How Minimum Wage Increases Influence Student Enrollments

Increases to state minimum wages are associated with falling enrollment at local community colleges, according to a new study by Diane Whitmore Schanzenbach, Julia A. Turner, and Sarah Turner. In Raising State Minimum Wages, Lowering Community College Enrollment (NBER Working Paper 31540), the researchers found that increases in state-level minimum wages were followed by enrollment reductions of just over 4 percent at two-year institutions in the following year. The reduced enrollment rate held steady for four years following the wage increase. The change in enrollment was not sensitive to the size of the wage increases, which were broadly organized into hikes of 6 percent, 8 percent, and 10 percent or more. Minimum wage increases had no effect on enrollment rates at four-year institutions.
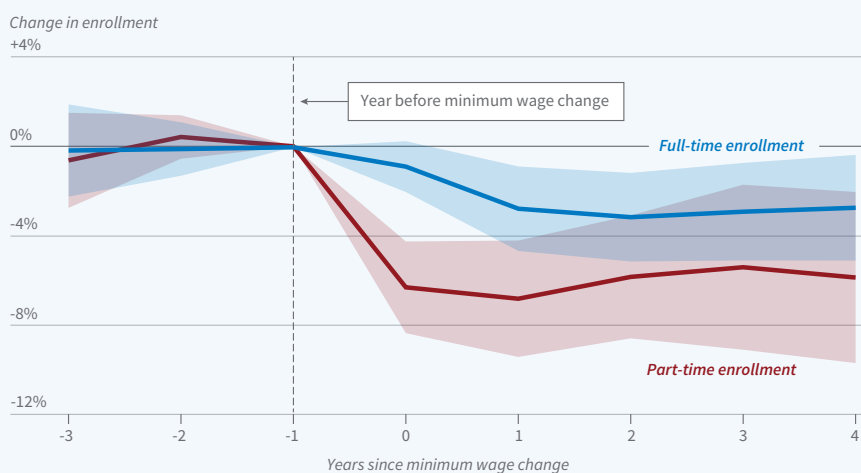
The researchers broke down their findings into subgroups by sex, race, and between full- and part-time students. They found no statistically significant differences in changing enrollment rates between men and women or across different racial groups at either two-year or four-year institutions. They did find a difference between full-time and part-time students, with part-time enrollees at two-year institutions seeing the largest dip in enrollment — 6 percent — in the year following a minimum wage increase.

> Students who are least likely to earn an education credential are the most likely to withdraw from their studies following a minimum wage hike.

When assessing the effect of minimum wage increases on educational enrollment, the researchers used federal Integrated Postsecondary Education Data System data on student enrollment by type of institution, full- or part-time status, and student demographics for the period 1986–2019; local and regional demographics data from the American Community Survey and the Current Community Population Survey; and unemployment data from the Bureau of Labor Statistics. They estimated the effect of each minimum wage increase by comparing enrollment data in the two years before and the four years after the increase to enrollment data from all other states.

Changes in Public College Enrollment around Minimum Wage Increases

Change in enrollment

Year before minimum wage change

Full-time enrollment

Part-time enrollment

Years since minimum wage change

Minimum wage changes are defined as increases of 8% or more. Shaded area represents 95% confidence intervals.
Source: Researchers' calculations using data from the National Center for Education Statistics.

The researchers also looked at the effects of minimum wage increases on the attainment of a certificate or a degree. They did not find any changes that were statistically different from zero. The researchers did find that in the year following a minimum wage increase, 5.3 percent fewer people registered for the General Educational Development exam, an alternative credential to the secondary school diploma, and 3.6 percent fewer passed it.

The researchers concluded that increasing the minimum wage significantly affects enrollment decisions for the subset of students enrolled part-time at two-year institutions. They find that rising minimum wages do not affect degree attainment for any subgroup of students, which suggests that the students most likely to stop their studies in response to rising minimum wages are those with the longest road ahead in terms of money, time, and effort required before they gain an educational credential that could meaningfully affect their income potential.

— *Emma Salomon*

Estimating Consumer Welfare Gains from Free Online Services

Over the last decade, digital products such as Google, WhatsApp, and Facebook have proliferated. In the US and UK, for example, people now spend an average of 24 hours online each week. The statistics suggest the possibility of substantial welfare gains for consumers, who typically access these products at no cost. They also present a measurement challenge to traditional measurement methods that rely on price data to construct national accounts metrics such as GDP.

