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Program Report

International Trade and Investment

Stephen J. Redding*

The International Trade and Investment (ITI) Program holds three regular meetings annually, in winter, spring, and at the NBER Summer Institute. The ITI Program has 85 research associates, 11 faculty research fellows, two research economists, and 34 members with primary affiliations in other NBER programs, making a total of 132 members. Research within the group covers a wide range of topics, such as explaining patterns of international trade and foreign direct investment, understanding the impact of trade policies, and examining the spatial distribution of economic activity within countries.

The regular meetings are often complemented with specialized conferences. In recent years, these have included "International Fragmentation, Supply Chains, and Financial Frictions" (2023), organized by Pol Antràs, Sofía Bauducco, Linda S. Goldberg, and Şebnem Kalemli-Özcan; "Trade and Trade Policy in the 21st Century" (2022), "The Future of Globalization" (2021), and "International Trade Policy and Institutions" (2020), all organized by Robert W. Staiger and myself; "The Rise of Global Supply Chains" (2021), organized by Laura Alfaro and Chad Syverson); "Risks in Agricultural Supply Chains" (2021), organized by Antràs and David Zilberman; "Agricultural Markets and Trade Policy" (2020), organized by Dave Donaldson; "Economic Consequences of Trade" (2019), organized by Redding; "Firms and Networks" (2018), organized by Alfaro, Antràs, and Redding; and "Trade and Geography" (2017), organized by Redding and Esteban Rossi-Hansberg.

This report focuses on research during 2016–22 period; the last ITI program report was in 2016. During this period, two ITI program members — Donaldson in 2017 and Oleg Itskhoki in 2022 — received

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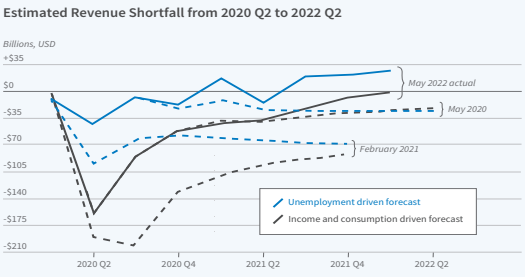
ALSO IN THIS ISSUE



The COVID-19 Pandemic and Challenges Facing State & Local Governments 12
Longevity and the Well-Being of Populations 17
Stiglerian Growth 21
Evaluating Urban Transportation Policies 26
NBER News 30
Conferences and Meetings 37
NBER Books 40

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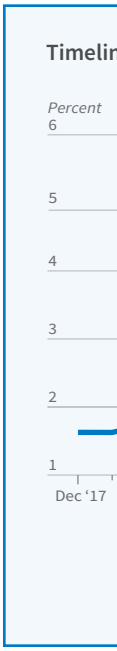
the John Bates Clark Medal, awarded by the American Economic Association to American economists under the age of 40 who have made significant contributions to economic thought and knowledge.



Trade Policy

The last six years have witnessed a resurgence in protectionist policies and an accompanying renaissance in research on trade policy. Although several previous US presidents have introduced protectionist measures early in their first terms, the Trump administration followed this historical precedent with more breadth and force than hitherto observed, and these policies have largely remained in place in the Biden administration. During 2018, six waves of tariffs were introduced on $283 billion of US imports, with further waves of tariffs introduced in 2019. As illustrated in Figure 1, the average US import-weighted tariff rose sharply from less than 2 percent to more than 5 percent, with a marked increase in the number of US tariffs of more than 10 percent. In response, China, the European Union, Russia, Canada, Turkey, Mexico, Switzerland, Norway, India, and Korea all filed disputes with the United States at the World Trade Organization (WTO). Many countries retaliated against the US actions by applying tariffs of their own.[1]

A growing body of research has estimated the economic impact of the US-China trade war. Two early empirical studies — one by Mary Amiti, David Weinstein, and me, and one by Pablo Fajgelbaum, Pinelopi Goldberg, Patrick Kennedy, and Amit Khandelwal — estimated aggregate real income losses for the United States of $8.2 billion and $7.2 billion, respectively. While these real income losses correspond to less than 1 percent of GDP, they are comparable to estimates of US welfare gains from tariff reductions under the North American Free Trade Agreement (NAFTA).[2] Figure 2 shows event-study estimates in which imposition of the US tariffs is followed by sharp reductions in import values.[3] One surprising finding of these and other empirical studies is that the US tariffs were largely passed through into higher prices for US firms or consumers, with little evidence of reductions in the prices received by Chinese exporters. In contrast, neoclassical trade theory would predict incomplete pass-through for a country that is large relative to world markets, such as the US. These high rates of pass-through into import prices remain somewhat

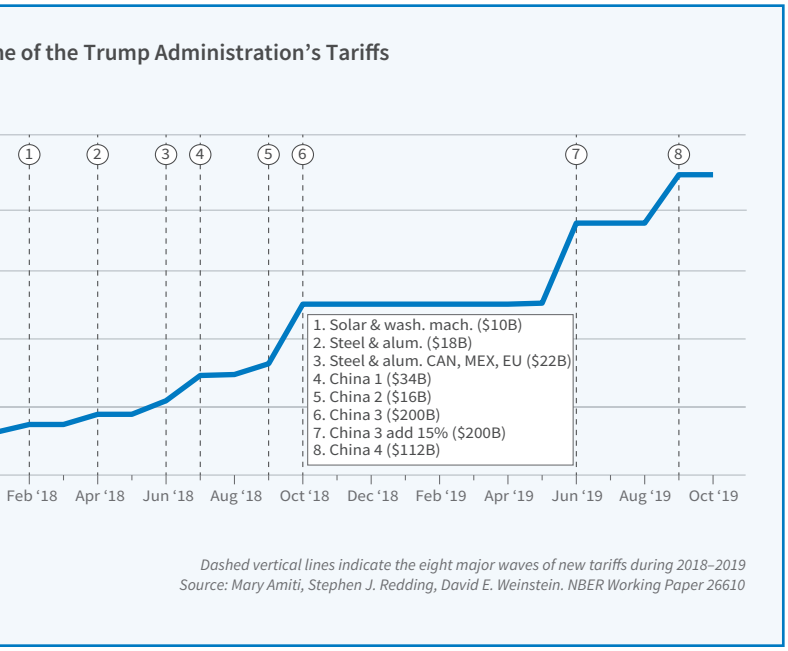


Figure 1

of a puzzle for ongoing research.

Whether the US tariffs were passed on fully into US consumer prices is harder to discern because of the challenges of developing comprehensive mappings from Harmonized Tariff Schedule (HTS) products to final consumer expenditure categories. Using product-level data from several large retailers, Alberto Cavallo, Gita Gopinath, Brent Neiman, and Jenny Tang find more limited movements in consumer prices, suggesting that these tariffs were mainly absorbed in retail and wholesale margins within the United States.[4] In a detailed study of washing machines, Aaron Flaaen, Ali Hortaçsu, and Felix Tintelnot find that the 2018 tariffs increased the US consumer price of washing machines by nearly 12 percent. Notably, even though dryers were not themselves subject to tariffs, the price of dryers increased by an equivalent amount, suggesting a role for complementarities in demand between goods.[5]

A distinctive feature of US tariffs on imports from China was that the initial waves mainly concentrated on intermediate and capital goods. Later waves expanded to include consumer goods as the administration began to run out of intermediate and capital goods to target. Gene M. Grossman and Elhanan Helpman analyze the reorganization of firm supply chains in response to such tariffs on intermediate goods in a setting with costly supplier search and bargaining.[6] Kyle Handley, Fariha Kamal, and Ryan Monarch analyze the impact of these tariffs on intermediate goods on the ability of US firms to export, and find a resulting decline in US export growth equivalent to an ad valorem tax on US exports of 2 percent for the typical product and up to 4 percent for products with higher than average exposure.[7]

Although most research has focused on the impact of the US-China trade war on the United States, Davin Chor and Bingjing Li use high-frequency night-lights data across latitude and longitude grid cells to provide evidence on the impact on China.[8] While grid cells with negligible direct exposure to the US tariffs account for up to 70 percent of China's population, the 2.5 percent of the population located in grid cells with the largest US tariff shocks saw a 2.52 percent decrease in predicted income per capita and a 1.62 percent predicted drop in manufacturing employment. More broadly, Fajgelbaum, Goldberg, Kennedy, Khandelwal, and Daria Taglioni examine the reallocation of global trade patterns and find that a number of third countries, such as Vietnam, benefited from the US tariffs, experiencing increased exports to the United States and the rest of the world.[9] Fajgelbaum and Khandelwal survey the burgeoning empirical literature on the impact of the US-China trade war,[10] while Lorenzo Caliendo and Fernando Parro provide a broader review of the theoretical and empirical literature on the normative and positive aspects of trade policy.[11]

The decades leading up to the US-China trade war were a time of ongoing multilateral and preferential trade liberalization. A number of studies have argued that the recent change in the direction of US trade policy, alongside other retreats from trade liberalization such as the United Kingdom's Brexit decision to leave the European Union, have substantially increased trade policy uncertainty. This increase in uncertainty by itself can depress trade and investment, as firms adopt a "wait-and-see" strategy before engaging in large investments such as in overseas plant and machinery. Using data on movements in stock prices around the dates of US-China tariff announcements, Amiti, Sang Hoon Kong, and Weinstein estimate that these changes in trade policy lowered the investment growth rate of listed US companies by 1.9 percentage points, and reduced aggregate US welfare through all channels including uncertainty by 4.9 percentage points.[12] More broadly, Andrew Greenland, Mihai Ion, John Lopresti, and Peter Schott use move-

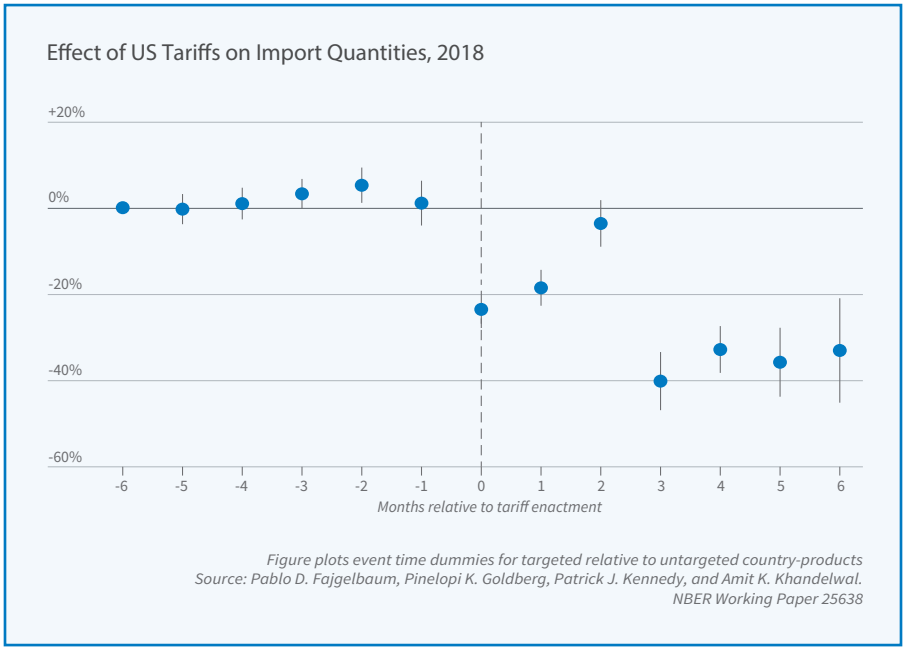


Figure 2

ments in stock prices around trade policy announcements to develop an overall measure of trade liberalization.[13]

A growing number of studies examine the relationship between international trade flows and trade policy uncertainty. Alejandro Graziano, Handley, and Nuno Limão find that increases in the probability of Brexit in prediction markets reduced both bilateral export values and the extensive margin of firm trade participation.[14] Saad Ahmad, Limão, Sarah Oliver, and Serge Shikher show that these increases in the predicted probability of Brexit had a pronounced impact on services trade, with reductions in services exports from Britain to the European Union of around 20 log points.[15] Using data on Chinese firms, Felipe Benguria, Jaerim Choi, Deborah L. Swenson, and Mingzhi Xu find that increases in both US tariffs and Chinese retaliatory tariffs raised measures of trade policy uncertainty (TPU), with a one standard deviation increase in TPU reducing firm-level investment, research and development (R&D), and profits by 1.4, 2.7, and 8.9 percent, respectively.[16] Isaac Baley, Laura Veldkamp, and Michael E. Waugh demonstrate that the effects of greater uncertainty are in fact uncertain. They provide conditions under which increased uncertainty can promote trade.[17] Handley and Limão survey this growing literature on trade policy uncertainty.[18]

The recent resurgence of protection in the United States and elsewhere has led to renewed debate about the future of the WTO and the multilateral rules-based trading system that has characterized the period since the Second World War. Staiger reviews recent research on the economic rationale for the WTO and its underlying principles of reciprocity and nondiscrimination, as captured in the so-called most-favored-nation (MFN) rule. These principles can be rationalized as a mechanism for countries to overcome the externality from each nation having an incentive to introduce protection in order to improve its terms of trade.[19] Kyle Bagwell, Staiger, and Ali Yurukoglu develop a quantitative model of tariff negotiations between countries to study the design of the institutional rules of the General Agreement on Tariffs and Trade and the WTO. Abandoning the MFN principle in bilateral tariff negotiations is found to reduce world welfare as a whole, although some individual countries, such as Japan and the United States, experience welfare gains.[20]

Recent years have seen a proliferation of so-called "new trade agreements" which not only constrain governments' choices of tariffs, but also restrict their domestic regulatory policies. Grossman, Phillip McCalman, and Staiger study the rationale for these new agreements in a setting in which firms design products to cater to local tastes.[21] If government choices of tariffs are constrained by international trade agreements, but domestic regulatory policies are not restricted, these domestic regulations can be used as a form of protection that benefits domestic consumers and producers at the cost of exerting a negative externality on foreign consumers and producers.

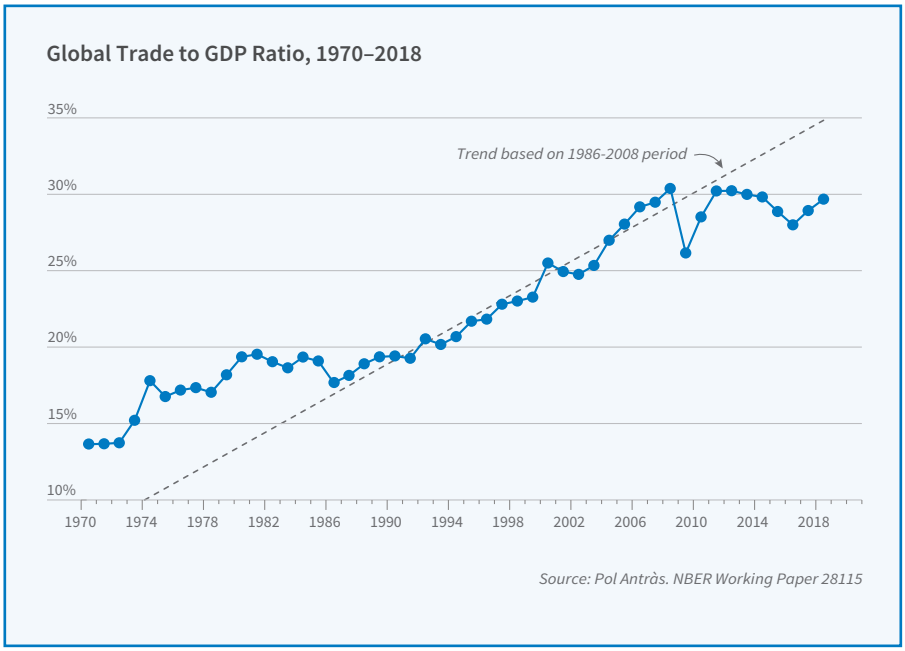


Figure 3

Global Value Chains (GVCs) and Networks

One of the distinctive features of globalization in recent decades has been global value chains (GVCs). Sometimes called slicing the value-added chain, fragmentation, vertical specialization, trade in tasks, or the unbundling of production, this refers to the spreading of stages of production across national borders. In contrast, international trade in earlier episodes of globalization, such as the late-nineteenth century, was concentrated on the exchange of raw materials and final goods.[22]

Antràs and Richard Baldwin provide recent reviews of the evolution of globalization and the emergence of GVCs.[23] As shown in Figure 3, world trade grew substantially more rapidly than world production from the end of the Second World War to the 2008 financial crisis, after which it stagnated. Measuring GVC trade is more complicated than measuring overall trade, but a natural measure is the share of a country's exports that flow through at least two national borders — for example, a semiconductor chip that is shipped from Japan to China, where it is put into an iPhone which is then shipped to the United States. GVC trade based on this measure grew substantially more rapidly than overall trade over the same period, again before stagnating after the 2008 financial crisis.

