Knowledge Is Power:
The Importance of Economic Education

Based on a speech given by President Santomero at the Pennsylvania Economic Association Annual Conference, West Chester University, West Chester, PA, on May 30, 2003

BY ANTHONY M. SANTOMERO

As technological advances continue to expand the range of financial services available to consumers, money management becomes increasingly complicated. Helping consumers navigate this sea of financial products is important. When households are capable of building wealth, they are also capable of building more economically stable neighborhoods and communities. That's one reason economic education is vital to the future health of our nation's economy. In this article, President Santomero outlines what the Federal Reserve is doing to promote economic education and explains why knowledge is indeed power in our ever more complex world.

Economic education is vital to the future health of our nation's economy. It gives our students the building blocks for a successful financial future. It empowers consumers by giving them the knowledge and tools to improve their economic well being. It is the best investment we can make to strengthen our nation's economy.

Economists recognize that developing basic economic and financial knowledge is an important goal for a democratic society that relies heavily on informed citizens and personal economic decision-making. When households are capable of building wealth, they are also capable of building more economically stable neighborhoods and communities.

I would like to share with you my perspective on the importance of economic and financial education and give you some examples of what we're doing at the Philadelphia Fed to further this important cause.

KNOWLEDGE IS POWER

In today's ever-changing and increasingly competitive financial marketplace, knowledge is power. We are living in an age in which the communications revolution has inundated consumers with more information than ever before, even as the financial marketplace has become more complex. But simply having more information does not necessarily mean people have more knowledge.

As we all know, the business of managing our money in this environment has become increasingly complicated. Technological advances continue to expand the range of financial services available to consumers. While choice and flexibility are certainly beneficial to the consumer, they come with increased risks — especially among consumers who lack the knowledge and resources to discern their choices.

American consumers must not only have access to information, but they must also be able to both *understand* and *use* it. This is our challenge. It is difficult enough for the average American to understand and choose wisely among the complex financial products and services now available. Think what an exceptionally daunting challenge it is for those with limited financial experience or education to make such decisions. Therefore,

Anthony M. Santomero, President, Federal Reserve Bank of Philadelphia

educating consumers on the basics of economics is an issue of critical importance.

ECONOMIC EDUCATION AND THE FED

The Federal Reserve has been involved in economic education initiatives for some time. We consider them integral to our mission. As you know, the Fed serves a three-fold function in our economy: it conducts monetary policy, supervises and regulates banks and financial institutions, and maintains an effective payments system. Our economic education efforts are important to, and intertwined with, all three functions.

First, educating the nation's populace about economic issues is an integral part of our role in monetary policy. Economic education fosters a better understanding of how policymakers have an impact on the economy. This basic knowledge of economics helps consumers better understand Federal Reserve policy actions and how changes in policy ultimately affect their own lives.

Second, as a regulator and supervisor of banks and other depository financial institutions, the Federal Reserve is responsible for promoting safety and soundness in the industry. In addition, Congress has given us the job of overseeing the industry's compliance with many consumer protection laws, including fair access to credit and service to communities, including provisions of the Community Reinvestment Act. Given Congress's mandate to bank regulators to ensure fair and equitable treatment of consumers, we believe economic education is a logical extension of our regulatory duties.

Third, the Federal Reserve's duty to maintain an effective payments system is facilitated by knowledgeable consumers. Simply stated: If people are informed about available choices, they will be better able to make appropriate decisions about their payments. For instance, consumers must make decisions about when to pay by cash, check, credit card, or debit card. The options are increasing, and the choices have become more complicated.

For all these reasons, economic education is critical to the Federal Reserve's long-term objective of maximum sustainable economic growth. Educated consumers are the key to a well-functioning financial market, one that best serves the nation's economy. At the Federal

Reserve Bank of Philadelphia, we consider educating consumers on the basics of economics to be a vital part of our business.

Effective economic education helps people develop the skills to meet their financial and personal objectives, including savings, financial stability, home ownership, higher education, or retirement. Rather than being merely reactive in correcting abuses that occur in financial markets — which we must — it is better to be proactive in developing an educated consumer, knowledgeable enough to avoid being abused.

The Fed clearly recognizes the importance of education, but how best to achieve it is often situational. I believe the far-reaching nature of the problem requires an attack on two fronts: one as a long-term solution and one as a short-term response to observed problems in the market for financial services. Let me outline each part of this approach.

ECONOMIC EDUCATION: A LONG-TERM SOLUTION

As a long-term solution to the gap in economic and financial knowledge, economic education programs should be aimed at school children, our most important audience. Broad-based economic education initiatives for school-age children will translate into a society of financially literate adults.

Yet, according to a survey conducted by the American Savings Education Council, only 21 percent of students between the ages of 16 and

Economic education fosters a better understanding of how policymakers have an impact on the economy.

22 say they have had any exposure to personal finance training in school. The current situation stems in part from the fact that economics and basic financial concepts are often not part of a school's curriculum. Another problem arises when these courses are badly taught and, as a result, not learned. Either way, the result is the same. Graduates enter the workforce without an understanding of how our economy — or their finances — work.

The National Council on Economic Education reported that in 2002, 48 states and the District of Columbia had economics standards in their schools. However, only 34 states require those standards to be implemented, and only 27 require testing of students' knowledge of economics. It gets worse. Only 17 states require that an economics course even be offered in high school, and just 14 states require students to take such a course in order to graduate.

What is the situation closer to

home? Of the three states in the Third Federal Reserve District — Pennsylvania, Delaware, and New Jersey — none requires students to take an economics course in high school. In fact, none requires that high schools even offer an economics course. In Delaware, schools are required to implement the economics standards, and student achievement in economics is tested as one-quarter of the state's social studies test. That test is given at the beginning of 4th grade, the beginning of 6th grade, the end of 8th grade, and the end of 11th grade. The 11th grade test plays a part in determining the type of high school diploma the student receives. In New Jersey and Pennsylvania, although standards are in place, testing of student achievement in economics is not required.

Starting now, we must all work to secure economics a place in school curricula, with substantial classroom time devoted to economic instruction.

This is an area where Federal Reserve financial education programs can help. To date, the Philadelphia Fed's greatest success has been in Delaware, where a financial literacy program introduced in one high school has now spread to seven other schools. Fortunately, we have built strong partnerships with the University of Delaware's Center for Economic Education and Entrepreneurship, the Delaware Bankers Association, and the Consumer Credit Counseling Services of Maryland and Delaware. These partners have been instrumental in making this venture a success. We expect the course to be offered in roughly 20 Delaware high schools in 2003-2004. In addition, we are hoping to replicate our success in Pennsylvania and New Jersey. To that end, we are building relationships with state councils on economic education and with economic education centers at

colleges and universities. We would like to find partners to pilot similar programs in these states.

Equally important are teacher training programs. Unfortunately, the overwhelming majority of high school teachers are ill-equipped to teach economics and personal finance. Few majored in these fields when they attended college. This is an area where we can have an impact by following a

train-the-teacher model. As a result, the Philadelphia Fed provides significant training and resources to teachers so they can get the right message to students.

We seek ways to excite educators about economic education in the K-12 classroom by showing those educators how economics can be incorporated into existing language arts, mathematics, and social studies curricula.

The greater emphasis that the No Child Left Behind Act places on mathematics and reading standards increases the need to show teachers

ways to infuse economics into these assessed disciplines. Our train-the-teacher approach is grounded in the premise that well-trained teachers will be able to educate large numbers of students about economics and its role in our daily lives.

In Pennsylvania, our key partnership with ECONOMICSPennsylvania and its associated centers for economic education makes possible the

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implementation of ongoing programs to train teachers to teach economics in the K-12 classroom.

We are having some success. Last year, our Community Affairs Department presented day-long programs to students in the Pennsylvania Governor's School for Entrepreneurship and to teachers as part of the Summer Institute of the South Jersey Chamber of Commerce. In addition, the Bank held an economics seminar for teachers from Philadelphia and its suburbs. This year, the Philadelphia Fed offered a course for New Jersey teachers on personal financial education and co-

sponsored a summer institute with the University of Delaware, the Delaware Financial Literacy Institute, and Citigroup. The program, called "Money Talks," attracted 32 teachers. We are also starting to host sessions to educate interested people on how to become economic education trainers.

Across the country, the Federal Reserve System is playing an important role in educating students and teachers about the functions and characteristics of money. We're emphasizing the role of the Federal Reserve in ensuring price stability and sustainable economic growth, the important function that bank supervision and regulation play in keeping the economy strong, and the importance of a strong, viable payments system. Moreover, each Federal Reserve Bank has its own economic education specialists who provide tools and resources to educators and help develop programs to teach economic education to both teachers and students.

ECONOMIC EDUCATION AS A RESPONSE TO PROBLEMS: A REACTIVE AGENDA

Reaching people before they make financial mistakes is critical, and the preventive economic and financial education programs I just mentioned serve this purpose well. However, we also advocate programs for people already in dire financial straits. These initiatives typically target consumers without banking relationships or with few financial assets. They provide ways to reach out to consumers, giving them the tools to build a better financial future.

I believe curative programs are our best defense against financial abuse, fraud, and illegality. To effectively combat these issues, we must target those market areas that are most vulnerable, such as the elderly or low-income and minority communities.

There are many such communities in our Federal Reserve District.

But in the process of addressing predatory lending practices, we must be careful to effectively differentiate between standard risk-based lending and exploitative practices. This is an important distinction. In fact, it is essential for regulators to counter

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But predatory lending activities carry disproportionately high interest rates and/or onerous terms, not justified by the borrower's higher risk. These terms are imposed by lenders who are willing to exploit the borrower's lack of financial knowledge, market access, or economic resources.

The best defense against these harmful practices is education. Consumers who are financially knowledgeable are more likely to be financially responsible. Unfortunately, many people learn only through experience — once burned, twice informed. While learning and working through their own financial difficulties, consumers can effect change in their overall behavior.

Successful programs combine counseling and education, to empower consumers in controlling their financial future. Disclosures can be useful but only if consumers read and understand them; therefore, education is the core of the solution. Here, the Fed provides literature and recommended curricula, for both educators and consumers. Over the longer term, we

can create a knowledgeable consumer, able to understand and use the basics of money management.

Targeted campaigns built on motivation and coaching can also encourage consumers to build wealth for their future through sustained savings plans and informed investment decisions. The Philadelphia Fed is

working with partners such as Philadelphia Saves, a campaign designed to help create wealth through savings, to change attitudes about money and saving.

Programs such as these are part of a wide effort to promote economic and financial education. Currently, efforts are booming in this area. The FDIC has announced a national pilot program for financial education. In addition, the Treasury is establishing an Office of Financial Education, which will oversee outreach efforts and develop new policies regarding financial education.

Across the nation, Federal Reserve Banks are partnering with a broad constituency of community-based organizations and associations to draw attention to the need for economic and financial education and the programs designed to support it. We are also engaged in a national effort to promote education through our new campaign "There's a Lot to Learn about Money." The strength of the campaign lies in several key elements. Fed Chairman Alan Greenspan recorded a public service announcement that extols the virtues of economic and financial education.

This is an aggressive program of media outreach to be sure our message is heard. We have launched a national web site, www.FederalReserveEducation.org, which features Internet links to instructional materials and tools to increase understanding of economics and financial education. The site includes such useful resources as brochures, newsletters, curricula, references, and research.

On a local level, the Philadelphia Fed continues to develop and promote its own programs to encourage economic education. We have forged strong partnerships with organizations like the Greater Philadelphia Urban Affairs Coalition; Isles, a New Jersey-based community organization; and state councils and centers for economic education. These partnerships help us reach out to communities and educators. With these partners, we've developed a number of programs aimed at increasing economic and financial education, including conferences, training seminars, and economics courses for educators.

We have fostered greater economic education by providing materials and curricula and by supporting local efforts through our Community Affairs Department. As I mentioned, teaching the teacher is of prime importance. We have increased that commitment, bringing more resources to this important part of our agenda. We help educators identify appropriate programs and curricula, and we create evaluation tools to monitor progress.

We also have an aggressive and ongoing research agenda. We target training to various constituencies, such as children, adults, low-income people, and so on, and help economic education providers assess audience demographics and needs. In this way, we hope to provide substance to the economic education research agenda by measuring what participants have learned and determining how programs meet needs over the long term.

Finally, a new project will put a unique spin on the Philadelphia Fed's education efforts. We have opened a

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financial exhibit called "Money in Motion." It employs the latest presentation technology and interactive displays to entertain visitors and simultaneously teach them the unique role of the Federal Reserve System. It is fitting that Philadelphia, the home of our nation's first bank, should share the story of our nation's financial history.

CONCLUSION

Economic education programs developed and promoted by the Philadelphia Federal Reserve Bank help consumers make better financial decisions. In classrooms around our District, we help young people understand the workings of the economy and the financial system in which they are just beginning to participate. In low- and moderate-income communities — often targets of unscrupulous business practices — we help people understand risks and evaluate alternatives.

Knowledge is power. Economic education generates knowledge. It gives people the tools to understand economic and financial issues and to interpret events that will affect their financial futures.

In short, informed, well-educated consumers make better decisions, increasing their economic security and well being. These consumers are better able to contribute to vital, thriving communities, further fostering economic development. Improved economic education will result in more productive, fulfilling lives for individuals and families — and, in turn, more vibrant, economically stable neighborhoods and communities.

Most important, economic education is critical to building bridges between educators, businesses, and consumers. These bridges will prepare our society to meet the challenges of an increasingly knowledge-based economy. As we work to increase familiarity with new technological and financial tools, we give people the resources necessary to secure individual economic success. Done right, economic education can have large-scale results — results that are sweeping, significant, and supportive of a higher standard of living for all Americans. BR

For more information on the Philadelphia Fed's economic education programs, call Andrew Hill, economic education specialist, at 215-574-4392, or send e-mail to andrew.hill@phil.frb.org. Or visit www.phil.frb.org/education.

Agglomeration Economies:
The Spark That Ignites a City?