In The Digital Welfare of Nations: New Measures of Welfare Gains and Inequality (NBER Working Paper 31670), Erik Brynjolfsson, Avinash Collis, Asad Liaqat, Daley Kutzman, Haritz Garro, Daniel Deisenroth, Nils Wernerfelt, and Jae Joon Lee use a survey-based experiment to estimate the welfare impacts of digital goods. The researchers use Facebook's internal survey platform to administer a large-scale incentivized online choice experiment to 39,717 Facebook users across 13 countries. They query users about their preferences regarding ten digital goods — Facebook, Twitter, Instagram, WhatsApp, Snapchat, TikTok, Google Search, Google Maps, YouTube, and Amazon Shopping — as well as the amount of money they would be willing to accept in exchange for deactivating their Facebook accounts for one month. They use the resulting survey data to calculate the consumer welfare gains generated by each of these products.

Freely available digital goods reduce welfare inequality between richer and poorer countries as well as between richer and poorer individuals.

The survey data suggest that among Facebook users, the ten digital goods generate $2.52 trillion in consumer welfare across the 13 countries, corresponding to 5.95 percent of the countries' total GDP, and ranging from $1.29 trillion in the United States to $13 billion in Romania. The gains represent a higher share of income in lower-income countries as well as a higher share of income among individuals with lower income and wealth. The researchers therefore conclude that freely available digital goods reduce disparities in consumer welfare both within and across nations.

The results suggest that most of the welfare gains from using these digital goods accrue to consumers and not to the platforms. For example, the researchers estimate that the user value generated by Facebook is $284 billion for the 13 countries studied, more than twice as much as Meta's $115 billion in advertising revenue from Facebook,

Correlation between Valuation of Digital Goods and GDP per capita

Valuation of digital goods by Facebook users, percentage of GDP per capita

GDP per capita, 2020 USD
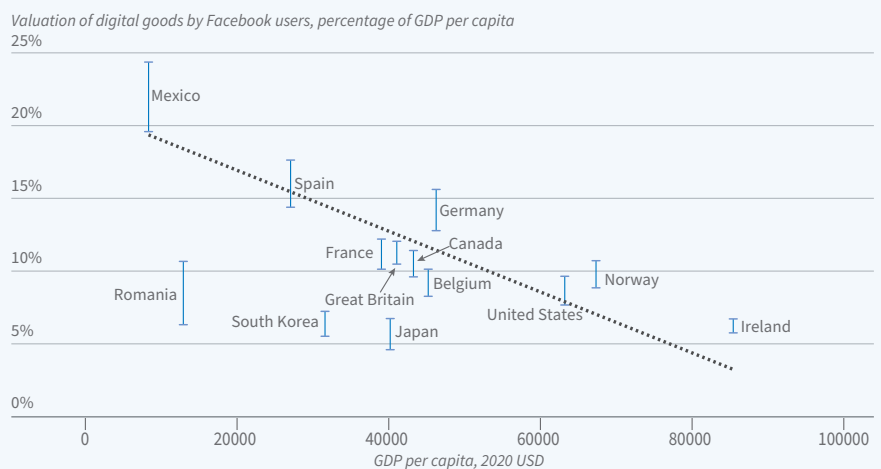
Estimates are based on survey valuations of willingness to pay. Bars represent 95% confidence intervals.
Source: Researchers' calculations using data from multiple sources and surveys.

Instagram, and WhatsApp globally.

Because free digital goods generate substantial welfare for consumers but are not included in GDP, economic growth and labor productivity — typically defined as GDP per hour worked — have been underestimated in recent years, at least for the countries in the study's sample. Traditional measures of output and productivity do not reflect the full contribution of digital goods.

The researchers' findings are not driven by consumers who spend an outsize amount of time on digital platforms. The estimated welfare gains are distributed across a broad range of users, not concentrated among those who are very active online.

— *Abby Hiller*

How Much Do Renewable Portfolio Standards Promote Green Electricity?

Industrialized countries aiming to reach carbon neutrality by 2050 have several strategies for decarbonizing electricity generation. In the US, renewable portfolio standards (RPS) are among the most prominent. Most states have RPS programs that either require or encourage electricity suppliers to rely on renewable sources, such as solar and wind, for a minimum share of their electricity generation. Although RPS have been used for 30 years, their efficacy in promoting low-carbon electricity generation is still being debated because of a lack of definitive causal evidence. Between 2015 and 2019, renewable generating capacity from wind and solar increased by 40 and 164 percent respectively. What role did RPS play?

In Causal Effects of Renewable Portfolio Standards on Renewable Investments and Generation: The Role of Heterogeneity and Dynamics (NBER Working Paper 31568), Olivier Deschenes, Christopher Malloy, and Gavin G. McDonald present new evidence on the impact of RPS on renewable electricity capacity investments and generation. They analyze state-level data for the 1990–2019 period and provide source-specific evidence on the take-up of renewables.

The researchers find that on average, RPS policies increase wind generation capacity by between 600 and 1,200 megawatts (MW), an increase of about 44 percent relative to the installed wind capacity in 2019. The effect takes time to develop; most RPS-related wind investments are made at least five years after RPS adoption, and the study considers adoptions as many as 11 years after the standard takes effect. The researchers do not find any effect on investments in solar generation capacity, but given the timing of utility-scale solar deployment in the US, their data sample may not be well suited to testing for this effect.

The findings underscore the importance of accounting for gradual responses to RPS, distinguishing the effects on different sources of renewable generation, and considering the stark differences in RPS design across states. The rates at which the marginal generation

> In the average state that adopts renewable portfolio standards, electricity generation capacity from wind energy rises by at least 600 MW.

costs from solar and wind have declined in the last decade are markedly different than before RPS, and so are the rates at which their shares of generating capacity have increased. The researchers conclude that if a national clean energy standard operated in the same way as existing state-level RPS, it could increase the share of US electricity generated from green sources.

— *Lauri Scherer*

Effect of Renewable Portfolio Standards on Wind and Solar Generation
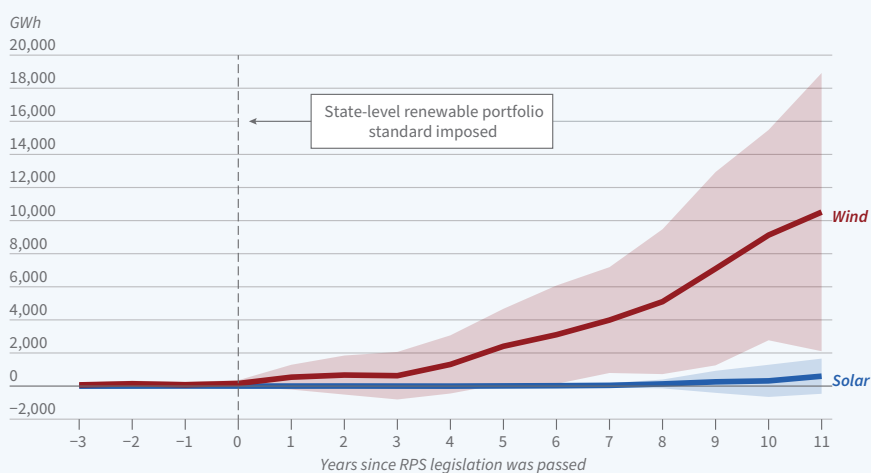
Shaded area represents 95% confidence intervals.
Source: Researchers' calculations using various data sources.

Recent Evolution of Retirement Readiness for Blacks and Hispanics

Americans' readiness for retirement depends on three primary income streams — pensions, savings, and Social Security. These income streams have evolved over time in different ways for different racial and ethnic subsets of the US population.

In Trends in the Retirement Preparedness of Black and Hispanic Households in the US (NBER Working Paper 31532), Edward N. Wolff uses data from the Survey of Consumer Finances to construct three comprehensive measures of retirement adequacy for each household: annual projected retirement income, whether the household's projected retirement income places them above the poverty line, and the percentage of the household's preretirement income that is projected to be replaced by retirement income. He uses population-level data on these three measures to document trends in retirement preparedness both overall and by race and ethnicity.

From 1989 to 2007, Black and Hispanic households made substantial progress in terms of their expected income security during retirement. Mean retirement income increased from $31,200 to $58,400 among Black families and from $59,400 to $95,600 among Hispanic families, narrowing the gap between them and White households, who increased from $92,400 to $164,100. In 1989 the median retirement income among Black families was 18.6 percent of that of White families. In 2007, it was 50.8 percent. Hispanic families had median retirement earnings that were 33.5 percent of those of White families in 1989, and 43.8 percent of those of White families in 2007. The percentage of households whose expected income during retirement placed them below the poverty line fell from 56.1 percent in 1989 to 14.0 percent in 2007 among Black families and from 39.6 percent to 18.8 percent among Hispanic families.

After 2007, however, the improvement in retirement income security stopped and, among Black households, reversed. Between 2007 and 2019, Black households' median retirement income fell by 29.2 percent, while the share of those whose expected retirement income placed them below the poverty line grew by 8.1 percentage points. Additionally, the share of Black households with expected retirement income greater than or equal to 75 percent of their income at age 64 fell by 1.2 percentage points. Expected mean retirement income rose modestly, by 8.7 percent.

In contrast to Black households, Hispanic households during the period from 2007 to 2019 experienced both setbacks and gains in retirement preparedness. While average expected income during retirement fell by 12.4 percent, the share of households whose expected retirement income placed them in poverty dropped by 4.7 percentage points, and the share of Hispanic households who expected to earn in retirement at least 75 percent of what they earned at age 64 grew by 6.2 percent. For non-Hispanic Whites, mean retirement income rose by 31.0 percent over this period, although median retirement income fell by 3.7 percent.

Wolff finds tremendous variation in the

The gap in retirement security between White and non-White households narrowed between 1989 and 2007 but expanded over the subsequent decade.

composition of households' expected retirement income by race and ethnicity. In 2019, Social Security represented 12.4 percent of White households' mean expected retirement income, compared to 27.6 percent and 39.0 percent for Black and Hispanic households, respectively. White households were projected to draw 46.7 percent of their retirement income from non-home, non-pension wealth, compared to 15.7 percent for Black households and 15.9 percent for Hispanic households. Income from Social Security reduced poverty among retired Black and Hispanic households by roughly 30 percentage points in 2007 and by between 36 and 39 percentage points in 2019, making the program an equalizer for minority households, who tend to have less accumulated wealth than White households.

— Abby Hiller

Households with Expected Retirement Income Less than the Poverty Line
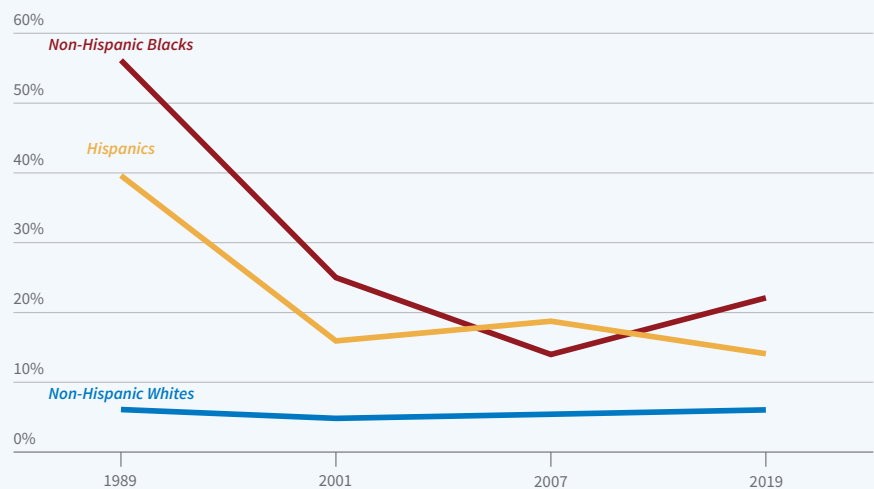
Source: Researchers' calculations using data from the SCF

Economics, Politics, and the Evolution of Global Supply Chains

World trade grew steadily in the four decades before the 2008 global financial crisis. In the 1990s, the ratio of trade in goods and services to GDP was 38 percent for the world, 20 percent for the US, and 22 percent for China. By 2006, the ratios for the world and the US had grown to 60 percent and 27 percent respectively. China's had reached 65 percent on the back of China's rise as a key cog in global supply chains.

