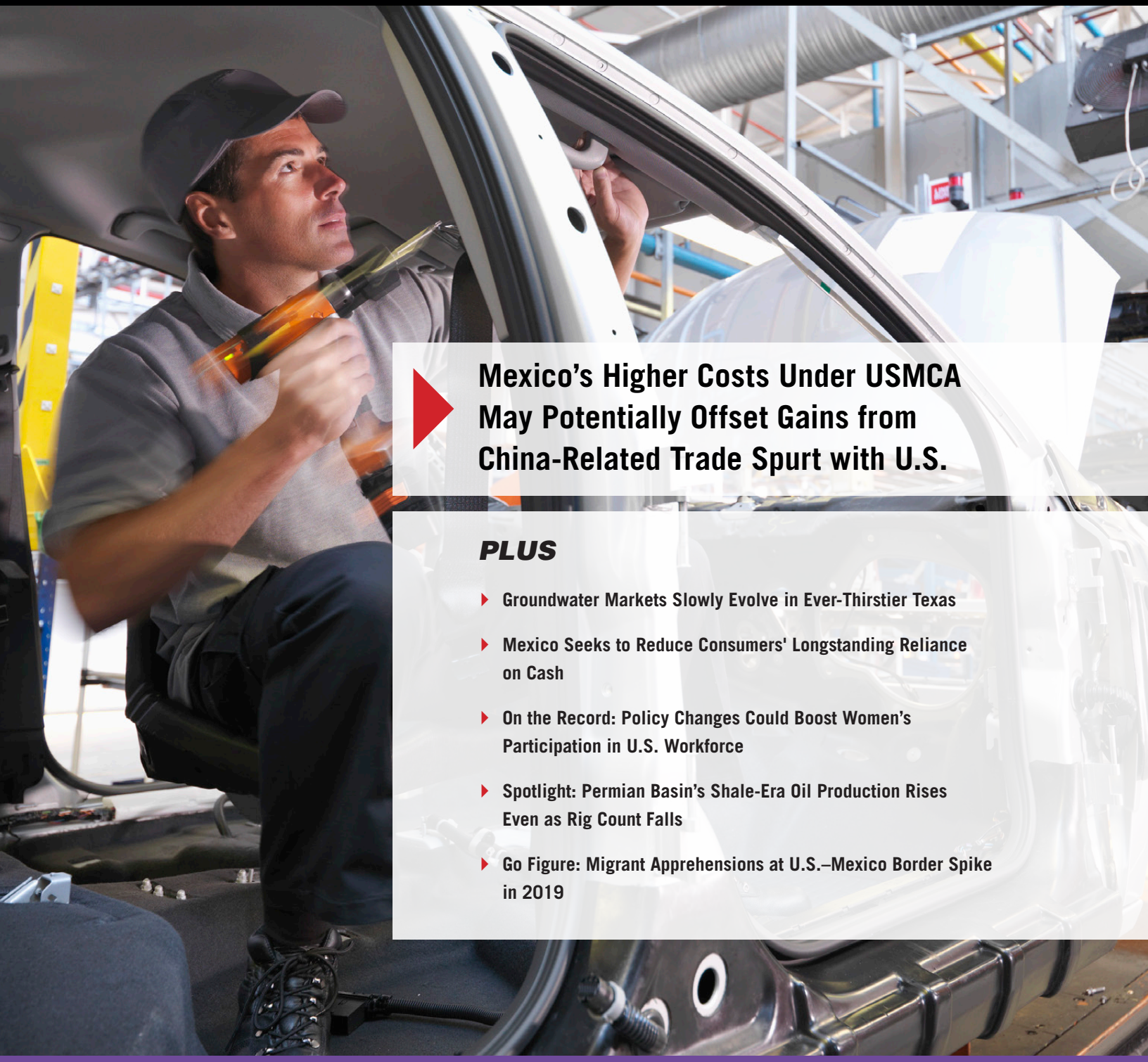
FIRST QUARTER 2020

Southwest Economy



Mexico's Higher Costs Under USMCA May Potentially Offset Gains from China-Related Trade Spurt with U.S.

PLUS

This issue of *Southwest Economy* publishes at a difficult time for the nation. These articles were prepared before the coronavirus (COVID-19) pandemic; thus, the issue contains a selection of material examining longer-run trends within the Eleventh District that, while not directly related to the current challenges, will remain relevant as we move forward.

Fed Chairman Jerome Powell Comments on FOMC Rate Cut

"… The virus presents significant economic challenges. Like others, we expect that the illness and the measures now being put in place to stem its spread will have a significant effect on economic activity in the near term. Those in travel, tourism and hospitality industries are already seeing a sharp drop in business. In addition, the effects of the outbreak are restraining economic activity in many foreign economies, which is causing difficulties for U.S. industries that rely on global supply chains. The weakness abroad will also weigh on our exports for a time. Moreover, the energy sector has recently come under stress because of the large drop in global oil prices. Inflation, which has continued to run below our symmetric 2 percent objective, will likely be held down this year by the effects of the outbreak."

—Excerpted from Federal Reserve Chairman Jerome Powell's statement following the Federal Open Market Committee's emergency reduction of the federal funds rate to a range of 0–0.25 percent, March 15, 2020.

Mexico's Higher Costs Under USMCA May Potentially Offset Gains from China-Related Trade Spurt with U.S.

By Daniel Chiquiar, Jesus Cañas, Armando Aguirre and Alfonso Cebreros

ABSTRACT: Approval of the United States–Mexico–Canada Agreement (USMCA) could change trade within the North American region, affecting output and weakening North America's global competitiveness. At the same time, while Mexico is achieving some temporary gains arising from trade tension between the U.S. and China, it stands to incur a substantial overall long-term economic cost.

A recent easing of global trade tensions has not come without critical change involving two of the U.S.' largest trade partners: Mexico and China.

Talks aimed at easing underlying trade policy differences between the U.S. and Mexico and the U.S. and China concluded earlier this year with two agreements. The United States–Mexico–Canada Agreement (USMCA) replaces the North American Free Trade Agreement (NAFTA), which had been in place since 1994. It sets a new framework for North American regional integration among the three nations.

The U.S.–China Phase One deal included Chinese pledges for the purchase of U.S. farm products, safeguards for intellectual property and the promise of further talks to reduce trade frictions between the two nations. The trade dispute has included successive rounds of tariffs since early 2018.

Taken together, the two agreements present challenges and opportunities for Mexico, both in the short term and long term, with regard to how it will do business—including with Texas that counts its neighbor as its largest trading partner and as a key link in the production of intermediate and finished goods.

USMCA, while opening the possibility of further regional integration in areas such as digital commerce, is more restrictive than NAFTA in other sectors, such as the automotive sector, where lower Mexican output could adversely affect its gross domestic product (GDP). On the other hand, even with the latest agreement between the U.S. and China, ongoing policy differences between the two have prompted trade diversion toward Mexico, which has acquired an increasing share of the U.S. import market.

However, these positive effects of trade diversion may be short lived and come with the cost of higher prices to consumers.

Uncertainty of Projections

Projections of the economic effects of new trade agreements, particularly of their short-term impact, are tentative given the high level of uncertainty that persists regarding trade policy and global growth. In this sense, rising protectionism across the world and within the North American region is one of the main risks confronting the global economy.

In particular, there is uncertainty regarding the extent of the distortions that measures such as tariffs and non-tariff barriers may pose for global trade, supply chains and the international organization of productive processes. There is also uncertainty about the effects that tariffs and the deterioration in international trade conditions could have on the global economy and investment in the short and medium terms.

Finally, over a longer horizon, greater barriers to trade could lead to a reconfiguration of global value chains to the detriment of aggregate productivity as manufacturing moves away from the efficient allocation of the production of goods and services.

USMCA Auto Sector Effect

USMCA is more restrictive in some respects than NAFTA, particularly in the automotive sector. Under USMCA,

the value of regionally sourced content has increased significantly. Additionally, there are new restrictions regarding the origin of steel, aluminum and vehicle parts used in the production process and new requirements governing labor value content and the wages paid.

Specifically, USMCA stipulates several notable changes in vehicle production. The North American share of the value of automobiles and light trucks produced increases from 62.5 percent under NAFTA to 75 percent under USMCA and from 60 percent to 70 percent for heavy trucks.

Rather than applying NAFTA's uniform content standard for vehicle parts, USMCA sets separate content requirements (the percentage that must be produced in North America) for three groups: core parts, such as engines and transmissions, 75 percent; principal parts, like electrical and electronic parts, 70 percent; and complementary parts, which include brake systems and miscellaneous parts, 65 percent.

At least 70 percent of the steel and aluminum used in the manufacture of automobiles and light trucks must originate in the U.S., Canada or Mexico.

Notably, requirements for labor value content were introduced in the updated agreement: 40 percent of the materials for automobiles and 45 percent of the content for light trucks must be produced by regional enterprises that pay workers at least $16 per hour. Since Mexican autoworkers currently earn about $7.30 per hour for auto assembly and $3.40 while making automotive parts, this new provision most directly affects Mexico.[1]

The USMCA requirements could make automotive production less efficient and decrease the competitiveness of the automotive industry across the North American region relative to the rest of the world, our estimates show.[2] Using a quantitative general equilibrium trade model—typically used to study the effects of trade reforms on industry—we estimate the effects of the new requirements, comparing USMCA with NAFTA.[3]

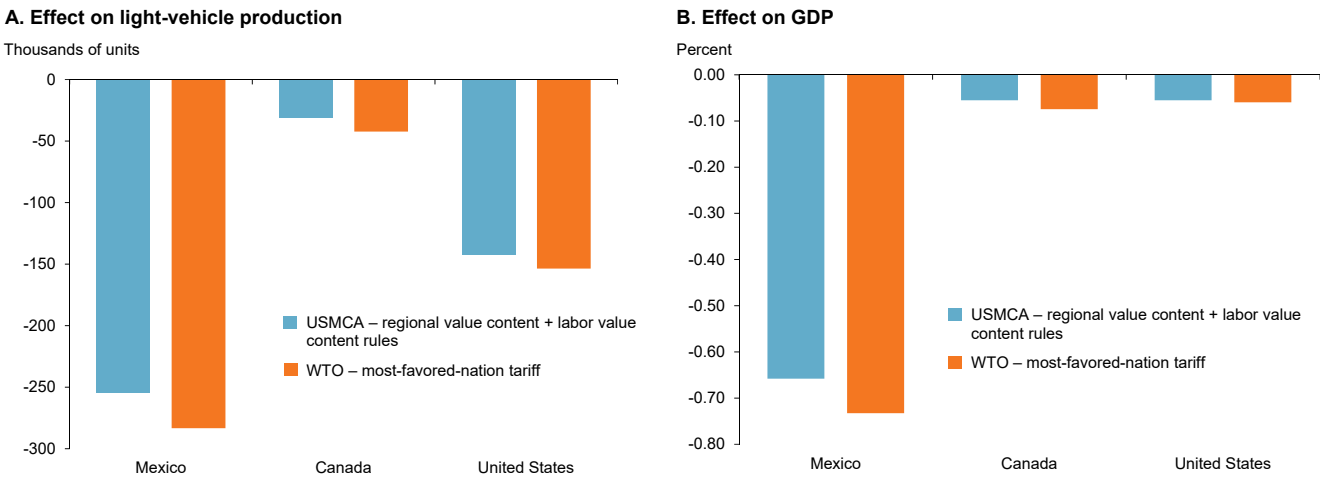
In the baseline scenario, more restrictive rules-of-origin requirements will increase production costs that, in turn, will imply higher prices, reduced output and a decrease in consumer surplus in the region *(Chart 1, blue bars)*.[4] Furthermore, at the regional level, spending on the transport equipment sector will shift away from local producers and toward foreign suppliers of these goods.