BY SATYAJIT CHATTERJEE

In industrially developed countries, employment is heavily concentrated in cities. A concentration of workers and businesses in one location — what economists call agglomeration economies — lowers production costs. In fact, most economists believe that in the absence of agglomeration economies, the spatial distribution of employment would be much more even. In this article, Satyajit Chatterjee discusses his research, which questions this belief. He finds that while agglomeration economies are an important factor, they're *not* the most important one. The combined effects of factors unrelated to agglomeration economies, such as the availability of natural resources and local economic policies, appear to account for the bulk of the spatial concentration of U.S. employment.

The bulk of an industrially developed country's economic activity takes place in cities. Typically, these cities make up a relatively small portion of the country's overall territory. For instance, 83 percent of total employment in the U.S. is located in metropolitan areas, and these areas account for 24 percent of the total land area of the country.

Why is employment so heavily concentrated in selected areas of the country? Economists think that spatial concentration of employment (or, more generally, economic activity) develops for two very different reasons. The first reason — and one that comes most readily to mind — is that a location attracts people and businesses because of the presence of some valuable natural resource. Petroleum, coal, lumber, minerals, and proximity to a navigable river or to the coast are all examples of valuable natural resources. Because such resources are not available everywhere, people and businesses end up flocking to resource-rich areas.

However, the natural resource reason does not explain the full extent of the remarkable spatial concentration we see in reality. For instance, access to a deep harbor was no doubt important for the emergence of Philadelphia as a colonial city, but can it be the main reason for Philadelphia's subsequent evolution into one of America's pre-eminent metropolitan areas? Studies of urban evolution suggest a second reason for spatial concentration: A concentration of workers and businesses in one location lowers production costs because proximity permits workers and businesses to save on the costs of transporting goods and people. Economists refer to this cost advantage as economies of spatial concentration, or *agglomeration* economies, for short.

Agglomeration economies can be a powerful force for attracting large numbers of people to a given location. They can cause a location with some small advantage in terms of natural resources to become a place with a large concentration of diverse businesses and households. While the natural resource initially attracts businesses and households to the location, this original group then becomes the factor that attracts other businesses and households to that location. As the location grows in size, business costs fall and the location's attractiveness as a potential spot for other businesses and households rises, and more people and businesses move in.

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6 Q4 2003 *Business Review*   www.phil.frb.org

Although rising congestion eventually chokes off the inflow of people, agglomeration economies can be the spark that ignites the development of a city.

Economists generally believe that agglomeration economies are the primary factor that leads to the large clusters of people and jobs we see in the real world. In other words, most economists believe that in the absence of agglomeration economies, the spatial distribution of employment would be much more even.

In this article I discuss my research, which tried to determine if this belief is, in fact, accurate. My research indicates that while agglomeration economies are an important contributor to the spatial concentration of employment, they're *not* the most important factor. Contrary to expectations, factors other than agglomeration economies appear to account for the bulk of spatial concentration. It's not clear exactly what these other factors are, but they could be differences in the availability of natural resources across metropolitan areas, differences in economic policies across cities and states, or some other advantage of spatial concentration distinct from agglomeration economies. Whatever the case, my research suggests that agglomeration economies are probably just one of several important factors affecting spatial concentration of employment.

THE FACT OF SPATIAL CONCENTRATION

To determine the contribution of agglomeration economies to spatial concentration, we need a measure of the extent of spatial concentration in U.S. employment. An effective way to do this is by using a Lorenz curve, a graphical tool originally developed to show the extent to which income is unevenly distributed across

people.[1] But Lorenz curves can also be used to show how unevenly employment is distributed across space.

To construct a Lorenz curve of spatial concentration, I first ranked metropolitan areas and rural counties in the continental United States by their employment density, the densest areas being ranked first. Using this ranking, I then calculated the percentage of employment accounted for by the first, or top, 1 percent of the total continental land area, then the

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[1] The statistician Max O. Lorenz (1880-1962) developed the Lorenz curve. The curve is probably the tool most used to analyze income and other distributions. Remarkably, Lorenz came up with the idea of the curve in his undergraduate thesis at the University of Iowa, circa 1894, at the age of 14! He went on to have a distinguished career, becoming the chief statistician of the Interstate Commerce Commission in Washington, D.C.

top 2 percent, and so on. The Lorenz curve is simply a graph that plots these calculations (Figure 1). If employment were uniformly distributed over the continental landmass, this graph would coincide with the 45-degree line shown in the figure. That is, the top 1 percent of the continental land area would account for 1 percent of employment, the top 2 percent of the area would account for 2 percent of employment, and so on. But if employment is not uniformly distributed, the graph will be bowed above the 45-degree line — as, in fact, it is.

As Figure 1 indicates, the top 1 percent of total continental land area accounts for about 15 percent of employment, the top 2 percent accounts for about 25 percent, and so on. Indeed, by the time we include the top 20 percent of the continental land area, we can account for more than 80 percent of total employment! Clearly,

FIGURE 1

Spatial Concentration of U.S. Employment, 1999

Gini Index = 0.78

Y-axis: Percentage of Employment
X-axis: Percentage of Land Area (Most to Least Dense)
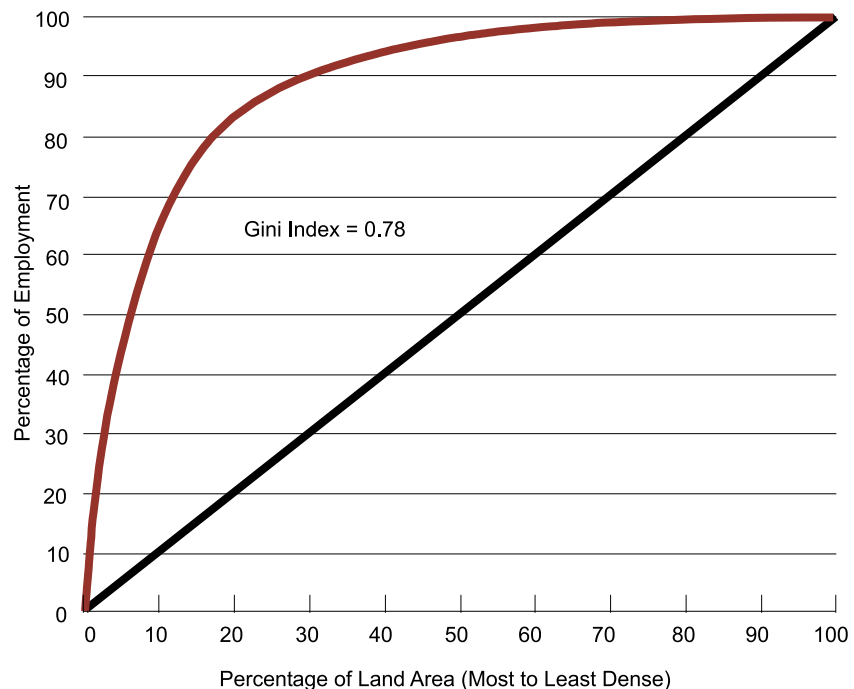
U.S. employment is very unevenly distributed over space.

The Lorenz curve is an effective visual representation of the degree of spatial concentration of employment. It also provides the basis for the Gini index, a well-known index of concentration. The Gini index is a number between zero and one, and it is a measure of the difference between the Lorenz curve and the 45-degree line. It is computed by dividing the area between the Lorenz curve and the 45-degree line by the total triangular area above the 45-degree line. When employment is uniformly distributed, the Lorenz curve coincides with the 45-degree line, and the Gini index is zero. The more unevenly employment is distributed, the more bowed the Lorenz curve and the larger the area between the curve and the 45-degree line. Thus, the Gini index is higher for a more uneven distribution of employment and lower for a more even one. In Figure 1, the value of the Gini index is 0.78, which means the area between the 45-degree line and the bowed line represents close to 80 percent of the total area above the 45-degree line. This is the measure of spatial concentration I used in my research.

NATURE AND MAGNITUDE OF AGGLOMERATION ECONOMIES

As mentioned earlier, agglomeration economies arise because proximity permits workers and businesses to save on the costs of transporting goods and people. In this section I'll highlight one way in which this happens, then discuss what economists know about the magnitude of agglomeration economies in the U.S.

One reason agglomeration economies arise is that a large concentration of workers allows a business to deal more effectively with fluctuations in the volume of sales. Consider a business whose future demand can be

either high or low, with equal probability. When demand is high, the business needs four workers; when demand is low, it needs only two. The business has to hire workers *before* it knows how large demand will be. Suppose the business chooses to hire three workers. If demand turns out to be low, workers work at two-thirds capacity, and all demand is met. If demand turns out to be high, all workers work at full capacity, but one-quarter of demand is not met. So there is a 50 percent chance that every worker works at less than full capacity.

Now imagine that another enterprise in the same line of business moves into the area and this enterprise faces a similar uncertainty with respect to demand. However — and this is the key assumption — the level of the new firm's demand is independent of the level of the first firm's demand. This may happen if the firms have different sets of customers and serve different markets. This means that the combinations of demand across the two firms can take one of four possibilities, all with equal probability: (high, high), (high, low), (low, high), and (low, low). Now, when the two businesses have different levels of demand (which happens with probability one-half), the firm with low demand has an incentive to rent out its one excess worker to the firm with high demand. This is feasible because both firms are in the same location and the cost of moving workers between firms is presumably low. If the two firms shifted workers between them in this way, the only time any worker would work at less than full

capacity is when demand at *both* firms is low, which happens with probability one-quarter.

The movement of workers between businesses in the same location does happen in reality, although it takes the guise of contract workers selling their services to businesses on a temporary basis. For instance, we might have a situation where both businesses hire two permanent employees, and each business has the option to hire additional contract employees in the event the level of demand is high. In this arrangement, there are

Agglomeration economies arise because proximity permits workers and businesses to save on the costs of transporting goods and people.

four permanent workers and two contract workers. The permanent workers always work at full capacity while contract workers have a 75 percent chance of working at full capacity or a 25 percent chance they won't work at all. Contract workers take on the risk of unemployment, but if the two firms use some of their cost savings to pay contract workers more than full-time employees, contract workers might feel compensated for the risk.

To summarize, physical proximity makes it possible for firms to share workers and so allows businesses to take advantage of the fact that the combined demand of several firms is more stable than the demand of a single firm. This stability permits a group of businesses to better utilize workers than a single business. The improved utilization of workers lowers business costs and provides a reason for firms and workers to cluster together.

Let's turn now to a description of the strategies economists have used to estimate the magnitude of ag-

glomeration economies that stem from better utilization of workers. The most direct way to do this is to measure changes in the utilization of workers due to spatial concentration. However, because it's not easy to directly measure how hard employees work, economists have used more indirect methods. Let's look at two of these methods along with the estimates of agglomeration economies obtained using each one.

The first method uses information on labor hours and equipment purchased (also called capital) and goods (output) sold by different industries in different metropolitan areas. For any given industry, labor and capital purchased will have a higher utilization rate in metro areas with a large concentration of workers and firms. Thus, for any given industry and for any given amounts of labor and capital, more output will be produced in a large metro area than in a small one. The estimate we get from this method suggests that agglomeration economies make businesses in metro areas with more than 2 million people 8 percent more productive than businesses in metro areas with less than 2 million people.[2]

The second method uses information on hourly wages businesses pay to workers. Businesses that use workers more effectively face lower costs and so make higher profits. Given that, a business would be motivated to locate in a large metro area rather than a small one. But when businesses do so, they compete with one another and end up paying more for each worker they hire. In other words, in a competitive environment, higher worker

productivity will result in higher wages being paid to workers in large metro areas. By measuring the wages paid to similarly skilled workers in metro areas of varying sizes, we can estimate how much more productive workers are due to agglomeration effects. Studies that follow this approach have found that as a metro area doubles in size, the productivity of its workers rises 3 percent.[3]

AGGLOMERATION ECONOMIES' CONTRIBUTION TO SPATIAL CONCENTRATION

Given these estimates of the magnitude of agglomeration economies, the question is: How important are these agglomeration effects for the spatial concentration of employment? Answering this question involved two steps.

First, I constructed an economic model of local employment that can exactly reproduce the Lorenz curve in Figure 1, which gives the distribution of workers across metropolitan areas and rural counties in 1999. Second, I constructed a new Lorenz curve for a model economy that's identical to the one in the first step except that in this model, there are no agglomeration economies. If the Lorenz curve for this new model economy turns out to be close to the 45-degree line, I can reasonably conclude that agglomeration effects account for the bowed shape of the Lorenz curve in Figure 1. More generally, any difference between the Lorenz curve in Figure 1 and the Lorenz curve predicted by the model with no agglomeration effects can be attributed to the

effects of agglomeration economies. In particular, the difference between the Gini indexes for the two Lorenz curves is a measure of the contribution of agglomeration effects to the spatial concentration of U.S. employment.

Description of the Model Economy. Briefly, the macroeconomic model in the first step has the following features.[4] There is a given set of locations, corresponding to the 275 metropolitan areas and 2,248 rural counties in the continental U.S.[5] Each location can produce two types of goods. One type, which I call *traded goods*, can be shipped without cost to other locations; the second type, which I call *local goods*, cannot be shipped at all. A household living in a given location derives benefit (or what economists call utility) from the consumption of the traded good and from consumption of the local good produced in that location. (The household cannot consume the local good of other locations because local goods cannot be shipped.)

Locations differ in terms of natural resources. In my model, the natural resources available to a location affect the productivity of labor and capital employed in the production of the traded good in that area. It may also affect how much enjoyment a household gets from living there. A location that has high productivity due to the presence of some natural

[2] Reported in David Segal's article.

[3] This estimate is the median value of agglomeration economies across manufacturing industries reported in Leo Sveikauskas's article.

[4] With some modifications, this is the same model I have used in previous research. The details of the model are in my article with Gerald Carlino.

[5] The 275 metropolitan areas consist of 258 primary metropolitan areas and 17 consolidated metro areas. A consolidated metropolitan area is a group of neighboring primary metro areas between which there is a significant amount of commuting.

resources will attract firms making the traded good; an area that's pleasant to live in because it has some other natural amenity will attract households.

As a location with some natural advantage attracts businesses and households, it gains employment. The rise in employment generates agglomeration economies and lowers business costs. This serves to make the location more attractive to businesses, and more businesses move in and create jobs. However, the people who move in to take these jobs make the location increasingly congested, and this congestion causes the price of the local good to rise. The rising price of the local good reduces the purchasing power of the wages workers receive in that location and limits the inflow of workers. The migration of workers between locations will make the wage (adjusted for amenities) equal across all metro areas, and every person seeking work will be employed in some location.

In this model, the distribution of employment across locations reflects the availability of natural resources in each area, the magnitude of agglomeration economies, and the magnitude of congestion costs. The magnitude of the agglomeration effects in the model is consistent with the evidence on agglomeration effects noted in the previous section. Also, the magnitude of congestion costs is consistent with the evidence on congestion costs that researchers have found for U.S. metro areas.

Finally, the model's parameters use values that determine the effects of natural resources on employment, so that the employment density in each metro area and rural county in the model exactly matches the employment density of that metro area or rural county in reality. This final step makes it possible for the model to exactly reproduce the Lorenz curve shown in Figure 1.

**What Does the Model Say About the Role of Agglomeration Economies in Spatial Concentration?** Using this model I can investigate the role of agglomeration economies in the spatial concentration of U.S. employment. As noted earlier, my strategy for doing this is to examine what happens to the spatial distribution of employment in my model when I eliminate the reduction in production costs due to agglomeration economies while keeping all other aspects of the model unchanged. The solid black line in Figure 2 plots actual employment densities for metro areas in 1999; the dotted line plots what happens to employment densities in these metro areas when agglomeration effects are removed. As the figure shows, a relatively small set of high-density locations become less dense and a large set of relatively low-density locations become denser.

The first set includes large metro areas, which benefit the most from agglomeration economies. These metro areas shed employment because they can no longer productively employ as many workers. Workers from these metro areas end up moving to smaller metro areas (and also to rural counties not shown in the figure), and consequently, these areas become denser.

The table lists the top 20 metro areas for which agglomeration economies seem most important. As one would expect, big cities like New York, Los Angeles, Chicago, and Atlanta are on the list. Los Angeles appears to be the city that benefits most from agglomeration economies in that almost 80 percent of its jobs would disappear if agglomeration economies were absent; Phoenix-Mesa is another area that appears to owe a lot of its employment to agglomeration econo-

FIGURE 2

Metropolitan Employment Densities With And Without Agglomeration Economies

Logarithm of Metropolitan Employment Density (y-axis)

No Agglomeration Economies

Actual

Metropolitan Areas Ranked by 1999 Employment Density (x-axis)
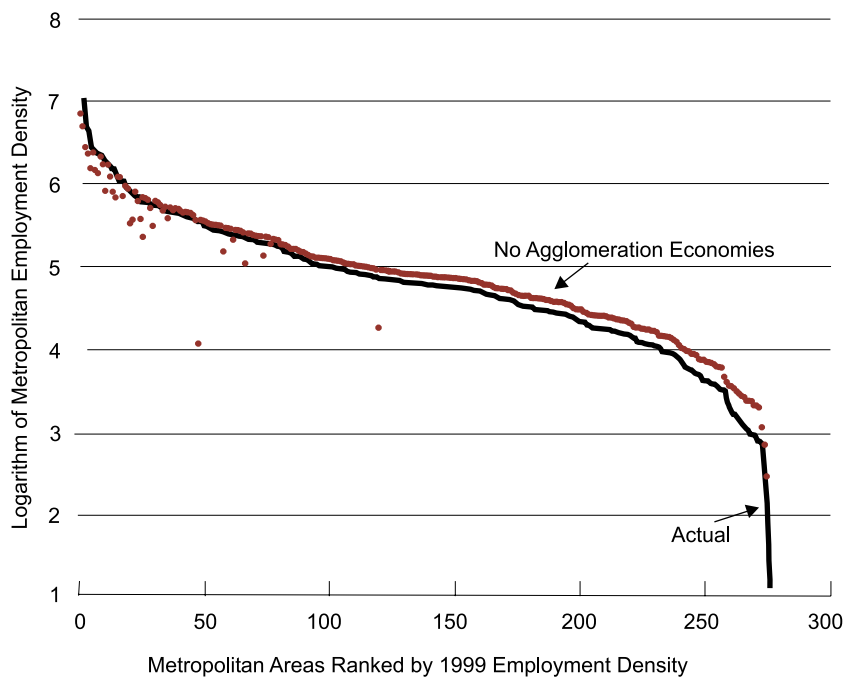
mies. Philadelphia also makes the list and appears to owe 20 percent of its jobs to agglomeration economies.

Clearly, agglomeration economies appear to be very important for the development of specific cities, especially Los Angeles and Phoenix-Mesa. But how important is it generally? Figure 3 helps to answer this question. It compares the Lorenz curve when agglomeration effects are removed from the model constructed in step 1 with the Lorenz curve from Figure 1. The new Lorenz curve is less bowed, indicating that in the absence of agglomeration economies, employment is more evenly distributed. The Gini index declines about 16.5 percent, from 0.78 to 0.65.

The most striking feature of the new Lorenz curve is that it's still pretty far from the 45-degree line. Even in this world without agglomeration economies (but which is otherwise similar to the U.S. in important respects), there is considerable spatial concentration of employment. In other words, although the contribution of agglomeration economies is substantial, it's not as large as we might have expected. Recall that most economists consider agglomeration economies the most important reason for spatial concentration. But my model predicts that the U.S. would continue to be spatially concentrated, that is, have very dense areas, even if agglomeration economies were completely absent. Apparently, agglomeration economies are generally not needed to spark the development of cities! [6]

What, Then, Are the Other Determinants of Spatial Concentration? If agglomeration economies are not the key contributor to spatial concentration, what is? Taken at face value, my model suggests that it's the uneven distribution of natural resources that accounts for the bulk of spatial concentration. Indeed, some

researchers have suggested that access to a navigable river or coast is, in fact, a key determinant of spatial concentration in the U.S.[7] Nevertheless, it's not accurate to say that any concentration left unexplained by agglomeration economies must result from the effects

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[6] It's possible that economists may have mismeasured the magnitude of agglomeration economies and congestion costs, thus affecting the values built into my model. However, when I varied the model's magnitude of agglomeration economies and congestion costs within plausible ranges (while ensuring that the model exactly reproduced the Lorenz curve in Figure 1), the drop in spatial concentration from elimination of agglomeration economies rarely exceeded 50 percent. Therefore, even with generous allowances for mismeasurement, agglomeration economies do not appear to account for the bulk of spatial concentration.

[7] See the article by Jordan Rappaport and Jeffrey Sachs.

of natural resources. There are other factors, besides geography, that might affect spatial concentration and that are not captured in my simple model.

One potentially important factor is city- or state-specific economic policies. If an area happens to be located in a state with pro-business laws and regulations, it will have an advantage in terms of job creation relative to other areas.[8] Another factor could be the cost savings from transporting goods from one region to another.[9] For instance,

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[8] The article by Thomas Holmes presents evidence that state policies affect the location of industry.

[9] The cost savings from shipping goods within metro areas are captured in the estimates of agglomeration economies used in my model.

TABLE

Metropolitan Areas	Percentage of Employment Due to Agglomeration Economies
Los Angeles-Riverside-Orange County	79
Phoenix-Mesa	48
Dallas-Fort Worth	32
Washington-Baltimore	29
Houston-Galveston-Brazoria	28
Denver-Boulder-Greeley	27
Seattle-Tacoma-Bremerton	25
Detroit-Ann Arbor-Flint	23
San Francisco-Oakland-San Jose	23
Atlanta	22
Boston-Worcester-Lawrence-Lowell-Brockton	22
Minneapolis-St. Paul	22
St. Louis	22
Chicago-Gary-Kenosha	20
Philadelphia-Wilmington-Atlantic City	20
New York-Northern New Jersey-Long Island	19
Portland-Salem	18
San Diego	13
Cleveland-Akron	12
Pittsburgh	11

part of Philadelphia's attraction as a business location is its proximity to two other large metro areas: Washington, D.C. and New York City. Philadelphia's proximity to these two places means that businesses in Philadelphia can ship goods relatively cheaply to two other large metro areas, thus giving them relatively cheap access to a very large customer base.[10] A third factor could be that some benefits of spatial concentration go beyond reducing the costs of producing goods and services. It's well known, for instance, that most inventive activities take place in cities. Just as spatial concentration can reduce the costs of producing goods and services, it may also reduce the costs of producing new knowledge through better utilization of knowledge workers.[11]

SUMMARY

Economists have generally pointed to agglomeration economies as the principal reason a country's employment tends to get concentrated in a relatively small number of geographic areas. Agglomeration economies refer to the reduction in business costs that results from a concentration of businesses and workers in the same geographic area. This reduction in business costs provides incentives for workers and firms to cluster together, despite the costs associated with increased congestion. Several empirical studies have found evidence of significant agglomeration economies in U.S. metro areas.

However, the mere existence of agglomeration economies does not settle the question of whether these effects are the primary cause of the spatial concentration of em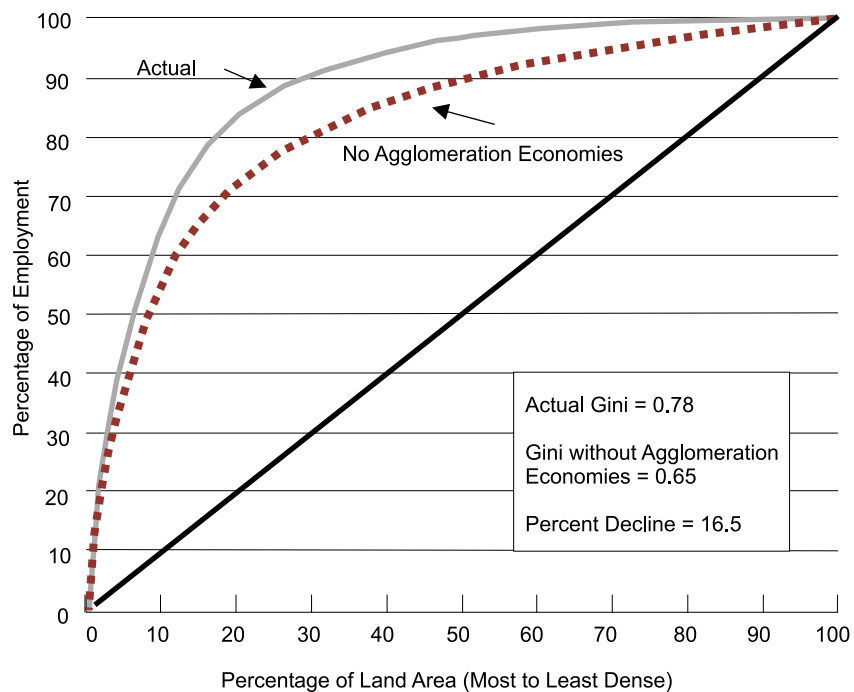ployment. To settle that point, we need to determine if agglomeration economies, as measured, are powerful enough to give rise to the degree of spatial concentration we see in the real world. This

> Just as spatial concentration can reduce the costs of producing goods and services, it may also reduce the costs of producing new knowledge through better utilization of knowledge workers.

article highlighted research that seeks to make this determination. Contrary to expectations, I found that the bulk of the spatial concentration of employment results from factors other than agglomeration economies.

The flip side of my finding is that some set of other factors accounts for the bulk of spatial concentration. Although my research cannot shed light on the contribution of these other factors, it's possible to hazard a guess (based on the work that other economists have done) as to what these other factors might be: natural resources, state and local economic policies, proximity to other metro areas, and spatial concentration's benefits in creating new knowledge. Whatever the case is, my research suggests that agglomeration economies are one of several important factors, but not the principal factor, affecting spatial concentration of employment. **BR**

[10] See the article by Gordon Hanson for evidence in favor of this point.

[11] The article by Adam Jaffe, Manuel Trajtenberg, and Rebecca Henderson and my article with Gerald Carlino present evidence that proximity may help in the communication of new knowledge.

FIGURE 3

Lorenz Curves With and Without Agglomeration Economies

Actual

No Agglomeration Economies

Percentage of Employment

Percentage of Land Area (Most to Least Dense)

Actual Gini = 0.78

Gini without Agglomeration Economies = 0.65

Percent Decline = 16.5

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The Impact of Immigration on American Cities: An Introduction to the Issues

BY ALBERT SAIZ

According to the U.S. Census Bureau, about 1 million people immigrated to the U.S. in 2001—a number not too far from the record 1.3 million who arrived in 1907. Like their fellow newcomers of long ago, latter-day immigrants generally come here for one reason: to seek a better life. Debate still rages today – as it did a century ago – over immigrants' effect on a host country's economic and social structures. Nevertheless, several factors make the current immigration inflows distinctive. In this article, Albert Saiz discusses immigration's impact on a receiving country's labor and housing markets, fiscal systems, and social interactions.

The United States is a country of immigrants. A majority of Americans trace their roots to people who journeyed from far away to seek a better life. And today's immigrants to the United States are doing the same. Recent immigrants tend to concentrate in a handful of metropolitan areas, and immigration has become a

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salient feature of these cities. According to the Census Bureau, about 1 million people immigrated to the U.S. in 2001. That figure was not too far from the record 1.3 million immigrants who arrived in 1907 (Figure). However, immigration at the start of the century had a relatively greater impact as the U.S. was much less populated. Relative immigration rates were at their highest during the first decade of the 20th century: 11 immigrants per year for each 1,000 inhabitants, compared with five per 1,000 in the last decade of the century. The U.S. was absorbing twice the proportion of immigrants than it is today.

