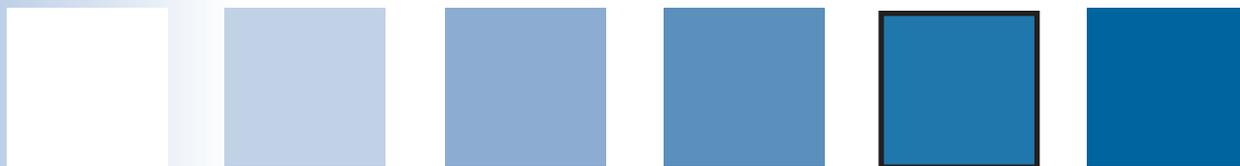


Federal Reserve Bank of St. Louis

REVIEW

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Seven Faces of “The Peril”

[James Bullard](#)

In this paper the author discusses the possibility that the U.S. economy may become enmeshed in a Japanese-style deflationary outcome within the next several years. To frame the discussion, the author relies on an analysis that emphasizes two possible long-run steady states for the economy: one that is consistent with monetary policy as it has typically been implemented in the United States in recent years and one that is consistent with the low nominal interest rate, deflationary regime observed in Japan during the same period. The data considered seem to be quite consistent with the two steady-state possibilities. The author describes and critiques seven stories that are told in monetary policy circles regarding this analysis and emphasizes two main conclusions: (i) The Federal Open Market Committee’s “extended period” language may be increasing the probability of a Japanese-style outcome for the United States and (ii), on balance, the U.S. quantitative easing program offers the best tool to avoid such an outcome. (JEL E4, E5)

Federal Reserve Bank of St. Louis *Review*, September/October 2010, 92(5), pp. 339-52.

THE PERIL

In 2001, three academic economists published a paper entitled “The Perils of Taylor Rules.”¹ The paper has vexed policymakers and academics alike, as it identified an important and very practical problem—a *peril*—facing monetary policymakers, but provided little in the way of simple resolution. The analysis appears to apply equally well to a variety of macroeconomic frameworks, not just to those in one particular camp or another, so that the peril result has great generality. And, most worrisome, current monetary policies in the United States (and possibly Europe as well) appear to be poised to head straight toward the problematic outcome described in the paper.

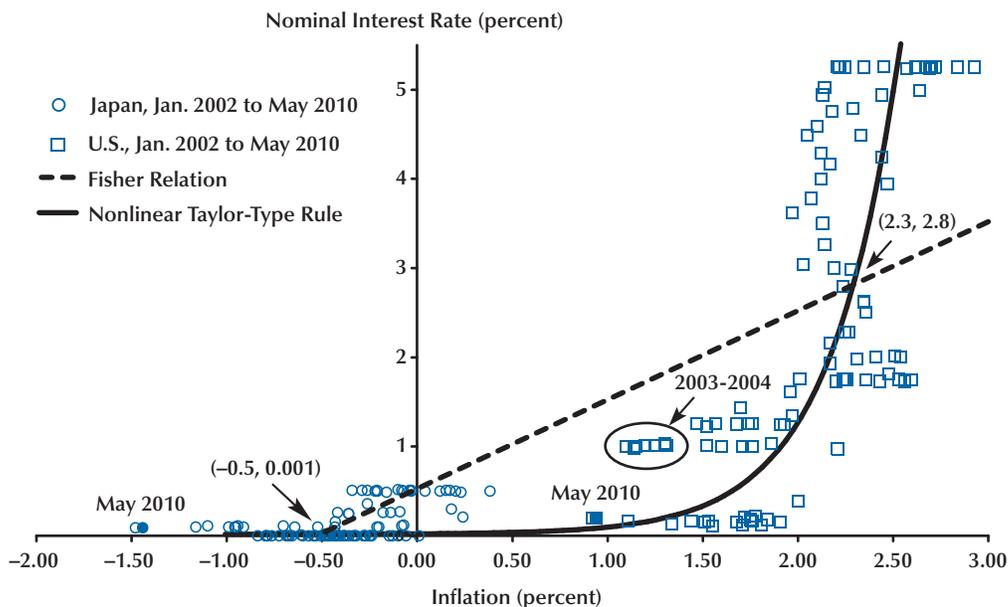
The authors of the 2001 paper—Jess Benhabib at New York University and Stephanie Schmitt-Grohé and Martín Uribe both now at Columbia University—studied abstract economies in which the monetary policymaker follows an active Taylor-type monetary policy rule—that is, the policymaker changes nominal interest rates more than one for one when inflation deviates from a given target. Active Taylor-type rules are so commonplace in present-day monetary policy discussions that they have ceased to be controversial. Benhabib, Schmitt-Grohé, and Uribe also emphasized the zero bound on nominal interest rates. They suggested that the combination of an active Taylor-type rule and a zero bound on nominal interest rates necessarily creates a new long-run outcome for the economy. This new long-run outcome can involve deflation and a very low

¹ See Benhabib, Schmitt-Grohé, and Uribe (2001).

James Bullard is president and CEO of the Federal Reserve Bank of St. Louis. Any views expressed are his own and do not necessarily reflect the views of other Federal Open Market Committee members. The author benefited from review and comments by Richard Anderson, David Andolfatto, Costas Azariadis, Jess Benhabib, Cletus Coughlin, George Evans, William Gavin, Seppo Honkapohja, Narayana Kocherlakota, Michael McCracken, Christopher Neely, Michael Owyang, Adrian Peralta-Alva, Robert Rasche, Daniel Thornton, and David Wheelock. Marcela M. Williams provided outstanding research assistance.

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Figure 1
Interest Rates and Inflation in Japan and the U.S.



NOTE: Short-term nominal interest rates and core inflation rates in Japan and the United States, 2002-10.
 SOURCE: Data from the Organisation for Economic Co-operation and Development.

level of nominal interest rates. Worse, there is presently an important economy that appears to be stuck in exactly this situation: Japan.

To see what these authors were up to, consider Figure 1. This is a plot of nominal interest rates and inflation for both the United States and Japan during the period from January 2002 through May 2010. The frequency is monthly. The Japanese data are the circles in the figure, and the U.S. data are the squares. The short-term nominal interest rate is on the vertical axis, and the inflation rate is on the horizontal axis. To maintain as much international comparability as possible, all data are from the Organisation for Economic Co-operation and Development (OECD) main economic indicators (MEI). The short-term nominal interest rate is taken to be the policy rate in both countries—the overnight call rate in Japan and the federal funds rate in the United States. Inflation in the figure is the core consumer price index inflation rate measured from one year earlier in both coun-

tries. The data in the figure never mix during this time period: The U.S. data always lie to the northeast, and the Japanese data always lie to the southwest. This will be an essential mystery of the story.

Benhabib, Schmitt-Grohé, and Uribe (2001) wrote about the two lines in the figure. The dashed line represents the famous Fisher relation for safe assets—the proposition that a nominal interest rate has a real component plus an expected inflation component. I have taken the real component (also the rate of time preference in the original analysis by Benhabib, Schmitt-Grohé, and Uribe) to be fixed and equal to 50 basis points in the figure.² Practically speaking, any macroeconomic model of monetary phenomena will have a Fisher

² This is just for purposes of discussion—much of the formal analysis to which I refer later in the paper has stochastic features that would allow the real rate to fluctuate over time. Generally speaking, short-term, real rates of return on safe assets in the United States have been very low during the postwar era.

relation as a part of the analysis, and so this line is hardly controversial. The solid line in the figure represents a Taylor-type policy rule: It describes how the short-term nominal interest rate is adjusted by policymakers in response to current inflation. In the right half of the figure, when inflation is above target, the policy rate is increased, but more than one for one with the deviation of inflation from target. And when inflation is below target, the policy rate is lowered, again more than one for one. When the line describing the Taylor-type policy rule crosses the Fisher relation, we say there is a steady state at which the policymaker no longer wishes to raise or lower the policy rate, and, simultaneously, the private sector expects the current rate of inflation to prevail in the future. It is an equilibrium in the sense that, if there are no further shocks to the economy, nothing will change with respect to inflation or the nominal interest rate. In the figure, this occurs at an inflation rate of 2.3 percent and a nominal interest rate of 2.8 percent (denoted by an arrow on the right side of the figure). This is sometimes called the “targeted” steady state.³

The “active” policy rule—the fact that nominal interest rates move more than one for one with inflation deviations in the right half of the figure—is supposed to keep inflation near the target. It also means that the line describing the Taylor-type policy rule is steeper than the line describing the Fisher relation in the neighborhood of the targeted inflation rate. It cuts the Fisher relation from below. Taken at face value, the Taylor-type policy rule has been fairly successful for the United States: Inflation (by this measure) has been neither above 3 percent nor, until very recently, below 1 percent during the January 2002–May 2010 period.

None of this so far is really the story told by Benhabib, Schmitt-Grohé, and Uribe. On the right-hand side of the figure, short-term nominal interest rates are adjusted up and down to keep inflation low and stable. It’s all very conventional. The point of the analysis by Benhabib, Schmitt-Grohé, and Uribe is to think more carefully about what these seemingly innocuous assumptions—

the Fisher relation, the active Taylor-type rule, the zero bound on nominal interest rates—really imply as we move to the left in the figure, far away from the targeted steady-state equilibrium. And, what these building blocks imply is only one thing: The two lines cross again, creating a second steady state. In the figure, this second steady state occurs at an inflation rate of –50 basis points and an extremely low short-term nominal interest rate of about one-tenth of a basis point (see the arrow on the left side of the figure).⁴ The Japanese inflation data are all within about 100 basis points of this steady state, between –150 basis points and 50 basis points. That’s about the same distance from low to high as the U.S. inflation data. But for the nominal interest rate, most of the Japanese observations are clustered between 0 and 50 basis points. The policy rate cannot be lowered below zero, and there is no reason to increase the policy rate since—well, inflation is already “too low.” This logic seems to have kept Japan locked into the low nominal interest rate steady state. Benhabib, Schmitt-Grohé, and Uribe sometimes call this the “unintended” steady state.⁵

At the unintended steady state, policy is no longer active: It has instead switched to being passive. The policy line crosses the Fisher relation from above. When inflation decreases, the policy rate is not lowered more than one for one because of the zero lower bound. And when inflation increases, the policy rate is not increased more than one for one because, in this region of the diagram, inflation is well below target. Fluctuations in inflation are in fact not met with much of a policy response at all in the neighborhood of the unintended steady state. At this steady state, the private sector has come to expect the rate of deflation consistent with the Fisher relation accompanied by very little policy response; thus,

³ Steady states are considered focal points for the economy in macroeconomic theories—the economy “orbits” about the steady state in response to shocks.

⁴ This example is meant as an illustration only. The formula I used to plot the nonlinear Taylor-type policy rule is $R = Ae^{B\pi}$, where R is the nominal interest rate, π is the inflation rate, and A and B are parameters. I set $A = 0.005015$ and $B = 2.75$. Taylor-type policy rules also have an output gap component, and in the literature that issue is discussed extensively. For the possibility of a second steady state, it is the inflation component that is of paramount importance.

⁵ I discuss the social desirability of each of the two steady states briefly in the section titled “Traditional Policy.”

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nothing changes with respect to nominal interest rates or inflation. Where does policy transition from being active to being passive? This occurs when the slope of the nonlinear Taylor-type rule is exactly 1, which is at an inflation rate of about 1.56 percent in Figure 1.

Again, the data in this figure do not mix at all—it's boxes on the right and circles on the left. But the most recent observation for the United States, the solid box labeled "May 2010," is about as close as the United States has been in recent times to the low nominal interest rate steady state. It is below the rate at which policy turns passive in the diagram. In addition, the Federal Open Market Committee (FOMC) has pledged to keep the policy rate low for an "extended period." This pledge is meant to push inflation back toward target—certainly higher than where it is today—thus moving to the right in the figure. Still, as the figure makes clear, pledging to keep the policy rate near zero for such a long time would also be consistent with the low nominal interest rate steady state, in which inflation does not return to target but instead both actual and expected inflation turn negative and remain there. Furthermore, we have an example of an important economy that appears to be in just this situation.

A key problem in the figure is that the monetary policymaker uses only nominal interest rate adjustment to implement policy. This is the meaning of the nonlinear Taylor-type policy rule continuing far to the left in the diagram. The policymaker is completely committed to interest rate adjustment as the main tool of monetary policy, even long after it ceases to make sense (long after policy becomes passive), creating a second steady state for the economy. Many of the responses described below attempt to remedy the situation by recommending a switch to some other policy when inflation is far below target. The regime switch required must be sharp and credible—policymakers have to commit to the new policy and the private sector has to believe the policymakers. Unfortunately, in actual policy discussions nothing of this sort seems to be happening. Both policymakers and private sector players continue to communicate in terms of interest rate adjustment as the main tool for the implementa-

tion of monetary policy. This is increasing the risk of a Japanese-style outcome for the United States.

My view is that the 2001 analysis by Benhabib, Schmitt-Grohé, and Uribe is an important one for current policy, that it has garnered insufficient attention in the policy debate, and that it is indeed closely related to the current "extended period" pledge of the FOMC. Below I relate and critique seven stories—both formal ones and informal ones—that I have encountered concerning this analysis. The fact that there are seven "faces" shows just how fragmented the economics profession is on this critical issue. These stories range from reasons not to worry about the implications of Figure 1, through ways to adjust nominal interest rates to avoid the implications of Figure 1, and on to the uses of unconventional policies as a tool to avoid "the peril."

I conclude that promises to keep the policy rate near zero may be increasing the risk of falling into the unintended steady state of Figure 1 and that an appropriate quantitative easing policy offers the best hope for avoiding such an outcome.

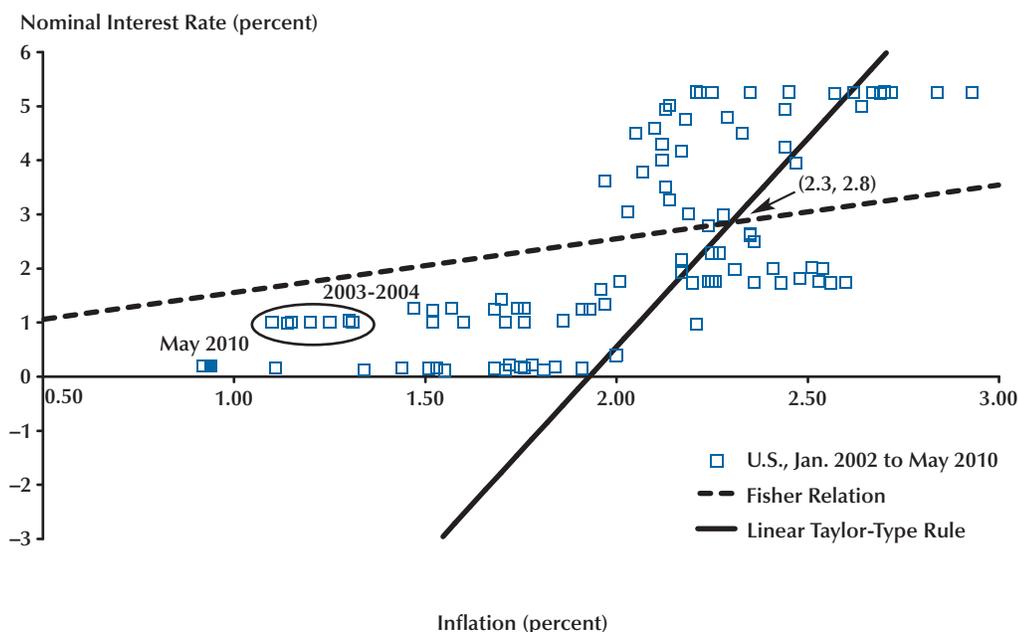
SEVEN FACES

Denial

I think it is fair to say that, for many who have been involved in central banking over the past two or three decades, it is difficult to think of Japan and the United States in the same game, as Figure 1 suggests. For many, the situation in Japan since the 1990s has been a *curiosum*, an odd outcome that might be chalked up to particularly Byzantine Japanese politics, the lack of an inflation target for the Bank of Japan (BOJ), a certain lack of political independence for the BOJ, or some other factor specific to the Land of the Rising Sun. The idea that U.S. policymakers should worry about the nonlinearity of the Taylor-type rule and its implications is sometimes viewed as an amusing bit of theory without real ramifications. *Linear models tell you everything you need to know.* And so, from this *denial* point of view, we can stick with our linear models and ignore the data from Japan (Figure 2).

Figure 2

Denial



In Figure 2, the targeted steady state remains at an inflation rate of 2.3 percent, but the Taylor-type rule is now linear. The policy rate still reacts to the current level of inflation, and more than one for one; that is, the Taylor-type rule is still *active*. In fact, in the neighborhood of the targeted steady state, there would be very little difference in choosing the linear or the nonlinear versions of the Taylor-type rule. For lower values of inflation, however, the linear Taylor-type rule now extends into negative territory, violating the zero bound on nominal interest rates. Some contemporary discussion of monetary policy pines for a negative policy rate exactly as pictured here. One often hears that, given the state of today's economy, the desired policy rate would be, say, -6.0 percent, as suggested by the chart. This is nonsensical, since under current operating procedures such a policy rate is infeasible and therefore we cannot know how the economy would behave with such a policy rate.⁶

The most disturbing part of Figure 2, however, is that the Japanese data are not part of the

picture. This tempts one to argue that, because core inflation is currently below target, there is little harm in keeping the policy rate near zero and, indeed, in promising to keep the policy rate near zero in the future. There is no danger associated with such a policy according to Figure 2. There is a sort of faith that the economy will naturally return to the targeted steady state, since that is the only long-run equilibrium outcome for the economy that is part of the analysis.

Stability

There is another version of the denial view that is somewhat less extreme but nevertheless still a form of denial in the end. It is a view that I have been associated with in my own research.

⁶ Over the years, some discussion in monetary theory has contemplated currency taxes as a means of obtaining negative nominal rates, but that is a radical proposal not often part of the negative rates discussion. See Mankiw (2009). Interestingly, even negative rates would not avoid the multiple-equilibria problem—see, for instance, Schmitt-Grohé and Uribe (2009).

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In this view, one accepts the zero bound on nominal interest rates and the other details of the analysis by Benhabib, Schmitt-Grohé, and Uribe. One accepts that there are two steady states. However, the steady states have stability properties associated with them in a fully dynamic analysis, and the argument is that the targeted steady state is the stable one, while the unintended, low nominal interest rate steady state is unstable. Therefore, according to this argument, one should expect to observe the economy in the neighborhood of the targeted steady state and need not worry about the unintended, low nominal interest rate steady state.

The original analysis by Benhabib, Schmitt-Grohé, and Uribe entailed much more than what I have described in Figure 1. The figure outlines just the big picture. In fact, the authors wrote down complete DSGE economies⁷ and analyzed the dynamics of those systems in a series of papers. In the original analysis, the 2001 paper, they endowed both the central bank and the private sector in the model with rational expectations. They then showed that it was possible for the economy to begin in the neighborhood of the targeted steady state and follow an equilibrium path to the unintended, low nominal interest rate steady state. These dynamics in fact spiraled out from the targeted steady state.

I did not find this story very compelling, for two reasons: because the dynamics described seem unrealistic—they imply a volatile sequence of interest rates and inflation rates followed by sudden arrival at the low nominal interest rate steady state—and because they rely heavily on the foresight of the players in the economy concerning this volatile sequence.

A 2007 paper by Stefano Eusepi, now at the Federal Reserve Bank of New York, addressed some of these concerns. Eusepi accepted the nonlinear nature of Figure 1 with its two steady states. He also backed off the rational expectations assumption that characterized the original analysis by Benhabib, Schmitt-Grohé, and Uribe. Instead he assumed that the actors in the model

might learn over time in a specific way by considering the data produced by the economy itself.⁸

One key result in the Eusepi paper (2007) was the following: If the monetary authority, with its nonlinear Taylor-type policy rule, reacts to inflation one period in the past (as perhaps one might expect of many central banks), then the only possible long-run outcome for the economy is the targeted steady state. I found this comforting. It suggests that one need not worry about the unintended steady state and that exclusive focus on the targeted steady state is warranted. To be sure, a careful reading of the Eusepi paper reveals that many other dynamic paths are also possible, including some that converge to the unintended steady state. Still, one might hope that the targeted steady state is somehow the stable one—and that for this reason one can sleep better at night.

I've said this is a form of denial. First, as fascinating as they are, the results are not that clean, as many dynamics are possible depending on the details of the model. It is hard to know how these details truly map into actual economies. But more importantly, Figure 1 suggests that at least one large economy has in fact converged to the unintended steady state. The stability argument cannot cope with this datum, unless one is willing to say that conditions are subtly different in Japan compared with the United States, producing convergence to the unintended steady state in Japan but convergence to the targeted steady state in the United States. I have not seen a compelling version of this argument. I conclude that the stability argument is actually a form of denial in the end.⁹

The FOMC in 2003

In Figure 1, a set of data points is circled. These data are labeled “2003-2004” and are associated with a policy rate at 1.0 percent and the inflation rate between 1.0 and 1.5 percent. This

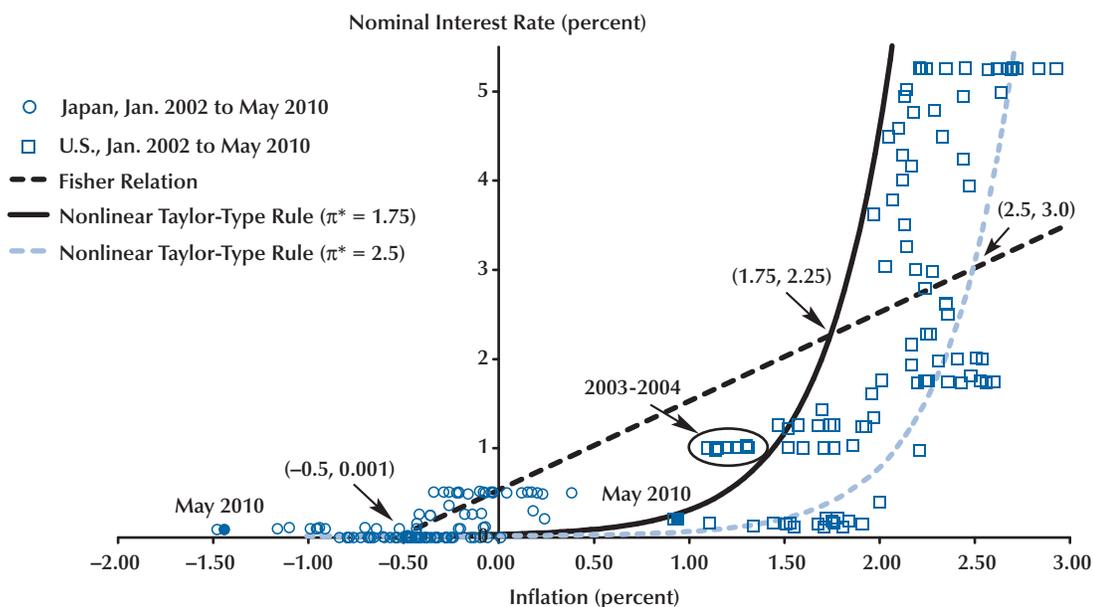
⁸ See Evans and Honkapohja (2001).

⁹ For an argument that, under learning, the targeted steady state is locally but not globally stable, see Evans, Guse, and Honkapohja (2008). In their paper, the downside risk is much more severe, as under learning the economy can fall into a deflationary spiral in which output contracts sharply.

⁷ That is, dynamic, stochastic, general equilibrium economies.

Figure 3

Inflation Expectations, Interrupted



NOTE: The 2003-04 episode. Thornton (2006, 2007) argues that FOMC communications increased the perceived inflation target of the Committee.

episode was the last time the FOMC worried about a possible bout of deflation. While core inflation did move to a low level during this period—not quite as low as the current level—inflation moved higher later and interest rates were increased. This episode surely provides comfort for those who think the Japanese-style outcome is unlikely. It suggests that the economy will ultimately return to the neighborhood of the targeted steady state, perhaps even indicating that the stability story is the right one after all. The 2003 experience did not involve a near-zero policy rate, however.

One description of this period is due to Daniel Thornton, an economist at the Federal Reserve Bank of St. Louis.¹⁰ The Thornton analysis emphasizes (i) how the FOMC communicated during this period and (ii) how the market expectations of the longer-term inflation rate responded to the communications. At the time, some meas-

ures of inflation were hovering close to 1 percent, similar to the most recent readings for core inflation in 2010. At its May 2003 meeting, the Committee included the following press release language: “[T]he probability of an unwelcome substantial fall in inflation, though minor, exceeds that of a pickup in inflation from its already low level.” At several subsequent 2003 meetings, the FOMC stated that “the risk of inflation becoming undesirably low is likely to be the predominant concern for the foreseeable future.” By the beginning of 2004, inflation had picked up and FOMC references to undesirably low inflation ceased. Thornton shows that before any of these statements were made the longer-run expected inflation rate, as measured from the 10-year Treasury inflation-indexed security spread, was 1.74 percent during the period from January 2001 through April 2003. After the statements, from January 2004 to May 2006, the longer-run inflation expectation averaged 2.5 percent. Thornton interprets

¹⁰ See Thornton (2006, 2007).

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the FOMC language as putting a lower bound on the Committee's implicit inflation target range. This had the effect of increasing the longer-run expected rate of inflation.

Figure 3 shows how such a change in longer-run inflation expectations might play out. Accepting the other premises of the analysis by Benhabib, Schmitt-Grohé, and Uribe, the private sector now views the central bank as taking action to contain inflation only once inflation has attained a somewhat higher level. Those in the private sector thought they understood policy as the solid black line, but after the FOMC communication, they understood policy as the dashed blue line. This alters the targeted steady-state inflation rate of the economy from 1.75 percent (the second arrow from the right in Figure 3) to 2.5 percent (right-most arrow).

It is not immediately obvious from Figure 3 why this should have a desirable impact on whether the economy ultimately returns to the neighborhood of the targeted steady state or converges to the unintended, low nominal interest rate steady state. Credibly raising the inflation target is actually moving the target steady-state equilibrium to the right in the diagram, farther away from the circled data from 2003 and 2004. One might think that creating more distance from the current position to the desired outcome would not be helpful.

In the event, all worked out well, at least with respect to avoiding the unintended steady state.¹¹ Inflation did pick up, the policy rate was increased, and the threat of a Japanese-style deflationary outcome was forgotten, at least temporarily. Was this a brilliant maneuver, or did the economic news simply support higher inflation expectations during this period?

Discontinuity

If the problem is the existence of a second, unintended steady state—and this is partly caused by the choice of a policy rule that is controlled by

¹¹ Many have criticized the FOMC for allowing the target rate to remain too low for too long during this period. For a discussion, see remarks by Fed Chairman Bernanke (2010) delivered at the annual meeting of the American Economic Association.

policymakers—why not just choose a different policy rule? This can, in fact, be done and was discussed by Benhabib, Schmitt-Grohé, and Uribe in their original paper. Furthermore, some parts of the current policy discussion have exactly this flavor.

The problem illustrated in Figure 1 is precisely that the two lines, one describing policy and one describing private sector behavior, cross in two places. But the policy line can be altered by policymakers. A simple version is illustrated in Figure 4. Here, the nonlinear Taylor-type policy rule is followed so long as inflation remains above 50 basis points. For inflation lower than that level, the policy rate is simply set to 1.5 percent and left there. This creates the black bar in Figure 4 between an inflation rate of -1.0 percent (or lower) and 0.5 percent. The policy would be that, for very low levels of inflation, the policy rate is set somewhat higher than zero, but still at a very accommodative level. After all, short-term nominal interest rates at 1.5 percent would still be considered aggressively easy policy in nearly all circumstances.

Of course, this policy looks unusual and perhaps few would advocate it, but again *we are trying to avoid all those circles down there in the southwest portion of the diagram*. The discontinuous policy has the great advantage that it is a very simple way to ensure that the unintended, low nominal interest rate steady state no longer exists. The only point in the diagram where the Fisher relation and the policy rule can be in harmony is the targeted equilibrium. This would remove the unintended steady state as a focal point for the economy.^{12,13}

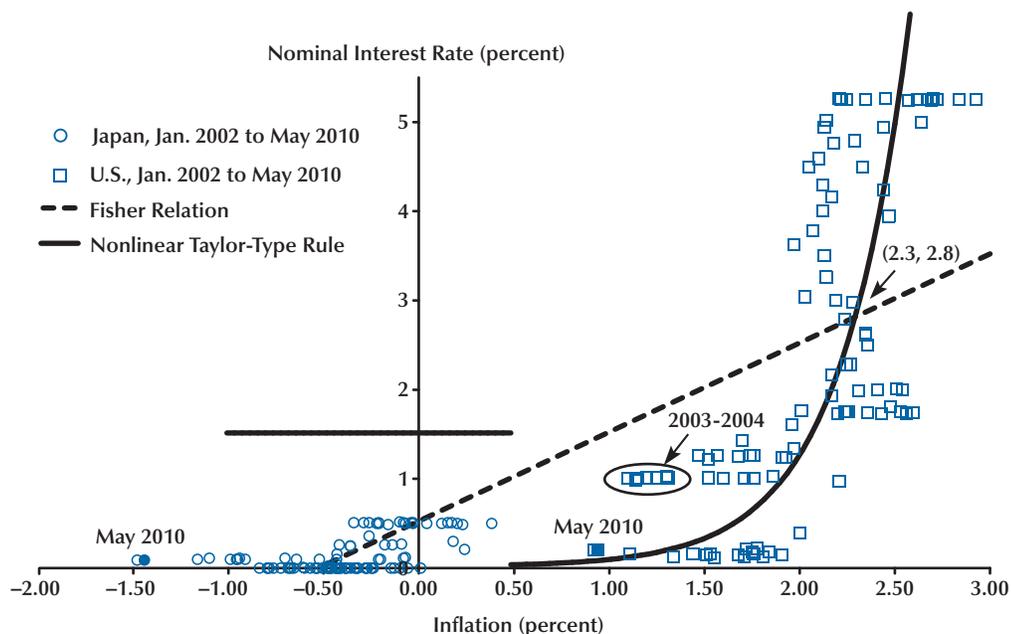
Some of the current policy discussion has included an approach of this type, although not exactly in this context. The FOMC's near-zero

¹² The academic literature regarding the use of fiscal policy measures, as described below, has the same goal—unintended outcomes are eliminated as equilibria. But the fiscal policy route is far more convoluted.

¹³ Two astute reviewers—Costas Azariadis and Jess Benhabib—both stressed that a discontinuous policy could create a *pseudo steady state* (at the point of discontinuity) and that the economy might then oscillate about the pseudo steady state instead of converging to the targeted outcome. This has not been a subject of research in this context as far as I know.

Figure 4

Discontinuity



NOTE: The discontinuous Taylor-type policy rule looks unusual but eliminates the unintended steady state.

interest rate policy and the associated “extended period” language have caused many to worry that the Committee is fostering the creation of new, bubble-like phenomena in the economy that will eventually prove counterproductive. One antidote to this worry may be to increase the policy rate somewhat, while still keeping the rate at a historically low level, and then to pause at that level.¹⁴ That policy would have a similar flavor to the one suggested in Figure 4, although for a different purpose.

Traditional Policy

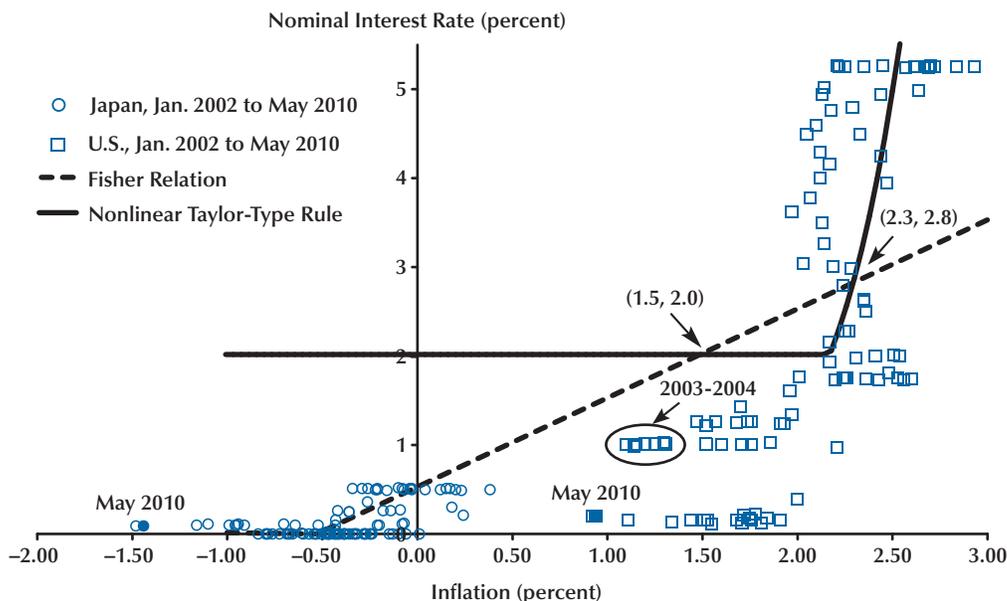
According to the Bank of England,¹⁵ for 314 years the policy rate was never allowed to fall

¹⁴ My colleague Thomas Hoenig (2010), president of the Federal Reserve Bank of Kansas City, has advocated such a policy. See his speech, “The High Cost of Exceptionally Low Rates.”

¹⁵ For historical data since 1694 on the official Bank of England policy rate, see www.bankofengland.co.uk/statistics/rates/baserate.xls.

below 2.0 percent. During more than three centuries the economy was subject to large shocks, wars, financial crises, and the Great Depression—yet 2.0 percent was the policy rate floor until very recently. A version of this policy is displayed in Figure 5. This policy rule does not eliminate the unintended steady state; it simply moves it to be associated with a higher level of inflation. In the figure, this point occurs at an interest rate of 2.0 percent and an inflation rate of 1.5 percent (the center arrow in the figure). This policy seems very reasonable in some ways. To the extent that one of the main purposes of the interest rate policy is to keep inflation low and stable, this policy creates two steady states, but the policymaker may be more or less indifferent between the two outcomes. Then one has to worry much less about the possibility of becoming permanently trapped in an unintended, deflationary steady state. This policy prevents the onset of interest rates that are “too low.”

Figure 5
Traditional Policy



The idea that policymakers might be more or less indifferent between the two steady states brings up an important question about the original analysis by Benhabib, Schmitt-Grohé, and Uribe. Why should one steady-state equilibrium be preferred over the other? This question has some academic standing—there is a long literature on the optimal long-run rate of inflation, and lower is usually better. In the conventional policy discussion, however, the targeted steady state is definitely preferred. Perhaps the most important consideration is that, in the unintended steady state, the policymaker loses all ability to respond to incoming shocks by adjusting interest rates—ordinary stabilization policy is lost, possibly for quite a long time. In addition, the conventional wisdom is that Japan has suffered through a “lost decade” partially attributable to the fact that the economy has been stuck in the deflationary, low nominal interest rate steady state illustrated in Figure 1. To the extent that is true, the United States and Europe can hardly afford to join Japan in the quagmire. Most of the arguments I know of

concerning the low nominal interest rate steady state center on the idea that deflation, even mild deflation, is undesirable. It is widely perceived that problems in the U.S. financial system are at the core of the current crisis. Given that many financial contracts (and, in particular, mortgages) are stated in nominal terms and given that these contracts were written in the past (under the expectation of a stable inflation around 2.0 percent), it is conceivable to think that deflation could hurt the financial system and hamper U.S. growth.¹⁶

If we suppose that deflation is the main problem, then this could likely be avoided by simply not adopting a rule that calls for very low—near-zero—interest rates. Instead, the rule could call

¹⁶ Some have argued that ongoing deflation in Japan is not an important contributory factor for the nation’s relatively slow growth. See, for instance, Hayashi and Prescott (2002). In addition, the United States grew rapidly in the late nineteenth century despite an ongoing deflation. So, the relationship between deflation and longer-run growth is not as obvious as some make it seem. Still, the conventional wisdom is that a turn toward deflation would hamper U.S. growth.

for rates to bottom out at a level somewhat higher than zero, as the traditional policy rule does. Of course, a policy rule like the one depicted in Figure 5 does not allow as much policy accommodation in the face of shocks to the economy at the margin. But is it worth risking a “lost decade” to get the extra bit of accommodation?

Fiscal Intervention Given the Situation in Europe

In the academic literature following the 2001 publication of the *perils* paper, some attempt was made to provide policy advice on how to avoid the unintended steady state of Figure 1.¹⁷ This advice was given in the context of trying to preserve the desirable qualities of the Taylor-type interest rate rule in the neighborhood of the targeted steady state. That is, even though interest rate rules are the problem here, the advice is given in the context of those rules—as opposed to simply abandoning them altogether.

The advice has a certain structure. It involves not changes in the way monetary policy is implemented, but changes in the fiscal stance of the government. By itself, this makes the practicality of the solution much more questionable. But it gets worse. The proposal is for the government to embark on an aggressive fiscal expansion should the economy become enmeshed in a low nominal interest rate equilibrium. The fiscal expansion has the property that total government liabilities—money plus government debt—grow at a sufficiently fast rate. Inside the model, such a fiscal expansion eliminates the unintended steady state as an equilibrium outcome. By this roundabout method, then, the only remaining longer-run outcome for the economy is to remain in the neighborhood of the targeted steady state.

The described solution has the following flavor: The government threatens to behave unreasonably if the private sector holds expectations (such as expectations of very low inflation) that the government does not desire. This threat, if it is credible, eliminates the undesirable equilibrium. Some authors have criticized this type of

solution to problems with multiple equilibria as “unsophisticated implementation.”¹⁸

Today, especially considering the ongoing European sovereign debt crisis, these proposed solutions strike me as wildly at odds with the realities of the global economy. The proposal might work in a model setting, but the practicalities of getting a government to essentially threaten insolvency—and be believed—seem to rely far too heavily on the rational expectations of the private sector.¹⁹ Furthermore, governments that attempt such a policy in reality are surely playing with fire. The history of economic performance for nations actually teetering on the brink of insolvency is terrible. This does not seem like a good tool to use to combat the possibility of a low nominal interest rate steady state.

Beyond these considerations, it is questionable at this point whether such a policy actually works. Japan, our leading example in this story, has in fact embarked on an aggressive fiscal expansion, and the debt-to-GDP ratio there is now approaching 200 percent. Still, there does not appear to be any sign that their economy is about to leave the low nominal interest rate steady state, and now policymakers are worried enough about the international reaction to their situation that fiscal retrenchment is being seriously debated.

Quantitative Easing

The quantitative easing policy undertaken by the FOMC in 2009 has generally been regarded as successful in the sense that longer-term interest rates fell following the announcement and implementation of the program.²⁰ Similar assessments apply to the Bank of England’s quantitative easing policy. For the United Kingdom in particular, both expected inflation and actual inflation have remained higher to date, and for that reason the United Kingdom seems less threatened by a deflationary trap. The U.K. quantitative easing program has a more state-contingent character

¹⁷ See, in particular, Benhabib, Schmitt-Grohé, and Uribe (2002), Woodford (2001, 2003), and Eggertsson and Woodford (2003).

¹⁸ See Atkeson, Chari, and Kehoe (2010).

¹⁹ For a version that backs off the rational expectations assumption, but still eliminates the undesirable equilibrium, see Evans, Guse, and Honkapohja (2008).

²⁰ See, for instance, Neely (2010).

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than the U.S. program. The U.S. approach was to simply announce a large amount of purchases but not adjust the amounts or pace of purchases according to changing assessments of macroeconomic prospects.

The quantitative easing program, to the extent it involves buying longer-dated government debt, has often been described as “monetizing the debt.” This is widely considered to be inflationary, and so inflation expectations are sensitive to such purchases. In the United Kingdom, all the purchases were of gilts (Treasury debt). In the United States, most of the purchases were of agency—Fannie Mae and Freddie Mac—mortgage-backed securities, newly issued in 2009. It has been harder to judge the inflationary effects of these purchases, and so perhaps the effects on inflation expectations and hence actual inflation have been somewhat less reliable in the United States than in the United Kingdom.

The experience in the United Kingdom seems to suggest that appropriately state-contingent purchases of Treasury securities are a good tool to use when inflation and inflation expectations are “too low.” Not that one would want to overdo it, mind you, as such measures should only be undertaken in an effort to move inflation closer to target. One very important consideration is the extent to which such purchases are perceived by the private sector as temporary or permanent. We can double the monetary base one day and return to the previous level the next day, and we should not expect such movements to have important implications for the price level in the economy. Base money can be removed from the banking system as easily as it can be added, so private sector expectations may remain unmoved by even large additions of base money to the banking system.²¹ In the Japanese quantitative easing program, beginning in 2001, the BOJ was unable to gain credibility for the idea that they were prepared to leave the balance sheet expansion in place until policy objectives were met. And in the end, the BOJ in fact did withdraw the

program without having successfully pushed inflation and inflation expectations higher, validating the private sector expectation. The United States and the United Kingdom have enjoyed more success, perhaps because private sector actors are more enamored with the idea that the FOMC and the U.K.’s Monetary Policy Committee will do “whatever it takes” to avoid particularly unpleasant outcomes for the economy.

CONCLUSION

The global economy continues to recover from the very sharp recession of 2008 and 2009. During this recovery, the U.S. economy is susceptible to negative shocks that may dampen inflation expectations. This could push the economy into an unintended, low nominal interest rate steady state. Escape from such an outcome is problematic. Of course, we can hope that we do not encounter such shocks and that further recovery turns out to be robust—but hope is not a strategy. The United States is closer to a Japanese-style outcome today than at any time in recent history.

In part, this uncomfortably close circumstance is due to the interest rate policy now being pursued by the FOMC. That policy is to keep the current policy rate close to zero, but in addition to promise to maintain the near-zero interest rate policy for an “extended period.” But it is even more than that: The reaction to a negative shock in the current environment is to extend the extended period even further, delaying the day of normalization of the policy rate farther into the future. This certainly seems to be the implication from recent events. When the European sovereign debt crisis rattled global financial markets during the spring of 2010, it was a negative shock to the global economy and the private sector perception was certainly that this would delay the date of U.S. policy rate normalization. One might think that is a more inflationary policy, but TIPS-based measures of inflation expectations over 5 and 10 years fell about 50 basis points.

Promising to remain at zero for a long time is a double-edged sword. The policy is consistent with the idea that inflation and inflation expect-

²¹ For discussions of how forms of quantitative easing can help achieve the intended steady state, in combination with appropriate fiscal policy, see Eggertsson and Woodford (2003, pp. 194-98) and Evans and Honkapohja (2005).

tations should rise in response to the promise and that this will eventually lead the economy back toward the targeted equilibrium of Figure 1. But the policy is also consistent with the idea that inflation and inflation expectations will instead fall and that the economy will settle in the neighborhood of the unintended steady state, as Japan has in recent years.²²

To avoid this outcome for the United States, policymakers can react differently to negative shocks going forward. Under current policy in the United States, the reaction to a negative shock is perceived to be a promise to stay low for longer, which may be counterproductive because it may encourage a permanent, low nominal interest rate outcome. A better policy response to a negative shock is to expand the quantitative easing program through the purchase of Treasury securities.

²² Evans and Honkapohja (2010) have made a version of this argument more formally.

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The Economic Progress of African Americans in Urban Areas: A Tale of 14 Cities

Dan A. Black, [Natalia A. Kolesnikova](#), and Lowell J. Taylor

How significant was the economic progress of African Americans in the United States between 1970 and 2000? In this paper the authors examine this issue for black men 25 to 55 years of age who live in 14 large U.S. metropolitan areas. They present evidence that significant racial disparities remain in education and labor market outcomes of black and white men, and they discuss changes in industrial composition, migration, and demography that might have contributed to the stagnation of economic progress of black men between 1970 and 2000. In addition, the authors show that there was no progress in the financial well-being of black children, relative to white children, between 1970 and 2000. (JEL J15, J31, J71, R23)

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How significant was the economic progress of African Americans in the United States between 1970 and 2000? The common perception is that inequality between races has decreased. In 1954, the Supreme Court's decision in the famous *Brown v. Board of Education* case proclaimed racial segregation of public schools unconstitutional. It paved the way for the Civil Rights Act of 1964, which outlawed racial segregation in schools and the workplace, among other provisions. By making racial discrimination illegal, the Act opened doors to better education, including higher education, and offered greater employment opportunities to African Americans.

This progress is undeniable, but questions remain: Did these societal changes translate into economic changes as well? Did earnings of blacks increase relative to earnings of whites? Did labor force attachment of blacks become more secure? How much did educational attainment and skill

acquisition improve? Did the economic well-being of black children improve?

Most of the previous research on these topics was done on a national level.¹ Such studies, at most, “control for” the geographic region (South, Northeast, Midwest, etc.) and/or whether a person resides in an urban/rural area. This paper, however, examines and compares various aspects of African-American progress in labor markets between 1970 and 2000 across large U.S. cities. Analysis on a city rather than national level addresses two issues: First, cities in the United States vary widely in their characteristics, including labor market conditions and industrial structure. Second, and more importantly, the history of the black population varies among the different regions of the country. These differences warrant a separate look at each city—Memphis and Detroit,

¹ A very good overview of existing studies is presented in Altonji and Blank (1999).

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for instance—to distinguish between them and thus better analyze changes in individual economic conditions of blacks.

Finally, a recent study by Black et al. (2009) demonstrates that it is important to take into consideration geographic location when studying racial differences. Performing analysis on a national level masks underlying trends in local labor markets.² The study shows, in particular, that a failure to account for city-specific differences in black-white wage gaps results in a significant (about 50 percent) overestimation of black-white wage-gap conversion. In many local labor markets, especially high-productivity, high-wage markets, the black-white wage gap essentially stayed the same over the years. But as more and more black men moved into high-wage cities, the national black-white wage gap has decreased dramatically even though there was little change in each particular market. The reason for the seeming black-white wage convergence was not only a change in labor markets but simply a redistribution of black population from low-wage to high-wage markets—something that would not be apparent if looking only at national averages.

It seems reasonable, therefore, to document economic progress of African Americans in the context of a specific labor market and then compare the progress across cities. Performing such analysis is the goal of this paper.³

DATA DESCRIPTION

In particular, we study African-American progress in 14 metropolitan statistical areas (MSAs; as defined by the Census Bureau⁴) from 1970 to 2000. In what follows, we use “MSA” and “city” interchangeably. We use 1970 through 2000

decennial U.S. Census data provided by the Integrated Public Use Microdata Series⁵ (IPUMS). The 14 cities in the sample were chosen based on having at least 700 black respondents in the IPUMS 1970 Census data. They are the Atlanta, Baltimore, Chicago, Cleveland, Detroit, Houston, Los Angeles, Memphis, New Orleans, New York, Philadelphia, St. Louis, San Francisco, and Washington, D.C., MSAs.^{6,7}

In this paper we restrict the analysis to black and non-Hispanic white men of prime working age—25 to 55 years old.⁸ For each respondent in the sample, the data provide a wealth of information, including age, educational attainment, employment status, income, industry and occupation of employment, class of worker, and marital status.⁹

An important concern with the Census data is that respondents occasionally choose not to answer some questions. Those who did not answer questions related to the issues of this study were not included in the sample. Also, the respondents who lived in institutions (such as correctional facilities) and non-institutional group quarters (such as military barracks) were not included. Thus, the final sample consists of black and white men of prime working age who were not in the military and not incarcerated. Increasing rates of incarceration of black men is an alarming trend

⁵ See Ruggles et al. (2010).

⁶ There are no MSA identifiers in the 1960 IPUMS Census data, which makes it impossible to extend this analysis to earlier years. The smallest geographic unit in the 1960 IPUMS Census data is a state.

⁷ In 1970 a quite large proportion, about 43 percent, of black men of prime working age, 25 to 55 years old, lived in these 14 MSAs. Nevertheless, it is worth pointing out that the results of this paper should not be taken as a picture of the economic progress of black men in the United States as a whole. Rather, the paper focuses on economic progress of black men in large urban areas.

⁸ A similar investigation of the economic progress of black women is equally interesting but presents additional challenges. There has been a significant change in the labor force participation of black and white women over the period studied. In addition, women's attachment to the labor force tends to be weaker than men's because women often exit the labor force for childbearing and child care. This makes a direct comparison of white and black women's labor market outcomes even more complicated. It is an important topic we plan to pursue in future research.

⁹ A detailed description of the variables is provided in Appendix 1.

² Black et al. (2009) also show that in the presence of location-specific wages and prices, a racial wage gap is the same across locations only in the case of very specific (and usually unrealistic) preferences.

³ In this paper we concentrate on documenting city-specific changes in various measures of economic and social conditions of African Americans, leaving the explanation of the observed changes and differences in the observed changes to our future research.

⁴ The general concept of an MSA is that of a central city and its adjacent communities having a high degree of economic and social integration.

Table 1**Black-White Weekly Wage Ratios for Men (percent)**

MSA	1970	1980	1990	2000
South				
Houston	65	76	74	72
Memphis	63	73	71	78
Atlanta	62	75	75	78
New Orleans	63	73	74	75
Washington, D.C.	72	80	81	83
East				
New York	75	76	77	78
Philadelphia	79	77	77	77
Baltimore	71	78	76	79
Midwest				
St. Louis	74	77	73	77
Cleveland	76	82	80	77
Chicago	75	75	74	74
Detroit	81	83	81	78
West				
Los Angeles	74	77	81	80
San Francisco	78	79	82	80

NOTE: The table is adapted from Black et al. (2009). For convenience, log differences of positive weekly wages of black and white men were converted into ratios.

Table 2**Black-White Annual Earnings Ratios for Men (percent)**

MSA	1970	1980	1990	2000
South				
Houston	59	67	61	59
Memphis	52	60	56	66
Atlanta	56	64	66	66
New Orleans	57	63	60	65
Washington, D.C.	62	71	70	72
East				
New York	68	64	60	58
Philadelphia	72	63	63	61
Baltimore	66	65	65	67
Midwest				
St. Louis	66	63	59	62
Cleveland	70	70	62	63
Chicago	69	62	56	55
Detroit	71	66	60	63
West				
Los Angeles	66	66	64	62
San Francisco	68	63	62	62

NOTE: Authors' calculations. See Appendix 2 for details. The calculation includes individuals with zero earnings.

and a subject of many studies.¹⁰ It is not a focus of this paper, however.

CHANGES IN RELATIVE WAGES AND ANNUAL EARNINGS

Many studies concentrate on wages as a measure of earnings. It is a logical approach because a wage is a price that labor markets put on a unit of labor of a certain skill level. In this case, a

decrease in the black-white wage gap means labor markets' valuations of black and white labor converge. It also indicates the convergence of skill levels of black and white workers.

However, differences in wages is only one of the labor market characteristics that potentially contribute to racial economic disparity. Other important factors include labor force participation, unemployment, and underemployment. To better assess the economic progress of blacks, we consider a different measure—annual earnings, which take into consideration both wages and labor force attachment. Analyzing annual earnings instead of wages allows a better assessment of an individual's overall economic well-being.

Table 1, adapted from Black et al. (2009), shows in percent form a ratio of the average weekly wages of black men to those of white men.

¹⁰ See, for example, Western (2006) and Charles and Luoh (forthcoming). Charles and Luoh document an astonishing increase of incarceration rates of black men 25 to 35 years old between 1970 and 2000. For example, in 2000 almost 30 percent were incarcerated in New Mexico, 23 percent in Wisconsin and Minnesota, and 22 percent in Arizona. In 2000, their lowest incarceration rate was 7 percent, in Washington, D.C., whereas state incarceration rates of white men ranged from 0.8 and 3.2 percent.

From 1970 to 2000, the relative weekly wages of black men increased in all but three cities (Philadelphia, Chicago, and Detroit). For example, in 1970 in Houston, black men earned on average 65 percent of the weekly wages of white men. The ratio increased to 72 percent in 2000. Atlanta experienced the largest increase, from 62 percent in 1970 to 78 percent in 2000—a 16-percentage-point increase. In Philadelphia, Chicago, and Detroit the relative wages of black men decreased between 1970 and 2000, but only slightly: from 79 percent to 77 percent in Philadelphia, from 75 percent to 74 percent in Chicago, and from 81 percent to 78 percent in Detroit.

Table 2 provides a summary of changes of black-white *annual earnings* ratios in the 14 cities from 1970 to 2000.¹¹ The picture of economic progress of black men is much less bright when we consider their annual earnings. In contrast to weekly wages, relative annual earnings of black men *declined* in most cities. In southern cities that did experience an increase in relative annual earnings of black men, most of the progress occurred between 1970 and 1980, with no significant changes after that.¹² In Chicago, where their relative annual earnings fell the most (14 percentage points), black men were earning 69 percent of white men's annual income in 1970 but only 55 percent in 2000. Most of midwestern and eastern cities in the sample experienced a similar decline. Interestingly, the magnitude and timing of the declines vary across cities. In New York, for example, the overall decrease of 10 percentage points was spread somewhat equally over the three decades. In Philadelphia, the almost 10-percentage-point drop between 1970 and 1980 was followed by virtually no change after 1980. In Cleveland, the largest decrease occurred between 1980 and 1990. In Detroit and St. Louis, two decades of regress were followed by a 3-percentage-point increase between 1990 and 2000. In Baltimore and Los Angeles, in contrast, the ratio remained fairly stable over the three decades.

¹¹ See Appendix 2 for details of the estimation.

¹² Memphis was an exception. There, the ratio declined by 4 percentage points in 1980-90 but then increased by 10 percentage points in 1990-2000.

CHANGES IN LABOR FORCE PARTICIPATION

The main reason for the discrepancy between the two measures of economic progress of black men from 1970 to 2000 is the labor force attachment of black men. During that time, black men experienced a significant decline in their average annual weeks of work. (This, of course, affected their average annual earnings.) Figure 1 illustrates this fact and Table 3 reports corresponding numbers.¹³ The average decreased in every city, in some cases by as much as 25 percent. In 2000, black men on average worked only 33 weeks per year in San Francisco (down from 42 in 1970), 34 weeks in Los Angeles and Chicago (down from 43 and 45, respectively, in 1970), and 35 weeks in Detroit (down from 45 in 1970). In contrast, in 2000, Atlanta and Washington, D.C., both experienced the highest average number of weeks worked: 41. But even this number is not higher than the average in any of the 14 cities in 1970.¹⁴

Figure 2 and Table 4 show that, in contrast, the *weekly hours* of work of black men stayed remarkably stable between 1970 and 2000, with relatively small increases in some cities and decreases in others.^{15,16} The low average in 2000 implies not only underemployment for many black men but also that many did not work at all, which drives the average numbers down.

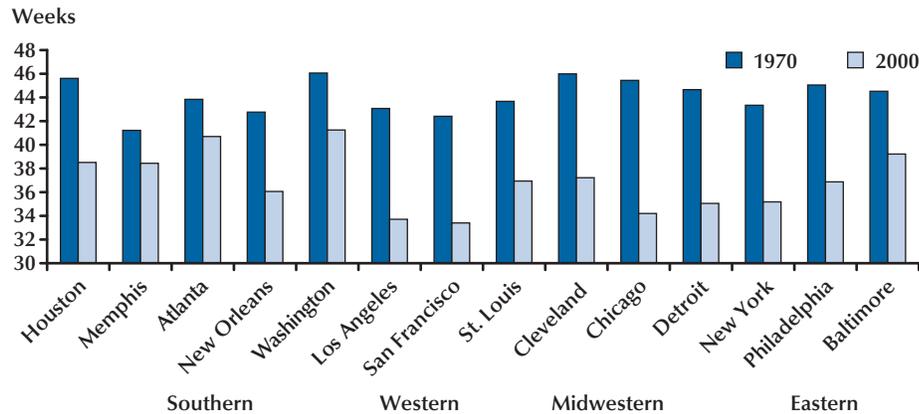
To better assess changes in the labor force participation of black men between 1970 and 2000, Table 5 reports the proportion of black men employed, unemployed, or not in the labor force.

¹³ See Appendix 2 for details of the estimation. It describes, in particular, an imputation technique for 1970 data.

¹⁴ In comparison, white men experienced only a small decline in their average annual weeks of work over the same period in all 14 cities: from 47 to 49 weeks in 1970 to 43 to 48 weeks in 2000. The largest declines, from 47 weeks in 1970 to 43 weeks in 2000, occurred in New York and Los Angeles. In the rest of the cities, white men worked on average 1 to 2 weeks less per year in 1970 than in 2000. Detailed results are available from the authors upon request.

¹⁵ See Appendix 2 for details of the estimation. It describes, in particular, an imputation technique for 1970 data.

¹⁶ Weekly hours of work of white men increased slightly over the same period in all 14 cities: from 39 to 43 hours per week in 1970 to 40 to 45 hours per week in 2000. Detailed results are available from the authors upon request.

Figure 1**Average Annual Weeks of Work of Black Men: 1970-2000**

The table shows two main changes between 1970 and 2000: decreases in the proportion of black men employed and increases in the proportion of black men not in the labor force. The table shows also that in a number of cities, after the unemployment rate rose in 1980 and 1990, it decreased in 2000 while the proportion of black men not in the labor force increased. This observed trend seems consistent with a “discouraged workers” explanation: When the unemployment rate is high for a prolonged period, workers looking for jobs give up and opt out of the labor force and thus are not counted as unemployed.¹⁷ For example, consider Chicago in 1970: 88 percent of black men were employed, 4 percent were unemployed, and 8 percent were not in the labor force. By 1980, their employment dropped to 75 percent, their unemployment rate rose to 10 percent, and 14 percent were not in the labor force. Things kept getting

¹⁷ There is evidence that access to personal job-search networks is very important. Holzer (1987) finds that “informal methods of search...account for 87-90 percent of the difference in youth employment probabilities between blacks and whites” (p. 451). Calvó-Armengol and Jackson (2004) use a similar social-networking approach to argue that the probability of obtaining a job decreases with the length of time one remains unemployed. They also examine related inequality. In particular, they show that “if one group starts with worse employment status, then that group’s drop-out rate will be higher and their employment prospects will be persistently below that of the other group” (p. 426).

Table 3**Average Annual Weeks of Work of Black Men**

MSA	1970	1980	1990	2000
South				
Houston	46	41	38	39
Memphis	41	39	39	38
Atlanta	44	40	41	41
New Orleans	43	39	35	36
Washington, D.C.	46	41	42	41
East				
New York	43	37	36	35
Philadelphia	45	36	37	37
Baltimore	45	39	39	39
Midwest				
St. Louis	44	38	36	37
Cleveland	46	38	34	37
Chicago	45	37	35	34
Detroit	45	35	33	35
West				
Los Angeles	43	37	35	34
San Francisco	42	35	32	33
United States	44	39	38	38

NOTE: Authors’ calculations. See Appendix 2 for details. The calculation includes individuals with zero weeks of work.

Figure 2

Average Weekly Hours of Work of Black Men: 1970-2000

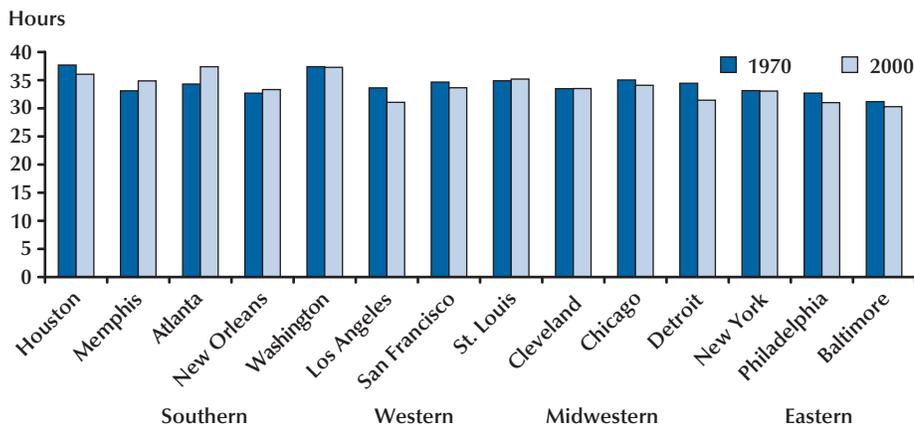


Table 4

Average Weekly Hours of Work of Black Men

MSA	1970	1980	1990	2000
South				
Houston	38	36	35	36
Memphis	33	34	34	35
Atlanta	34	35	37	37
New Orleans	33	34	33	33
Washington, D.C.	37	36	37	37
East				
New York	34	31	32	31
Philadelphia	35	32	34	34
Baltimore	35	34	35	35
Midwest				
St. Louis	33	33	33	34
Cleveland	35	34	31	34
Chicago	34	32	32	31
Detroit	33	32	31	33
West				
Los Angeles	33	33	32	31
San Francisco	31	31	29	30
United States	34	34	34	34

NOTE: Authors’ calculations. See Appendix 2 for details. The calculation includes individuals with zero weekly hours of work.

worse and by 1990, 71 percent were employed, 13 percent were unemployed, and 16 percent were not in the labor force. In 2000, their employment rate decreased further, to 69 percent, yet their unemployment rate actually improved and decreased from 13 percent to 9 percent. The proportion of black men not in the labor force, however, rose to a staggering 22 percent.¹⁸ A similar pattern of changes can be observed in many other cities, including Houston, New Orleans, St. Louis, Cleveland, Detroit, and Philadelphia. In 2000, in 10 of the 14 cities, the proportion of black men not in the labor force was above 20 percent. This high level is observed even in cities where the unemployment rate was relatively stable at 7 to 9 percent, such as in Los Angeles and San Francisco.

In all cities except Atlanta, the employment rate of black men decreased by 11 to 19 percentage points between 1970 and 2000. Atlanta had a much smaller drop of only 6 percentage points—from 87 percent to 81 percent. In 2000, Atlanta had the highest employment and lowest unemployment rates of black men.

To sum up, between 1970 and 2000 in 14 major urban areas in the United States, black men

¹⁸ To put the numbers in the right context, it is worth remembering that the sample consists of black men of prime working age (25 to 55 years old) who are not incarcerated and not in the military.

Table 5**Employment Status of Black Men (percent)**

MSA	1970	1980	1990	2000	MSA	1970	1980	1990	2000
South					Midwest				
<i>Houston</i>					<i>St. Louis</i>				
Has a job	92	89	79	77	Has a job	83	74	71	72
Unemployed	2	3	10	6	Unemployed	8	13	13	7
Not in labor force	6	8	11	17	Not in labor force	10	13	16	21
<i>Memphis</i>					<i>Cleveland</i>				
Has a job	85	79	79	74	Has a job	85	75	68	72
Unemployed	3	9	7	6	Unemployed	6	11	13	8
Not in labor force	11	13	14	20	Not in labor force	9	14	18	20
<i>Atlanta</i>					<i>Chicago</i>				
Has a job	87	82	84	81	Has a job	88	75	71	69
Unemployed	3	7	7	4	Unemployed	4	10	13	9
Not in labor force	10	11	9	15	Not in labor force	8	14	16	22
<i>New Orleans</i>					<i>Detroit</i>				
Has a job	84	80	71	71	Has a job	86	65	66	69
Unemployed	4	6	10	6	Unemployed	7	19	15	8
Not in labor force	12	14	18	23	Not in labor force	7	16	19	23
<i>Washington, D.C.</i>					West				
Has a job	92	85	87	81	<i>Los Angeles</i>				
Unemployed	1	5	5	5	Has a job	83	78	76	70
Not in labor force	7	9	8	14	Unemployed	7	8	9	9
East					Not in labor force				
<i>New York</i>					10 14 15 21				
Has a job	86	77	76	71	<i>San Francisco</i>				
Unemployed	3	8	9	7	Has a job	83	76	73	71
Not in labor force	10	15	15	22	Unemployed	7	9	7	7
<i>Philadelphia</i>					Not in labor force				
Has a job	86	74	76	72	11 15 21 22				
Unemployed	5	10	10	8	United States				
Not in labor force	9	16	14	21	Has a job	87	79	77	74
<i>Baltimore</i>					Unemployed				
Has a job	87	78	78	74	4 8 9 6				
Unemployed	4	8	8	7	Not in labor force				
Not in labor force	9	14	14	19	9 13 14 19				

NOTE: Authors' calculations. See Appendix 1 for details.

experienced significant decreases in their rates of employment while their rates of unemployment and the number of those opting out of the labor force increased. As a result, their average annual weeks of work decreased dramatically, as did their annual earnings relative to those for white men.

Why did this happen? What were the contributing factors? To begin answering these important questions we need to take a closer look at changes in labor markets and the social structure.

CHANGES IN EDUCATIONAL ATTAINMENT

A big part of black-white economic convergence is attributed to a significant increase in educational attainment levels of blacks over the past century. As reported in Table 6, we consider five major educational categories: less than high school, high school diploma (or General Educational Development [GED] certificate), some college but no bachelor's degree, bachelor's degree, higher than a bachelor's degree. (For comparison, Table 7 provides similar statistics for white men.)

There are several main points worth noting. First, in 1970 in most cities, the majority of black men did not have a high school diploma. The situation was the worst in the South. In Memphis, 77 percent of black men who were 25 to 55 years old in 1970 did not have a high school diploma, only 7 percent had some college experience, and only 3 percent had a bachelor's degree or higher. In New Orleans, 70 percent did not have a high school diploma. The situation was much better in the West: In Los Angeles and San Francisco, only 38 and 42 percent, respectively, did not have a high school diploma. Washington, D.C., also had a relatively small proportion of black men without a high school diploma in 1970: 47 percent.

Second, the educational attainment of black men progressed significantly between 1970 and 2000. In 2000 in New Orleans, only 26 percent (down from 70 percent in 1970) did not have a high school diploma. This proportion is even smaller in the other 13 cities. The proportion of black men who went to college significantly increased as well, although less than half of those

who pursued their education beyond high school received a bachelor's degree or higher.

Third, despite their progress, black men still lag far behind white men in educational attainment. Figure 3 illustrates this point for black men in the 14 cities in 1970 and 2000. The top panel shows the fractions with no high school diploma, the middle panel the fractions with a high school diploma (or GED certificate), and the bottom panel the fractions with at least a bachelor's degree.

Figure 3 makes it easy to see that the proportion of black men without a high school diploma dropped considerably between 1970 and 2000 in all cities. The progress was more significant in the southern cities than in the midwestern and eastern cities. However, in all the cities except Atlanta, the rates of black men not completing high school are still at least double those of white men. In 2000, in all cities except New Orleans, less than 10 percent of white men did not have a high school diploma; in contrast, in 9 of the 14 cities at least 19 percent of black men did not have a high school diploma.

Given a sharp rise in the demand for educated labor over the past several decades, it is particularly alarming that only a very small number of black men had a bachelor's or higher degree even by 2000. Washington, D.C., and Atlanta had the largest proportions with at least a bachelor's degree: 26 and 23 percent, respectively. However, almost twice as many white men in these cities, 58 and 44 percent, respectively, had at least a bachelors' degree. In Memphis, New Orleans, St. Louis, Cleveland, and Detroit, only 12 to 14 percent of black men had graduated from college. In San Francisco, 62 percent of white men had at least a bachelor's degree, yet only 23 percent of black men did.

Tables 6 and 7 and Figure 3 demonstrate that black men, despite their important gains in educational attainment between 1970 and 2000, still do not have levels of education anywhere near those of white men. Of additional concern is the quality of education that blacks receive, especially in inner-city schools in major urban areas. Progress in educational attainment in itself, though, is not as important as a resulting black-white convergence in skill levels. It has been shown that black-

white skill convergence stopped in the late 1980s.¹⁹

DE-INDUSTRIALIZATION AND CHANGES IN INDUSTRIAL COMPOSITION

Industrial composition changed considerably between 1970 and 2000, especially in manufacturing cities. De-industrialization hurt both blacks and whites, but blacks were more affected. One reason is that, as we discuss below, black men were more likely to be employed in manufacturing industries. Another is that black men on average have lower levels of educational attainment, which makes it harder for them to adapt to new labor market conditions and find new jobs in a different industry. Also, as more and more jobs require training beyond high school, black men are worse off than white men because of their relatively low education levels.²⁰

Table 8 shows the changes from 1970 to 2000 in the distribution of all working men across industries. (Table 9 reports similar statistics for black men only.) The main story across the decades is a decline in manufacturing employment and a rise in service industry employment. The proportion of men employed in other industries changed very little. With the exception of Washington, D.C., where government jobs have historically dominated, employment of men in manufacturing dropped by at least 8 percentage points (as in New Orleans). In cities that were predominantly industrial, such as St. Louis, Cleveland, Chicago, Detroit, Philadelphia, and Baltimore, manufacturing employment fell by 17 to 20 percentage points. In 1970 in Detroit, for instance, 51 percent of men

worked in manufacturing. That number declined to 33 percent by 2000. Cleveland experienced a similar decrease, from 45 percent in 1970 to 26 percent in 2000.

As shown in Table 9, black men were more likely to be employed in manufacturing in 1970 and thus were more affected by de-industrialization. In 1970, 56 percent of black men in Detroit had manufacturing jobs, 47 percent in Cleveland, and 37 percent in Chicago. By 2000, these numbers had decreased by 30, 26, and 24 percentage points, respectively. More generally, in 1970 in 10 of 14 cities, manufacturing employed the largest proportion of black workers; by 2000, as a result of de-industrialization, manufacturing lost its leading role in all cities except Detroit. Even so, Detroit's proportion of black men employed in manufacturing still decreased from 56 percent in 1970 to 26 percent in 2000.

Not surprisingly, labor market conditions deteriorated more significantly in cities with a high manufacturing concentration. In cities with a more-diverse industrial mix, the results of de-industrialization were less dire. As previously noted, labor force participation of black men did not decrease nearly as dramatically in Atlanta and Washington, D.C., as in Chicago and Detroit.

THE ROLE OF MIGRATION

It is impossible to talk about changes in the local labor markets of these 14 cities without discussing underlying population changes. As Table 10 shows, most southern cities, especially Houston and Atlanta, were growing between 1970 and 2000. In contrast, eastern and midwestern cities were either declining or experiencing very slow growth well below the overall U.S. rate.

Table 11 documents changes in black population in the 14 cities and the United States from 1970 to 2000. It shows that the pattern of changes in these cities did not always follow the overall changes in the United States. For example, between 1970 and 1980, when New York City lost 9 percent of its population, black population there actually increased by 13 percent. Similar events occurred in other cities with declining

¹⁹ See Neal (2006) for an excellent discussion of the topic.

²⁰ Bound and Holzer (1993) show that the decline in manufacturing in the 1970s and 1980s reduced employment for both blacks and whites. They also find that blacks generally had larger employment declines than whites. Other studies (Bound and Freeman, 1992, for example) show similar results. Bound and Johnson (1992) find that during the 1980s the labor demand shifted dramatically toward high-skilled labor, which was a major cause of a huge increase in relative wages of highly educated workers.

Table 6
Educational Attainment of Black Men (percent)

MSA	1970	1980	1990	2000	MSA	1970	1980	1990	2000
South					Midwest				
<i>Houston</i>					<i>St. Louis</i>				
Less than high school	63	31	23	16	Less than high school	59	37	26	20
HSD/GED	22	35	31	30	HSD/GED	25	33	32	33
Some college, no degree	10	20	28	34	Some college, no degree	11	20	29	34
Bachelor's degree	2	8	13	15	Bachelor's degree	2	6	9	10
Above a bachelor's	3	7	5	5	Above a bachelor's	3	5	4	4
<i>Memphis</i>					<i>Cleveland</i>				
Less than high school	77	44	29	22	Less than high school	55	35	29	20
HSD/GED	15	34	34	36	HSD/GED	33	41	35	37
Some college, no degree	4	14	27	30	Some college, no degree	8	16	27	30
Bachelor's degree	2	5	8	10	Bachelor's degree	2	5	6	9
Above a bachelor's	1	3	3	3	Above a bachelor's	2	4	4	4
<i>Atlanta</i>					<i>Chicago</i>				
Less than high school	64	34	21	13	Less than high school	52	37	26	19
HSD/GED	26	38	32	29	HSD/GED	31	34	29	28
Some college, no degree	5	15	28	34	Some college, no degree	11	20	32	35
Bachelor's degree	2	8	14	17	Bachelor's degree	3	5	9	12
Above a bachelor's	2	5	6	6	Above a bachelor's	2	4	4	5
<i>New Orleans</i>					<i>Detroit</i>				
Less than high school	70	43	34	26	Less than high school	58	36	28	21
HSD/GED	19	32	28	33	HSD/GED	30	36	30	34
Some college, no degree	7	16	26	29	Some college, no degree	7	19	31	32
Bachelor's degree	3	5	8	9	Bachelor's degree	2	5	7	9
Above a bachelor's	2	3	3	3	Above a bachelor's	3	4	4	5
<i>Washington, D.C.</i>					East				
Less than high school	47	28	20	13	<i>New York</i>				
HSD/GED	33	36	30	29	Less than high school	51	33	30	22
Some college, no degree	9	19	28	31	HSD/GED	35	38	29	29
Bachelor's degree	6	8	14	17	Some college, no degree	8	17	27	30
Above a bachelor's	6	9	8	9	Bachelor's degree	3	6	10	13
West					Above a bachelor's				
<i>Los Angeles</i>					3 5 5 6				
Less than high school	38	21	18	15	<i>Philadelphia</i>				
HSD/GED	35	36	26	25	Less than high school	56	36	28	19
Some college, no degree	19	29	38	40	HSD/GED	31	41	36	38
Bachelor's degree	4	7	13	14	Some college, no degree	7	13	23	28
Above a bachelor's	4	7	6	6	Bachelor's degree	3	5	9	11
<i>San Francisco</i>					Above a bachelor's				
Less than high school	42	19	18	16	3 5 4 5				
HSD/GED	32	34	23	24	<i>Baltimore</i>				
Some college, no degree	17	30	37	37	Less than high school	66	44	29	20
Bachelor's degree	5	8	13	14	HSD/GED	23	32	32	34
Above a bachelor's	4	9	9	9	Some college, no degree	5	15	25	29
					Bachelor's degree	4	4	9	11
					Above a bachelor's	3	5	5	6

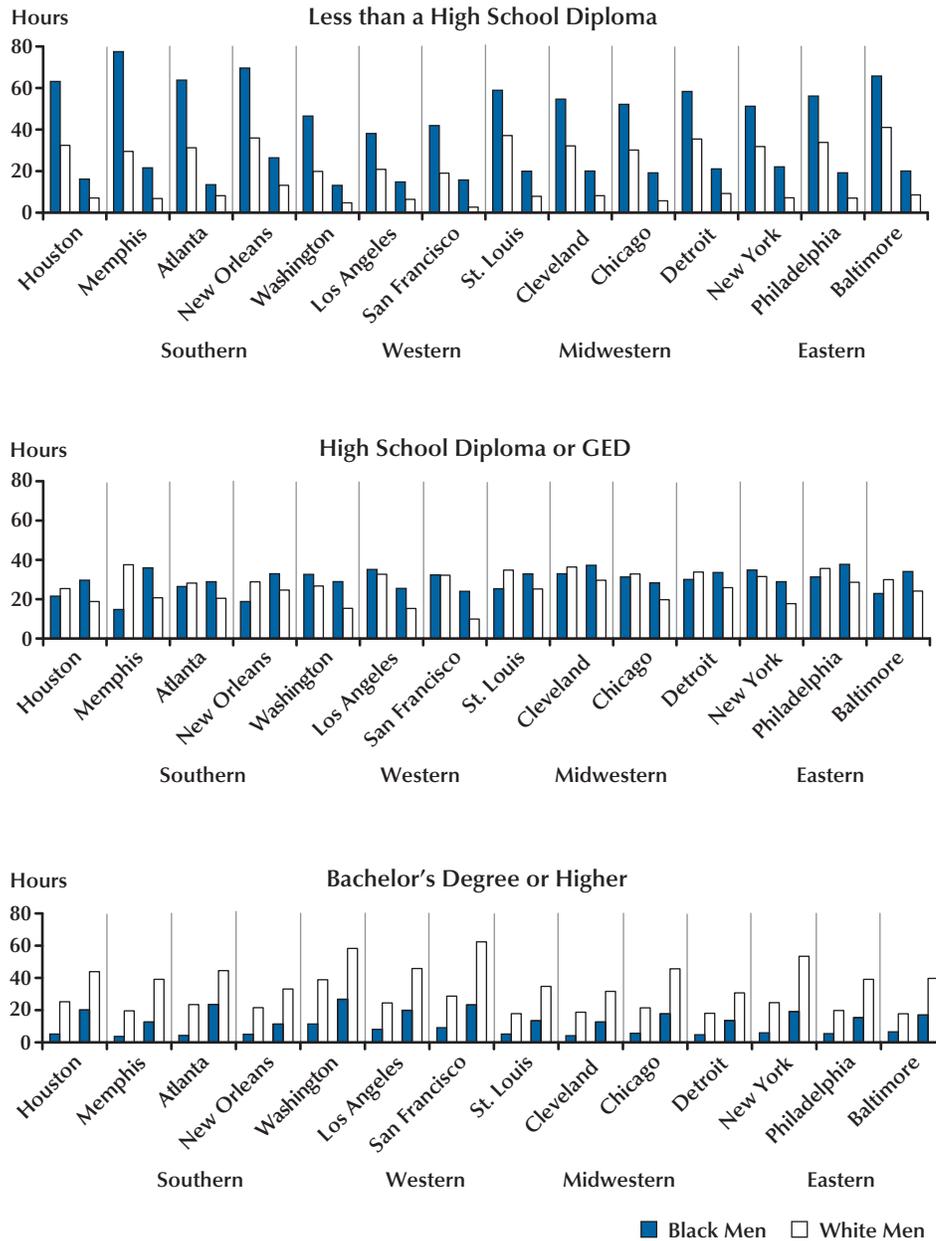
NOTE: Authors' calculations. See Appendix 1 for details. HSD/GED, high school diploma or GED.

Table 7
Educational Attainment of White Men (percent)

MSA	1970	1980	1990	2000	MSA	1970	1980	1990	2000
South					Midwest				
<i>Houston</i>					<i>St. Louis</i>				
Less than high school	32	13	9	7	Less than high school	37	18	11	8
HSD/GED	25	26	20	19	HSD/GED	35	35	27	25
Some college, no degree	17	23	30	30	Some college, no degree	10	19	30	32
Bachelor's degree	14	21	27	30	Bachelor's degree	10	14	21	23
Above a bachelor's	11	18	14	14	Above a bachelor's	8	14	11	12
<i>Memphis</i>					<i>Cleveland</i>				
Less than high school	29	14	8	7	Less than high school	32	18	11	8
HSD/GED	38	32	21	21	HSD/GED	36	37	30	30
Some college, no degree	13	22	34	33	Some college, no degree	13	18	28	31
Bachelor's degree	11	16	24	26	Bachelor's degree	10	15	19	21
Above a bachelor's	9	15	13	13	Above a bachelor's	8	13	11	11
<i>Atlanta</i>					<i>Chicago</i>				
Less than high school	31	16	9	8	Less than high school	30	15	9	6
HSD/GED	28	27	20	20	HSD/GED	33	32	22	20
Some college, no degree	17	21	28	27	Some college, no degree	16	20	29	29
Bachelor's degree	14	20	29	30	Bachelor's degree	12	17	25	29
Above a bachelor's	9	16	14	14	Above a bachelor's	10	16	15	17
<i>New Orleans</i>					<i>Detroit</i>				
Less than high school	36	17	11	13	Less than high school	35	19	12	9
HSD/GED	29	30	23	25	HSD/GED	34	35	27	26
Some college, no degree	14	19	29	29	Some college, no degree	13	21	34	34
Bachelor's degree	11	16	22	21	Bachelor's degree	9	12	17	20
Above a bachelor's	10	17	15	12	Above a bachelor's	9	13	9	11
<i>Washington, D.C.</i>					East				
Less than high school	20	9	6	5	<i>New York</i>				
HSD/GED	27	21	16	15	Less than high school	32	17	10	7
Some college, no degree	15	16	23	22	HSD/GED	32	28	20	18
Bachelor's degree	14	20	29	31	Some college, no degree	12	17	22	22
Above a bachelor's	24	33	27	27	Bachelor's degree	11	17	25	30
West					Above a bachelor's 13 22 22 24				
<i>Los Angeles</i>					<i>Philadelphia</i>				
Less than high school	21	11	8	6	Less than high school	34	19	10	7
HSD/GED	33	27	17	15	HSD/GED	36	37	31	29
Some college, no degree	22	27	34	33	Some college, no degree	11	15	23	25
Bachelor's degree	11	16	24	28	Bachelor's degree	11	15	22	25
Above a bachelor's	13	19	16	17	Above a bachelor's	9	15	13	15
<i>San Francisco</i>					<i>Baltimore</i>				
Less than high school	19	8	5	3	Less than high school	41	23	12	9
HSD/GED	32	25	13	10	HSD/GED	30	32	26	24
Some college, no degree	20	25	30	25	Some college, no degree	11	16	26	28
Bachelor's degree	14	18	30	37	Bachelor's degree	10	14	21	24
Above a bachelor's	15	24	23	25	Above a bachelor's	8	15	14	16

NOTE: Authors' calculations. See Appendix 1 for details. HSD/GED, high school diploma or GED.

Figure 3
Educational Attainment of Black and White Men: 1970-2000



NOTE: The first set of bars shows data from 1970; the second shows data from 2000.

Figure 4

Marital Status of Black Men: 1970-2000

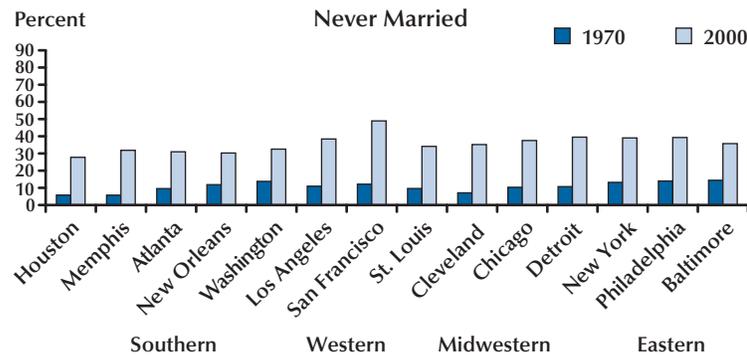
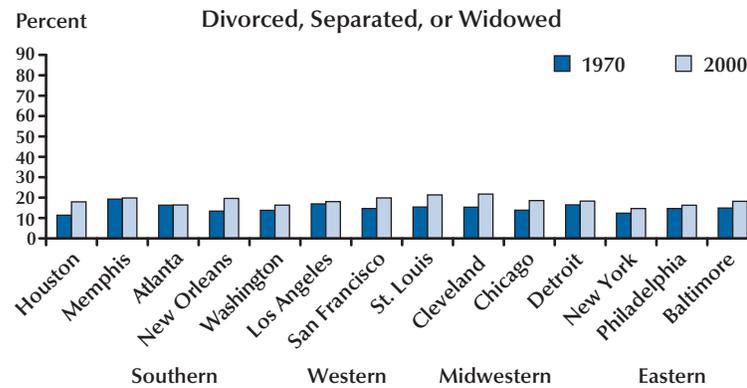
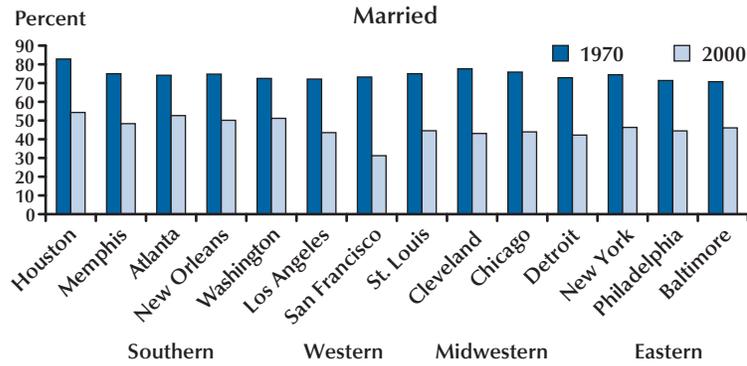


Table 8**Employment Distribution of All Men by Industry (percent)**

MSA	1970	1980	1990	2000	MSA	1970	1980	1990	2000
South					Midwest				
<i>Houston</i>					<i>St. Louis</i>				
Construction	14	15	13	14	Construction	8	8	10	11
Manufacturing	28	24	18	16	Manufacturing	37	32	26	20
Transportation	11	10	10	10	Transportation	12	12	11	11
Sales	18	17	20	18	Sales	16	15	17	16
Finance	3	4	5	4	Finance	3	4	5	5
Service	16	18	22	24	Service	13	17	20	25
Public administration	3	3	3	3	Public administration	6	6	5	4
Other	7	9	9	10	Other	5	6	6	7
<i>Memphis</i>					<i>Cleveland</i>				
Construction	7	8	9	9	Construction	8	8	8	10
Manufacturing	25	22	16	13	Manufacturing	45	39	28	26
Transportation	13	14	14	17	Transportation	10	10	10	8
Sales	20	19	20	18	Sales	15	14	17	15
Finance	4	5	5	4	Finance	4	4	5	5
Service	17	18	22	24	Service	13	17	21	23
Public administration	6	6	6	5	Public administration	4	4	4	5
Other	8	7	9	9	Other	2	4	7	7
<i>Atlanta</i>					<i>Chicago</i>				
Construction	10	9	11	12	Construction	8	8	8	10
Manufacturing	26	20	15	14	Manufacturing	37	31	23	20
Transportation	12	14	13	13	Transportation	12	12	11	11
Sales	21	20	22	19	Sales	17	16	18	16
Finance	6	6	7	6	Finance	4	6	7	7
Service	16	20	23	25	Service	15	19	23	26
Public administration	5	6	5	4	Public administration	4	5	4	4
Other	4	5	4	6	Other	3	5	6	7
<i>New Orleans</i>					<i>Detroit</i>				
Construction	11	12	9	12	Construction	7	6	8	9
Manufacturing	20	14	12	12	Manufacturing	51	45	35	33
Transportation	16	15	12	11	Transportation	8	8	7	8
Sales	18	18	19	17	Sales	13	13	16	15
Finance	6	4	4	4	Finance	3	3	4	4
Service	17	20	25	26	Service	13	15	19	21
Public administration	5	6	5	5	Public administration	4	4	3	3
Other	7	11	14	14	Other	2	4	6	7
<i>Washington, D.C.</i>					East				
Construction	8	8	11	11	<i>New York</i>				
Manufacturing	7	6	7	6	Construction	6	5	7	8
Transportation	9	9	9	10	Manufacturing	20	17	11	8
Sales	13	12	14	13	Transportation	16	13	12	12
Finance	4	5	6	5	Sales	19	17	17	16
Service	21	26	29	34	Finance	8	9	11	10
Public administration	26	24	16	13	Service	22	26	29	31
Other	12	9	8	8	Public administration	5	6	5	5
West					Other				
<i>Los Angeles</i>					4				
Construction	7	7	9	9	<i>Philadelphia</i>				
Manufacturing	33	29	23	17	Construction	8	8	10	10
Transportation	10	9	8	9	Manufacturing	36	28	21	16
Sales	17	17	18	19	Transportation	10	10	9	10
Finance	4	5	6	5	Sales	16	16	18	17
Service	20	23	25	30	Finance	4	5	6	6
Public administration	4	4	3	3	Service	15	20	23	28
Other	4	6	7	9	Public administration	6	6	5	5
<i>San Francisco</i>					Other				
Construction	9	8	8	8	5				
Manufacturing	20	17	11	10	<i>Baltimore</i>				
Transportation	14	12	11	9	Construction	9	10	12	11
Sales	18	18	19	18	Manufacturing	31	22	16	12
Finance	6	7	8	8	Transportation	11	11	10	10
Service	21	25	30	38	Sales	14	14	16	16
Public administration	7	6	4	3	Finance	4	4	5	6
Other	5	6	7	6	Service	15	18	22	28
					Public administration	9	13	11	9
					Other	7	8	8	8

NOTE: Authors' calculations. See Appendix 1 for details.

Table 9**Employment Distribution of Black Men by Industry (percent)**

MSA	1970	1980	1990	2000	MSA	1970	1980	1990	2000
South					Midwest				
<i>Houston</i>					<i>St. Louis</i>				
Construction	14	12	8	7	Construction	7	6	5	6
Manufacturing	24	25	16	12	Manufacturing	36	34	23	18
Transportation	14	16	17	17	Transportation	13	14	13	16
Sales	22	17	18	17	Sales	13	10	14	13
Finance	3	2	3	3	Finance	1	2	3	3
Service	17	15	22	25	Service	17	17	23	25
Public administration	1	4	4	6	Public administration	8	7	6	5
Other	6	8	12	13	Other	6	10	14	15
<i>Memphis</i>					<i>Cleveland</i>				
Construction	11	8	9	7	Construction	6	4	5	6
Manufacturing	28	26	16	15	Manufacturing	47	40	22	21
Transportation	13	17	17	20	Transportation	15	13	13	10
Sales	17	17	17	16	Sales	12	11	12	14
Finance	1	2	2	2	Finance	3	2	4	4
Service	15	15	19	20	Service	12	16	22	25
Public administration	3	7	7	5	Public administration	3	5	5	5
Other	11	9	12	15	Other	3	9	18	13
<i>Atlanta</i>					<i>Chicago</i>				
Construction	13	10	9	8	Construction	6	5	5	4
Manufacturing	25	20	15	13	Manufacturing	37	29	17	13
Transportation	14	17	16	19	Transportation	16	16	17	16
Sales	20	16	19	17	Sales	16	12	14	12
Finance	2	4	5	5	Finance	2	4	5	5
Service	15	18	23	25	Service	15	17	22	25
Public administration	5	7	7	5	Public administration	4	5	5	5
Other	6	8	6	8	Other	4	12	15	18
<i>New Orleans</i>					<i>Detroit</i>				
Construction	14	13	9	11	Construction	6	4	5	5
Manufacturing	21	15	10	12	Manufacturing	56	50	31	26
Transportation	22	20	18	14	Transportation	9	8	8	9
Sales	19	16	17	14	Sales	9	8	11	12
Finance	3	2	3	3	Finance	2	2	3	3
Service	15	17	21	22	Service	12	12	18	22
Public administration	2	5	4	5	Public administration	3	6	6	4
Other	5	12	18	20	Other	3	10	18	18
<i>Washington, D.C.</i>					East				
Construction	11	9	10	8	<i>New York</i>				
Manufacturing	7	6	5	5	Construction	5	5	7	7
Transportation	15	15	15	16	Manufacturing	19	16	10	5
Sales	17	12	14	13	Transportation	21	17	17	16
Finance	3	4	5	5	Sales	17	12	12	11
Service	22	25	28	32	Finance	7	7	8	7
Public administration	22	23	17	13	Service	22	26	28	32
Other	4	6	6	8	Public administration	4	6	6	6
West					Other				
<i>Los Angeles</i>					6				
Construction	7	5	6	5	<i>Philadelphia</i>				
Manufacturing	28	25	16	9	Construction	8	7	8	6
Transportation	13	14	15	15	Manufacturing	32	23	16	11
Sales	14	13	13	12	Transportation	15	13	13	12
Finance	3	4	6	5	Sales	12	12	15	15
Service	24	24	26	33	Finance	2	3	4	5
Public administration	6	6	6	5	Service	18	20	25	30
Other	4	9	13	16	Public administration	8	9	8	7
<i>San Francisco</i>					Other				
Construction	12	7	6	5	5				
Manufacturing	18	16	8	5	<i>Baltimore</i>				
Transportation	21	18	16	14	Construction	9	9	9	7
Sales	10	12	12	15	Manufacturing	32	23	15	11
Finance	2	5	5	5	Transportation	17	14	14	13
Service	20	23	32	37	Sales	12	12	14	15
Public administration	14	9	5	5	Finance	2	4	4	4
Other	4	11	16	14	Service	16	18	22	27
					Public administration	7	11	11	10
					Other	5	10	11	13

NOTE: Authors' calculations. See Appendix 1 for details.

Table 10**Overall Population Changes by MSA (percent)**

MSA	1970-80	1980-90	1990-2000
South			
Houston	45	21	24
Memphis	10	7	12
Atlanta	27	33	35
New Orleans	14	-1	4
Washington, D.C.	9	21	15
East			
New York	-9	3	8
Philadelphia	-2	3	3
Baltimore	5	8	7
Midwest			
St. Louis	-2	3	4
Cleveland	-6	-3	2
Chicago	2	2	11
Detroit	-2	-3	4
West			
Los Angeles	6	19	6
San Francisco	0	8	8
United States	11	10	13

SOURCE: Metropolitan (MSA) Population Data: Population and Household Data, U.S. Metropolitan Statistical Areas, MSA (1999 definition), 1970-present, Real Estate Center, Texas A&M University; <http://recenter.tamu.edu/data/popm/>.

populations as well.²¹ Thus, while manufacturing was losing its importance and labor market conditions were deteriorating, black population in those cities was increasing.

On the other hand, rapidly growing cities, such as Houston and Atlanta, had large increases in black population as well. What sets Atlanta apart, however, is that black population there was growing even faster than the overall city population.

Tables 12 and 13 report changes in the population of black and white men, respectively, by

²¹ It is tempting to explain these changes by recalling that one of the main demographic trends during the 1970s and 1980s was the migration of white population away from urban centers. Readers are reminded, however, that the unit of analysis in this paper is a metropolitan area that includes a central city together with adjacent communities (usually counties). Thus, the observed phenomenon cannot be explained only by white flight to the suburbs.

Table 11**Black Population Changes by MSA (percent)**

MSA	1970-80	1980-90	1990-2000
South			
Houston	37	18	22
Memphis	16	9	14
Atlanta	41	39	33
New Orleans	19	5	2
Washington, D.C.	15	20	11
East			
New York	13	22	3
Philadelphia	5	6	4
Baltimore	13	10	13
Midwest			
St. Louis	7	4	7
Cleveland	5	3	8
Chicago	17	0	7
Detroit	16	6	7
West			
Los Angeles	24	9	1
San Francisco	1	-4	2
United States	17	13	16

SOURCE: Population Estimates Archives, U.S. Census Bureau.

decades: 1970-80, 1980-90, and 1990-2000. As expected, changes in the population of black men (Table 12) are consistent with changes in black population in general (see Table 11). However, they vary widely with the changes in the population of white men. While the population of black men was increasing in the three decades in almost all cities, the population of white men was decreasing. For example, in New York in 1980-90, the population of black men grew by 23 percent while the population of white men decreased by 31 percent. Other eastern and midwestern cities had a similar experience. Even when the population of white men grew, it did so at a lower rate than the population of black men. The 1970-80 population increase in Los Angeles was 1 percent for white men and 24 percent for black men.

Table 14 offers a different way to look at migration flows of blacks. It reports the proportion of black men who were "locals" in the 14

Table 12**Black Male Population Changes by MSA (percent)**

MSA	1970-80	1980-90	1990-2000
South			
Houston	37	18	21
Memphis	15	8	14
Atlanta	41	41	33
New Orleans	18	3	2
Washington, D.C.	13	19	11
East			
New York	11	23	4
Philadelphia	4	6	4
Baltimore	11	10	12
Midwest			
St. Louis	6	3	7
Cleveland	3	2	9
Chicago	15	0	7
Detroit	14	4	7
West			
Los Angeles	24	9	0
San Francisco	2	-2	2

SOURCE: Population Estimates Archives, U.S. Census Bureau.

cities, meaning those born in the relevant state or, for some cities, born in a specified neighboring state. Ideally, we would like to know how many men were born in the city they lived in, but the data do not offer this information. In 1970, the southern cities had a very high proportion of black men who were locals. In 1970, for example, in Memphis, 91 percent of black men were locals born either in Tennessee or Mississippi; in Atlanta, 86 percent were locals and born in Georgia. The difference between these two cities, however, is that while the black population of Memphis stayed predominantly local throughout the three decades, Atlanta had a steady inflow of migrants from other parts of the country. In Atlanta, by 1980 the proportion of locals declined to 73 percent, by 1990 to 55 percent, and by 2000 to only 43 percent. This “churning” of the population contributed to Atlanta having one of the highest

Table 13**White Male Population Changes by MSA (percent)**

MSA	1970-80	1980-90	1990-2000
South			
Houston	48	-15	9
Memphis	4	5	5
Atlanta	22	26	24
New Orleans	11	-12	-1
Washington, D.C.	-1	11	6
East			
New York	-17	-31	-9
Philadelphia	-5	-3	-3
Baltimore	1	5	0
Midwest			
St. Louis	-4	2	2
Cleveland	-8	-8	-2
Chicago	-3	-14	2
Detroit	-8	-8	3
West			
Los Angeles	1	-40	-14
San Francisco	-6	-18	-9

SOURCE: Population Estimates Archives, U.S. Census Bureau.

average educational attainments of black men. Recall also that in 2000 black men in Atlanta had the highest employment rate and lowest unemployment rate.

Table 14 shows that in the midwestern cities the population dynamic was the opposite of that in Atlanta. In 1970, most black men living in these cities were born elsewhere. This was, of course, a result of the Great Migration in the earlier part of the century that moved blacks northward. In 1970, only 28 percent of black men in Detroit were born in Michigan; in Cleveland, Chicago, and St. Louis the proportions of locals were, respectively, 34, 36, and 37 percent. In the following three decades, however, the inflow significantly decreased: By 2000, the proportion of black men in Detroit who were born in Michigan reached 69 percent. The other midwestern cities experienced similar increases.

Table 14**Non-Migrant Black Men by MSA (percent)**

MSA	1970	1980	1990	2000
South				
Live in Houston, born in TX	74	65	61	61
Live in Memphis, born in TN or MS	91	91	88	84
Live in Atlanta, born in GA	86	73	55	43
Live in New Orleans, born in LA	82	81	84	86
Live in DC, born in MD, VA, or DC	56	50	52	52
East				
Live in New York, born in NY	38	30	35	40
Live in Philadelphia, born in PA or NJ	54	59	69	73
Live in Baltimore, born in MD	54	58	65	66
Midwest				
Live in St. Louis, born in MO	37	44	58	64
Live in Cleveland, born in OH	34	41	57	72
Live in Chicago, born in IL	36	38	56	67
Live in Detroit, born in MI	28	39	58	69
West				
Live in Los Angeles, born in CA	13	21	34	47
Live in San Francisco, born in CA	15	25	37	45

NOTE: Authors' calculations. See Appendix 1 for details.

The picture of migration is somewhat similar, though less dramatic, in Philadelphia and Baltimore. In New York, the proportion of locals stayed pretty stable in the 30 to 40 percent range. In 1970 in the western cities, San Francisco and Los Angeles, only a small proportion of black men were locals (15 and 13 percent, respectively). By 2000, the proportions increased to 45 percent in San Francisco and 47 percent in Los Angeles.

Differences in migration are clearly related to differences in the economic well-being of black men across cities. Cities that are doing well, such as Atlanta, attract more educated workers looking for good job opportunities. Struggling cities have difficulty raising their levels of human capital because they cannot attract talented, educated workers from other places and are losing their own educated population.

CHANGES IN FAMILY STRUCTURE

Stable families are important indicators of healthy communities. Table 15 shows the distribution of the marital status of black men in each city in 1970, 1980, 1990, and 2000 in these categories: married, divorced/separated/widowed, and never married. Figure 4 compares changes in these distributions between 1970 and 2000. The most striking finding is that marriage rates of black men decreased dramatically between 1970 and 2000.

In 1970 across the cities, the rates varied from 71 percent (in Baltimore and Philadelphia) to 83 percent (in Houston). By 2000, the rates varied from only 31 to 54 percent²² and were

²² Table 16 presents the statistics for white men based on the same categories and shows their marriage rates declined as well but not as dramatically. In 1970, 78 to 89 percent of white men were married. By 2000, the proportion had declined to 47 to 69 percent.

Table 15**Marital Status of Black Men by MSA (percent)**

MSA	1970	1980	1990	2000	MSA	1970	1980	1990	2000
South					Midwest				
<i>Houston</i>					<i>St. Louis</i>				
Married	83	67	54	54	Married	75	59	47	45
D/S/W	11	17	21	18	D/S/W	15	23	20	21
Never married	6	16	26	28	Never married	10	18	33	34
<i>Memphis</i>					<i>Cleveland</i>				
Married	75	58	49	48	Married	78	60	47	43
D/S/W	19	22	21	20	D/S/W	15	21	25	22
Never married	6	20	30	32	Never married	7	19	28	35
<i>Atlanta</i>					<i>Chicago</i>				
Married	74	61	53	53	Married	76	57	44	44
D/S/W	16	19	18	16	D/S/W	14	21	21	19
Never married	10	20	29	31	Never married	10	21	36	38
<i>New Orleans</i>					<i>Detroit</i>				
Married	75	61	50	50	Married	73	55	43	42
D/S/W	13	20	20	20	D/S/W	16	24	23	18
Never married	12	18	30	30	Never married	11	21	34	39
<i>Washington, D.C.</i>					East				
Married	72	56	49	51	<i>New York</i>				
D/S/W	14	22	17	16	Married	74	57	49	46
Never married	14	23	34	33	D/S/W	12	19	17	15
West					Never married				
<i>Los Angeles</i>					13 24 35 39				
Married	72	55	46	44	<i>Philadelphia</i>				
D/S/W	17	23	21	18	Married	71	54	45	44
Never married	11	22	34	38	D/S/W	15	23	20	16
<i>San Francisco</i>					Never married				
Married	73	51	39	31	14 23 35 39				
D/S/W	15	23	21	20	<i>Baltimore</i>				
Never married	12	26	40	49	Married	71	52	44	46
					D/S/W	15	24	20	18
					Never married	14	24	36	36

NOTE: Authors' calculations. See Appendix 1 for details. D/S/W, divorced/separated/widowed.

Table 16**Marital Status of White Men by MSA (percent)**

MSA	1970	1980	1990	2000	MSA	1970	1980	1990	2000
South					Midwest				
<i>Houston</i>					<i>St. Louis</i>				
Married	88	76	70	69	Married	88	81	72	69
D/S/W	6	12	13	14	D/S/W	5	9	11	13
Never married	6	12	17	17	Never married	7	11	17	18
<i>Memphis</i>					<i>Cleveland</i>				
Married	89	79	72	69	Married	86	77	69	66
D/S/W	4	11	11	15	D/S/W	5	8	11	13
Never married	7	11	16	16	Never married	9	14	20	21
<i>Atlanta</i>					<i>Chicago</i>				
Married	88	77	71	69	Married	84	75	66	67
D/S/W	5	11	11	12	D/S/W	5	9	10	10
Never married	7	12	18	19	Never married	11	16	24	23
<i>New Orleans</i>					<i>Detroit</i>				
Married	85	74	66	63	Married	87	78	71	67
D/S/W	6	11	13	14	D/S/W	5	10	11	12
Never married	10	15	21	22	Never married	9	13	18	21
<i>Washington, D.C.</i>					East				
Married	85	71	65	66	<i>New York</i>				
D/S/W	5	11	10	11	Married	78	67	59	58
Never married	10	19	24	23	D/S/W	5	9	9	9
West					Never married				
<i>Los Angeles</i>					17 25 33 34				
Married	79	63	56	54	<i>Philadelphia</i>				
D/S/W	9	15	14	13	Married	85	76	70	68
Never married	12	22	30	33	D/S/W	5	9	9	10
<i>San Francisco</i>					Never married				
Married	79	62	50	47	10 15 21 22				
D/S/W	8	14	13	11	<i>Baltimore</i>				
Never married	14	24	37	42	Married	86	76	70	67
					D/S/W	6	11	12	13
					Never married	8	14	19	20

NOTE: Authors' calculations. See Appendix 1 for details. D/S/W, divorced/separated/widowed.

particularly low in the western and midwestern cities: Only 31 percent of black men were married in San Francisco, 44 percent in Los Angeles, and only 42 to 45 percent in the midwestern cities overall. Houston still had the highest proportion of married black men in 2000, but it was down to 54 percent. Atlanta had the second highest—53 percent. Overall, as shown in Table 15, the largest decline in marriage rates occurred between 1970 and 1980, followed by a somewhat smaller decline between 1980 and 1990. The rates then stayed essentially the same between 1990 and 2000.

Remarkably, as easily seen in Figure 4, divorce rates for black men from 1970 to 2000 did not change much in most cities. Instead, the proportion who have never married increased dramatically—in some cities by more than five times. In 1970 in Memphis, for instance, only 6 percent of black men had never married and in San Francisco only 12 percent (see Table 15). In 2000, the proportion reached 32 percent in Memphis and 49 percent in San Francisco. In midwestern cities, the proportion increased from 7 to 11 percent in 1970 to 34 to 39 percent in 2000.

This trend describes significant demographic changes in the black community.²³ One direct consequence is more single mothers and, thus, more children who grow up in single-parent households.

THE WELL-BEING OF BLACK CHILDREN

The paper thus far has documented mainly negative developments in economic and social conditions of blacks between 1970 and 2000: increased rates of unemployment and those not

in the labor force, decreased relative annual incomes, insufficient progress in educational attainment, and decreased marriage rates. One question that seems very important is how these changes affect the well-being of the children. Has there been any progress in their welfare? To address this question in the most straightforward way, we compare the income distributions of white and black families with children 8 to 12 years old.²⁴ Comparison of family incomes allows us to summarize how decreased marriage rates, increased single-mother households, and changes in labor force participation and wages affect children; it also allows us to capture the economic progress of women.²⁵

First we compute an annual income distribution of white children's families. Then we calculate the 75th percentile, the median, and the 25th percentile of annual income distribution of black children's families. Finally, we determine where each of these quartiles of black family income distribution falls in the white family income distribution. The results are reported in Table 17.

Consider Houston in 1970, for instance. As the table shows, the median family income of black children corresponds to the 12th percentile of white children, which means that only 12 percent of white children had family income below the median family income of black children. Put another way, half of black children have family income that was less than that of 88 percent of white children.

Charles and Luoh (forthcoming) present evidence that an increase in incarceration rates of black men negatively affected the marriage market for black women. It led to a shift of gains from marriage from women toward men. Our sample, however, does not include men in prison at the time of the survey. Thus, the estimated marriage rates are likely to be even lower if one includes incarcerated men.

²³ There is a literature that suggests that the structure of welfare payments discourages marriage (e.g., Duncan and Hoffman, 1990, and Lichter, LeClere, and McLaughlin, 1991). Moffit (1997), however, reviews this literature and concludes that “considerable uncertainty surrounds this consensus because a significant minority of the studies find no effect at all, because the magnitudes of the estimated effects vary widely, and because puzzling and unexplained differences exist across the studies by race and methodological approach” (p. 1). Black, McKinnish, and Sanders (2003) find that when low-skilled workers have high-wage jobs (as did miners during the coal boom), welfare expenditure decreases partly because of the decline in single-parent households.

²⁴ For this exercise, the income measurement we use includes annual pre-tax family income from all sources, including Social Security and welfare payments, as well as veterans' payments, unemployment compensation, child support, and alimony. Incomes were recorded for all persons in a family who were 15 years old and older (14 years old and older in 1970 data).

²⁵ We do not study economic progress of black women in this paper, leaving this important topic to future research. Stagnation of the economic progress of black men is likely to have behavioral responses from women. Charles and Luoh (forthcoming) find, for example, that black women who face marriage markets with reduced quality of potential spouses increase their schooling and labor supply.

Table 17**Well-Being of Black Children Compared with White Children Based on Place in Family Income Distribution of White Children (Percentile)**

MSA	1970	1980	1990	2000	MSA	1970	1980	1990	2000
South					Midwest				
<i>Houston</i>					<i>St. Louis</i>				
75th percentile	27	38	39	38	75th percentile	37	37	39	33
Median	12	14	15	16	Median	12	12	13	12
25th percentile	4	4	4	6	25th percentile	4	4	4	4
Ratio of medians	0.5	0.5	0.5	0.4	Ratio of medians	0.5	0.4	0.4	0.4
<i>Memphis</i>					<i>Cleveland</i>				
75th percentile	20	34	32	33	75th percentile	35	43	44	39
Median	8	14	10	12	Median	10	12	15	14
25th percentile	4	5	3	3	25th percentile	4	4	4	5
Ratio of medians	0.4	0.4	0.4	0.4	Ratio of medians	0.5	0.5	0.5	0.4
<i>Atlanta</i>					<i>Chicago</i>				
75th percentile	27	32	39	40	75th percentile	33	37	37	34
Median	12	15	13	17	Median	11	11	11	11
25th percentile	6	3	10	7	25th percentile	4	4	3	3
Ratio of medians	0.5	0.5	0.5	0.5	Ratio of medians	0.6	0.4	0.4	0.4
<i>New Orleans</i>					<i>Detroit</i>				
75th percentile	26	35	32	35	75th percentile	45	45	41	42
Median	10	13	9	14	Median	14	18	14	16
25th percentile	4	4	3	4	25th Percentile	4	7	5	6
Ratio of medians	0.5	0.4	0.3	0.4	Ratio of medians	0.6	0.6	0.4	0.5
<i>Washington, D.C.</i>					East				
75th percentile	33	44	47	40	<i>New York</i>				
Median	13	17	17	17	75th percentile	40	40	46	43
25th percentile	6	6	5	4	Median	15	16	21	23
Ratio of medians	0.5	0.6	0.6	0.5	25th percentile	6	6	7	7
West					Ratio of medians				
<i>Los Angeles</i>					0.5				
75th percentile	36	44	51	39	<i>Philadelphia</i>				
Median	15	20	18	17	75th percentile	44	41	46	40
25th percentile	6	8	7	6	Median	14	15	14	13
Ratio of medians	0.5	0.5	0.5	0.4	25th percentile	5	5	5	4
<i>San Francisco</i>					Ratio of medians				
75th percentile	46	41	37	36	0.6				
Median	16	17	17	11	<i>Baltimore</i>				
25th percentile	7	6	4	4	75th percentile	46	41	43	41
Ratio of medians	0.6	0.5	0.5	0.3	Median	16	15	15	16
					25th percentile	6	3	6	4
					Ratio of medians	0.6	0.5	0.5	0.5

NOTE: Authors' calculations. See Appendix 1 for details.

Similarly, the 25th percentile of the “black distribution” corresponds to the 4th percentile of the “white distribution,” which means that 25 percent of black children’s families were as poor as the bottom 4 percent of white children’s families. The 75th percentile of the black distribution corresponds to the 27th percentile of the white distribution, which means that 73 percent of white children’s families were at least as wealthy as the top 25 percent of black children’s families.

In addition, Table 17 reports a ratio of median incomes of black and white families. For example, in 1970 in Houston the median income of black children’s families was only half the median income of white children’s families. The picture is similarly bleak across all the cities and decades—the median annual income of black children’s families is only about one half the median annual income of white children’s families. What is more, this ratio *did not increase* in any of the 14 cities over the 1970-2000 period.²⁶ In fact, in 10 of the 14 cities the ratio decreased, meaning that the median income of black children’s families decreased relative to the median income of white children’s families. From 1970 to 2000, in San Francisco it decreased from 0.6 to 0.3 and in Chicago from 0.6 to 0.4.

Where does the median income of black children’s families fit into the income distribution of white children’s families? In 2000, the situation was the “best” in New York, where the median of the black distribution corresponds to the 23rd percentile of the white distribution. Thus, in New York in 2000, 50 percent of black children’s families had incomes below those of 77 percent of white children’s families. The situation in 2000 was even worse in the rest of the cities—the median black distributions fell within only the 11th to the 17th percentiles of the white distributions.

For black children’s families, the situation at the top and bottom quartiles of the income distribution is no better than in the middle. In 2000, the 75th percentile of the black distribution still corresponds to only the 33rd to the 43rd percentile of the white distribution. Perhaps even more sig-

nificant is that 25 percent of black children’s families have incomes as low as those of the poorest 3 to 7 percent of white children’s families. To sum up, there was no progress in the financial well-being of black children, relative to white children, between 1970 and 2000.

CONCLUDING REMARKS

More than 35 years after the Civil Rights Act, the economic status of black men is still much worse than that of white men. What is more, there appears to be virtually no progress of black men in the labor markets between 1970 and 2000. Some important indicators, such as the rate of those not in the labor force and relative annual earnings, have actually become worse. The social and family structure of the black population also experience negative changes.

This paper does not attempt to determine why there was stagnation, and even a reversal, of the economic progress of African Americans between 1970 and 2000.²⁷ Instead, the main goal of this paper was to describe changes in various economic conditions of black men and their families at a city level. The second goal was to compare those changes across cities.

Although the overall picture is rather bleak, there are clear differences among the 14 cities studied. Industrial cities in the Midwest (Chicago, Detroit, Cleveland, and St. Louis) experienced more serious deterioration of their labor markets precisely because they used to be predominantly manufacturing cities. With the decline of the importance of manufacturing and a move to high-tech and service industries, the black labor force, which was generally less educated, faced tough labor market conditions that resulted in high levels of unemployment. In addition, growing numbers of black men became discouraged about their job prospects and dropped out of the labor force completely. Family structure was disrupted as well as more and more black men chose not to marry. As a result, more black children are growing up in single-mother households and the economic

²⁶ We also looked at ratios of various other percentiles of the two distributions. The results were the same—there is no change in ratios over the years.

²⁷ Neal (2008) presents a short summary of possible explanations and a discussion of several related studies.

well-being of black children has not improved since 1970.

Most eastern and western cities in the study showed declines similar to those in midwestern cities but of a somewhat lesser degree. Southern cities, on the other hand, did see some economic progress of black men, mostly between 1970 and 1980. These improvements, together with the reversal of economic progress in the Midwest, resulted in more uniform conditions for black men in 2000 than in 1970. Educational attainment of black men in the South, in particular, has increased dramatically compared with 1970.

Atlanta and Washington, D.C., stand out on a number of characteristics. In 2000, black men in those cities had the highest employment rates, as well as low rates of unemployment and those not in the labor force. They also had the highest proportions of those who went to college and those

who had a bachelor's degree or higher. One of the reasons these two cities fared better is their industrial structure. Atlanta has a very vibrant mix of industries and never relied heavily on manufacturing. Washington, D.C., has a high proportion of service and stable government jobs. As a result, these cities have been able to attract high-skilled educated workers from other parts of the country.

Despite remarkable changes in society when it comes to racial acceptance and equality, the evidence presented in this paper reveals that significant racial disparities remain in education and labor market outcomes. A better understanding of underlying causes of the observed economic stagnation and a design of policies that would help improve the social and economic status of African Americans is an important topic for future research.

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APPENDIX 1: DATA AND VARIABLES DESCRIPTION

Individual-level U.S. Census data were provided by the Integrated Public Use Microdata Series (IPUMS). See Ruggles et al. (2010).

Educational Attainment

The five education categories are did not finish high school; high school diploma (or GED); some college but no bachelor's degree; bachelor's degree; and higher than a bachelor's degree.

Employment Status

The three employment status categories are has a job, unemployed, and not in the labor force.

Industry Variables

Because of the relatively small size of the sample, it was necessary to combine Census-defined industries and occupations into larger groups. For consistency, the 1990 Census Bureau industrial classification scheme is used for all years. First, 11 industry categories were generated according to the Department of Labor's Standard Industrial Classification code: agriculture, forestry, and fishing; mining; construction; manufacturing; transportation, communications, and utility; wholesale trade; retail trade; finance, insurance, and real estate; service; public administration; and other. "Other" represents military personnel, temporary unemployed workers, and people with missing information. Then, wholesale trade and retail trade were combined into a category called "sales." Since only a very small fraction of people living in urban areas are employed in either agriculture, forestry, and fishing or mining, these two categories were combined with the "other" category. In the end, there are eight industrial categories.

Marital Status

The three marital status categories are married; separated, divorced, or widowed; and never married.

Non-Migrant Indicator

The non-migrant indicator variable was set equal to 1 if a person satisfied one of the following: born in Georgia and lives in Atlanta; born in Maryland and lives in Baltimore; born in Illinois and lives in Chicago; born in Ohio and lives in Cleveland; born in Michigan and lives in Detroit; born in Texas and lives in Houston; born in California and lives in Los Angeles; born in Tennessee and lives in Memphis; born in Mississippi and lives in Memphis; born in Louisiana and lives in New Orleans; born in New York and lives in New York; born in Pennsylvania and lives in Philadelphia; born in New Jersey and lives in Philadelphia; born in Missouri and lives in St. Louis; born in California and lives in San Francisco; born in Washington, D.C., and lives in Washington, D.C.; born in Maryland and lives in Washington, D.C.; and born in Virginia and lives in Washington, D.C. The indicator was set to 0 for all other persons.

MSA Population

MSA population data for 1970, 1980, 1990, and 1999 were downloaded from the Population database, Real Estate Center at Texas A&M University and calculated based on U.S. Census data (<http://recenter.tamu.edu/data/popm/>). For consistency, the 1999 definition of MSAs was used.

MSA Black Population

County-level black population data for 1970, 1980, 1990, and 2000 were downloaded from the Population Estimates Archives, U.S. Census Bureau and aggregated into MSA-level data according to 1999 MSA definitions (www.census.gov/popest/archives/).

APPENDIX 2: ESTIMATION

Black-White Annual Earnings Gap

A simple matching estimator was used to calculate for each metropolitan area j the black-to-white ratio of annual earnings. Intuitively, black men were “matched” with white men based on their age and education. More precisely, let b index black individuals and w white individuals, and let x_i be the age-education combination of individual i —for example, “31-year-old man with a high school diploma.” Let y_i be the annual earnings of individual i , and $E(y_{\{b,i\}}|x)$ the expected value of the annual earnings of that (black) individual given that his age-education combination is x . There are four education categories (see Appendix 1) and six age intervals: 25 to 30, 31 to 35, 36 to 40, 41 to 45, 46 to 50, and 51 to 55 years old.

Our interest then is in

$$Ratio_j = \sum_{x=25}^{55} \left[\frac{E_j(y_{\{b,i\}}|x)}{E_j(y_{\{w,i\}}|x)} \right] f_{b(x)},$$

where $f_b(x)$ is the p.d.f. of age-education combinations among *black* workers in all cities. The equation is then directly estimated for each city by calculating the conditional means at each point in the distribution of covariates and then taking a weighted average. Observations with zero values are included in the calculations.

Average Annual Weeks and Average Weekly Hours of Work

One of the limitations of the data is that the 1970 Census asked respondents to select only among intervals of weeks and hours of work. Black et al. (2009) compute the average weeks and hours of work for those in the corresponding interval using 1980 Census data. In this paper, the values from Black et al. (2009) were used to make imputations for nonzero categories as follows:

Interval	Imputed weeks	Interval	Imputed hours
1-13 weeks	1.1	1-14 hours	8.57
14-26 weeks	21.4	15-29 hours	21.95
27-39 weeks	33.3	30-34 hours	30.64
40-47 weeks	43.4	35-39	36.35
48-49 weeks	48.3	40 hours	40
50-52 weeks	51.8	41-48 hours	45.46
		49-59 hours	51.41
		60 or more hours	67.02

Then, for each city, the weighted-average annual weeks and weekly hours of work were calculated conditional on age and education. The distribution of the age-education combinations across all cities was used for weighting. Observations with zero values are included in the calculations.



Measuring International Trade Policy: A Primer on Trade Restrictiveness Indices

[Cletus C. Coughlin](#)

Measuring the overall restrictiveness of a country's international trade policies is important and, in fact, essential for estimating the effects of trade policies and for negotiations to reduce trade barriers. A good measure is also difficult to produce: Trade restrictiveness indices are constructed by combining the actual structure of trade restrictions, which is generally quite different across goods, into a single number. Under certain assumptions, this single number is the uniform tariff that would produce the same trade restrictiveness as the actual differentiated structure of restrictions. In this paper, the economic intuition underlying the construction of these indices is presented and estimates of these indices and the resulting insights are summarized. (JEL F00, F13, C43)

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Countries commonly use tariffs and other barriers to deter the importation of foreign-produced goods. Such trade policies affect economic activity and economic well-being not only in the country enacting these policies but in other countries as well. A fundamental question when assessing these policies is how restrictive overall a country's trade policies actually are. Ideally, one would like to have a measure that provides insights concerning not only how a country's restrictiveness has changed over time, but also how it compares with its trading partners'.

The present paper focuses on the measurement of trade restrictiveness. Particular attention is given to measures that are termed *trade restrictiveness indices*. Such indices are produced by combining actual trade restrictions, which are generally quite different across goods, into a single number. This single number is the uniform tariff factor equivalent that would produce the same trade restrictiveness as the actual structure of restrictions. In the case of a specific index discussed later, this tariff,

if applied to every imported good, would generate the same result for a nation's economic well-being as the actual set of trade barriers.¹ Trade restrictiveness indices are valuable for many purposes, such as assessing the impact of trade policy on economic and social outcomes and providing useful information for trade negotiations. Because of the importance of trade restrictiveness indices, an elementary introduction to these indices should be of value for researchers, policymakers, and students.

Unlike trade restrictiveness indices, more common measures of trade restrictiveness can be characterized as ad hoc and, thus, flawed. Therefore, studies using these less-rigorous measures of the impacts of trade policy on economic welfare and performance should be viewed with skepticism.

Beginning with the pioneering efforts of James Anderson and Peter Neary in the early 1990s,

¹ As discussed later, trade restrictiveness indices can also be constructed relative to other measures of economic activity, such as the volume of imports.

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much progress on the measurement of trade restrictiveness indices has occurred, including developments in economic theory and estimation that will be discussed here.² The theoretical advances use general equilibrium analysis, an approach that examines all markets in an economy at the same time. Thus, changes in one market can affect many other markets, and the determination of all equilibrium prices and quantities of all goods and services occurs simultaneously. Without question, such an analysis provides strong foundations for trade restrictiveness indices. However, to increase reader understanding of the key points in this paper, the following discussion of trade restrictiveness indices relies on partial equilibrium analysis, an approach that considers only part of an economy, such as the market for a specific good.

MEASURES OF TRADE RESTRICTIVENESS: CONSTRUCT WITH CARE³

To show how difficult it is to measure a country's trade restrictiveness, I examine a number of situations that illustrate problems with existing measures and provide the foundation for understanding the advances associated with trade restrictiveness indices.

A Very Simple Case

The measurement of trade restrictiveness is straightforward when there is only one imported good and a tariff is applied. Figure 1 illustrates this simple case. The import demand for this good is represented by D^M .⁴ The price in world markets for this good is P_W , which is the price

faced by domestic producers and consumers prior to the imposition of the tariff. Thus, the quantity of imports is M_W .

Now assume a tariff is imposed that raises the price faced by domestic producers and consumers to P_T . As a result of the higher price, imports would decrease to M_T . The deadweight loss caused by the tariff is represented by the triangle ABC.⁵ The restrictiveness of this tariff is simply the height of the tariff, which is the difference between P_T and P_W . Trade restrictiveness increases the larger the difference between the domestic price and the price in world markets. This simplicity vanishes, however, when assessing trade restrictiveness with two or more goods and tariffs.

Problems with Existing Measures

Let's begin with a case of two goods that are subjected to different tariffs. One approach could be to construct a measure of trade restrictiveness by computing the simple (i.e., unweighted) average of the two tariff rates. An obvious problem here is that all goods are treated identically. Intuitively, the goods should be weighted in terms of their importance.⁶ One common weighting approach is to use actual import volumes as weights. Unfortunately, such an approach is flawed.

When a uniform tariff is imposed on all the goods in question, the calculation of an average tariff weighted by import volumes generates a reasonable index: that a higher average tariff accu-

because it is derived from the country's supply and demand curves for the good. Using prices less than the price associated with the intersection of the supply and demand curves, the import demand curve is the difference between quantity demanded and quantity supplied.

² See Anderson and Neary (1992, 1994, 1996, 2003, and 2007) and Anderson (1998). A compilation of their work is presented in Anderson and Neary (2005).

³ A more thorough discussion of the ideas in this section can be found in Anderson and Neary (2005).

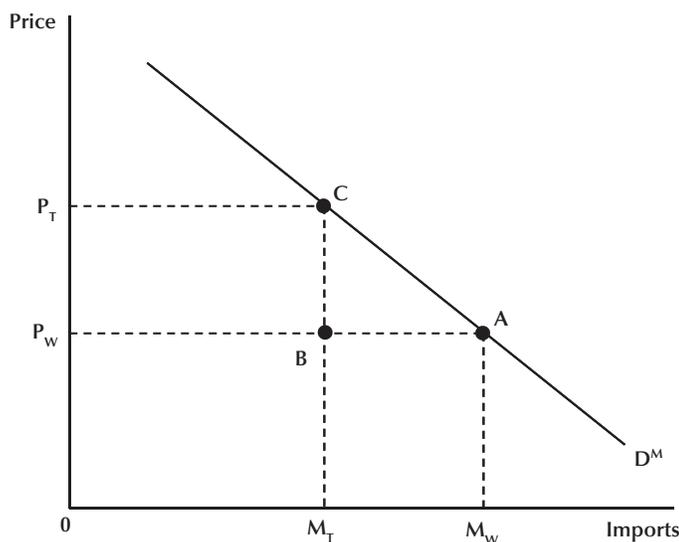
⁴ To be consistent with the underlying theory, this demand curve is a compensated net import demand curve. A compensated demand function, also known as a Hicksian demand function, reflects demand for a bundle of goods that minimizes expenditure while providing a fixed level of utility. The curve is characterized as "net"

⁵ The deadweight loss stems from the distortion of consumption and production decisions resulting from the wedge between the domestic price and the world price caused by the tariff. The fact that domestic consumers and producers face a price that exceeds the world price leads to inefficiencies associated with consumption as well as production. First, some would-be purchasers whose marginal benefits would exceed the world price are not buying—and, therefore, not consuming—the good because of the additional costs imposed by the tariff. Second, some domestic producers whose marginal costs exceed the world price are producing the good.

⁶ As pointed out by Mariana Spatareanu in personal correspondence, the simple average can be easily manipulated. To reduce its average tariff rate, a country may simply create a large number of categories of goods with zero or very low tariffs.

Figure 1

One Imported Good Subject to Tariff



rately indicates a more restrictive policy. However, with a differentiated tariff structure, goods subject to high tariffs will tend to receive lower weight than goods subject to low tariffs. The reason is that the price of a good with a high tariff will tend to rise relative to a good with a low tariff, so consumers will tend to substitute the good with the low tariff for the one with the high tariff. As a result, in the calculation of the import-weighted average tariff, goods with high tariffs will tend to receive less weight than goods with low tariffs. This would tend to reduce the value of the index, which is precisely the opposite of what seems reasonable.⁷

Using Figures 2 and 3, let's examine more closely the usefulness of an average tariff weighted by import volumes. Identical to the preceding discussion, we use the case of two goods with different tariffs. In Figure 2, the left half of the diagram contains information on good M1 and the right half on good M2. Similar to Figure 1, the

demand for M1 is represented by D^{M1} and the demand for M2 is represented by D^{M2} . Note that the quantity of M1 increases with leftward movements along the horizontal axis and that the quantity of M2 increases with rightward movements along the horizontal axis. To simplify, but without losing any generality, the price in world markets for both goods is assumed to be P_W . Prior to the imposition of a tariff, P_W is the price faced by domestic producers and consumers for both goods. Thus, the quantity of imports of M1 is $M1_W$ and of M2 is $M2_W$.

Now assume tariffs are imposed such that a lower tariff rate is imposed on the good with the higher price elasticity of import demand (i.e., M1) than is imposed on the good with the lower price elasticity of import demand (i.e., M2).⁸ In other words, the tariff rate imposed on M1 is $(P_1 - P_W)/P_W$, while the tariff rate imposed on M2 is $(P_2 - P_W)/P_W$. Thus, as drawn, there is a negative

⁷ In an extreme case, a restriction could be so high that no imports occur, so that the restriction would receive no weight in the calculation.

⁸ The price elasticity of demand is the percentage change in quantity demanded divided by the percentage change in price. This elasticity is generally expressed as an absolute value, a convention that we follow in our discussion. Consequently, larger values for the price elasticity of demand are associated with flatter demand curves.

Figure 2

Tariff Rates and Import Demand Elasticities: Negative Correlation

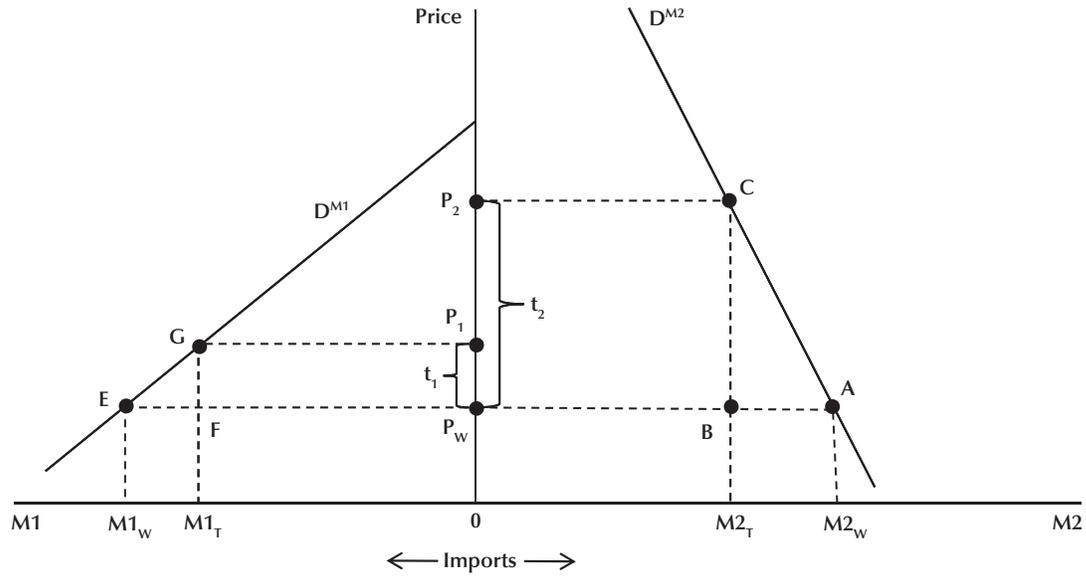
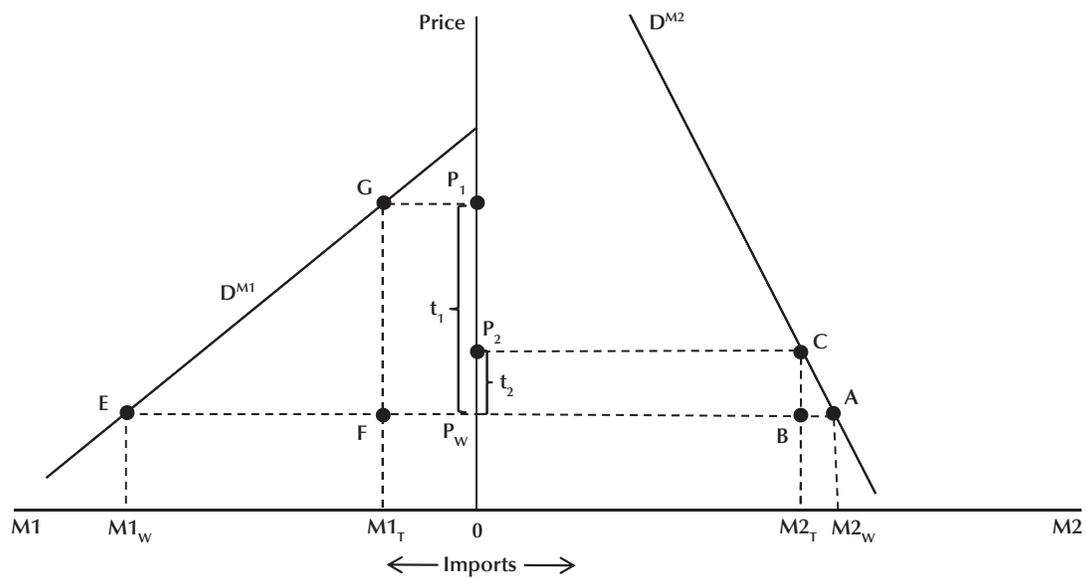


Figure 3

Tariff Rates and Import Demand Elasticities: Positive Correlation



correlation between the tariff rate and the elasticity. In this case the tariff on M1 causes the price for domestic consumers and producers to increase to P_1 and the tariff on M2 causes the price to increase to P_2 . As a result, imports would decrease to $M1_T$ and $M2_T$, respectively.

Using Figure 2, let t_1 be the specific (i.e., dollar amount) tariff for M1 and t_2 be the specific tariff for M2. Then, the trade-weighted average tariff rate, t_w , is: $t_w = (t_1M1_T + t_2M2_T)/(P_wM1_T + P_wM2_T)$.⁹ The numerator is the value of tariff revenue, while the denominator is the value of imports using world prices, which were assumed to be identical for the two goods.¹⁰

Now let's examine Figure 3. Once again, the left half contains information on good M1 and the right half on good M2, where the demand for M1 is represented by D^{M1} and the demand for M2 by D^{M2} . The price in world markets for both goods is assumed to be P_w . Prior to the imposition of a tariff, P_w is the price faced by domestic producers and consumers for both goods. Thus, the quantity of imports of M1 is $M1_w$ and of M2 is $M2_w$. Now assume tariffs are imposed such that a higher tariff rate is imposed on the good with the higher price elasticity of import demand (i.e., M1) than on the good with the lower price elasticity of import demand (i.e., M2). The tariff rate imposed on M1 is $(P_1 - P_w)/P_w$, while the tariff rate imposed on M2 is $(P_2 - P_w)/P_w$. Thus, there is a positive correlation between the tariff rate and the elasticity. In this case, the tariff on M1 causes the price for domestic consumers and producers to increase to P_1 and the tariff on M2 causes the price to increase to P_2 . As a result, imports would decrease to $M1_T$ and $M2_T$, respectively.

In Figure 3, compared with Figure 2, imports of M1 are lower and imports of M2 are higher. Thus, for the calculation of the trade-weighted average tariff rate, M1 will receive less weight

and M2 will receive more weight. Moreover, the absolute decrease in the quantity of imports of M1 exceeds the increase in the quantity of imports of M2. Recall also that the tariff rate on M1 (M2) in Figure 3 is the tariff rate on M2 (M1) in Figure 2. Thus, M1 (M2) is subject to a higher (lower) tariff rate in Figure 3 than in Figure 2. Consequently, the trade-weighted average tariff rate in Figure 3 must be less than in Figure 2. That trade is more restricted in Figure 3 than in Figure 2 suggests that the trade-weighted average tariff rate is a flawed measure.¹¹

Another way to show that the tariffs in Figure 3 are more restrictive than those in Figure 2 is to examine the deadweight losses. The deadweight losses in Figure 3 exceed those in Figure 2. These losses are determined by the sizes of the triangles formed by EFG for good M1 and by ABC for good M2. By visual inspection and by mathematics as well, the sum of the areas of EFG and ABC is larger in Figure 3 than in Figure 2. The economic reason for this result hinges on the correlation between tariff rates and import demand elasticities. For a specific good, the higher (lower) the tariff, the larger (smaller) the deadweight loss. In comparing Figure 2 with Figure 3, when the higher tariff is switched to the good that is relatively elastic and the lower tariff is switched to the good that is relatively inelastic, then the increase in the deadweight loss associated with M1 exceeds the decrease in the deadweight loss for M2. Thus, from the perspective of national well-being, trade restrictiveness is more pronounced for the situation in Figure 3 than in Figure 2.

A Better Way

One suggestion for improving the calculation of the import-weighted average tariff rate is to use the import volumes that would result under

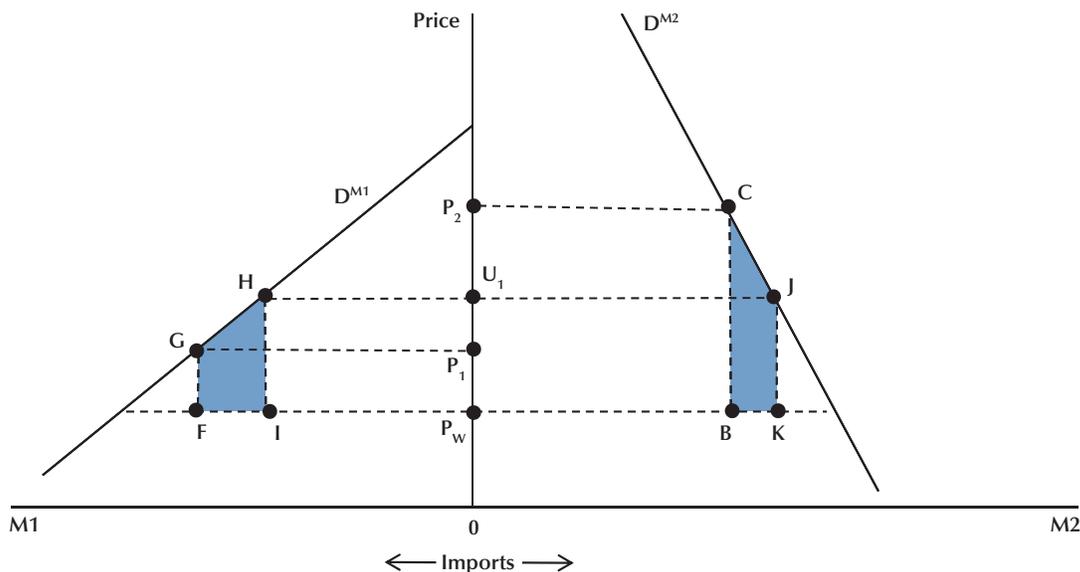
⁹ Often, this tariff rate is multiplied by 100 to express the rate in percentage terms.

¹⁰ The example uses two imported goods. Sometimes the calculation is made using only goods with tariffs. If all other goods can be imported without any restrictions, the calculation will overstate the degree of restrictiveness. As we shall discuss later, additional complications arise when imported goods are subjected to trade barriers that yield no tariff revenue.

¹¹ Another common measure of trade restrictiveness is the import weighted coefficient of variation of tariffs, which is the standard deviation of tariff rates divided by the trade-weighted average tariff rate. The reasoning is that if two tariff schedules generate identical import-weighted tariff rates, then the schedule with less variance and, hence, a smaller standard deviation is preferred because of relatively less distortion of relative prices. However, this index still relies on the calculation of the import-weighted average tariff rate. Most importantly, it may be unreliable because it is not derived directly from economic theory.

Figure 4

Trade Restrictiveness Index: Tariff Rates and Import Demand Elasticities Negatively Correlated



free trade to weight tariff rates rather than using the actual imports that result under current trade policy. One attractive feature of such an index is that it necessarily increases when any specific tariff rate is increased. However, because the actual trade flows under free trade are not directly observable, the trade flows and the resulting trade weights must be estimated. It turns out that the information required to estimate free-trade flows is the same as that necessary to estimate “true” indices, which are superior. We now illustrate how to construct an index that is connected to a true index, one based on the welfare or utility impacts of trade policy.

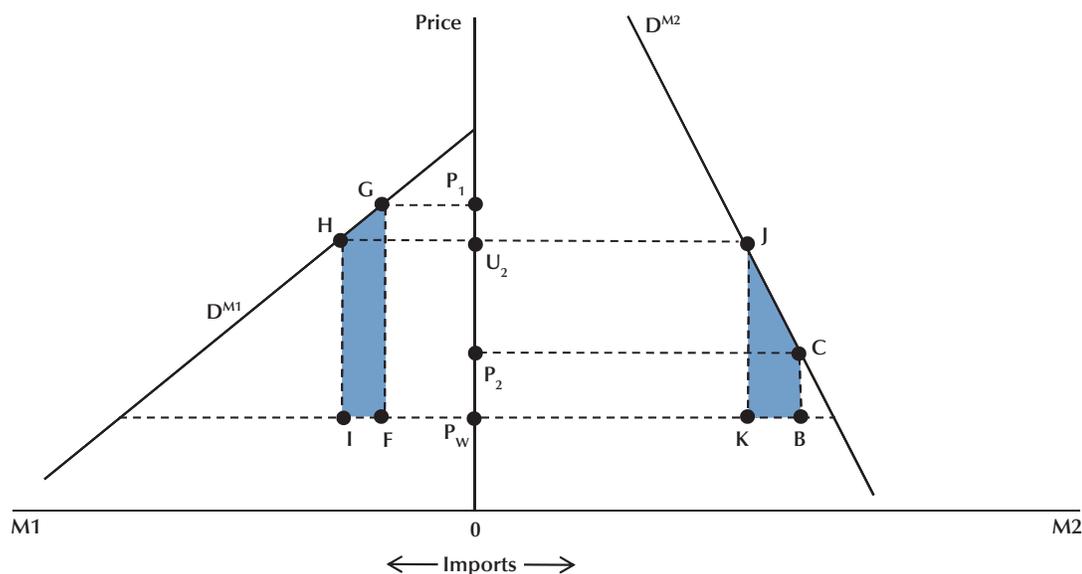
Figure 4 uses the same demand curves, prices, and tariff rates as in Figure 2. Recall that the tariff rates and the import demand elasticities are selected to be negatively correlated. The specific tariff on good M1 is $P_1 - P_W$ and on good M2 is $P_2 - P_W$. To find the uniform tariff, one must, without changing national well-being, increase the tariff on the good with the lower tariff and decrease the tariff on the good with the higher tariff until

the two tariffs are equal. In the present case, the tariff associated with U_1 meets this requirement. When the specific tariff on M1 increases from $P_1 - P_W$ to $U_1 - P_W$, the decline in welfare (due to the higher price and reduced imports) is represented by the area FGHI. At the same time, when the specific tariff on M2 decreases from $P_2 - P_W$ to $U_1 - P_W$, the increase in welfare (due to the lower price and increased imports) is represented by the area BCJK. Thus, the specific tariff, $U_1 - P_W$, is chosen so that the area FGHI equals the area BCJK. The trade restrictiveness index is simply $(U_1 - P_W)/P_W$.

Next, Figure 5 uses the same demand curves, prices, and tariff rates as in Figure 3. Recall that the tariff rates and the import demand elasticities are selected to be positively correlated. The specific tariff on good M1 is $P_1 - P_W$ and on good M2 is $P_2 - P_W$. As noted above, to find the uniform tariff, without changing national well-being, one must increase the tariff on the good with the lower tariff and decrease the tariff on the good with the higher tariff until the two tariffs are equal. In the present case, the tariff associated with U_2 meets

Figure 5

Trade Restrictiveness Index: Tariff Rates and Import Demand Elasticities Positively Correlated



this requirement. When the specific tariff on M1 decreases from $P_1 - P_w$ to $U_2 - P_w$, the increase in welfare (due to the lower price and increased imports) is represented by the area FGHI. At the same time, when the specific tariff on M2 increases from $P_2 - P_w$ to $U_2 - P_w$, the decrease in welfare (due to the higher price and reduced imports) is represented by the area BCJK. Thus, the specific tariff, $U_2 - P_w$, is chosen so that the area FGHI equals the area BCJK. The trade restrictiveness index is simply $(U_2 - P_w)/P_w$. Note that, consistent with our previous discussion, the trade restrictiveness index is larger in Figure 5 than in Figure 4.

MOVING FROM THEORY TO REALITY

So far, the focus here has been on how to aggregate tariff restrictions across different markets. In the graphical analysis, the number of different markets was restricted to two. In reality, the number of different markets is much larger. Kee, Nicita,

and Olarreaga (2009) note that it is common to have more than 5,000 tariff lines in a tariff schedule. However, aggregating across different markets is not the only aggregation challenge. An even larger challenge arises because tariffs are not the only form of trade restriction. One must also aggregate different *forms* of trade policies. In addition to tariff restrictions, trade is also restricted by a variety of other policies, such as quotas, anti-dumping duties, and technical/safety regulations.¹² As tariffs were negotiated downward during the second half of the twentieth century, non-tariff barriers tended to rise in importance. To allow these barriers to be compared with tariffs, a common approach is to construct *ad valorem* tariff equivalents of non-tariff barriers.¹³

¹² As noted by Lloyd, Croser, and Anderson (2009), as well as by many others, world agricultural markets are subject to numerous non-tariff policies that distort trade.

¹³ For example, a non-tariff barrier could take the form of limiting the quantity of imports. Such a quantity restriction likely causes the price in the importing country to increase from the world price. In this case, the *ad valorem* tariff equivalent is the difference between the domestic and world prices relative to the world price.

Such *ad valorem* tariff equivalents are an essential component in allowing Kee, Nicita, and Olarreaga (2009) to generate estimates of trade restrictiveness indices.¹⁴ Using a large, multi-country data set on tariffs and non-tariff barriers, they generate estimates using a partial equilibrium approach analogous to the graphical analysis in the previous figures. The focus here will be on the resulting formula for calculating the trade restrictiveness indices rather than on the underlying details of the estimation.¹⁵

The Uniform Tariff Associated with Unchanged Well-Being

This index, which we identify as TRI, attempts to answer a basic question: What is the uniform tariff that, if applied to imports in place of the current levels of restriction, would allow home welfare to remain at its current level? As derived by Kee, Nicita, and Olarreaga (2009), the formula for this partial equilibrium trade restrictiveness index that answers this question is as follows:

$$(1) \quad TRI_c = \left(\frac{\sum_n m_{n,c} \varepsilon_{n,c} T_{n,c}^2}{\sum_n m_{n,c} \varepsilon_{n,c}} \right)^{1/2}.$$

That is, for a country, c , importing goods designated by $n = 1 \dots N$, the trade restrictiveness index is the square root of the weighted sum of squared protection levels ($T_{n,c}^2$), where the weights are given by the elasticity of import demand ($\varepsilon_{n,c}$) and imports ($m_{n,c}$).¹⁶

So far in this paper, the focus has been on trade distortions a country imposes that relate directly to its economic well-being. Such a focus allows one to identify the uniform tariff that, if applied to imports in place of the current structure of protection, leaves the home country's well-

being at its current level. This information is potentially very useful. There are, however, other trade restrictiveness indices, two of which are discussed below, that provide additional information that would be useful in trade negotiations and in understanding trade flows.¹⁷

The Uniform Tariff Associated with Unchanged Aggregate Imports

Policymakers and the general public are more comfortable thinking in concrete terms. Kee, Nicita, and Olarreaga (2009) generate estimates of trade restrictions that do not hinge on the abstract notion of economic well-being but instead focus on a more concrete measure: the level of trade flows. They create an overall trade restrictiveness index (OTRI) to determine the uniform tariff that, if imposed on imports in place of the existing structure of protection, would leave aggregate imports at their current level.¹⁸ The formula for their index is as follows:

$$(2) \quad OTRI_c = \frac{\sum_n m_{n,c} \varepsilon_{n,c} T_{n,c}}{\sum_n m_{n,c} \varepsilon_{n,c}}.$$

In this case, the trade restrictiveness index is the weighted sum of protection levels ($T_{n,c}$), where the weights are the elasticity of import demand ($\varepsilon_{n,c}$) and imports ($m_{n,c}$).¹⁹ Note that unlike TRI, the variance of protection does not affect this trade restrictiveness index. Moreover, note that this index cannot exceed TRI.²⁰

¹⁷ See Bach and Martin (2001) and Manole (2004) for a discussion of additional indices.

¹⁸ Lloyd, Croser, and Anderson (2009) make a distinction between a welfare reduction index, which is identified as a specific trade restrictiveness index (TRI) in this paper, and trade reduction indices, which are exemplified by the overall trade restrictiveness index (OTRI) and the market access overall trade restrictiveness index (MA-OTRI).

¹⁹ This index is Anderson and Neary's (2003) "mercantilist trade restrictiveness index."

²⁰ The economic intuition for this result is straightforward. The change from a differentiated to a uniform tariff structure is welfare-improving because such a change eliminates the distortions stemming from the relative price changes caused by a differentiated tariff structure. Because the calculation of OTRI does not preclude economic well-being (i.e., real income) from increasing, the rate associated with TRI must be higher than (or at least as large as) OTRI so that economic well-being is held constant.

¹⁴ A similar comment applies to recent work by Manole and Spatareanu (2010) and by Lloyd, Croser, and Anderson (2009). The former authors generate yearly trade restrictiveness indices, taking account of all import tariffs for 131 countries between 1990 and 2004; the latter authors produce indices between 1955 and 2007 related to the trade and welfare impacts of distortions to agricultural markets.

¹⁵ See Kee, Nicita, and Olarreaga (2009 and forthcoming).

¹⁶ Kee, Nicita, and Olarreaga (2009) note that the formula for this trade restrictiveness index is based on a second-order linear approximation of "Harberger triangles."

The Uniform Tariff Associated with Unchanged Aggregate Exports

Another potentially useful trade restrictiveness index is based on the following question: What is the uniform tariff that, if imposed by all trading partners on exports of country c in place of their current structure of protection, would leave exports of country c at their current level? This market access overall trade restrictiveness index (MA-OTRI) is the mirror image from the exporter's perspective of OTRI. The formula for MA-OTRI is as follows:

$$(3) \quad MA-OTRI_c = \frac{\sum_p \sum_n m_{n,c,p} \varepsilon_{n,p} T_{n,c,p}}{\sum_p \sum_n m_{n,c,p} \varepsilon_{n,p}}.$$

The subscript p identifies the trading partners of country c . That is, this index is the weighted sum of protection levels in other countries ($T_{n,c,p}$), where the weights are the elasticities of demand in other countries ($\varepsilon_{n,p}$) and their imports from c ($m_{n,c,p}$).

Results and Insights

As mentioned previously, estimates of trade restrictiveness indices have been produced by Kee, Nicita, and Olarreaga (2009) and by Manole and Spatareanu (2010). These indices, which are constructed using many goods for many countries, require information on the protection levels associated with tariffs and non-tariff barriers, the elasticity of import demand, and the level of imports.²¹ Acquiring and, in many cases, generating estimates of the required information is a major job. Moreover, because all this information may change over time, the estimates of these indices are also likely to change over time.

Using a partial equilibrium approach, Kee, Nicita, and Olarreaga (2009) produce estimates for 78 countries of three trade restrictiveness

indices—TRI, OTRI, and MA-OTRI—for two cases, one of which is focused solely on tariffs and one of which combines tariffs and non-tariff barriers. The estimates are based on data for the early 2000s. Table 1 presents their estimates for the uniform tariff based on the combined effects of tariffs and non-tariff barriers. Using a general equilibrium approach, Manole and Spatareanu (2010) generate annual estimates of TRI based solely on tariffs for 131 countries for as many years as the data allowed between 1990 and 2004.²² The estimates in both papers provide a number of insights about trade restrictiveness and allow for some interesting analyses. Some of these results and insights are highlighted below.

Let's start with the indices generated by Kee, Nicita, and Olarreaga (2009). The simple average across countries of trade restrictiveness for specific indices that combine tariff and non-tariff barriers is as follows: OTRI, 0.182; MA-OTRI, 0.161; and TRI, 0.332. The OTRI estimates range from 0.017 in Hong Kong to 0.533 in Tanzania. The MA-OTRI estimates range from 0.002 in Algeria to 0.657 in Mauritius. The TRI estimates range from 0.087 in both Costa Rica and Uganda to 0.671 in Tanzania. The trade restrictiveness imposed and faced by the United States is slightly below average: OTRI, 0.104; MA-OTRI, 0.130; and TRI, 0.294. In ranking the 78 countries with 1 being the least restrictive and 78 being the most restrictive, the ranking of the United States is as follows: OTRI, 21; MA-OTRI, 38; and TRI, 35.

Non-tariff barriers constitute a substantial portion of trade restrictiveness for many countries. For example, the average of trade restrictiveness using only tariffs relative to using tariffs and non-tariff barriers is 0.555 for OTRI, 0.305 for MA-OTRI, and 0.497 for TRI. In other words, on average across countries, tariffs as a share of the total effect of tariffs and non-tariff barriers account for 56 percent of OTRI, 31 percent of MA-OTRI, and 50 percent of TRI.

For a number of countries, non-tariff barriers provide more trade restrictiveness than tariffs. For example, the TRI for the United States solely

²¹ The estimation of these indices requires the authors to deal with numerous challenging data and econometric issues, most of which are beyond the scope of this paper. Assumptions, which can be questioned, must be made. For example, Kee, Nicita, and Olarreaga (2009) assume that an individual country, even a large trader such as the United States, does not affect world prices. Such an assumption has empirical support. For example, Magee and Magee (2008) found that the United States had little power to affect world prices through its trade policies.

²² One reason for the difference in country coverage is that Kee, Nicita, and Olarreaga (2009) combine members of the European Union into one "country," while Manole and Spatareanu (2010) do not.

Table 1**Trade Restrictiveness Indices**

Country	OTRI	Rank	MA-OTRI	Rank	TRI	Rank
Albania	0.124	26	0.340	69(T)	0.150	8
Algeria	0.392	73	0.002	1	0.557	71
Argentina	0.181	50	0.275	64	0.279	33
Australia	0.119	23(T)	0.147	46	0.250	26
Bangladesh	0.255	62(T)	0.346	71	0.399	56
Belarus	0.168	44	0.101	32	0.312	41
Bolivia	0.148	35	0.122	37	0.272	32
Brazil	0.270	64	0.149	47	0.497	68
Brunei	0.185	51	0.056	16	0.596	73
Burkina Faso	0.158	40(T)	0.121	36	0.268	31
Cameroon	0.164	43	0.138	45	0.224	20
Canada	0.063	7	0.072	24	0.191	12(T)
Chile	0.110	22	0.158	49	0.202	14(T)
China	0.204	54	0.066	19(T)	0.343	45
Colombia	0.249	61	0.132	39(T)	0.456	61
Costa Rica	0.050	5	0.202	53	0.087	1(T)
Cote d'Ivoire	0.315	67(T)	0.263	62	0.495	67
Czech Republic	0.049	4	0.027	10	0.094	3
Egypt	0.411	74	0.088	30	0.586	72
El Salvador	0.132	28	0.454	76	0.257	28
Estonia	0.024	2	0.064	18	0.132	6
Ethiopia	0.151	36	0.490	77	0.222	19
European Union	0.079	13	0.086	29	0.406	60
Gabon	0.155	38	0.003	2	0.178	11
Ghana	0.178	46(T)	0.321	68	0.296	36
Guatemala	0.180	49	0.349	72	0.356	47(T)
Honduras	0.085	18	0.379	75	0.161	9
Hong Kong	0.017	1	0.174	51	0.122	5
Hungary	0.119	23(T)	0.055	15	0.259	29(T)
Iceland	0.064	8	0.226	57	0.234	21
India	0.327	70	0.162	50	0.469	62
Indonesia	0.080	14	0.136	43	0.202	14(T)
Japan	0.319	69	0.076	26(T)	0.660	77
Jordan	0.255	62(T)	0.209	55	0.405	59
Kazakhstan	0.162	42	0.036	11	0.364	50
Kenya	0.131	27	0.340	69(T)	0.213	16(T)
Latvia	0.139	32(T)	0.046	14	0.337	44
Lebanon	0.202	53	0.137	44	0.402	57(T)
Lithuania	0.057	6	0.116	34	0.191	12(T)
Madagascar	0.043	3	0.277	65(T)	0.109	4
Malawi	0.156	39	0.197	52	0.254	27
Malaysia	0.242	59(T)	0.067	21(T)	0.476	63

Table 1, cont'd**Trade Restrictiveness Indices**

Country	OTRI	Rank	MA-OTRI	Rank	TRI	Rank
Mali	0.135	31	0.015	6	0.213	16(T)
Mauritius	0.217	57	0.657	78	0.402	57(T)
Mexico	0.315	67(T)	0.067	21(T)	0.493	66
Moldova	0.074	11	0.203	54	0.243	24
Morocco	0.484	77	0.223	56	0.627	75(T)
New Zealand	0.133	29(T)	0.355	73	0.305	38
Nicaragua	0.141	34	0.243	58	0.307	39
Nigeria	0.424	75	0.012	5	0.617	74
Norway	0.083	16(T)	0.022	8(T)	0.345	46
Oman	0.178	46(T)	0.010	4	0.365	51(T)
Papua New Guinea	0.101	19	0.104	33	0.308	40
Paraguay	0.207	55	0.135	42	0.356	47(T)
Peru	0.229	58	0.133	41	0.397	55
Philippines	0.170	45	0.076	26(T)	0.361	49
Poland	0.152	37	0.062	17	0.281	34
Romania	0.179	48	0.154	48	0.300	37
Russia	0.288	66	0.022	8(T)	0.480	64
Rwanda	0.133	29(T)	0.083	28	0.242	23
Saudi Arabia	0.158	40(T)	0.016	7	0.371	53
Senegal	0.375	72	0.246	59	0.537	70
Slovenia	0.194	52	0.038	12	0.323	43
South Africa	0.081	15	0.074	25	0.162	10
Sri Lanka	0.076	12	0.277	65(T)	0.142	7
Sudan	0.458	76	0.093	31	0.627	75(T)
Switzerland	0.067	9	0.066	19(T)	0.247	25
Tanzania	0.533	78	0.251	60	0.671	78
Thailand	0.139	32(T)	0.132	39(T)	0.259	29(T)
Trinidad & Tobago	0.083	16(T)	0.039	13	0.321	42
Tunisia	0.368	71	0.264	63	0.527	69
Turkey	0.102	20	0.117	35	0.235	22
Uganda	0.068	10	0.377	74	0.087	1(T)
Ukraine	0.285	65	0.069	23	0.489	65
United States	0.104	21	0.130	38	0.294	35
Uruguay	0.211	56	0.300	67	0.365	51(T)
Venezuela	0.242	59(T)	0.009	3	0.393	54
Zambia	0.121	25	0.252	61	0.219	18
Mean	0.182		0.161		0.332	
Range	0.017-0.533		0.002-0.657		0.087-0.671	

NOTE: This table is based on Table 4 in Kee, Nicita, and Olarreaga (2009). The measure includes the impact of tariffs and non-tariff barriers. The ranks are ordered from least restrictive (1) to most restrictive (78); (T) indicates a tie in rank.

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based on tariffs is 0.051 and based on tariffs and non-tariff barriers is 0.294; thus, tariffs account for less than 20 percent of the overall trade restrictiveness. Tariffs also account for less than 20 percent of the overall trade restrictiveness for the European Union.

Looking across all countries, the ratios of tariff to non-tariff barriers for trade restrictiveness range from zero to one. For example, the ratio pertaining to overall trade restrictiveness for Hong Kong, which has no tariffs, is zero, while the ratio for Gabon, which uses only tariffs, is one. Obviously, for many countries, a focus exclusively on tariffs produces a misleading view of trade restrictiveness.²³

The results in Table 1 also show that the TRI, which is based on economic well-being, is larger than the OTRI, which is based on trade volume. For many countries, especially developed countries, the TRI is more than double the OTRI. For example, the TRI for the United States (0.294) is nearly three times its OTRI (0.104). For the European Union, its TRI (0.406) is more than five times its OTRI (0.079).

By using these indices in some straightforward calculations, Kee, Nicita, and Olarreaga (2009) generate some additional observations that can provide the foundation for additional studies. They find a negative association between OTRI and GDP per capita (technically the natural logarithm of GDP per capita), which suggests that rich countries tend to impose lower trade barriers on imports. They also find a negative association between MA-OTRI and GDP per capita, which suggests that rich countries face lower trade restrictions on their exports than do poor countries. The preceding findings may be explained by reciprocity in trade agreements in that countries with high import trade barriers likely face high barriers on their exports.

Finally, Kee, Nicita, and Olarreaga (2009) find no clear pattern between TRI and GDP per capita. They suggest that the variance of the pro-

tection structure in rich countries tends to offset the lower trade restrictions associated with OTRI and MA-OTRI. Also, structural adjustment programs may reduce the tariff variance and levels in many low-income countries.

However, Manole and Spatareanu (2010) do find a negative relationship between trade restrictiveness and per capita income. They argue that lower protection leads to higher per capita income. Many reasons can be offered for the differing results between Kee, Nicita, and Olarreaga (2009) and Manole and Spatareanu (2010). First, the former study explores only the relationship between trade restrictiveness and GDP per capita, while the latter study controls for the impact of other variables that might affect GDP per capita. Accounting for the impact of other variables could influence the estimated relationship between trade restrictiveness and GDP per capita. Second, the former study uses the level of trade restrictiveness and the natural logarithm of GDP, while the latter study uses the natural logarithms of both variables. Estimations based on different functional forms, semi-log versus log-linear, can lead to differing results. Third, the former's measure of trade restrictiveness uses tariffs and non-tariff barriers, while the latter uses only tariffs. As noted previously, a measure based on tariffs and non-tariff barriers might well behave differently from a measure based on only tariffs. Moreover, differences in the data used (e.g., countries in the sample and the years considered) and the estimation of trade restrictiveness likely come into play as well.

To provide additional information on the similarity of the generated indices, I have taken the countries used in both studies and focused on the overall restrictiveness indices that are based on tariffs alone. For the 74 common countries, the average trade restrictiveness index generated by Manole and Spatareanu (2010) was 0.169, with a range of 0 to 0.45, while the average trade restrictiveness index generated by Kee, Nicita, and Olarreaga (2009) was 0.153, with a range of 0.046 to 0.418.²⁴ The correlation coefficient between

²³ Although these specific examples use estimates of TRI, the generalizations in the paragraph pertain to the other measures of trade restrictiveness as well. For example, Kee, Nicita, and Olarreaga (2009) note that in 34 of the 78 countries the impact of non-tariff barriers on OTRI is larger than the impact of tariffs. Thus, a focus on tariffs alone can be misleading.

²⁴ Because Manole and Spatareanu (2010) calculate a time series for each country, while Kee, Nicita, and Olarreaga (2009) generate one estimate for each country, additional calculations underlie this simple calculation. Details are available upon request.

the two measures was 0.56. Thus, these two indices, while similar, are far from interchangeable and caution should be taken in using and interpreting empirical results using these indices.

CONCLUSION

Constructing a single number that accurately summarizes the effects of various international trade distortions is a major challenge. Trade restrictiveness indices represent a significant improvement over commonly used measures of the stance of trade policy, such as trade-weighted average tariffs, coefficients of variation of tariffs, and non-tariff barrier coverage ratios. Trade restrictiveness indices are grounded in theory and can handle different forms of protection simultaneously.

This paper has highlighted the existence of three trade restrictiveness indices. The existence of multiple indicators follows from the issue under consideration. One measure cannot simultaneously capture the trade distortions that a country imposes on itself and the trade distortions that a country imposes on its trading partners. In many cases, the preferred measure is one that relates trade restrictions to domestic welfare. This measure, identified as TRI (i.e., trade restrictiveness index), converts a country's current structure of protection into a uniform tariff rate so that the country's economic well-being is unchanged. Meanwhile, two other measures discussed here, focused on trade flows and market access, gener-

ate measures of uniform tariff rates that maintain the level of trade. For example, the measure identified as OTRI (i.e., overall trade restrictiveness index) converts a country's current structure of protection into a uniform tariff rate so that the country's level of aggregate imports is unchanged, while the measure identified as MA-OTRI (i.e., market access overall trade restrictiveness index) converts the current structures of protection for all the trading partners of a country into a uniform tariff rate so the country's level of aggregate exports is unchanged.

Recent progress in estimating trade restrictiveness indices suggests that such indices will become increasingly prominent in informing those involved in trade negotiations and in research. For example, the indices provide basic information for trade negotiations. They can be used in growth studies to assess the impact of trade policies on income. They can also be used in research aimed at explaining trade costs. These indices also provide various insights about the openness of an economy and how openness has changed over time. As illustrated by Kee, Nicita, and Olarreaga (2009), the indices allow for comparisons of developed economies with developing economies. They found that poor countries have more restrictive trade policies than rich countries, but also face relatively more restrictive trade policies. Finally, the indices can be used for specific issues, such as assessing a country's fulfillment of its World Trade Organization commitment.

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The Geographic Distribution and Characteristics of U.S. Bank Failures, 2007-2010: Do Bank Failures Still Reflect Local Economic Conditions?

Craig P. Aubuchon and [David C. Wheelock](#)

The financial crisis and recession that began in 2007 brought a sharp increase in the number of bank failures in the United States. This article investigates characteristics of banks that failed and regional patterns in bank failure rates during 2007-10. The article compares the recent experience with that of 1987-92, when the United States last experienced a high number of bank failures. As during the 1987-92 and prior episodes, bank failures during 2007-10 were concentrated in regions of the country that experienced the most serious distress in real estate markets and the largest declines in economic activity. Although most legal restrictions on branch banking were eliminated in the 1990s, the authors find that many banks continue to operate in a small number of markets and are vulnerable to localized economic shocks. (JEL E32, G21, G28, R11)

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The financial crisis and recession that began in 2007 brought a sharp increase in the number of failures of banks and other financial firms in the United States. The failures and near-failures of very large financial firms, such as Bear Stearns, Lehman Brothers, and American International Group (AIG), grabbed the headlines. However, 206 federally insured banks (commercial banks, savings banks, and savings and loan associations, hereafter “banks”)—or 2.4 percent of all banks in operation on December 31, 2006—failed between January 1, 2007, and March 31, 2010.¹ Failed banks held \$373 billion of deposits (6.5 percent of total U.S. bank deposits) as of June 30, 2006; Washington Mutual Bank alone accounted for \$211 billion of deposits in failed banks.

The recent spike in bank failures followed a period of relative tranquility in the U.S. banking industry. Between 1995 and 2007, on average

fewer than four banks failed per year. Bank failures were much more common in the 1980s and early 1990s, however, including more than 100 commercial bank failures each year from 1987 to 1992. As percentages of the total number of U.S. banks and volume of bank deposits, the failures of 2007-10 approach the failures of the 1980s and early 1990s (Figures 1 and 2).²

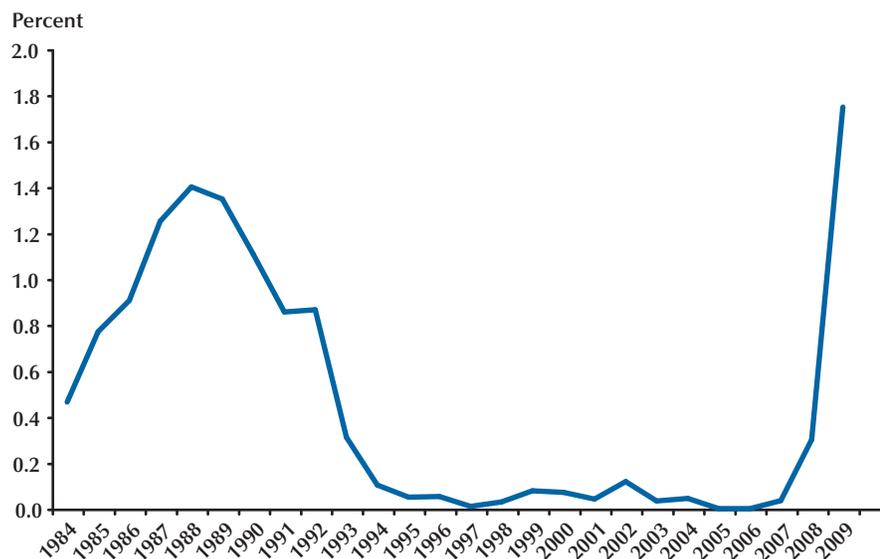
The bank failures of the 1980s and early 1990s were concentrated in regions of the country that

¹ The 206 failures include only banks that were declared insolvent by their primary regulator and were either liquidated or sold, in whole or in part, to another financial institution by the Federal Deposit Insurance Corporation (FDIC). This total does not include banks, bank holding companies, or other firms that received government assistance but remained going concerns, such as the Federal National Mortgage Association (Fannie Mae), Federal Home Loan Mortgage Corporation (Freddie Mac), Citigroup, and GMAC.

² Figures 1 and 2 include data for both commercial banks and savings institutions but exclude another 747 savings institutions (with \$394 billion of total assets) that were resolved by the Resolution Trust Corporation between 1989 and 1995 (Curry and Shibut, 2000).

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Figure 1**Bank Failures as a Percent of Total Banks (annually, 1984-2009)**

NOTE: Data include all commercial banks and savings institutions except institutions resolved by the Resolution Trust Corporation.

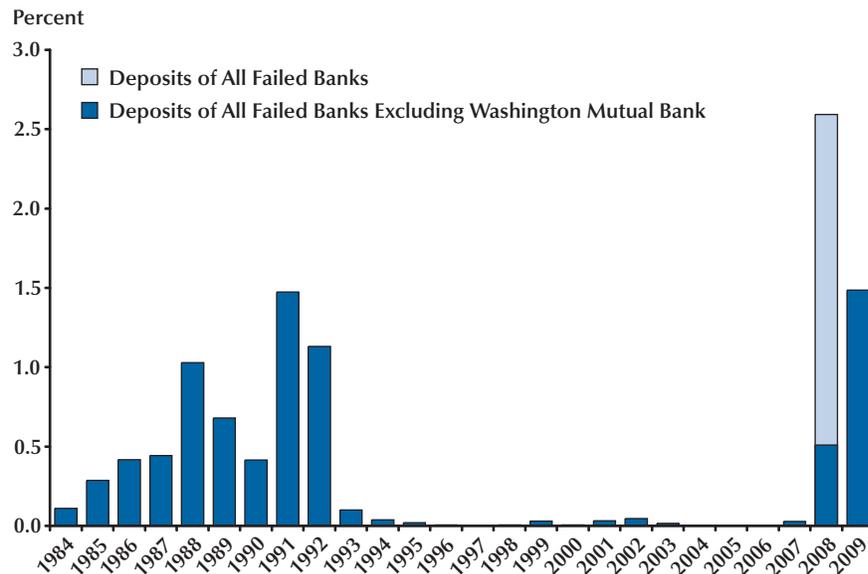
SOURCE: FDIC *Historical Statistics on Banking* and authors' calculations.

experienced unusual economic distress. More than half of all bank failures occurred in Texas alone. Texas and other energy-producing states experienced high numbers of bank failures following a sharp drop in energy prices and household incomes in the mid-1980s. Later, in the early 1990s, New England states had numerous bank failures when state incomes and real estate prices declined. Analysts argued that the concentration of bank failures in regions experiencing high levels of economic distress reflected the geographically fragmented structure of the U.S. banking system in which banks were not permitted to operate branches in more than one state (e.g., Calomiris, 1992; Horvitz, 1992; Federal Deposit Insurance Corporation [FDIC], 1997). Bank failures were especially numerous in Texas and other states that had long restricted branch banking within their borders. Many states eased intrastate branching restrictions during the 1980s, and the Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994 subsequently removed federal restric-

tions on interstate branching.³ Proponents of deregulation argued that the removal of branching restrictions would encourage banks to diversify geographically, which would lessen the impact of local economic shocks on bank performance.

This article examines the characteristics of bank failures during 2007-10 and investigates whether the geographic distribution of failures reflected differences in local economic conditions. The removal of restrictions on branch banking, both within and across state lines, has been followed by substantial consolidation of the U.S. banking industry. Bank failures and mergers have reduced the number of U.S. banks from a postwar peak of 14,496 in 1984 to fewer

³ State and federal laws prohibited interstate branching before the Riegle-Neal Act of 1994, and state laws governed branching within states. By the 1980s, a few states permitted entry by out-of-state bank holding companies, usually through the acquisition of an existing bank. However, holding companies were not permitted to merge the operations of their subsidiary banks located in different states. See Spong (2000) for more information about branching and other U.S. bank regulations.

Figure 2**Percentage of U.S. Bank Deposits in Failed Banks (annually, 1984-2009)**

NOTE: Data include all commercial banks and savings institutions except institutions resolved by the Resolution Trust Corporation.

SOURCE: FDIC *Historical Statistics on Banking* and authors' calculations.

than half that number today, and many banks now operate extensive branching networks. Nonetheless, even now most banks have offices in no more than a few states, and many have offices in just a single market. Although banks can reduce their vulnerability to local economic shocks by participating in loans made in other markets, investing in securities, and using other means, the large number of banks that operate predominantly in a single market and serve mainly a local clientele suggests that bank failures are likely to be more numerous in locations experiencing adverse economic shocks.⁴

⁴ This article does not address why many banks choose not to operate in more than one market. However, for some banks, the costs of managing operations in multiple markets might outweigh the potential benefits of geographic diversification. Emmons, Gilbert, and Yeager (2004) find that small, community banks could reduce their failure risk more by simply increasing their size, regardless of where growth occurs, than by expanding into multiple markets. However, Berger and DeYoung (2006) find that, over time, advances in information-processing technology have reduced the costs of managing far-flung operations, suggesting that banks increasingly will find it advantageous to operate in multiple markets.

We compare the characteristics of failing and non-failing banks during 2007-10, focusing on differences in size and branch operations. We derive state-level bank failure rate measures using branch-level data, which allows us to capture the impact of interstate branching on state-level failure rates. We then investigate the correlation between state bank failure rates and measures of state economic conditions, including measures of distress in housing markets, as well as personal income growth and unemployment rates. Finally, we compare our findings for 2007-10 with evidence on bank failures during the 1980s and early 1990s. We find that, as in earlier periods, during 2007-10 bank failure rates typically were higher in states experiencing more severe economic distress. Thus, even though most branching restrictions were removed more than a decade ago, the regional patterns of bank failures during 2007-10 indicate that many banks remain vulnerable to local economic shocks.

The next section profiles U.S. bank failures during 2007-10. First, we briefly describe the failures and near-failures of very large financial organizations that succumbed to the collapse of the U.S. housing and mortgage markets. We then focus explicitly on commercial bank and savings institution failures and compare failing and non-failing banks in terms of size and branching characteristics. We similarly compare failing and non-failing commercial banks during 1987-92. Subsequently, we derive state-level bank failure rates and investigate the correlation between failure rates and measures of the housing boom and subsequent bust, as well as other measures of state economic conditions. Again, we compare the recent experience with that of 1987-92. The final section summarizes our findings and conclusions.

PROFILE OF BANKS THAT FAILED DURING 2007-10

Large Financial Institution Failures and Near-Failures

The recent financial crisis and recession was punctuated by several high-profile financial failures and near-failures. This article focuses on the failures of commercial banks and savings institutions. However, we briefly describe the failures and near-failures of some other large financial firms during the financial crisis and recession of 2007-10. The financial crisis was triggered when the housing boom ended and house prices began to fall in many markets. By 2006-07, falling house prices had led to rising home mortgage delinquency rates, which lowered the profits of mortgage lenders, such as Countrywide Financial Corporation, Washington Mutual Corporation, and GMAC, Incorporated. All three of these bank holding companies incurred enormous losses on the mortgage portfolios of their subsidiary banks. Countrywide was acquired by Bank of America in 2008. Washington Mutual was declared insolvent and closed by the Office of Thrift Supervision in September 2008. JPMorgan Chase later acquired the banking operations of Washington Mutual in a transaction facilitated by the FDIC.⁵ GMAC remains a going concern, but to date has received

a total of \$17.2 billion of government support under the Troubled Asset Relief Program (TARP).⁶

Other casualties of the collapse of house prices and rise in mortgage delinquencies included Bear Stearns and Company, Lehman Brothers, Federal National Mortgage Association (Fannie Mae), Federal Home Loan Mortgage Corporation (Freddie Mac), American International Group (AIG), and several large bank holding companies, including Citigroup, Bank of America, Wachovia Corporation, and National City. Bear Stearns and Lehman Brothers were investment banks that invested heavily in mortgage-backed securities for their own accounts and for hedge funds they created and marketed to other investors. The values of mortgage-backed securities fell when subprime mortgage delinquency rates began to rise in 2007 and hedge funds and other investors in subprime mortgages experienced substantial losses. The hedge funds created by Bear Stearns were among the largest and most prominently affected. At first, Bear Stearns covered the losses in its hedge funds, but eventually the funds declared bankruptcy. Bear Stearns itself faced bankruptcy in March 2008 when the firm's creditors refused to renew short-term loans to the firm. The Federal Reserve prevented a bankruptcy filing by creating a special-purpose vehicle (Maiden Lane, LLC) that invested in \$30 billion of mortgage-backed securities held by Bear Stearns, which facilitated the acquisition of Bear Stearns by JPMorgan Chase.⁷ By contrast, when the creditors of Lehman Brothers were no longer willing to lend to the firm, the Fed determined that Lehman

⁵ See the FDIC press release, "JPMorgan Chase Acquires Banking Operations of Washington Mutual" (www.fdic.gov/news/news/press/2008/pr08085.html).

⁶ The TARP was established by the Emergency Economic Stabilization Act (HR 1424), which President George W. Bush signed into law on October 3, 2008. The nine largest U.S. bank holding companies were all required to accept government capital under the program. Other banks could apply for capital under the TARP, but only those deemed viable by their primary regulator were eligible to receive capital. Of some 650 banks that received TARP capital, only three subsequently failed before March 31, 2010. These three banks constituted just 1.6 percent of the total number of bank failures between October 1, 2008, and March 31, 2010.

⁷ Details of this transaction are available on the website of the Federal Reserve Bank of New York (www.newyorkfed.org/newsevents/news/markets/2008/rp080324.html).

lacked sufficient assets to serve as collateral for a rescue loan and the firm was forced to file for bankruptcy in September 2008.

Fannie Mae and Freddie Mac are government-sponsored enterprises that provide support for the housing market by purchasing home mortgages from loan originators. As government-sponsored corporations, Fannie Mae and Freddie Mac traditionally enjoyed lower borrowing costs than most private firms because many investors believed that the federal government would stand behind the firms' debts even though they were privately held companies. Their implicit federal guarantees allowed Fannie Mae and Freddie Mac to become highly leveraged by borrowing heavily to invest in large portfolios of mortgages and mortgage-backed securities. Both firms grew rapidly during the past decade and became significant purchasers of nonprime mortgage-backed securities (Leonnig, 2008; Greenspan, 2010). The increase in subprime mortgage delinquency rates and decline in the value of subprime mortgage-backed securities quickly eroded the thin capital of both firms, and they were placed under federal government conservatorship in September 2008.⁸ Since then, the firms have required billions of dollars of capital from the federal government to remain going concerns.

AIG is a large financial conglomerate with global operations. The traditional business of AIG is insurance—automobile, life, and so on. AIG also owns a federally chartered savings bank (AIG Bank, FSB). AIG's unregulated activities, notably the underwriting of credit default insurance, produced substantial losses when the housing market slumped badly in 2007-08. These unregulated operations had grown so large that government officials feared that AIG's sudden collapse could impose severe losses on other firms and seriously impair the functioning of the entire financial system. To avoid this outcome the U.S. Treasury and Federal Reserve provided AIG with loans and a capital injection in October 2008 when it appeared that the firm would default on its outstanding debts.⁹

⁸ See "Statement by Secretary Henry M. Paulson, Jr. on Treasury and Federal Housing Finance Agency Action to Protect Financial Markets and Taxpayers" (www.ustreas.gov/press/releases/hp1129.htm).

Washington Mutual Bank, a federally chartered savings bank with some \$300 billion of assets, was declared insolvent by the Office of Thrift Supervision in September 2008 and placed under the receivership of the FDIC. No other bank with more than \$100 billion of assets was liquidated or sold by the FDIC during 2007-10. However, among other large bank holding companies, both Citigroup and Bank of America received special assistance from the federal government in the form of capital, portfolio guarantees, and liquidity access; and Wachovia and National City were acquired by other bank holding companies when it became clear that neither remained viable on its own. In providing capital and guarantees to Citigroup, Bank of America, and AIG, as well as assistance to facilitate the acquisition of troubled firms such as Bear Stearns, the Federal Reserve and Treasury Department sought to promote stability of the financial system by avoiding possible systemic repercussions should such a large financial firm fail or declare bankruptcy.¹⁰

Comparison of Failed and Non-Failing Commercial Banks and Savings Institutions

Next we focus on the characteristics of commercial banks and savings institutions that were declared insolvent by their primary regulator and whose deposits were either liquidated or sold to another institution by the FDIC. With some \$300 billion of assets and \$189 billion of deposits when it was closed by the Office of Thrift Supervision, Washington Mutual Bank was by far the largest bank failure in U.S. history. Only five banks had more assets than Washington Mutual when it failed, and Washington Mutual was nearly 10 times larger in terms of total assets than the next-largest bank to fail between January 2007 and March 2010.¹¹

⁹ See the Board of Governors' October 8, 2008, press release (www.federalreserve.gov/newsevents/press/other/20081008a.htm).

¹⁰ See Bullard, Neely, and Wheelock (2009) for a discussion of systemic risk and the financial crisis of 2008-09.

¹¹ JPMorgan Chase, Bank of America, Citibank, Wachovia Bank, and Wells Fargo Bank had more total assets than Washington Mutual at the time of its failure.

Between January 1, 2007, and March 31, 2010, 206 commercial banks and savings institutions (savings banks and savings and loan associations, hereafter “thrifts”) were declared insolvent by their primary regulator and either closed or sold, in whole or in part, to another institution.¹² This total includes Washington Mutual but does not include AIG, Bank of America, Citigroup, Fannie Mae, Freddie Mac, GMAC, and other firms that received special government assistance in the form of loans, guarantees, or capital injections to avoid failure. It also does not include Bear Stearns or Lehman Brothers, which were not depository institutions or bank holding companies, and it does not include Countrywide Financial Corporation, National City Corporation, Wachovia Corporation, and other financially troubled bank or thrift holding companies that were acquired by other banks without government assistance.

Table 1 provides summary information for banks and thrifts that failed (i.e., were closed by bank regulators) between January 2007 and March 2010, along with similar information for non-failing institutions. The summary information is based on data for individual banks as of June 2006.¹³ We exclude eight banks that were chartered after June 2006 and failed between January 2007 and March 2010. Of the remaining 198 failures, 162 held commercial bank charters, 33 were savings banks, and 3 were savings and loan associations.¹⁴ The smallest bank that failed held \$11 million of assets and \$5 million of deposits (as of June 2006), whereas the largest (Washington Mutual Bank) held \$350 billion of assets and \$211 billion of deposits. Washington Mutual operated 2,213 branches in 15 states when it was closed on September 25, 2008 (it had 2,167 branches in 15 states on June 30, 2006).

Most banks that failed between 2007 and 2010 were much smaller than Washington Mutual

both in total assets and deposits and in numbers of branches and numbers of states with branch offices. The mean total assets and deposits of failing banks other than Washington Mutual were \$1.2 billion and \$824 million, respectively. Reflecting the highly skewed distribution of bank assets, median assets and deposits were much smaller, at \$263 million and \$204 million, respectively. By comparison, among non-failing banks, mean total assets and deposits were \$1.2 billion and \$695 million, respectively, and median total assets and deposits were \$119 million and \$97 million.¹⁵ Thus, among failed banks other than Washington Mutual, mean total assets and deposits of failing banks were similar to those of non-failing banks, but median assets and deposits were considerably larger than those of non-failing banks.

Figure 3 shows kernel density plots for the natural log (ln) of total assets of failing and non-failing banks during 2007-10, based on data for June 2006. The figure shows that the banks and thrifts that failed during 2007-10 tended to be larger than non-failing institutions over the range of asset sizes most commonly observed (though as noted, five non-failing banks held more total assets than Washington Mutual). By contrast, during the wave of bank failures of the late 1980s and early 1990s, the commercial banks that failed tended to be smaller than non-failing commercial banks (Figure 4).¹⁶

Figure 5 shows kernel density plots for the natural log (ln) of total assets for failed commercial banks, failed savings institutions, and non-failing banks (both commercial banks and savings institutions) as of June 2006. As shown, savings institutions that failed between 2007 and 2010 tended to be much larger than both commercial banks that failed and non-failing banks. Thrifts tend to specialize in home mortgage lending, and many grew rapidly during the housing boom. Several

¹² A list of failed banks since 2000 is available from the FDIC (www.fdic.gov/bank/individual/failed/banklist.html).

¹³ Our data are from the *Summary of Deposits* (www2.fdic.gov/sod/index.asp), which provides branch-level information.

¹⁴ Of the 162 commercial banks that failed, 109 were state-chartered non-Federal Reserve member banks, 21 were state-chartered Federal Reserve members, and 32 were national banks.

¹⁵ Data for non-failing banks include banks that were acquired after June 2006 and banks that survived through March 2010.

¹⁶ As noted previously, our data for 2007-10 include both commercial banks and savings institutions. However, comparable data on savings institution failures are not available for the late 1980s and early 1990s and, hence, the densities shown in Figure 4 for 1987-92 are based exclusively on data for commercial banks.

Table 1**Descriptive Statistics, Failed Banks January 2007–March 2010 (based on data for 2006:Q2)**

Type of bank	Total assets (\$ thousands)	Total deposits (\$ thousands)	totbr	tot_zipbr	tot_cntybr	tot_statebr
Failed banks						
N	198	198	198	198	198	198
Min	11,073	5,161	1	1	1	1
Max	350,890,182	210,626,236	2,167	1,746	82	15
Mean	2,999,689	1,883,978	21.0	17.8	3.6	1.3
Q1	100,486	80,662	1	1	1	1
Median	265,800	210,198	4	3	2	1
Q3	693,429	579,578	8	7	3	1
SD	25,079,179	15,054,713	155.8	126.0	7.8	1.2
Failed banks (excluding Washington Mutual)						
N	197	197	197	197	197	197
Min	11,073	5,161	1	1	1	1
Max	22,962,845	16,242,689	301	267	52	6
Mean	1,233,748	824,373	10.1	9.0	3.2	1.2
Q1	100,486	80,662	1	1	1	1
Median	262,721	204,070	4	3	2	1
Q3	690,828	575,772	8	7	3	1
SD	3,398,678	2,087,900	28.0	25.2	5.5	0.7
Non-failing banks						
N	8,307	8,307	8,307	8,307	8,307	8,307
Min	1,205	0	1	1	1	1
Max	1,160,260,442	563,906,844	5,781	4,124	177	30
Mean	1,244,305	694,999	10.8	8.3	2.7	1.1
Q1	56,366	46,301	1	1	1	1
Median	119,175	97,474	3	2	1	1
Q3	281,289	226,378	6	5	2	1
SD	21,858,396	9,775,712	99.3	70.3	6.4	0.9

NOTE: N, number of observations; Q1 and Q3, first and third quartiles, respectively; SD, standard deviation; totbr, total number of branches; tot_zipbr, total number of unique zip codes; tot_cntybr, total number of counties; tot_statebr, total number of states in which a bank operates at least one branch.

Figure 3
Size Distribution of Banks (2006:Q2)

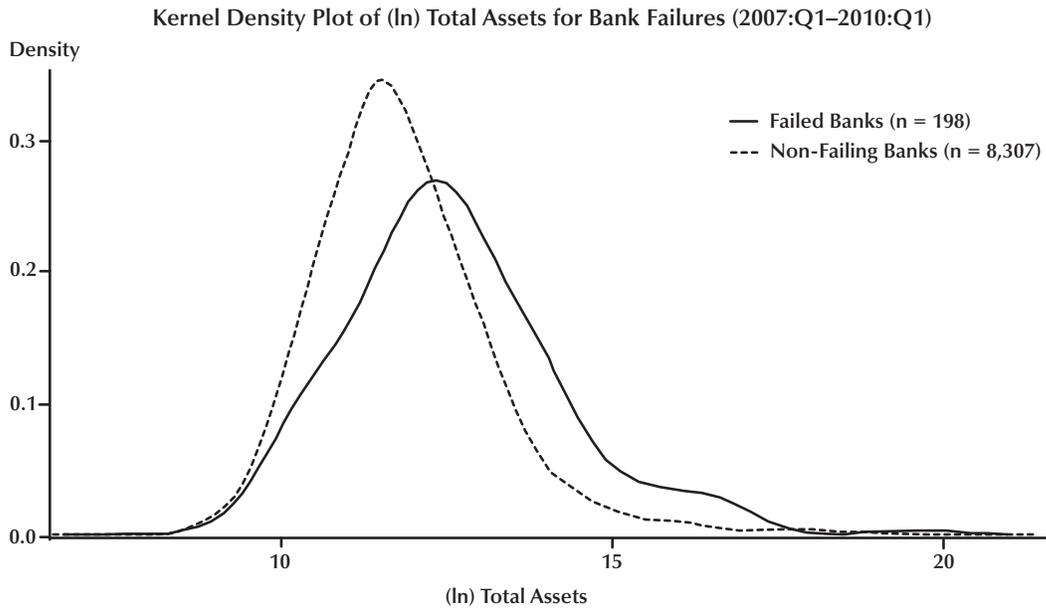
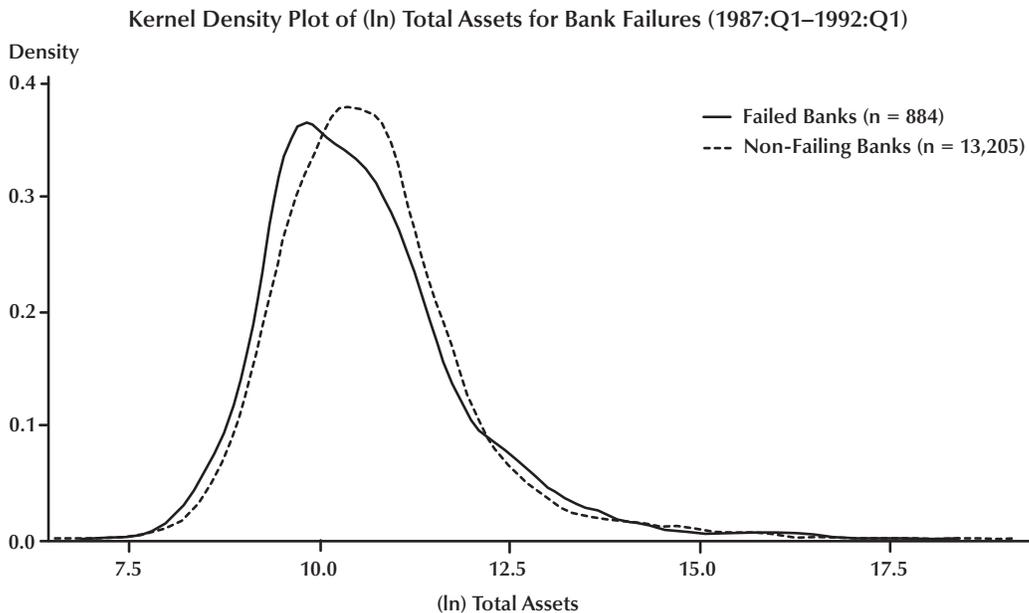


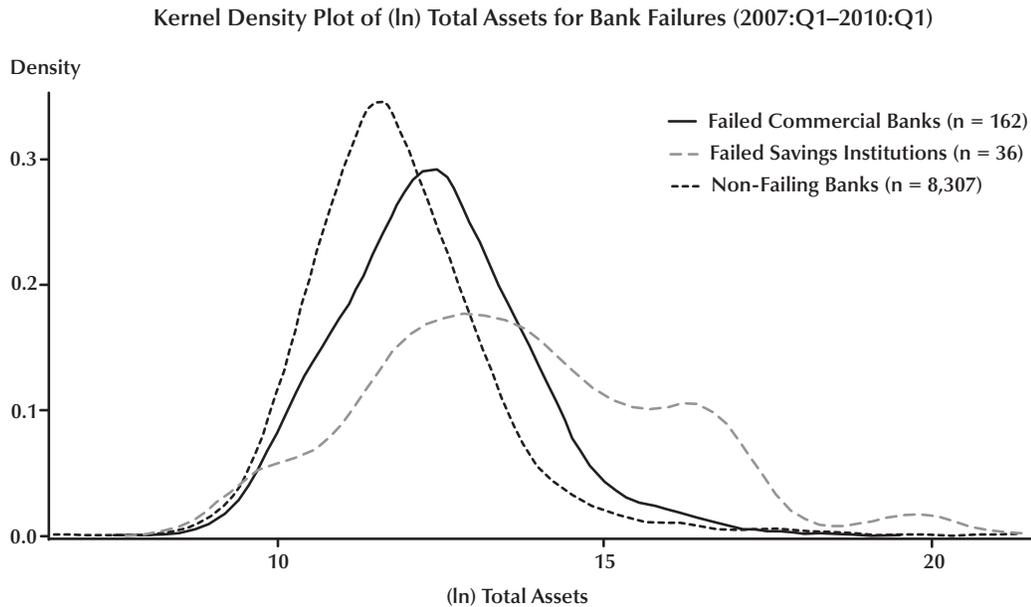
Figure 4
Size Distribution of Commercial Banks (1986:Q2)



NOTE: Densities shown are based exclusively on data for commercial banks.

Figure 5

Size Distribution of Commercial Banks (2006:Q2)



large thrifts failed when house prices began to fall and mortgage delinquencies rose.

Table 2 lists the 20 largest failed banks in terms of total assets on June 30, 2006. Of the 20 largest failures, 11, including Washington Mutual Bank, were savings institutions. Of the 36 thrifts that failed during 2007–10, 16 (44 percent) had at least \$1 billion of assets. By contrast, of the 162 commercial banks that failed, only one (Colonial Bank of Montgomery, Alabama) had more than \$10 billion of assets, and only 22 (14 percent) had more than \$1 billion of assets. As noted previously, in a few cases the federal government intervened to ensure that a very large, systemically significant commercial bank would not fail. In addition, several thrifts experienced large declines in total assets in the months between June 2006 and their failure dates.

Next we compare failed and non-failing banks on the basis of the number and location of branch offices. The sharp increase in bank failures during the 1980s and the apparent vulnerability of banks to sudden changes in local economic conditions

led many states and, ultimately, the federal government to relax restrictions on branch banking.¹⁷ Branching proponents argue that geographic restrictions on bank location contribute to banking system instability by making it more costly for banks to diversify or exploit economies of scale.¹⁸ Although banks can achieve geographic diversification through loan participations, brokered deposits, and other techniques, most banks served mainly a local loan and deposit market before branching restrictions were relaxed.

Branching deregulation promoted a substantial consolidation of the U.S. banking industry and the advent of banks with interstate branches. The largest U.S. banks operate thousands of branch offices across several states. For example, as of June 30, 2009, Bank of America had 6,173 branches in 35 states and JPMorgan Chase operated 5,229

¹⁷ Kroszner and Strahan (1999) and Garrett, Wagner, and Wheelock (2005) examine the determinants of state branching deregulation.

¹⁸ See Wheelock and Wilson (2009) and references therein for recent estimates of scale economies in banking.

Table 2**Largest 20 Bank Failures January 2007—March 2010**

Bank name	City	State	Total assets (\$ Thousands)	Total deposits (\$ Thousands)	Total branches	Total states with a branch	Entity type
Washington Mutual Bank, FSB	Henderson	Nevada	350,890,182	210,626,236	2,167	15	S
Colonial Bank, National Association	Montgomery	Alabama	22,962,845	16,242,689	301	5	C
IndyMac Bank, FSB	Pasadena	California	22,743,262	9,575,579	26	1	S
Downey Savings and Loan Association	Newport Beach	California	17,464,594	11,936,431	172	2	S
Guaranty Bank	Austin	Texas	16,920,624	9,362,598	152	2	S
Ohio Savings Bank, FSB*	Cleveland	Ohio	16,605,531	11,188,582	56	3	S
BankUnited, FSB	Coral Gables	Florida	12,866,372	6,014,740	73	1	S
First Federal Bank of California, FSB	Santa Monica	California	10,256,842	5,542,113	32	1	S
Corus Bank, National Association	Chicago	Illinois	9,369,988	8,320,397	14	1	C
United Commercial Bank	San Francisco	California	8,280,022	5,497,301	47	4	C
Irwin Union Bank and Trust Co.	Columbus	Indiana	6,020,353	3,412,938	24	4	C
California National Bank	Los Angeles	California	5,518,094	4,573,222	66	1	C
Franklin Bank	Houston	Texas	5,091,755	2,533,644	36	1	S
PFF Bank and Trust	Pomona	California	4,382,916	3,140,649	30	1	S
NetBank	Alpharetta	Georgia	4,151,957	2,726,334	1	1	S
Park National Bank	Chicago	Illinois	3,573,050	2,931,298	26	1	C
Imperial Capital Bank	La Jolla	California	3,202,090	1,834,731	9	2	C
La Jolla Bank, FSB	La Jolla	California	2,773,055	1,532,533	10	2	S
San Diego National Bank	San Diego	California	2,356,452	2,055,567	21	1	C
Orion Bank	Naples	Florida	2,080,071	1,511,496	17	1	C

NOTE: Data are from the June 30, 2006, FDIC *Summary of Deposits*. S, savings institution; C, commercial bank. *On the date of its failure, Ohio Savings Bank was known as Amtrust.

branches in 26 states. To the extent that branching has facilitated geographic diversification or scale economies, the U.S. banking system should be less vulnerable to local economic shocks than in the past.¹⁹ Although the recent downturn in U.S. house prices and economic recession affected most of the country, the extent to which house prices and personal incomes fell varied widely across state and local markets. Hence, branching may have afforded banks some protection against downturns in local real estate markets and economic activity.

The opportunity to operate branches in different banking markets clearly does not insulate banks from local economic downturns if they choose not to diversify across markets. Heavy investment in nonprime mortgages and mortgage-backed securities produced significant losses for many large banks with extensive branching networks, such as Washington Mutual. Most banks that failed during 2007-10 operated far fewer offices than Washington Mutual. As shown in Table 1, the median number of branches operated by banks that failed during 2007-10, other than Washington Mutual, was four. Further, most banks that failed had branches over only a limited geographic area: The median failed bank operated branches in just three zip codes across two counties in a single state. A lack of widespread branching is not, however, a distinguishing characteristic of banks that failed. The median non-failing bank operated only three branches located in two zip codes in a single county in a single state.

STATE BANK FAILURE RATES

The advent of interstate branch banking has made it more difficult to discern the relationship between changes in local economic conditions and bank performance. However, as noted previously, most banks continue to operate in a limited number of banking markets in a single state.

Hence, it remains interesting to consider the extent to which bank failures are associated with changes in local or regional economic conditions. We identified the home state of every bank that failed between January 1, 2007, and March 31, 2010, and calculated state-level failure rates as (i) the ratio of the number of banks headquartered in a state that failed to the total number of banks headquartered in that state as of June 30, 2006; and (ii) the ratio of the deposits held by failed banks in a state to the total amount of deposits held by all banks in that state as of June 30, 2006. We used annual branch-level data on total deposits for all U.S. banks to calculate the deposits-based failure rate.²⁰ This measure captures the influence on a state's failure rate of the deposits in branches of banks that are headquartered in another state.

Figure 6 shows the distribution of the failure rate (ratio of failed to total banks) across U.S. states. Georgia had the highest number of failures, with 36 (of 346 banks), but Nevada experienced the highest failure rate, with 5 of 28 banks failing. Arizona, California, and Oregon also had failure rates of at least 8.5 percent. Fifteen states had no bank failures during this period, including six states in the Northeast (Delaware, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont), four southeastern states (Kentucky, Mississippi, South Carolina, and Tennessee), and two Great Plains states (Montana and North Dakota).

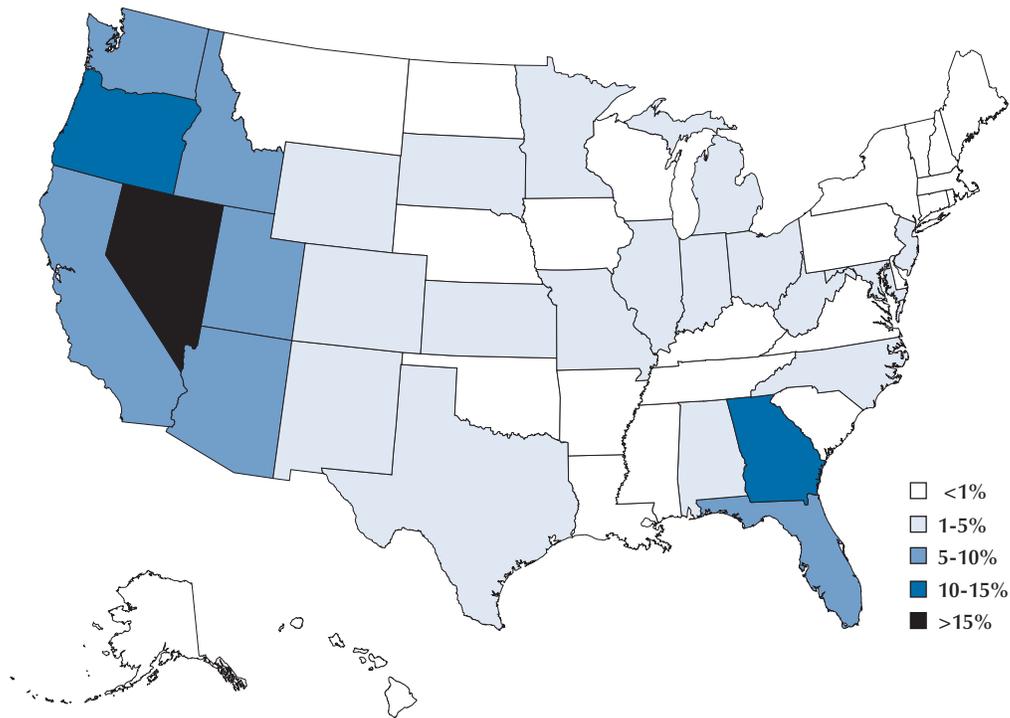
Figure 7 shows the distribution of the deposits-based failure rate measure across states. The impact of interstate branching and differences in the sizes of failed banks across states is apparent. For example, only two small banks chartered in New York failed, giving the state a bank failure rate of only 0.99 percent. However, because of the failure of Washington Mutual Bank, which operated 209 branches with some \$15 billion of deposits in New York, 1.95 percent of the state's bank deposits were in banks that failed. California, Nevada, and Washington are other states for which

¹⁹ However, as discussed in more detail below, branching regulations and other restrictions on market entry may have enhanced the charter values of existing banks and thereby encouraged them to assume less risk than banks in perfectly competitive markets. Hence, the relationship between branching restrictions and bank failures is ultimately an empirical question.

²⁰ Our branch-level data on deposits are from the *Summary of Deposits* database, which is maintained by the FDIC (www2.fdic.gov/sod/index.asp). The appendix presents definitions and source information for all variables and data used in this article.

Figure 6

Bank Failure Rates (2007-10)



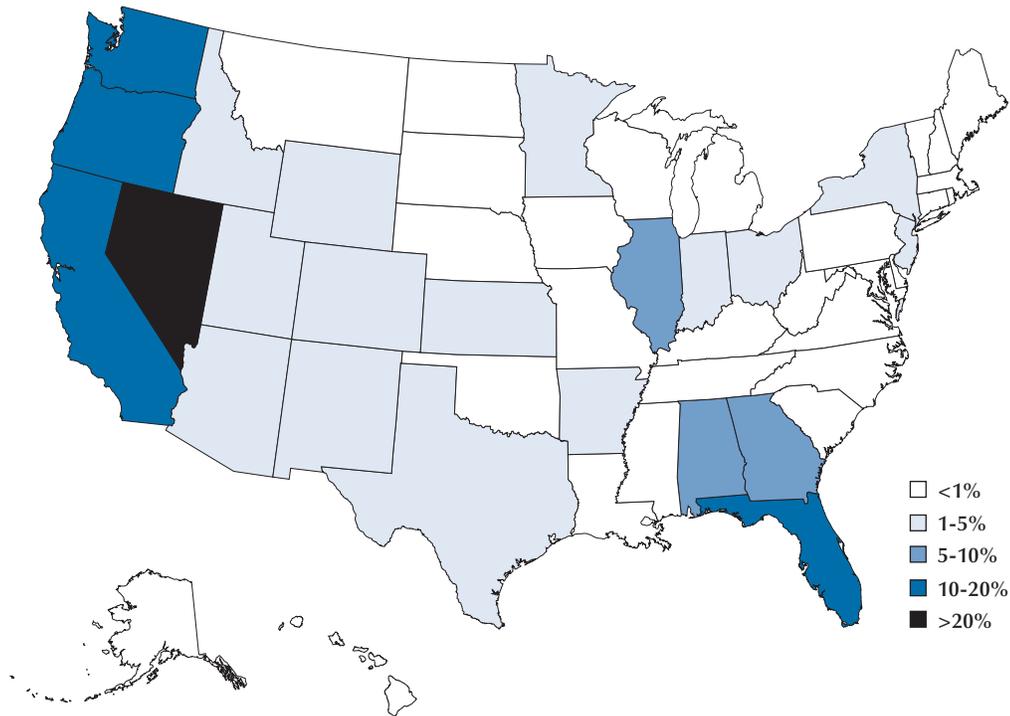
the failure of Washington Mutual caused the percentage of deposits in failed banks to exceed the state's bank failure rate. Similarly, the failure of a single large bank (Corus Bank National Association) caused Illinois to have a relatively high percentage of deposits in failed banks compared with the state's bank failure rate. By contrast, Georgia had a relatively low percentage of deposits in failed banks, despite a high failure rate based on the number of failed banks, because most of the banks that failed in Georgia were small.

STATE BANK FAILURE RATES AND ECONOMIC CONDITIONS

The recent decline in U.S. house prices was the largest and most widespread since the Great Depression. Mortgage delinquency rates rose throughout the United States and were a prox-

imate cause of the financial crisis and recession. The decline in U.S. house prices was particularly problematic for savings institutions—entities that historically have focused on residential mortgage lending. However, many commercial banks have increased their real estate lending in recent years because of increased competition in commercial lending and apparent profit opportunities in real estate lending.²¹ For example, between December 31, 1996, and December 31, 2006, real estate loans (both residential and commercial) rose from 39.5 percent to 57.4 percent of total U.S.

²¹ Small, community banks traditionally have dominated small business lending, where close proximity and personal relationships have been important for ascertaining the creditworthiness of potential borrowers. However, advances in information-processing technology have increased competition in local bank markets by making quantifiable information about potential borrowers more readily available (Petersen and Rajan, 2002). In addition, the easing of branching restrictions and other entry barriers increased competition in local banking markets.

Figure 7**Percentage of Deposits in Failed Banks (2007-10)**

commercial bank loans while commercial and industrial loans fell from 25.2 percent to 19.0 percent of total loans.²²

Although house prices fell throughout the United States, distress in housing and mortgage markets was especially acute in states that had experienced large increases in house prices in preceding years. Correlations reported in Table 3 show that states with large increases in house prices between 2003:Q3 and 2007:Q1, as measured by the state-level Federal Housing Finance Agency (FHFA) House Price Index, also tended to have (i) relatively high percentages of subprime home mortgages as of 2006:Q4, (ii) large increases in subprime mortgages as a percentage of all residential mortgages between 2003 and 2006, and (iii) rapid growth in total real estate loans (resi-

dential and commercial) between 2003 and 2006.²³ Further, these states tended to have the largest declines in house prices between 2007:Q1 and 2009:Q4.

Table 4 reports correlations of the number of bank failures and the two failure rate measures with various measures of state-level economic conditions. As shown, the two failure rate measures are highly correlated with the percentage change in house prices during both the period of rising house prices (2003:Q3–2007:Q1) and the period of falling prices (2007:Q1–2009:Q4). State

²² These calculations are based on data from the FDIC *Statistics on Banking* for all U.S. commercial banks (www2.fdic.gov/SDI/SOB/).

²³ State-level data on real estate loans attribute all of a bank's loans to the state in which the bank is headquartered. Branch-level loan data are not available. We report data for all insured commercial banks, trust companies, and savings institutions as provided by the FDIC. State-level delinquency rates measure the percent of all mortgages past due (not including mortgages in the foreclosure process), as reported by the Mortgage Bankers Association National Delinquency Survey. Similarly, data for the number of conventional subprime loans are from the Mortgage Bankers Association. See the appendix for additional information.

Table 3**Correlation of State-Level Economic Variables**

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) Percentage change in the FHFA House Price Index (2003:Q3–2007:Q4)	1.00										
(2) Percentage change in the FHFA House Price Index (2007:Q1–2009:Q4)	–0.68 (0.00)	1.00									
(3) Percentage change in the level of gross loans secured by real estate for all insured commercial banks, trusts, and savings institutions (2002-06), annual data-year end	0.19 (0.18)	–0.31 (0.03)	1.00								
(4) Ratio of subprime mortgages to all mortgages (2006:Q4)	0.20 (0.16)	–0.59 (0.00)	0.11 (0.43)	1.00							
(5) Change in the ratio of subprime mortgages to all mortgages (2003:Q3–2006:Q4)	0.31 (0.03)	–0.53 (0.00)	0.20 (0.16)	0.69 (0.00)	1.00						
(6) Change in the mortgage delinquency rate (all loans) (2009:Q4–2007:Q1)	0.46 (0.00)	–0.83 (0.00)	0.27 (0.06)	0.75 (0.00)	0.65 (0.00)	1.00					
(7) Change in the unemployment rate (2009:Q4–2006:Q4)	0.31 (0.03)	–0.63 (0.00)	0.14 (0.33)	0.58 (0.00)	0.52 (0.00)	0.77 (0.00)	1.00				
(8) Percent change in real per capita income (2005 \$) (2006-09), annual data	–0.19 (0.18)	0.56 (0.00)	–0.15 (0.31)	–0.57 (0.00)	–0.49 (0.00)	–0.62 (0.00)	–0.61 (0.00)	1.00			
(9) Percent change in nominal gross state product (2006-08), annual data	–0.13 (0.37)	0.54 (0.00)	0.16 (0.27)	–0.58 (0.00)	–0.34 (0.01)	–0.62 (0.00)	–0.67 (0.00)	0.62 (0.00)	1.00		
(10) Change in the ratio of business bankruptcies to all establishments (2007-09)	0.15 (0.29)	–0.15 (0.23)	0.06 (0.68)	0.11 (0.47)	0.10 (0.51)	0.18 (0.22)	0.19 (0.20)	–0.29 (0.04)	–0.25 (0.08)	1.00	
(11) Branching Restriction Indicator (2006), 0 (no restriction) to 4 (highest restrictions)	–0.11 (0.46)	0.14 (0.33)	0.14 (0.32)	–0.21 (0.14)	–0.21 (0.14)	–0.13 (0.38)	–0.12 (0.40)	–0.15 (0.30)	0.23 (0.11)	0.15 (0.34)	1.00

NOTE: Numbers in parentheses represent *p* values indicating the statistical significance of the correlation coefficients.

Table 4**Correlation of Bank Failures (Rates) and Local Economic Conditions (2007-10)**

Variable	Failure measure		
	nfail_2010	failrt_06	dep_failrt06
House Price Index percent change (2003:Q3–2007:Q1)	0.09 (0.53)	0.50 (0.00)	0.41 (0.00)
House Price Index percent change (2007:Q1–2009:Q4)	–0.37 (0.01)	–0.68 (0.00)	–0.61 (0.00)
Percent change in gross loans secured by real estate (2002-06) (commercial and savings banks)	–0.02 (0.91)	0.48 (0.00)	0.72 (0.00)
Percent of subprime to all mortgages (2006:Q4)	0.24 (0.09)	0.40 (0.00)	0.40 (0.00)
Increase in percent of subprime mortgages (2003:Q3–2006:Q4)	0.28 (0.05)	0.47 (0.00)	0.40 (0.00)
Change in mortgage delinquency rate (2009:Q4–2007:Q1)	0.44 (0.00)	0.65 (0.00)	0.60 (0.00)
Percent change in real per capita income (2006-09)	–0.40 (0.00)	–0.58 (0.00)	–0.41 (0.00)
Percent change in gross state product (2006-08)	–0.23 (0.11)	–0.18 (0.20)	–0.11 (0.46)
Change in bankruptcy ratio (2007-09)	0.01 (0.95)	0.07 (0.65)	0.07 (0.61)
Change in unemployment rate (2009:Q4–2006:Q4)	0.40 (0.00)	0.51 (0.00)	0.48 (0.00)
Branching restriction (2006)	0.10 (0.49)	0.15 (0.30)	0.16 (0.27)

NOTE: Numbers in parentheses represent p values indicating the statistical significance of the correlation coefficients. Failure measure definitions: nfail_2010, number of bank failures (2007–2010:Q1); failrt_06, number of bank failures (2007-10) divided by total banks in 2006:Q2; dep_failrt06, ratio of deposits of failed banks (2007-10) to total deposits (2006:Q2) calculated at the branch level.

failure rates are also highly positively correlated with the percentage of subprime mortgages in 2006, the growth in the percentage of subprime mortgages between 2003 and 2006, and the percentage increase in total real estate loans between 2003 and 2006. States that experienced the largest increases in house prices during the boom, or the largest declines during the bust, had the highest bank failure rates, as did those with the most rapid growth in subprime mortgage loans and total real estate loans. Not surprisingly, since the delinquency rates on subprime mortgages are much higher than those on prime loans, state bank failure rates are also highly positively correlated with the increase in residential mortgage loan delinquency rates between 2006 and 2009.²⁴

Many states with large declines in house prices also experienced relatively large declines in personal income and gross state product and relatively large increases in unemployment rates. For example, Florida and Arizona were the only states where real per capita personal income fell more than 7 percent between 2006 and 2009; along with Nevada and California, they were the only states where the decline in house prices between 2007 and 2009 exceeded 30 percent.

²⁴ Distress in commercial real estate markets has frequently been cited as another cause of losses and bank failures during 2007-10 (e.g., Bair, 2010; Wutkowski, 2009). State-level data on commercial real estate market conditions are not available; historically, however, many bank failures have been associated with downturns in commercial real estate markets (FDIC, 1997).

Similarly, Michigan had the smallest increase in gross state product between 2006 and 2008 and had the fifth-largest decline in house prices, 17 percent, behind Arizona, California, Florida, and Nevada. As shown in Table 4, bank failure rates were higher in states that experienced relatively large declines in real per capita personal income or nominal gross state product between 2006 and 2008 (though the correlations with gross state product are not statistically significant), and relatively large increases in the unemployment rate between 2006:Q4 and 2009:Q4. We found no correlation, however, between bank failure rates and changes in business bankruptcy rates between 2007 and 2009.²⁵

Lastly, we investigated the association between market entry restrictions on banks and state bank failure rates. As noted previously, many states relaxed restrictions on branching and began to permit entry by out-of-state bank holding companies during the 1970s and 1980s, and a federal prohibition on interstate branching was removed in 1994. However, several states retained limits on entry, such as caps on the share of a state's deposits that a single bank can hold and requirements that a bank seeking to enter a new market must do so by acquiring an existing bank. Rice and Strahan (2010) find that these types of entry barriers reduce the supply of credit to small business borrowers and increase interest rates on loans by 25 to 45 basis points. Similarly, Favara and Imbs (2009) find that relaxing restrictions on bank entry increases the number and volume of home mortgage loans originated by commercial banks within a state and increases house prices. Several studies find that branching and other entry barriers affect state-level measures of economic performance. For example, Jayaratne and Strahan (1996) find that relaxation of state branching restrictions in the 1970s and 1980s significantly increased state real income growth rates. However, estimates of the impact of deregulation

on growth from studies that account for either the possibility that slowly growing states were more likely to deregulate (Freeman, 2002) or spatial dependence in state growth rates (Garrett, Wagner, and Wheelock, 2007) find considerably smaller effects of deregulation on state income growth. More recently, Acharya, Imbs, and Sturgess (2009) find that branching restrictions limit the scope of banks to pursue efficient diversification, which in turn limits the diversification of investment activity within a state.

The literature concludes that branching and other entry regulations can inhibit efficient diversification by banks and affect the cost and supply of credit for borrowers. To the extent that diversification is limited, entry barriers might make banks more vulnerable to local economic distress, as discussed previously. Entry barriers might also promote instability by protecting inefficient banks from competitive forces. On the other hand, entry barriers might allow incumbent banks to earn higher-than-normal profits, which would tend to encourage conservative practices and thereby keep bank failure rates lower than failure rates in states with low entry barriers.²⁶ Hence, the relationship between entry barriers and bank failure rates is an empirical question.

Rice and Strahan (2010) construct an index of bank entry restrictions for each U.S. state, ranging from 0 for no restrictions to a maximum of 4 for states that impose the most restrictions on bank entry. Table 4 reports the correlation of values of this index for December 2006 with state-level bank failure rates for 2007-10. The correlation is positive, indicating that bank failure rates were higher in states that imposed more entry restrictions, but not statistically significant at conventional significance levels. Hence, we find some weak evidence that entry restrictions contributed to the high bank failure rates observed in some states.

COMPARISON WITH 1987-92

The close association between state bank failure rates and economic conditions during 2007-10

²⁵ We calculated the business bankruptcy rate as the number of business bankruptcy filings during a year divided by the number of private firms in existence in the fourth quarter of the prior year. Data on bankruptcy filings are from the Administrative Office of the United States Courts. Data on the number of private firms are from the Bureau of Labor Statistics Quarterly Census of Employment and Wages.

²⁶ Keeley (1990) finds that increased competition reduces bank charter values, which in turn encourages banks to increase asset risk and hold less capital, and ultimately raises the risk of bank failure.

Table 5**Correlation of Bank Failures (Rates) and Local Economic Conditions (1987-92)**

Variable	Failure measure		
	nfail_1992	failrt_86	dep_failrt86
House Price Index percent change (1982:Q3–1987:Q1)	–0.17 (0.23)	0.01 (0.94)	0.12 (0.40)
House Price Index percent change (1987:Q1–1992:Q4)	–0.24 (0.10)	–0.38 (0.01)	–0.41 (0.00)
Percent change in gross loans secured by real estate (1982-86) (commercial banks)	0.12 0.42	0.26 0.07	0.36 0.01
Change in mortgage delinquency rate (1992:Q4–1986:Q4)	–0.12 (0.40)	–0.19 (0.18)	–0.12 (0.41)
Percent change in real per capita income (1986-92)	–0.18 (0.21)	–0.54 (0.00)	–0.30 (0.03)
Change in unemployment rate (1992:Q4–1986:Q4)	–0.15 (0.30)	–0.04 (0.79)	0.04 (0.80)
Percent change in gross state product (1986–1992)	–0.10 (0.47)	–0.37 (0.01)	–0.32 (0.02)
Branching restrictions (1986:Q4)	0.32 (0.03)	–0.04 (0.79)	–0.00 (0.98)

NOTE: Numbers in parentheses represent p values indicating the statistical significance of the correlation coefficients. Failure measure definitions: nfail_1992, number of commercial bank failures (1987-92); failrt_86: number of commercial bank failures (1987-92), divided by total commercial banks in 1986:Q2; dep_failrt86: ratio of deposits of failed commercial banks (1987-92) to total deposits in all commercial banks (1986:Q2), calculated at the branch level.

is reminiscent of previous episodes when the United States experienced high numbers of bank failures. Most recently, during the 1980s and early 1990s, hundreds of commercial banks and thrifts failed when states experienced large declines in personal income and real estate prices. States with large declines in real estate values tended to sustain longer and deeper declines in economic activity—and more bank distress—than did other states (Wheelock, 2006). A similar phenomenon occurred in the 1920s, when falling commodity prices reduced agricultural incomes and caused the failure of thousands of banks located in farm states and other rural areas. States where farm land values and cultivated acreage had expanded the most during boom years surrounding World War I experienced the highest farm and bank failure rates subsequently (Alston, Grove, and Wheelock, 1994).

Table 5 reports correlations of state bank failure rates for 1987-92 with various measures of

economic conditions. More than 200 commercial banks failed in 1987—the most in any year since the Great Depression—and the number of commercial bank failures exceeded 100 in every year through 1992.²⁷ A total of 884 commercial banks failed between 1987 and 1992. Texas alone had 450 bank failures (among 1,955 active banks in June 1986). Other states with high numbers of failures included Oklahoma (78 failures among 528 banks), Louisiana (57 failures among 300 banks), and Colorado (38 failures among 435 banks). All four states experienced sharp declines in state incomes when energy prices fell. Although all four states also had relatively high bank failure

²⁷ Here we focus on commercial bank failures because comparable data on thrift failures for 1987-92 are not available. We include both commercial bank and thrift failures in Figures 1 and 2, but the dating of thrift failures during the 1980s is imprecise because many insolvent thrifts remained open when the Federal Savings and Loan Insurance Corporation lacked the resources to resolve them.

rates, both Alaska (where 5 of 16 banks failed) and Arizona (where 14 of 53 banks failed) had higher failure rates than Texas. Other states with high failure rates included Connecticut (10 of 59 banks failed), New Hampshire (7 of 52 banks failed), and Massachusetts (11 of 102 banks failed). New England states experienced rapid income growth and a real estate boom during the 1980s. The New England economy slowed toward the end of the decade, however, when cuts in federal defense spending and increased competition in the computer industry had a disproportionately large impact on the region (FDIC, 1997). Among U.S. census regions, New England experienced the largest decline in real personal income during the recession of 1990-91.

Although New England states experienced rapid increases in house prices in the 1980s and relatively sharp declines in house prices during 1987-92, other states with high bank failure rates during 1987-92 did not have rapidly rising house prices before the onset of bank failures. As shown in Table 5, state bank failure rates for 1987-92 are not highly correlated with changes in house prices between 1982 and 1987, though they are correlated with changes in house prices during 1987-92: Failure rates typically were higher in states that experienced larger declines in house prices. Bank failure rates are not, however, correlated with changes in mortgage loan delinquency rates between 1986:Q4 and 1992:Q4. Thus, compared with the bank failures of 2007-10, those of 1987-92 were not as strongly associated with distress in housing markets.²⁸

As with the bank failures of 2007-10, state bank failure rates for 1987-92 are strongly negatively correlated with growth of per capita personal income and gross state product between 1986 and 1992. States with the largest declines

in personal income or gross state product tended to have the highest bank failure rates. However, bank failure rates are not closely correlated with state unemployment rates. Finally, we find that the number of bank failures in a state is positively correlated with the presence of restrictions on branch banking.²⁹ The four states with the most bank failures—Texas, Oklahoma, Colorado, and Louisiana—either prohibited or severely limited branching within their borders. However, several states with high bank failure rates or high percentages of deposits in failed banks, such as Alaska, Arizona, and most states in New England, permitted statewide branching and their state bank failure rates during 1987-92 are not closely correlated with limits on branching within states. Of course, banks in all states were prohibited from operating branches in more than one state, and this prohibition may have been a more important impediment to diversification and scale than branching restrictions within states.³⁰

CONCLUSION

The removal of legal restrictions on branch banking, first by many states in the 1970s and 1980s and then by the federal government in the 1990s, led to a substantial consolidation of the U.S. banking industry. By 2009, the number of commercial banks in the United States was less than half what it had been in 1984, when the number of banks reached its postwar peak. Still, because many U.S. banks operate only a few branches in a single or small number of markets, the geographic distribution of bank failures is likely to reflect, to some extent, regional differences in economic conditions. Historically, adverse shocks caused locally high numbers of bank failures, as in Texas and New England in

²⁸ However, commercial real estate market conditions may have played important roles in both periods. Spong and Sullivan (1999, pp. 73 and 74) note that between 1981 and 1986, tax laws allowed investors to use an accelerated depreciation schedule for real property, which tended to inflate commercial property values. The removal of these tax shelters “helped to send the industry into a downward spiral,” which was “at the forefront of many of the banking problems of the 1980s and early 1990s.” Unfortunately, as noted previously, state-level data on commercial real estate market conditions are not available to examine the correlation of commercial real estate conditions with bank failure rates.

²⁹ Here we use an index that takes a value of 1 for states that allowed unlimited statewide branching, 2 for states that permitted limited branching, and 3 for states that prohibited branching altogether (as of 1986:Q4).

³⁰ Meyer and Yeager (2001) and Yeager (2004) find that, in general, the performance of small banks that operate within only one county is more closely related to economic activity measured at the state level than to activity within the county in which the bank is located, suggesting that intrastate branching restrictions do not prevent banks from achieving diversification within state borders.

the late 1980s and early 1990s. Small banks with limited geographic diversification have been especially vulnerable to local economic shocks and have tended to fail in higher numbers than larger banks.

In several respects, the geographic patterns of recent U.S. bank failures have been similar to those of past episodes. During 2007-10, bank failure rates were higher in states with the largest declines in personal income and gross state product and the largest increases in unemployment rates. Failure rates were also higher in states experiencing the largest declines in house prices and the largest increases in home mortgage delinquency rates. Those states also had the largest increases in house prices and subprime mortgages before 2007. On average, the percentages of bank loans and assets devoted to home mortgages and mortgage-backed securities rose during the hous-

ing boom, which made banks more vulnerable to the subsequent decline in house prices. Unlike previous episodes, banks that failed during this episode tended to be somewhat larger on average than non-failing banks. In particular, reflecting the important role played by home mortgage distress during 2007-10, several large savings institutions failed.

We find that bank failure rates were only modestly correlated with restrictions on *intrastate* branch banking or bank entry, both in the recent episode and during the failure wave of 1987-92. However, evidence that bank failure rates during 2007-10 were closely correlated with measures of state economic conditions suggests that the long-standing prohibition of *interstate* branching, though eliminated more than a decade ago, continues to influence the market structure and geographic distribution of bank failures today.

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APPENDIX

Variable Definitions and Data Sources

Variable	Definition	Data source
Bank failure data		
nfail_2010	Number of bank failures (2007–2010:Q1)	FDIC Failed Bank List www2.fdic.gov/bank/individual/failed/banklist.html
failrt_06	Number of bank failures (2007–10) divided by total banks in 2006:Q2	FDIC Failed Bank List; FDIC Summary of Deposits (SOD) www2.fdic.gov/sod/
dep_failrt06	Ratio of deposits of failed banks (2007–10) to total deposits (2006:Q2) calculated at the branch level	FDIC SOD
nfail_1992	Number of commercial bank failures (1987–92)	FDIC Historical Statistics on Banking (HSOB) www2.fdic.gov/hsob/
failrt_86	Number of commercial bank failures (1987–92) divided by total commercial banks in 1986:Q2, by state	FDIC HSOB; Consolidated Reports of Condition and Income (Call Reports)
dep_failrt86	Ratio of deposits of failed commercial banks (1987–92) to total deposits in all commercial banks (1986:Q2)	Call Reports
Local economic conditions (2007–10)		
hpi_chg03_07	Percentage change in the FHFA House Price Index (2003:Q3–2007:Q1)	Federal Housing Finance Agency
hpi_chg07_09	Percentage change in the FHFA House Price Index (2007:Q1–2009:Q4)	Federal Housing Finance Agency
loan_chg02_06	Percentage change in the level of gross loans secured by real estate for all insured commercial banks, trusts, and savings institutions (2002–06), annual data-year end	FDIC Statistics on Depository Institutions (SDI) www2.fdic.gov/SDI/index.asp
subratio06	Ratio of subprime mortgages to all mortgages (2006:Q4)	Mortgage Bankers Association
sub_chg03_06	Change in the ratio of subprime mortgages to all mortgages (2003:Q3–2006:Q4)	Mortgage Bankers Association
deliq_chg07_09	Change in the mortgage delinquency rate (all loans) (2007:Q1–2009:Q4)	Mortgage Bankers Association
unemp_chg06_09	Change in the unemployment rate (2006:Q4–2009:Q4)	Bureau of Labor Statistics
pci_chg06_09	Percent change in real per capita income (2005 \$) (2006–09), annual data	Bureau of Economic Analysis
gdp_chg06_08	Percent change in nominal gross state product (2006–08), annual data	Bureau of Economic Analysis
bbq_chg07_09	Change in the ratio of business bankruptcies to all establishments (2007–09)	Administrative Office of the United States Courts; Bureau of Labor Statistics Quarterly Census of Employment and Wages
restrict06	Branching Restriction Indicator, 0 (no restriction) to 4 (highest restrictions)	Rice and Strahan (2010)
Local economic conditions (1987–92)		
hpi_chg82_87	Percentage change in the FHFA House Price Index (1982:Q3–1987:Q1)	Federal Housing Finance Agency
hpi_chg87_92	Percentage change in the FHFA House Price Index (1987:Q1–1992:Q4)	Federal Housing Finance Agency
loan_chg82_86	Percentage change in the level of gross loans secured by real estate for all insured commercial banks and trusts (1987–92), annual data-year end	FDIC Statistics on Depository Institutions (SDI) www2.fdic.gov/SDI/index.asp
all_chg86_92	Change in the mortgage delinquency rate (all loans) (1986:Q4–1992:Q4)	Mortgage Bankers Association
pci_chg86_92	Percent change in real per capita income (2005 \$) (1986–92), annual data	Bureau of Economic Analysis
gdp_chg86_92	Percent change in nominal gross state product (1986–92), annual data	Bureau of Economic Analysis
restrict86	Branching Restriction Indicator, 1 (unlimited statewide branching); 2 (limited branching); 3 (branching prohibited)	Authors' calculations



A Survey of Announcement Effects on Foreign Exchange Returns

[Christopher J. Neely](#) and S. Rubun Dey

Researchers have long studied the reaction of foreign exchange returns to macroeconomic announcements in order to infer changes in policy reaction functions and foreign exchange microstructure, including the speed of market reaction to news and how order flow helps impound public and private information into prices. These studies have often been disconnected, however; and this article critically reviews and evaluates the literature on announcement effects on foreign exchange returns. (JEL F31, F32, G14)

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Since the early 1980s researchers have sought to understand how foreign exchange markets react to various announcements. The motivation for studying this topic is a fundamental goal of economics: to understand the determination of prices. The study of announcement effects has lessons for both macroeconomics and microstructure. This paper surveys and summarizes the lengthy literature that has tenaciously built up a picture of how macroeconomic and policy announcements affect exchange rate returns.¹

Announcement reactions reveal market perceptions of policy and how such policies change over time and between countries. They provide a unique window into how the economy operates

because the efficient markets hypothesis (EMH) implies that asset prices should react directly and quickly to the surprise component of any announcement.² Thus, asset price reactions inform us about how markets form expectations of future fundamentals. Hardouvelis (1988) draws an analogy between research on the effect of macroeconomic announcements and controlled experiments.

The open-economy macro models of the 1970s, which focused on monetary determinants of exchange rates (e.g., Dornbusch, 1976), motivated the study of how money supply and interest rate announcements affected foreign exchange rates. For example, Cornell (1982) and Engel and Frankel (1984) used exchange rate responses to evaluate the evidence for how money supply shocks cause individuals to revise their expectations of inflation and future monetary policy.

¹ A related paper, Neely (2010b), surveys the literature on how foreign exchange volatility responds to macroeconomic announcements, including discontinuous reactions. Osler (2009) surveys the foreign exchange microstructure literature, including papers that focus on announcement effects. A chapter in Evans (2010) also reviews some of the issues in the literature on announcement effects on foreign exchange returns.

² Conveniently, survey expectations exist that allow us to decompose most announcements into their expected and unexpected components.

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Meese and Rogoff's (1983) failure to forecast exchange rates with a variety of macro variables further motivated researchers to study a broader array of macro announcements. By creating the widespread impression that exchange rates are "disconnected" from the broader economy, Meese and Rogoff (1983) strongly motivated researchers to link exchange rates to macroeconomic variables, as a first step toward comprehensive macroeconomic exchange rate modeling.

Analyzing foreign exchange reactions to announcements can inform us how market perceptions of policy rules or other factors change. Specifically, Hardouvelis (1984) and Hakkio and Pearce (1985) assess the Federal Reserve's changing inflation-fighting credibility by examining the reactions of exchange rates and interest rates to M1 innovations. International variation in reactions to announcements can similarly tell us about market expectations. For example, Love and Payne (2008) find that the USD/GBP exchange rate is more sensitive to the surprise component of U.S. inflation announcements than to that of the United Kingdom. The authors conjecture that market participants expect the Bank of England—which is an explicit inflation targeter—to bring inflation back down to the target. Alternatively, U.S. inflation shocks might simply have a larger effect on risk premia than do U.K. inflation shocks.

Cross-country institutional differences can also illuminate the importance of institutional details for outcomes. For example, U.S. macroeconomic announcements are regular and scheduled while Almeida, Goodhart, and Payne (1998) report that German announcements were not scheduled in the 1992-94 sample.³ These authors found that the unscheduled German announcements had a smaller and more prolonged impact on exchange rates. Reactions to scheduled announcements might be quicker because agents have had time to form expectations and plan actions in response to the surprise component.

³ Almeida, Goodhart, and Payne (1998) describe the time of German announcements as "not regular" and obtain specific times from Reuter's reports. They cite the transition from West German to unified German data as causing some irregularity in trade balance announcements. Andersen et al. (2003) report that markets had advance warning of the days but not the times of German macro announcements for their March 1993 to December 1998 sample.

The reaction to scheduled versus unscheduled announcements is only one example of how the literature has illuminated the microstructure of the foreign exchange market. Ederington and Lee (1995), for example, determined that the systematic reaction to announcements took no more than 40 seconds. Doukas (1985) was the first to suggest that the order of related announcements was important. More recently, the literature has begun to seriously explore how public information (an announcement) creates trading (order flow) that reveals private information. Order flow has a greater price impact after announcements and contributes to a response that can last for days (Evans and Lyons, 2002 and 2005).

In short, the literature on exchange rate responses to macroeconomic announcements has learned a great deal about market perceptions of policy reaction functions and the microstructure of foreign exchange markets. Unfortunately, the papers tend to be disconnected from each other, making it difficult to see broad themes. This paper attempts to remedy that situation by reviewing the literature on announcement effects on exchange rate returns and linking those works to broader points.

The next section of the article briefly discusses the most commonly studied U.S. announcements, and the rest of the paper reviews the major areas of research on the effects of announcements on the conditional means of foreign exchange returns.

U.S. MACROECONOMIC ANNOUNCEMENTS

Several factors facilitate the study of U.S. announcement effects on foreign exchange rates. U.S. announcements are scheduled and expectations of those announcements and accompanying exchange rate data are widely available. Thus, the literature has devoted disproportionate attention to U.S. announcements. Table 1 displays a number of commonly used U.S. announcements, as well as their source and the delay in their release. Other papers, such as Andersen et al. (2003), Ehrmann and Fratzscher (2005), and Faust et al.

(2007) also provide summary information on the releases they use.

Fama's (1970) semi-strong form EMH has guided researchers in connecting exchange rates to macroeconomic fundamentals. This hypothesis states that current prices reflect publicly available information to the extent that one cannot make a risk-adjusted profit by trading on the basis of that information (Jensen, 1978). Because at least some market participants continually gather information, develop expectations of macroeconomic conditions, and trade on those beliefs, asset prices should always approximately reflect the marginal investor's current expectations and prices should quickly react only to the surprise component of an announcement at the time of the release.⁴ Any systematic delay in the market reaction or systematic response to the expected component of the release would provide a profit opportunity and therefore should not exist. To test this no-risk-arbitrage hypothesis, researchers require good estimates of market expectations of the announcement and high-frequency data to precisely estimate the systematic response and to judge its speed. Fortunately, such data were available very early for U.S. announcements, which helps explain the attention that they received.⁵ Researchers generally use the median response from the Money Market Services (MMS) survey to estimate the expected announcement. Each Friday, MMS surveys 40 money managers on their expectations of economic indicators.⁶ (Ideally, the surveys would be conducted as close as possible to the announcement time to more precisely estimate the market's expectation at the time of the announcement.) Cornell (1982) and Engel and Frankel (1984) first used these survey data in the literature on

announcement effects in the foreign exchange market, though other researchers—for example, Grossman (1981)—had used them in other contexts. