Earnings Losses of Job Losers During the 2001 Economic Downturn*

SHIGERU FUJITA AND VILAS RAO

J ob losses may involve not only lost earnings during unemployment but also declines in earnings at subsequent jobs. After a time-consuming job search, workers may need to restart their careers from scratch, accepting a lower wage. Workers may also need time to acquire new skills, and total earnings lost during such a period of re-adjustment can be considerable. But experiences may vary widely. In this article, using a novel data set, Shigeru Fujita and Vilas Rao provide evidence on earnings losses after unemployment. Although the usefulness of the evidence is limited by the short sample period, the data set allows us to ask some important questions, the answers to which may help inform us about important macroeconomic issues such as the cost of business-cycle fluctuations and the benefits of policies intended to avoid such fluctuations.

During economic downturns, more workers become unemployed and finding a new job becomes harder. Consequently, unemployment rises. Higher unemployment also means that there is a more intensive reallocation of workers from one job to another during downturns.[1]

The main reason policymakers and economists are concerned about job losses is that job losses may involve not only lost earnings during the period of unemployment but also declines in earnings at subsequent jobs. It is conceivable that the experiences of job losers are painful and costly. After a time-consuming job search, the worker may need to restart his or her career from scratch in a new job, accepting a lower wage. Furthermore, working in a new environment might involve

acquiring new skills, establishing a new personal network of business associates, and so on, all of which may take a significant amount of time to accomplish. This re-adjustment period can be quite long, and thus total earnings lost can be considerable.

This painful story would be relevant for at least some workers. But experiences may vary widely across individuals. In contrast to the example above, it is possible to imagine a situation in which workers make the same amount of money (or more) after a short unemployment spell or one where workers make less at the new job initially, but the losses are recovered quickly as a result of subsequent earnings growth. In these cases, earnings losses associated with the job loss are minor relative to one's lifetime earnings, and unemployment may not be as costly and painful as the previous example suggests.[2]

[1] See the 2007 *Business Review* article by Shigeru Fujita.

[2] The process of destroying less productive jobs and replacing them with more productive jobs is important for long-run economic growth and provides the opportunity for workers to find higher paying jobs. See the 2008 *Business Review* article by Shigeru Fujita.

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This article provides evidence on earnings losses after unemployment, using a novel data set that traces the labor market experiences of a large number of workers over a three-year period that encompasses the recession in 2001. Although the usefulness of the evidence is limited by the short sample period, the data set allows us to ask important questions such as: What is the average individual loss (or gain) due to unemployment? Who loses the most? What are the sources of earnings losses? While not definitive, the answers to these questions may, in turn, help inform us about important macroeconomic issues such as the cost of business-cycle fluctuations and the benefits of policies intended to avoid such fluctuations.

A PANEL DATA SET ON EARNINGS LOSSES (OR GAINS) FOLLOWING UNEMPLOYMENT

To obtain information on earnings losses due to unemployment, it is necessary to trace the earnings history of a large number of workers over some length of time. Furthermore, since workers may lose and find new jobs within a relatively short period of time (say, within months), this history needs to be collected frequently, say, monthly.

Fortunately, the Census Bureau maintains a data set called the Survey of Income and Program Participation (SIPP) that satisfies these requirements. The SIPP 2001 panel keeps track of labor market experiences of a nationally representative sample of 73,205 workers over the roughly three-year period from October 2000 through December 2003.

With this data set in hand, we can look at workers' experiences during the U.S. economic downturn of 2001. We select the events in which a worker moves from one job to a new job with

an unemployment spell in between. The data set includes 1,380 such cases. (For details of the sample selection, see *The SIPP and Other Data Sets Used in Previous Studies*.)

## MONTHLY EARNINGS DROP IMMEDIATELY AFTER UNEMPLOYMENT

Figure 1 presents the distribution of earnings losses after unemployment in the early 2000s. It shows that, on average, a worker's monthly earnings immediately after unemployment drop roughly 7 percent compared with the monthly earnings immediately before unemployment.[3] The three bars next to the average correspond respectively to 25th percentile, median, and 75th percentile of the sample of employees in our sample.

We can make a couple of important observations here. First, there is a huge variation across individual workers in terms of changes in earnings after unemployment. Related to this are a large number of workers whose incomes actually increase after unemployment. The earnings gains can occur for two reasons. First, the outcome of a job search is affected by luck. That is, some workers are simply lucky to find an employer that is a "good match." Second, some workers become

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[3] All calculations using the SIPP are based on the comparison of average monthly earnings over the three-month periods before and after the unemployment spell. Earnings include only salary from the main job and do not include benefits.

FIGURE 1

Changes in Earnings After an Unemployment Spell
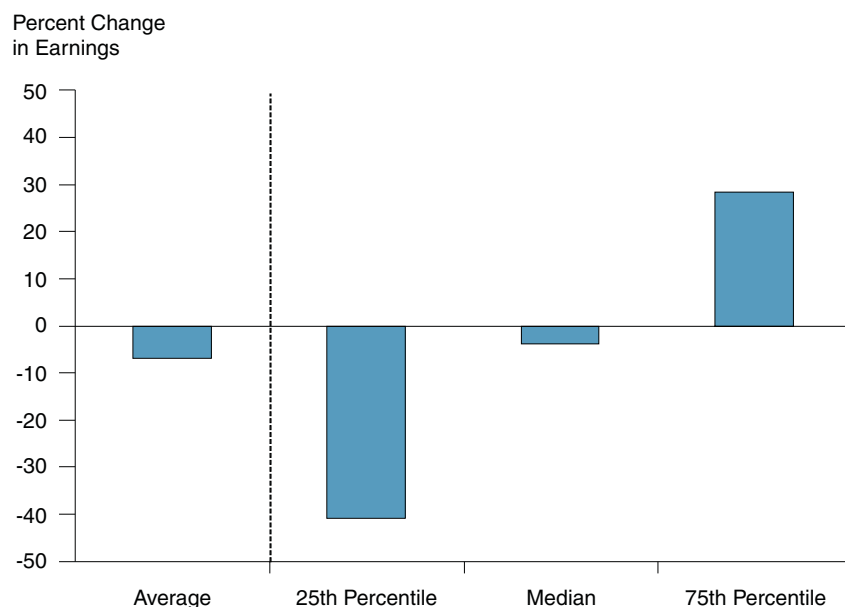
Percent Change in Earnings

Notes: Based on 2001 SIPP panel. Sample is restricted to workers who have been employed for three months continuously before and after an unemployment spell and switch firms after unemployment. A total of 1,380 unemployment experiences are included. This chart gives the distribution of earnings losses across unemployment experiences in our sample.

T he Survey of Income and Program Participation (SIPP) is a monthly survey conducted by the U.S. Census Bureau that follows the participation of individuals and households in income maintenance programs. Using a nationally representative sample of individuals 15 years of age and older from the civilian noninstitutionalized population, the SIPP gathers a variety of information: demographic characteristics, labor force participation, amounts and types of earned and unearned income, government program benefits, assets, and health insurance.

As a panel survey, the SIPP tracks the same individuals over a period of time. For this study, we used the 2001 SIPP panel, which tracked the labor market experiences of a nationally representative sample of 73,205 workers over the roughly three-year period from October 2000 through December 2003. Sample members who move to a new address are interviewed at their new address. This characteristic of the SIPP makes it a useful vehicle for exploring unemployment's impact on earnings, since we are able to comprehensively track an individual's earnings and employment status for an extended period of time.

We use each individual's labor force status after the second week of each month as his or her labor status for that month. Unemployment is defined as either not having a job but looking for work or having a job and on layoff or absent from work. Individuals who do not have a job and are not looking are considered not in the labor force. Individuals with a job who are not on layoff are considered employed. The same definitions are used in the BLS's Current Population Survey, which is the official source of the national unemployment rate, the employment population ratio, etc.

For this study, we restrict the sample in a few significant ways. First, only individuals 25 and older are included in our analysis. We look only at the primary job of individuals with multiple jobs, and we exclude workers who returned to the same job after unemployment.* Finally, we require that a worker be employed for at least three months on either end of his or her unemployment spell. Our analysis is based on 1,380 events that satisfy all requirements.

A handful of papers study earnings losses using different data sets covering different time periods, but our data set has many unique features that are absent from other data sets used in other studies. Previous studies have used the Displaced Worker Survey (DWS), a supplement to the Current Population Survey that has been administered every two years since 1984. The DWS collects relevant information on the experience of job losers, such as changes in earnings. However, it asks only about a single job loss in the past three years due to business decisions such as a plant closing or the abolition of a job position. While the information gathered is quite useful, it may not represent the experience of the average unemployed worker.

Other studies have used the data set called Panel Study of Income Dynamics (PSID). This data set also provides useful pieces of information on the experience of job losers. However, the interview is conducted only once a year, and thus it possibly misses many job-loss experiences that occurred between the two interview dates. One advantage of the PSID over the SIPP is that the PSID traces workers over a much longer time than the SIPP. This feature allows researchers to examine the long-run effects of job loss. See the discussion in the text on page 7, under the heading Long-Lasting Effects of Job Loss.

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* In fact, quite a few workers return to the same employer after unemployment. In our 2001 SIPP sample, 46 percent of workers returned to the same employer.

unemployed because they chose to quit their previous job in order to look for a better one. This result implies that the overly pessimistic view about "unemployment" may not necessarily

be an accurate description of the reality.

At the same time, despite the fact that some workers experience earnings gains after unemployment, it is true

that unemployment is, *on average*, accompanied by a drop in earnings. Furthermore, Figure 1 shows that the average change is below the median change (2 percent drop), implying that

the distribution of the earnings losses is skewed to the left. That is, some of the losses experienced are very large. For example, 25 percent of the workers have earnings losses of more than 40 percent.[4]

The average drop in earnings here appears smaller than that reported in previous studies. For instance, an article by Henry Farber reports that the average earnings losses that occurred between 2001 and 2003 were more than 13 percent. A plausible reason behind this difference is that Farber uses the Displaced Worker Survey (DWS), which focuses on a certain type of job separation, namely, displacement. (See *The SIPP and Other Data Sets Used in Previous Studies* for further explanation of the DWS.) In the DWS, "displacement" is defined as job separations associated with business decisions such as a plant closing or the abolition of a job position. The sample in our study, on the other hand, is selected based on whether workers experience unemployment regardless of underlying reasons and thus is broader than the DWS. The displacement events in the DWS are likely to correspond to the ones on the left-hand side of the distribution, i.e., ones with large earnings losses.

There are a few caveats to remember in our calculation. First, our calculations ignore the forgone earnings of job losers. That is, the job loser might have enjoyed growth in earnings had he not lost his job. But this part of the losses is likely to be small in our sample because we compare earnings between two dates that are relatively close, and thus

potential growth during that short period of time would be relatively small.[5] Second, the SIPP 2001 data set keeps track of individual workers for only about three years, and thus, it is difficult to assess whether the initial losses are recovered later and, if they are, how long it takes. The past literature suggests that the loss is persistent. We will come back to this issue later. Finally, we know that the size of earnings losses varies across the business cycle. Farber's article presents the average earnings losses for different time periods and shows that they increase significantly during recessions and decrease significantly during booms and that the deeper recessions tend to result in larger earnings losses. The latter fact implies that earnings losses in the current downturn may be significantly larger than those for the mild recession in 2001.[6]

With these caveats in mind, we will explore sources of earnings losses using the SIPP 2001 panel. Looking at how worker characteristics are correlated with their earnings losses is useful for this purpose.

NO CLEAR RELATIONSHIP WITH EDUCATION OR RACE

Are there any differences in earnings losses across different educational or racial groups? While we know that earnings levels are strongly correlated with these worker characteristics, there is a priori no reason to believe that the size of

earnings losses is related to these worker characteristics because these characteristics do not change before and after the unemployment spell.

Figure 2 confirms this prediction: While there are some variations in the size of earnings losses across races and educational levels, it is not the case that workers with a lower level of earnings lost more in percentage terms.[7] In fact, the reality is quite the opposite. If we simply look at the relationship between the level of earnings at the pre-unemployment job and the size of earnings losses (in percentage terms), we find a strong positive correlation between the two.[8]

## DURATION OF UNEMPLOYMENT WAS POSITIVELY RELATED TO EARNINGS LOSSES

One way to identify the sources of earnings loss is to look at the differences in worker characteristics before and after unemployment. First, let's see whether the length of unemployment has any relationship to earnings losses. If we assume that staying on the job plays an important role in the growth of earnings, say, reflecting the accumulation of human capital, we can expect that as unemployment duration becomes longer, human capital depreciates more and hence earnings losses become larger.[9]

[4] Of course, drops in earnings that many individual workers experience may again simply be due to luck. However, the facts that the average change in earnings is negative and that the distribution is skewed to the left imply that luck cannot be the only reason.

[5] In our data, almost 80 percent of workers found new jobs within six months.

[6] We also find the same pattern in the SIPP. The average earnings losses in the SIPP 1996 panel, which traces workers from the end of 1995 through late 2000, a period of economic expansion, are quite small (-1.7 percent), whereas the SIPP 1990 panel, which covers the three-year period encompassing the recession in the early 1990s, shows average earnings losses of -15.3 percent.

[7] In Figure 2, the losses of high school graduates and college graduates are roughly the same. Similarly, the average earnings losses of white workers are roughly the same as that of black workers, although white workers, on average, make considerably more than black workers.

[8] The correlation coefficient is 0.46.

[9] Of course, another possibility is that unemployed workers run down their wealth over time and thus are less selective about their jobs, and consequently, they accept jobs that pay less. But whether this story is important or not, it does not appear to change our overall conclusion below.

FIGURE 2

Changes in Earnings by Race and Education

Percent Change
in Earnings
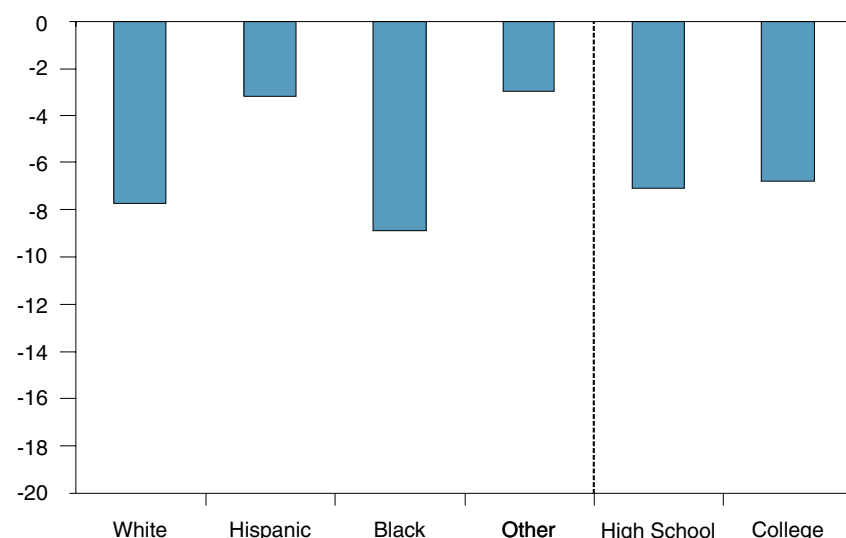
Notes: Based on 2001 SIPP panel. Sample is restricted to workers who have been employed for three months continuously before and after an unemployment spell and switch firms after unemployment. A total of 1,380 unemployment experiences are included. "High School" includes those with education up to a high school diploma. "College" includes those with some college experience, a college degree, or postgraduate study.

FIGURE 3

Changes in Earnings by Unemployment Duration

Percent Change
in Earnings
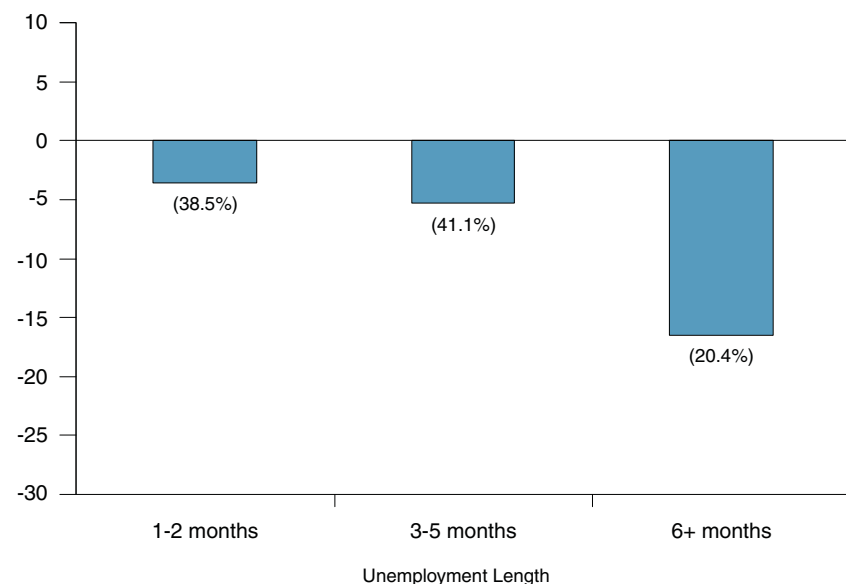
Notes: Based on 2001 SIPP panel. Sample is restricted to workers who have been employed for three months continuously before and after an unemployment spell and switch firms after unemployment. A total of 1,380 unemployment experiences are included. The numbers in parentheses indicate fractions of workers in each duration category.

Figure 3 presents earnings losses for workers with the following unemployment durations: one to two months, three to five months, and six months or more. The numbers below each bar represent the fraction of workers for each duration of unemployment.[10] First, note that the distribution of workers over the duration of unemployment implies that the average worker found a job fairly quickly during the sample period. This is consistent with the evidence found elsewhere.[11] For those who found a job within two months, earnings losses tended to be smaller than the average loss of 7 percent reported above. However, earnings losses increased with duration of unemployment. In particular, when workers were unemployed for six months or more, the average loss was more than 15 percent. This finding is consistent with the notion that workers who are unemployed for a longer time experience a larger decline in their stock of human capital. But what kind of human capital has the worker lost? Is it human capital that is useful in any job? Or is it human capital that is useful only for a certain firm or certain occupation?

To answer these questions, note that if human capital is tied entirely to a particular firm, there is no reason to expect a positive relationship between earnings losses and unemployment duration, given that workers are not returning to the same firm, as is the case in our sample. Therefore, the

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[10] Note that our data miss those workers who became unemployed in the sample period but could not find a new job. This censoring problem causes downward bias to our results. However, the bias is likely to be small given that, in our sample, 80 percent of these unemployed workers found a new job within five months, as shown in Figure 3.

[11] See the 2007 *Business Review* article by Shigeru Fujita.

evidence above does not appear to support the idea that firm-specific skills played a dominant role in earnings losses.

One way to assess the importance of occupation-specific human capital is to split the sample used in Figure 3 into those who stayed in the same occupation and those who switched occupations after unemployment.[12] The result, which is shown in Figure 4, is quite striking. The correlation between the duration of unemployment and earnings losses above was largely accounted for by those who switched occupations. For example, earnings losses for those who stayed in the same occupation were actually smaller than the average earnings losses of all job losers, and thus overall earnings losses of those who were unemployed more than six months were entirely accounted for by those who switched occupations. We will now investigate the robustness of this result further by slicing the data differently.

HIGH-TENURE WORKERS WHO SWITCHED OCCUPATIONS HAD LARGER EARNINGS LOSSES

If occupation-specific human capital is the dominant determinant of earnings, a larger drop in earnings is expected to follow when a worker is forced to switch occupations after a long career in a certain occupation. Unfortunately, we were unable to obtain information on occupation-specific tenure from the SIPP. However, the SIPP contains information on how many years

FIGURE 4

Changes in Earnings with Occupation Switch
(By Unemployment Duration)
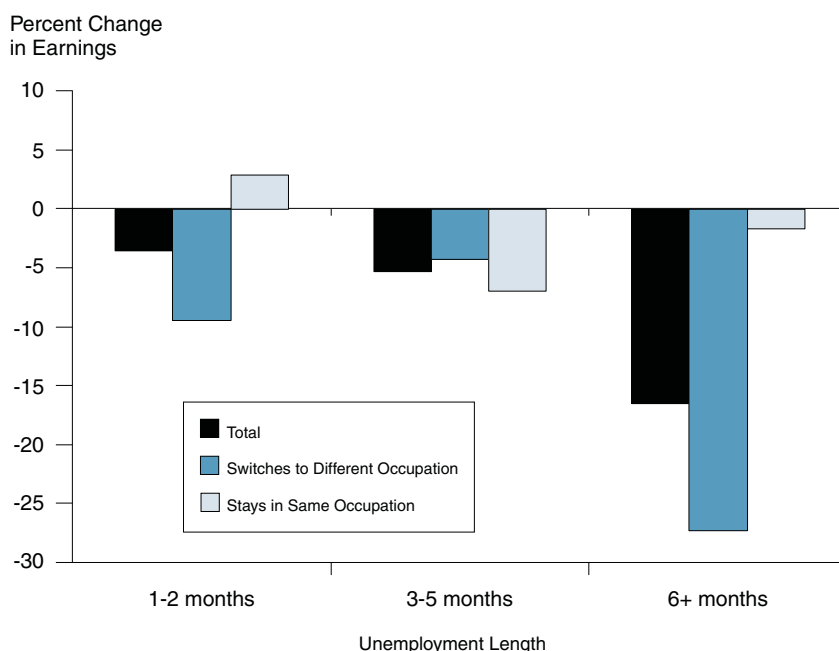
Notes: Based on 2001 SIPP panel. Sample is restricted to workers who have been employed for three months continuously before and after an unemployment spell and switch firms after unemployment. A total of 1,380 unemployment experiences are included. Jobs are divided into 14 occupation groups.

workers have worked for a particular firm. To the extent that the firm-specific tenure is correlated with occupation-specific tenure, this information can be useful to further infer the importance of occupation-specific human capital.[13]

First, let's look at earnings losses for workers with different firm tenures

(Figure 5). The figure shows that those who had longer tenure (five years or more) lost much more (19 percent) than those who had shorter tenure (2.5 percent). This evidence by itself appears to suggest the importance of firm-specific human capital in determining earnings. However, this correlation between firm tenures and the size of earnings losses disappears when we split the sample of high-tenure workers into those who stayed in the same occupation and those who switched occupations. The results are displayed in Figure 6. The large decline in earnings among high-tenure workers is accounted for by the even larger decline in earnings (more than

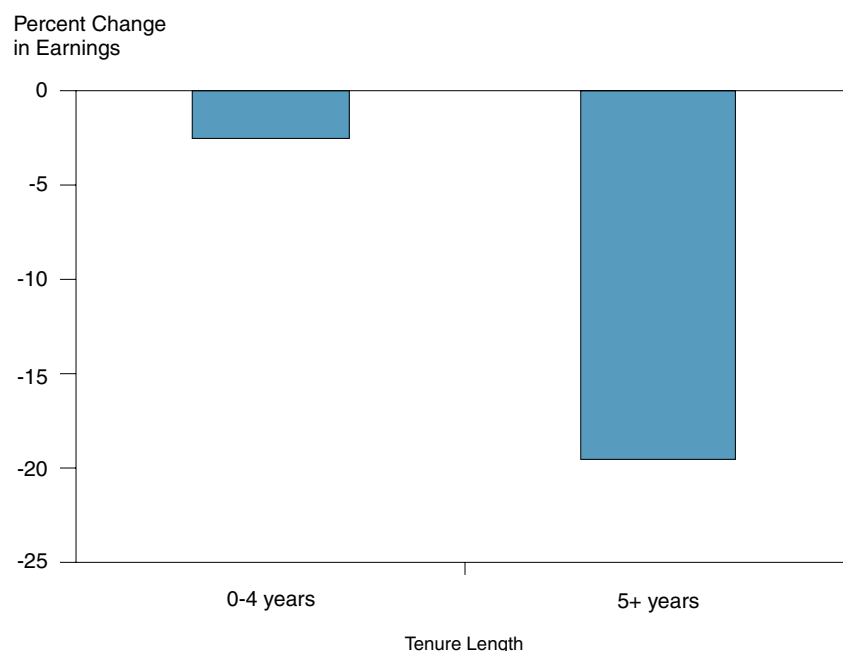## Changes in Earnings by Firm Tenure

Percent Change
in Earnings

Notes: Based on 2001 SIPP panel. Sample is restricted to workers who have been employed for three months continuously before and after an unemployment spell and switch firms after unemployment. A total of 1,380 unemployment experiences are included.

35 percent) among those who switched occupations. On the other hand, those who stayed in the same occupation experienced much smaller earnings losses, suggesting the relevance of occupation-specific human capital instead of firm-specific human capital.

The result here conforms to the conclusions in previous studies. Using DWS data on displaced workers in the 1980s, Derek Neal shows that earnings losses are strongly associated with industry tenure as opposed to firm tenure. While Neal emphasizes the role of industry-specific human

[14] Daniel Parent obtained results similar to Neal's using the PSID.

capital, the subsequent research has shifted emphasis to the occupational specificity of human capital.[14] For example, Gueorgui Kambourov and Iourii Manovskii estimate regression models of earnings growth using the Panel Study of Income Dynamics (PSID) and find that once occupation tenure is included in the regression, neither firm tenure nor industry tenure remains significant, while occupation tenure is highly significant.[15]

[15] Note that Kambourov and Manovskii's approach is different from looking at earnings losses of job losers in that they directly estimate the return to experience in a certain occupation by considering workers who are employed throughout the sample period.

LONG-LASTING EFFECTS OF JOB LOSS

As we mentioned before, the SIPP 2001 panel covers only the three-year period 2001 through 2003, and thus, it is difficult to assess how persistent the effect of job loss is. The question is whether the lower earnings level immediately after unemployment recovers quickly and, if not, how long it takes to regain earnings. Christopher Ruhm considered this issue by using the PSID, which allows him to trace workers from 1969 through 1982. He found that even four years after displacement, job losers make 10 to 13 percent less than their nondisplaced counterparts.[16]

An important point to note here is that the persistence can take two forms. First, it may take a long time to regain earnings after an unemployment spell even if the worker keeps his or her new job for a long time. Second, the initial unemployment spell may raise the risk of subsequent job losses. The latter may happen because new workers are the ones who tend to get laid off when a firm runs into difficult times. A study by Ann Huff Stevens attempts to sort out the two effects. She traces workers' labor market experience from 1968 through 1988 using the PSID and shows that much of the persistence of earnings losses is actually explained by the latter

[16] Louis Jacobson, Robert LaLonde, and Daniel Sullivan, who use a unique comprehensive data set derived from administrative records of the state of Pennsylvania, have done influential research in this area. While their study has important limitations — for example, their results are based on high-tenure workers (with firm tenure of more than six years) in Pennsylvania who were displaced during the early and mid-1980s — their data set offers important advantages in the form of very large sample sizes and detailed information on workers' pre-displacement employers. They also find that job losers in their sample experienced large initial earnings losses followed by very slow recovery of the earnings.

FIGURE 6

Changes in Earnings With and Without Occupation Switch for High-Tenure Workers
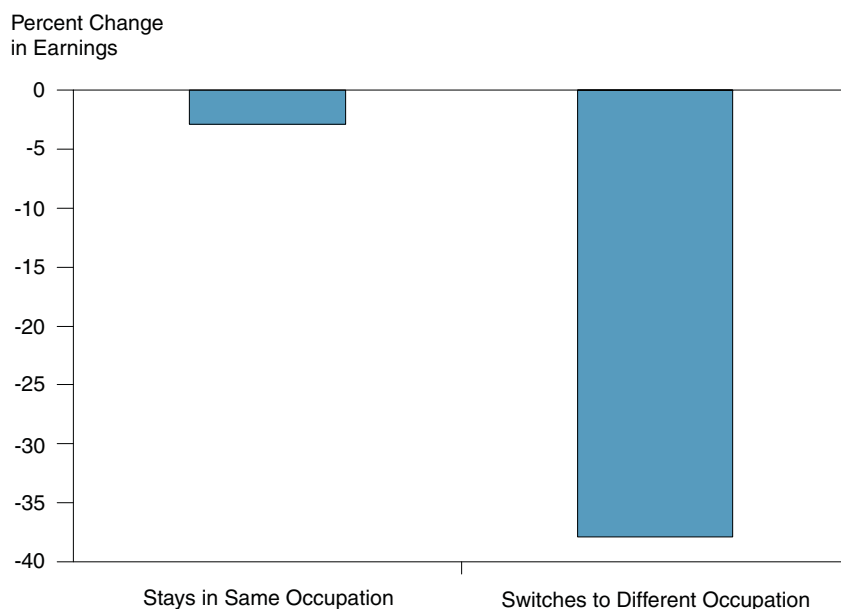
Percent Change
in Earnings

Notes: Based on 2001 SIPP panel. Sample is restricted to workers who have been employed for three months continuously before and after an unemployment spell and switch firms after unemployment. A total of 1,380 unemployment experiences are included. "High Tenure" is defined as five years with a firm or longer.

effect, i.e., an increased likelihood of multiple job losses. Specifically, her study shows that six or more years after job loss, earnings of job losers remain approximately 9 percent below those of their nondisplaced counterparts, but workers who avoid additional displacements have earnings losses of only 1 to 4 percent six or more years after job loss.

Note that the persistence found in the literature may not apply to all unemployed workers. In particular, the PSID is an annual survey and thus may possibly miss the majority of unemployment spells that occur within a year. As we noted above, one of the advantages of the SIPP is that it provides high-frequency data that include short-term unemployment. But the findings in the earlier studies do suggest that the earnings of at least some workers are affected even in the long run.

CONCLUSION

This article has summarized the experience of unemployed workers during and after the 2001 recession, focusing on changes in earnings following a period of unemployment. We found that most of the workers experienced earnings losses after unemployment. This is consistent with earlier findings in the literature, even though our data set focuses on a short period of time. Further, larger earnings losses were associated with loss of occupation-specific human capital, a finding that is also consistent with the results of earlier studies. While the SIPP does not allow us to assess the long-term effects of job loss, the literature suggests that job loss can have a significant long-term impact on workers' earnings and that the long-term impact takes the form of an increased likelihood of further job losses.

From an individual worker's point of view, the human capital "specificity" particularly linked to the worker's occupation represents the "human capital risk." For instance, in a rapidly changing economic environment, a seemingly secure job may not be secure five years from now. At that point, workers may be forced to find a job in a different occupation, in which case they may need to accept a much lower wage.

From a macroeconomic point of view, the presence of significant earnings losses and "specificity" of human capital implies that increased intensity of worker reallocation during economic downturns is not simply a reshuffling of workers between employers. For many workers, reallocation involves a costly and time-consuming re-building of human capital.

Despite the evidence presented in this article and elsewhere, the costly and time-consuming nature of worker reallocation is often ignored in the typical macroeconomic models often used in monetary or fiscal policy analysis. One of the few recent attempts includes the work by Tom Krebs. His study focuses on quantifying the cost of economic fluctuations when workers face the risk of earnings losses, such as those discussed in

this article, and finds that business-cycle fluctuations can be quite costly once earnings losses associated with job losses are incorporated into the analysis, which implies a potentially large benefit of macroeconomic stabilization policies.

Note, however, that there is an important caveat regarding the potential benefit of stabilization policies: Although stabilization policies may improve the welfare of the economy *in the short run* by avoiding the costly job reallocation process, they could potentially interfere with long-run economic growth. For example, another branch of the literature finds that labor market policies that impose costs on firing workers may potentially have a large negative impact on long-run growth because such restrictions allow firms to retain less profitable jobs.[17] It is important that this consideration also be an integral part of the discussion. 🅱️🆁

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[17] See, for example, the article by Hugo Hopenhayn and Richard Rogerson.

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China's Emergence as a Manufacturing Juggernaut: Is It Overstated?*

BEHZAD KIANIAN AND KEI-MU YI

China's emergence as a manufacturing juggernaut selling so many goods to so many countries has attracted enormous attention from academics, policymakers, and the media. In this article, Behzad Kianian and Kei-Mu Yi put China's manufacturing performance into a broader context. They emphasize two key themes: The wages of China's manufacturing workers are rising rapidly; and China's production of export goods relies heavily on imported inputs and the final exported goods face large mark-ups in their destination markets. The first theme implies that China will lose global market share in some categories of goods. The second implies that China's trading relationship with many countries is complementary, not competitive, and that the omnipresence of China's goods exaggerates the extent of its manufacturing performance. The authors conclude that China's emergence as a global manufacturing power should not be overstated, and concerns that China will "take over" all manufacturing markets are unfounded.

These days it's difficult to think of manufactured goods that are not made in China. If a product is smaller than an automobile, it seems, it must have been made there. China has indeed become an important, if not dominant, supplier in global markets for literally thousands of goods, ranging from dolls to athletic shoes, from bicycles to furniture, from steel to air conditioners, and from telephones to personal computers. China's emergence as a manufacturing juggernaut selling so many goods to so many countries has, of course, attracted enormous attention from academics, policymakers, and the media. Much of the media coverage conveys a tone of concern and consternation at this rapid emergence.

The purpose of this article is to put China's manufacturing performance into a broader context. The key themes we emphasize are that the wages of China's manufacturing workers are rising rapidly and that China's production of export goods relies heavily on imported inputs; these goods also face large mark-ups in their destination markets. The first theme implies that China will – and, in fact, has already begun to – lose global market share in some categories of goods. The second theme implies two important points. First, China's trading relationship with many countries is a complementary one, as opposed to a competitive one. Second, the omnipresence of China's goods exaggerates the extent of its manufacturing performance. Hence, we conclude that China's emergence as a global manufacturing power should not be overstated, and concerns

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that China will "take over" all manufacturing markets are unfounded.

OVERVIEW OF CHINA'S ECONOMIC PERFORMANCE

Before delving into our two primary themes, we believe it is useful to review China's economic performance overall and in manufacturing, including production and exports, during the past three decades. We will *not* discuss the theories and hypotheses for China's performance; an explanation for China's success is a very important but as yet unanswered question. However, see *Three Important Policy Reforms,* for a brief description of three key reforms that facilitated the rapid development of China's manufacturing sector.

GDP and Manufacturing Production and Exports. The broadest measure of a nation's economic performance is its gross domestic product (GDP). GDP can be measured in three ways. We find it useful to mention the "product" approach to GDP, which defines GDP as the sum of each firm's "value-added" – the market value of production minus the cost of materials and inputs – in a country in a particular time period, such as a quarter or year.[1] A

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[1] GDP also includes the economic "output" of local, state, and federal government. For the alternative accounting of GDP, it is useful to think of the government as a large firm that produces services, such as education, police and fire protection, and so forth.

Three Important Policy Reforms

China has implemented numerous economic policy reforms since 1978. We give a brief overview of three important trade and foreign direct investment reforms that have been the most relevant for China's manufacturing production and trade. Much of the description below is from the study by Nicholas Lardy and another by Lee Branstetter and Lardy.

Probably the single most important trade policy reform was the establishment of an export processing regime. In an export processing regime, raw materials, parts and components, and other intermediate goods can be imported duty-free as long as they are used to produce export goods. According to Lardy, this regime was developed between the late 1970s and the late 1980s. This regime greatly facilitated the ability of China's domestic and foreign-owned firms to compete in world markets.

Second, China has reduced its tariff barriers, and it has become integrated into the official world trading system. During the 1980s, official tariff rates were as high as 56 percent, but because of the export processing regimes, actual tariff collections fell sharply. By 1992, actual tariffs collected represented less than 5 percent of total imports. China began sharply reducing its official tariff barriers during the 1990s. They fell to 15 percent by 2001.

In addition, the U.S. granted China "most favored nation" status in 1980. This was important because most favored nation status meant that China had the same access to U.S. markets as Canada, Mexico, Europe, Japan, and other countries that were signatories to the General Agreement on Tariffs and Trade (GATT).[a] China officially joined the World Trade Organization (WTO) in 2001. Hence, China lowered its own tariffs, and its most favored nation status and entry into the WTO meant that its goods faced lower tariffs.

Third, China implemented policies to encourage foreign direct investment beginning in 1979. That year, a legal framework for joint ventures was established, along with four special economic zones in which "foreign firms were offered preferential tax and administrative treatment."[b] In 1984, the number of special economic zones was expanded by 14. In 1986, foreign direct investment that was export-oriented and technologically advanced became eligible for additional special benefits.

A key feature of these reforms is that machinery and equipment could be imported duty-free, as well. These policies facilitated a surge in inflows of both financial capital and physical capital so that in recent years China received more foreign direct investment than the United States. Importantly, the influx of technology associated with this foreign direct investment allowed China to produce more sophisticated products more rapidly than otherwise.

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[a] The General Agreement on Tariffs and Trade was the precursor to the World Trade Organization.

[b] See the article by Lee Branstetter and Nicholas Lardy, p. 11.

second way to measure GDP is the more familiar – to anyone who has taken a course in macroeconomics – expenditure approach, which measures GDP as the sum of four major categories of spending on final goods: consumption (C), investment (I), government purchases (G), and net exports, or exports – imports (X-M). These two ways are related in that the market value of goods and services produced in a given period must equal the amount that is spent on those goods. The measurement of China's GDP has sometimes generated controversy. (See *Measurement of China's Real GDP*, for a discussion of some of the issues.)

With this caveat in mind, we will proceed. The growth rate of a country's GDP is a simple way to measure how rapidly a country is developing. Also, the growth rate of a country's GDP per capita is a simple way to measure how rapidly a country's living standards are rising.[2]

Since 1978, when major economic reforms were first introduced, China has experienced very high growth rates of its GDP. In at least 14 of these years, annual GDP growth exceeded 10 percent. Since 1980, China's economy has increased more than 10-fold and more than 400 percent since 1987 alone. By comparison, from 1987 to 2006, the economies of the United States and Japan grew only 76 percent and 46 percent, respectively.

How large a share of the world economic pie does China produce? When converted to dollars at current exchange rates, China's GDP as a

Measurement of China's Real GDP

In emerging market economies, the prices of many goods and services tend to be lower than in the United States, for example, when the prices are converted at current exchange rates into dollars. To appropriately compare standards of living across countries, we must compute an alternative measure of GDP — a purchasing power parity (PPP) measure. The PPP measure of GDP adjusts for the price differences across countries. Because prices tend to rise with income, so that high-income countries also have high prices, PPP measures have the effect of raising the GDP estimate for countries not as rich as the United States. For example, using the yuan/dollar exchange rate in 2005, China's GDP that year was about 5 percent of global GDP. Measured in PPP terms, it was 14 percent of global GDP.

Recently, the World Bank issued revised PPP estimates of national GDPs for more than 100 countries for 2005. The revised estimates were based on more complete data on prices of goods and services. A key result of these revisions was that China (and India) had its PPP estimates of GDP revised considerably downward; China's share of global GDP is now estimated to be 10 percent.
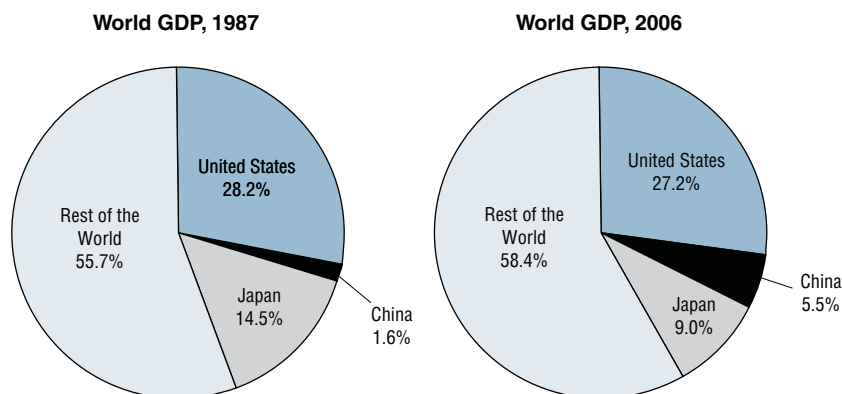
To the extent that prices and changes in prices are understated, this will overstate the level and growth rate of China's real GDP. However, mismeasurement of prices is unlikely to be occurring in the manufacturing sector because a large fraction of manufactured goods are goods sold on world markets. The possibility that prices are not measured correctly would presumably be less than for goods or services that are sold only in China.

share of world GDP has more than tripled since 1987, reaching 5.5 percent in 2006 (Figure 1). This made it the fourth largest economy in the world, after the United States, Japan, and Germany. Note, however, that China's economy is still considerably smaller than that of the United States. Also, the increase in China's share of world GDP is not unprecedented, as Japan experienced a similar jump between 1960 and 1979.

Fueling much of China's growth performance has been its manufacturing sector. As with countries like Japan, Taiwan, South Korea, Singapore, and Ireland before it, China's rapid economic development has gone hand-in-

hand with extraordinary growth in manufacturing. According to the World Bank's World Development Indicator (WDI) database, China's share of the world's manufacturing value-added increased from 2.8 percent to 9.9 percent between 1991 and 2005.[3] The United States remains the world's largest producer of manufactured goods, but the data suggest that China will surpass the United States by 2009 or 2010. Moreover, China is exporting an increasingly large share

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[2] Both growth rates are important and useful indicators. However, they are imperfect indicators of a country's overall development, which would also include indicators of health, poverty, and education, for example. For more on China's contribution to global economic inequality, see the article by Keith Sill.

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[3] To put this large growth in perspective, consider another large emerging country, India. During the same period, India's share of world manufacturing value-added rose slightly, from 0.9 percent to 1.6 percent.

FIGURE 1

China's Share of World GDP

World GDP, 1987

United States 28.2%
Rest of the World 55.7%
Japan 14.5%
China 1.6%

World GDP, 2006

United States 27.2%
Rest of the World 58.4%
Japan 9.0%
China 5.5%

Current Exchange Rates

Source: World Development Indicators

FIGURE 2

China's Share of World Manufacturing Exports

1980

China 0.8%
United States 13.0%
Rest of the World 29.6%
Japan 11.2%
NICs* 5.4%
Germany 14.8%
Other Euro Area 25.1%

2006

United States 10.0%
China 10.8%
Rest of the World 26.3%
Japan 7.1%
NICs* 12.1%
Germany 11.6%
Other Euro Area 21.9%
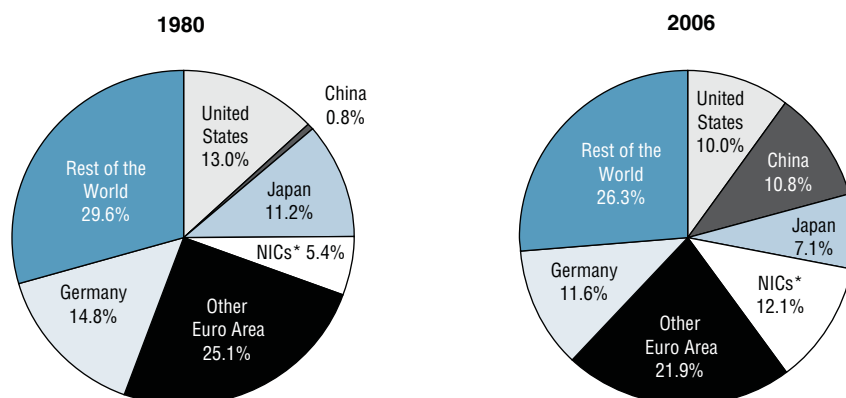
Note: NICs = China, Hong Kong, Singapore, S. Korea, Taiwan

Source: World Trade Organization

of its manufacturing production. Manufacturing exports as a share of GDP have more than doubled: from 14.5 percent in 1991 to 33.8 percent in 2006.

On the world market for manufactured goods, Germany, the United States, and Japan have long been the dominant exporters of the world's manufactured goods. Figure 2 shows how much the make-up of the world's manufactured exports has changed in the past quarter century. In 1980, China accounted for less than 1 percent of the world's manufactured exports, ranking 21st in the world, according to the World Trade Organization. In 2006, China exported

almost $900 billion of manufactured goods, more than Japan and the United States, and 10.8 percent of the world total. Only Germany exported more.

Composition of China's Exports. Moving beyond the aggregate picture, it is useful to present the evolution of the composition of China's manufacturing exports over time. China's abundance of labor has made it an appealing country for the production and export of labor-intensive goods such as footwear, toys, and apparel. In 1994, exports of these and similar goods accounted for over one-third of China's total exports and were almost three times the amount of China's exports of computers, telecommunications equipment, and other electric machinery (Figure 3). Over the next 12 years, exports of the traditional labor-intensive goods grew rapidly – China continues to be the world's leading exporter of many of these goods – but exports of the more high-tech goods grew even more rapidly — so much so, that by 2006, exports of the high-tech goods were almost twice as large as exports of traditional goods.

Tables 1, 2, and 3 present China's top 10 exports for three years: 1992, 1999, and 2006.[4] They clearly show the evolution of China's exports from toys, footwear, and clothing to electronics and other telecommunication devices, including cell phones and computers. Thus, China's manufacturing performance of the past 15 years has been characterized not only by an enormous increase in exports and in

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[4] These data come from the United Nations Comtrade database. They are categorized under the Standard International Trade Classification (SITC) system, Revision 3. We use the four-digit level of categorization, which contains approximately 600 categories.

FIGURE 3

China's Exports Shifting from Traditional Goods to Machinery

1994

2006
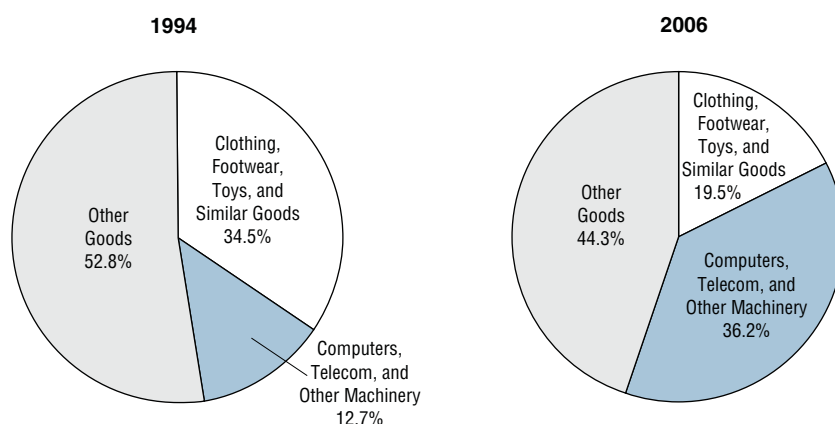
Source: UN Comtrade, SITC, Rev. 3

TABLE 1

China's Top Exports, 1992

Top Chinese Exports to World, 1992	% of Exports
Petroleum oils, crude oil	3.3%
Toys	2.8%
Jerseys & similar articles	1.9%
Footwear, leather uppers	1.6%
Pants, men's	1.5%
Other maize, unmilled	1.4%
Other radio-broadcast receivers	1.4%
Bed, table, toilet, and kitchen linen	1.3%
T-shirts & vests	1.3%
Dress shirts, men's	1.2%
Other footwear	1.1%

Source: UN, SITC, Rev. 3

world market share but also by a steady shift toward exporting more high-tech goods in the realm of electronics and telecommunications equipment.

There have been more formal and in-depth analyses of the transformation of China's exports over time. In his article, Peter K. Schott uses highly disaggregated U.S. import data to examine the "sophistication" of China's export bundle and how it has changed over time. Schott compares the Chinese export bundle to the U.S. with that of the Organization for Economic Cooperation and Development (OECD), a group of developed economies. Schott's measure of sophistication is an export similarity index, which is equal to 1 if two countries in a given year have the same set of export goods *and* each good's share of total exports is the same across the two countries. At the other extreme, the index is 0 if the two countries have no export goods in common. China's index number quadrupled between 1972 and 2005, rising from 0.05 to 0.21. Moreover, China's rank in sophistication among developing countries rose from 19th in 1972 to fourth in 2005. Schott finds that while China's sophistication is consistent with a country of its size, it is unexpected given China's level of development.

Dani Rodrik finds equally compelling results about the relative sophistication of China's exports. Rodrik uses an indicator that "measures the productivity level associated with a country's export basket." Rodrik finds that compared to other countries, China is a major outlier. In 1992, for example, the productivity level associated with China's export basket corresponded to countries with six times the per capita income of China. Though the number has shrunk over time, to three times the per capita income of China in 2003, Rodrik finds that the initial high level has been fundamentally important to China's enormous growth.

The common thread in both Schott's and Rodrik's work is that the story of China's emergence as a manufacturing juggernaut is more than just an enormous increase in exports. Just as important, if not more so, is the increasing sophistication of China's exports. We now turn to

TABLE 2

China's Top Exports, 1999

Top Chinese Exports to World, 1999	% of Exports
Children's toys	2.6%
Input or output units for computers	2.5%
Jerseys, pullovers, cardigans, waistcoats	2.0%
Parts, data processing machines	2.0%
Parts, telecommunications equip.	1.9%
Footwear, leather uppers	1.4%
Footwear, rubber/plastic soles/uppers	1.3%
Trunks, suitcases, etc.	1.2%
Plastic articles	1.1%
Storage units, data processing	1.1%
Pants, men's	1.1%

Source: UN, SITC, Rev. 3

TABLE 3

China's Top Exports, 2006

Top Chinese Exports to World, 2006	% of Exports
Computers, etc.	4.5%
TV, radio transmitters, etc.	3.7%
Parts, data processing machines	3.4%
Parts, telecommunications equip.	3.2%
Input or output units for computers	2.7%
Electronic microcircuits	2.2%
Sound, video recording, etc.	2.2%
Liquid crystal devices; lasers	1.4%
Jerseys, pullovers, cardigans, waistcoats	1.3%
Television receivers, color	1.3%
Storage units, data processing	1.2%

Source: UN, SITC, Rev. 3

our first theme in putting China's manufacturing performance in context.

