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Tighter US Lead Pollution Standards Shifted Industry to Mexico

A key concern in environmental policy debates is that tighter pollution regulations in richer countries may lead to the relocation of dirty production activities to poorer countries with weaker regulations. This could have adverse health effects on the “pollution haven” countries’ populations.

In **North-South Displacement Effects of Environmental Regulation: The Case of Battery Recycling** (NBER Working Paper 29146), [Shinsuke Tanaka](#), [Kensuke Teshima](#), and [Eric Verhoogen](#) find that the tightening of airborne lead standards in the United States in 2009 was associated with a shift in recycling of used lead-acid batteries from the US to Mexico and a decline in infant health near Mexican battery-recycling plants.

Battery recycling is well-suited to empirical study. First, the industry is an intensive emitter of lead, a particularly noxious pollutant linked to retarded fetal growth, lower IQ and educational achievement, and other adverse outcomes. Second, a sharp regulatory change occurred

in 2009 when the US tightened the National Ambient Air Quality Standard for lead by a factor of 10 while the standard in Mexico remained unchanged. Third, there are reli-

After the United States restricted lead emissions, the Mexican lead-acid battery-recycling industry expanded rapidly, and the incidence of low birthweight infants near recycling plants in Mexico increased.

able data that permit tracking of the relocation of battery recycling.

The researchers focus on the locations of battery-recycling plants in the US and on ambient lead levels at monitoring stations

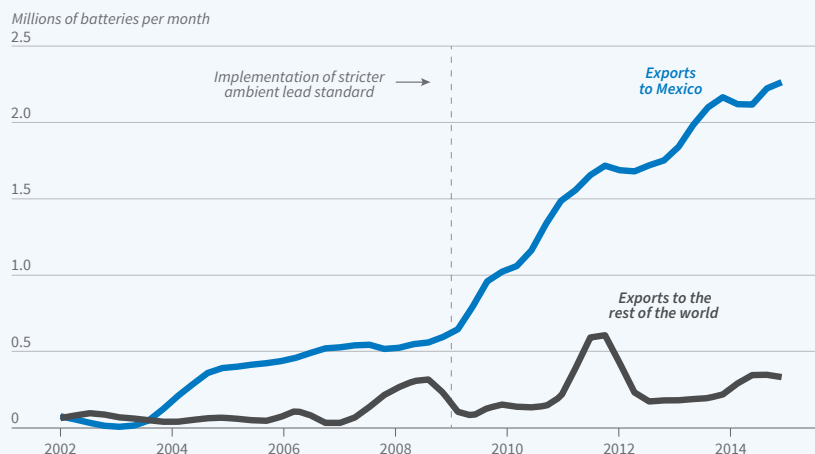
nearby, on used lead-acid battery (ULAB) trade flows from the US to Mexico, on the locations of ULAB recycling plants in Mexico, and on the birthweight of infants

born to mothers who live near these plants. Birthweight is a particularly well-measured and fast-responding health outcome with regard to lead pollution.

When the US air-quality standard was tightened, ambient lead concentrations around US battery-recycling plants where the new regulation was binding fell sharply. At the same time, ULAB exports from the US to Mexico rose markedly. After having remained roughly constant between 2005 and 2008, battery exports rose four fold between January 2009 and December 2014.

Relative to similar industries, the growth of value added and output in Mexican battery-recy-

Used Lead-Acid Battery Exports from the US, 2002–2015



Source: Researchers' calculations using data from the US Census Bureau Foreign Trade Division

cling plants was sharply higher in 2008–13 than in 2003–08. Value added rose by 62.2 percent over the five-year period from 2003–08 and by 243.2 percent from 2008–13. Between 2008 and 2013, the incidence of low-birthweight infants increased signifi-

cantly within a two-mile radius of Mexican battery-recycling plants relative to areas two to four miles away. Health effects were concentrated among mothers in hospitals run by the Mexican Ministry of Health. These women tended to be of lower socioeconomic

status than mothers in other hospital types. The researchers conclude that the tightening of the US lead regulation induced the relocation of battery recycling and caused negative health spillovers in Mexico.