There are considerable losses of real output in the transportation manufacturing sector, as the whole region will reduce its output in the sector. While all countries in the region are negatively affected, Mexico stands to sustain the biggest loss both in terms of the absolute number of vehicles produced and GDP. The competitiveness of some assembly operations in Texas could be affected since facilities such as Toyota's truck plant in San Antonio and the General Motors SUV unit in Arlington rely on Mexican parts.

Opting Out of USMCA Trade

It is also possible that the new auto provisions increase the burden of compliance to the point that firms opt out of using the benefits of the USMCA and prefer, instead, to source their inputs from the least-cost country (not necessarily from North America) and pay the most-favored-nation (MFN) tariff when exporting. Such a move

CHART 1 Long-Term Effects of Transition to USMCA Trim Automotive Sector Output



NOTES: Effect on light-vehicle production is calculated by applying the percent losses estimated for transport equipment sector output in the counterfactual exercises to each country's light-vehicle production for 2018. Effect on gross domestic product (GDP) is calculated by running the percent losses estimated for transport equipment sector output in the counterfactual exercises through each country's input-output table as available from the Organization for Economic Cooperation and Development (OECD). Regional value content refers to production in North America. USMCA is United States–Mexico–Canada Agreement. WTO is the World Trade Organization.

SOURCES: Banco de México; *Automotive News;* Canada's National Statistical Agency; Bureau of Economic Analysis; OECD.

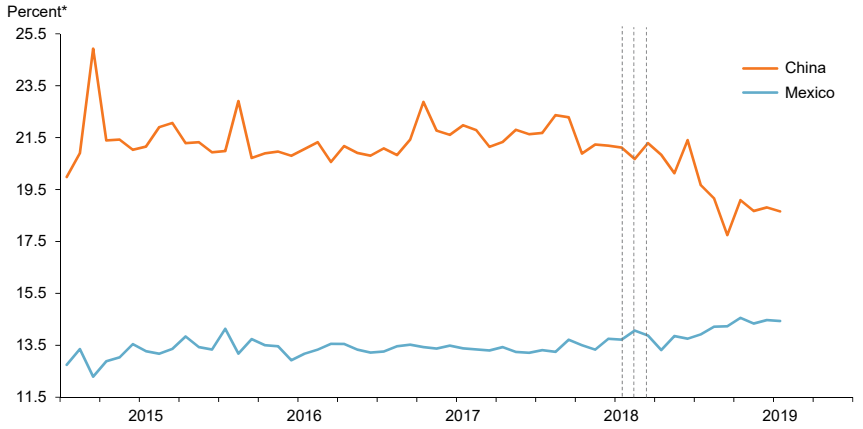
would hurt regional suppliers. Thus, even in a mildly disruptive scenario, the increase in the rules of origin may increase regional content at the cost of lower North American competitiveness in the automotive industry. In a heavily disruptive scenario, the tougher rules could actually lead to a reduction in the overall regional content in the sector.

Using our model, we estimate the effects that opting out of USMCA could have on the auto sector by considering an MFN opt-in scenario in which all regional trade in the sector faces MFN tariffs. Our estimates imply that this scenario is harsher than our benchmark USMCA scenario, although not drastically so *(Chart 1, orange bars)*. This suggests the possibility that any further tightening of the rules of origin requirements in the auto sector could create the incentives for firms to opt out of the USMCA as a means of conducting trade within the region.

Trade Diversion to Mexico

Trade conflicts between the U.S. and China have also been a factor behind Mexico's recent export performance.

CHART 2 Mexico Gains Share of Total U.S. Imports as China Slips



*Seasonally adjusted.

NOTE: Dashed lines indicate the month when various tariffs on China became effective—July, August and September 2018.

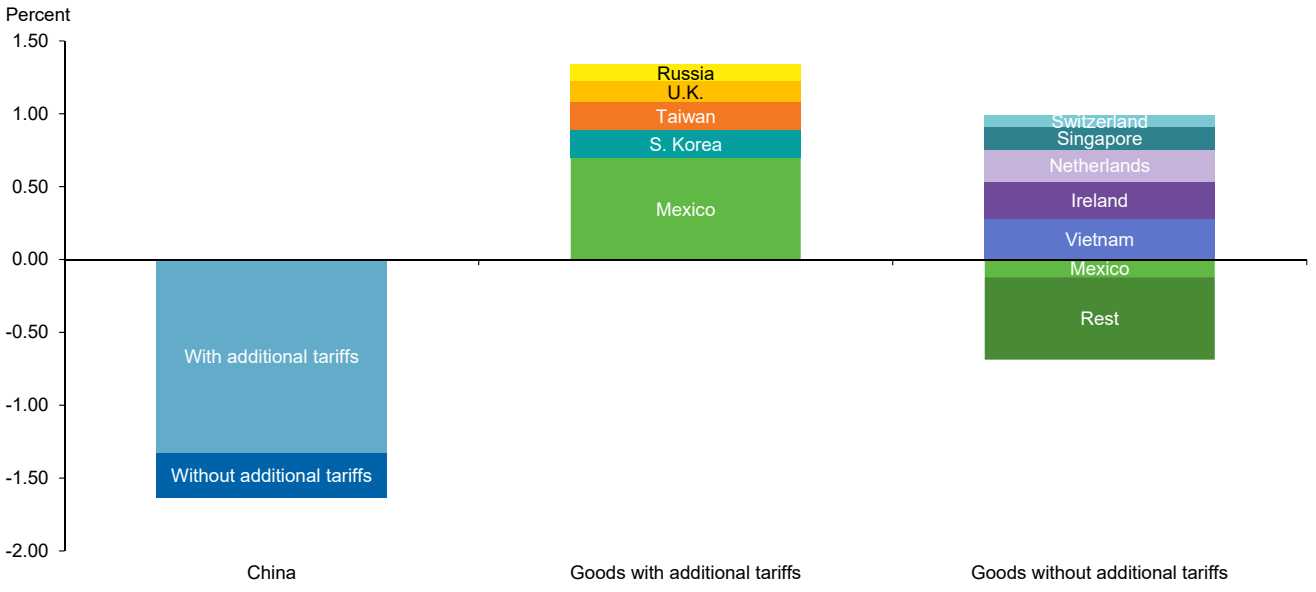
SOURCES: Banco de México; U.S. Department of Commerce.

Electrical and optical equipment, machinery, footwear and textiles are among the sectors where the U.S. has imposed high tariffs on China and where Mexico competes with China for market share.

Thus, it is natural to believe that trade diversion could boost Mexican exports in some industries. Since the U.S.–China dispute began, China has lost market share in the U.S., and Mexico has recorded gains *(Chart 2)*. Most of the market share that China lost in the U.S. involved goods subject to higher tariffs—the same set of goods in which Mexico achieved its largest gains of market share in U.S. imports *(Chart 3)*.

It is important to note that some of Mexico's gains were in sectors in which China did not export to the U.S. Thus,

CHART 3 Mexico Gains Share of U.S. Imports After Tariffs on China Goods



NOTE: Approximately 80 percent of the value of total U.S. imports of light vehicles is excluded from the analysis because China had no share of the products making up this item in 2017.

SOURCES: Banco de México; U.S. Department of Commerce.

it appears that Mexican exports have benefited from trade diversion, though perhaps not as much as some might have initially expected.

Notice that the declining share of Chinese imports in the U.S. has outpaced Mexico's gains. In fact, the increases that Mexico has achieved due to trade diversion amount to only one-third of what China lost. Thus, trade diversion has benefited other countries too, as the rest of the world acquired market share in the U.S. In particular, South Korea and Taiwan have also gained considerable presence in the U.S. import market.

Mexico has gained not only in terms of market share of U.S. imports. China's market share losses positively affected Mexico's manufacturing production in sectors in which China lost the most.

However, even though Mexico has been able to gain some output from trade diversion, this improvement has come at someone else's expense since trade diversion entails an efficiency loss.

In this case, it seems that U.S. consumers have borne the loss through higher prices of imports. Mexico has realized higher prices for the type of exported goods that would have faced tariffs had they come from China. Prices for those Mexican exports to the U.S. increased relatively more than the export prices of goods unaffected by the tariffs.

While there is evidence suggesting that Mexico has, at the margin, benefited from trade diversion, these "gains" may be short lived if trade tensions lead to a further slowdown of global economic activity, larger trade distortions and a breakup of global value chains.

Estimates of a counterfactual scenario in which the U.S.–China trade dispute was persistent suggest that both the U.S. and China would sustain real output losses, while Mexico and Canada would increase production, albeit only marginally. However, prices would be much higher, particularly across North America. These higher prices would reduce the gains from globalization for consumers in the region.

Changing Trade Patterns

The adverse impact on economic activity, trade and investment flows of an evolving and uncertain global trade environment is not surprising. However, calculating the magnitude of this effect is difficult. Mexico as a key U.S. trade partner is, not surprisingly, subject to the crosscurrents of trade tensions between the U.S. and China. These impacts are especially important for Texas, which counts Mexico as its largest trade partner.

Approval of the USMCA, an update to the almost quarter-century-old NAFTA, could by itself change trade. Indeed, costs—especially in the key automotive sector—will rise and tend to make North American products potentially less competitive than they might have been over the longer term, depressing Mexico's GDP.

However, Mexico stands to gain, albeit in the short term, from trade tensions between the U.S. and China and the imposition of retaliatory tariffs that began in 2018. Mexico has been a beneficiary of trade diversion, accounting for a portion of what China previously supplied to the U.S.