MANUFACTURING WAGES

One of the concerns expressed in the media is that China's huge population means there is an almost limitless supply of labor available to work in factories. According to this story, the large labor force holds down wages and allows China to extend its manufacturing tentacles into ever more categories of goods – from the most labor-intensive to the most high tech – and ever more markets abroad. Figure 4 illustrates the flaw in this argument because, measured in dollars, China's manufacturing wage has risen at an extremely rapid rate since 1983. For example, it has increased by 232 percent between 1996 and 2006. By contrast the manufacturing wage in the United States rose by only 36 percent in the same period; wages in two countries competing more directly with China, Mexico and South Korea, rose by 60 and 81 percent, respectively.[5]

While this trend may be surprising to some, it is, in fact, a natural outcome of a rapidly growing economy supported by strong manufacturing. A hallmark of such economies is increased labor productivity, that is, output per worker. Increased labor productivity at the national level can arise from two broad channels. First, existing goods can be manufactured in a more efficient manner, or existing goods can be manufactured with more capital per worker. Second, there can be an increase in the production of "new" goods – goods that have not been manufactured by the country before – whose production makes very effective use of labor, so that labor productivity is high. These two channels result

[5] The source for the U.S., Mexico, and South Korea wage data is the Bureau of Labor Statistics' hourly compensation costs in U.S. dollars in manufacturing: www.bls.gov/news.release/ichcc.t02.htm. To facilitate a comparison with Chinese wages, these wages are not adjusted for inflation.

FIGURE 4

China's Manufacturing Wages Rising Rapidly

U.S. $ (annual)

Manufacturing Wages

Source: CEIC, IMF

FIGURE 5

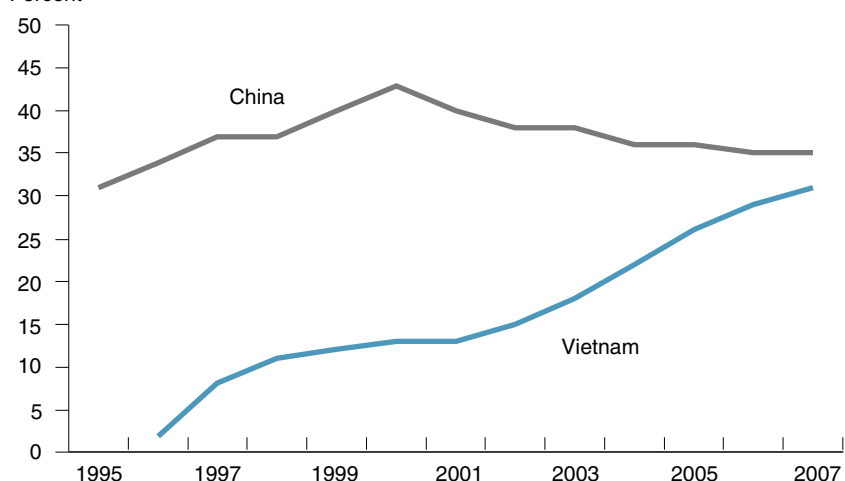### Share of Nike Footwear Production

Percent

China

Vietnam

Source: Nike Annual Reports

To illustrate this phenomenon, consider one of the most prominent athletic shoe companies, Nike. During the 1980s a large share of Nike's production took place in countries such as South Korea. However, as South Korean wages rose, Nike sought other countries in which to produce its products. In the 1990s, Nike increasingly located its production in China (Figure 5). However, after 2000 – likely owing to China's rising wages – this share has declined. Meanwhile, Nike has found Vietnam increasingly attractive. From 1995 to 2007, the share of Nike's production in Vietnam rose from less than 1 percent to 31 percent; its current share is now second to China's.

Looking at footwear more broadly, we see a similar pattern. While China's share of total U.S. imports of footwear continues to grow, it is at a slower rate than before. On the other hand, U.S. imports of Vietnamese-made footwear are growing rapidly. Between 2002 and 2006, for example, China's share of U.S. imports rose from 67 percent to 73 percent, while Vietnam's share more than tripled from 1.5 percent to 5.1 percent. The evolution of both China's share of Nike's production and of China's overall footwear share is illustrative of a larger phenomenon in which rapidly growing economies like China are also experiencing rapidly growing wages.

To summarize, the picture we want to paint in this section has two brush strokes. The first is that a key effect of China's increasing manufacturing prowess is that manufacturing wages are rising rapidly. The second is that rising manufacturing wages are leading China to lose market share for some types of manufactured goods (and also likely leading China to develop the ability to produce and export more sophisticated goods). To be sure, the

in higher wages for workers in most market-oriented economies. China's manufacturing sector tends to be more market-oriented than other sectors of its economy because a large fraction of its production is sold in world markets.

What does the trend of rising manufacturing wages imply for China's

manufacturing performance? The primary consequence is that China is becoming less competitive at producing goods that other countries, such as Vietnam or Bangladesh, are also producing. This would apply, in particular, to clothing, footwear, and toys, and similar types of goods.

types of goods for which China is losing market share are not the areas in which the U.S. competes with China. Our main point is that the gains in manufacturing prowess overall lead almost inevitably to declines in some types of manufactured goods.

CHINA'S IMPORTED INPUTS AND EXPORT MARK-UPS

We begin by first providing two examples of China's market penetration that some commentators find worrisome. The total number of goods that the United States imported from China doubled between 1989 and 2001, and the share of the total number of goods increased from 40 percent to 62 percent.[6] In other words, China had a presence in more than

three-fifths of all U.S. markets for goods by 2001. Only three countries had a larger presence in U.S. markets. To be sure, a presence in a large number of markets does not necessarily mean that China is exporting a large dollar amount in each market. However, in dollar terms, only three countries exported more to the United States in 2001, suggesting that China's presence in many or most markets is comparable to that of the other major countries exporting to the United States.

Tables 4, 5, and 6 show the top 10 exports by China and South Korea for 1992, 1999, and 2006.[7] They have become more similar over time. In 1992, only one industry was a top 10 export industry in both countries. In

1999, there were three industries, and in 2006, there were six industries that were in the top 10 in both countries.

China's Imported Inputs. The above examples suggest that China is increasingly competitive with countries such as the U.S. and South Korea, as well as other countries such as Japan and Germany. However, a key feature of Chinese production of its export goods is that the production relies heavily on imported intermediate goods, such as parts and components. We present two pieces of data on this issue. Data from the CEIC database indicates that in recent years, about 40 percent of China's imports are intermediate goods that are used directly to produce China's exports.[8] In addition, a study by Robert Koopman,

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[6] A "good" is defined as a Harmonized Tariff Schedule (HTS) 10-digit good. See www.usitc. gov. We thank Christian Broda for providing these data to us. See the article by Broda and David Weinstein.

[7] As with the earlier top 10 export data on China, these data are from the United Nations Comtrade database and follow the SITC, Rev. 3 categorization.

[8] This is a comprehensive database of national accounts, trade, industry, financial, employment, and other data for many countries. See www.ceicdata.com.

TABLE 4

China and South Korea in 1992

Top S.K. Exports to World, 1992	% of Exports	Top Chinese Exports to World, 1992	% of Exports
Electronic microcircuits	8.1%	Petroleum oils, crude oil	3.3%
Ships, boats, etc.	5.4%	Toys	2.8%
Fabric, synthetic yarn	4.1%	Jerseys & similar articles	1.9%
Motor vehicles	3.3%	Footwear, leather uppers	1.6%
Footwear, leather uppers	2.4%	Pants, men's	1.5%
Input or output units for computers	2.1%	Other maize, unmilled	1.4%
Television receivers, color	1.9%	Other radio-broadcast receivers	1.4%
Sound, video recording, etc.	1.8%	Bed, table, toilet, and kitchen linen	1.3%
Leather apparel, accessories	1.7%	T-shirts & vests	1.3%
Flat-rolled products of iron and steel	1.7%	Dress shirts, men's	1.2%
Containers	1.5%	Other footwear	1.1%

Source: UN, SITC, Rev. 3

TABLE 5

China and South Korea in 1999

Top S.K. Exports to World, 1999	% of Exports	Top Chinese Exports to World, 1999	% of Exports
Electronic microcircuits	12.4%	Children's toys	2.6%
Motor vehicles	6.9%	Input or output units for computers	2.5%
Ships, boats, etc.	4.6%	Jerseys, pullovers, cardigans, waistcoats	2.0%
TV, radio transmitters, etc.	2.6%	Parts, data proc. machines	2.0%
Input or output units for computers	2.6%	Parts, telecommun. equip.	1.9%
Fabric, synthetic yarn	2.3%	Footwear, leather uppers	1.4%
Parts, data proc. machines	2.2%	Footwear, rubber/plastic soles/uppers	1.3%
Gas oils	2.1%	Trunks, suitcases, etc.	1.2%
Gold, nonmonetary excl. ores	2.1%	Plastic articles	1.1%
Parts, telecommun. equip.	1.8%	Storage units, data processing	1.1%
Liquid crystal devices; lasers	1.7%	Pants, men's	1.1%

Source: UN, SITC, Rev. 3

TABLE 6

China and South Korea in 2006

Top S.K. Exports to World, 2006	% of Exports	Top Chinese Exports to World, 2006	% of Exports
Motor vehicles	9.4%	Computers, etc.	4.5%
Electronic microcircuits	7.8%	TV, radio transmitters, etc.	3.7%
Ships, boats, etc.	6.1%	Parts, data proc. machines	3.4%
TV, radio transmitters, etc.	5.3%	Parts, telecommun. equip.	3.2%
Parts, telecommun. equipt.	4.5%	Input or output units for computers	2.7%
Liquid crystal devices; lasers	4.5%	Electronic microcircuits	2.2%
Parts of motor vehicles	2.9%	Sound, video recording, etc.	2.2%
Parts, data proc. machines	2.7%	Liquid crystal devices; lasers	1.4%
Input or output units for computers	1.8%	Jerseys, pullovers, cardigans, waistcoats	1.3%
Cyclic hydrocarbons	1.5%	Television receivers, color	1.3%
Electrical machines and apparatus	1.4%	Storage units, data proc.	1.2%

Source: UN, SITC, Rev. 3

Zhi Wang, and Shang-Jin Wei develops a methodology to accurately compute the value of imported intermediate goods directly and indirectly embodied in exports. Indirect embodiment occurs if, for example, an imported intermediate is used to produce another intermediate good, which is then used as an input to produce the exported good. Koopman, Wang, and Wei report two interesting findings. First, up to 50 percent of the value of China's exports consists of imported intermediates. Second, the imported intermediate content is higher for more sophisticated products, such as computers and telecommunication equipment.

These data suggest the following interpretation. Because China's production of its export goods relies so heavily on imported intermediate goods, the economic relationship between China and many of its trading partners may be more complementary than competitive. Indeed, in recent years, the export data suggest the development of an East Asian trading network in which intermediate goods are produced and exported from "emerging Asia" and Japan to China, where they are used to make final goods; the final goods are then exported to the United States.[9] Between 1994 and 2006, emerging Asia's and Japan's exports to China rose 389 percent and 191 percent, respectively (Figure 6). In addition, China's exports to the United States rose 345 percent. By contrast, exports shipped directly from emerging Asia and Japan to the United States increased by far smaller percentages. These increases are so large that emerging Asia now exports
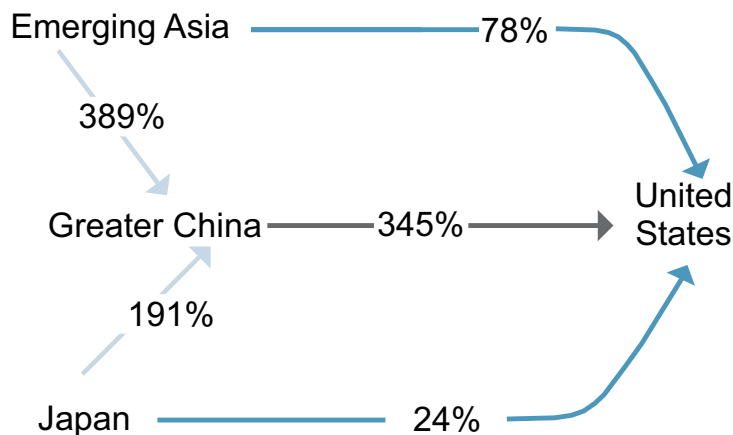
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[9] Emerging Asia includes South Korea, Taiwan, the Philippines, Singapore, Indonesia, Malaysia, and Thailand.

FIGURE 6

China Integrating into Asian Trading Network
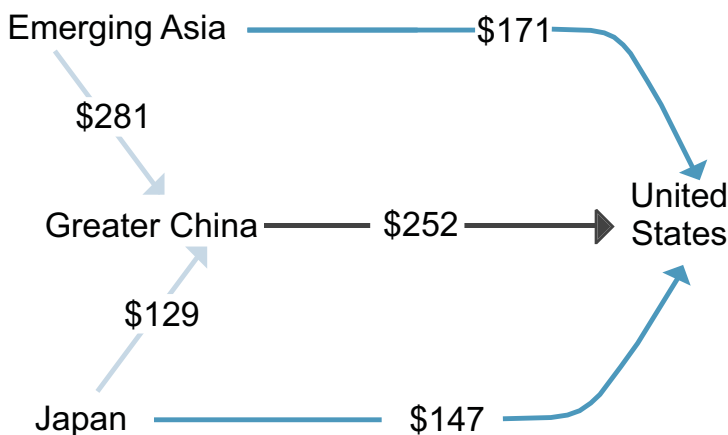**Geography of Asian Trade**
percent change, 1994 - 2006

Source: IMF Direction of Trade Statistics, National Statistics (Taiwan)

FIGURE 7

China Integrating into Asian Trading Network
Geography of Asian Trade
$U.S. billions, 2006

Note: Emerging Asia = S. Korea, Indonesia, Malaysia, the Philippines, Singapore, Taiwan, and Thailand

Source: IMF Direction of Trade Statistics, National Statistics (Taiwan)

almost twice as much to China as it does to the United States (Figure 7). For example, China has replaced the United States as South Korea's largest trading partner.

This network interpretation suggests that even though Table 6 suggests that South Korea and China are now heavily in competition with each other, the two countries are, in

fact, exporting different goods; that is, South Korea exports computer chips to China, which then uses them to produce computers. Furthering the complementary nature of its trade with other countries, China has also required capital goods such as machinery and equipment to fuel its growth in manufacturing. A large fraction of these goods are imported from its richer trading partners.

Mark-Ups on China's Export Goods. In addition to their high content of imported inputs, Chinese exports often have large mark-ups once they arrive in their destination country. Mark-ups include wholesale distribution costs, retailing costs, and profit margins. Each of these mark-ups is an essential part in the process of coordinating the delivery and ensuring the quality of a manufactured good to a consumer. The profit margins can be thought of as the return to investment in the good's intangible asset capital. The investment could be the costs associated with developing a new type of shoe, for example, and the intangible asset capital would be the shoe's brand name. Many Chinese-made goods carry U.S. brands.

Footwear is an excellent example of this. In 2007, U.S. consumers spent $59.2 billion on shoes. Close to 100 percent of U.S. expenditure was on imports.[10] As discussed above, about three-fourths of the imports are from China. But U.S. imports of shoes in 2007 were about $20.4 billion. The difference between the U.S. consumer expenditure value and the value of imports is the retail and wholesale costs, transportation costs, and profit

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[10] In 2003, 99 percent of all footwear purchased in the U.S. was imported. In 2002, it was 98 percent. In 2004, the U.S. Census Bureau discontinued its surveys of U.S. footwear production.

margins. The numbers indicate that these costs and margins are about twice as large as the value of the imported shoes!

Putting the imported input content and large mark-up forces together suggests that Chinese "value-added" – the value of production less the cost of inputs, that is, wages to workers plus the rents paid to capital – in "made in China" goods is not large. For footwear, Chinese value-added on the roughly $45 billion of expenditure on Chinese-made shoes was on the order of $7.5 billion or less, or about 17 percent of the expenditure.