—Lauri Scherer

South Korea's Industrial Policy: Growth with Inefficiency

Between 1965 and 1990, four “tigers”—South Korea, Taiwan, Singapore, and Hong Kong—were among the leaders in a period of rapid industrialization and economic growth that became known as the East Asian Miracle. Some analysts have linked this growth to these countries’ reliance on government cultivation and support of strategic industries. However, the overall efficacy of this form of industrial policy remains debatable.

Two recent papers—one using firm-level balance sheets, the other using plant-level production data—examine the long-term effects of a high-profile example of industrial policy: South Korea’s Heavy and Chemical Industry (HCI) Drive of 1972 to 1979, which targeted development in steel, nonferrous metal, electronics, machinery, chemicals, and shipbuilding. This push was concentrated in nine southeastern regions of the country, where the Korean government built large HCI complexes. Both studies estimate the impacts of the HCI Drive by comparing firms’ long-term growth in targeted industry-region pairs with that in non-targeted industries or regions.

In **The Long-Term Effects of Industrial Policy** (NBER Working Paper 29263), Jaedo Choi and Andrei Levchenko find that firms with access to subsidized credit through the HCI Drive were larger than unsub-

sidized firms even 30 years after subsidies ended. As part of its HCI push, the Korean government backed large foreign loans for targeted firms, allowing them to borrow at interest rates far below those available domestically. The researchers find

The Heavy and Chemical Industry Drive of 1972 to 1979 increased the size and output of targeted firms and industries but was also associated with increased misallocation of resources.

that a subsidized firm that received the average credit subsidy during this period experienced 8.6 percent higher annual sales growth between 1982 and 2009 than a comparable nonrecipient firm.

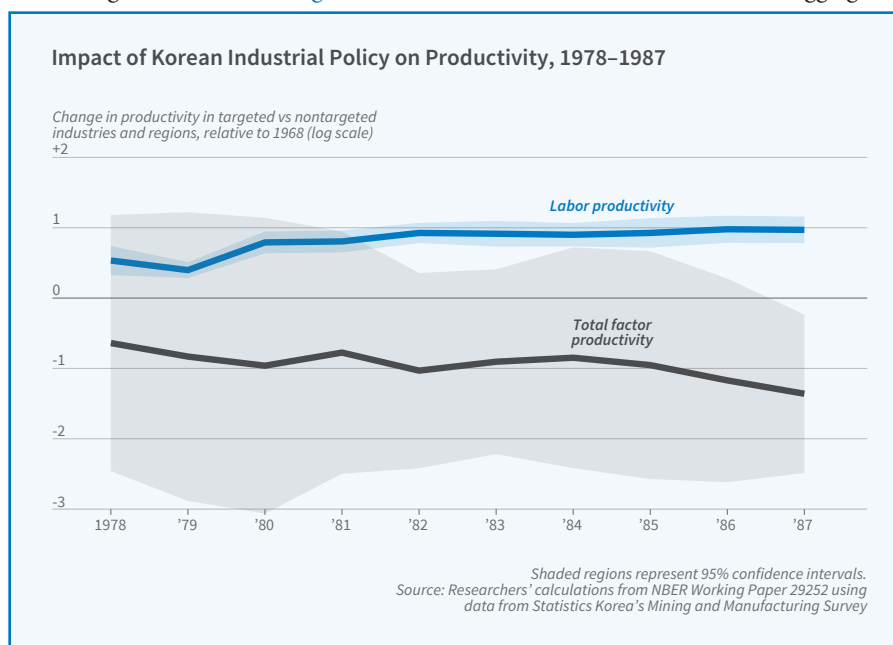
In **The Plant-Level View of an Industrial Policy: The Korean Heavy Industry Drive of 1973** (NBER Working Paper 29252), Minhoo Kim, Munseob Lee, and Yongseok Shin find similar evidence

that targeted industry-regions saw higher growth during and after the HCI Drive. These effects persisted until at least 1987, when the researchers’ data end. They document growth in targeted industry-regions as a whole, as well as in the average number of

employees per plant in these sectors. In particular, they find an increase in the number of very large plants.