Nevertheless, several factors make the current immigration inflows distinctive. First, the U.S. government

reduced immigration inflows drastically at the beginning of the Great Depression in 1929. Current immigration levels are the highest in the memories of most Americans. Second, the countries of origin of immigrants are more diverse today than in the 19th and early 20th centuries. The traditional countries of origin (Germany, Holland, Italy, Ireland, UK, and central Europe) are no longer important sources of immigration. Third, even if immigration inflows are small relative to the population *levels*, they will still have an important impact on population *growth*. If current immigration rates are sustained, two-thirds of population growth in the United States *could* be accounted for by immigration by 2050.

Are such projections realistic? That depends on future immigration policies. Any time immigration has fueled a country's population, it has also sparked heated debates over the desirability of further immigration. For example, on September 1, 1910, the *Wall Street Journal* ran the following story on the front page:

"The Labor party in the colony of Victoria, Australia, which is practically the dominating influence in the Government, is protesting against the immigration of skilled artisans when they add to the congested population of Melbourne. It is our belief that these immigrants would in time tend to distribute themselves to points where they were more needed, *but the attitude of the Labor party is by no means unreasonable*" [emphasis added].

More than 90 years later, immigration continues to be a furiously debated topic. Public opinion does not

always favor letting more people in. Economists Kenneth Scheve of Yale University and Matthew Slaughter of Dartmouth College have demonstrated that less skilled workers favor limiting immigrant inflows into the U.S. Thomas Bauer, Magnus Lofstrom, and Klaus Zimmermann, from Bonn University, also report that survey respondents in OECD countries show substantial support for immigration limits.[1]

This article provides background for a reasoned discussion of the impact of immigration. Economists and other social scientists have produced substantial research on immi-

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[1] OECD, the Organization for Economic Co-operation and Development, was formed by the governments of a group of medium- to high-income countries to "tackle the economic, social, and governance challenges of a globalized economy."

gration's impact on local economies. Individual and collective preferences for policies should be strongly founded on the available evidence.

Economists generally agree that a worldwide labor market without

Immigration continues to be a furiously debated topic. Public opinion does not always favor letting more people in.

any border restrictions is efficient: that is, people achieve a maximum level of production of goods given the existing availability of resources. The issue with immigration is its impact on the distribution of real income. Who are the winners and the losers worldwide? Can inhabitants of a country that allows immigration lose because of
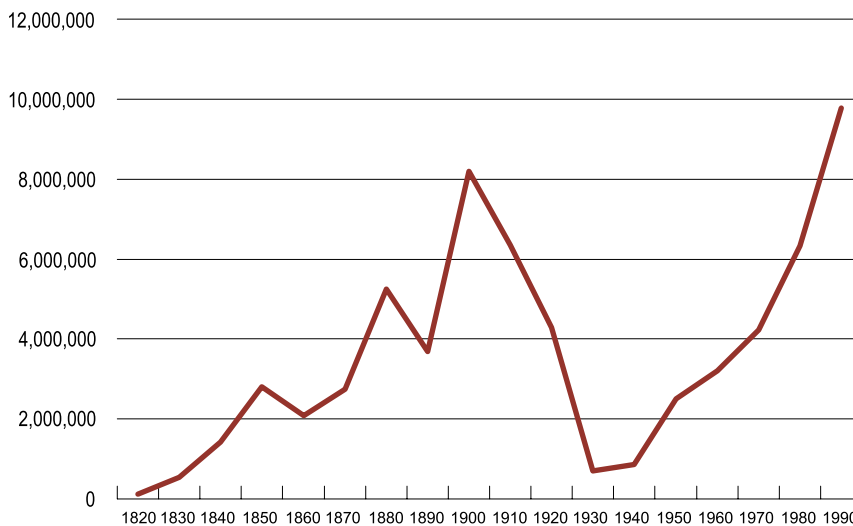
it? Regardless of the average impact on a country, what is the distribution within a country of gains and costs arising from immigration?

This article will deal with these questions from the point of view of countries receiving immigrants. Although other important questions, such as the impact on countries sending immigrants and the progress and welfare of immigrants themselves, should also be part of the discussion on immigration policies, they will not be covered here. We will examine immigration's impact on host countries' labor and housing markets, their fiscal systems, and social interactions.

IMMIGRATION'S IMPACT ON LABOR MARKETS

Immigration's impact on labor markets can be gauged by wages or employment. Does immigration affect wages? How? Does it influence the employment prospects of natives or change the unemployment rate?

Wages. By far, most of the economic literature on immigration has concentrated on its impact on labor markets, specifically wages. Do immigrants compete with natives in the labor market and drive real wages down?

To answer this question we need to think first about what distinguishes international labor flows (emigration and immigration) from international trade. Actually, the United States can use foreign labor by importing products produced by workers in the rest of the world. In theory, international trade of goods

FIGURE

Immigrants in the U.S. by Decade

and services could equalize the wages and other payments made to the different factors of production worldwide. After all, why would a firm in the U.S. pay more for an input, such as labor, when it faces price competition from producers in other countries?

In practice, under current economic and political conditions, this so-called factor-price equalization does not happen. Why? First, there are a number of trade barriers, such as import quotas and tariffs. Second, there are products, such as personal services and local public goods, that cannot be traded and thus do not face international competition. Third, education levels, technological developments, and institutions have proved difficult to transplant. Many countries do not possess the skills or technology to compete in some product markets.

Thus, the impact of immigration will not be quite the same as that of importing goods produced by foreign labor. For this reason, and given the relatively small size of exports and imports in the United States, labor economists have concentrated on models of the economy without international trade. These economic models, which are simplified representations of the economy (as a map is a simplified representation of a geographic area), help us understand the effects of changes in fundamental variables, such as population, on outcomes of interest, such as wages. According to Harvard economist George Borjas, these models indicate there are positive overall gains to natives from immigration but point to a distributive impact: There may be winners and losers within the native population.

The simplest model considers a single type of labor and a fixed amount of capital.[2] This model predicts overall gains from immigration.

The increase in labor supply exerts downward pressure on wages, but the gains to firms from greater availability of labor more than offset native workers' wage losses. The distribution of the benefits from immigration hinges on the initial distribution of firms' shares of ownership. For instance, if everyone is a worker but also an investor,

The relative skills of immigrants in the U.S. have been decreasing since the 1960s.

everyone experiences net gains from the availability of more people who produce at a lower cost.

But, in reality, the amount of capital in the economy is not fixed. When we allow capital to adjust freely (maybe because of the availability of foreign capital), results are different. Suppose that if we doubled the total amount of resources devoted to production, we would double the amount we produce.[3] In this setup, immigration does not generate any change in wages and does not generate economic gains or losses to natives. This happens because as the amount of available labor increases via immigration, investors find it desirable to increase the amount of capital as well, so that the

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[2] Capital refers to investments in durable productive assets, such as computers, factories, and so on.

[3] In economists' jargon, this technology exhibits constant returns to scale. Such productive technology seems to represent fairly well the production process at the national level. However, at the local level, for example, in metropolitan areas, this need not be the case. See Satyajit Chatterjee's article on agglomeration economies.

amount of capital per worker is kept at the initial level before immigration. This level was the one that minimized the costs of production, and immigration doesn't change that.

For example, imagine that the population of a country doubles because of immigration. Capital per worker will adjust to the initial level (the level that is optimal for investors). The new economy, after immigration, will just be a duplicate of the old economy! Total gross domestic product (GDP) will double, but *per capita* GDP will stay the same. Wages will remain unchanged and so will the dividends paid to each owner of capital.

An even more realistic model takes into account the existence of several types of labor. Take, for example, the case in which there are two types of labor: highly skilled and unskilled. The availability of formal education and knowledge, which help determine the level of skills that a country's workers have, is approximately fixed in the medium run.

In this situation, and if new capital can be put into place, immigration will benefit natives only if the distribution of skills in the immigrant population (for example, the proportion of people who are low skilled) is different from that of the native population. If the skill composition of immigrants and natives is identical, we are back to a "replicated economy" scenario: Doubling the country's population just doubles the economy without any changes in income per capita. But if the composition of skilled and unskilled workers is different in the immigrant and the native populations, relative wages will change. For example, if immigrants tended to be more highly skilled, this would increase the relative supply of highly skilled individuals, reducing wages for the highly skilled and increasing wages for low-skilled workers.

In reality, economists have worried about the potential impact of immigration on *low-skilled* natives. George Borjas, one of the most active economists studying immigration in the past decade, has pointed to the fact that the relative skills of immigrants in the U.S. have been decreasing since the 1960s. To be sure, the United States attracts a good deal of highly skilled professionals, such as doctors, computer programmers, engineers, scientists, and Ph.D. economists. In 1990, 26.2 percent of male immigrants 25 years or older were college graduates (the same proportion as natives). Nevertheless, the share of immigrants with less than a high school diploma was 37.1 percent, much higher than the same proportion for natives (14.1 percent). Is the influx of such a relatively low-skilled population affecting wages for low-skilled workers? Considerable research has been devoted to answering this question.

Most studies have compared the change in wages in cities that receive major immigration inflows to the change in wages in other areas. These are generally known as area studies. Surprisingly, the results only yield evidence of a weak negative association between immigration and wages in the sectors and metropolitan areas where immigrants tend to find employment.

Area studies have been criticized because they do not take into account firms' and immigrants' responses to changing economic conditions. If, for instance, immigrants are *systematically* attracted to areas that are experiencing economic booms, we should not expect to see a clear-cut negative association between immigration and wages. Without immigration, wages may have been higher in these areas, but there is no way to disentangle the impact of immigration from the positive effect of a booming economy. Similarly, firms that tend to use immigrant labor will move to areas where immigrants tend to concentrate, increasing the demand for labor in those areas.

David Card, a labor economist at Berkeley, studied the impact of the Mariel boatlift on wages and employment in Miami, Florida. Between May and September 1980, about 125,000 Cuban immigrants arrived in southern Florida. The sudden inflow of people arriving in boats (*balsas* in Spanish and, hence, the name *balseros* for contemporary Cuban immigrants who follow the same route) resulted from the Cuban government's decision to allow free emigration from the island's port of Mariel. Card estimates that about 50 percent of the Mariel immigrants settled in Miami in 1980. Initially, this represented a sudden 7 percent increase in the city's labor force. By 1983, many more resettled refugees had found their way south to Miami. Mariel immigrants were relatively unskilled, both in terms of formal education and fluency in English. The advantages of studying that massive immigration episode, in light of the criticisms of area studies, are that its timing was independent of the evolution of Miami's economy and that firms could not have predicted it in advance.

But Card's study suggests that even a major shock of low-skilled immigrants such as that represented by the Mariel boatlift did not change the relative wages of low-skilled workers in Miami compared with those in similar metropolitan areas.

Still, some economists think that looking at specific high-immigration metropolitan areas is not enough to learn about the general impact of immigrants on wages. George Borjas, teaming with Larry Katz and Richard Freeman from Harvard, argues that the mobility of natives may counteract the local effects of immigration on wages. If immigration puts downward pressure on wages in the areas where immigrants concentrate, natives may decide to leave or may be less willing to move into these areas. In this sense local economies are interconnected: The impact of immigration on wages will be spread over the entire nation as natives move in response to immigration inflows into specific areas.

Borjas, Katz, and Freeman estimated the national impact of immigration on wages. They used a simplified model of the economy and estimates of the general responsiveness of wages to changes in the supply of low-skilled workers in order to approximate the impact of immigration. They report a modest impact. Wages for high-school dropouts would have been about 3 percent higher *relative to wages for other workers* in 1990 without any immigration in the 1980s. Notice that this implies that relative wages for other workers (those with at least a high school diploma) would have been *lower* without the immigration of the 1980s. However, as George Borjas pointed

Some economists think that looking at specific high-immigration metropolitan areas is not enough to learn about the general impact of immigrants on wages.

out, the estimates from the Harvard trio can be subject to criticism.[4] Their calculations are rather uncertain, since they rely on their model's adequacy and the accuracy of its parameters.

We are left with the impression that the empirical evidence is inconclusive as to the actual magnitude of the impact of immigration on wages. However, it is fair to argue that immigration may have had a modest negative impact on the wage growth of low-skilled individuals in the United States and a corresponding positive impact on wages for the rest.

Employment. Economists have also investigated the association between immigration and employment. Does immigration reduce the proportion of natives who are working or actively looking for jobs, usually referred to as labor force participation? Does immigration generate unemployment?

Immigration affects labor force participation only if wage effects are sizable. In other words, if immigration substantially *reduced* the wages of a particular group, some individuals in that group may decide to *withdraw* from the labor force. Similarly, if immigration substantially *increased* the wages of a particular group, some individuals in that group may decide to *enter* the labor force. In practice, since wage effects are very small, we expect the impact on labor participation to be minor.

Using an *area study* approach, David Card has looked at such an impact. Confirming what the evidence from the research on wages suggests, he finds that immigration has a very small impact on the employment of natives in the same skill category.

Robert Fairlie of the Univer-

sity of California at Santa Cruz and Bruce Meyer of Northwestern University have found that immigration can have a negative effect on native self-employment. Immigrants are more likely than natives to own and operate small businesses such as convenience stores and restaurants. However, these authors also found that immigration does not affect self-employment by African-Americans. Since immigration barely affects total employment and wages, the results imply that some natives prefer to take on other, more available jobs rather than compete with immigrants' small businesses.

The effect of immigration on unemployment depends on the nature of the labor market. Institutional and social factors sometimes make quick transitions from unemployment to jobs difficult. For example, the geographical distribution of jobs may not correspond to the geographical distribution of population (so jobs may not necessarily be where people are). Or some people might be unwilling to move from their hometown and would rather stay unemployed.

In a market with few such institutional and social factors, immigration should not affect unemployment. Economists agree that this is the case in the United States. A large majority of people looking for a job at current wages are usually able to find a job after some searching. Moreover, according to Borjas, immigration may "grease the wheels" of the labor market. Immigrants are much more mobile than natives and respond more quickly to changes in the economic situation. This may speed the process of match-

ing people to jobs within the country.