This stagnation of both overall trade and GVC trade since the 2008 crisis has led to much debate about the extent to which the world economy will experience "deglobalization." It is important to keep in mind that 1986–2008 was a period of especially rapid trade integration — sometimes called "hyper-globalization" — as shown by the dashed gray linear time trend for this period in Figure 3. This was driven by the conflu-

ence of three sets of forces: (1) multilateral and regional trade policy integration; (2) technological innovations such as the computer, satellite phone, and internet that reduced the cost of international communication; and (3) geopolitical and institutional changes, such as domestic reform in China, Eastern Europe, and India and their emergence into world markets. Against this backdrop of especially rapid trade integration, some slowdown in the pace of globalization might be expected, which has led a number of authors to refer to "slowbalization" rather than deglobalization. Nevertheless, the recent resurgence of protectionism and increased geopolitical tensions, such as the potential decoupling of China and the United States and the Russia-Ukraine War, provide considerable headwinds that could stall or reverse the increasing economic integration of the last few decades.

Recent research has examined the implications of the emergence of GVCs for our understanding of international trade. This is part of a broader and growing wave of research in economics on networks domestic and foreign. Viewing international trade as a network of buyers and sellers has a number of implications for our understanding of the causes and consequences of such trade.[24] A first set of implications relates to the international propagation of shocks, an issue which has received renewed prominence in the wake of the large-scale shocks from the US-China trade war, the COVID-19 pandemic, and the Russia-Ukraine War. From a theoretical perspective, a classic insight from the closed-economy macroeconomics literature is Hulten's theorem: for efficient economies and under minimal assumptions, the first-order impact of a technology shock to a firm or industry is equal to that industry's or firm's sales as a share of output. David Baqaee and Emmanuel Farhi show how to generalize this result to open economies in order to characterize the response of the aggregate economy to productivity shocks, tariffs, and iceberg trade costs.[25] Emmanuel Dhyne, Ken Kikkawa, Magne Mogstad, and Tintelnot show that although relatively few firms directly import, many firms are indirectly affected by foreign shocks because they are connected through production networks to direct importers.[26] Zhen Huo, Andrei A. Levchenko, and Nitya Pandalai-Nayar show that the network transmission of shocks is quantitatively relevant for the international comovement of GDP, although most comovement is explained by the correlation of the underlying national shocks.[27]

The aftermath of the COVID-19 pandemic saw large-scale disruptions to supply chains, shortages of critical components such as semiconductors, growing transportation delays, and record transportation rates on key shipping routes, such as from Shanghai to the West Coast of the United States. Additionally, the US-China trade war and growing geopolitical tensions have raised concerns about the national security implications of GVCs. In response, there is a growing debate about the resiliency of supply chains and the extent to which these large-scale shocks will lead to onshoring, reshoring, friend-shoring, and/or diversification. Grossman, Helpman, and Hugo Lhullier develop a theoretical framework to analyze optimal policy in the face of supply chain disruptions. In general, a government needs at least two policy instruments, such as subsidizing or taxing diversification while subsidizing or taxing offshoring, to achieve efficient sourcing. When a government is limited to one policy instrument, either policies towards diversification or those towards onshoring or offshoring can dominate.[28]

National security concerns in particular have led to a renewed debate about the potential scope for industrial policy. Dominick G. Bartelme, Arnaud Costinot, Donaldson, and Andrés Rodríguez-Clare study the rationale for industrial policy in the presence of external economies of scale in some sectors. Although they find evidence of significant and heterogeneous economies of scale across manufacturing sectors, the implied welfare gains from industrial policy are relatively modest, and equal to less than 1 percent of GDP on average.[29] Jaedo Choi and Levchenko examine the impact of South Korea's industrial policy in the form of its Heavy and Chemical Industry (HCI) Drive. Combining historical data on the universe of firm-level subsidies with a theoretical model of trade and development, they find that the HCI Drive was overall welfare improving for South Korea, in part because of an externality from firms' learning by doing. Ernest Liu and Song Ma study the cross-sector allocation of R&D in a multisector growth model with an innovation network in which each sector can benefit from other sectors' innovations. A social planner that values long-term growth should allocate more R&D to central sectors in the innovation network, but this incentive is muted in open economies that benefit more from foreign knowledge spillovers.[30]

A second set of implications of a network perspective relates to the sources of firm success in international markets. Andrew B. Bernard, Dhyne, Glenn Magerman, Kalina Manova, and Andreas Moxnes develop a theoretical framework in which larger firm size can come from high production capability, more or better buyers and suppliers, and/or better matches between buyers and suppliers.[31] They find that the production network, in the form of access to buyers and suppliers, can account for more than half the cross-sectional dispersion in firm size. Ezra Oberfield and Johannes Boehm find that the cost of contract enforcement influences firms' sourcing of intermediate inputs in production networks.[32] In Indian states with more congested courts, plants in industries that rely more heavily on relationship-specific intermediate inputs shift their expenditures away from intermediate inputs and adopt more vertically integrated production structures. Jonathan Eaton, Marcela Eslava, David Jinkins, C. J. Krizan, and James R. Tybout develop a model of firm-level export dynamics with costly consumer search, in which a firm's customer base is a valuable intangible asset.[33] Costly consumer search shapes the dynamic response of firm exports to foreign demand shocks, with

the five-year response of total export sales to an exchange rate shock exceeding the one-year response by about 40 percent. Jonathan Eaton, Samuel S. Kortum, and Francis Kramarz develop a model of firm-to-firm matching in which domestic and imported intermediate inputs compete directly with labor in performing production tasks.[34] Applying this framework to the 2004 expansion of the European Union, they find that workers benefited overall, but those competing most directly with imports gained less, even losing in some countries entering the EU.

More generally, ITI researchers have explored the determinants of GVCs and their aggregate economic implications. Antràs and Alonso de Gortari develop a multistage general equilibrium model of GVCs in which the optimal location of production of a given stage in a GVC is not only a function of its own marginal cost in each location, but also depends on the proximity of that location to those of the preceding and subsequent stages of production.[35] Reductions in trade frictions generate somewhat larger welfare gains than in models without multistage production, in part because the lower trade costs accrue at each of the stages of production. Antràs develops a model of multistage production in which the time length of each stage is endogenously determined.[36] Letting the production process mature for a longer period of time increases labor productivity, but comes at the cost of higher working capital needs. A worldwide decline in interest rates lowers the cost of working capital and raises the share of GVC trade in world trade.

Multistage production can be organized either within firm boundaries — foreign direct investment (FDI) — or in separate firms — outsourcing. Antràs, Evgenii Fadeev, Teresa C. Fort, and Tintelnot combine Census Bureau and Bureau of Economic Analysis data to provide new evidence on the role of multinational enterprises (MNEs) in the US economy.[37] MNEs comprise only 0.23 percent of all firms in the United States, yet employ one-quarter of the workforce and account for 44 percent of aggregate sales, 69 percent of US imports, and 72 percent of US exports. Other related ITI research provides evidence of spillovers from MNEs to domestic firms, including work by Brian McCaig, Nina Pavcnik, and Woan Foong Wong for Vietnam, and by Bradley Setzler and Tintelnot for the United States.[38]

COVID-19

Antràs, Rossi-Hansberg, and I develop a theoretical framework for analyzing the two-way interaction between globalization and pandemics.[39] In this framework, business travel facilitates trade, and travel leads to human interactions that transmit disease. This trade-motivated travel generates an epidemiological externality across countries, such that whether a global pandemic occurs depends on domestic disease transmission in the country with the worst domestic disease environment. If agents internalize the threat of infection, social distancing leads to a reduction in travel that is larger for higher-trade-cost locations, which generates an initial sharp decline and a subsequent rapid recovery in the ratio of trade to output, as observed during the COVID-19 pandemic. The outbreak of the COVID-19 pandemic triggered an explosion of research by economists on the spread of the disease.

Barthélémy Bonadio, Zhen Huo, Levchenko, and Pandalai-Nayar study the role of global supply chains in shaping the impact of the COVID-19 pandemic on GDP growth using a multisector quantitative model and data on 64 countries.[40] One-quarter of the total model-implied real GDP decline is explained by cross-country transmission through global supply chains. However, "renationalization" of global supply chains does not in general make countries more resilient against pandemic-induced contractions in labor supply because reducing reliance on foreign inputs increases reliance on domestic inputs, which are also disrupted by lockdowns. Gaurav Khanna, Nicolas Morales, and Pandalai-Nayer use Indian data to identify firms with larger supplier risk following COVID-19 lockdowns.[41] They find that firms that buy more complex products with fewer available suppliers are less likely to break buyer-supplier relationships in response to lockdowns. Alfaro, Anusha Chari, Greenland, and Schott use stock market returns and an event-study approach to show that COVID-19–related losses in firm value were larger in industries with higher capital intensity, greater leverage, and greater scope for disease transmission.[42]

Fajgelbaum, Khandelwal, Wookun Kim, Cristiano Mantovani, and Edouard Schaal examine optimal dynamic lockdowns against COVID-19 within a model of a commuting network.[43] Applying this framework to Seoul, Daegu, and New York City, which differ substantially in terms of initial disease diffusion, they find that spatial lockdowns achieve substantially smaller income losses than uniform lockdowns. Actual commuting reductions were too weak relative to this optimal policy in central locations in Daegu and New York City, and too strong in Seoul.

A growing body of research has begun to examine the long-run implications of the COVID-19 pandemic in terms of a shift to remote and hybrid working. Jonathan I. Dingel and Brent Neiman provide evidence on the feasibility of working from home (WFH) for workers in different occupations. Overall 37 percent of jobs in the United States can be performed entirely at home, with substantial variation across occupations. Examples of occupational roles in which workers are largely able to work from home are managers, educators, and those working in computers, finance, and law. In contrast, examples of occupations in which workers are largely unable to work from home are farming, construction, and production.

Spatial Economics

One area of particularly active ITI research in recent years is spatial economics, namely the study of the distribution of economic activity across locations within countries.[44] Many of the same issues involved in studying inter-

national trade also apply to internal trade within countries, with a key difference being that labor mobility is typically much higher within countries than across national borders.[45]

Three factors have contributed to this growth of research in spatial economics. First, new theoretical techniques have been developed that enable researchers to analyze spatial interactions in settings with many heterogeneous locations connected by a rich network of trade and migration costs. Second, data from geographic information systems that encode latitude and longitude have dramatically improved our ability to measure the distribution of economic activity within countries at a fine spatial scale. Third, new sources of data have expanded the range of economic activities that can be measured at this fine level, including ride-hailing data, GPS data from smartphones, firm-to-firm shipments data, credit-card data, barcode-scanner data, and satellite-imaging data. An exciting aspect of this research on spatial economics in the ITI Program is the connections that it makes with related research in other NBER programs, including Development Economics, Industrial Organization, Labor Studies, and Public Economics.

Another active area of research has been on the economy's response to local labor demand shocks from, for example, changes in technology or international trade. Building on their own previous research, David Autor, David Dorn, and Gordon Hanson show that the China trade shock had persistent effects on US local labor markets out to 2019, despite the fact that this trade shock plateaued in 2010.[46] Rodríguez-Clare, Mauricio Ulate, and José Vásquez show that incorporating nominal rigidities is important in accounting for the estimated impacts of the China trade shock on unemployment and labor force participation across local labor markets.[47] Rodrigo Adão, Michal Kolesár, and Eduardo Morales, and Adão, Costas Arkolakis, and Federico Esposito, develop improved methods for estimating the effects of these local labor demand shocks which take into account the spatial correlation of these shocks across locations and spillover effects to proximate locations.[48]

Robert C. Feenstra and Akira Sasahara highlight the importance of taking into account both exports and imports in understanding the impact of international trade shocks on US employment across sectors.[49] Dingel and Tintelnot argue that granularity, in which the idiosyncratic decisions of individual agents affect equilibrium outcomes, can be important at small spatial scales.[50] Rafael Dix-Carneiro, João Paulo Pessoa, Ricardo M. Reyes-Heroles, and Sharon Traiberman provide theory and evidence that aggregate trade imbalances shaped the impact of the China shock on the US manufacturing sector.[51]

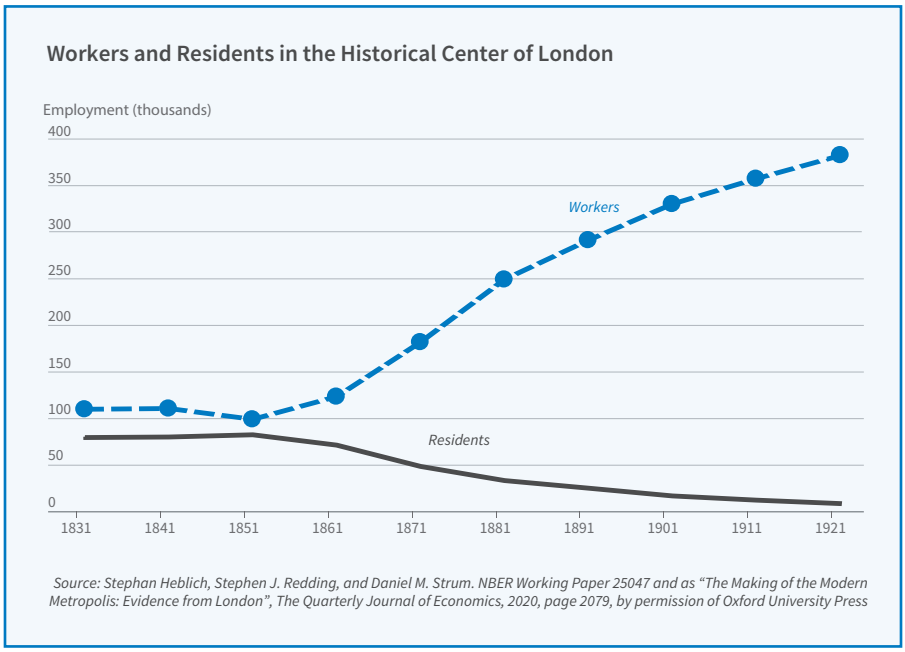
In general, the economy's response to local labor demand shocks can be gradual because of migration frictions for mobile factors such as labor, and the gradual accumulation of immobile factors such as plant and equipment. Benny Kleinman, Liu, and I show that capital and labor dynamics interact to shape the economy's speed of convergence to steady state.[52] When the gaps of both capital and labor from steady state are positively correlated across locations, this reduces the economy's speed of convergence because of the interdependence between factors' marginal products in the production technology. A high capital stock relative to steady state raises labor's marginal product, which retards its downward adjustment, and vice versa. Using data on US states between 1965 and 2015, we find this interaction between capital and labor dynamics plays a central role in explaining the observed decline in the rate of income convergence across states and the persistent and heterogeneous impact of local shocks.

Treb Allen and Donaldson investigate the role of history in shaping the current distribution of economic activity through either *persistence* — the long-lived dependence of current outcomes on temporary events — or *path dependence* where temporary events can permanently affect long-run outcomes. The analysis incorporates agglomeration externalities, forward-looking agents, and many heterogeneous locations which are connected through costly goods trade and migration. Despite this rich economic environment, the analysis yields sharp conditions on model parameters under which there are unique dynamics that nevertheless feature substantial persistence and path dependence. Estimating the model using data on US counties from 1800 to 2000, they find that small historical shocks leave a sizable trace for several centuries, and can cause large and permanent differences in long-run aggregate welfare.[53]

Related research has explored the implications of the sorting of heterogeneous agents across geographic space. Cecile Gaubert examines the role of the sorting of firms of heterogeneous productivity in explaining the productivity advantages of large cities.[54] Victor Couture, Gaubert, Jessie Handbury, and Erik Hurst study the implications of the sorting of workers of heterogeneous skill for gentrification and changes in real income inequality.[55] Such sorting of heterogeneous agents across geographic space has important implications for the rationale for so-called place-based policies that target particular regions, as analyzed by Fajgelbaum and Gaubert; Gaubert, Patrick Kline, and Danny Yagan; and Rossi-Hansberg, Pierre-Daniel Sarte, and Felipe Schwartzman.[56]

There is also a growing body of empirical research on the impact of transport infrastructure investments on the location of economic activity.[57] Stephan Heblich, Daniel Sturm, and I use the natural experiment of the mid-nineteenth-century invention of steam railways to provide evidence on the role of transport networks in shaping the spatial organization of economic activity.[58] Their key finding is that this new transport technology dramatically reduced travel times, thereby lowering commuting costs and permitting large-scale separation of workplace and residence. A quantitative urban model is shown to be remarkably successful at capturing the sharp divergence between nighttime and daytime population observed in the historical center of London from the mid-nineteenth cen-

tury onwards, as shown in Figure 4. Although this historical center experiences the largest absolute increase in employment as it specializes as workplace rather than residence, the highest percentage rates of growth in employment and population occur in the outlying suburbs, as these are transformed from open fields. These findings suggest that present-day technological changes that further reduce commuting costs, such as innovations in remote working and autonomous vehicles, have the potential to further decentralize economic activity.

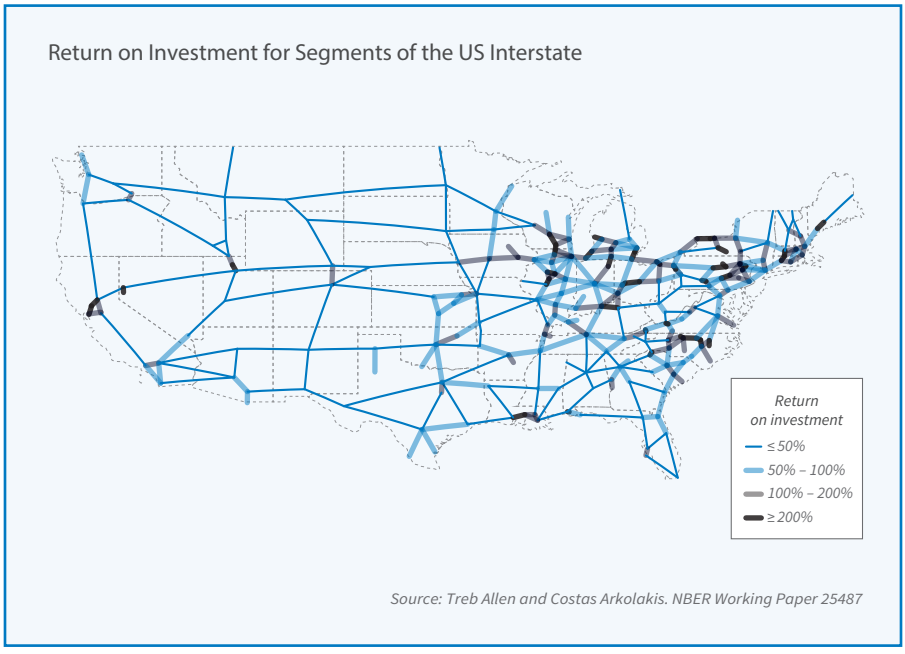


Source: Stephan Heblich, Stephen J. Redding, and Daniel M. Strum. NBER Working Paper 25047 and as "The Making of the Modern Metropolis: Evidence from London", The Quarterly Journal of Economics, 2020, page 2079, by permission of Oxford University Press

Figure 4

Policymakers are often interested in comparing possible alternative transport investments, such as which links in a railway or highway network to improve. To develop a theoretical framework to address this question, Allen and Arkolakis embed a specification of endogenous route choice in a quantitative spatial model.[59] In their approach, individuals consider travel costs and choose the least-costly route. A key implication of this framework is that the welfare effects of a small improvement in a transport link are equal to the percentage cost saving multiplied by the initial value of travel along that link. Applying this framework to both the US highway network and the Seattle road network, they find that the returns to investment are highly variable across different links in the transport network, as shown in Figure 5 for the US highway network, highlighting the importance of well-targeted infrastructure investment.

More generally, Fajgelbaum and Schaal develop a framework for characterizing optimal transport networks in spatial equilibrium.[60] They show that the problem of finding the optimal transport network can be transformed into the problem of finding the optimal flow in a network, which has been studied in the operations research literature. The planner chooses the optimal amount to invest in each link in the transport link, where the trade costs for each link are assumed to be increasing with the volume of traffic. Applying this framework to road networks in European countries, they find that road misallocation from the actual network deviating from the optimal network reduces real consumption by around 2 percent.



Source: Treb Allen and Costas Arkolakis. NBER Working Paper 25487

Figure 5

Trade and the Environment

The ITI Program has also contributed to research on the economics of climate change and the clean energy transition as a leading issue of contemporary debate.[61] Joseph S. Shapiro examines the role of international trade policy in shaping global carbon dioxide (CO_2) emissions patterns.[62] In most countries, import tariffs and non-tariff barriers are substantially lower on "dirty industries" — those with high CO_2 emissions per dollar of output — than on "clean industries," thereby providing an implicit subsidy to CO_2 emissions. Using a quantitative trade model to undertake a counterfactual in which similar trade policies are applied in clean and dirty industries, researchers find that global CO_2 emis-

sions fall substantially, with little cost in terms of global real income.[63]

A central feature of climate change is its uneven impact across locations, depending on initial climatic conditions, temperature, and proximity to the coast. Klaus Desmet, Robert E. Kopp, Scott A. Kulp, Dávid Krisztián Nagy, Michael Oppenheimer, Rossi-Hansberg, and Benjamin H. Strauss use a dynamic model of the world economy that features migration, trade, and innovation to evaluate the economic cost of coastal flooding.[64] Under an intermediate greenhouse gas concentration trajectory, permanent flooding is projected to reduce global real GDP in 2200 by 0.11 percent. Adaptation mechanisms are important in mitigating these real income costs of climate change. When the adaptation mechanisms of migration and investment are shut down, the loss in real GDP in 2200 increases to 4.5 percent. José-Luis Cruz and Rossi-Hansberg study the economic geography of global warming in a setting in which temperature directly affects both productivity and amenities, and the economy can adjust through goods trade, migration, innovation, and natality.[65] Welfare losses from global warming are as large as 15 percent in parts of Africa and Latin America, but also highly heterogeneous across locations, with northern regions in Siberia, Canada, and Alaska experiencing gains. Carbon taxes delay consumption of fossil fuels and help flatten the temperature curve but are much more effective when an abatement technology is forthcoming.

An important challenge in tackling environmental externalities that are global in scope is the so-called problem of leakage: when climate policies vary across countries, energy-intensive industries have an incentive to relocate to places with few or no emissions restrictions. David Weisbach, Kortum, Michael Wang, and Yujia Yao characterize optimal policy in such a setting with leakage and show it involves taxing both the supply of and demand for fossil fuels.[66] Bruno Conte, Desmet, and Rossi-Hansberg examine the economic impact of local carbon taxes in an economic geography model with agglomeration and congestion forces, in which regions are linked through both trade and migration.[67] In the presence of agglomeration and congestion forces, the market equilibrium need not be efficient. A unilateral carbon tax can be welfare improving, even in the short run when its effects on temperature have not been fully realized, with the effects of this policy depending importantly on how the revenue from the unilateral carbon tax is rebated.

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The COVID-19 Pandemic and Challenges Facing State and Local Governments

Jeffrey Clemens

Economic crises bring questions about the design and implications of fiscal systems to the forefront. In the United States, state and local governments employ roughly one in seven workers and spend an amount equivalent to one-fifth of GDP. Because many of these entities operate with balanced budget requirements, downturns create pressure because declines in revenue coincide with a rise in demand for public services. These pressures come with some urgency, as state and local governments play roles in the administration and financing of safety net programs, the delivery of public health services, and the provision of public transit and education.

At the outset of the COVID-19 pandemic, concerns over the budgetary health and service performance of state and local governments were top of federal policymakers' minds. This was driven in part by the experience of the Great Recession, after which the state and local public sectors were widely perceived as a drag on the broader economy. In an effort to avoid a repeat of this, federal policymakers legislated close to $1 trillion in fiscal assistance to state and local governments, substantially exceeding the roughly $225 billion in fiscal assistance appropriated during the Great Recession through the American Recovery and Reinvestment Act (ARRA).

Three distinct sets of questions relate to the design of federal fiscal assistance. One involves the design of formulas through which the assistance is delivered. Another addresses the macroeconomic impacts of federal fiscal assistance, an issue on which research blossomed following the Great Recession. A third set relates to the core functions of state and local governments: how was fiscal assistance deployed and what impacts did it have on outcomes under the purview of public health officials, safety net program administrators, school districts, and other government agencies?

The Stabilization Problem

At the pandemic's outset, Stan Veuger and I projected the potential effects of the pandemic on the revenues of state and local governments, as did a number of independent research teams.[1] An objective of our work was to inform policymakers regarding the amount of aid that might be justified on revenue stabilization grounds. We illustrated how the Congressional Budget Office's (CBO's) early-pandemic forecasts for personal income and personal consumption expenditures could be used as forecasts of the evolution of state and local tax bases. Multiplied by historical estimates of the elasticity of revenues with respect to fluctuations in tax bases, CBO's forecasts of declines in economic activity could be translated into forecasts of revenue shortfalls.

As Veuger and I explained later, two lessons emerged from our analysis.[2] First, in a predictive sense, revenue forecasts tended to perform better when they relied on close

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Clemens received both his BA and PhD in economics from Harvard University. He joined UCSD in 2012 after a year as a postdoctoral scholar at the Stanford Institute for Economic Policy Research. In addition to his NBER affiliation and position at UCSD, he is a visiting fellow at the Hoover Institution and a CESifo Network Fellow. His research has appeared in journals including the *American Economic Review*, the *Journal of Political Economy*, the *Journal of Economic Perspectives*, *American Economic Journal: Economic Policy*, *American Economic Journal: Applied Economics*, and a number of leading field journals.

rather than distant proxies for state and local governments' tax bases. At the COVID-19 pandemic's onset, forecasts that relied on the historical relationship between revenues and states' unemployment rates produced relatively inaccurate predictions. This is illustrated in Figure 1, which shows one set of projections, by Timothy Bartik of the Upjohn Institute,[3] that relied on forecasts of the unemployment rate, and another, by Veuger and me, that was based on projections of aggregate income and consumption. Because realized revenues would ultimately — and, to be clear, surprisingly — exceed prepandemic forecasts, larger shortfall forecasts were less accurate than smaller shortfall forecasts.[4] Forecasts that relied on disaggregated consumption and income data performed even better.[5] The shift in consumption towards goods and away from services led sales tax revenues to be more robust than most analysts expected. Predictions based on forecasts of disaggregated consumption data thus performed better than predictions based on forecasts of aggregate data.

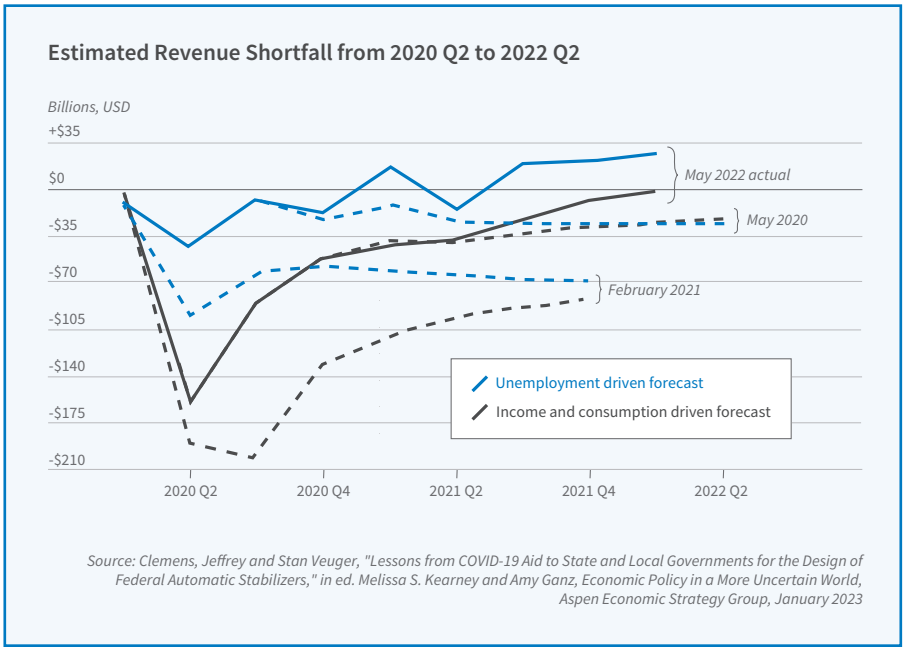

Figure 1

Second, revenue forecasts suffered from a reliance on forecasts of economic activity that, in CBO's tradition, reflected "current law." Consequently, the associated forecasts for the evolution of states' tax bases did not account for the effects of not-yet-passed pandemic-related aid for households and businesses. As a result, the forecasts of revenue shortfalls were based on a conceptual error of viewing revenue shortfalls and household and business financial stress as separate rather than interconnected phenomena.

The pandemic experience raises interesting questions about the tradeoffs associated with assistance distributed through pre-designed automatic stabilizers versus assistance delivered through ad hoc legislation. On the one hand, the use of automatic stabilizers enables aid to adjust seamlessly in response to economic conditions. This makes either over- or undershooting less likely and eases the pressure to legislate large-scale aid provisions in the midst of a crisis. On the other hand, ad hoc assistance packages might be better suited for targeting states in greatest need, since plans can be drawn up in response to events on the ground.

Veuger and I also examined the design of the specific formulas through which aid is dispensed. In one study, we explored the predictors of variations in per capita aid distributions across states.[6] Two interesting results emerged from this analysis, both of which connect aid distributions to variations in political representation. First, small states, which enjoy disproportionate representation in the Senate, received much larger per capita aid distributions than their midsize and large state counterparts. This "small-state bias" is illustrated in Panel A of Figure 2. At the extremes, the smallest, most overrepresented states enjoyed allocations in excess of $3,000 per capita larger than the largest and least represented states. Second, the transition from divided govern-

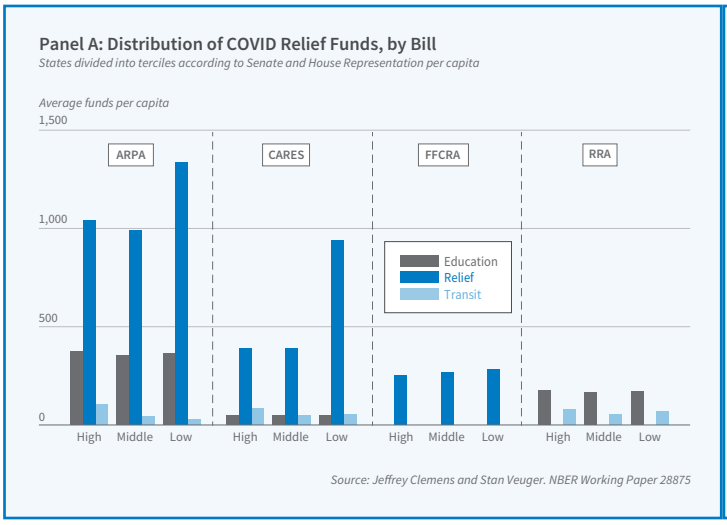

Figure 2, Panel A

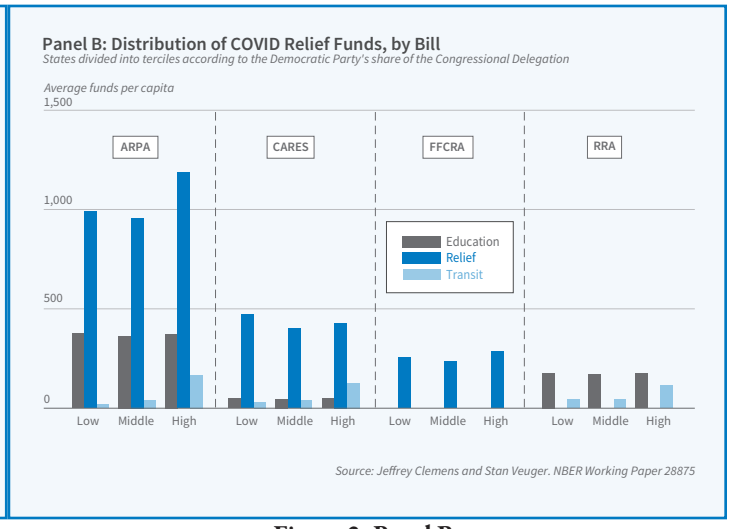

Figure 2, Panel B

ment to unified Democratic control in January 2021 mattered. Consistent with a role for this political shift, the formulas adopted for distributing general fiscal assistance and transportation grants became more favorable to Democratic-leaning states, as illustrated in Panel B of Figure 2. Education aid, by contrast, does not appear to have been reshuffled in a way that correlates with state-level partisanship.

In a second paper on the design of fiscal assistance formulas, Veuger, Benedic Ippolito, and I consider the prominent role of the Medicaid program in the design of fiscal assistance packages.[7] During each of the last three recessions, Congress has legislated aid to state governments in part by increasing the Federal Medical Assistance Percentage (FMAP) — the share of Medicaid expenditures reimbursed by the federal government. Such provisions distribute greater aid to states with higher baseline levels of Medicaid spending. It is of interest to know whether this aid targets states that experienced larger shocks to their Medicaid spending needs, rather than simply their baseline spending levels. On this first point, we found that changes in Medicaid enrollment through September 2020 were weakly correlated with the relief funds states received. Second, the Coronavirus Aid, Relief, and Economic Security Act linked the increase in states' FMAPs to their compliance with a requirement known as the continuous coverage provision. It prevented states from terminating benefits for Medicaid beneficiaries whose incomes rose beyond applicable eligibility thresholds. Congress removed the link between this provision and the availability of pandemic support funds in late 2022, and some states have now dropped it. We found that the projected costs of the continuous coverage requirement and the projected revenues linked to the enhancement of the FMAP were of similar magnitudes, making the net implications of these provisions for state budgets roughly neutral based on forecasts that were available when we conducted our analysis.