It is likely that the retail, wholesale, and transportation costs and profit margins are not as high for other U.S. imports from China as they are for footwear. Consider a hypothetical case in which these costs and margins are the same as – rather than twice as large as – the value of the imported goods. In 2007, the U.S. imported $322 billion worth of goods from China. Hence, in this hypothetical case, U.S. consumers spent $644 billion on "made in China"
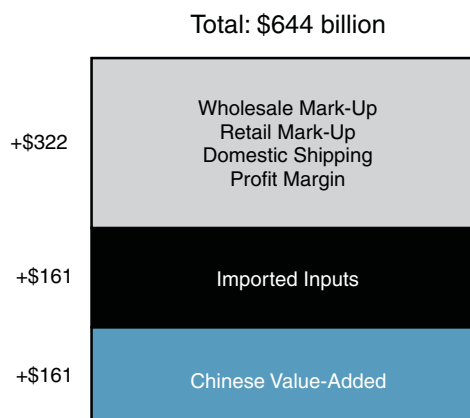
goods, equivalent to 36 percent of all U.S. consumer expenditure on merchandise other than food, fuel, and automobiles. However, only about $160 billion of this expenditure represents Chinese value-added (Figure 8).

CONCLUSION

Our main theme is that while China's manufacturing growth has been spectacular – China will undoubtedly become the largest manufacturing nation in the world within a few years – some of the existing data on its performance overstate the extent of China's current importance in the world economy. We demonstrated this by showing that China's manufacturing wages are rising rapidly, both in absolute terms, and relative to other nations, which means it is losing its status as the preferred location of production for some categories of goods, such as Nike shoes. Moreover, as wages continue to rise, China will need to continually produce more sophisticated goods that require the use of highly productive labor. We also showed that Chinese

FIGURE 8

U.S. Consumer Expenditure on Made in China Goods, 2007

Total: $644 billion

+$322 — Wholesale Mark-Up / Retail Mark-Up / Domestic Shipping / Profit Margin

+$161 — Imported Inputs

+$161 — Chinese Value-Added

Source: BEA, Authors' Calculations

export goods rely heavily on imported inputs and that these goods may have large mark-ups added on, so that the final sale price to the consumer of a "made in China" good exaggerates by several times the Chinese value-added to that price. Our conclusion is that the extent of the manufacturing juggernaut is overstated.

Our conclusion does not in any way diminish the current and growing importance of China in global markets. To give one example, between 2002 and 2007, the demand for oil in China – fueled by China's high GDP growth rates – rose by two-and-one-half times more than it did in the United States. This contributed to the global increase in the price of oil during this period. Moreover, China's wages are not rising by accident. They are rising because the country is becoming more productive, as well as more capable of producing a wider range of goods, as well as higher quality goods.

If China follows the pattern of many other countries, eventually the manufacturing juggernaut may actually diminish in size. Many countries go through a "structural transformation" as they develop, in which large numbers of workers leave the agricultural sector and the share of agriculture in GDP falls. In addition, the services sector grows as a share of total employment and GDP. Finally, the manufacturing sector typically increases in importance during the high growth years, but then falls in importance when the economy matures. For example, in the United States, manufacturing's share in GDP has fallen steadily during the post-World War II period. In Japan, the manufacturing share of GDP peaked in the early 1970s and has fallen steadily since then. It is likely, then, that as China's per capita income and wages rise to developed-country status, manufacturing will decrease in importance. **BR**

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News About the Future and Economic Fluctuations*

BY KEITH SILL

I n the late 1990s, as tech-stock prices were surging, we often heard discussion about a "new economy" in which advanced communications technologies would lead to higher future productivity growth and greater economic efficiency. But the boom times largely came to a halt after August 2000, and in March 2001, the economy entered a recession that lasted eight months. Economist A.C. Pigou argued that news about the future or changes in expectations are important drivers of the business cycle. His theory seems to offer a plausible explanation of what happens in boom-bust cycles. But is his theory consistent with how modern macroeconomic models account for business cycles? In this article, Keith Sill investigates some of the empirical evidence for the economic importance of news shocks, discusses the failings of the standard macroeconomic model in accounting for the role of news in business cycles, and touches on what the news view of business cycles means for the conduct of monetary policy.

Our expectations about how the future will unfold can have important implications for the choices we make today. An expectation of future unemployment might result in reduced consumption and higher savings today. Or an expectation of a future promotion and higher salary may induce higher consumption and lower saving today, even before the higher salary is realized. This rather obvious feature of individual behavior may have important implications for the economy as a whole. Macroeconomic aggregate variables such as consumption and investment could rise in response to a collective belief that the economy will experience higher productivity in the future.

A recent example of how collective beliefs can influence economic variables is the dot-com boom and bust of the late 1990s. In the late 1990s, as tech-stock prices were surging, we often heard discussion about an impending "new economy" in which advanced Internet and communications technologies would lead to higher future productivity growth and greater economic efficiency. We could argue that those collective beliefs about the future became embedded in stock prices and led to dramatic gains in the equity prices of technology-related companies. In turn, higher stock prices made households feel wealthier, which induced increased consumption. Businesses began investing in the emerging technologies in the hopes of generating higher future profits.

These boom times, seemingly driven at least in part by overly optimistic expectations about the future, largely came to a halt after August 2000. After the fact, expectations proved to be optimistic. Over the next three years, the stock market declined on the order of 40 plus percent. In March 2001, the economy entered a recession that lasted eight months. The level of real private nonresidential fixed investment (business fixed investment) declined 16 percent from the fourth quarter of 2000 to the first quarter of 2003. The boom was followed by a bust.

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*The views expressed here are those of the author and do not necessarily represent the views of the Federal Reserve Bank of Philadelphia or the Federal Reserve System.

In 1927, A.C. Pigou, an economics professor at Cambridge University who studied business cycles, wrote a book called *Industrial Fluctuations*. In that book, Pigou argued that news about the future or changes in consumers' and businesses' expectations are important drivers of the business cycle and economic fluctuations. In particular, when firms and suppliers of capital are optimistic about the future, they decide to invest more today in order to accumulate capital to meet higher expected future demand. If it turns out that expectations are overly optimistic, firms pull back on investment and consumers retrench, leading to an economic downturn or recession.

This seems to be a plausible explanation of what happens in boom-bust cycles like the dot-com episode. But do the data really support this story, and are Pigou cycles pervasive features of modern economies? Also, is Pigou's theory consistent with how modern macroeconomic models account for business cycles? An emerging body of empirical evidence supports the view that news about the future is an important factor in explaining fluctuations in output and employment. However, the standard workhorse model used by macroeconomists predicts that good news about the future leads to what looks a lot like a recession today! If good news about the future results in booms today, the standard macroeconomic model needs some modification if it is to explain such behavior.

We will investigate some of the empirical evidence for the economic importance of news shocks and how they affect the economy. We will also discuss the failings of the standard macroeconomic model when it comes to accounting for the role of news in business cycles. A recent line

of research explores this issue and examines the features necessary to get models to predict booms in response to good news about the future economy. Finally, we will touch on what the news view of business cycles means for the conduct of monetary policy.

stock market is a key component of the analysis because it is generally perceived to be forward-looking in the sense that news that people receive about future prospects for the economy should be reflected right away in stock prices, since participants trade on that information.

Is there any hard evidence that changes in expectations about the future lead to significantly large changes in economic activity today?

EMPIRICAL EVIDENCE ON EXPECTATIONS AND FLUCTUATIONS

Is there any hard evidence that changes in expectations about the future lead to significantly large changes in economic activity today? The key problem that must be addressed when deciding whether news about the future affects the economy is separating the scenario "economic booms lead to changes in expectations" from the scenario "changes in expectations lead to economic booms." That is, we have to account for the fact that changes in current economic activity also give rise to changes in expectations about the future economy. Once we control for that possibility, we can investigate the extent to which changes in expectations can drive economic fluctuations.

A recent paper by Paul Beaudry and Franck Portier provides some evidence of the importance of news about the future to fluctuations in economic variables such as consumption and hours worked. Beaudry and Portier undertake a statistical analysis of data on productivity and stock market prices to investigate this question. The

Beaudry and Portier are able to tease shocks out of the data on stock prices and productivity that give insight into how expectations about the future affect today's economy.[1] They find that their shocks contain information about future productivity growth that is also reflected in current stock prices. In addition, they find that long-run changes in productivity are reflected in stock prices before these changes show up in near-term productivity. These findings are consistent with the view that financial market participants can anticipate productivity improvements, perhaps because there is a long delay between receiving news about a new productivity-enhancing technology and the realization of higher productivity once the technology is implemented. Beaudry and Portier call this the "news view."

We can interpret the shocks that Beaudry and Portier identify as news shocks because they represent unpredicted or unexpected information that shows up in productivity and stock prices. This

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[1] For our purposes, a shock can be thought of as the difference between a predicted outcome and the actual outcome.

is what news is: information that wasn't previously available that tells us something about final outcomes.

With news shocks in hand, we can now investigate whether changes in news about the future have an impact on current variables such as consumption, investment, and hours worked. Figure 1 shows how stock prices, per capita consumption, and hours worked per capita respond to a positive news shock. The figure shows the response of these variables over time to two different measures of the news shock, though we see that it makes little difference which shock we focus on, since they both imply the same paths for stock prices, consumption, and hours worked. If there were no response to the news shocks, the lines in the figure for stock prices, consumption, and hours would stay near zero. What we see instead is that stock prices, consumption, and hours worked all jump up right away in response to positive news. Consumption and hours worked continue to rise for about five quarters and then give up some of their gains in apparent recession-like behavior. Eventually, consumption resumes its general upward trend. Hours worked flatten out because hours per capita tend not to rise over time. (People do not work more and more hours as productivity increases — leisure is valuable, too!)

Beaudry and Portier also investigate how much of the variation in consumption and hours worked can be explained by their identified news shocks.[2] This is a measure of how economically important such shocks might be. They find that news shocks

[2] More precisely, they compute how much of the variance of forecast errors for consumption, hours, and investment can be explained by news shocks. These are called variance decompositions.

FIGURE 1

Response of Stock Prices, Consumption, and Hours Worked to Two Measures of Positive News About the Future
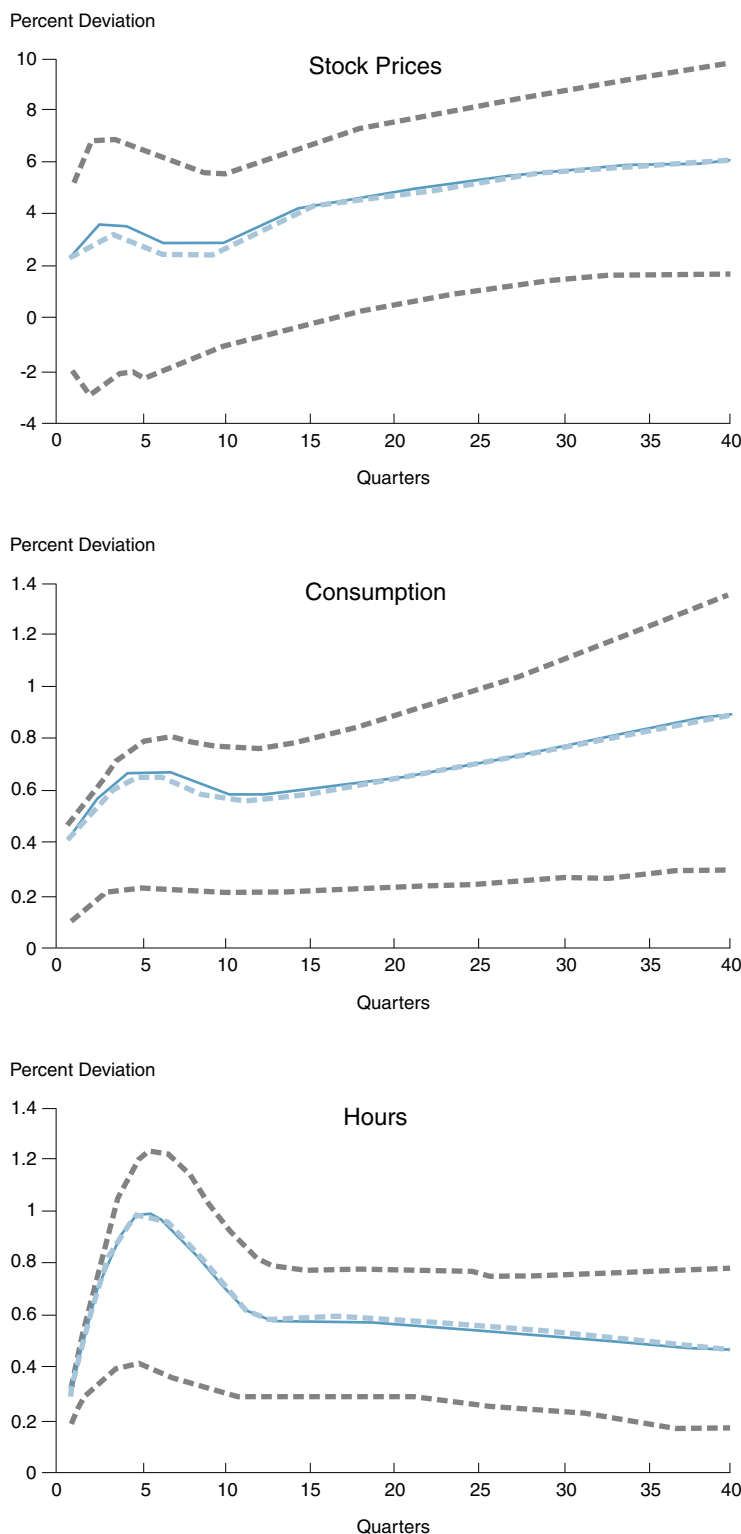
From Beaudry & Portier (2006). Used with permission. Dotted gray lines indicate 95 percent confidence interval

account for 40 to 80 percent of the variation in consumption, investment, and hours worked over the postwar period. This is a huge number and suggests that news about the future may be an important determinant of the economy's fluctuations.

A second piece of evidence on the importance of news shocks for economic fluctuations can be found in recent research I conducted with Sylvain Leduc. We use data from the Philadelphia Fed's Livingston Survey and the Survey of Professional Forecasters (SPF) to identify news shocks and to assess their effect on variables such as the unemployment rate, stock prices, and inflation. Both the Livingston and the SPF are surveys of professional forecasters who are asked to make forecasts of a range of macroeconomic variables. The Philadelphia Fed then tabulates and publishes the forecasts.[3]

Survey data give us a unique insight into expectations of the future, since they are a direct measure of such expectations. Since we know the time at which the surveys are conducted, we can use that information to help us identify news shocks. That is, broadly speaking, we know which realizations of economic variables the forecasters already knew or had in hand when they made their forecasts. So forecasters for a June survey would know May unemployment rates but not June unemployment rates, since those data would not have been released yet. We can use that type of information to identify news shocks and assess their impact on economic variables. More specifically, we analyze a statistical model that contains forecasts of future unemployment rates, current

unemployment rates, interest rates, and inflation. We align the data in such a way as to help us identify shocks to forecasts of future unemployment that are not driven by the other variables in the system. We interpret these shocks as news about the future that changes people's expectations because the shocks are the difference

Survey data give us a unique insight into expectations of the future, since they are a direct measure of such expectations.