If institutional and social factors associated with high unemployment rates are present, as is the case in many European countries, one

The effect of immigration on unemployment depends on the nature of the labor market.

might suspect that immigrants to those countries are competing with natives for jobs. There is no empirical evidence that this is actually the case.[5] The explanation is akin to the argument advanced when we discussed what would happen if we doubled a country's population. Immigration increases the *scale of* the economy, but it needn't change the unemployment *rate*.

IMMIGRATION'S IMPACT ON THE HOUSING MARKET

As we discussed earlier, using labor from other countries is not exclusively a matter of immigration. Trading goods between countries also means using foreign labor. What sets immigration apart from trade is its residential aspect: immigration involves foreign workers living in the U.S. Therefore, one might expect to find that immigration has a major effect on the local housing market.

Does immigration affect housing prices? Immigration certainly increases the *demand* for housing. Its impact on prices depends on what economists call the elasticity of housing supply—that is, the sensitivity of the supply of housing to changes in price. In some markets, only small

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[4] See George Borjas' 2002 Harvard University mimeo.

[5] See, for instance, Rudolf Winter-Ebmer and Josef Zweimuller's article, which reports a lack of evidence that immigration has a negative impact on youth unemployment in Austria.

price hikes are necessary to increase supply enough to accommodate increasing demand. In these cases, supply is very elastic. In other markets, where supply isn't as elastic, small changes in demand translate into higher prices. In these markets, it takes a much greater increase in prices for supply to respond to the increased demand.

Studies in housing economics demonstrate that, at the national level, the supply of housing is fairly elastic. Increases in population that are spread out over the country needn't translate into higher housing prices. The supply of housing increases sufficiently with small changes in price. But while housing supply may be relatively elastic at the national level, it *may be* much more inelastic in specific locations. Plus, immigrants tend to concentrate in densely populated metropolitan areas where housing supply is typically fairly inelastic (see Table and map). This implies that housing rents and prices may be expected to grow faster in response to population growth in these areas.

My research has focused on the impact of immigration on local housing rents and prices. I started by looking at the Mariel boatlift. It is an interesting episode because of its magnitude and exact timing. It is also important because, as David Card convincingly demonstrated, it is an example of the small impact of even massive immigration on wages. My research shows that one year after the Mariel boatlift, rents in Miami

## TABLE

MAJOR IMMIGRANT METROPOLITAN AREAS (1983-1997)

The table shows the main 20 destinations of legal immigrants in the 15 years from 1983 to 1997. Impact is defined as the total number of immigrants as a proportion of the initial (1983) population. Philadelphia is the only metropolitan area in the Third District that makes it to the top of the list. However, immigration in Philadelphia is not very important in terms of its population impact over this period (3.23 percent) compared to other close major metropolitan areas such as New York, the Northern New Jersey cities, and Washington.

Rank	MSA	Population in 1983	Immigrants 83-97	Impact*
1	New York	8,491,429	1,653,393	19.47%
2	Los Angeles-Long Beach	8,182,905	1,111,542	13.58%
3	Chicago	7,301,085	476,754	6.53%
4	Miami	1,776,909	455,085	25.61%
5	Washington, D.C.	3,809,206	359,918	9.45%
6	San Francisco	1,570,619	268,688	17.11%
7	Anaheim-Santa Ana	2,171,929	253,008	11.65%
8	Houston	3,205,171	230,027	7.18%
9	San Jose	1,419,521	215,957	15.21%
10	Boston	5,383,370	203,951	3.79%
11	Oakland	1,908,848	196,428	10.29%
12	San Diego	2,126,091	184,192	8.66%
13	Newark	1,953,893	172,904	8.85%
14	**Philadelphia**	**4,818,838**	**155,583**	**3.23%**
15	Bergen-Passaic	1,301,487	150,603	11.57%
16	Nassau-Suffolk	2,621,547	139,701	5.33%
17	Dallas	2,432,840	134,703	5.54%
18	Seattle-Bellevue-Everett	1,778,460	124,525	7.00%
19	Detroit	4,224,650	112,249	2.66%
20	Jersey City	568,869	111,619	19.62%
	20 Biggest Immigrant Cities	67,047,667	6,710,830	10.01%

IMMIGRATION IN THE THIRD DISTRICT

The map shows the number of immigrants as a percentage of population by postal zip code. The data correspond to the 15-year period starting in 1983. It is easy to see that immigrants tend to cluster in metropolitan areas (delimited in the map). Many areas of the Third District are not exposed to immigration. The main areas of attraction are northern New Jersey and Philadelphia.
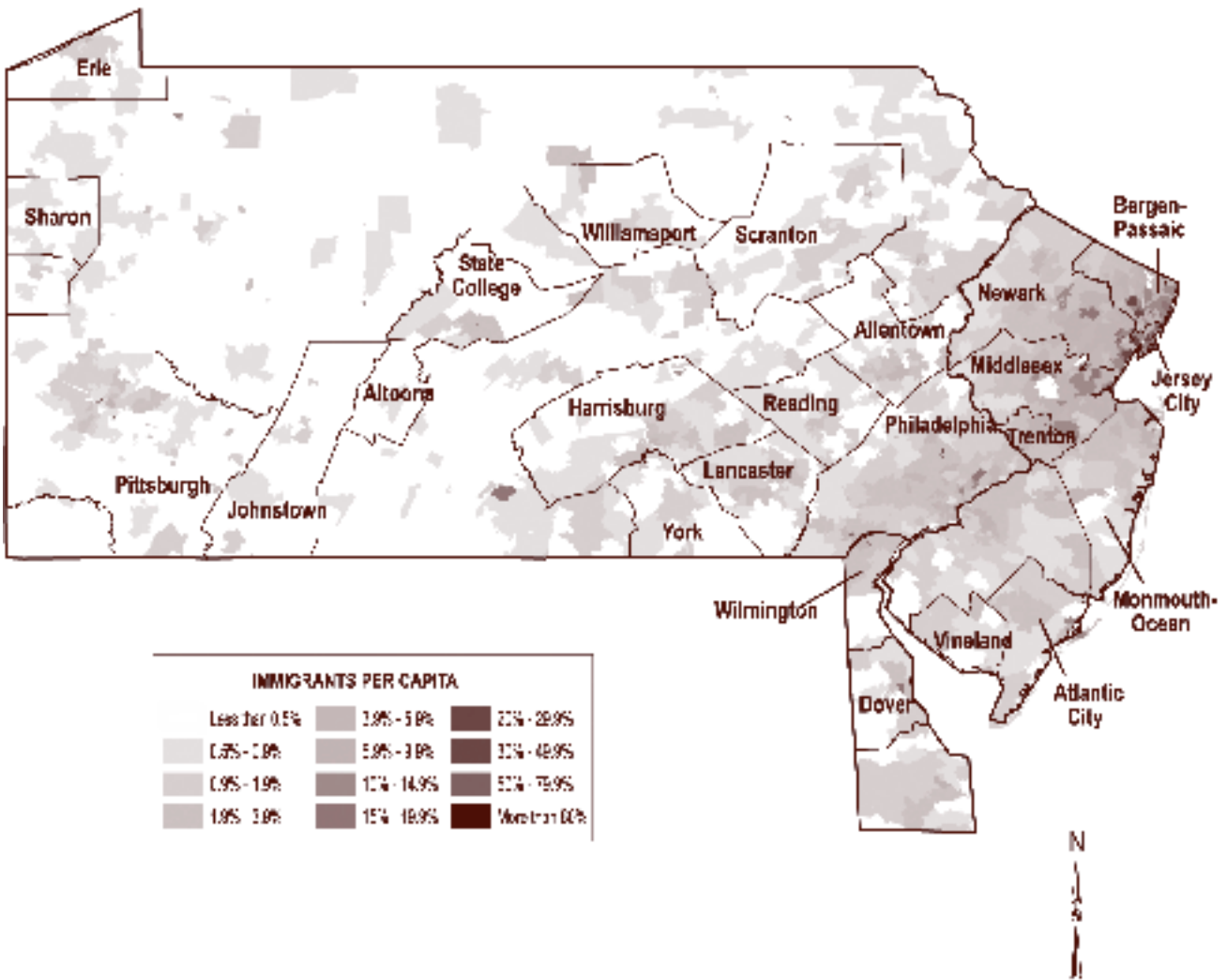
increased 7 percent to 11 percent. I have obtained similar results for other immigrant destinations in the United States. An immigration inflow that amounts to 1 percent of the city's population is associated with increases in housing values and rents of about 1 percent.

Immigration's effects on housing markets are much more substantive than its effects on labor markets. Remember that one explanation for why immigration may not have an impact on labor markets is that some natives avoid areas where immigrants concentrate, such as New York or Los Angeles. Although there is no definitive consensus on how the internal flows of native workers respond to immigration, a National Research Council report on immigration has argued that "competing native workers migrate out of the areas to which immigrants move." Given the fact

that immigration doesn't affect wages, higher housing rents can help explain why certain areas might become less attractive to natives.

In the short run, the results have implications for the distribution of real income through the housing market. Homeowners stand to gain from immigration while renters experience slightly higher prices. But there are reasons to think that these effects may disappear in the long run. Remember the idea of an economy as an interconnected system of cities. When a city becomes more expensive, some people will find it less attractive to live there. In time, immigrants become natives in terms of tastes and motivations. Thus, in time, some natives and immigrants can be expected to leave immigrant areas for less expensive areas. Housing demand will decrease in immigrant cities and increase in the rest of the country. Since supply is highly elastic at the national level, the long-run impact of immigration on *national* housing prices may be relatively small.

Some people have argued that immigration can help revitalize rundown neighborhoods, especially in declining cities. Joe Gyourko and I have demonstrated a clear link between housing prices, building costs, and housing reinvestment (investment in housing renovation, additions, and maintenance). A house with a market value below what it would cost to build a unit with similar characteristics is not a good investment: the cost of replacing parts of the house that deteriorate over time is greater than the market value of what is replaced. We would expect landlords (and home owners) not to invest much in these units. Immigration pushes up demand and prices in rundown areas. If house values go from being below to being above replacement costs, we should expect major revitalization. In other

cases (in which there are price hikes but units are above or below construction costs both before and after immigration), changes in renovation expenditures will be relatively small. Immigration needs to be associated with higher prices in a neighborhood in order to bring revitalization. But higher prices are a necessary, not sufficient, condition for revitalization.

NONMARKET IMPACT OF IMMIGRATION

Immigration has many other economic and social impacts that don't involve markets. We will consider two of these issues: taxes and crime.

Taxes. Immigrants come to the United States in search of a better life, but they can avoid neither death nor taxes here. Indeed, legal immigrants pay federal, state, and local taxes. Immigrant families also enjoy some of the benefits of public services and receive transfer payments. Social scientists have studied whether, on average, natives are subsidizing or being subsidized by immigrants through the federal, state, and local tax systems.

Ronald Lee and Timothy Miller, two demographers at the University of California at Berkeley, concluded that immigrants are net contributors to the federal tax system. New immigrants have relatively high labor participation rates and pay federal income and social security taxes. The taxation of immigrants through the social security system is

a singularly good deal for Americans, since about 35 percent of immigrants emigrate back to their countries of origin after some time in the U.S. and never claim the benefits.[6]

But are immigrants net contributors to the total tax system,

Social scientists have studied whether, on average, natives are subsidizing or being subsidized by immigrants through the federal, state, and local tax systems.

including state and local taxes as well as federal taxes? The National Research Council found a small negative contribution (that is, native taxpayers subsidizing immigrants) in the case of New Jersey and a substantial deficit in California, once local and state taxes are taken into account. Since New Jersey and California are among the states with a higher proportion of immigration, immigrant families in these states are among the major beneficiaries of the school system and other local public spending programs. The results point to the fact that the net contribution of immigrants is very sensitive to local and state policies.

Indeed, in the same study, the National Research Council found the fiscal benefits of immigrants for the *average* U.S. taxpayer to be positive, taking all federal, state, and local taxes and outlays into account. How can we reconcile this fact with the findings from New Jersey and California? Again, immigration has a mild *distributive* impact. In states with a major number of immigrants and generous spending policies, immigrants

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[6] For more on social security and immigration, see the article by Alan Gustman and Thomas Steinmeier.

receive more than they contribute in taxes. In other states, taxpayers enjoy their share of the positive contribution of immigrants to the federal budget without requiring major additional expenditures. These two scenarios average out as a positive surplus for the typical native U.S. taxpayer.

An issue that has captured the attention of many researchers is participation in welfare programs. Economists Michael Fix, Jeffrey Passel, and Wendy Zimmermann, at the Urban Institute in Washington, D.C., summarized the main facts of the early 1990s. Immigrants used welfare slightly more than natives (6.6 percent versus 4.9 percent). However, welfare use was disproportionately concentrated among refugees and elderly immigrants. Non-refugee, working-age immigrants had welfare participation rates similar to those of natives. In any case, changes in federal assistance programs in the late 1990s made it more difficult for immigrants to access such programs.

Crime. Economists have only recently started to examine the impact of immigration on social interactions. Clearly, these interactions are important in assessing immigration's general impact.

Economists Kristin Butcher and Anne Morrison Piehl have studied one of the most controversial topics in this area: the relationship between immigration and crime. Their results are quite unexpected. They found that the incarceration rate of male immigrants was about two-thirds that of natives. The fact that immigrants tend to be incarcerated less often than natives (and presumably to commit less crimes) is even more surprising when one considers they have, on average, less education and earn lower wages.[7] Butcher and Piehl also found that the longer the time a foreign-born individual had spent in the United States, the closer his probability of incarceration is to that of natives. These authors argued that "this suggests that immigrants may assimilate to the (higher) criminal propensities of natives."

CONCLUSION

Immigration has been at the center of many policy debates over the past two centuries. Unfortunately, the discussion has not always revolved around the existing evidence. I have argued that immigration provides overall economic gains to a country. Indeed, the U.S. experience as an immigrants' country is one of phenomenal economic growth.

However, there are winners and losers in the short run. The trend toward a relatively more unskilled immigrant population has been associated with mildly slower growth in the wages of low-skilled individuals. This effect is hard to measure, but it seems

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[7] These results may be explained by the threat of deportation, but more research in the U.S. and other countries will help us learn more about this topic.

to be small. I have also argued that immigration seems to have no sizable impact on employment or unemployment in the United States.

Immigration has a positive impact on housing prices and rents in cities that attract the foreign-born. This benefits existing homeowners and landlords but makes these cities less attractive to renters and prospective native in-migrants. In the long run, these effects are bound to dissipate as immigrants and their offspring become Americans and leave the traditional port-of-entry cities.

The *average* U.S. taxpayer benefits from immigrants' contributions to the tax system, taking all federal, state, and local taxes and outlays into account. But the impact is mild, and the average distribution of income through the tax system is not uniform. Immigrants' federal tax contributions result in benefits to natives in most states with low immigration levels. But states with high immigration levels have higher expenditures associated with the increased burden on public services.

The distributive consequences of recent immigration inflows cannot be ignored, although which mix of distributive or immigration policies is better for dealing with them is a matter of opinion.

Finally, I have discussed that, in the United States, there is evidence that immigrants have lower propensities to commit crimes than natives.

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Taking the Measure of Manufacturing

BY TIMOTHY SCHILLER & MICHAEL TREBING

Despite manufacturing's decline as a share of the U.S. economy, it is still a significant sector, and an increasing number of surveys monitor its movements. Why this continuing strong interest in manufacturing? Because it is more cyclically sensitive than the total economy, the manufacturing sector can serve as an indicator of cyclical fluctuations as they develop. In this article, Tim Schiller and Mike Trebing outline several of the most important surveys and indexes that track manufacturing, describe their similarities and differences, and discuss their usefulness in providing timely and accurate data on the sector.

Why the continued strong interest in manufacturing? Manufacturing remains an important industry, and because it is more cyclically sensitive than the total economy, the manufacturing sector can serve as an indicator of cyclical fluctuations as they develop.[1]

Several measures have been developed to monitor conditions in the manufacturing sector. One of the broadest and oldest series is the Federal Reserve System's national Industrial Production Index, which has sub-indexes for manufacturing, mining, and utilities. Because of the cyclical sensitivity of these sectors, this monthly index is included as a component of the index of coincident indicators of the overall economy.

Other monthly measures of

The decline in the manufacturing sector as a share of the U.S. economy in the last half of the 20th century has been one of the most notable changes in the nation's economic structure. In nominal terms (that is, in current dollars), manufacturing's share of the total output of the U.S. economy is only about half of what it was in 1950. Manufacturing employ-

ment has also declined as a share of total employment. These trends have been even stronger in the Third Federal Reserve District — Pennsylvania, New Jersey, and Delaware — than in the nation. Despite these trends, manufacturing is still a significant part of the U.S. economy, and it remains a key indicator of changes in national and regional economic conditions. Thus, even while manufacturing's share of total output has declined, it continues to be closely monitored and analyzed. Data collection devoted to monitoring manufacturing has not declined; in fact, it has increased, and the manufacturing sector receives as much attention now, both nationally and regionally, as it ever has.

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[1] The cyclical sensitivity of manufacturing is evident in an analysis of the average decline during recessions. The average decline in gross domestic product (GDP) during the nine recessions in the past 50 years was 1.7 percent; the average decline in manufacturing as measured by the Industrial Production Index was 7 percent. GDP itself can be separated into the production of goods excluding structures and all other production. The average decline in the goods component, of which approximately 75 percent is manufacturing, was 4.7 percent during recessions; the average decline in the production of services and structures was 0.1 percent.

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manufacturing come from the Census Bureau, which compiles statistics on manufacturers' orders, shipments, and inventories. Among private organizations, the Institute for Supply Management publishes a monthly survey of changes in manufacturing activity that receives wide attention. There are also regional surveys and indexes of manufacturing, such as the Philadelphia Fed's Business Outlook Survey.

LONG-RUN TRENDS IN MANUFACTURING

Before we look at some of the short-run measures of manufacturing, a brief review of the long-run trends in the sector will provide some context. From 1950 to 2000 (the last full year before the 2001 recession), manufacturing's share of current-dollar GDP fell from 29 percent to 15 percent. Nevertheless, by this measure, manufacturing is still the third largest of the industry classifications into which the economy is usually divided for analytical purposes (Table 1).[2] From 1950 to 2000, the number of manufacturing jobs in the nation increased by around 3 million, a 21 percent gain. Meanwhile, total nonagricultural employment increased by approximately 87

million jobs, nearly a 200 percent gain. As a result, manufacturing's share of nonagricultural employment declined by more than half, from 34 percent to 14 percent.[3] Still, manufacturing is the fourth largest industry division by employment (Table 2).[4] (There have also been shifts in the regional distribution of manufacturing within the U.S. For a discussion of how they have affected the Third District's region, see *Manufacturing in the Region*.)

The decline in manufacturing's share of national nonagricultural employment and nominal GDP can be attributed to several developments. In part, this decline in share represents stronger-than-average growth in pro-

ductivity in this sector of the economy. This growth in productivity made it possible for real output in manufacturing (the value of output adjusted for inflation) to expand while the number of workers required to produce the expanded output decreased.[5] Another factor in manufacturing's declining share of employment and output is the fact that a greater portion of the U.S. economy is now devoted to the consumption of services.[6] And even if goods had retained their share of U.S. consumption, the share of domestically produced goods would have declined because imports now make up a greater portion of goods consumed in the U.S. than they did in the past.[7]

Also contributing to the

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[2] These are the industry divisions of the Standard Industrial Classification (SIC) system. Beginning in 2004, GDP by industry will be organized using the North American Industry Classification System (NAICS).

[3] Agricultural employment is not measured in the same way as employment in other sectors, so it is not included in the employment comparisons used here.

[4] Employment data for 2000 (the most recent year in the table) are available in NAICS, but we use SIC for historical comparisons and to be consistent with the GDP data, which will use SIC until 2004.

[5] From 1950 to 2000 manufacturing output per hour increased 3.8 times while output per hour in the total nonfarm business sector increased 2.7 times.

[6] In 1950 manufactured goods made up 63 percent of personal consumption expenditures. By 2000, manufactured goods accounted for just 41 percent of personal consumption expenditures.

[7] In 1950, U.S. exports of manufactured goods exceeded imports. By 2000, the balance of trade in manufactured goods was reversed, and U.S. imports of manufactured goods exceeded exports.

TABLE 1

GDP Shares, Current$, Percent

	1950	2000
Services	8.2	21.5
Finance, insurance, and real estate	10.5	20.1
Manufacturing	28.6	15.5
Government	10.8	12.4
Retail trade	10.8	9.0
Transportation and public utilities	9.1	8.2
Wholesale trade	6.7	7.1
Construction	4.5	4.7
Agriculture, forestry, and fishing	7.0	1.4
Mining	3.2	1.4

TABLE 2

National Nonagricultural Employment Shares (Percent)

	1950	2000
Services	11.9	30.7
Retail trade	14.9	17.7
Government	13.3	15.7
Manufacturing	33.7	14.0
Finance, insurance, and real estate	4.2	5.8
Transportation and public utilities	8.9	5.3
Wholesale trade	5.9	5.3
Construction	5.2	5.1
Mining	2.0	0.4

T he broad trends that affected the national manufacturing sector during the last half of the 20th century also had an impact on manufacturing in the tri-state region (Pennsylvania, New Jersey, and Delaware). Manufacturing has declined as a share of both output and employment in the region. Besides the national trends, the region has also been affected by the shift of manufacturing away from northern and eastern areas of the nation and toward the southern and western areas (see the article by Ted Crone).

The shift in manufacturing within the nation has resulted in increases in the share of manufacturing output in the five southern and wester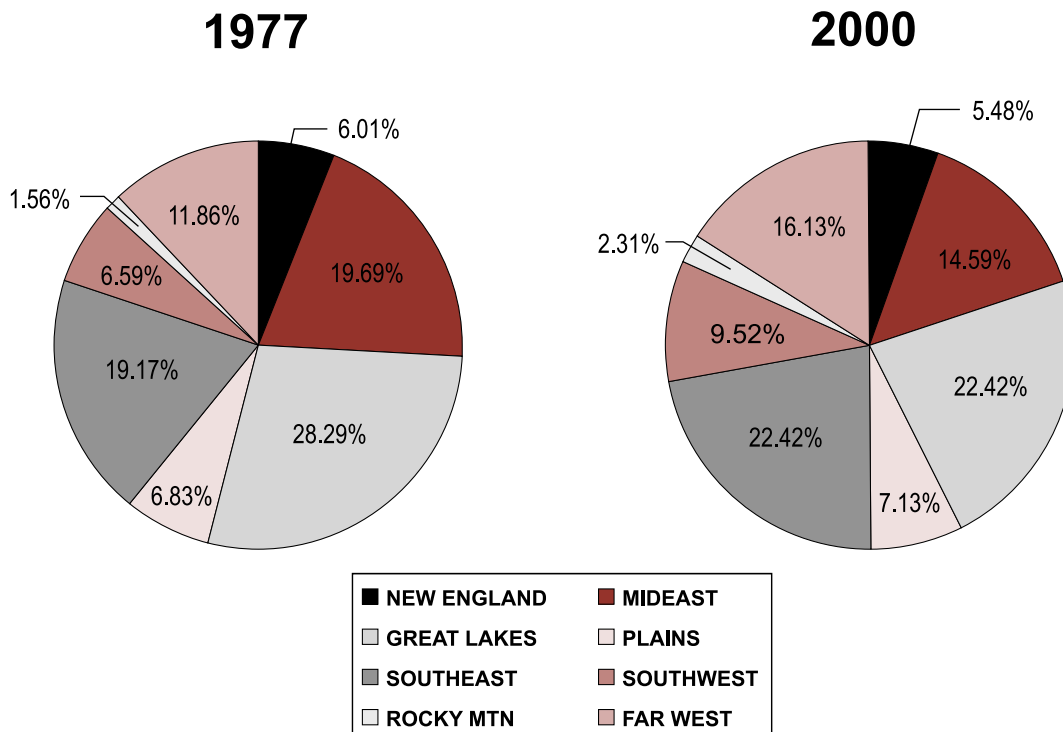n economic regions as defined by the Bureau of Economic Analysis and declines in the three northern and eastern regions — New England, Mideast, Great Lakes (see Figure).[a]   The three states in the Third Federal Reserve District, which are in the Mideast region, shared in this decline.[b]   In fact, the Mideast had the greatest relative decline in its share of manufacturing output among all the regions. Within the Mideast region, the relative decline in manufacturing was greater in New York than in any of the other states.

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[a] The eight BEA regions are New England, Mideast, Great Lakes, Plains, Southeast, Southwest, Rocky Mountain, and Far West.

[b] The Mideast region also includes New York and Maryland.

FIGURE

Shares of Manufacturing Output*

1977

6.01%
1.56%
11.86%
19.69%
6.59%
19.17%
28.29%
6.83%

2000

5.48%
2.31%
16.13%
14.59%
9.52%
22.42%
22.42%
7.13%

Legend:
- ■ NEW ENGLAND
- ■ MIDEAST
- □ GREAT LAKES
- □ PLAINS
- ■ SOUTHEAST
- ■ SOUTHWEST
- □ ROCKY MTN
- ■ FAR WEST

*Output is measured by total GSP for the 50 states and the District of Columbia. Regions are those defined by the Bureau of Economic Analysis.

Consequently, the share of the Mideast region's manufacturing output accounted for by Pennsylvania, New Jersey, and Delaware (as well as Maryland) rose slightly from 1977 (the first year for which gross state product data are available) to 2000. Even though each of the three states fared better than the Mideast region as a whole, they each lost shares of national manufacturing output (see Table).

As the region's manufacturing sector has declined with respect to national manufacturing, it has also diminished as a part of the region's overall economy. In Pennsylvania, New Jersey, and Delaware, manufacturing output as a share of total state output declined from 1977 to 2000, and the relative decline in the three states was greater than in the nation. Manufacturing's share of the total GSP of all 50 states fell from 23 percent in 1977 to 16 percent in 2000.[c] Manufacturing's share of GSP in Delaware decreased from 35 to 15 percent; in New Jersey it decreased from 27 to 14 percent; and in Pennsylvania it decreased from 29 to 19 percent. Pennsylvania's economy was more manufacturing oriented than the national economy in 1977, and it remained somewhat more manufacturing oriented in 2000. Over the same period, New Jersey moved from a greater concentration in manufacturing than the nation to a lesser concentration. Delaware, which started with a significantly greater concentration in manufacturing, moved to a virtually equal concentration.

Employment from 1977 to 2000 shows a pattern similar to that in the data for output. Nationally, manufacturing employment declined 6 percent. The decline was much greater in all three Third District states. Manufacturing employment fell 31 percent in Pennsylvania, 40 percent in New Jersey, and 14 percent in Delaware. As a share of employment, manufacturing declined from 24 percent to 14 percent nationally. The decline in manufacturing's share of employment in each of the three states was greater: from 30 percent to 16 percent in Pennsylvania, from 27 percent to 12 percent in New Jersey, and from 28 percent to 14 percent in Delaware. In 2000, manufacturing retained a greater share of employment in Pennsylvania than it did in the nation, but the difference narrowed. Manufacturing employment fell from a greater to a lesser share in New Jersey than in the nation. In Delaware, manufacturing's share decreased from above the national share to an equal share.

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[c] There is a slight difference in the methods by which national output (GDP) and state output (GSP) are calculated, and this accounts for the difference between manufacturing's share of national output and its share of the total of states' GSP.

The trend of dispersion in manufacturing around the country away from the traditionally heavy manufacturing centers was also reflected to some extent within the region. From 1977 to 2000, manufacturing employment declined in all the metropolitan statistical areas in the three states except Lancaster. Moreover, the manufacturing jobs that remain in the region have become more dispersed. Manufacturing jobs in some of the more populous counties in the larger metro areas are now a smaller percentage of total manufacturing employment in the three states. This is true for Allegheny and Philadelphia counties in Pennsylvania; Essex and Union counties in New Jersey; and New Castle County in Delaware. Conversely, some of the counties in the less populous metro areas had higher percentages of the manufacturing jobs in the tri-state area, for example, Lancaster, York, and Centre counties in Pennsylvania; Cumberland, Middlesex, Somerset, and Hunterdon counties in New Jersey; and Kent County in Delaware. This dispersion of manufacturing jobs from large metro areas to smaller ones was part of a general shift in the shares of all types of jobs from more densely populated to less densely populated areas (see the article by Gerald Carlino).