The U.S.–China Phase One agreement that called a ceasefire to the dispute and a pledge for further trade talks makes calculating the future benefit to Mexico difficult. The impact of disrupting the production of goods and services and the global value chains that they represent could exacerbate any broader economic slowdown, further trimming Mexico's short-term gains and negatively affecting its trading partners.

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The views expressed are those of the authors and should not be attributed to Banco de México, the Federal Reserve Bank of Dallas or the Federal Reserve System.

Notes

[1] For more information, see "NAFTA Briefing: Review of Current NAFTA Proposals and Potential Impacts on the North American Automotive Industry," by Kristin Dziczek, Michael Schultz, Bernard Swiecki and Yen Chen, Center for Automotive Research, April 2018.

[2] Estimates are derived from a model that can be used to analyze different counterfactual scenarios regarding changes in tariffs and trade costs among different countries and sectors based on two main data requirements: sector-level trade elasticities and expenditure shares between countries and sectors. For more information, see "Trade Theory with Numbers: Quantifying the Consequences of Globalization," by Arnaud Costinot and Andrés Rodríguez-Clare, *Handbook of International Economics*, Gita Gopinath, Elhanan Helpman, and Kenneth Rogoff editors, 2014, vol. 4, pp. 197–261.

[3] To properly interpret the results of this exercise, it is important to keep in mind that it only contemplates the general equilibrium implications of changes to the barriers that shape automotive trade in the region. The shift from NAFTA to USMCA contemplates changes in other sectors that are not considered for the purposes of this exercise but can have important macroeconomic consequences (i.e., reducing uncertainty). In addition, important assumptions were made in order to map regional value content and labor value content requirements into the model. For more information about the modeling results, contact Alfonso Cebreros or Armando Aguirre (carlos.cebreros@banxico.org.mx ; aaguirre@banxico.org.mx).

[4] See note 2 for details of the methodology used to produce the estimates depicted in Chart 1.

Groundwater Markets Slowly Evolve in Ever-Thirstier Texas

By Keith R. Phillips and Judy Teng

ABSTRACT: Texas' growing population is increasing the demand for water, a commodity that in many parts of the state is subject to wide swings from abundance during wet cycles to shortfall during droughts. Water markets offer one way to help meet some of the growing need. However, legal challenges and a variety of government entities overseeing water use complicate water markets' applicability.

The year after one of the worst droughts in Texas history, the 2012 State Water Plan was developed, combining plans from 16 regions across the state. It called for conservation, reuse, redistribution, new reservoirs and the development of water markets that could significantly increase water-usage efficiency.

Although those drought conditions eased, water scarcity remains. The state's projected growth over the next 50 years highlights the need for officials to ensure water availability. Development of water markets remains a key dimension of water planning.

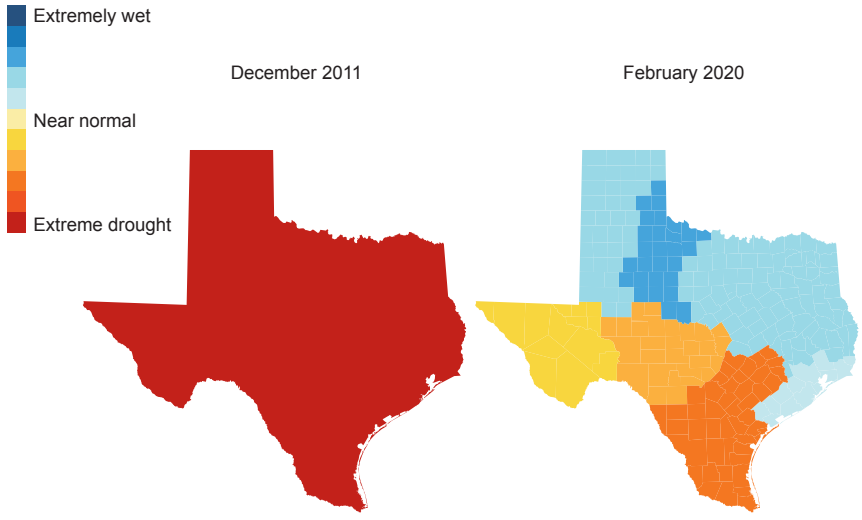
Drought Conditions in Texas

Texas has a long history of regular and severe droughts. The Edwards Plateau and South Central climate divisions were two of 10 in Texas experiencing moderate drought as of February 2020, based on the long-running Palmer Drought Index (*Chart 1*). This contrasts greatly with 2011, when water rationing and limits were ordered in many communities as Texas suffered the worst year of drought since records began in 1895.

A notable example of drought-induced rationing occurred along the Coastal Bend, where water availability for agriculture was significantly reduced in 2012 and 2013.[1] Because of the drought's severity, the Lower Colorado River Authority decreased most of the flow to rice farmers to limit water curtailment in Austin.

This action lowered the authority's allotted share of water for agriculture to 21 percent in 2012 from 60 percent in 2011. The reduction lasted four years, resulting in significant financial losses to farmers and the community businesses that served them.[2]

CHART 1 Texas Not Currently Facing Significant Drought



SOURCE: Texas Water Development Board.

Water Use Based on Source

Texas water comes from groundwater (aquifers) and surface water (rivers, lakes and reservoirs), with water usage differing greatly depending on its source (*Chart 2*).

The Ogallala and Gulf Coast aquifers are among the largest in Texas and this year will provide more than 50 percent of the 12.3 million acre-feet of available groundwater in Texas. (An acre-foot is the amount of water needed to cover an acre of land to a depth of one foot.)

The Ogallala Aquifer is one of the world's largest, covering eight U.S. states. It serves approximately 95 percent of the agricultural needs of a region that includes West Texas and most of the Panhandle.

The portion of the Ogallala under Texas has a slow water recharge rate, and excessive pumping is leading to depletion. Water levels in some areas have fallen several feet annually in recent years as the annual average recharge rate has held at a mere half-inch.

State water authorities estimate that groundwater availability will drop 20 percent from 2020 to 2070, largely due to declines in the Ogallala and Gulf Coast aquifers.[3] Water levels in the other seven major aquifers in Texas vary from stable to declining.

Rising population levels will primarily drive future water scarcity. Indeed, more people will require more water in municipalities for sanitation, industrial use, landscaping and individual consumption. Texas' population is expected to grow more than 70 percent, from 29.5 million in 2020 to 51 million in 2070. The Texas Water Development Board forecasts that water demand will rise 17 percent.[4]

One reason water use likely won't increase more is that nonresidential irrigation (primarily agricultural), which accounts for the largest share of state water usage, is anticipated to decline 18 percent by 2070.[5] The transfer of water rights from agriculture to municipalities, where the population growth will occur, is responsible for part of the sector's decline.

Surface, Groundwater Allocation

Water laws in the U.S. fall into two general categories: prior appropriation and riparian rule. Many western states, such as California and Colorado, follow the law of prior appropriation, which holds that water rights are obtained through fulfillment of specific statutory requirements. Other states follow riparian rule, which means that the rights to a body of water are determined by property ownership.

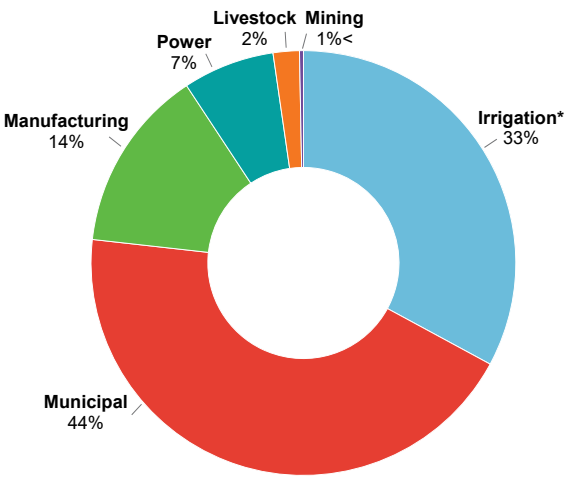
In Texas, surface water rights are subject to both prior appropriation and riparian rule, and the state is largely responsible for issuing water permits. Close to 70 percent of surface water rights are owned by 23 river authorities that typically manage reservoirs and regulate the flow of water to rivers.

When river authorities sell water to farmers or cities, the price is dictated by policies and is usually based on purification and transportation costs. In times of scarcity, the authorities often restrict supply to certain groups—just as the Lower Colorado River Authority did in 2012—rather than rely on market pricing and allocation.

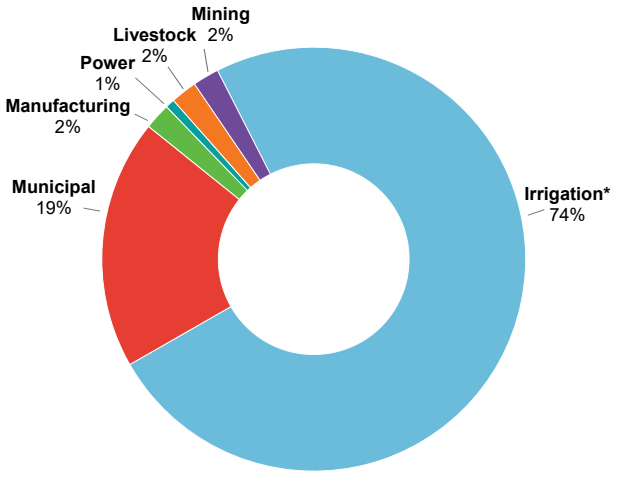
Groundwater rights are based on riparian rule and historically governed by the rule of capture, allowing landowners to pump as much water as they choose even when the water source extends to adjacent properties. Because water becomes private property only after it is drawn, there is a strong incentive to pump as much water as desired.