between what we expect the predicted unemployment rate to be and what the prediction actually turns out to be. In this context, a positive shock is bad news because it implies that forecasts of future unemployment rates were higher than we would have predicted them to be.
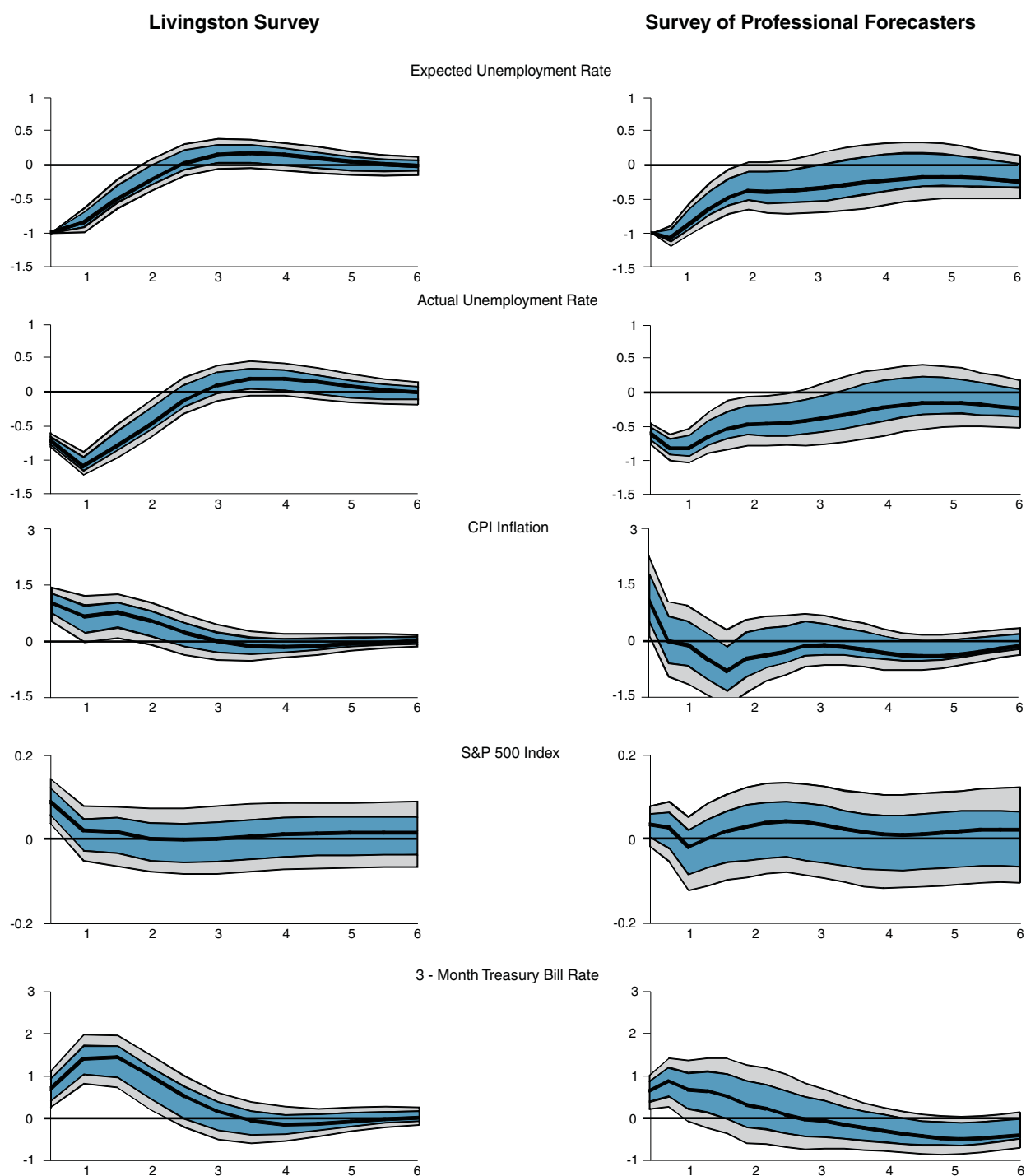
Once we have these news shocks, we can examine how they affect the other variables in the model, such as the unemployment rate, CPI inflation, and interest rates.[4] Figure 2 presents a set of responses from such a shock. The two columns from the figure show which survey measure was used in the model: The left side shows the Livingston Survey and the right side, the Survey of Professional Forecasters. Each row represents the response of a different variable to a news shock that decreases the expected unemployment rate (what economists call impulse responses). The top row of the figure shows how forecasts of six-month-ahead unemployment rates evolve when there is a news shock that leads forecasters to expect lower future

unemployment. The second row shows how actual, or current, unemployment responds to the shock. We see that the unemployment rate falls, so that in response to expectations of future bad times, current times turn better. The third row shows the response of inflation to the news shock. Consistent with the current upturn story, near-term inflation rises. The next row shows the response of stock returns, measured using the S&P 500, to the news shock. Here we see that when news about expected good times arrives, the current stock market rises. Finally, the last row shows the response of short-term interest rates to the news shock. Here, we see that monetary policy tightens as the economy booms in the near term in response to the good news shock.

The impulse responses in Figure 2 suggest that the current economy surges when the future economy is expected to be better. But how strong are the results? Plotted around the impulse responses are confidence bands that indicate how sure we are that a response is different from zero. We see from the figure that the responses of all the variables are significantly different from zero. To further assess the strength of the results, we performed variance decompositions similar to those in the Beaudry and Portier paper described above. We find that about 50 percent of the variability of forecast errors for our variables can be explained by news shocks, a result that is in line with the findings in Beaudry and Portier. So, in

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[3] A description of the surveys and survey data are available on the Philadelphia Fed's website at http://www.philadelphiafed.org/research-and-data/real-time-center/.

[4] We chose these variables because they are not generally subject to data revisions over time.

FIGURE 2

Economic Response to Good News About the Future

Livingston Survey   **Survey of Professional Forecasters**

Expected Unemployment Rate

Actual Unemployment Rate

CPI Inflation

S&P 500 Index

3 - Month Treasury Bill Rate

The responses were generated from a VAR with expected unemployment percent, actual unemployment, inflation, equity prices, the 10-year T-bill rate, the 3-month T-bill rate, and dummy variables for oil and fiscal shocks. All of the responses are expressed in percentage terms. The x-axis denotes years. In each chart, the darker area represents the 68 percent confidence interval, while the sum of the darker and lighter areas denotes the 90 percent confidence interval.

sum, we find that the economy surges in response to expectations of better times ahead and that the response of the unemployment rate, inflation, and the short-term interest rate are different enough from zero and explain enough of the variance of the series that we can be pretty confident that it is not a statistical fluke.[5]

THE PIGOU CYCLE

We have seen some of the empirical evidence that suggests that changes in expectations about the future can alter aggregate economic outcomes today. That is, news about the future seems to be a significant driver of current economic fluctuations. What does economic theory have to say about how we might interpret the statistical evidence?

In the early 1900s, A.C. Pigou wrote: "The varying expectations of businessmen ... constitute the immediate cause and direct causes or antecedents of industrial fluctuations." In other words, Pigou believed that changes in expectations about the future were a principal cause of business cycles in the economy. If people were optimistic about the future, current consumption, investment, and output would rise. If they were overly optimistic, once they realized that their expectations were too rosy, the economy would go into recession as businesses and households pulled back on their spending. A Pigou cycle then can arise when

output, consumption, investment, and hours worked jointly increase in response to an anticipated rise in productivity. When the anticipated increase fails to materialize, a recession ensues.

This view of booms and busts seems consistent with the way events unfolded during the dot-com bubble. Expectations about higher future productivity driven

News about the future seems to be a significant driver of current economic fluctuations. What does economic theory have to say about how we might interpret the statistical evidence?

by Internet-related technologies led to an investment boom in products such as fiber-optic cable. The stock market value of technology stocks rose to unprecedented highs. The rationalization for such high valuations was that the economy was entering a new era of high productivity that should be reflected in future stock earnings and dividends. After the fact, these expectations turned out to be overly optimistic, and the dot-com bust dovetailed into the recession that began in 2001.

Anecdotal evidence suggests that people receive and process news about the future and that such news can affect behavior. For example, stock prices and consumer confidence measures are thought to lead the business cycle. We can tell stories that seem consistent with the Pigou cycle theory of booms and busts. However,

it turns out that this view of the world does not work particularly well in the standard workhorse model of modern macroeconomics.[6] In fact, in the standard model, good news about the future in the form of higher expected productivity can lead to a drop in hours worked, output, and investment today. In the standard model, expected booms lead to what look a lot like recessions today!

To develop some insights into why the standard model gives this result, consider first a case in which households observe an increase in current productivity that they expect will persist into the future. With persistently higher productivity, households are wealthier, since their current and expected future real incomes are higher (for example, real wages rise with productivity in the standard model). In this case, output, employment, consumption, and investment all rise today.

Two forces are at work behind this result. The first is a wealth effect. Higher productivity means higher real income in the standard model. Thus, household wealth increases, and being richer induces more consumption today, since households like to smooth out their consumption over time. But higher wealth also means that households want to consume more leisure; so the wealth effect predicts that hours worked will fall. Offsetting the impact of the wealth effect on work effort is a substitution effect. The substitution effect says that households

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[5] See also the paper by Robert Barsky and Eric Sims. They examine how output and consumption respond to innovations using responses from the Michigan Survey. They also find that changes in people's expectations about the future lead to significant changes in current output, consumption, and productivity. Stephanie Schmitt-Grohe and Martin Uribe estimate an equilibrium model with news shocks and find that news about the future can account for a substantial fraction of economic fluctuations.

[6] By a standard macroeconomic model I am referring to the neoclassical growth model. That model is one of a representative household that maximizes its consumption and leisure, subject to the constraint that consumption and investment are no greater than what can be produced with capital on hand and labor effort. For a very accessible discussion of the neoclassical growth model, see the *Business Review* article by Satyajit Chatterjee.

work harder when productivity is higher and then invest the proceeds to attain higher consumption in the future when productivity is lower. Thus, the substitution effect indicates that in response to higher productivity today, households work harder, consume less, and save more.

Which effect is dominant: wealth or substitution? It depends first on how persistent the increase in productivity is expected to be. The more persistent the rise in productivity, the stronger the wealth effect. Also important is how responsive labor supply is to changes in the real wage. If labor supply increases a lot in response to an increase in wages, the substitution

effect becomes stronger. Figure 3 shows how consumption, investment, output, and hours worked respond in the standard model to a productivity shock calibrated in the standard way — a fairly persistent shock. We see that for labor supply, the substitution effect dominates the wealth effect and hours worked increase. In addition, output, consumption, and investment all rise in response to a positive productivity shock.

Consider now what the model predicts if the productivity shock is expected to affect the economy in the future but not directly today. In anticipation of higher real wages in the future, households feel wealthier today

and so spend more on consumption and leisure. Because the productivity shock hits in the future, there is not a strong substitution effect today. (Households are not more productive today; they only expect to be in the future.) Consequently, households have little incentive to work harder today, since they are no more productive than before. Thus, in response to higher expected future productivity, current consumption rises and hours worked fall. With lower hours worked, output falls. Since output falls and consumption rises, investment must fall, since output equals consumption plus investment (we are ignoring net exports). Thus, an expected

FIGURE 3

Standard Model: Response to a Positive Productivity Shock
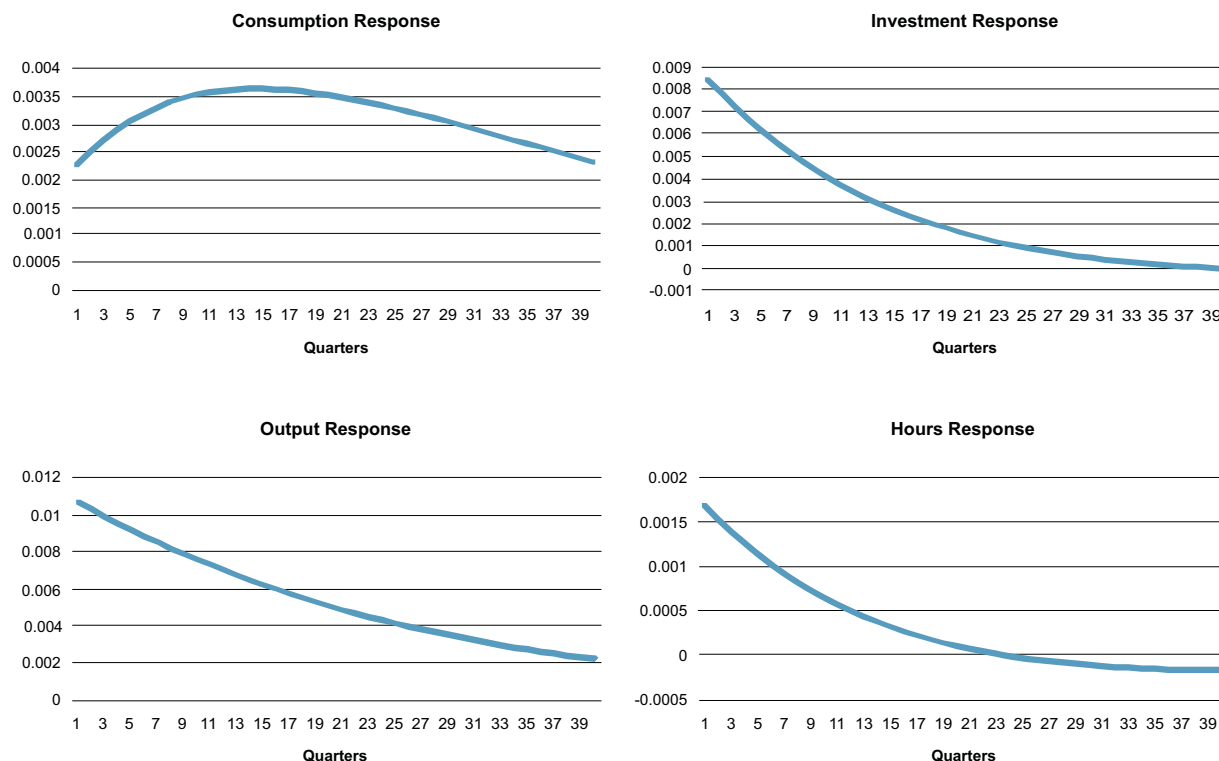
Panels show the response of consumption, investment, output, and hours to a percent increase in the productivity shock at time 1.

boom in productivity leads to lower output and hours worked today (but higher consumption). This intuition is revealed in the impulse responses shown in Figure 4. Here, we show the response of consumption, investment, hours worked, and output to a shock that signals that productivity will rise one year from now.

So it seems that the standard model does not deliver a result about the effect of news on the economy that agrees with the empirical evidence we presented earlier. Remember, that evidence suggested that in response to good news about the future economy, there is a boom today, with consumption, output, and investment all increasing. Is there a model whose predictions agree with that evidence?

It turns out that a modified version of the standard model can predict a boom in response to expectations of good times in the future. The standard model has to be modified so that the wealth effect on labor supply is not strong. In addition, various other frictions must be added to the model so that both consumption and investment respond positively to good news about the future. These modifications are detailed in a recent paper by Nir Jaimovich and Sergio Rebelo. They allow firms to vary the intensity with which they use capital, which is important because it increases the extent to which output can respond to news about the future. They also assume that it is costly for firms to adjust their stock of capital, which gives firms an incentive to respond immediately to future productivity changes in order to smooth out costs over time.

A somewhat different approach is taken in a recent paper by Wouter den Haan and Georg Kaltenbrunner. They postulate that in order to benefit from future productivity gains, firms and households have to invest resources today. In den Haan

FIGURE 4

Standard Model: Response to News Today That Productivity Will Increase in Four Quarters
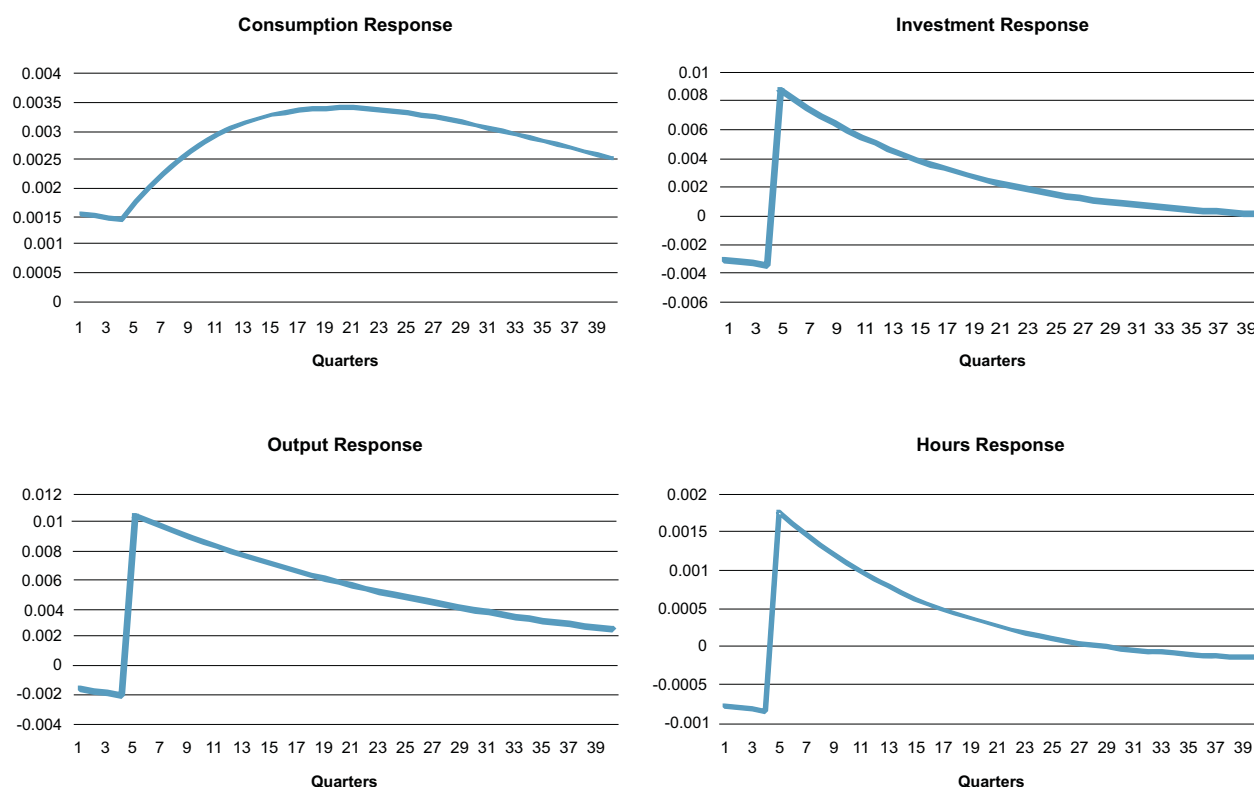
Panels show the response of consumption, investment, output, and hours to a 0.01 percent increase in the productivity shock at time 1 that is realized at time t=4.

and Kaltenbrunner's model, firms and workers that are not already engaged in production when news about higher future productivity is revealed need to get together today and form productive relationships. Since building productive relationships requires both time and resources, firms start investing in new projects right away and immediately begin looking for new workers with whom to build productive relationships. Thus, employment, investment, and output rise in response to expectations of higher future productivity growth in their model.