Dispersion also took place within the large metro areas, as suburban counties gained shares of manufacturing employment and central city counties lost shares. Examples include gains in share for Bucks, Burlington, and Camden counties in the Philadelphia metro area and Morris County in the Newark, NJ, metro area.

TABLE

State Shares of National Manufacturing Output*

	% 1977	% 2000
Delaware	0.46	0.35
New Jersey	3.83	3.20
Pennsylvania	6.31	4.82

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*Measured as a percent of the manufacturing portion of total GSP for the nation

decline of measured employment in the manufacturing sector has been the increased outsourcing of manufacturing firms' ancillary nonproduction functions. Workers in areas such as accounting, marketing, and shipping would have been counted in manufacturing employment if they were employees of manufacturing firms. If they are employed by accounting firms, advertising agencies, and transportation companies — as many now are — they are counted in service-producing employment. Similarly, a large increase in the use of temporary workers in the manufacturing sector increased the number of workers counted in the services industry (where temporary employment is counted) and decreased the number counted in manufacturing.[8] Manufacturing firms now make greater use of service firms that provide ancillary functions, and they more frequently turn to agencies that supply temporary workers rather than using their own employees for these activities. In addition, some of the decline in measured manufacturing employment has come about because workers had been classified by the industry of the firm for which they worked; now they are classified by the type of work done at their place of employment.[9]

MEASURING MONTHLY CHANGES IN MANUFACTURING OUTPUT

Changes in Levels. As noted earlier, the manufacturing sector continues to be more cyclical than the overall economy (especially the service sectors). The cyclical variability of

manufacturing has prompted efforts to develop measures of manufacturing that would give frequent and timely indicators of change in activity in the sector.

The Federal Reserve's Industrial Production Index (IP) has evolved from statistical efforts that began in 1919 with the goal of providing monthly measures of the physical volume of production and trade (it does not give dollar value) in major industries and in total.[10] Because it is an index number, this measure can be used to compare the level of activity in one period with the level in another and to show changes over time.

The Census Bureau publishes other indicators of the level of manufacturing activity. These measure the dollar value of manufacturers' shipments, orders, and inventories. The data series are monthly from 1958 and include measures for many subsectors of manufacturing as well as total manufacturing. Like the Industrial Production Index, these series can be used to compare the level of activity in one period with that in another period and to show changes over time. For the Census measures and the Industrial Production Index, interest in the monthly reports focuses on the change from the previous month as an indication of the direction of change in manufacturing activity.

There are few monthly data

below the national scale on the level of output in the manufacturing sector. The Federal Reserve Bank of Dallas computes a monthly Texas Industrial Production Index, similar to the national index, but most sub-national data are annual.[11] The most detailed data are at the state level, and they are available with a lag from the Census Bureau's *Annual Survey of Manufactures*, which includes a measure of value added in manufacturing. Some

data on manufacturing establishments and employment are included in *County Business Patterns*, another annual series available with a lag from the Census Bureau.[12]

Breadth of Changes. In addition to measuring the level of production, there's another way to track changes in activity: national and regional surveys that directly measure the breadth of change in the manufacturing sector. These surveys often attract interest because of their timeliness.

One of the most widely followed measures of manufacturing activity is the index based on the monthly survey of manufacturing firms by the Institute for Supply Management (ISM), which was formerly the National Association of Purchasing Managers. The ISM's index is still of-

> The cyclical variability of manufacturing has prompted efforts to develop measures of manufacturing that would give frequent and timely indicators of change in activity in the sector.

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[8] The increase was especially sharp in the 1980s and 1990s; see the article by Bill Goodman and Reid Steadman.

[9] The new NAICS classifies workers by the type of work performed at their location. For example, a manufacturing firm's research facility is now classified under services instead of manufacturing.

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[10] For a description of the Industrial Production Index methodology, see the publication from the Board of Governors.

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[11] For a description of the Texas Industrial Production Index, see the article by Franklin Berger and William Long.

[12] The lag between the reference year and publication year for these Census Bureau statistical series is up to two years.

ficially called the Purchasing Managers Index, or PMI. In its current form, the PMI is a weighted average of five indexes that track monthly changes in new orders, production, employment, supplier delivery times, and inventories at ISM's member firms. Firms surveyed report whether each of these measures of activity has increased, decreased, or been unchanged since the previous month.

Surveys of the direction of change have several advantages compared with other economic statistics. They are usually less intrusive and easier for firms to respond to, since they do not require specific numbers but only an indication of an increase, decrease, or no change. This contributes to a better response rate among firms surveyed and quicker compilation of results compared with more detailed survey questions. Diffusion indexes are derived from the difference between the percentage of survey respondents indicating an increase in some measure of activity and the percentage of survey respondents indicating a decrease in that measure. Over time, diffusion indexes reflect how changes in economic conditions actually develop, as the spread between the percentage of firms reporting increases and decreases widens.

According to Geoffrey Moore, former director of the Center for International Business Cycle Research, "One of the fundamental features of our economic system is that economic movements spread from one firm to another, from one industry to another, from one region to another, and from one economic process to another. Moreover, these spreading movements cumulate over time. This being so, it is desirable to have measures showing how this spreading and cumulation goes on. A diffusion index is just such a measure."

By measuring the diffusion, or spreading, of survey responses (toward one extreme or another of the index's range), diffusion indexes reflect the way changes in the pace of economic activity are propagated across firms. For example, in an economic expansion, the first effects are usually felt by just a few firms. When they experience a pickup in business, they step up production to meet the stronger demand. They buy more raw materials and machinery, hire more labor, and so forth. This process repeats itself at the firms that supply materials to the first few firms, and the higher employment leads to higher incomes and spending, which gives a boost to other firms and

By measuring the diffusion, or spreading, of survey responses, diffusion indexes reflect the way changes in the pace of economic activity are propagated across firms.

industries. As the process continues, the expansion spreads through the economy. As the expansion spreads, statistical measures of the level of output begin to increase, confirming in detail the process first reflected by the increase in diffusion indexes that signaled the beginning and spreading of the expansion.

In addition to national measures of changes in manufacturing activity, there are regional surveys. Local associations of the ISM produce their own reports that include diffusion indexes. Currently, 13 local associations produce reports, although not all of them are monthly. The local associations that conduct surveys are Arizona, Austin, Buffalo, California, Chicago, Cleveland, Dallas, Georgia, Houston, New York, Northwest Ohio, Pittsburgh, and Western Washington. Within the Federal Reserve System, the Federal Reserve Banks of

Philadelphia, Kansas City, New York, and Richmond conduct manufacturing surveys.[13] Diffusion indexes are compiled from these surveys, as they are from the ISM's survey. (See *Constructing Diffusion Indexes* for a description of the different ways in which the diffusion indexes discussed here are calculated.)

EVALUATING THE INDICATORS OF MONTHLY CHANGE FROM NATIONAL AND REGIONAL SURVEYS

While the Federal Reserve Board's index of industrial production tells us a great deal about trends in the manufacturing sector and about the magnitude of the monthly changes in production, market participants rely on surveys to get an even earlier indication of changes in the sector. Both the PMI and the index constructed by Chicago's local association of the ISM, which is called the Business Barometer Index, have a long history, and they are available near the beginning of each month.[14]

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[13] Monthly releases are available on the Federal Reserve Banks' web sites: Richmond, www.rich.frb.org/research/surveys/; Kansas City, www.kc.frb.org/mfgsurv/mfgmain.htm; New York, www.newyorkfed.org/rmaghome/regional/mfg_survey/index.html; Philadelphia, www.phil.frb.org/econ/bos/. More details on the surveys conducted by Philadelphia, Richmond, and Kansas City are available in the article by Michael Trebing, the article by Christine Chmura, and the one by Tim Smith.

[14] Historical data are available for the PMI from 1931 and for the Chicago Purchasing Managers index from 1948.

Both are used extensively to forecast changes in the IP index, which is published later in the month. Several Federal Reserve Bank manufacturing surveys are also available before the IP index, and the Philadelphia Fed's Business Outlook Survey (BOS) is the oldest of these.

Table 3 presents the correlations between four measures of monthly change in manufacturing activity: monthly changes in the manufacturing component of the industrial production index (IP-M), the Philadelphia Fed's general activity index, the PMI, and the Chicago Purchasing Managers Business Barometer Index. The correlations cover the 36-year period corresponding to the history of the Philadelphia Fed's Business Outlook Survey. Similar diffusion measures constructed at the Kansas City, New York, and Richmond Federal Reserve Banks have a much shorter history and thus are not included in the table.[15] The two purchasing manager surveys (the PMI and Chicago Business Barometer Index) are highly correlated with each other, and both are correlated with monthly changes in the IP-M. In addition, the correlation of the Philadelphia Fed's Business Outlook Survey index with the IP-M is comparable to the correlation between the IP-M and the PMI.

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[15] The regional measures for the Richmond Fed shipments index and the Kansas City production index have the lowest correlation with the monthly change in the IP-M (0.42 for Richmond and 0.43 for Kansas City). The broadest measure in the Richmond Fed's survey is manufacturing shipments, and seasonally adjusted data are available from November 1993. Kansas City's index is not available seasonally adjusted because of its short history (available only since July 2001), which may explain its lower correlation to the national manufacturing measures. The New York Fed's new Empire State Index is highly correlated with the IP-M (0.66), but its limited history (since July 2001) may limit its usefulness as a forecasting tool.

Constructing Diffusion Indexes

The principle of the diffusion index is the same for all of the diffusion indexes discussed in this article, but their arithmetic computation varies. Consequently, the base or "no change" level and the minimum and maximum values that the indexes can take are different. The Philadelphia Fed's Business Outlook Survey consists of a number of questions about business processes such as new orders, shipments, employment, and workweek among manufacturing firms in the Third Federal Reserve District. Diffusion indexes are calculated for each question in the survey. To gauge how widespread changes in an indicator are among firms, we calculate the percentages of firms reporting increases, decreases, and no change, and we subtract the percentage decrease from the percentage increase. The resulting diffusion index can vary from +100, when all firms report an increase, to –100, when all firms report a decrease. The midpoint is 0, when the percentage of firms reporting increases equals the percentage reporting decreases. Firms in the survey have never been unanimous, so the diffusion index has taken on a value between –100 and +100. The indexes computed by other Federal Reserve Banks are similar. The closer the index is to either of these two extremes, the more diffuse, or widespread, is the change (either decrease or increase) in the indicator reported.

The Institute of Supply Management's Purchasing Managers Index (PMI) is computed differently. Instead of subtracting the percentage decrease from the percentage increase, the PMI adds one-half of the percentage of firms reporting no change to the percentage reporting an increase to form the index. As a result, the PMI can vary from 0 to 100, with 50 being the midpoint. Another difference among the surveys is that the overall index in the Philadelphia Fed's Business Outlook Survey is derived from a separate question that measures manufacturers' assessments of overall business conditions; in the other surveys, the overall index is a composite of the indexes calculated for specific questions.

FORECASTING INDUSTRIAL PRODUCTION WITH MANUFACTURING SURVEYS

The diffusion indexes from the major surveys are positively correlated with changes in IP-M, but how much *new* information do they provide about manufacturing? The availability of diffusion indexes ahead of the release of the industrial production indexes provides a test of their usefulness in forecasting the current month's change in the manufacturing component of the IP. The ISM releases its data on the first business day of each month covering the previous month.

In addition to the composite index for manufacturing (PMI), the ISM produces 10 sub-indexes, including one for production. Since the IP indexes are not released until mid-month, the information contained in the ISM indexes provides forecasters with a way to predict the IP-M.

The statistical relationship between the PMI and the IP-M is well established, which explains the attention it receives from financial analysts.[16] Table 4 presents statistical

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[16] See the articles by Mark Rogers; Ethan Harris; and Evan Koenig.

TABLE 3

Correlation Coefficients for Key Measures of Monthly Change in Manufacturing

	Monthly Change in Manufacturing Component of Industrial Production Index (IP-M)*	Philadelphia Fed Business Outlook Survey, General Activity Index	ISM Composite Index (PMI)	Chicago Purchasing Managers Business Barometer Index
Monthly Change in Manufacturing Component of Industrial Production Index (IP-M)*	1.0	0.57	0.54	0.48
Philadelphia Fed Business Outlook Survey, General Activity Index		1.0	0.74	0.67
ISM Composite Index (PMI)			1.0	0.92
Chicago Purchasing Managers Business Barometer Index				1.0

NOTES: Sample period is from May 1968 to June 2003, the period for which data are available for the Business Outlook Survey.

* Monthly change is calculated as the log difference in the index multiplied by 100, which is approximately equal to percent change.

TABLE 4

Forecasting Monthly Change in the U.S. Manufacturing Production Index (IP-M)

Explanatory Variables:	R^2	**Coefficient on Diffusion Index***
1. Current Month's Purchasing Managers Composite Index (PMI)	0.29	0.064 (13.2)
2. Current Month's Purchasing Managers Production Index	0.36	0.065 (15.2)
3. 12 lagged values of percent change in IP-M	0.21	
4. 12 lagged values of percent change in IP-M plus current month's PMI (composite index)	0.32	0.065 (8.2)
5. 12 lagged values of percent change in IP-M plus current month's ISM production index	0.36	0.068 (9.8)
6. Percent change in manufacturing hours (current and lagged 3 months)	0.60	—
7. Percent change in manufacturing hours, lagged IP-M, plus current month's PMI (composite index)	0.61	0.023 (3.7)
8. Percent change in manufacturing hours, lagged IP-M, plus current month's ISM Production Index	0.63	0.035 (6.0)

NOTES: Regressions are based on the estimation period of 1969 to 2003. Monthly change is calculated as the log difference multiplied by 100, which is approximately equal to percent change.