Effects of Fiscal Assistance on Macroeconomic Outcomes

Macroeconomic recovery, the preservation of employment, and the delivery of vital health and educational services were the primary stated goals of the federal government's fiscal assistance to state and local governments during the pandemic. What impact did federal fiscal assistance have on these outcomes in practice?

The key challenge to estimating the effects of fiscal stabilization funds is a standard endogeneity concern: stabilization efforts tend to target areas where conditions are poor, and therefore correlate negatively with economic activity. To overcome this source of bias, Philip Hoxie, Veuger, and I study the macroeconomic effects of pandemic fiscal assistance using an instrumental variables strategy.[8] Veuger's and my earlier work on the relationship between per capita aid distributions and political representation examined whether the large distributions of aid to small states could be explained by other factors. We found that factors including estimated state-level revenue shortfalls, the severity of the threat to public health, or other proxies for funding needs are only weakly correlated with variations in political representation. These findings support the use of the outsize aid distributions received by comparatively high-representation states as a form of natural experiment.

Using the variations in aid predicted by variations in political representation as a source of quasi-experimental variation, Hoxie, Veuger, and I analyzed the effects of fiscal assistance on employment and other macroeconomic outcomes. We estimated that the federal government allocated $855,000 for each state or local government job-year preserved, with plausible estimates ranging from $400,000 to $1.3 million. Further, we found little evidence for spillovers to either the broader labor market or to macroeconomic indicators including output and income. In a companion paper, John Kearns, Beatrice Lee, Veuger, and I found little evidence that pandemic fiscal assistance raised economic activity through spillovers that extended across state lines.[9]

The estimated effects of fiscal assistance on economic activity and employment are modest when compared to the estimated effects of similar programs during the Great Recession. Studies of the ARRA of 2009 suggest an employment multiplier ranging between $50,000 and $112,000 per job-year.[10] Our estimates of the cost per job-year also exceed estimates from analyses of the Paycheck Protection Program.[11] Furthermore, we find no effect on aggregate income, and cannot reject an output multiplier of zero for this spending, while estimates of the multiplier from previous periods dating back to the 1930s range from $0.50 to $2 in overall economic activity per dollar of government spending .[12]

More work on how pandemic fiscal assistance affected macroeconomic outcomes is sorely needed. While macroeconomic research has illuminated a pandemic's potential influence on both fiscal and monetary policy transmission mechanisms, direct evidence on the effects of pandemic-era fiscal assistance packages is limited.[13] In the wake of the Great Recession, by contrast, a wave of research on the stimulus impact of government spending exploited the rules that were used to allocate ARRA funds. Studies focused on variations in funding associated with Medicaid expenditures, highway assistance, and other assorted programs, arguing that the rules by which assistance was allocated were plausibly exogenous for the purpose of estimating jobs multipliers.[14] Of course, the renaissance in fiscal policy research following the Great Recession extended well beyond studies of the ARRA.[15] To date, few studies have considered the stimulus and jobs multipliers effects of pandemic fiscal assistance to state and local governments. Future research comparing the effects of pandemic and Great Recession-era fiscal assistance may have high returns, as the contrast between these episodes can help to shed further light on mechanisms through which fiscal assistance impacts economic activity.

Effects of Fiscal Assistance on Microeconomic Outcomes

One of the goals of policymakers designing pandemic-era fiscal assistance was the maintenance of education and public health services. The latter include the distribution of tests and vaccines and the collection of data describing the pandemic's advance. Hoxie, Kearns, Veuger, and I analyzed whether states that received more generous allocations of fiscal assistance established more robust testing and vaccination campaigns.[16] We estimated that fiscal assistance had at most a modest impact on the pace of vaccine rollouts, although it did have a substantial impact on the volume of tests administered. With respect to vaccines, these findings are consistent with the possibility that efforts to expand take-up of vaccines had reached their limit, making it difficult for additional federal funds to move the needle further. The demand for tests, by contrast, is less readily satiated, since tests deliver value with repeat rather than one-time use. Additional federal funds thus appear to have had room to expand the demand for and consumption of tests.

The data required to fully analyze the incidence of the pandemic fiscal relief packages on different spending programs and on tax revenues are not yet complete. For example, while data on school enrollments, staffing, and test scores well into the pandemic are now available, data on school district finances from the National Center for Education Statistics are processed with longer lags. Similarly, the Census Bureau's Annual Survey of State and Local Government Finances was not updated to include 2020 data until July 2022. It will thus take time before the budgetary impacts of pandemic fiscal assistance can be more fully understood.

In contrast, data on major tax policy changes already exist. Veuger and I have found that larger fiscal relief allocations predict a lower likelihood of reductions in corporate tax rates, suggesting that fiscal assistance packages did not initiate a wave of corporate tax competition.[17] Future analyses can explore the impact of pandemic fiscal assistance on a richer array of tax policy instruments, budgetary outcomes, educational attainment outcomes, and other outcomes linked to the core functions of state and local governments.

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Longevity and the Well-Being of Populations

Adriana Lleras-Muney

Life expectancy has increased tremendously in the United States, from an average of roughly 47 years in 1900 to 77 years in 2020. However, increases in longevity have not been equally distributed among all subgroups of the population. Longevity is an important component of well-being, possibly as important as income; people are willing to pay very large sums to protect and increase it. Understanding the evolution and distribution of lifespan is critical to understanding changes in population well-being. In this article I discuss how my research has contributed to our understanding of these patterns.

Disparities in Childhood Environments

Lifespan is unequally distributed across space and depends on where individuals are born and where they live. For example, among women born in 1900 who survived to age 40, those born in West Virginia lived to age 76.6, while those born in North Dakota lived 3.4 years longer. Similarly, the gap between men born in the highest and lowest life expectancy states was about four years.[1] This suggests that some disparities can be traced to childhood and particularly to the environments in which children grow. But what elements of the environment matter and, more importantly, what interventions would benefit children and increase their longevity?

Perhaps not surprisingly, family income during childhood matters. Previous work has shown that the association between family income and health is small at birth but grows over the lifetime.[2] Poor children eventually turn into poor adults, and poor adults live substantially shorter lives.[3] But can governments help children growing up in poverty? Anna Aizer, Shari Eli, Joseph Ferrie, and I show that cash transfers to poor mothers given through the Mothers' Pensions program — the precursor to Aid to Families with Dependent Children — increased the longevity of their sons (Figure 1).[4] The median transfer lasted three years and amounted to roughly 30 percent of family income. Boys in families that received transfers lived more than a year longer as a result.

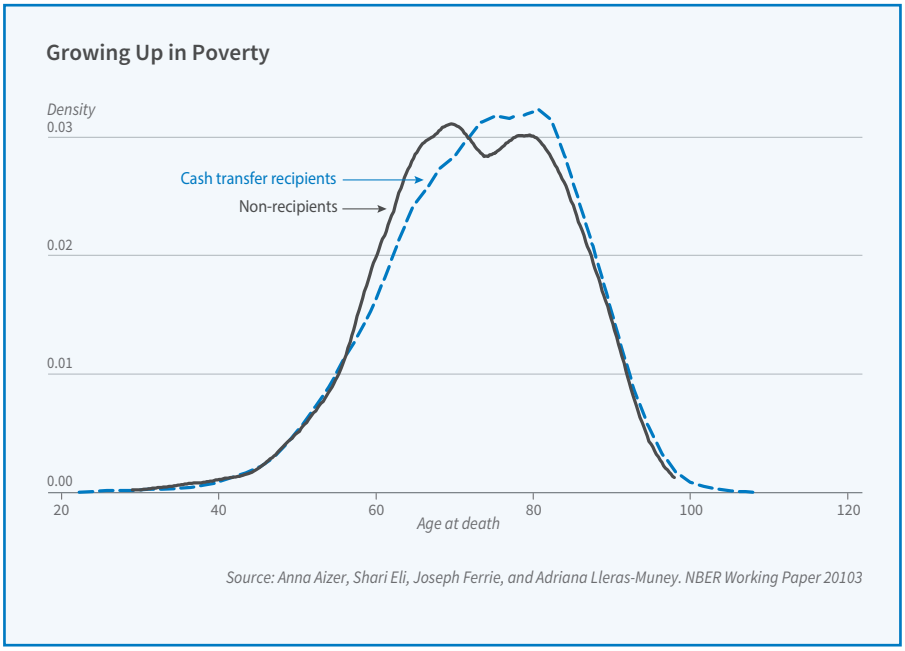

Figure 1

Adriana Lleras-Muney is a professor of economics in the Department of Economics at the University of California, Los Angeles (UCLA). She is an NBER research associate affiliated with the programs on Health Economics, Health Care, Economics of Aging, and Children. She is an associate editor of the *Journal of Health Economics*, serves on the board of editors of *Demography*, and will join the board of editors of the *American Economic Review* in July. She served as a permanent member of the Social Sciences and Population Studies Study Section at the National Institutes sof Health, and was an elected member of the American Economic Association Executive Committee. In 2017, she won a Presidential Early Career Award for Scientists and Engineers.

Lleras-Muney's research examines the relationships between socioeconomic status and health, with a particular focus on the impacts of education, income, and policy. Her most recent work investigates the long-term impact of government policies on children by analyzing the effects of programs like the Mother's Pension program and the Civilian Conservation Corps, implemented during the first half of the twentieth century. Her work has been published in leading journals such as the *American Economic Review*, *Econometrica*, *The Review of Economic Studies*, and *The Quarterly Journal of Economics*. Lleras-Muney received her PhD in economics from Columbia University and was an assistant professor of economics at Princeton University before moving to UCLA.

Previous work also has shown that individuals graduating from college in recessions have substantially higher mortality later in life, and lower lifetime incomes, than those who graduate in stronger economic circumstances.[5] But can programs that target unemployed youth undo these harms? Aizer, Eli, Guido Imbens, Keyoung Lee, and I study the impacts of the Civilian Conservation Corps, a youth employment program in place during the Great Depression that provided employment and training to unemployed men (but not women) ages 17 to 25.[6] We find that young men who participated in the training program for a longer time had greater lifetime earnings and longevity (Figure 2).

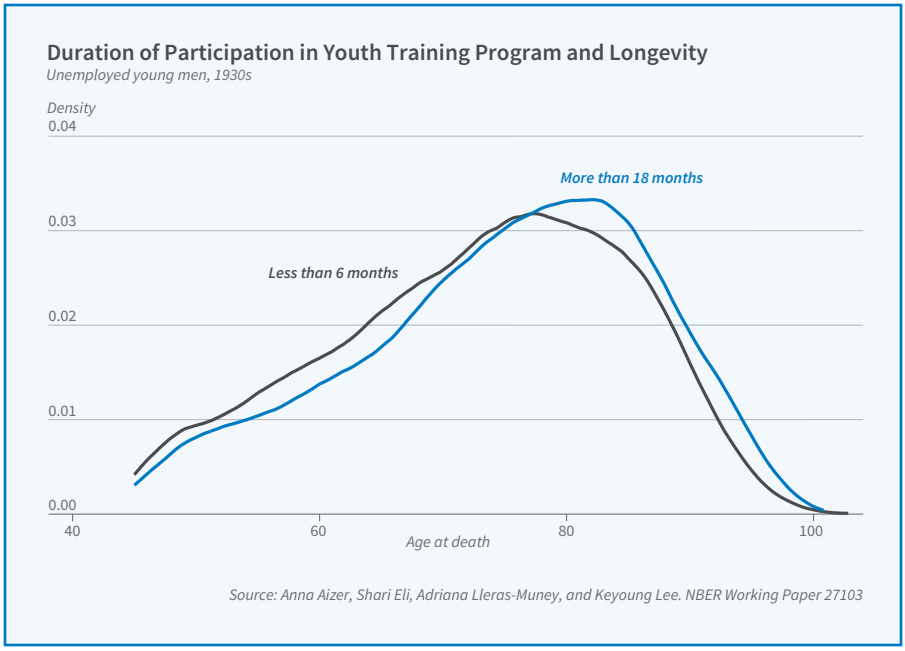

Figure 2

These studies show that the environments in which children grow up and the conditions in which they enter adulthood matter, and more importantly, they show that interventions to improve their circumstances can have large consequences over the lifetime, at least for men.

In both studies, we only observe intervention-related declines in mortality at older ages: there is no visible impact before age 55 or so. Why do the effects of childhood conditions manifest only later in life, and how can we predict the long-term effect of changes in the environment? To understand this, Flavien Moreau and I posit and estimate a model that tracks the evolution of health and mortality from birth to death for a given cohort and use it to understand the effects of temporary and permanent shocks.[7] The model predicts that adverse conditions throughout life will have nonlinear effects on health and mortality. The gap in mortality rates between affected and unaffected populations is U-shaped (Figure 3, right axis). Early on, adverse circumstances increase mortality. But because of selective mortality — the least healthy die — and health investments among the survivors, the gaps in mortality between affected and unaffected populations will not be large between ages 5 and 40. Starting in middle age, when mortality rates start rising with age, the gap in mortality rates between affected and unaffected populations grows. As the figure shows, these patterns are quite different when expressed in logs (left axis): log gaps, or effects in roughly percentage terms, are hump shaped instead of U shaped and diminish with age after a certain point. These predicted patterns by age match previously documented differences in mortality rates by education and income.

Our model in combination with the empirical evidence suggests caution for those evaluating interventions: longevity gains to early interventions may be substantial, but we should not expect to observe them before individuals reach mature ages. These results also suggest optimism for the future of populations I have not studied. Disparities in longevity by race today are large, but it is likely that the improved childhood conditions experienced by Black people in recent years, manifested in the continued decline in under-5 mortality rates for this group in the last four decades, presage increased longevity in the future despite recent negative shocks.[8]

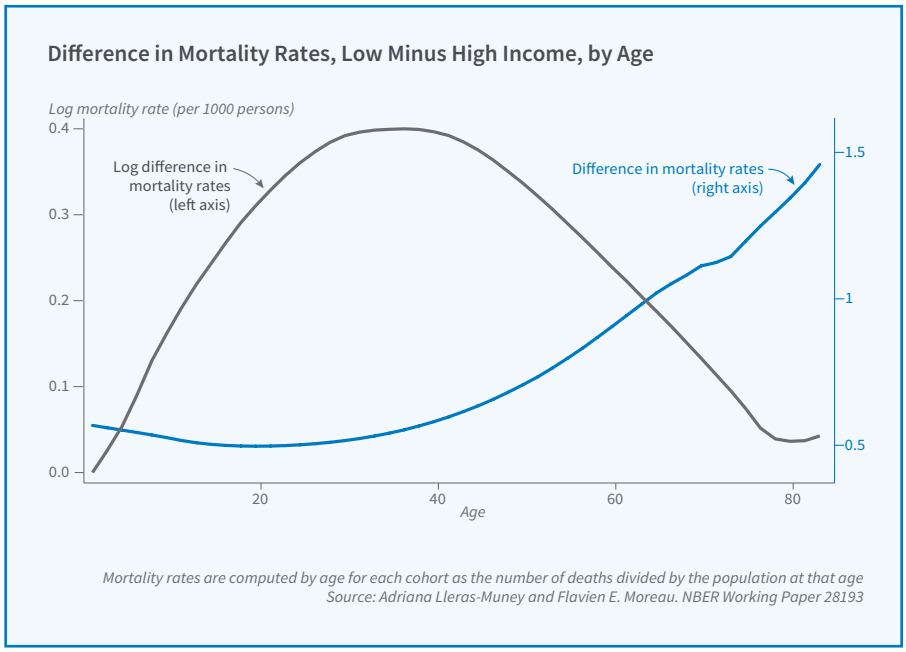

Figure 3

Education Disparities: When and Why?

Education, which is largely experienced in childhood, is a very strong predictor of many lifetime outcomes, including longevity. In the early 1990s, those with a college degree could expect to live 2.6 years longer than those without one. By 2020, this gap had grown to more than 6 years.[9] A key question then is whether the effect of education on longevity is causal or whether the association is due to other factors.

I attempted to answer this question by comparing the life expectancy of those who attended secondary school for different durations in the first half of the twentieth century because compulsory education laws in the US forced children to attend school for a different number of years over time and across states.[10] Many subsequent studies followed a similar strategy in other countries and for different cohorts. Titus Galama, Hans van Kippersluis, and I summarized this body of research.[11] Although the original US study suggested the effect of education on mortality was causal and large, the same does not hold true in all other settings. In general, the benefits of education appear to be larger for men than for women, but even among men the effects only exist for some cohorts and in some countries. Why?