So we see that there are several reasonable approaches we might take in order to get a coherent theoretical model of the economy that has the feature that expectations of good times in the future lead to booms today. Discriminating among these alternative modeling strategies is only at the earliest stages in the economics profession. Time will tell which modeling strategy most closely aligns with the regularities found in the data.

EXPECTATIONS, BUSINESS CYCLES, AND MONETARY POLICY

If economic variables such as stock prices, output, employment, consumption, and investment do respond in a meaningful and important way to expectations about the future, what are the implications for policymakers? Recently, the economy has experienced an unusual amount of asset-price volatility whose source can perhaps ultimately be traced to overly optimistic expectations about continued increases in house prices. When house prices began falling instead of rising, financial markets began to perform badly, and a downturn in real economic activity ensued. This episode is not unique. Over the past 20 years or so, several

boom-bust cycles have unfolded around the world, including Japan in the late 1980s and East Asia in the late 1990s. These episodes have generated debate about the importance of the role played by monetary policy in booms and busts: Often the episodes were accompanied by heightened criticism of central banks for fueling the booms by keeping monetary policy too easy for too long.

Asset-price run-ups and asset-price

volatility seem to be key features of expectations-driven booms in practice. This raises a question about the extent to which monetary policymakers should take asset prices into account when setting policy. Unfortunately, it is difficult to determine the extent to which asset prices are aligned with "true fundamentals" or are being driven by nonfundamental factors. For monetary policymakers who are concerned with stabilizing inflation and employment growth, determining the "right" level of asset prices seems a tall order. However, it may be the case that by focusing on stabilizing inflation and employment growth, policymakers can stabilize asset prices as a byproduct. This is the message of a study by Ben Bernanke and Mark Gertler.

Consider the case of a central bank that operates monetary policy in such a way as to try to achieve an inflation target. That is, the central bank's mandate is to keep inflation

close to some level — say, 2 percent — over a suitably defined length of time. There is some reason to expect that such a monetary policy will act as a natural stabilizing force with respect to boom-bust cycles. The inflation-targeting approach to monetary policy dictates that monetary policy should be adjusted to offset emerging inflationary or deflationary pressures.[7] Bernanke and Gertler argue that by focusing on inflation, central banks

> Recently, the economy has experienced an unusual amount of asset-price volatility whose source can perhaps ultimately be traced to overly optimistic expectations about continued increases in house prices.

in effect respond to the bad effects of booms and busts without having to take an explicit stand on whether asset prices are valued fairly (according to economic fundamentals) in booms. For purposes of the ensuing discussion, we will say that, in a boom, asset prices are rising, an assumption that agrees with most definitions of booms in the data.

How can inflation targeting end up "getting it right" with respect to policy and expectations-driven cycles?

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[7] Bernanke and Gertler actually argue for a regime of flexible inflation targeting, which, they contend, has three characteristics. The first is that monetary policy is committed to attaining a target level of inflation in the long run and price stability is the overriding goal of monetary policy. Second, within the constraints imposed by achieving a long-run inflation target, policymakers have some flexibility in the short run to achieve other objectives, such as stable output and employment. Third, there is a commitment to transparency and openness on the part of monetary policymakers so that private-sector expectations about policy and the economy are well grounded.

Bernanke and Gertler argue that inflation targeting leads policymakers to automatically adjust interest rates in such a way as to stabilize the economy in the face of booms. The idea is that booms are associated with increases in demand; that is, consumption, investment, and ultimately output rise. In Bernanke and Gertler's view, increases in demand are in turn associated with rising inflation. But an inflation-targeting central bank will raise the interest rate in response to rising inflation. In effect, the central bank leans against the wind. This reins in the increase in demand and stabilizes financial markets as well.

Financial markets are likely to stabilize for several reasons. The first is that the stability of the broader economy is, in itself, stabilizing for financial markets. Second, suppose the economy starts to go into recession and asset prices start to decline — which will tend to erode the balance sheets of banks (and other firms, as well). The falloff in demand and declining inflation call for policymakers to lower the interest rate, which can reduce the economy's vulnerability to further bad shocks. Finally, if financial market participants expect policymakers to act in this way, it may mean that the overreaction of asset prices might be moderated. Overreaction could occur if asset prices are in part driven by a market psychology or some other factor, such as poor regulatory practices, not directly fundamental to determining asset prices.

Bernanke and Gertler's paper is really about monetary policy and asset-price volatility. They note that financial stability is becoming an increasing concern for monetary policymakers because, over the past 25 years, a number of countries have experienced major boom-bust cycles in the prices of assets such as equities and real estate. Associated with the bust part of the cycles, as asset prices are falling, real economic activity is declining significantly. We have presented evidence that changes in expectations that can influence real activity also show up in asset prices, such as stock prices. So expectations-driven cycles fit naturally into the asset-price boom-bust cycles with which Bernanke and Gertler are concerned.

> If asset prices fall, the amount of collateral falls, which raises the ratio of borrowing relative to assets, worsens balance-sheet positions, and makes it harder to borrow.

In the Pigou cycles story, the bust part of the cycle comes about when overly optimistic expectations are not realized and firms and households cut back on their consumption and spending. Bernanke and Gertler point out another negative force at work in the bust part of the cycle: negative balance-sheet effects on firms and households from declines in asset prices. This channel can be important because credit markets are characterized by problems such as differential information between parties to a contract, problems of contract enforcement, and misaligned incentives between lenders and borrowers, or managers and investors. Because these problems exist, credit is most widely available and on the best terms to institutions and households that have strong balance sheets (i.e., are in good financial shape with respect to their assets and liabilities). So balance-sheet conditions become important determinants of borrowing and lending. But falling asset prices can have an adverse impact on balance sheets because firms and households may use the assets they own as collateral for borrowing. If asset prices fall, the amount of collateral falls, which raises the ratio of borrowing relative to assets, worsens balance-sheet positions, and makes it harder to borrow. In turn, the reduced borrowing lowers demand in the economy and may also adversely affect supply by reducing working capital for firms and inhibiting investment. These factors work to further slow down economic activity and worsen economic downturns.

Thus, it can be quite important for monetary policymakers to recognize the downside of an expectations-driven boom-bust cycle. If there is a significant decline in asset prices, households and firms face greater difficulty in financing their consumption and investment decisions, which lowers aggregate demand and can make economic downturns more severe. The good news is that in the Bernanke and Gertler story, central banks can help alleviate these policies not by focusing policy on movements in asset prices but rather by focusing on inflation. Asset prices stabilize as a consequence.

However, there may be circumstances in which inflation targeting does not lead to a good outcome in the face of asset booms. Lawrence Christiano, Roberto Motto, and Massimo Rostagno make this point in their paper. They look at asset price swings since the 1870s and argue that there were three significant boom-bust episodes: one that began in 1920 and ended with the Great Depression, one that began in the mid 1950s and ended in the 1970s,

and one that began in the mid 1990s and ended in the early 2000s. Their model includes inflation-targeting monetary policymakers in an economy with sticky wages and prices as well as adjustment costs to investment.[8] In that environment, boom-bust cycles can easily arise. A feature that distinguishes their paper is sticky wages, which means that nominal wages are not fully flexible in response to the shocks hitting the economy, but rather take time to adjust to the new equilibrium level. Some researchers have argued that this feature of the model is important for matching certain features of the data on the economy.[9]

Suppose then that nominal wages are sticky. How does this cause a problem for an inflation-targeting central bank? When the boom phase starts, it is typical in macroeconomic models for real wages (defined as the nominal wage divided by a general price index) to rise to induce people to work harder. But with sticky nominal wages, the only way that happens is if prices start to fall. An inflation-targeting policymaker sees the drop in inflation and so eases monetary policy by reducing interest rates in order to stimulate demand and push inflation back up to the target level. But this stimulative action ends up feeding the already-present optimism about the economy and generates even faster growth of consumption, investment, and output. Monetary policy ends up making the boom even bigger, and the eventual bust, worse.

FIGURE 5

Log Stock Prices and Inflation
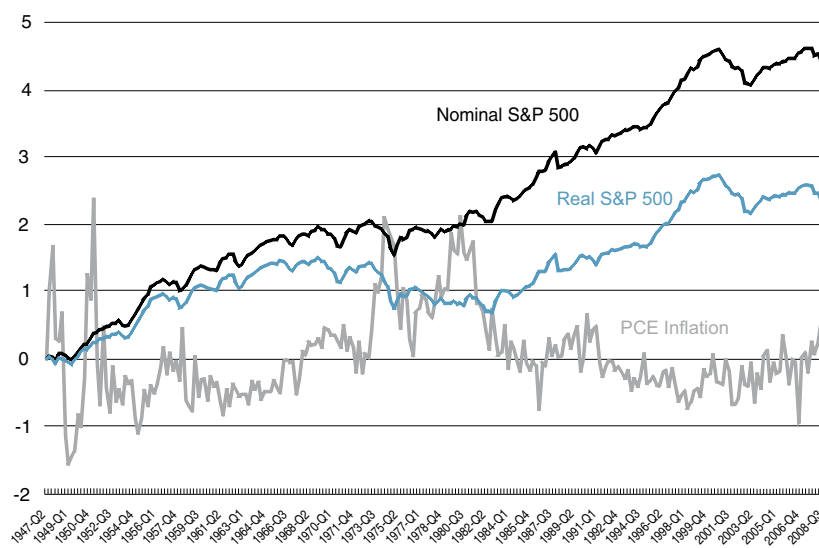
Each variable is normalized to 1 in 1947Q2. The chart shows 100 times the log of the resulting series.

If inflation targeting is counter-productive in this environment, what should a monetary policymaker do? Christiano, Motto, and Rostagno argue that policymakers also need to monitor credit market conditions as well as inflation because credit growth is correlated with booms. Consequently, if policymakers observe strong credit growth and declining inflation, they should still "lean against the wind" and raise interest rates to slow the economy and temper the boom.

Bernanke and Gertler and Christiano, Motto, and Rostagno have different takes on whether inflation targeting helps stabilize an economy that experiences a boom. The key difference between the conflicting accounts is how inflation behaves during the boom phase of the cycle. If inflation rises in the boom phase, Bernanke and Gertler's stabilization argument holds and inflation targeting will be stabilizing for the economy. If inflation falls during the boom phase, Christiano, Motto, and Rostagno's argument holds and inflation-targeting policy is destabilizing for the economy. Unfortunately, the data do not give a clear-cut answer about the relationship between stock market booms and inflation. The big problem is defining what constitutes a boom in asset prices: There is no completely objective measure. Figure 5 plots the log of the S&P 500 index in both nominal and real terms and the rate of inflation measured by the personal consumption expenditures (PCE) index.[10] Clearly, the correlation between inflation and asset-price

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booms depends in part on how booms are identified. For example, we might try to define a boom as above-trend growth in the stock market index. But then we would have to decide how to measure trend growth in the stock price index. Deviations from a linear trend look different than deviations from a trend that varies smoothly over time or a linear trend that has breaks in it.

For a more general look at the data, we can go back to Figure 2. Here we have not defined booms or busts but instead relied only on the postwar data (although we have also made some identification assumptions as detailed above). The figure shows that in response to higher expectations of future unemployment, stock prices decline and inflation declines. Flipping that around, we can say that when expectations for the future economy are unusually good, stock prices rise as does inflation. At least over the postwar period, the response of asset prices and inflation seems to line up better with the view in Bernanke and Gertler. Indeed, Figure 2 also shows that the Federal Reserve tended to tighten policy in booms and ease policy in bad times. That is not to say, though, that the Christiano, Motto, and Rostagno story is without merit. It is hard to argue against the view that monetary policymakers would be well served by monitoring credit market conditions as well as inflation in setting policy. Indeed, the Federal Reserve looks at a broad array of indicators when making decisions about the appropriate stance of monetary policy, even if low and stable inflation is a principal goal of policy.

SUMMARY

Expectations play an important role in decision-making at the individual level, and there is increasing evidence that expectations about the future are important in accounting for fluctuations in economic aggregates. New economic models are attempting to explicitly model the expectations channel for business cycles. With the recent housing-related boom and bust in the U.S. and its manifestations across the globe, it seems even more important that macroeconomists develop models that can help us understand this episode and guide monetary policymakers in their decision-making. **BR**

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WHAT DETERMINES LOCAL PATENT RATES?

The authors geocode a data set of patents and their citation counts, including citations from abroad. This allows them to examine both the quantity and quality of local inventions. They also refine their data on local academic R&D to explore effects from different fields of science and sources of R&D funding. Finally, they incorporate data on congressional earmarks of funds for academic R&D.

With one important exception, results using citation-weighted patents are similar to those using unweighted patents. For example, estimates of the returns to density (jobs per square mile) are only slightly changed when using citation-weighted patents as the dependent variable. But estimates of returns to city size (urbanization effects) are quite sensitive to the choice of dependent variable.

Local human capital is the most important determinant of per capita rates of patenting. A 1 percent increase in the adult population with a college degree increases the local patenting rate by about 1 percent.

With few exceptions, there is little variation across fields of science in the contribution of academic R&D to patenting rates. The exceptions are computer and life sciences, where the effects are smaller. There is greater variation in the contribution of R&D funded by different

sources — academic R&D funded by the federal government generates smaller increases in patenting rates than R&D funded by the university itself. This effect is somewhat stronger for federally funded applied R&D than for basic R&D. The authors also find small negative effects for cities with greater exposure to academic R&D allocated by congressional earmarks. The authors discuss the implications of these results for policy and future research.
Working Paper 09-12, "What Explains the Quantity and Quality of Local Inventive Activity?" Gerald Carlino, Federal Reserve Bank of Philadelphia, and Robert Hunt, Federal Reserve Bank of Philadelphia

A NEW CLASS OF CONFIDENCE SETS FOR DSGE MODEL PARAMETERS

The authors show that in weakly identified models (1) the posterior mode will not be a consistent estimator of the true parameter vector, (2) the posterior distribution will not be Gaussian even asymptotically, and (3) Bayesian credible sets and frequentist confidence sets will not coincide asymptotically. This means that Bayesian DSGE estimation should not be interpreted merely as a convenient device for obtaining asymptotically valid point estimates and confidence sets from the posterior distribution. As an alternative, the authors develop a new class of frequentist confidence sets for structural DSGE model

parameters that remain asymptotically valid regardless of the strength of the identification. The proposed set correctly reflects the uncertainty about the structural parameters even when the likelihood is flat, it protects the researcher from spurious inference, and it is asymptotically invariant to the prior in the case of weak identification.