An increase in the size and output of industries targeted by the HCI Drive does not imply that these industries became more productive. Indeed, while this push increased both aggregate labor productivity and plant-level total factor productivity (TFP), it did not increase aggregate TFP at the industry-region

level. This is because resource misallocation increased substantially in targeted industry-regions, as resources were directed to lower-productivity uses. The researchers suggest that this may be explained by *chaebols*—megaconglomerate firms, mostly family owned—that preferentially attracted support in the HCI Drive. If this misallocation had been avoided, average TFP in the targeted industry-regions would, on



average, have been 40 percent higher in 1980.

The factory-level analysis of the HCI Drive suggests two additional conclusions. First, higher flows of intermediate goods from targeted industries to non-targeted industries

may have yielded broad benefits by lowering the cost of inputs for the latter group. Second, to the extent that production processes exhibit learning by doing and an initial burst of output reduces future production costs, the policy of supporting some industries could have raised

welfare in South Korea by increasing labor productivity not just during, but after the period when subsidies were available. The firm-level study suggests welfare gains of between 22 and 31 percent through this channel.

—Lucy E. Page

What the COVID-19 Pandemic Meant for Public Schools

Public-school enrollment has fallen during the COVID-19 pandemic as parents have shifted their children to homeschooling and private schools.

In **The Pandemic's Effect on Demand for Public Schools, Homeschooling, and Private Schools** (NBER Working Paper 29262), Tareena Musaddiq, Kevin M. Stange, Andrew Bacher-Hicks, and Joshua Goodman find that the impact varies across grades and across racial and economic groups. Results also differ depending on whether public schools offered instruction fully in class, remotely, or in a hybrid model. The researchers analyze student-level data from Michigan and nationally representative surveys from the US Census.

In Michigan in the autumn of 2020, kindergarten enrollment dropped 10 percent from the previous year; for all grades the decline averaged 3 percent. Among previous public-school students, the percentage of those leaving for alternatives was highest in the lower

grades. Before the pandemic, 4 percent of the state's public elementary students did not re-enroll the following year; in the autumn of 2020, that rate was over 6 percent. The share of kindergarteners not returning for first grade almost doubled, from 4 to nearly 8 percent. Exit rates remained elevated through

the eighth grade. More high school students returned to public schools than in the past.

Most Michigan parents who pulled their children from public schools opted

by 13 percent, while high schools saw a 0.4 percent increase in enrollment.

Nationwide, 7.3 percent of households reported at least one child being home-

Total enrollment in autumn, 2020, was down 3 percent, with the sharpest declines in lower grades, especially kindergarten, as families shifted to options such as homeschooling and private schools.