In Global Supply Chains: The Looming "Great Reallocation" (NBER Working Paper 31661), Laura Alfaro and Davin Chor discuss how trade policy shifts, technological advances, and perceptions of different kinds of risk have altered cross-border production and supply chain arrangements, especially over the past five years. They summarize US import and export profiles using data from UN Comtrade and also assemble data from other sources to characterize multinational activity and foreign direct investment.

Other high-income countries have historically provided the bulk of US imports. The European Union and the United Kingdom have provided about 20 percent of US imports since 1994. China and Mexico took US import share from Japan and Canada in the 1990s with the passage of NAFTA and trade shifts towards low-wage countries. Japan has to some extent replaced trade with multinational activity as a mode for accessing the US market, with both Canada and Japan remaining closely engaged with the US economy through foreign direct investment.

Since 2017 though, there have been substantial shifts in the source-country composition of US imports. The Chinese share of US goods imports peaked at 21.6 percent in 2017. A fall in China's share to 16.5 percent in 2022 has coincided with gains in the import shares of Vietnam and Mexico. At least some of the reallocation of US sourcing patterns seems to have been driven by US-China trade friction.

But the increase in the roles of Vietnam and Mexico as sources of US imports has come with some costs, as the unit prices of goods from Vietnam and Mexico have risen between 2017 and 2022.

China's share of US goods imported declined from 21.6 percent in 2017 to 16.5 percent in 2022 while Vietnam's and Mexico's shares have increased.

The researchers compute a measure of product "upstreamness" — how close a product is to finished — and use it to profile how US imports have changed over time. Examples of products close to final consumer use are toys, clothes, furniture, and automobiles, while products such as chemicals, petroleum, and minerals go through multiple steps before reaching their final consumers.

US exports tend to be farther from final use than its imports. In the last decade, increases in agricultural and petroleum product exports have solidified this position. However, even when petroleum and agricultural products are excluded, US exports are used earlier in the production process while imports are relatively finished and close to final consumption, reflecting the US position as an exporter of upstream machinery and intermediate inputs for overseas assembly.

In a potential reversal of the long-run decline in US manufacturing activity, a slight rise in the "upstreamness" of imports has been observed over the past five years, which suggests that more of the finishing stages of production may be occurring in the US. Establishment and employment counts in manufacturing sectors have also increased.

While the US may be reallocating its direct sourcing and imports towards Vietnam and Mexico, it does not necessarily mean that it has become less dependent on China, as it remains connected with China through third countries. While China's share of US imports has fallen, its share of Europe's imports has risen, and it has increased its trade with, and foreign direct investment in, both Vietnam and Mexico.

— *Linda Gorman*

US Import Market Share Change for Importing Countries, 2017—22

Percentage points
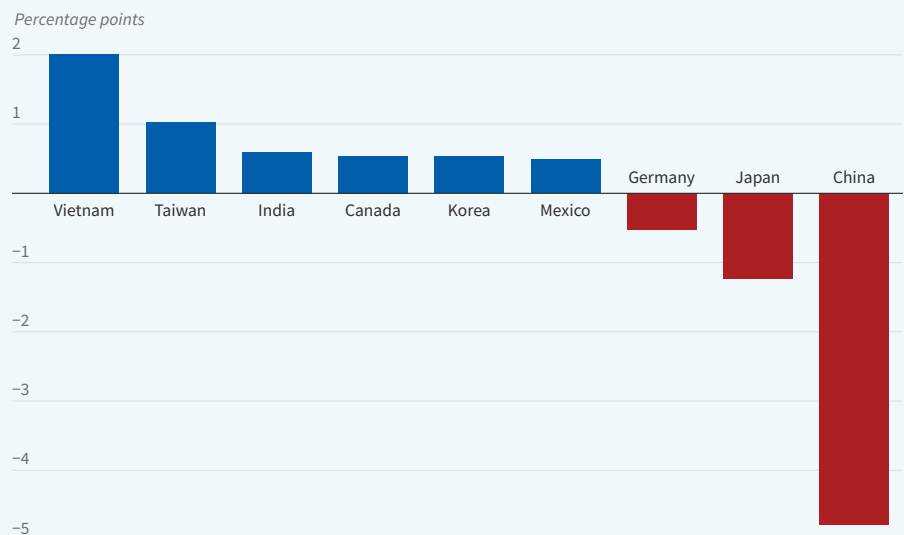
The Effect of the Fed's Quantitative Easing on Bank Lending

Banks face a tradeoff between lending out as many of their assets as possible to maximize interest revenue and keeping enough liquid assets on hand to stave off potential bank runs. Since a run on a specific bank can lead to broader financial contagion, governments typically intervene to constrain banks' behavior through instruments like leverage ratio regulations. These regulations involve restrictions on the ratio of a bank's Tier 1 capital — its shareholders' equity and retained earnings — to its total assets.

In response to the financial crisis of 2007–08, the Federal Reserve's multitrillion dollar quantitative easing program used central bank reserves — liquid assets that must be held within the banking system — to purchase assets from outside the banking system. This had the effect of substantially increasing banks' holdings of liquid assets as well as their total asset holdings. In aggregate, central bank reserves rose from less than $50 billion at the beginning of 2008 to $2.8 trillion in 2015.

In [The Reserve Supply Channel of Unconventional Monetary Policy](#) (NBER Working Paper 31693), [William Diamond](#), [Zhengyang Jiang](#), and [Yiming Ma](#) study the effect of this inflow of liquid assets on banks' total lending. They note that the potential impact is ambiguous because an injection of liquid assets into a bank reduces the risk of extending the bank's illiquid lending, which could result in more lending, but it also worsens the bank's leverage ratio. Central bank reserve holdings count as part of a bank's total assets, so a bank that holds more reserves must either reduce its holdings of other assets such as loans or raise more costly equity financing to satisfy leverage ratio regulations.

The researchers present time series evidence showing that the expansion of central

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Every $1 increase in central bank reserves crowds out 8 cents of new bank lending, especially lending to firms.

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bank reserves from $0.02 trillion to $3.8 trillion between 2006 and 2021 coincided with a fall in banks' share of loans and other illiquid assets from 83 percent to 63 percent. This suggests that growth in central bank reserves led to reduced lending, but it is inconclusive because the fall in lending could be explained by depressed demand for loans due to the Great Recession and business cycle fluctuations.

The researchers therefore develop estimates of both the demand for bank lending, using natural disasters as a source of variation in demand, and the cost of supplying loans, by tracing out the effects of differential deposit growth across different regions on banks' observed costs. Combining these estimates in a structural model, they find that every additional $1 of central bank reserves crowds out about 8 cents of new bank lending to firms, consistent with the time series evidence. Overall, the researchers find that the expansion of central bank reserves between 2008 and 2017 reduced new bank lending by an average of about $140 billion per year, with a large part of this effect on bank lending to firms.

— *Shakked Noy*

Reserve Supply and Reduction in Corporate Loan Issuance
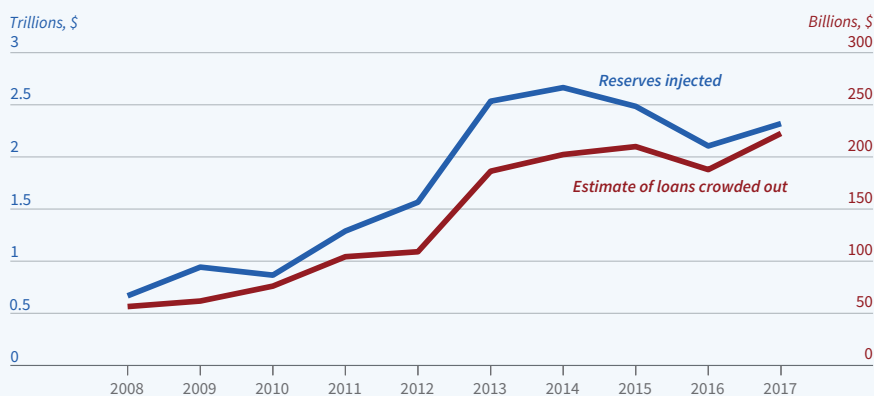
Source: Researchers' calculations using data from the FDIC, RateWatch, and the Thomson Reuters Dealscan database.

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