Working Paper 09-13, "Frequentist Inference in Weakly Identified DSGE Models," Pablo Guerron-Quintana, Federal Reserve Bank of Philadelphia; Atsushi Inoue, North Carolina State University; and Lutz Kilian, University of Michigan and CEPR

VACANCIES, HIRES, AND VACANCY YIELDS IN THE JOB OPENINGS AND LABOR TURNOVER SURVEY (JOLTS)

The authors study vacancies, hires, and vacancy yields (success rate in generating hires) using the Job Openings and Labor Turnover Survey, which provides job opening and labor turnover data collected from a large representative sample of U.S. employers. The authors also develop a simple framework that identifies the monthly flow of new vacancies and the job-filling rate for vacant positions, which is the employer counterpart to the job-finding rate for unemployed workers. The job-filling rate moves counter to employment at the aggregate level but rises steeply with employer growth rates in the cross section. It falls with employer size, rises with the worker turnover rate, and varies by a factor of four across major industry groups. The authors' analysis also indicates that more than one in six hires occurs without benefit of a vacancy, as defined by JOLTS. These findings provide useful inputs for assessing, developing, and calibrating theoretical models of search, matching, and hiring in the labor market.

Working Paper 09-14, "The Establishment-Level Behavior of Vacancies and Hiring," Steven J. Davis, University of Chicago and NBER; R. Jason Faberman, Federal Reserve Bank of Philadelphia; and John C. Haltiwanger, University of Maryland and NBER

DETERMINING A FIRM'S EXPORT STATUS

Exporters are few — less than one-fifth among U.S. manufacturing firms — and they are larger than nonexporting firms — about four to five times more total sales per firm. These facts are often cited as support for models with economies of scale and firm heterogeneity as in Melitz (2003). The authors find that the basic Melitz model cannot simultaneously match the size and share of exporters given the observed distribution of total sales. Instead, exporters are expected to be between 90 and 100 times larger than nonexporters. It is easy to reconcile the model with the data. However, a lot of variation independent of firm size is needed to do so. This suggests that economies of scale play only a minor role in determining a firm's export status. The authors show that the augmented model also has markedly different implications in the event of trade liberalization. Most of the adjustment is through the intensive margin, and productivity gains due to reallocation are halved.

Working Paper 09-15, "Economies of Scale and the Size of Exporters," Roc Armenter, Federal Reserve Bank of Philadelphia, and Miklós Koren, Central European University, IEHAS, and CEPR

CONCENTRATION OF R&D ACTIVITY IN THE U.S.

This study details the location patterns of R&D labs in the U.S., but it differs from past studies in a number of ways. First, rather than looking at the geographic concentration of manufacturing firms (e.g., Ellison and Glaeser, 1997; Rosenthal and Strange, 2001; and Duranton and Overman, 2005), the authors consider the spatial concentration of private R&D activity. Second, rather than focusing on the concentration of employment in a given industry, the authors look at the clustering of individual R&D labs by industry. Third, following Duranton and Overman, the authors look for geographic clusters of labs that represent statistically significant departures from spatial randomness using simulation techniques. The authors find that R&D activity for most industries tends to be concentrated in the Northeast corridor, around the Great Lakes, in California's Bay Area, and in southern California. They argue that the high spatial concentration of R&D activity facilitates the exchange of ideas among firms and aids in the creation of new goods and new ways of producing existing goods. They run a regression of an Ellison and Glaeser style index measuring the spatial concentration of R&D labs on geographic proxies for knowledge spillovers and other characteristics and find evidence that localized knowledge spillovers are important for innovative activity.

Working Paper 09-16, "The Geography of Research and Development Activity in the U.S.," Kristy Buzard, University of California-San Diego, and Gerald Carlino, Federal Reserve Bank of Philadelphia

AGGLOMERATION ECONOMIES' ROLE IN APPLYING NEW KNOWLEDGE TO PRODUCTION

Where does adaptation to innovation take place? The author presents evidence on the role of agglomeration economies in the application of new knowledge to production. All else equal, workers are more likely to be observed in new work in locations that are initially dense in both college graduates and industry variety. This pattern is consistent with economies of density from the geographic concentration of factors and markets related to technological adaptation. A main contribution is to use a new measure, based on revisions to occupation classifications, to closely characterize cross-sectional differences across U.S. cities in adaptation to technological change. Worker-level results also provide new evidence on the skill bias of recent innovations.

Working Paper 09-17, "Technological Adaptation, Cities, and New Work," Jeffrey Lin, Federal Reserve Bank of Philadelphia

TRANSMISSION OF CREDIBLE INFORMATION BY A BENEVOLENT CENTRAL BANK

The authors study credible information transmission by a benevolent central bank. They consider two possibilities: direct revelation through an announcement versus indirect information transmission through monetary policy. These two ways of transmitting information have very different consequences. Since the objectives of the central bank and those of individual investors are not always aligned, private investors might rationally ignore announcements by the central bank. In contrast, information transmission through changes in the interest rate creates a distortion, thus lending an amount of credibility. This induces the private investors to rationally take into account information revealed through monetary policy.

Working Paper 09-18, "Money Talks," Marie Hoerova, European Central Bank; Cyril Monnet, Federal Reserve Bank of Philadelphia; and Ted Temzelides, Rice University

TRADE REFORM POLICIES, TARIFF REDUCTIONS, AND OUTPUT PER WORKER IN KOREA'S MANUFACTURING SECTOR

South Korea's growth miracle has been well documented. A large set of institutional and policy reforms in the early 1960s is thought to have contributed to the country's extraordinary performance. In this paper, the authors assess the importance of one key set of policies — the trade policy reforms in Korea — as well as the concurrent GATT tariff reductions. They develop a model of neoclassical growth and trade that highlights two forces by which lower trade barriers can lead to increased per worker GDP: comparative advantage and specialization, and capital accumulation. The authors calibrate the model and simulate the effects of three sets of tariff reductions that occurred between early 1962 and 1995. Their main finding is that the model can explain up to 32 percent of South Korea's catch-up to the G7 countries in output per worker in the manufacturing sector. The authors find that the effects of the tariff reductions taken together are about twice as large as the sum of each reduction applied individually.

Working Paper 09-19, "How Much of South Korea's Growth Miracle Can Be Explained by Trade Policy?," Michelle Connolly, Duke University, and Kei-Mu Yi, Federal Reserve Bank of Philadelphia

TECHNOLOGY, UNCERTAINTY, AND FLUCTUATIONS IN REAL EXCHANGE RATES

This paper investigates the extent to which technology and uncertainty contribute to fluctuations in real exchange rates. Using a structural VAR and bilateral exchange rates, the author finds that neutral technology shocks are important contributors to the dynamics of real exchange rates. Investment-specific and uncertainty shocks have a more restricted effect on international prices. All three disturbances cause short-run deviations from uncovered interest rate parity.

Working Paper 09-20, "Do Uncertainty and Technology Drive Exchange Rates?" Pablo A. Guerron-Quintana, Federal Reserve Bank of Philadelphia

SECURITIZATION AND THE POOR PERFORMANCE OF MORTGAGES IN THE FINANCIAL CRISIS

The academic literature, the popular press, and policymakers have all debated securitization's contribution to the poor performance of mortgages originated in

the run-up to the current crisis. Theoretical arguments have been advanced on both sides, but the lack of suitable data has made it difficult to assess them empirically. We examine this issue by using a loan-level data set from LPS Analytics, covering approximately three-quarters of the mortgage market from 2003-2007 and including both securitized and nonsecuritized loans. We find evidence that privately securitized loans do indeed perform worse than similar, nonsecuritized loans. Moreover, this effect is concentrated in prime mortgage markets; for example, a typical prime ARM loan originated in 2006 becomes delinquent at a 20 percent higher rate if it is privately securitized, ceteris paribus. By contrast, subprime loan performance does not seem to be worse for most classes of securitized loans.

Working Paper 09-21, "Securitization and Mortgage Default: Reputation vs. Adverse Selection," Ronel Elul, Federal Reserve Bank of Philadelphia

HOUSING SHOCKS, HOUSE PRICES, AND DEFAULT: A QUANTITATIVE MODEL FOR EXPLORING THE IMPACT OF THE FORECLOSURE PREVENTION POLICY

The authors construct a quantitative model of the housing market in which an unanticipated increase in the supply of housing triggers default mortgages via its effect on house prices. The decline in house prices creates an incentive to increase the consumption of housing space, but leverage makes it costly for homeowners to sell their homes and buy bigger ones (they must absorb large capital losses). Instead, leveraged households find it advantageous to default and rent housing space. Since renters demand less housing space than homeowners, foreclosures are a negative force affecting house prices. The authors explore the possible effects of the government's foreclosure prevention policy in their model. They find that the policy can temporarily reduce foreclosures and shore up house prices.

Working Paper 09-22, "Foreclosures and House Price Dynamics: A Quantitative Analysis of the Mortgage Crisis and the Foreclosure Prevention Policy," Satyajit Chatterjee, Federal Reserve Bank of Philadelphia, and Burcu Eyigungor, Koç University

BANK CAPITAL REQUIREMENTS AND BUSINESS-CYCLE EFFECTS

This paper attempts to quantify the business-cycle

effects of bank capital requirements. The authors use a general equilibrium model in which financing of capital goods production is subject to an agency problem. At the center of this problem is the interaction between entrepreneurs' moral hazard and liquidity provision by banks as analyzed by Holmstrom and Tirole (1998). They impose capital requirements on banks and calibrate the regulation using the Basel II risk-weight formula. Comparing business-cycle properties of the model under this procyclical regulation with those under hypothetical countercyclical regulation, the authors find that output volatility is about 25 percent larger under procyclical regulation and that this volatility difference implies a 1.7 percent reduction of the household's welfare. Even with more conservative parameter choices, the volatility and welfare differences under the two regimes remain nonnegligible.

Working Paper 09-23, "Time-Varying Capital Requirements in a General Equilibrium Model of Liquidity Dependence," Francisco Covas, Federal Reserve System Board of Governors, and Shigeru Fujita, Federal Reserve Bank of Philadelphia

MORTGAGE SALES, MORTGAGE INVENTORIES, AND TRADE

Consider the sale of mortgages by a loan originator to a buyer. As widely noted, such a transaction is subject to a severe adverse selection problem: The originator has a natural information advantage and will attempt to sell only the worst mortgages. However, a second important feature of this transaction has received much less attention: Both the seller and the buyer may have existing inventories of mortgages similar to those being sold. The authors analyze how the presence of such inventories affects trade. They use their model to discuss implications for regulatory intervention in illiquid markets.

Working Paper 09-24, "Why Do Markets Freeze?" Philip Bond, University of Pennsylvania, and Yaron Leitner, Federal Reserve Bank of Philadelphia

IMPLICATIONS OF RELAXED BORROWING CONSTRAINTS IN THE PRESENCE OF HYPERBOLIC DISCOUNTING

Is the observed rapid increase in consumer debt over the last three decades good news for consumers? This paper quantitatively studies macroeconomic and welfare implications of relaxing borrowing

constraints when consumers exhibit a hyperbolic discounting preference. In particular, the author constructs a calibrated general equilibrium life-cycle model with uninsured idiosyncratic earnings shocks and a quasi-hyperbolic discounting preference and examines the effect of relaxation of the borrowing constraint, which generates increased indebtedness. The model can capture the two contrasting views associated with increased indebtedness: the positive view, which links increased indebtedness to financial-sector development and better insurance, and the negative view, which associates increased indebtedness with consumers' over-borrowing. He finds that while there is a welfare gain as large as 0.4 percent of flow consumption from a relaxed borrowing constraint, which is consistent with the observed increase in aggregate debt between 1980 and 2000 in the model with standard exponential discounting consumers, there is a welfare loss of 0.2 percent in the model with hyperbolic discounting consumers. This result holds in spite of the observational similarity of the two models; the macroeconomic implications of a relaxed borrowing constraint are similar between the two models.

Cross-sectionally, although consumers of high and low productivity gain and medium productivity consumers suffer due to a relaxed borrowing constraint in both models, the welfare gain of low-productivity consumers is substantially reduced (and becomes negative in the case of strong hyperbolic discounting) in the hyperbolic discounting model due to the welfare loss from over-borrowing. Finally, the author finds that the optimal (social welfare maximizing) borrowing limit is 15 percent of average income, which is substantially lower than both the optimal level implied by the exponential discounting model (37 percent) and the level of the U.S. economy in 2000 implied by the model (29 percent).

Working Paper 09-25, "Rising Indebtedness and Hyperbolic Discounting: A Welfare Analysis," Makoto Nakajima, Federal Reserve Bank of Philadelphia

A STUDY OF BANKING USING MECHANISM DESIGN

The authors study banking using the tools of mechanism design, without a priori assumptions about what banks are, who they are, or what they do. Given preferences, technologies, and certain frictions — including limited commitment and imperfect monitoring — they describe the set of incentive feasible allocations and interpret the outcomes in terms of institutions that resemble banks. The bankers in the authors' model endogenously accept deposits, and their liabilities help others in making payments. This activity is essential: If it were ruled out, the set of feasible allocations would be inferior. The authors discuss how many and which agents play the role of bankers. For example, they show that agents who are more connected to the market are better suited for this role, since they have more to lose by reneging on obligations. The authors discuss some banking history and compare it with the predictions of their theory.

Working Paper 09-26, "Banking: A Mechanism Design Approach," Fabrizio Mattesini, University of Rome Tor-Vergata; Cyril Monnet, Federal Reserve Bank of Philadelphia; and Randall Wright, University of Wisconsin, and Visiting Scholar, Federal Reserve Bank of Philadelphia

IMPLEMENTING MONETARY POLICY: STANDING FACILITIES AND OPEN MARKET OPERATIONS

The authors compare two stylized frameworks for the implementation of monetary policy. The first framework relies only on standing facilities, while the second framework relies only on open market operations. They show that the Friedman rule cannot be implemented when the central bank uses standing facilities, while it can be implemented with open market operations. For a given rate of inflation, the authors show that standing facilities unambiguously achieve higher welfare than just conducting open market operations. They conclude that elements of both frameworks should be combined. Also, their results suggest that any monetary policy implementation framework should remunerate both required and excess reserves.

Working Paper 09-27, "Monetary Policy Implementation Frameworks: A Comparative Analysis," Antoine Martin, Federal Reserve Bank of New York, and Cyril Monnet, Federal Reserve Bank of Philadelphia

ASSESSING THE PRECISION OF ECONOMIC PREDICTIONS: EARLY RELEASE DATA AND DEFINITIONAL CHANGES

In this paper, the authors empirically assess the extent to which early release inefficiency and definitional change affect prediction precision. In

particular, they carry out a series of ex-ante prediction experiments in order to examine the marginal predictive content of the revision process, the trade-offs associated with predicting different releases of a variable, the importance of particular forms of definitional change, which the authors call "definitional breaks," and the rationality of early releases of economic variables. An important feature of their rationality tests is that they are based solely on the examination of ex-ante predictions, rather than on in-sample regression analysis, as are many tests in the extant literature. Their findings point to the importance of making real-time datasets available to forecasters, as the revision process has marginal predictive content, and because predictive accuracy increases when multiple releases of data are used when specifying and estimating prediction models.

The authors also present new evidence that early releases of money are rational, whereas prices and output are irrational. Moreover, they find that regardless of which release of their price variable one specifies as the "target" variable to be predicted, using only "first release" data in model estimation and prediction construction yields mean square forecast error (MSFE) "best" predictions. On the other hand, models estimated and implemented using "latest available release" data are MSFE-best for predicting all releases of money. The authors argue that these contradictory findings are due to the relevance of definitional breaks in the data-generating processes of the variables they examine. In an empirical analysis, they examine the real-time predictive content of money for income, and they find that vector autoregressions with money do not perform significantly worse than autoregressions when predicting output during the past 20 years.

Working Paper 09-28, "Real-Time Datasets Really Do Make a Difference: Definitional Change, Data Release, and Forecasting," Andres Fernandez, Rutgers University and Universidad de Los Andes, and Norman R. Swanson, Rutgers University, and Visiting Scholar, Federal Reserve Bank of Philadelphia

TESTING THE ACCURACY OF PREDICTIVE DENSITIES DERIVED FROM DIFFUSION MODELS

This paper develops tests for comparing the accuracy of predictive densities derived from (possibly misspecified) diffusion models. In particular, the authors first outline a simple simulation-based framework for constructing predictive densities for one-factor and stochastic volatility models. Then, they construct accuracy assessment tests that are in the spirit of Diebold and Mariano (1995) and White (2000). In order to establish the asymptotic properties of their tests, the authors also develop a recursive variant of the nonparametric simulated maximum likelihood estimator of Fermanian and Salanié (2004). In an empirical illustration, the predictive densities from several models of the one-month federal funds rates are compared.

Working Paper 09-29, "Predictive Density Construction and Accuracy Testing with Multiple Possibly Misspecified Diffusion Models," Valentina Corradi, University of Warwick, and Norman R. Swanson, Rutgers University, and Visiting Scholar, Federal Reserve Bank of Philadelphia