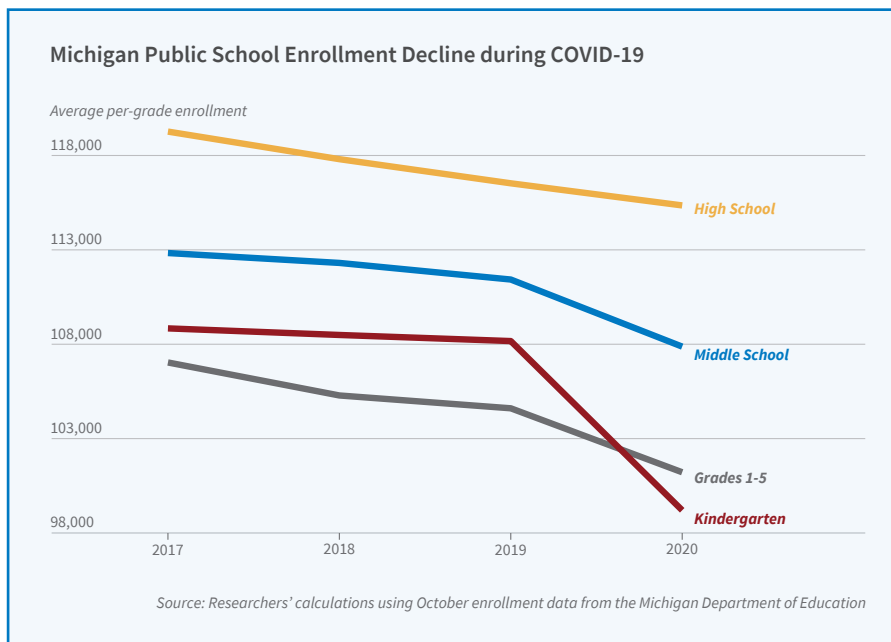
to teach them at home, with a smaller share shifting them to private schools. This trend was most pronounced in districts that offered a fully in-person or hybrid option;

schooled in September 2020, up from 4.5 percent before the pandemic. The researchers estimate that a state that offered every student in-person instruction in September 2020 would have seen homeschooling rates more than double.

Among Michigan kindergarteners, enrollment drops were highest among Black students, at 19 percent, and among low-income students, at 11 percent. The researchers note that these communities faced higher rates of COVID-19 cases than the general population.

The racial and ethnic trends were different among already enrolled, older students in public school. The exit rate

among White students in the autumn of 2020 was 6.2 percent, nearly double the rate of the previous year. Among Black and Hispanic students, the exit rate rose by less than 1 percentage point. Higher-income students' exit rates rose by 2.7 percentage points, compared with 1.9 percentage



districts that went entirely remote saw more students exiting for private schools.

The national figures from the US Census Household Pulse Survey are similar to those in Michigan. Public school enrollment fell 3 percent, with the lower grades taking the biggest hit. Kindergarten numbers declined

points among low-income students.

How the enrollment patterns of 2020 will affect public schools over the longer term is an open question. The research-

ers outline a scenario in which White and higher-income students, who showed the highest exit rates during the pandemic, are slow to return, while Black and lower-

income students who delayed starting school flood into kindergarten and first grade classes.

—Steve Maas

International Reserve Management in Emerging Market Economies

When global financial risk spikes, emerging market economies can experience widened credit spreads, plunging investment, capital flow reversals, and heightened speculation about impending debt crises. If a country's central bank accumulates international reserves during good times, it can "lean against the wind" by selling those reserves in bad ones. Management of international reserves by central banks can alleviate the financial market instabilities created by global shocks that increase business financing costs, thereby mitigating the worst effects of economic downturns and helping governments to service debt when borrowing costs increase.

In **International Reserve Management, Global Financial Shocks, and Firms' Investment in Emerging Market Economies** (NBER Working Paper 29303), [Joshua Aizenman](#), [Yin-Wong Cheung](#), and [Xingwang Qian](#) track the investment behav-

ior of 21,447 publicly traded firms in 46 emerging market economies. They explore the impact of active international reserve management policies that were pursued by some central banks over the 2000 to 2018 period. The researchers estimate that active reserve management is positively associated with business investment. They illustrate their findings for the case of the Philippines, a country with a GDP near the median in their sample. They estimate that a \$1 billion

Analysis of the behavior of 21,447 firms in 46 emerging economies finds active central bank management of international reserves increases business investment.

reserve accumulation by the Philippine central bank was associated with about \$200 million more in investment by the country's 222 publicly listed firms.