I argue that the effect of education on health and longevity — the "education gradient" — is mediated by context. One important contextual dimension is the rate of technological innovation. Gradients vary with technical innovation and knowledge because individuals with more education can adopt and access innovations first and at greater rates. Indeed, David Cutler and I document that more educated individuals were more likely to smoke in the 1950s, but they became less likely to smoke in subsequent decades as information about the harms of smoking was disseminated.[12] Relatedly, in work with Sherry Glied, I find that education disparities in mortality are larger for diseases for which there has been more innovation.[13] This relationship suggests that the effects of education on longevity might be less important when there is less innovation.

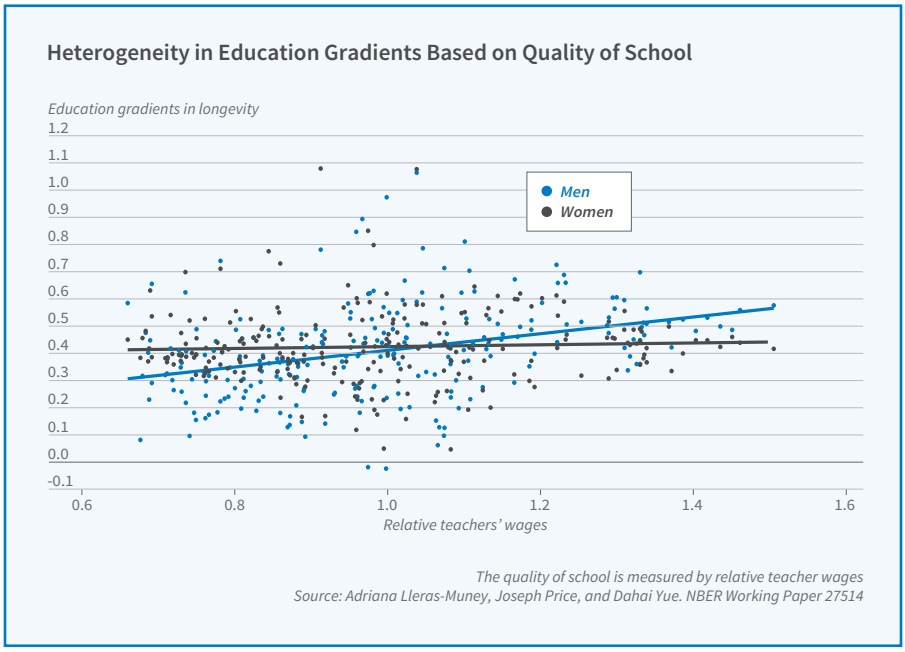

Figure 4

Economic conditions also matter because they determine the employment and earnings paths of individuals throughout their lives. Both employment and lifetime income affect longevity. Cutler, Wei Huang, and I show that education is more strongly associated with longevity among those graduating in bad economic times than for those graduating in good times.[14] This suggests that the effects of education on longevity are larger when the labor market benefits of schooling are larger.

Finally, variation in education gradients may reflect variation in the quality of schooling. The number of years spent in school, the measure most typically used in research studies, can lead to different levels of cognitive and noncognitive skills in different settings because the quality of education varies: two individuals with 12 years of school can have vastly different levels of mathematics skills, or levels of writing proficiency for example, depending on the quality of the school they attended. These differences can matter for health because many of the skills learned in school affect decision-making. Joseph Price, Dahai Yue, and I document that for White men, but not women, the gap in longevity between the more and less educated within families was substantially larger in places where teachers were well paid, the school year was longer, and pupil-teacher ratios were lower. Figure 4 shows these results for teachers' wages. We find that these education gaps also were larger for men who grew up in richer environments and among more educated people, and where the level of health care was greater. In sum, in places with greater inputs to human capital, the benefits of schooling in terms of longevity are also larger, at least for men.

Gender Puzzles

Today, women live longer than men in almost every country. In the US, women live on average to age 79.8, whereas men live only to age 74.1, a 5.7-year gap. In 1900 this gap was only 2.5 years.[15] Though several genetic and other biological differences benefit women, it is not clear why gender gaps in longevity have grown so much. Some of the increases in female longevity were driven by the near elimination of maternal mortality, due to the development of sulfa drugs and later of blood transfusions and penicillin, as Seema Jayachandran, Kim Smith, and I show.[16] However, Claudia Goldin and I demonstrate that these declines in mater-

nal mortality can explain only a modest portion of the increases in life expectancy for women and thus of the gender gap in life expectancy.[17] Declines in fertility might explain another portion, but this explanation also seems unlikely to be a large contributor: in 1900 the total fertility rate was already relatively low, at fewer than four births per woman.

Innovation in female disease could also explain the gaps. However, with some important exceptions, technological advances in medicine after 1950 typically targeted diseases associated with males and were tested mostly on men. It thus remains a puzzle whether or why women have gained more over time from these advances. It is also not clear that women's life expectancy gains are due to the economic progress of women more generally. In fact, others have noted that the gender gap in life expectancy started to fall as women entered the labor force and became "more like men" in terms of work and consumption behaviors such as smoking. Goldin and I hypothesize instead that the decline in infectious disease that occurred in the first half of the twentieth century benefited women more: as caretakers, women were more likely to be exposed to infectious disease early in life, and they might have suffered more long-term consequences from this exposure in the past when infectious diseases were rampant. However, this theory linking exposure to infectious disease early in life and longevity remains untested.

More generally, the environments or conditions that benefit women's longevity are poorly understood but they appear to be quite different from those that benefit men. Aizer, Eli, Sungwoo Cho, and I find that poor women who received transfers as adults through the Mothers' Pension program did not live longer, even though their sons did.[18] In recent (unpublished) work, we follow the daughters of the recipients and we also find that, in contrast to their brothers, daughters did not live longer as a result of the cash transfers. It is unclear why.

Socioeconomic gradients in mortality by gender also present a puzzle. As noted earlier, education gradients are typically larger, when they exist, for men than for women. Even when gradients are observed for both men and women, factors that predict the size of the gradient for men cannot explain it for women. As Figure 4 shows, the correlation between education and longevity is larger for men who grew up in states where the quality of education was better. However, the same does not appear to be true for women. In fact, we cannot find any marker for childhood conditions that explains why the associations between education and longevity vary for women across cohorts and places, whereas almost all the characteristics of the environments we measure — average education, income, health care availability — affect the correlation between education and longevity for men. The finding that innovation leads to greater education disparities in mortality among men was not true for women either.[19] Understanding what environments benefit women and why women's health and longevity respond differently to the same inputs as men's is an important area for future research.

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Stiglerian Growth

Guido Menzio

Search frictions in the labor market make it difficult for workers to locate the jobs that best suit their abilities. Search frictions in the product market make it difficult for buyers to find the products that best suit their preferences. Improvements in information and communications technology (ICT) that have ostensibly reduced search frictions —telephones, fax machines, the internet, smartphones — should have made it easier for workers to find better jobs and, in turn, led to labor productivity growth. The same technological improvements should have made it easier for buyers to locate sellers and, in turn, led to welfare gains.

I refer to the economic growth generated by declining search frictions as "Stiglerian growth" because George Stigler was the first to recognize the importance of information frictions in product and labor markets, and to understand that they can cause misallocation. In Stigler's words, "The better informed the labor market, the closer each worker's product to its maximum at any given time," and conversely, "In a regime of ignorance, Enrico Fermi would have been a gardener, Von Neumann a checkout clerk at a drugstore."[1]

Stiglerian Growth in the Labor Market

Paolo Martellini and I try to measure the effect of declining search frictions on productivity growth in the labor market.[2] Measuring this effect requires identifying the structure of the search problem facing workers and firms, assessing the effect of technological improvements on the rate at which workers and firms come into contact, and assessing the addition to productivity induced by an increase in the contact rate between workers and firms.

Search frictions in the labor market cause unemployment and vacancies to coexist. In fact, search frictions make it time-consuming for workers to locate job openings and for firms to locate workers to fill vacant jobs, and in aggregate they lead to the coexistence of unemployment and vacancies. As search frictions decline due to improvements in ICT, one would expect the labor market to converge towards an equilibrium in which the unemployment and vacancy rates are both zero. Indeed, this is the prediction of the canonical Diamond-Mortensen-Pissarides search-theoretic model of the labor market.

This prediction is not borne out in the data, calling this model into question. Figure 1 is the scatterplot of the unemployment rate and the vacancy rate — the Beveridge curve — in the United States from 1927 to 2019. There is no evidence that the curve has shifted inward — to the left — over time. Figure 2 plots the time series of the unemployment rate and the vacancy rate, and Figure 3 plots the time series of the rate at which unemployed workers become employed (UE rate) and the rate at which employed workers become unemployed (EU rate). There are no clear secular trends in any of these series.

A credible search model must rationalize the stability of the Beveridge curve and the stationarity of unemployment, vacancy, UE, and EU rates in the face of the massive improvements in ICT that took place between 1927 and 2018. How can it do that? Suppose that firms and workers searching the labor market meet according to some matching function with an efficiency parameter that grows over time at the rate

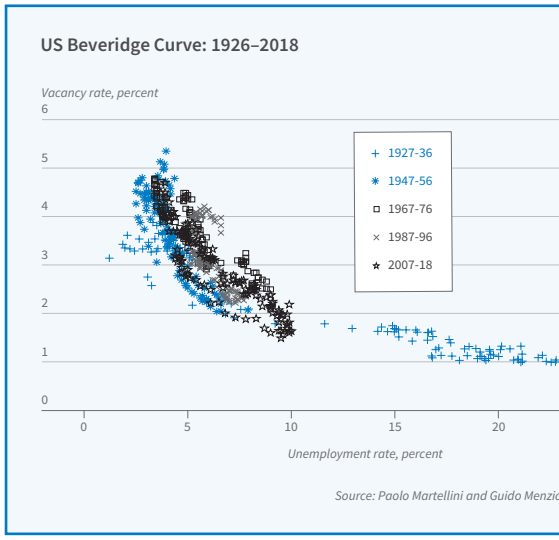


Figure 1

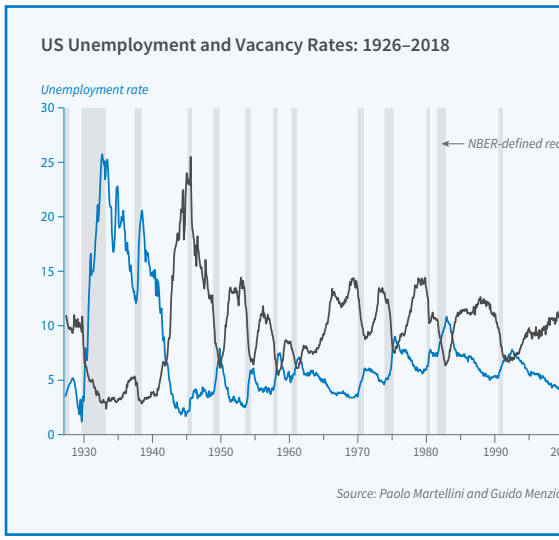


Figure 2

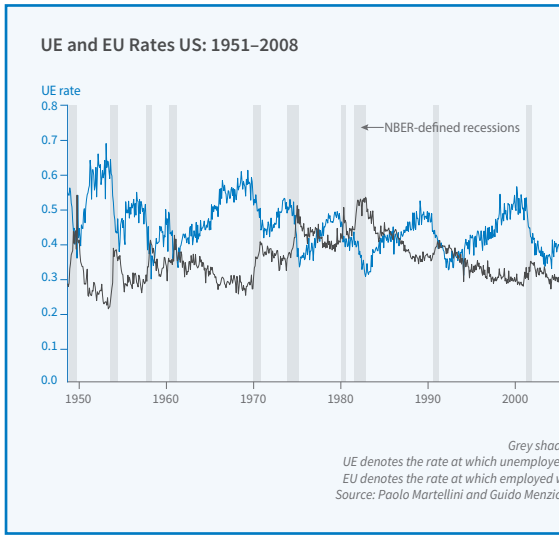
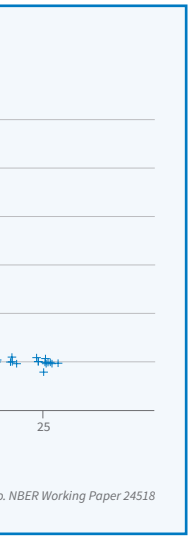
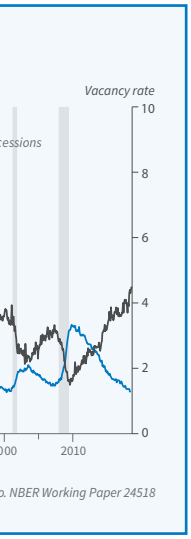
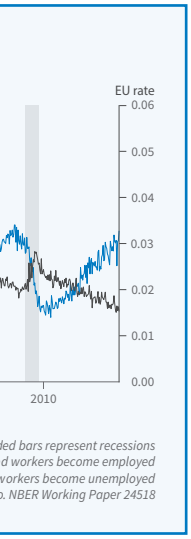


Figure 3







of g_A. Suppose that upon meeting, a firm and a worker observe how productive their match will be, and based on that, they decide whether to enter an employment relationship. In such a model, declining search frictions have two countervailing effects on the unemployment rate. On the one hand, declining search frictions increase the rate at which workers meet firms, which tends to lower the unemployment rate. On the other hand, declining search frictions increase the quality cutoff above which workers and firms are willing to enter an employment relationship, which tends to increase the unemployment rate. If match quality is distributed according to a Pareto distribution, the two effects cancel out. Specifically, there exists a balanced growth path along which the unemployment, vacancy, UE, and EU rates remain constant and the Beveridge curve remains stable. Along the balanced growth path, declining search frictions generate economic growth and labor productivity grows at the rate of g_A/α, where α is the tail index parameter for the Pareto distribution of match quality.

The rate of "Stiglerian growth" in the labor market, g_A/α, thus depends on the product of the rate at which search frictions decline, g_A, and the reciprocal of the Pareto distribution parameter, $1/\alpha$, which is a measure of the heterogeneity in a worker's productivity when employed in different jobs. Conceptually, measuring these two quantities is a straightforward task. The rate at which search frictions decline is equal to the growth rate of the average number of workers who apply to a vacancy before the vacancy is filled. The tail index α of the Pareto distribution of match quality is related to the cross-sectional dispersion of wages for identical workers. Concretely, measuring g_A and α is difficult. It is, nonetheless, possible to carry out some back-of-the-envelope calculations.

In 1980, the average number of applicants per vacancy was around 24. In 2010, it was around 45. Thus, over the period 1980–2010, the average growth rate of applicants per vacancy was about 2.2 percent per year; this is an estimate of g_A. If the Pareto parameter is 5, the productivity of a worker who draws a match at the 90th percentile of the distribution — a very good match — is 37 percent greater than that of an identical worker who draws a median (50th percentile) match. In light of empirical studies that provide structural decompositions of wage dispersion, a 90-50 percentile ratio of 37 percent seems like a conservative estimate of the extent of residual wage dispersion. For g_A = 2.2 percent and α = 5, Stiglerian growth in the labor market is about 0.44 percent per year, about 20 percent of the observed long-term growth rate of labor productivity.

In follow-up research, Martellini and I try to measure the extent to which Stiglerian growth has unequal effects across different workers.[3] The aggregate return to declining search frictions depends on the extent to which, on average, the productivity of an individual worker varies across different jobs. If the heterogeneity in a worker's productivity in different jobs varies systematically across different subgroups of workers, the return to declining search frictions will also vary across groups. The growth rates of productivity and wages will also vary. For workers who are equally productive across many different jobs, who we call "jacks of all trades," the return to additional job search is minimal and so are the productivity and wage gains from declining search frictions. For workers whose productivity is very different in different jobs, "masters of one trade," the return to search is large and so are the productivity and wage gains from declining search frictions. We similarly classify occupations based on the tasks that workers in them must perform. We assume that workers in routine occupations — where the same tasks are performed over and over again, for example by retail clerks or machine operators — are more likely to

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Before joining NYU, Menzio was a professor in the Department of Economics at the University of Pennsylvania. He was a National Fellow at the Hoover Institution at Stanford University in 2008, a visiting professor at Princeton University in 2013, and a consultant at the Federal Reserve Bank of Minneapolis in 2016. He was awarded the biannual Carlo Alberto Medal for the best Italian economist under the age of 40 in 2015, and was elected a Fellow of the Econometric Society in 2022.

Menzio is a theoretical macroeconomist. His research focuses on the conceptual — and occasionally the empirical — analysis of markets where finding trading partners is time consuming. He received a BA in economics at the University of Torino in 1999 and a PhD from Northwestern University in 2005. He currently lives in New York with his wife, Tal Correm, and two daughters, Agata and Aliza.

be jacks of all trades. We correspondingly assume that workers in nonroutine occupations are more likely to be masters of one trade, since the nature of their tasks may vary significantly from job to job.

We sort occupations into bins based on their degree of routine. Figure 4 plots the average ratio of the 75th percentile wage to the 25th percentile wage in the 1980 cross-sectional distribution of wages for occupations with different degrees of routine. There is a clear negative relationship between the degree of routine in an occupation and its wage dispersion, which corroborates the presumption that the productivity of a worker in a routine occupation is less heterogeneous across jobs than the productivity of a worker in a nonroutine one. Figure 5 plots an occupation's 75-25 percentile ratio in 1980 and the growth rate of wages between 1980 and 2015 for occupations in different bins. There is a clear positive relation between an occupation's wage dispersion and the growth of wages in that occupation. Since an occupation's degree of routine is related to its wage dispersion, this finding is consistent with the prediction of Stiglerian growth: the return to declining search frictions positively depends on the extent of heterogeneity in a worker's productivity across different jobs. Naturally, not all the difference in wage growth between routine and nonroutine occupations is due to unequal returns to declining search frictions. Back-of-the-envelope calculations suggest that about 30 percent is.

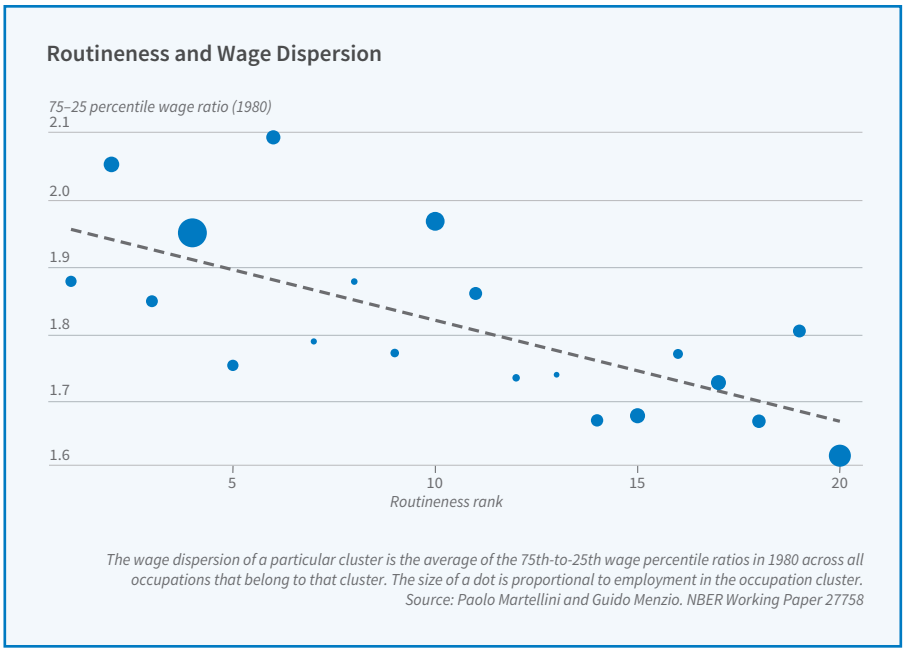

Figure 4

Stiglerian Growth in the Product Market

My recent work seeks to understand the implications of declining search frictions for price dispersion, competition, and growth in product markets.[4] In the context of a product market, search frictions mean that buyers cannot purchase from just any seller, but only from those with which they come into contact. With search frictions, there is price dispersion in equilibrium. Buyers cannot eliminate price dispersion through arbitrage because they are not in contact with all of the sellers. Sellers post different prices because mass points in the price distribution create opportunities to increase profits. As search frictions decline, the market becomes more competitive: sellers post lower prices, price dispersion declines, and buyers capture an increasing share of the gains from trade. As search frictions vanish, sellers post prices equal to marginal cost, price dispersion disappears, and buyers capture all of the gains from trade. These are the predictions of the canonical search-theoretic model of the product market of Gerard Butters,[5] Hal Varian,[6] and Kenneth Burdett and Kenneth Judd.[7]

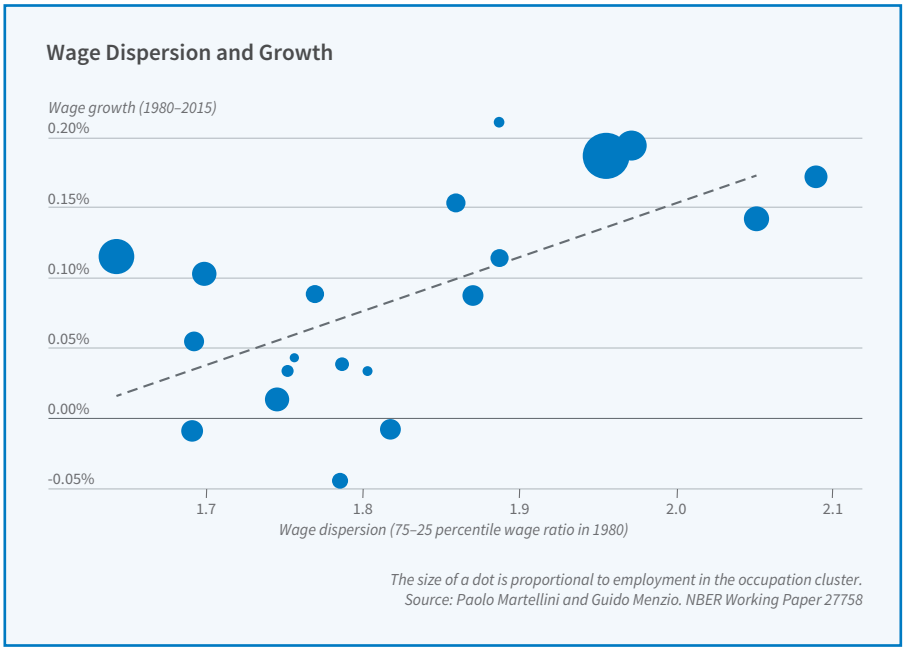

Figure 5

From the perspective of the model, it is puzzling that improvements in ICT — which presumably made it easier for buyers to contact sellers — have not led to a noticeable decline in price dispersion. Indeed, the extent of price dispersion in the 1970s, in the 1990s, and in the 2000s is quite similar. Relatedly, price dispersion does not appear to be significantly lower in online than offline markets.

How can the search-theoretic model of the product market be reconciled with the empirical evidence? Suppose that sellers choose whether to design more or less specialized varieties of a product. Varieties that are more specialized appeal to a smaller fraction of buyers but, conditional on being appealing to a buyer, they provide higher value. Varieties that are less specialized appeal to a larger fraction of buyers but, conditional on being appealing to a buyer, they provide lower value. Buyers contact a number of randomly selected sellers. This number is assumed to be drawn from a Poisson distribution with a mean that grows over time, reflecting declining search frictions. Declining search frictions once again have countervailing effects on the extent of market competition. On the one hand, they allow buyers to contact more sellers. This effect tends to make the market more competitive. On the other hand, declining search frictions imply that sellers meet more potential buyers and, for this reason, they find it optimal to design more specialized product varieties. This tends to make the market less competitive, as it reduces the probability that a buyer finds a particular seller's variety appealing. Under some conditions, the two effects offset each other. More specifically, there exists a balanced growth path along which the shares of the gains from trade accruing to buyers and sellers and the extent of price dispersion remain constant in the face of declining search frictions.

A version of the search-theoretic product market model in which sellers can decide to horizontally differentiate explains why price dispersion has not been trending down. The same version of the model implies that declining search frictions generate economic growth. In fact, along the balanced growth path, declining search frictions raise buyers' gains from trade, sellers' gains from trade, and welfare at the rate which is proportional to the elasticity of the buyers' utility with respect to the degree of specialization of a variety of the product that the buyer finds appealing. Intuitively, declining search frictions increase welfare because they allow sellers to design varieties of the product that are more precisely tailored to the heterogeneous preferences of different buyers. As in the labor market, the return to lower search frictions, and hence Stiglerian growth, leverages heterogeneity. In the labor market, the relevant notion of heterogeneity is the extent to which the productivity of an individual worker varies across different jobs. In the product market, the relevant notion is the extent to which buyers differ in their valuation of a particular product variety.

In follow-up work, James Albrecht, Susan Vroman, and I examine the effect of declining search frictions on competition and growth in a version of the search-theoretic model of the product market in which sellers can decide to vertically differentiate.[8] Buyers have identical preferences. Sellers invest in the quality and variety of their products. Now, in contrast to the search-theoretic model with horizontal differentiation, declining search frictions make sales more concentrated and quality more dispersed. Intuitively, as search frictions decline, buyers' set of choices grow, high-quality sellers trade with more buyers, and low-quality sellers trade with fewer. Since high-quality sellers trade more, they choose to invest more in quality, while low-quality sellers trade less and disinvest in quality. Price dispersion may actually increase.

As in the version of the model with horizontal differentiation, declining search frictions generate economic growth, but for different reasons. Declining search frictions make the gains from trade accruing to buyers and to sellers as well as total welfare grow at a rate that depends on the rate at which frictions decline and the elasticity of the sellers' product design cost with respect to quality. With horizontal differentiation, declining search friction leads to growth by leveraging the heterogeneity in the preferences of different buyers. With vertical differentiation, it leads to growth by leveraging increasing returns to scale. Returns to scale are increasing because a seller's cost of designing a product variety is a fixed cost. Search frictions constrain the reach of a seller and limit the extent to which increasing returns can be realized. As search frictions decline, the reach of a seller grows, which unlocks the power of increasing returns.

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Evaluating Urban Transportation Policies

Panle Jia Barwick and Shanjun Li

Traffic congestion poses a significant challenge in urban centers, especially in fast-growing emerging economies where rapid urbanization and increased travel demand have outpaced road infrastructure and regulations. Longer travel times and worsened air quality resulting from congestion hinder mobility and urban development while reducing the overall quality of life. In the 2018 TomTom Traffic Index, which is based on real-time GPS traffic data from 403 cities in 56 countries, the 10 most congested cities were all in developing and emerging economies. In these cities, commuters spent over 200 hours of extra travel time per year relative to when transport was flowing freely.

Local governments have implemented a range of policies to address traffic congestion, targeting both the demand and supply sides of road infrastructure. On the demand side, policies encompass command-and-control style driving restrictions, vehicle purchase quota systems, and market-based congestion pricing. On the supply side, efforts have been made to expand public transit options and to enhance road capacity.

This summary describes our research on the impact of various urban transportation policies aimed at alleviating traffic congestion and air pollution. We focus on measuring crucial quantities, including the marginal external cost of traffic congestion, and evaluating different policies in terms of both efficiency and equity within an integrated framework. Much of our analysis focuses on Beijing. With a population of over 21 million, the city has consistently ranked among the most congested in the world. Its municipal government has implemented aggressive demand-side and supply-side policies over the past 15 years, making it an ideal setting for studying urban transportation policies.

Estimating the Marginal External Cost of Congestion

Economic theory indicates that the optimal congestion charge is equal to the marginal external cost of congestion (MECC) at the socially optimal level of traffic. The MECC critically hinges on the incremental effect of traffic density on traffic speed: how much an additional vehicle on the road slows down the traffic. Empirical estimation of the density-speed

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relationship is subject to the endogeneity challenge, as speed and density affect each other and both are equilibrium outcomes influenced by idiosyncrasies. Our study provides, to our knowledge, the first causal estimate of the density-speed relationship by leveraging plausibly exogenous variations in traffic introduced by Beijing's driving restriction policy.[1]

There are six circumferential or "ring" roads around central Beijing. Government policy prohibits certain vehicles from driving within the fifth ring road from 7 am to 8 pm during workdays. There is a predetermined rotation schedule based on the last digit of a vehicle's license plate. There are days for numbers 1 and 6, 2 and 7, 3 and 8, 4 and 9, and 5 and 0. Due to the nonuniform distribution of the last digit of license plate numbers, the policy exogenously shifts the number of vehicles on the road. Notably, vehicles with license plates ending in the number 4 constitute only about 2 percent of all vehicles due to Chinese cultural aversion to the number 4. Consequently, on days when vehicles with license plates ending in 4 and 9 are restricted, there are more vehicles on the road, leading to heightened congestion compared to other days. This variation in traffic speed and density as shown in Figure 1 is used to establish the causal relationship between traffic speed and density.

Our analysis, utilizing a year's worth of hourly traffic data from about 1,500 monitors in Beijing, reveals that addressing endogeneity in the relationship between speed and density results in a 60 percent increase in the estimate of the MECC compared to that obtained through an ordinary least squares regression. Therefore, relying on the latter would induce a significant downward bias in optimal congestion charges. Additionally, the MECC exhibits notable heterogeneity over time and particularly across different locations. Our analysis demonstrates that implementing time-varying and location-specific congestion charges could lead to substantial congestion reduction, welfare gains, and increased government revenue.

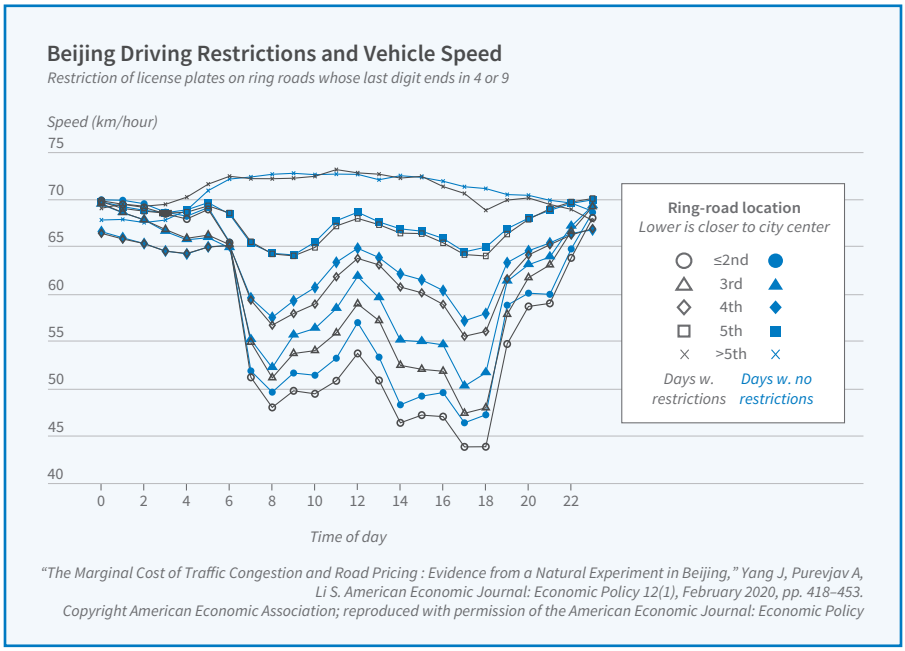
A Unified Framework for Policy Comparison

Our studies are part of a large literature that examines the effects of transportation policies on outcomes such as vehicle ownership, travel mode choices, traffic congestion, air pollution, housing prices, and job access. Our analysis of vehicle quota systems suggests that while a lottery system is more equitable and effective than an auction in reducing automobile externalities, this advantage is offset by a significant cost from misallocation.[2] Studying the opening of 14 new subway lines during 2008–16 in Beijing, we found that subway expansions improved air quality, but that the resulting health benefit was small relative to the construction and operating costs. Hence, the cost of subway expansion would need to be justified by traffic congestion relief and other economy-wide impacts.[3] With respect to driving restrictions, we find that the policy in Beijing steepened the housing bid-rent curve, led to a higher premium for properties closer to subway stations, and changed the spatial distribution of households around subway lines.[4]

Empirical studies that evaluate and compare different policies within a unified framework are scarce. To address this gap, we have developed an equilibrium model of residential sorting that allows us to compare the efficiency and equity impacts of various transportation policies.[5]

In the model, households choose a residence based on the job locations of their working members. A key consideration is ease of commute for each working member. The ease-of-commute measure is derived from a model of travel mode choices and crucially depends on traffic congestion, which varies across locations and results from all households' travel choices and residential locations. Our explicit modeling of the travel mode choices to derive the ease-of-commute measure provides a microfoundation for the linkage of the housing market and the transportation sector. This modeling choice represents an important departure from the literature which typically uses distance to the central business district to capture the ease of the commute without endogenizing congestion.

In the housing market, choices of individual households aggregate to total housing demand and house prices adjust to equalize demand and supply. In the transportation sector, the equilibrium congestion level and hence driving speed are jointly determined by the driving demand of all individuals and road capacity. These two markets interact in two dimensions: the spatial loca-



"The Marginal Cost of Traffic Congestion and Road Pricing : Evidence from a Natural Experiment in Beijing," Yang J, Purevjav A, Li S. American Economic Journal: Economic Policy 12(1), February 2020, pp. 418–453.

Figure 1

tions of households affect the distance of work commutes and the choice of travel mode, hence congestion and driving speeds. At the same time, the level of traffic congestion affects the attractiveness of residential locations through ease-of-commute considerations; the attractiveness of different locations, in turn, feeds back to shape the spatial distribution of households.

The model premises include two sets of preferences that govern household choices: preference parameters for housing attributes including the ease-of-commute measure, and preference parameters for travel mode attributes such as travel time and travel cost. With these underlying parameters estimated, the model allows us to conduct counterfactual simulations to predict new equilibrium outcomes for house prices, congestion, and welfare under different policy scenarios.

We rely on two rich datasets for estimation. One is the Beijing Household Travel Survey, a large representative survey that records households' home and work locations, trips made in a 24-hour window, and other demographic and transportation-related information. Based on application programming interface (API) requests from online mapping service and geographic information system software, we compile the commuting route, distance, travel time, and cost for each travel mode of all home-to-work trips. The other dataset contains housing transactions from a major government-run mortgage program and provides a large representative sample of Beijing homebuyers. Critically for our analysis, the housing data report not only the home location but also the work locations of household members. We then construct over 13 million hypothetical work-commute and travel-mode combinations for all properties in each homebuyer's choice set, using the same procedure as in the travel survey.

Our estimation follows a two-step procedure. The first recovers heterogeneous preferences for travel times and monetary costs — and thereby the value of time — based on the travel data. We then utilize the estimated parameters from this step and household members' work locations to construct the ease-of-commute measure separately for each commuter in the household and for all properties in a household's choice set. These variables are included as household-property-specific attributes in the housing demand estimation in the second step, which recovers preferences for housing attributes, including the preference for ease of commute, based on the housing transaction data.

We simulate equilibrium residential sorting and transportation outcomes under different policies: driving restrictions, subway expansion, distance-based congestion pricing, as well as combinations of the three such as subway expansion plus driving restrictions and subway expansion plus congestion pricing. To facilitate comparison, the congestion charge is chosen to achieve the same level of congestion reduction as driving restrictions, though our model also yields estimates of the optimal congestion charge.

Our policy simulations provide four important findings. First, different transportation policies exhibit distinct efficiency properties (Figure 2). While driving restrictions and congestion pricing achieve the same level of congestion reduction by design, congestion pricing improves welfare but driving restrictions reduce it because of the large distortion in travel mode choices. Beijing's rapid subway expansion increased aggregate welfare, despite the fact that it achieved only a modest congestion reduction. Congestion pricing and subway expansion in tandem deliver the largest improvement to traffic speed and net welfare gain — equivalent to 3 percent of average household income. In addition, revenue from congestion pricing could fully finance capital and operating costs of subway expansion, eliminating the need to resort to distortionary taxes.

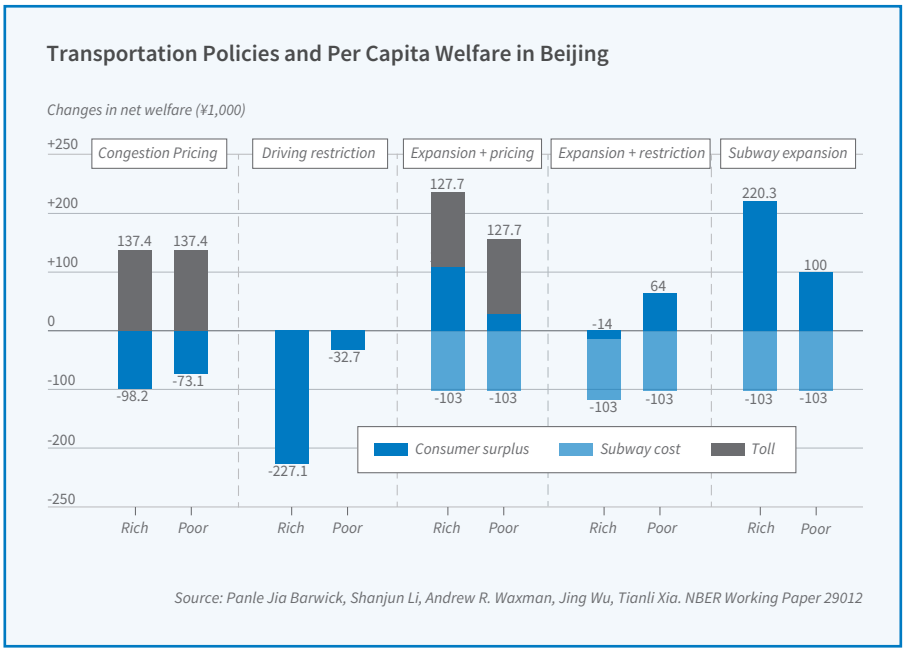


Figure 2

Second, policies differ in terms of distributional consequences. Without revenue recycling, congestion pricing is regressive, which poses a substantial obstacle to its practical implementation. In contrast, driving restrictions and particularly subway expansion are progressive, which likely contributes to their greater adoption in practice. However, it is worth noting that with appropriate revenue recycling, congestion pricing can be welfare enhancing for low-income households, thereby addressing distributional concerns.

Third, although all three policies help alleviate congestion, they have distinct and even contrasting effects on the spatial distribution of residential areas and equilibrium housing prices

(Figure 3). Distance-based congestion pricing creates strong incentives for both high- and low-income commuters to relocate closer to their workplaces. In contrast, subway expansion increases the spatial separation between residential and job locations by dispersing households from the city center toward suburban areas and locations near new subway stations.

Finally, residential sorting can either bolster or undermine the effectiveness of transportation policies aimed at reducing congestion. Sorting reinforces the efficiency of congestion pricing as households, particularly those with lengthy commutes, are motivated to reside closer to their workplaces and reduce driving. This especially amplifies the welfare benefits of congestion pricing for high-income households. Conversely, sorting in response to subway expansion results in increased spatial separation between residential and work areas, diminishing both the congestion-reduction effect and the welfare gains derived from this infrastructure investment.

Additional simulations reveal that our aggregate welfare findings are sensitive to whether we endogenize traffic congestion, and that excluding preference heterogeneity induces a substantial change in the welfare estimates. These findings underscore the advantages of our equilibrium sorting model as a unified framework for policy analysis. The model effectively captures diverse adjustment mechanisms while allowing for general equilibrium effects and preference heterogeneity.

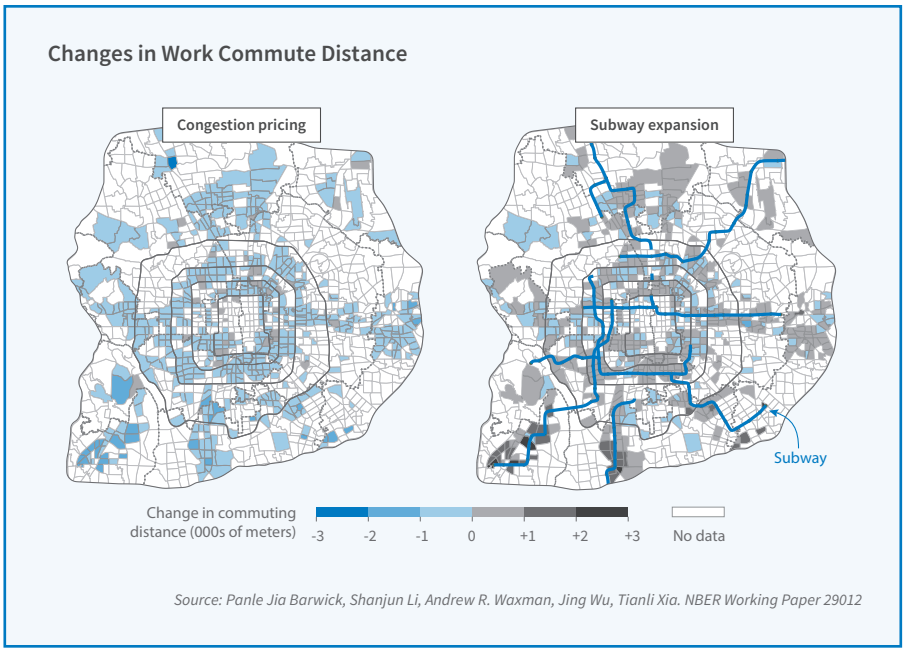


Figure 3

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NBER News

NBER Appoints 22 Research Associates, 53 Faculty Research Fellows

Following a call for nominations in January, the NBER has appointed 68 new affiliates: 15 research associates and 53 faculty research fellows. In addition, seven faculty research fellows have been promoted to research associates.

The directors of the NBER's 20 research programs recommend appointments after consulting with steering committees made up of leading scholars. Research associate appointments must be approved by the NBER Board of Directors, while faculty research fellows are appointed by the NBER president. All new affiliates must hold primary academic appointments in North America; research associates must have tenure.

The newly appointed researchers serve on the faculties of 35 different colleges and universities. They received their graduate training at 34 different institutions. The new appointments bring the total number of research associates to 1,414 and the number of faculty research fellows to 347. As of April 28, 2023, 25 of these affiliated researchers are on leave; most are serving in government policy roles.

The names and university affiliations of the newly appointed NBER affiliates are listed below.

Research Associates

* Promotion from Faculty Research Fellow

* David Baqaee	University of California, Los Angeles	**Economic Fluctuations and Growth**
Carola Binder	Haverford College	**Monetary Economics**
* Luigi Bocola	Stanford University	**Economic Fluctuations and Growth**
Vicki Bogan	Cornell University	**Children**
Celeste Carruthers	University of Tennessee	**Economics of Education**
Richard Clarida	Columbia University	**Monetary Economics**
Kimberly Clausing	University of California, Los Angeles	**Public Economics**
Wioletta Dziuda	University of Chicago	**Political Economy**
Ina Ganguli	University of Massachusetts	**Productivity, Innovation, and Entrepreneurship**
Daniel Grossman	West Virginia University	**Health Economics**
* Tatiana Homonoff	New York University	**Public Economics**
* Benjamin Keys	University of Pennsylvania	**Public Economics**
Philipp Kircher	Cornell University	**Economic Fluctuations and Growth**
* Bradley Larsen	Washington University in St. Louis	**Industrial Organization**
Nadya Malenko	University of Michigan	**Corporate Finance**
Erica Myers	University of Calgary	**Environment and Energy Economics**
Andrea Prat	Columbia University	**Productivity, Innovation, and Entrepreneurship**
Vincenzo Quadrini	University of Southern California	**International Finance and Macroeconomics**
* Benjamin Schoefer	University of California, Berkeley	**Economic Fluctuations and Growth**
Morten Sorensen	Dartmouth College	**Corporate Finance**

Research Associates (continued)

Sandip Sukhtankar	University of Virginia	**Development Economics**
* Ashley Swanson	University of Wisconsin, Madison	**Health Care**

Faculty Research Fellows

Hassan Afrouzi	Columbia University	**Monetary Economics**
Francesco Agostinelli	University of Pennsylvania	**Children**
Milena Almagro	University of Chicago	**Industrial Organization**
Belinda Archibong	Columbia University	**Development Economics**
David Argente	Pennsylvania State University	**Economic Fluctuations and Growth**
David Arnold	University of California, San Diego	**Labor Studies**
Bocar Ba	Duke University	**Law and Economics**
Tania Babina	Columbia University	**Productivity, Innovation, and Entrepreneurship**
Vittorio Bassi	University of Southern California	**Development Economics**
Augustin Bergeron	University of Southern California	**Public Economics**
Susanna Berkouwer	University of Pennsylvania	**Environment and Energy Economics**
Zarek Brot-Goldberg	University of Chicago	**Health Care**
Sydnee Caldwell	University of California, Berkeley	**Labor Studies**
Juan Camilo Castillo	University of Pennsylvania	**Industrial Organization**
Christopher Campos	University of Chicago	**Economics of Education**
Michela Carlana	Harvard University	**Economics of Education**
Mert Demirer	Massachusetts Institute of Technology	**Industrial Organization**
Chloe East	University of Colorado, Denver	**Children**
Alex Eble	Columbia University	**Economics of Education**
Alessandra Fenizia	George Washington University	**Political Economy**
Andreas Ferrara	University of Pittsburgh	**Development of the American Economy**
Ashvin Gandhi	University of California, Los Angeles	**Economics of Aging**
Jorge Luis García	Clemson University	**Children**
Andrew Garin	University of Illinois	**Labor Studies**
Mesay Gebresilasse	Amherst College	**Development Economics**
Niels Gormsen	University of Chicago	**Asset Pricing**
Atul Gupta	University of Pennsylvania	**Health Care**

Faculty Research Fellows (continued)

Elisa Jacome	Northwestern University	**Law and Economics**
Lawrence Jin	Cornell University	**Asset Pricing**
Matthew Johnson	Duke University	**Labor Studies**
Diego Kaenzig	Northwestern University	**Monetary Economics**
Ken Kikkawa	University of British Columbia	**International Trade and Investment**
Gregory Lane	University of Chicago	**Development Economics**
Emily Lawler	University of Georgia	**Health Economics**
Moritz Lenel	Princeton University	**Economic Fluctuations and Growth**
Eoin McGuirk	Tufts University	**Political Economy**
Angelica Meinhofer	Cornell University	**Health Economics**
Michael Mueller-Smith	University of Michigan	**Law and Economics**
Abhishek Nagaraj	University of California, Berkeley	**Productivity, Innovation, and Entrepreneurship**
Aurelie Ouss	University of Pennsylvania	**Law and Economics**
Alessandra Peter	New York University	**Economic Fluctuations and Growth**
Sarah Quincy	Vanderbilt University	**Development of the American Economy**
Will Rafey	University of California, Los Angeles	**Environment and Energy Economics**
Daniel Reck	University of Maryland	**Political Economy**
Robert Richmond	New York University	**Asset Pricing**
John Singleton	University of Rochester	**Economics of Education**
Edoardo Teso	Northwestern University	**Political Economy**
Rosen Valchev	Boston College	**International Finance and Macroeconomics**
Jessica Van Parys	Hunter College	**Economics of Aging**
Emil Verner	Massachusetts Institute of Technology	**International Finance and Macroeconomics**
Tianyi Wang	University of Toronto	**Development of the American Economy**
Melanie Wasserman	University of California, Los Angeles	**Labor Studies**
Barton Willage	University of Colorado, Denver	**Health Economics**

Ten Researchers Receive Postdoctoral Fellowships, 2023-24

Ten postdoctoral scholars have been awarded NBER fellowships for the 2023–24 academic year, following widely disseminated calls for applications.


League

Riley League, who received his PhD from Duke University, and Parker Rogers, who received his PhD from the University of California, San Diego, will hold postdoctoral fellowships in aging and health economics supported by the National Institute on Aging. League is focusing on the role of administrative burdens in shaping the delivery, cost, and outcomes of health care in the United States. Rogers analyzes how government healthcare regulations affect innovation and the affordability and quality of healthcare products and services.


Rogers


Gabriel

Ricardo Filipe Duque Gabriel, who received his PhD from the University of Bonn, and Patrick Kennedy, whose doctorate is from the University of California, Berkeley, will investigate various aspects of long-term fiscal policy. Gabriel studies the political costs of tightening fiscal policy and pursuing austerity measures. Kennedy is focusing on the efficiency and equity implications of major US tax policies. Their fellowships are sponsored by the Peter G. Peterson Foundation.


Kennedy


Noray

Kadeem Noray, who received his PhD from Harvard University, is the holder of the NBER postdoctoral fellowship to support diversity in the economics profession. He studies the extent to which educational institutions and tech firms overlook talented individuals from underrepresented groups, and how selection processes can be improved.

Jermaine Toney, who received his PhD from The New School for Social Research, will hold a fellowship in racial and ethnic disparities in economic outcomes that is sponsored by the Alfred P. Sloan Foundation. He plans to analyze the impact of historic federal redlining and private racial restrictions in residential communities on the contemporary provision of mortgage credit.


Toney


Cole

Allison Cole, who received her PhD from the MIT Sloan School of Management, will study how firms make decisions about the design of employer-sponsored retirement plans and how these plans affect the career decisions of workers. Her fellowship, on issues related to the aging US workforce, is supported by the Alfred P. Sloan Foundation.

Adam Steven Harris, who received his PhD from MIT, will study transportation economics, including the role of long-term relationships between shippers and carriers in the US trucking industry. His research fellowship is supported by the US Department of Transportation.

Harris

Sleiman

Léa Bou Sleiman, who received her PhD from CREST-École Polytechnique, will hold a fellowship on infrastructure economics supported by the Alfred P. Sloan Foundation. Her research focuses on the welfare effects of transportation policies that promote efficient infrastructure utilization, such as congestion pricing in urban areas.

Roger Prudon, who received his PhD at the Vrije Universiteit Amsterdam and the Tinbergen Institute, will examine the impact of inadequate provision of mental health treatment on late-life outcomes such as employment and receipt of disability benefits. The fellowship is sponsored by the NBER Retirement and Disability Research Center, which is in turn supported by the Social Security Administration.

Prudon

Gabriel Zucman Wins John Bates Clark Medal


Zucman

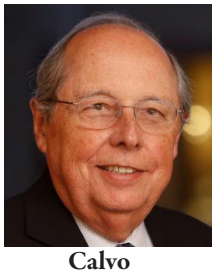
Gabriel Zucman of the University of California, Berkeley, a research associate in the NBER's Public Economics Program, has won the John Bates Clark Medal, awarded annually by the American Economic Association to an American economist under the age of 40 who has made a significant contribution to economic thought and knowledge.

Zucman has made path-breaking contributions in public finance, using rich new datasets to estimate the importance of both household and corporate tax evasion and its impact on revenues as well as reported income and wealth inequality. He also has pioneered the construction of distributional national accounts that provide critical insights into the share of national income accruing to households in different strata of the income distribution and the changes in the net-of-tax-and-transfer resource distribution over time.

The prize citation notes that his findings provide "key insights that inform policy debates on the practical design of tax systems around the world."

American Economic Association Names New Distinguished Fellows

The American Economic Association has named four new Distinguished Fellows, three of whom — **Guillermo Calvo**, **Olivia Mitchell**, and **Maurice Obstfeld** — are NBER research associates.


Calvo


Mitchell


Obstfeld

Guillermo Calvo of Columbia University, a leading contributor in macroeconomics, international finance, and the analysis of sovereign debt, is a research associate in the NBER's International Finance and Macroeconomics (IFM) Program.

Olivia Mitchell of the Wharton School of the University of Pennsylvania, who has made pioneering advances in the study of pensions, Social Security, and financial literacy, is a research associate in the Economics of Aging and the Labor Studies Programs.

Maurice Obstfeld of the University of California, Berkeley, whose research laid the foundation for the analysis of many key issues in open economy macroeconomics, is a research associate in the Economic Fluctuations and Growth, IFM, and International Trade and Investment Programs.

The fourth newly named Distinguished Fellow is economic theorist Drew Fudenberg of MIT.

The AEA issued a **press release** covering these and other award announcements.

Brent Neiman to Become Deputy Under Secretary of Treasury for International Finance


Neiman

Brent Neiman, an affiliate of the NBER's International Finance and Macroeconomics and International Trade and Investment Programs, is taking leave from the NBER to serve as Deputy Under Secretary for International Finance at the US Treasury Department.

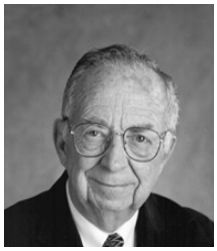
Neiman, the Edward Eagle Brown Professor of Economics at Chicago Booth, has carried out research on a wide range of issues examining the causes and consequences of trade, and the financial interactions among nations.

Inaugural Robert Summers Fellows Will Attend CRIW Meeting

The NBER has awarded five fellowships to enable economic statisticians working in government statistical agencies and international organizations to attend the Conference on Research in Income and Wealth (CRIW) meeting to be held July 17–18, 2023 in Cambridge, MA. The meeting will be part of the NBER Summer Institute.

The CRIW was founded in 1936 by Simon Kuznets to promote research and implementation of economic measurement. Its meetings provide opportunities for academic, government, and business economists to explore the latest developments in this field.

The fellowship program celebrates the intellectual legacy of longtime CRIW member and University of Pennsylvania professor Robert Summers, who pioneered the study of international price and output comparisons. Along with his colleagues Alan Heston and Irving Kravis, he developed the Penn World Tables (PWT), a detailed compendium of national income account data and other information presented in comparable format, and measured in the same way, for many countries across many years. The initial PWT, developed by Summers and his collaborators Heston and Kravis, was a product of the United Nations International Comparison Program, which began with 10 countries and a reference year of 1970. It has subsequently grown to include 190 countries. It is a standard source of publicly available data on both output and prices and it is widely used in research on the determinants of cross-country growth.



Robert Summers

The 2023 fellowship recipients are: Kassu Hossiso, a research economist in the US Department of Commerce's Bureau of Economic Analysis; Cecilia Jona-Lasinio, professor of applied economics at Luiss Business School, Rome and a senior researcher at the Italian National Institute of Statistics; Oscar Lemmers, an economist at Statistics Netherlands; T. Kirk White, an economist in the US Census Bureau's Center for Economic Studies, and Matthew Unrath, chief of the Census Bureau's Income Statistics Branch.

The fellowship program, which is expected to continue in future years, aims to promote research on economic measurement and to strengthen ties between the academics and practitioners working in this area. Fellows will participate in the research meeting and have an opportunity to interact with leading scholars as well as other practitioners in the field of economic measurement.

Health Care and Health Economics Programs Merge

For nearly three decades, two NBER programs have studied issues related to health and health care. The Health Economics Program, which was launched in the early 1970s, focused on the economic determinants of health capital and analyzed individual behaviors such as smoking and substance abuse that affect it. The Health Care Program, created in 1994, emphasized research on the delivery of health care by medical professionals and hospitals, and also explored the role of public and private insurance in covering the cost of this care.

In recent years, a rising share of the affiliates in each of these programs has been involved in cross-cutting research that addresses topics that historically might have fallen within the other program's remit. To recognize the growing interdependence of research on health capital, health care delivery, and the financing of health care, the NBER is launching a new Economics of Health Program that will draw together research on all of these issues. The new program will be co-directed by Christopher Carpenter of Vanderbilt University and Amy Finkelstein of MIT. Carpenter was previously the director of the Health Economics Program, and Finkelstein directed the Health Care Program. All of the affiliates of either of the prior programs — a total of 241 researchers — will become affiliates of the Economics of Health Program. The new Program will launch on July 1, 2023, replacing both the Health Care and Health Economics Programs, and it will hold its first meeting at the 2023 NBER Summer Institute.

Conferences and Meetings, Spring 2023

Detailed programs for NBER conferences are available at nber.org/conferences

East Asian Seminar on Economics
Organizers: Takatoshi Ito and Andrew K. Rose
June 5-6, 2023

Fertility and Declining Population Growth in High-Income Countries
Organizers: Melissa Schettini Kearney and Phillip B. Levine
June 1-2, 2023

Environmental and Energy Policy and the Economy Conference
Organizers: Tatyana Deryugina, Matthew Kotchen, and Catherine Wolfram
May 25, 2023

Megafirms and the Economy
Organizers: Chad Syverson and John Van Reenen
May 23-24, 2023

Economics of Energy Use in Transportation
Organizers: Meghan R. Busse, Christopher R. Knittel, and Kate S. Whitefoot
May 23-24, 2023

Economics of Transportation in the 21st Century
Organizers: Edward L. Glaeser, James Poterba, and Stephen J. Redding
May 19, 2023

The Economics of Decarbonizing Industrial Production: Pre-Conference
Organizers: Lint Barrage and Kenneth Gillingham
May 19, 2023

Insurance Working Group Meeting
Organizers: Benjamin R. Handel and Motohiro Yogo
May 18, 2023

Entrepreneurship and Innovation Policy and the Economy Conference
Organizers: Benjamin Jones and Josh Lerner
May 18, 2023

New Directions in Market Design
Organizers: Irene Y. Lo, Michael Ostrovsky, and Parag A. Pathak
May 11-12, 2023

Data Privacy Protection and the Conduct of Applied Research: Methods, Approaches and their Consequences
Organizers: Ruobin Gong, V. Joseph Hotz, and Ian M. Schmutte
May 4-5, 2023

Economics of Education Program Meeting
Organizer: Caroline M. Hoxby
May 4-5, 2023

Racial and Ethnic Health Disparities
Organizers: Jevay Grooms and Hannes Schwandt
April 28, 2023

Labor Studies Program Meeting
Organizers: David Autor and Alexandre Mas
April 28, 2023

Economics of Infrastructure Investment: Public Transportation
Organizers: Edward L. Glaeser and James Poterba
April 28, 2023

Economics of Culture and Institutions
Organizers: Alberto Bisin and Paola Giuliano
April 22, 2023

Investments in Early Career Scientists: Promoting Diversity in Science Careers
Organizers: Donna K. Ginther, Kaye Husbands Fealing, and Bruce A. Weinberg
April 21, 2023

Political Economy Program Meeting
Organizers: Renee Bowen and Melissa Dell
April 21, 2023

38th Annual Conference on Macroeconomics
Organizers: Martin S. Eichenbaum, Erik Hurst, and Valerie A. Ramey
April 20-21, 2023

Organizational Economics Working Group
Organizer: Raffaella Sadun
April 20-21, 2023

Corporate Finance Program Meeting
Organizers: Manuel Adelino and Margarita Tsoutsoura
April 14, 2023

Behavioral Finance Working Group Meeting
Organizer: Nicholas C. Barberis
April 14-15, 2023

International Trade and Investment Program Meeting
Organizer: Stephen J. Redding
April 14-15, 2023

Asset Pricing Program Meeting
Organizers: Wenxin Du and Adrien Verdelhan
April 14, 2023

New Developments in Long-Term Asset Management
Organizers: Luis M. Viceira and Annette Vissing-Jorgensen
April 14-15, 2023

Public Economics Program Meeting

Organizers: John N. Friedman, Adam Isen, and Juliana Londoño-Vélez
April 13-14, 2023

Historical Labor Markets and Inequality

Organizers: Martha J. Bailey, Leah Platt Boustan, and William J. Collins
April 1, 2023

Race and Stratification Working Group

Organizers: Trevon Logan, William Darity, Jevay Grooms, and Rodney J. Andrews
March 31, 2023

Development of the American Economy Program Meeting

Organizers: Leah Platt Boustan and William J. Collins
March 31, 2023

Environment and Energy Economics Program Meeting

Organizers: Tatyana Deryugina and Arthur A. van Benthem
March 30-31, 2023

Economics of Aging Program Meeting

Organizers: Kathleen M. McGarry and Jonathan S. Skinner
March 24, 2023

International Finance and Macroeconomics Program Meeting

Organizers: Yan Bai and Anusha Chari
March 24, 2023

Policy Responses to Tax Competition

Organizers: David R. Agrawal, James Poterba, and Owen M. Zidar
March 16-17, 2023

NBER Books

Challenges of Globalization in the Measurement of National Accounts

Nadim Ahmad, Brent R. Moulton, J. David Richardson, and Peter van de Ven, editors
www.nber.org/books-and-chapters/challenges-globalization-measurement-national-accounts

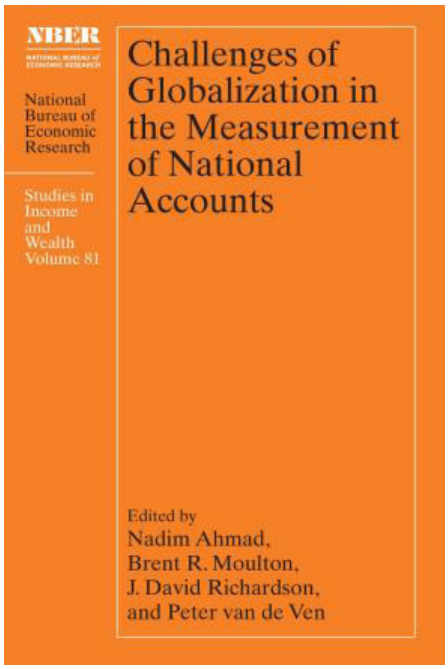
The substantial increase in the complexity of global supply chains and other production arrangements over the last three decades has challenged some traditional measures of national income account aggregates and raised the potential for distortions in conventional calculations of GDP and productivity.

Challenges of Globalization in the Measurement of National Accounts examines a variety of multinational business activities, including how multinational enterprises arrange their financing and assign ownership of intellectual property to avoid tax and regulatory burdens, and assesses their impact on economic measurement.

Several chapters consider how global supply chains complicate the interpretation of traditional trade statistics and how new measurement techniques, such as extended supply and use tables, can provide new information about global production arrangements.

Other chapters examine the role of intangible capital in global production, including the intangible output of factoryless goods producers and the problems of measuring R&D in a globalized world.

The studies in this volume also explore potential ways to enhance the quality of the national accounts by improving data collection and analysis and by updating the standards for measurement.



Entrepreneurship and Innovation Policy and the Economy, Volume 2

Benjamin Jones and Josh Lerner, editors
www.nber.org/books-and-chapters/entrepreneurship-and-innovation-policy-and-economy-volume-2

Entrepreneurship and innovation are widely recognized as key drivers of economic dynamics and long-term prosperity. This series communicates new findings about the determinants and implications of entrepreneurial and innovative activity across the economy.

In the first paper, Joseph Barberio, Jacob Becraft, Zied Ben Chaouch, Dimitris Bertsimas, Tasuku Kitada, Michael Li, Andrew Lo, Kevin Shi, and Qingyang Xu measure pharmaceutical firms' incentives to develop vaccines against prospective diseases, and document the high investment risks, low expected returns, and the rarity of pandemics. They analyze a portfolio approach to financing vaccine research.

Next, Daniel Hemel and Lisa Larrimore Ouellette describe the tradeoffs between quality, price, and access that arise after a generic pharmaceutical's patent expires, and explore the implications of these tradeoffs for regulatory policy.

The third paper, by Silvia Dalla Fontana and Ramana Nanda, examines the role of patents in the transition to a carbon-free world. The researchers find that although "net zero patents" are close to the scientific frontier, difficulties in commercializing inventions has resulted in a low level of funding from venture capitalists.

Jacquelyn Pless examines the effects of divestment from firms in carbon-intensive businesses on innovation and concludes that investing in firms and engaging with green corporate governance practices may induce more green innovation than divestment.

Next, Robert Fairlie and David Robinson find that Black-owned innovation-intensive businesses are smaller when launched and do not converge in size over time to comparable businesses owned by members of other groups. They attribute this to differential access to bank financing as well as "soft information" that can be important in the startup process.

Finally, Jonathan Gruber, Simon Johnson, and Enrico Moretti consider the regional concentration of innovative activity in the United States, pointing out that while the concentration of activity yields short-run advantages, there may be long-run benefits of more diffuse innovation clusters including equity, industrial diversification, and talent development.

Environmental and Energy Policy and the Economy, Volume 4

Matthew J. Kotchen, Tatyana Deryugina, and James H. Stock, editors
www.nber.org/books-and-chapters/environmental-and-energy-policy-and-economy-volume-4

This volume presents six new papers on environmental and energy economics and policy.

Gilbert Metcalf examines the distributional impacts of substituting a vehicle miles traveled tax for the existing federal excise tax in the United States.

David Weisbach, Samuel Kortum, Michael Wang, and Yujia Yao consider solutions to the leakage problem of climate policy with differential tax policies on the supply of and demand for fossil fuels and on domestic production and consumption.

Danae Hernandez-Cortes, Kyle Meng, and Paige Weber quantify and decompose recent trends in air pollution disparities from the US electricity sector.

Severin Borenstein and Ryan Kellogg provide a comparative analysis of different incentive-based mechanisms to reduce emissions in the electricity sector on a path to zero emissions.

Sarah Anderson, Andrew Plantinga, and Matthew Wibbenmeyer document distributional differences in the allocation of US wildfire prevention projects.

Finally, Mark Curtis and Ioana Marinescu provide new evidence on the quality and quantity of emerging "green" jobs in the United States.

NBER Macroeconomics Annual 2022, Volume 37

Martin Eichenbaum, Erik Hurst, and Valerie A. Ramey, editors
www.nber.org/books-and-chapters/nber-macroeconomics-annual-2022-volume-37

The NBER Macroeconomics Annual 2022 brings together leading scholars to discuss five research papers on central issues in contemporary macroeconomics.

First, Andrea Eisfeldt, Antonio Falato, and Mindy Xiaolan document the rise of a new class of worker that receives part of its labor income as equity-based compensation, its role in the recent decline in the labor share of income, and implications for the returns to skilled labor and the implied capital-skill complementarity.

Next, Michael Bauer and Eric Swanson focus on monetary policy shocks and argue the correlation between estimated monetary surprises and previously available information can be explained by uncertainty about the parameters of the monetary policy rule. Using new data and methods they find effects of monetary policy on macroeconomic variables that are much larger than previously estimated.

Job Boerma and Loukas Karabarbounis provide a framework for quantitatively exploring the gap in wealth between White and Black Americans over the past 150 years and examine the effectiveness of reparations as a tool for closing this gap.

Guido Menzio considers workers who do not have rational expectations, and whose "stubborn" beliefs change the response of wages to technology shocks, resulting in sticky wages. He finds that the larger the fraction of workers with stubborn beliefs, the more volatile unemployment is.

Finally, Rishabh Aggarwal, Adrien Auclert, Matthew Rognlie, and Ludwig Straub investigate the growth—particularly in the United States—of private savings, current account deficits, and fiscal deficits after 2020. They argue that fiscal deficits lead to large and persistent increases in private savings and current account deficits.

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