CHART 2

Water Usage Across Texas Varies Depending on Source of Supply



Surface water (43% of statewide water use)

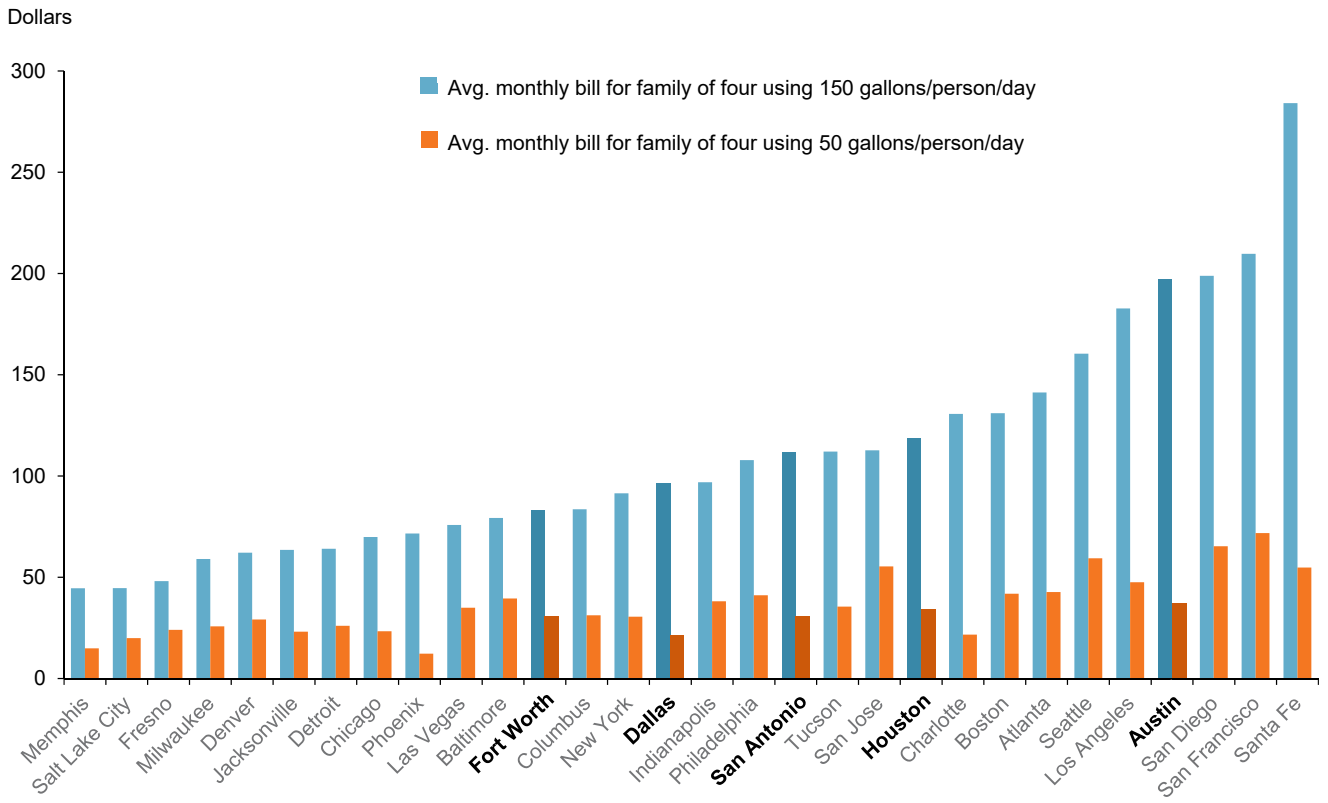


Groundwater (54% of statewide water use)

*Largely pertains to agricultural uses. Irrigation includes water used in irrigated field crops, vineyards, orchards and self-supplied golf courses.
NOTE: Data are as of 2017.
SOURCE: Texas Water Development Board.

CHART 3

Texas' Cities Rank Moderate to High for Monthly Water Bill



NOTES: Data are as of 2018 and refer to cities rather than metropolitan statistical areas. 50 gallons per person per day is regarded as an amount sufficient for basic needs.
SOURCE: Circle of Blue.

Overpumping groundwater can cause land subsidence and saltwater intrusion. Yet the rule-of-capture doctrine creates an incentive to pump water faster as it becomes scarcer. This results in overconsumption and resource depletion.

Water Market Efficiency

A water market, which is essentially a voluntary sale or lease of legal rights to water from one entity to another, is a useful way to allocate water. In general, markets are efficient because the price moves with changes in supply and demand so that shortages or excesses are avoided.

In a drought, for example, the price of water is driven higher, which encourages conservation and the movement of water from lower-value uses to higher-value ones. Faced with a high price, suburban homeowners may reduce lawn watering and farmers may plant fewer water-intensive crops and convert from flood irrigation to more efficient watering systems. Without markets and market prices, there may be little incentive to conserve even as scarcity increases. In some cases, the incentives can be the opposite—use as much as you can before it's gone.

Among the nation's 30 major cities, those in Texas rank moderate to high in terms of the average monthly water bill for a family of four using 150 gallons per person per day (*Chart 3*).

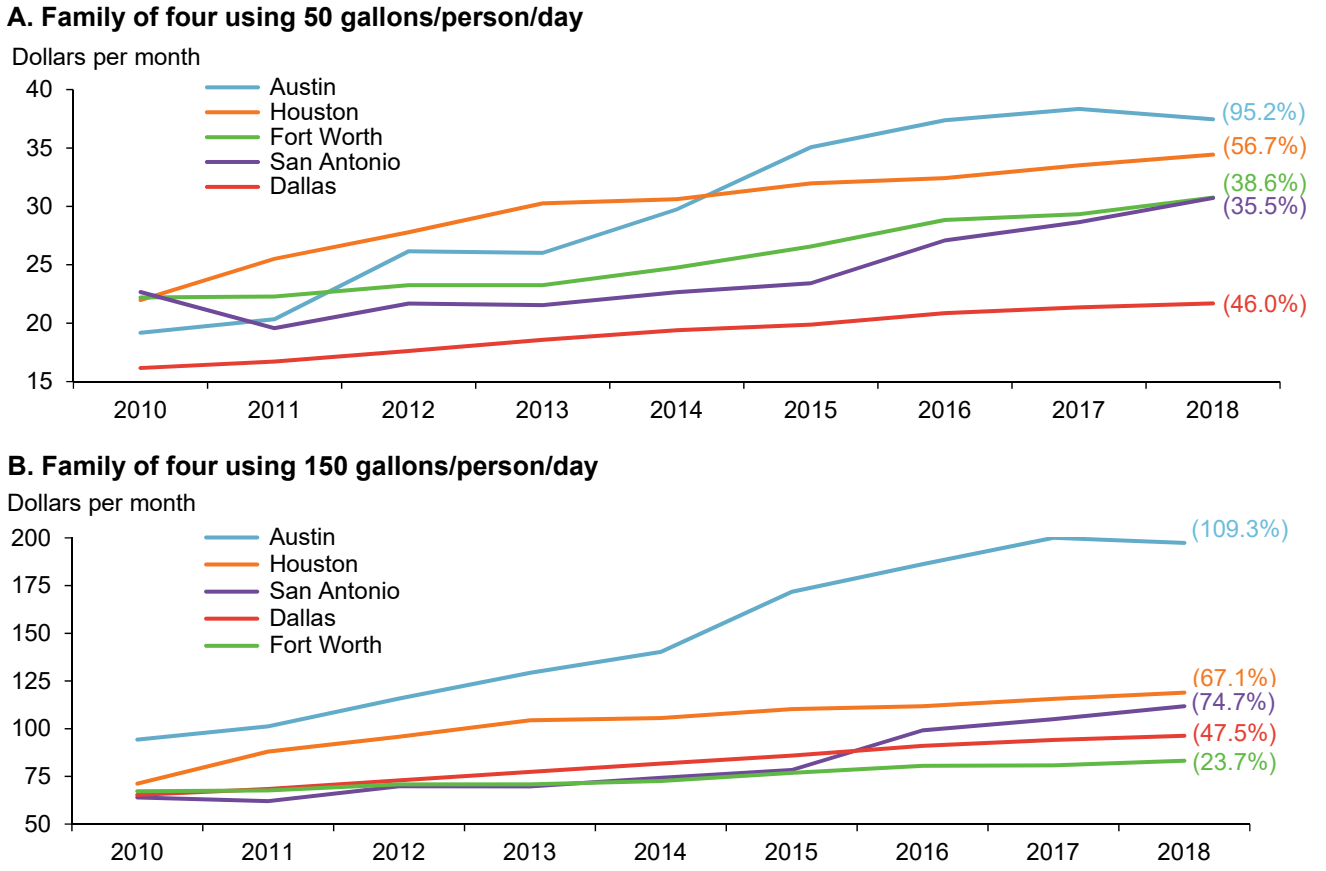
Many water agencies are concerned about the impact of high water prices on low-income families and, thus, offer prices at consumption levels generally sufficient for basic needs. There is less variation across cities in the cost of the lower consumption level. Tiered pricing is often used to discourage high water consumption, which typically results from landscape watering.

Municipal water rates in Texas increased sharply in the eight years ended in 2018, rising faster than the Texas consumer price index (*Chart 4*). The water price increase, particularly for high consumption levels, is likely the result of water agencies paying more for water and seeking to curtail consumption and generate revenue for alternative sources.

Dallas is one of the many cities that rely on surface water. With the area's population increasing, the number of lakes from which it draws water rose from three in 1970 to six today. The city is building infrastructure to buy water from Lake Palestine, 90 miles to the southeast.

By comparison, San Antonio relies solely on groundwater from the Edwards Aquifer. The Edwards Aquifer

CHART 4 Austin Sees Largest Increase in Average Monthly Residential Water Bill



NOTE: Numbers in parentheses refer to the percent increase in the average water bill in a metro from 2010 to 2018. 50 gallons per person per day is regarded as an amount sufficient for basic needs.

SOURCE: Circle of Blue.

Authority has spent money on recharge dams to enhance supply and has developed markets to encourage the sale and lease of water rights.

Meanwhile, the San Antonio Water System has sought alternative supplies. In 2017, it purchased water rights of up to 50,000 acre-feet from a separate aquifer 142 miles away. A pipeline to the source is scheduled to be completed this year, at a total project cost of nearly $3.4 billion.

State Groundwater Markets

The rule of capture applies to the more than 50 percent of Texas water coming from groundwater and limits the ability of water markets to allot it.[6] Senate Bill 1, enacted in 1997, gave groundwater conservation districts the ability to create markets for groundwater by establishing private property rights to the water. The law provided the conservation districts with the power to issue pumping permits and manage withdrawals. Once individuals and business entities had ownership of a specified amount of water, markets could form.

Still, few water markets exist in the state. The major exception is the Edwards Aquifer Authority, which got its authority before the Texas law took effect as a result of an Endangered Species Act claim brought by the Sierra Club in 1993.[7]

The court ruled in the case that excessive pumping from the aquifer threatened several endangered species and that the state was obligated to create a pumping cap, setting the stage for creation of the Edwards Aquifer Authority and its ability to allocate pumping rights and create markets.

To cap pumping at 572,000 acre-feet per year, the authority established permits based on past usage. It allowed new users to receive a permit after all historical permits had been issued—if any water remained under the cap. Permits were subject to temporary reduction if the aquifer dropped below predetermined levels that might threaten stream flows.

The cap is now fully subscribed, and no new permits are likely to be issued. In order for users such as the San Antonio Water System to increase their draw amount, they must buy or lease water from the existing permit owners.

Market Developments

Permit values have increased consistently since the authority was established. Sales and transfers that were initially free or of little value as of 2016

are now valued at between $5,000 and $10,000 per acre-foot. The Edwards Aquifer Authority does not manage or track sales, although it facilitates sales through a website that connects sellers and buyers.

Website transactions are usually short-term leases for small amounts of water and generally take place during droughts when water is restricted. Large water purchases occur outside the authority's marketplace. Buyers approach potential sellers with offers that are then transacted via a warranty deed that provides a clear claim to the water.

A recent innovation has been an option program involving voluntary irrigation suspension. Participating irrigators annually receive a guaranteed payment of $54 per acre-foot of water made available for the program. If the aquifer falls below 635 feet at a designated measurement location on Oct. 1, delivery of the enrolled water is suspended the following year. Participants also receive $160 per acre-foot for the year of suspension. Prices can be adjusted year to year to reach an enrollment goal of 40,000 acre-feet.

Implementation Limitations

While these developments are encouraging, the Edwards Aquifer marketplace faces constraints. Water can't be transported outside of the aquifer, and irrigators can only sell or lease up to half of their permitted volume. Domestic and livestock wells that pump up to 25,000 gallons a day need not be permitted and, thus, their usage can reduce permitted irrigators' available supply.

Furthermore, legal tension exists between the rule of capture, which remains in place, and the legislative authority given to the Edwards Aquifer Authority and groundwater conservation districts. The Texas Supreme Court in 2015 declined appeals by the authority of a case brought by Glenn and JoLynn Bragg, who had invested $2 million to grow pecans on 100 acres of land over the Edwards Aquifer in Hondo, Texas.[8]

The Braggs applied for 625 acre-feet per year but received a permit for only 120 acre-feet and sued for damages, claiming ownership of the water under the rule of capture. A jury awarded the Bragg family $4 million in compensation and interest based on the estimated value of the land with full water rights and the value with the water rights as permitted by the Edwards Aquifer Authority.

The potential for a growing number of such lawsuits challenges the financial viability of the Edwards Aquifer Authority and groundwater authorities in general.

Developing Water Markets

Water markets are evolving in Texas. Well-defined property rights governing surface water have served as the basis for marketplaces for a long time. A handful of large river authorities can hamper the formation of markets, but in places such as El Paso, Dallas and the Rio Grande Valley, cities are buying surface water primarily from irrigators.

The Legislature has encouraged water markets, setting a framework for them. Bulletin board markets, derivative markets, and environmental leasing and purchasing programs have been active since the 1990s. The Texas Water Bank, a bulletin board market, serves as a platform for buyers and sellers to post requests and offers.[9]

There are also market-based mechanisms seeking to secure water for environmental and wildlife purposes. The Texas Water Trust purchases or leases water from irrigators for purposes such as increasing instream flows in lakes for fish and other wildlife.

Developing groundwater markets remains a challenge. The rule of capture continues to threaten the legal rights of groundwater authorities to cap withdrawals and issue permits. Complicating the process are groundwater control districts, which generally follow county lines, sometimes leading to multiple districts with oversight of the same aquifer.[10]

Markets can't properly function unless all such groundwater control districts work together to coordinate a permitting process and establish a cap that ensures the viability of the water supply. While the 2012 State Water Plan established groundwater management areas that encompass the boundaries of entire aquifers or subdivisions, each district has the legal authority to permit as it sees fit. This has limited the use of the cap-and-trade system outside the Edwards Aquifer.

As Texas' population grows, markets will need to develop. In the future, water is likely to move from agriculture to burgeoning cities. Agriculture accounts for 54 percent of all water consumption in the state but produces less than 2 percent of state gross domestic product.

Texas households have experienced sharply higher water prices over the past 10 years. While the increase has been necessary to discourage consumption and develop alternative sources of supply, the further development of water markets would likely allow for smaller price increases as water freely moves from lower- to higher-value uses.

Phillips is an assistant vice president and senior economist and Teng is a research analyst in the San Antonio Branch of the Federal Reserve Bank of Dallas.

Notes

[1] See "Water Scarcity a Potential Drain on the Texas Economy," by Keith Phillips, Edward Rodrigue and Mine Yücel, Federal Reserve Bank of Dallas *Southwest Economy*, Fourth Quarter, 2013.

[2] See "During Drought, Once-Mighty Texas Rice Belt Fades Away," by Dylan Baddour, StateImpact, a reporting project of National Public Radio member stations, Aug. 12, 2014, https://stateimpact.npr.org/texas/2014/08/12/during-drought-once-mighty-texas-rice-belt-fades-away/.

[3] See the 2017 State Water Plan, Texas Water Development Board.

[4] See note 3.

[5] Nonresidential irrigation includes field crops, vineyards, orchards and golf courses.

[6] Much of the information is summarized from "Texas Groundwater Markets and the Edwards Aquifer," by Amy Hardberger, The Rockefeller Foundation, 2016.

[7] See note 6.

[8] *Edwards Aquifer Authority v. Bragg,* Court of Appeals of Texas, Nov. 13, 2013.

[9] See "A Place for Water Markets: Performance and Challenges," by Ereney Hadjigeorgalis, *Review of Agricultural Economics*, vol. 31, no. 1, 2009.

[10] See note 6.

A Conversation with Fang Yang

Policy Changes Could Boost Women's Participation in U.S. Workforce

Fang Yang is an associate professor of economics at Louisiana State University in Baton Rouge. Her research interests include labor economics, wealth inequality and housing. She discusses the labor market impacts of tax policy, an evolving U.S. workforce, the effects of gender and an aging population.

Q. In addition to an aging U.S. workforce and retiring baby boomers, what other recent demographic trends are affecting the labor market?

Another demographic trend affecting the labor market is the reduction in the fertility rate. In the short run, fewer children will boost female labor force participation, which increases the growth in the number of working people.

In the long run, in contrast, a lower fertility rate reduces the share of the working-age population and, thus, slows the growth of the aggregate economy. This reduction in the population growth rate in the United States can be mitigated by immigration, depending on what immigration policies are implemented.

Q. Your research has focused on the ways federal tax policy for married couples may suppress the labor supply of secondary earners. How big are the effects on work and income?

In the United States, income taxes depend on one's marital status. Among married couples, existing law tends to discourage the labor supply of the secondary earner. The disincentives from joint taxation stem from the fact that couples file taxes jointly, and taxation is progressive.

As a result, secondary earners face a higher marginal tax rate, which is a very important determinant in the decision to work. Since women tend to have lower wages than men, these secondary earners have historically been women.

In work with Margherita Borella [University of Torino, Italy] and Mariacristina De Nardi [University of Minnesota] to illustrate the magnitude of the disincentives embedded in the income tax system, we consider four marginal tax rates as a function of women's earnings.

A single woman earning $500 a year faces a marginal tax rate of –10 percent (due to the earned income tax credit), whereas a married woman earning the same amount faces a marginal tax rate of 14 percent, 18 percent or 21 percent if she is married to a man in the 25th, 50th or 75th income percentile, respectively. Thus, allowing married people to file taxes as singles (rather than jointly) implies much lower marginal tax rates for women and can lead to higher labor market participation.

Q. Your work has also looked into the work disincentives of the Social Security program. Why do these disincentives arise?

The disincentives to work due to Social Security benefits arise because married and widowed people can claim Social Security spousal and survivorship benefits using their spouses' past contributions rather than their own. More specifically, Social Security benefits for a married person are the higher of one's own benefit entitlement or half of the spouse's entitlement (spousal benefit).

In addition, Social Security benefits for a widow or widower are the higher amount between one's own benefit entitlement and that of the deceased spouse (survivor benefit). Those policies imply that the lower labor supply of the secondary earner does not necessarily infer lower Social Security benefits, so there is less incentive for secondary earners to work.

Q. What changes to Social Security do you find in your model to increase the incentives to work and to work more?

To evaluate the effect of marriage-related taxes and Social Security benefits on female labor supply, we estimate a rich life-cycle model of labor supply and savings with single and married people facing a possible change in marital status. The model incorporates skill building on the job, medical spending and longevity risk. Importantly, our model not only fits the observed data on labor supply and savings for single and married men and women over the life cycle, but it also implies realistic labor supply elasticities.

Using our model, we find that marriage-based income taxes and Social Security benefits strongly reduce female labor supply. When eliminating both spousal and survivor Social Security benefits, the participation of married women is, respectively, 10, 11 and 4 percentage points higher at ages 25, 55–60 and 65. In contrast, men decrease their participation starting at age 55, and their participation is 6 percentage points lower by age 65.

The elimination of both marriage-based income taxes and Social Security benefits would have raised participation at age 25 by more than 20 percentage points for married women and by 5 percentage points for single women. At age 45, participation would have been 15 percentage points higher for married women and 3 percentage points higher for single women without these marriage-related income tax and Social Security provisions.

Governments should implement policies that encourage labor participation by women so that the economy fully benefits from the increasing skills of women.

In contrast, the elimination of these marriage-based policies would reduce the participation of married men as of age 60, leading to a participation rate that is 8 percentage points lower by age 65.

I should point out that our analysis is based on a revenue-neutral reform. The cost savings from the elimination of marital Social Security benefits and extra revenue from labor income allows the government to reduce the proportional component of the income tax in order to balance the government budget. We find such revenue-neutral reform would be welfare-improving for the vast majority of people in this cohort.

Q. Younger cohorts of women are working more than their mothers. Because they are more likely to marry later in life and have fewer children, what is the impact?

The results I just discussed refer to the cohort born around 1945. We also study a cohort that is 10 years younger—born in 1955. The labor force participation of women in this cohort is higher and they have fewer children. Nevertheless, we find that even for the 1955 birth cohort, the effects of eliminating marriage-based taxation and Social Security benefits are large and similar to what I just discussed.

Q. What are other policy proposals that have been offered to boost labor force growth and work effort?

One policy aimed at increasing U.S. labor force participation is the Earned Income Tax Credit, which raises the incentives to work by providing a refundable tax credit for low-income workers, typically with children. Policies such as paid parental leave or the provision of affordable child care have been proposed to help caregivers balance work and family obligations.

Other advanced economies are also struggling with the lack of labor force growth. They have adopted or proposed policies such as increasing immigration, paid parental leave, free or affordable child care and a higher retirement age. The effects of these policies are still subject to evaluation.

Q. With more women than men graduating from college, how will the view of their contribution to the U.S. economy change?

The college attainment rate for women surpassed that for men decades ago. In work with Suqin Ge [Virginia Tech University], we compute, at each year, the percent of men and women age 25 to 34 with some college education by age 35, and we find that females overtook males in college attainment in 1987 and have led ever since.

With more and more women gaining human capital though college education, they contribute more to economic growth. Governments should implement policies that encourage labor participation by women so that the economy fully benefits from the increasing skills of women. The economy benefits not only in the short run through the increased labor force but also in the long run through increased skills acquired on the job.

Q. In another generation, how will the role of women in the workforce change?

While women are increasingly enrolling and completing college education, women are still underrepresented in science, technology, engineering and math (STEM)-related fields. Young girls should be encouraged to study STEM-related fields that bring higher earnings. In addition, future generations of women need to not only participate more in the labor force but also take on more leadership positions.

Q. To what degree are gender differences in the U.S. a reflection of global attitudes?

Economic gender inequality exists across the world. In every OECD [Organization for Economic Cooperation and Development] country, women's labor force participation is lower than that for men, despite higher schooling.

The U.S. has been lagging in reducing economic gender inequality compared with several countries. In 2015, the OECD reported that the participation rates of prime-age adult women were around 12 percentage points lower than those of men in the U.S., while the gap was only around 4 percentage points in Sweden, Finland and Norway.

Many OECD countries have adopted policies to boost the labor supply of women. For example, the U.S. is the only advanced country that does not offer national paid parental leave. In addition, while the U.S. adopts joint-income taxation, many countries tax the income of married people by allowing them to file as if they were single.

Mexico Seeks to Reduce Consumers' Longstanding Reliance on Cash

By Michael Perez

ABSTRACT: Cash is king when it comes to completing transactions in Mexico. Unlike the U.S., where consumers opt to pay with debit and credit cards or via apps, Mexico and its large informal economy continue to rely on hard cash. A new digital payment platform from the nation's central bank aims to reduce the role of currency.

The use of cash in the United States is declining, with the share of consumer transactions settled in dollars and cents falling from 32 percent in 2015 to 26 percent in 2018.[1] Consumers increasingly opt to pay with cards and apps that offer increased speed and convenience, a trend likely to continue.

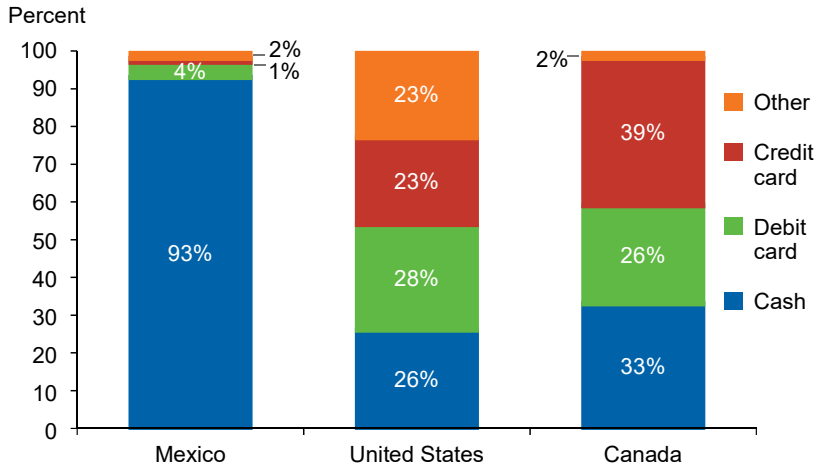
The situation is quite different in Mexico, where around 90 percent of retail, rent, utility, service and public transportation transactions were settled in cash in 2018—a share little changed in recent years.[2] Payments that could elsewhere be made easily over the web or through an app are instead made in person and in cash.

Data show that Mexico substantially lags the U.S. and Canada in terms of debit, credit and other cashless payment channels that include digital payment platforms, checks and prepaid cards (*Chart 1*). This is despite the growing presence of banks throughout the country as well as wider availability of electronic point-of-sale and mobile payment platforms.

There is no denying that cash offers conveniences over cashless alternatives. Cash is widely accepted and does not impose interest or fees on consumers and businesses for executing transactions. It also encourages prudent spending and saving; cash users have a more tangible perspective on their financial position and are less likely to incur heavy loads of debt. And unlike electronic payment platforms, cash is not subject to cybersecurity attacks and identity theft.

However, cash also generates nontrivial costs and challenges for individuals, enterprises and regulators that outweigh its conveniences. It is expensive to transport and store, and it requires all parties involved in the transaction to meet in-person to settle their payments. Moreover, it is a facilitator of criminal activity. Cash does not leave a paper trail, making it the

CHART 1 Cashless Payments Lag in Mexico Relative to U.S., Canada

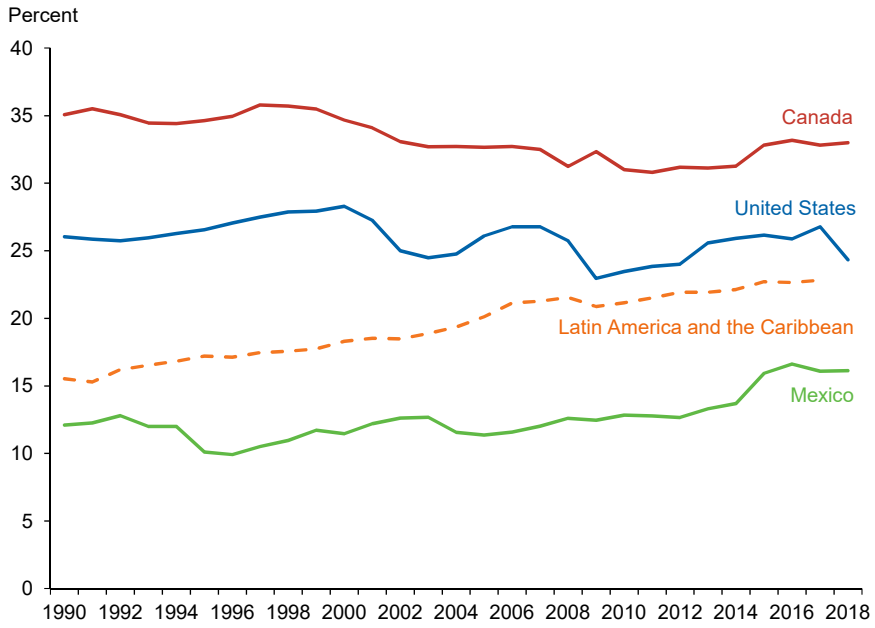


NOTES: Mexico figures represent the average across retail, rent, utility, service and public transport payments using the most recent data, 2017–19. Figures for the U.S. and Canada are aggregated at the source.

SOURCES: Mexican Banking and Securities Commission, 2018 Financial Inclusion Survey; Federal Reserve Bank of San Francisco, 2019 Findings from the Diary of Consumer Payment Choice; Bank of Canada, 2017 Methods-of-Payment Survey report.

CHART 2

Mexico Tax Revenue as Percent of GDP Comparatively Low



NOTE: 2018 tax data are not available for Latin America and the Caribbean aggregate.
SOURCE: Organization for Economic Cooperation and Development tax revenue statistics.

payment method of choice for those looking to avoid legal detection.

In Mexico, both public and private sector actors are collaborating on unique technological solutions to diminish the nation's cash reliance and facilitate its transition to digital payments. Significant challenges await, the greatest of which will be shifting the preference for physical currency.

Cash Is King

Heavy cash use in Mexico is driven by multiple, intertwined factors. First, only 35 percent of the adult population has a bank account.[3] Since most electronic payment platforms require users to have a bank account through which payments can be remitted and received, many Mexicans are unable to use automated payments.

Why do so many Mexicans lack bank accounts? The huge informal sector's role in Mexico's $1.2 trillion economy is an important factor. It accounts for over a quarter of the gross domestic product (GDP) and employs more than half of Mexicans age 15 or older.[4] These individuals typically earn wages in cash, do not pay income taxes and may not have the documentation necessary to open a bank account.

The banking sector is another part of the problem. Banks tend to be expensive, subjecting account holders to minimum deposits, fees and penalties. Also, Mexican banks have little incentive to sell products and services to low-income Mexicans. Such products are not as profitable as those catering to more-affluent clients. In addition, the banking sector is heavily regulated and, as is the case in the U.S., bank customers are potentially subject to government scrutiny if fraudulent or illegal activity is suspected.

On the sidelines, financial technology companies, known as fintechs, have attempted to offer Mexicans an alternative path to financial inclusion. However, the sector is nascent in Mexico and out of reach for many. To that end, 62 percent of Mexican fintech firms have raised less than $500,000 in funding, making it difficult for them to achieve economies of scale and reach a wide customer base.[5]

Moreover, the sector is subject to regulatory uncertainty from recent implementation of a fintech law that some in the sector fear will create tough barriers to entry for start-ups and generate higher compliance costs.[6]

Hiding Transactions

Despite cash's convenience, Mexico's heavy reliance on it comes with significant risks. Cash needs to be safely transported and stored, and failure to do so subjects it to theft. This especially affects low-income individuals and small businesses, which are typically unable to afford sophisticated security and transportation services for holding and moving cash. They instead store physical cash in their homes and spend a large amount of time traveling to offices to pay utility bills and taxes.

Additionally, cash can be a conduit of financial fraud. Authorities attempting to catch criminals operating solely in cash find it difficult to overcome the lack of a digital footprint that electronic transactions provide.

Cash operations also incentivize tax evasion, depressing public revenues. Mexico falls well behind Canada, the U.S. and Latin America in terms of total tax receipts as a percentage of GDP (*Chart 2*). While Mexico's 2015 tax reform increased tax revenue, it failed to bring Mexico into alignment with its peers.[7]

More recently, the government has confronted a slowing economy. Mexico narrowly avoided a recession in 2019 after GDP failed to grow in each quarter.[8] Similar trends in 2020 could suppress public tax receipts, limiting the government's ability to invest in programs that improve financial access and reduce cash dependence.

The Mexican government approved a tax reform package for 2020 in an attempt to address its persistent tax revenue gap. It seeks to align Mexico's tax code to the Organization for Economic Cooperation and Development's Base Erosion and Profit Shifting framework, an internationally focused initiative aimed at tackling tax evasion.[9]

The reform includes legal changes to Mexico's income and corporate tax structures and harshly punishes tax evaders. However, it remains unclear whether regulators will enforce these

new rules and whether the rules will meaningfully formalize Mexico's largely informal economy.

Collaborative Solutions

The Mexican government is seeking to increase Mexicans' access to the financial system, which would reduce the reliance on cash. Mexico's Finance Minister Arturo Herrera has noted that financial inclusion is one of the biggest obstacles in the government's fight against poverty, inequality and slow economic growth.[10]

As a result, the administration is seeking to encourage competition among private and public enterprises to lower bank product costs for low-income individuals. It also seeks to develop a sustainable technological infrastructure to improve Mexico's digital payments network.

In 2018, the Mexican government initially proposed a bill to reduce banking fees. Subsequently, officials sought feedback in meetings with banks and financial regulators. The current proposal, which is still before Mexico's Senate, requires banks to offer zero-fee accounts to low-income clients.[11] The measure also mandates that banks provide customers transparent explanations of their fee structures.

Technological Stepping Stone

Last year, Mexico's central bank unveiled its digital payments platform CoDi, short for *Cobros Digitales* (Digital Charges). CoDi, which runs on the central bank's Electronic Interbank Payment System, leverages the QR code technology commonly used on mobile devices to initiate real-time consumer-to-consumer and consumer-to-business payments.

The application is freely available to consumers and merchants, and transactions initiated over the CoDi network do not incur fees.[12] However, users must have an account at a financial institution as well as a smart device.

While bank account ownership in Mexico has remained low, smartphone usage is rising (*Chart 3*). Studies show that over 90 percent of Mexicans own a smart device, up from 67 percent in 2015.

CoDi ultimately seeks to reduce Mexico's reliance on cash by offering an easy, fee-less and secure digital alternative. The theory is that CoDi's simple, cost-free convenience will be enough to encourage consumers and merchants to adopt it and, in turn, inspire them to open bank accounts.

To use CoDi, a payment recipient generates a payment order using a CoDi-enabled mobile application. That order has a QR code, scanned by the remitter, which contains the transaction details. The remitter reviews the transaction details and approves it. Approval typically requires an authentication factor such as a PIN number, token, fingerprint or facial scan.

Since CoDi's release to the public last September, more than 2 million CoDi accounts have been opened, and the platform has registered field transactions totaling more than 160 million pesos ($8.4 million). The platform processes an average of 1,646 transactions daily, each averaging 600 to 700 pesos ($31 to $37) (*Chart 4*).[13]

Those numbers are expected to increase as a result of government mandates. The Mexican central bank requires all banking institutions operating in Mexico to offer CoDi, though only 38 of the nation's 51 commercial banks have built it into their digital banking applications.[14] Moreover, banks and fintechs are encouraged to develop innovative applications that leverage the CoDi network, which could potentially further drive down costs and improve financial access.

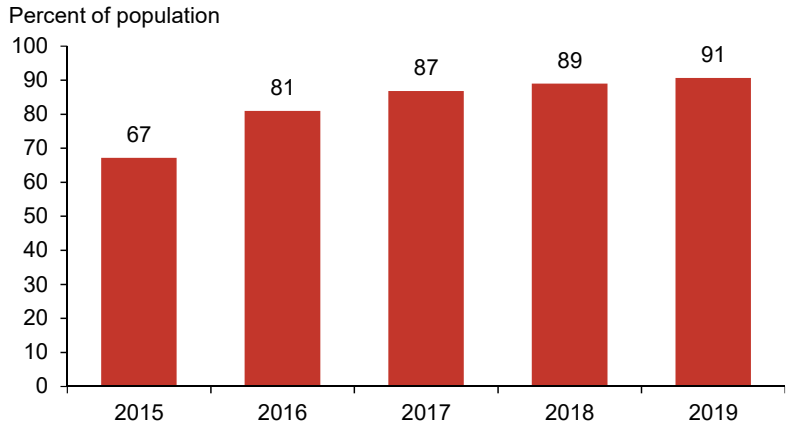
However, the platform has a long way to go before achieving scale—active CoDi accounts represent only 2 percent of total accounts open at Mexico's commercial banks.[15]

Many hurdles stand in the way of wider acceptance, particularly the required bank account, which excludes much of Mexico's informal workforce. Regulatory changes stipulating that banks offer fee-less accounts to low-income customers may ease that situation.

However, Mexico's regulators will need to actively engage with the financially excluded populace to convince it of the benefits of digital payments—a particularly hard sell when dealing with consumers and enterprises bent on evading taxation or those who are engaged in other criminal activities.

The platform has also generated some pushback from Mexico's fintech industry, displeased that CoDi's development did not include input from its members that already operate digital payment platforms in Mexico.[16] This could drive some fintechs to develop competing platforms that leverage more familiar cashless payment

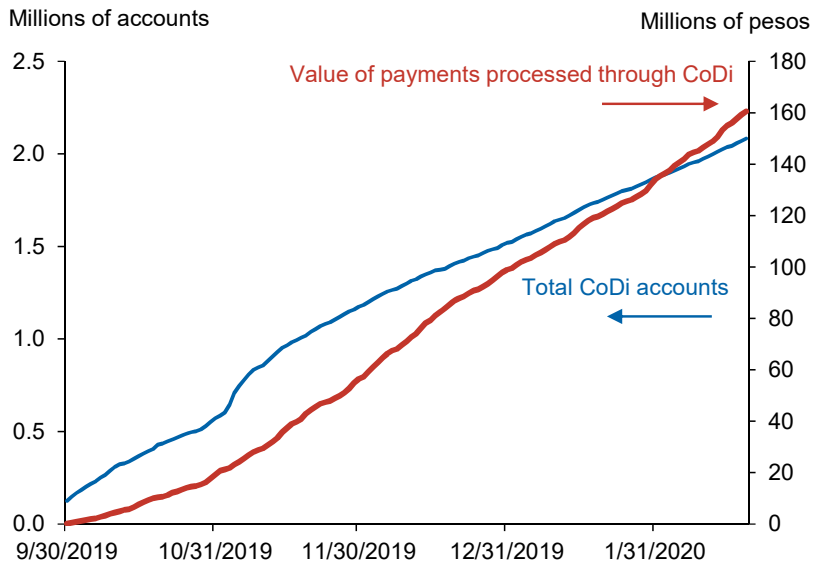
CHART 3 Smartphone Ownership in Mexico Steadily Increasing



SOURCE: Mexico National Statistics Institute, 2019 Survey on the Use of Information Technology.

CHART 4

CoDi Payments Platform Growing Following 2019 Debut



SOURCE: Banco de México.

technologies such as cards and mobile points of sale.

Shortly after CoDi's release, Mexican fintech startup Clip announced a joint venture with credit/debit card giant Visa to accelerate small- and medium-sized enterprises' acceptance of electronic payments.[17] Competition, while potentially driving more financial inclusion, might also limit CoDi's reach if alternative platforms gain traction.

In practice, CoDi won't fully address financial inclusion in Mexico, but it may lay the groundwork for an effective and secure digital payments platform as the country looks to improve its technological infrastructure and expand formal finance's reach in the Mexican economy.

Finding a Path Forward

Recent trends suggest that Mexico's government is prioritizing a payments transition. The Mexican public and private sectors will need to effectively coordinate and innovate to ensure long-term success.

While CoDi lays meaningful groundwork for what an inclusive electronic payment system will look like in Mexico, much remains to be done to communicate its benefits to the public and inspire a shift in preferences and practices away from cash.

Additionally, the government will need to adequately enforce its new tax reform plan and consider meaningful policies that help formalize informal pockets in Mexico's economy.

Perez is a financial industry analyst in the Supervisory Risk and Surveillance division at the Federal Reserve Bank of Dallas.

Notes

[1] See "2019 Findings from the Diary of Consumer Payment Choice," by Raynil Kumar and Shaun O'Brien, Cash Produce Office, Federal Reserve System, June 2019, www.frbsf.org/cash/publications/fed-notes/2019/june/2019-findings-from-the-diary-of-consumer-payment-choice/.

[2] See "National Survey for Financial Inclusion 2018," National Banking and Securities Commission (CNBV in Spanish), www.gob.mx/cms/uploads/attachment/file/421411/Cuadriptico_2018_ENG.pdf.

[3] See "Mexico Struggles to Move into Digital Payment Age," by Michael Perez and Justin Chavira, Federal Reserve Bank of Dallas *Southwest Economy*, Third Quarter, 2019, www.dallasfed.org/~/media/documents/research/swe/2019/swe1903g.pdf.

[4] See "Employment and Occupation," by the National Statistics Institute (INEGI), accessed March 6, 2020, www.inegi.org.mx/temas/empleo/.

[5] See "Fintech Radar 2019," Finnovista, May 2019, www.finnovista.com/the-mexican-fintech-ecosystem-recovers-the-leading-position-in-latin-america-and-approaches-nearly-400-fintech-startups/?lang=en.

[6] For more information on Mexico's fintech law, see "Mexico's Nascent Fintech Offers Promise, Faces New Rules," by Michael Perez, Federal Reserve Bank of Dallas *Southwest Economy*, Fourth Quarter, 2018, www.dallasfed.org/~/media/documents/research/swe/2018/swe1804c.pdf.

[7] See "Mexico's Fiscal Reform Earns Mixed Reviews," by Jesus Cañas, Federal Reserve Bank of Dallas *Southwest Economy*, Second Quarter, 2019, www.dallasfed.org/~/media/documents/research/swe/2019/swe1902f.pdf.

[8] See "GDP and National Accounts," INEGI, accessed March 6, 2020, www.inegi.org.mx/temas/pib/default.html#Informacion_general.

[9] See "Mexico Approves Significant Tax Reform," PricewaterhouseCoopers (PwC), October 2019, www.pwc.com/us/en/services/tax/library/insights/mexico-approves-significant-tax-reform.html.

[10] See "Mexico's New Government Wants Fintech, Banks to Help Financial Inclusion," by Stefanie Eschenbacher, Reuters, Aug. 21, 2018, www.reuters.com/article/us-mexico-politics/mexicos-new-government-wants-fintech-banks-to-help-financial-inclusion-idUSKCN1L704E.

[11] See "Senate Changes Proposal and Will Not Prohibit Banking Commissions, They Will Inform Them," by Antonio Hernández, *El Universal*, Feb. 2, 2020, www.eluniversal.com.mx/cartera/senado-cambia-propuesta-y-no-prohibiran-comisiones-bancarias-las-informaran.

[12] Payments initiated via the CoDi network are capped at 8,000 pesos (about $420).

[13] See "CoDi," Banco de México, accessed March 6.

[14] Banks not actively implementing CoDi in their mobile banking apps may be subject to fines in the future.

[15] The figure is based on the author's calculations using data from Banco de México and the National Banking and Securities Commission.

[16] The government's development of CoDi makes it unique relative to other QR-based payment applications around the world (e.g., WePay in China and M-Pesa in Kenya). See "Mexico's Fintech Solution for the Unbanked Is 'Great, but Flawed,'" by Helgi Gudmundsson, S&P Global Intelligence, June 2019, www.spglobal.com/marketintelligence/en/news-insights/trending/Zk0g7EXT4fbCM0KyM7ZrUg2.

[17] See "Visa and Clip Team Up to Accelerate Digital Payment Acceptance in Mexico," Visa, November 2019, www.visa.com.bs/about-visa/newsroom/press-releases/visa-clip-digital-payment-acceptance.html.

Permian Basin's Shale-Era Oil Production Rises Even as Rig Count Falls

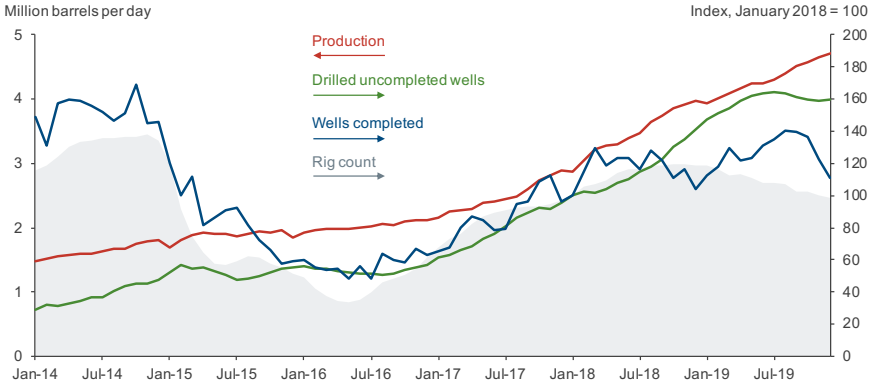
By Emma Marshall and Jesse Thompson

A change in the number of active drilling rigs is no longer the reliable predictor for near-term oil production growth that it once was.

Nowhere is this clearer than in the Permian Basin of West Texas and eastern New Mexico—by far the nation's largest shale oil production region. There, the number of rigs drilling for oil fell from 484 in August 2018 to 402 in December 2019, an almost 17 percent decline. Despite this, crude oil production increased 29 percent during the period *(Chart 1)*.

This interplay will likely become a key part of the sector's response to the sudden, sharp oil price decline in March.

CHART 1 Rig Count Falls While Oil Production Steadily Increases



NOTES: Shaded area represents the rig count, which is the number of active rigs. Data are for the Permian Basin.
SOURCE: Energy Information Administration.

Changing Production Pattern

Benchmark West Texas Intermediate crude oil priced in Cushing, Oklahoma—a hub for oil storage and pricing—dropped from $70 a barrel in August 2018 to a low of $45 per barrel at year-end 2018. Consistent with historical patterns, drilling activity started to decline a few months after oil prices began to fall.

Experience suggests this pattern would diminish production growth within six to eight months. However, Permian production grew by 0.7 million barrels per day in 2019. Energy firms accomplished this by completing more wells drilled earlier, drilling horizontally and increasing the total length of wells.

As firms were laying down rigs, the number of drilled but uncompleted wells (DUCs) rose 35 percent—to 3,600 wells—from August 2018 to December 2019, according to Energy Information Administration (EIA) estimates.[1]

Producers have worked through this inventory by completing the wells. The number of wells completed—those that have gone through hydraulic fracturing and been brought into production—increased from 445 to 485 per month in 2019. The number peaked at 555 last August, despite decreased drilling. Conversion of DUCs from past operations into producing wells accounts for the production gain.

Changing Well Composition

Since 2014, the composition of wells drilled has changed. The share of rigs drilling horizontally rose from 50 percent to 90 percent from 2014 to 2019 —leaving only 26 rigs drilling vertically, previously the conventional means of drilling.

A horizontal well coupled with hydraulic fracturing gives producers access to more oil per foot of pipe because the driller can follow underground layers of shale rock.

Moreover, the length of wells also increased—the average lateral well length was 6,000 feet in 2016 but increased to approximately 8,500 feet in second quarter 2019.[2]

These longer sections of horizontal pipe—and rising volumes of sand to prop open the fractures through which oil and gas flow—tend to increase well production.

More Oil, Fewer Rigs

Production per rig has risen rapidly over the past several years due to changes in the number and mix of completed wells. In 2014, the EIA estimated that the average amount of oil produced per rig was 130 barrels per day. Last year, the amount per rig averaged 800 barrels per day.

The previous production gains demonstrate how productivity and technology advances in U.S. shale have shifted the implications of a changing rig count. The recent collapse of energy prices implies that drilling activity may be poised for another significant drop, yielding a decline in future production.

Notes

[1] Firms in Texas dispute these data. See the Dallas Fed Energy Survey, Third Quarter, 2019, www.dallasfed.org/research/surveys/des/2019/1903.aspx#tab-questions.

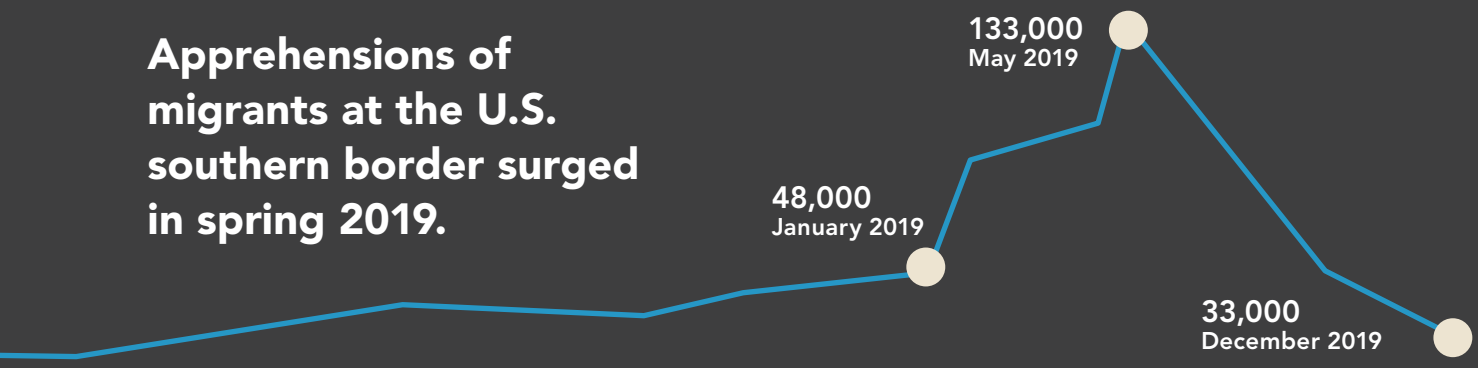
[2] "Permian Well Performance—More Complicated than It Appears," Rystad Energy Shale Newsletter, October 2019, accessed Feb. 3, 2020, www.rystadenergy.com/newsevents/news/newsletters/UsArchive/shale-newsletter-oct-2019/.

GO FIGURE

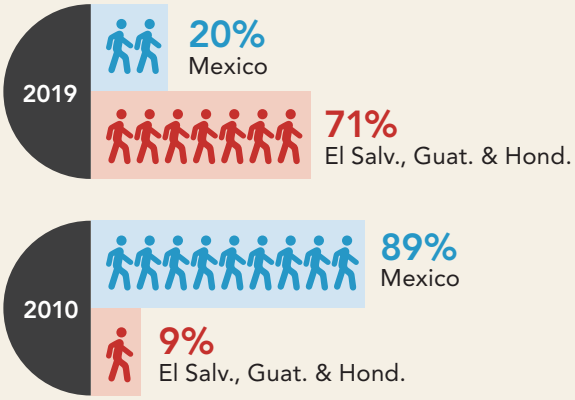
Migrant Apprehensions at U.S.–Mexico Border Spike in 2019

Design: Justin Chavira; Content: Carlee Crocker, Pia Orrenius and Chloe Smith

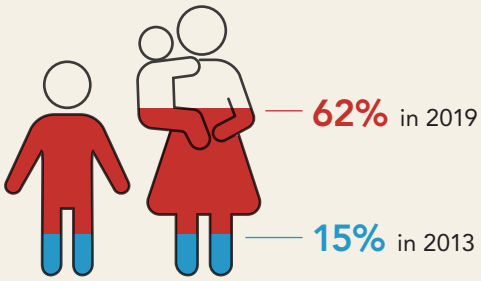
Apprehensions of migrants at the U.S. southern border surged in spring 2019.



In 2019, most migrants apprehended at the border came from Central America (El Salvador, Guatemala and Honduras), as opposed to Mexico.



In 2019, the share of migrants who are unaccompanied children and families rose.



Why did apprehensions initially rise?

- Greater ease of entry and transit via Mexico.
- Ongoing violence and lack of economic opportunity in El Salvador, Guatemala and Honduras.
- Policies allowing asylum seekers to stay and work in the U.S. while awaiting a decision on their case.

Why did apprehensions then fall?

- Mexico cracked down on transit migration, sending thousands of troops to its borders.
- U.S. implemented Migrant Protection Protocols, also known as "Remain in Mexico," returning asylum seekers to Mexico and requesting they wait outside the U.S. for the duration of their immigration court proceedings.

Final Thought

Asylum approval rates are very low: Only 1 in 9 cases from El Salvador, Honduras and Guatemala was granted asylum in 2019.

SOURCES: Department of Homeland Security; Department of Justice; U.S. Customs and Border Protection (CBP); United Nations.

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SNAPSHOT COVID-19 Hits Manufacturers

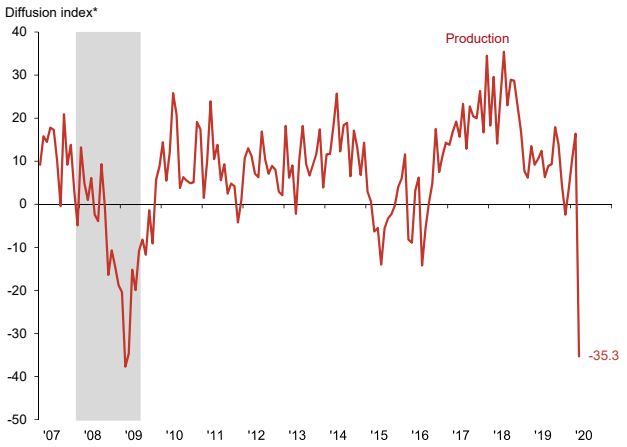
Texas factory activity declined sharply as the coronavirus (COVID-19) outbreak took hold in March, according to business executives responding to the Texas Manufacturing Outlook Survey. The production index, a key measure of state manufacturing conditions, plummeted from 16.4 in February to -35.3 (*Chart 1*).

Expectations regarding business conditions turned strongly negative. The company outlook index fell to an all-time low of -65.6. Indexes for future manufacturing activity also fell sharply.

The survey uses diffusion indexes—the percentage of respondents reporting a decrease is subtracted from the percentage reporting an increase. Negative values indicate contraction, positive ones expansion.

—Adapted from Texas Manufacturing Outlook Survey, March 30, 2020

CHART 1 Manufacturing Production Index Drops to Lowest Level Since 2009



*Seasonally adjusted.
NOTES: Data are through March 2020. Gray bar shows U.S. recession.
SOURCE: Dallas Fed Texas Manufacturing Outlook Survey.

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