The study finds that the marginal effect of reserve management on investment increases as shocks become more severe, and

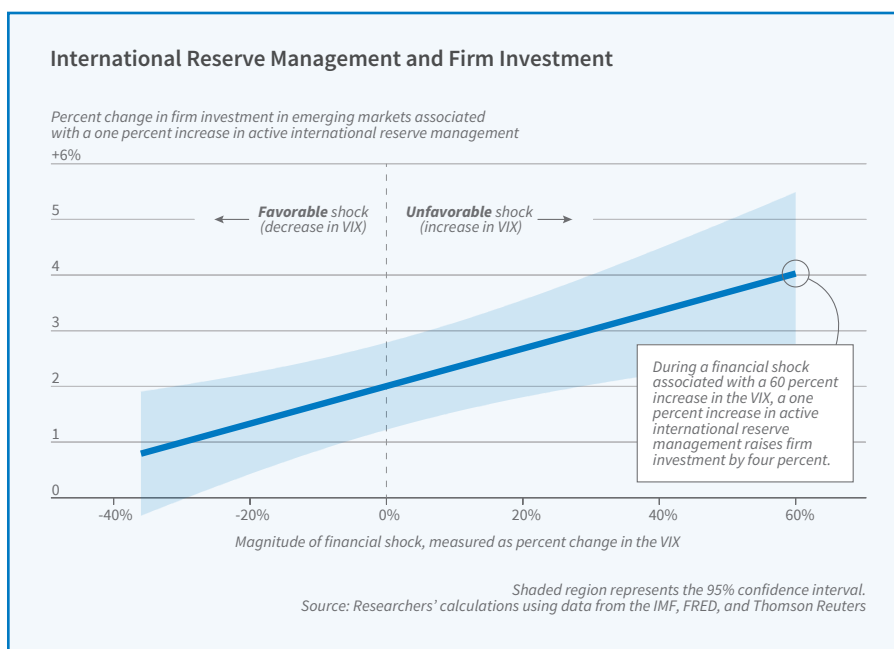
investment. Larger firms with higher cash flows and more rapid sales growth tend to be more responsive than other firms. Financially unconstrained firms are 4.5 times more responsive than financially constrained firms. For the purpose of the study, financial constraints are defined by access to external fund

sources, the ratio of tangible assets to long-term liabilities, and an estimate of the firm's cost of external financing.

The researchers find that higher country credit spreads—larger differences between the risk-free interest rate and the interest rate charged to borrowers in that country—are negatively associated with firm investment. Managing international reserves to narrow country credit spreads is therefore one channel through which active reserve manage-

ment supports firm investment. About 22 percent of the effect of active reserve management on the investment behavior of unconstrained firms, and 36 percent of the effect on financially constrained firms, is mediated by the impact of this policy on country spreads. The researchers also find that active international reserve management has a more substantial effect on firm investment in countries with capital controls.

—Linda Gorman



declines as global risk aversion fades. The researchers measure global financial shocks using changes in the VIX index, a measure of the implied volatility of S&P 500 stock options in the United States. They define active international reserve management transactions as the residual after detrending official international reserve data from the International Monetary Fund.

There are differences across firms in the impact of active reserve management on

Improved Market Access Helps the Fishermen of Remote Amazonia

In the impoverished communities of the Brazilian Amazon, one of the most remote settings in the world, fishermen harvest a huge, prehistoric, air-breathing fish called a pirarucu. Historically, they have sold the fish to middlemen who wield significant market power, resulting in a large gap between the price the fishermen receive and the price charged to the consumer.

In **Big Fish in Thin Markets: Competing with the Middlemen to Increase Market Access in the Amazon** (NBER Working Paper 29221) [Viva Ona Bartkus](#), [Wyatt Brooks](#), [Joseph P. Kaboski](#), and [Carolyn E. Pelnik](#) study an intervention that enabled communities to bring the fish to market directly and thereby increased incomes as much as 27 percent.

Fishing for pirarucu is straightforward: the fish must come to the surface to breathe, at which point they are harpooned. But because the fish are perishable, delivering them to market is a challenge. Prior to the intervention, direct access to the final market involved multiday ferry rides to Manaus, the capital city of Amazonas. Instead of making this journey, most fishermen sold to middlemen who have boats that permit faster delivery. The middlemen, part of a cartelized supply chain, brought the catch to outside markets. The intervention, initiated by a nongovernmental organization, involved community-financed procurement of boats, ice, and fuel to enable fishermen to cut out the middlemen.

Fundação Amazonas Sustentável (FAS) — the leading nongovernmental environmental organization in Brazil — focuses on sustainable economic development of both the

nificant increase in fishing, notable in a situation where overfishing could plausibly be a concern. Rather, they found an increase in the price fishermen received for the fish.

A community-financed program to procure boats, ice, and fuel enabled impoverished communities to avoid middlemen in trade, boosting incomes and increasing food consumption.

Amazon's natural resources and its river communities. FAS's Bolsa Floresta program, Bradesco Bank, and the state of Amazonas pay a monthly subsidy

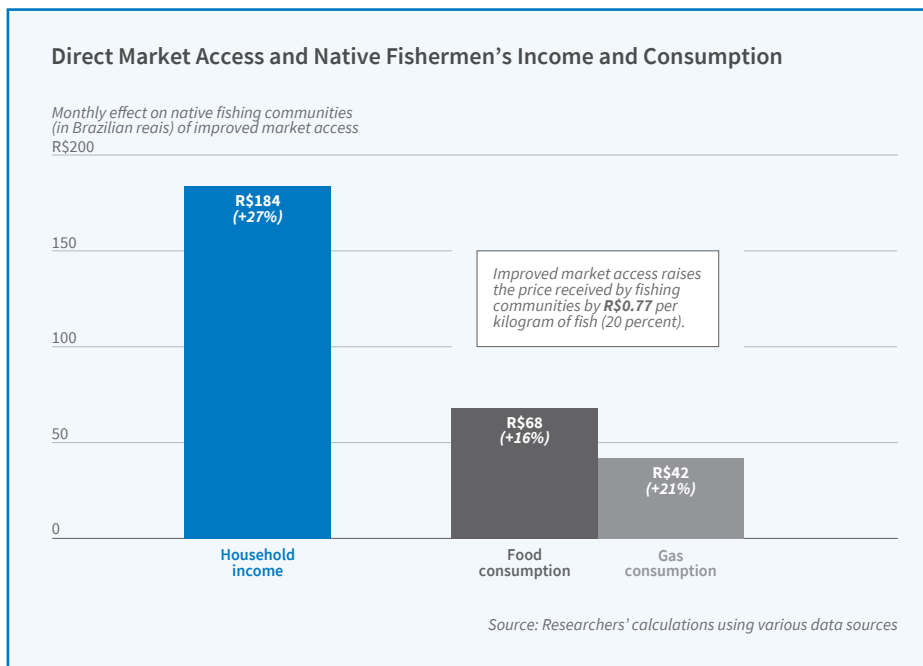
The researchers find that boat investments are cost effective: boats can be paid for in under three years, well within the lifespan of the typical boat. They also

find that, in the first year of the intervention, communities continued to sell to middlemen, but they may have earned a higher price when doing so. This may have reflected a risk-mitigation strategy, as communities continue to sell a substantial portion of their pirarucu to known buyers while also organizing their own boats.

The researchers explored why, if the intervention was cost effective, com-

munity members had not implemented such a strategy on their own. They suggest that the lack of a boat constituted a poverty trap, especially in the presence of a cartel with market power in pricing. Middlemen were capable of financing the large fixed cost of a boat, but poor communities were not. Market power enabled the middlemen to pay below-market prices for fish, thus creating a poverty trap even though the natural cost structure did not make this an inevitable outcome.

—Lauri Scherer



to households in river communities who promise to care for the forest. Communities that choose to participate in the boat-buying effort forego their Bolsa Floresta payments for the period of time needed to pay for a boat, approximately three years.

In evaluating the intervention, the researchers find that income in boat-acquiring communities rose by 27 percent relative to income in the control communities. The intervention also raised consumption, including food expenditures. They did not find a sig-

Effects of the First Court Ruling against School Segregation

The Supreme Court's *Brown v. Board of Education* ruling in 1954 is widely viewed as the seminal decision outlawing racial segregation of schools. But a decade earlier, in *Mendez v. Westminster*, a federal district court ruled against segregation of Mexican Americans in California schools. This case was the first successful challenge to segregation based on the Equal Protection Clause of the 14th Amendment to the US Constitution. Filed against school districts in Orange County, the case never reached the national level because the defendants decided not to pursue it after losing at the appellate level in 1947.

In **The Long-Run Impacts of Mexican-American School Desegregation** (NBER Working Paper 29200), [Francisca M. Antman](#) and [Kalena Cortes](#) document how *Mendez* boosted the educational attainment of Hispanics in California.

Determining the impact of segregation in California is complicated, because unlike in southern states that mandated separate schools for Blacks and Whites, in California segregation primarily occurred at the local level. Segregation was subtler: school boundaries were drawn to create Mexican zones, and any White children who happened to live

in those areas were offered the opportunity to transfer out.

In the absence of official records designating which California districts practiced

Hispanic students in California who began schooling after *Mendez v. Westminster* remained in school 0.9 years longer and were 19.4 percent more likely to graduate from high school.

segregation, the researchers rely on historical accounts indicating that segregation was most prevalent in counties with a large share of Hispanic students. They assume that schools were segregated in counties that fell in the top quarter statewide in their concentration of Hispanics.

In those counties, Hispanic students who began schooling after *Mendez* took effect

remained in school 0.9 years longer than students who began schooling a decade earlier. The post-*Mendez* cohort was 18.4 percent more likely to graduate from junior high school

and 19.4 percent more likely to graduate from high school than the pre-*Mendez* cohort.

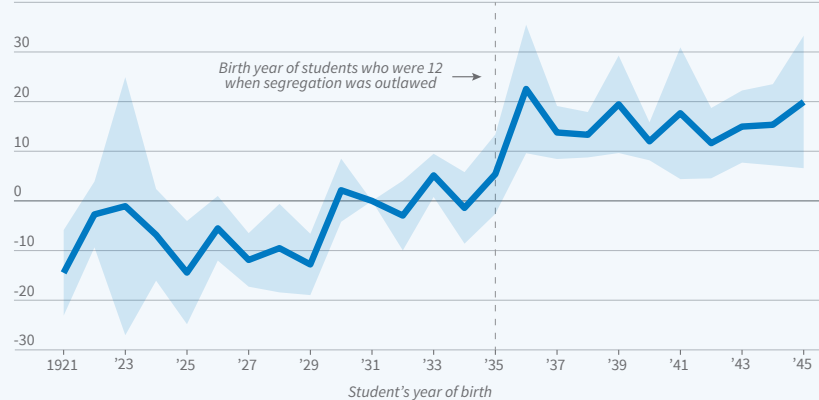
At the same time as Hispanics marked gains in educational attainment, their non-Hispanic White classmates showed a slight decline. The drop in attainment for non-Hispanic Whites was much smaller than the increase for Hispanics; the researchers conjecture that it might have resulted from a reallocation of resources.

Prior to the *Mendez* decision, Hispanic students in low-segregation counties — those in the 25 percent of counties with the lowest ratio of Hispanics to non-Hispanics — completed an average of 12 years of schooling, compared with nine years for their Hispanic peers in high-segregation counties. *Mendez* had no appreciable impact on the outcomes for Hispanics in low-segregation areas.

— Steve Maas

Desegregation and Junior High School Attainment among Hispanics

Percentage point difference in junior high completion probability, counties with a high vs low likelihood of segregation, relative to 1931 birth cohort



Shaded region represents 90% confidence interval.
Source: Researchers' calculations using data from the Integrated Public Use Microdata Series

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