* Absolute values of t-statistics are shown in parenthesis. The t-statistic tests the hypothesis that the diffusion index coefficient is significantly different from zero. In all of the regressions the diffusion index is significant at less than the 0.01 level, meaning there is less than a 1 percent probability that the diffusion index coefficient is equal to zero.

results of various regression models to estimate how well the indexes from the ISM survey predict the monthly change in the production index for manufacturing. Since the ISM produces both a composite diffusion index and a production index, results using each are shown in the table.[17] The regressions are estimated using data from 1969 through June 2003. That time period was chosen to correspond to availability of data for the Business Outlook Survey so that a comparison of forecast performance could be made. In each of the models shown, the dependent variable (the variable to be forecast) is the monthly percent change in the Industrial Production Index for manufacturing (IP-M). The explanatory variables include indexes from the ISM survey and other information available to the market at various times prior to the release of the Industrial Production Index.

The results demonstrate that, by themselves, the diffusion indexes from the ISM survey "explain" 29 to 36 percent of the month-to-month variation in the monthly changes in the IP-M (see rows 1 and 2 of Table 4).[18] The results also indicate that the PMI and the production index from the survey add information, even when the history of the IP-M itself is in the regressions. (Rows 3, 4, and 5 include

12 lagged values of the change in the IP-M as explanatory variables.)

Near the beginning of the month (following the release of the PMI and the production index from the ISM survey, but ahead of the release of the IP-M), data on manufacturing employment and work hours also become available to the market. Table 4 also shows that available employment and average workweek statistics also forecast monthly IP-M. By creating a total manufacturing work-hour statistic (average hours multiplied by manufacturing employment), we can "explain" about 60 percent of the month-to-month variation in the IP-M (row 6). But even when we use this additional information on hours worked, the PMI and the production index from the same survey remain significant in explaining the variation in IP-M (rows 7 and 8). Table 4 shows that the diffusion indexes by themselves are useful for predicting changes in manufacturing production. It also shows that when the diffusion indexes are combined with other available information, they can increase the accuracy of a forecast of changes in the IP-M.

Although the PMI and accompanying indexes add information to a forecast for the IP-M, the availability of the Philadelphia Fed's Business Outlook Survey indexes makes it possible to create a forecast even sooner. Since the BOS is released

on the third Thursday of the reference month for the IP-M, it is available almost a month earlier than the release of the IP-M and two to three weeks earlier than the PMI. Table 5 summarizes the statistical relationship between the Philadelphia Fed's general activity diffusion index and the monthly percent change in the IP-M for the months estimated over 1969 to 2003.

> **Although the PMI and accompanying indexes add information to a forecast for the IP-M, the availability of the Philadelphia Fed's Business Outlook Survey indexes makes it possible to create a forecast even sooner.**

Table 5 (row 1) shows that the simple model using the general activity index from the Business Outlook Survey explains approximately the same percentage of variation in the change in the IP-M as the national Purchasing Managers Index.[19] Table 5, row 2 also includes a model using a constructed BOS "weighted index" based on the same weights the PMI uses for its five sub-indexes. (We substituted the BOS shipments index for the production index, since the BOS does not include a production index.) The R^2 for that model (0.26) was lower than that for the general activity index (0.33), so weighting the individual questions from the BOS

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[17] The PMI is a composite index based on the seasonally adjusted diffusion indexes of five separate indicators with the following weights: new orders, 30 percent; production, 25 percent; employment, 20 percent; supplier deliveries, 15 percent; and inventories, 10 percent.

[18] The t-statistics indicate that the PMI diffusion index is statistically significant in the forecast of the IP-M, which is released about two weeks after the PMI. In all of the regressions, the coefficient on the diffusion index is significantly different from zero at less than the 0.01 level, meaning there is a less than 1 percent probability that the diffusion index coefficient is equal to zero.

[19] The relative size of the coefficients (0.024 for the BOS and 0.064 for the PMI) is to be expected because of differences in methods used for constructing indexes. The BOS diffusion ranges from -100 to +100 while the PMI ranges from 0 to +100; so the equivalent indexes are linear transformations of each other.

TABLE 5

Forecasting Monthly Change in the U.S. Manufacturing Production Index (IP-M) Using the Business Outlook Survey (BOS)

	Explanatory Variables:	R^2	Coefficient on Diffusion Index*
1.	Current month's Business Outlook Survey general activity index	0.33	0.024 (14.2)
2.	Current month's Business Outlook Survey weighted index**	0.26	0.038 (12.2)
3.	12 lagged values of percent change in IP-M	0.21	—
4.	12 lagged values of percent change in IP-M plus current month's BOS general activity index	0.34	0.021 (8.9)
5.	12 lagged values of change in IP-M plus current month's BOS weighted index	0.30	0.032 (7.2)
6.	Percent change in manufacturing hours (current and lagged 3 months)	0.60	—
7.	Percent change in manufacturing hours, lagged IP-M, plus current month's BOS general activity index	0.63	0.012 (6.3)
8.	Percent change in manufacturing hours, lagged IP-M, plus current month's BOS weighted index	0.62	0.016 (4.9)

NOTES: Regressions are based on the estimation period of 1969 to 2003.

The t-statistic tests the hypothesis that the diffusion index coefficient is significantly different from zero. In all of the regressions, the diffusion index is significant at less than the 0.01 level, meaning there is less than a 1 percent probability that the diffusion index coefficient is equal to zero.

Monthly change is calculated as the log difference multiplied by 100, which is approximately equal to percent change.

 * Absolute values of t-statistics are in parenthesis.

** Since the PMI is a weighted index of five sub-indexes, the BOS weighted index was constructed using the same weights as the PMI, but we substituted the BOS shipments index for the production index, since the BOS does not include a production index.

does not improve its ability to predict. When the recent history of the IP-M and information on employment and hours are used in the regression model, the general activity diffusion index retains its significance and matches the PMI in its ability to forecast changes in the manufacturing component of the Industrial Production Index (rows 4, 5, 7, and 8).

The Appendix evaluates the usefulness of the remaining Business Outlook Survey diffusion indexes in forecasting other measures of manufacturing activity, such as the change in new orders, shipments, and employment.

Although the models' ability to track changes in the IP-M within the sample period in which the models are estimated is important, the real test of the models' performance is their ability to forecast change in production outside that sample period. An evaluation of the out-of-sample performance of the PMI and the diffusion index from the Philadelphia Fed over the past several years can best be seen in the figure. The model forecasts are based on the historical relationships between IP-M and the diffusion indexes through December 2000 (Figure). That is, the monthly prediction after that time is based on the models estimated from the available diffusion indexes up to that time. The chart displays the actual monthly change in the IP-M and its predicted value based on the simple models using the PMI and the diffusion index from the Phila-

delphia survey as the sole explanatory variables. While neither of the models precisely captures the highly volatile month-to-month changes in the IP-M, the forecasts from the models track the broader accelerations and decelerations in the IP-M over several months. A closer examination of the forecast errors shows that, on average, the BOS model outperforms the PMI model for the period January 2001 to June 2003 (Table 6). This period covers the recent downturn in the manufacturing sector as well as the early stages of recovery. The standard measures of forecast performance — the root mean squared error and mean absolute error — are slightly smaller for the model using the BOS than for the model using the PMI.

SUMMARY

Although manufacturing has experienced rapid technological and managerial advances and continues to do so, it remains an important sector of the economy that is subject to significant cyclical movements. Therefore, business analysts and economic policymakers follow the sector closely. They rely on frequently published measures of activity, such as monthly reports and surveys, to track changes in this sector.

Qualitative surveys, such as the one conducted by the Institute for Supply Management, are intended to give an early read on changing conditions. The Institute's Purchasing Managers Index provides timely information on the manufacturing sector nationally. Regional surveys of manufacturing can provide even earlier indications about changes in the national manufacturing sector, in addition to the information they provide about conditions in their own regions' manufacturing sectors. The Philadelphia Fed's Business Outlook Survey is the oldest of the regional surveys produced by the Federal Reserve Banks. Moreover, the Philadelphia index comes out much earlier than the PMI, and it is as accurate as national surveys in predicting the monthly change in the U.S. Industrial Production Index for manufacturing. ⓑⓡ

TABLE 6

Forecast Prediction Performance for the Monthly Changes in the IP-M (BOS vs. PMI Model)

Model	RMSE	MAE
Business Outlook Survey Diffusion Index	0.318	0.215
PMI	0.378	0.268

NOTES: Estimation period was January 1969 to December 2000. Out-of-sample forecast errors are based on January 2001 to June 2003.
RMSE is root mean squared error and MAE is mean absolute error.
Regressions are for monthly percent change in Industrial Production Index for manufacturing and the explanatory variables are the subject diffusion indexes. Monthly change is calculated as the log difference multiplied by 100, which is approximately equal to percent change.

FIGURE

Model Forecasts and Actual Change in IP-M (Out-of-Sample Forecast for 2001:01 to 2003:06)
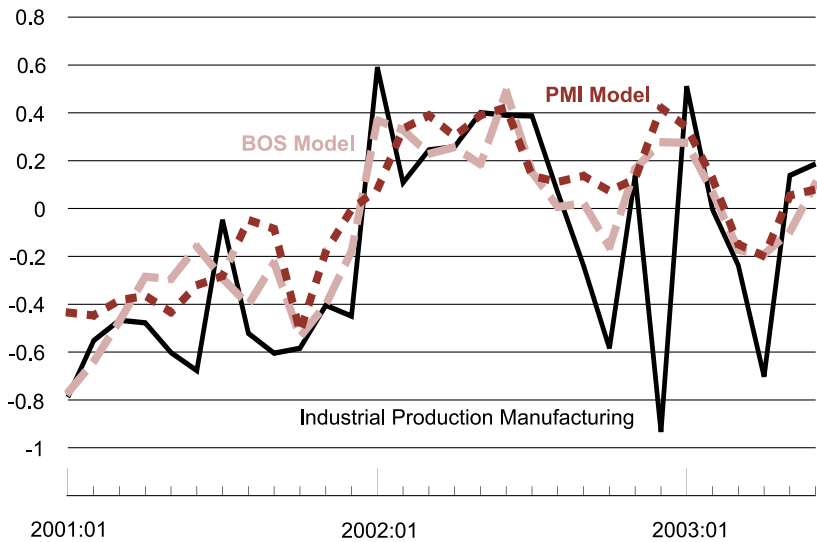
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Comparing the BOS Results with National and Regional Manufacturing Data

Although the main goal of the Philadelphia Fed's Business Outlook Survey is to obtain meaningful and timely information about the pace of growth of the Third Federal Reserve District's manufacturing sector, the evidence suggests that it can be useful in gauging national manufacturing activity as well. To determine the usefulness of the diffusion indexes from the survey's questions on specific measures of manufacturing activity, we again use the common technique of regression analysis.

The table shows the results of 12 regression models in which the current month's diffusion indexes alone are used to predict the change in the corresponding regional or national data. The BOS indexes are most successful at forecasting total industrial production, manufacturing production, regional and national manufacturing employment, manufacturing inventories, delivery times, and producer prices. The individual BOS indexes have very weak explanatory power (a low R^2 statistic) for national shipments, new orders, manufacturing workweek, and unfilled orders. The only series for which the BOS has no statistically significant relationship to the underlying national data (a low t-statistic on coefficient) are the manufacturing workweek and unfilled orders.

TABLE

Simple Regression Results—Explaining U.S. and Regional Economic Measures Using Counterpart Business Outlook Survey Diffusion Indexes

Dependent Variable: *National Data*	Constant	Diffusion Index Coefficients (t-statistic)	R^2	Time Period
Industrial Production	0.015 (0.44)	0.020 (13.32)	0.30	1969:01 2003:06
Manufacturing Production	0.005 (0.13)	0.028 (14.18)	0.33	1969:01 2003:06
Manufacturing Shipments	-0.067 (-0.46)	0.292 (3.24)	0.07	1992:02 2003:06
Manufacturing New Orders	-0.082 (-0.43)	0.034 (2.77)	0.05	1992:02 2003:06
Delivery Times/Vendor Deliveries	56.16 (109.00)	0.722 (14.52)	0.34	1969:01 2003:06

TABLE (continued)

Simple Regression Results—Explaining U.S. and Regional Economic Measures Using Counterpart Business Outlook Survey Diffusion Indexes

Dependent Variable: *National Data*	Constant	Diffusion Index Coefficients (t-statistic)	R^2	Time Period
Manufacturing Employment	-0.03 (-1.59)	0.023 (14.75)	0.35	1969:01 2003:06
Manufacturing Workweek	0.003 (0.92)	0.003 (0.92)	0.00	1969:01 2003:06
Manufacturing Unfilled Orders	-0.00 (-0.02)	-0.001 (-0.22)	0.00	1992:02 2003:06
Manufacturing Inventories	0.288 (6.14)	0.025 (5.63)	0.19	1992:02 2003.06
Producer Prices (Finished Goods)	0.148 (5.18)	0.016 (11.01)	0.23	1969:01 2003:06
Producer Prices (Intermediate Goods)	-0.244 (-5.70)	0.020 (16.89)	0.41	1969:01 2003:06
Regional Data				
District Manufacturing Employment (Tri-State)	-0.152 (-7.03)	0.018 (8.44)	0.31	1990:01 2003:04
District Manufacturing Employment (District Totals)	-0.151 (-5.19)	0.018 (6.74)	0.22	1990:01 2003:04

Source: Federal Reserve Board, Census Bureau, Bureau of Labor Statistics, Institute of Supply Management. District manufacturing data for state employment include Delaware, New Jersey, and Pennsylvania. District employment is the total of manufacturing employment for the metropolitan statistical areas (MSAs) within the Third Federal Reserve District. All of the dependent variables (except vendor deliveries) are calculated as the log difference multiplied by 100, which is approximately equal to percent change. The delivery times variable is the ISM's diffusion index for current month supplier deliveries.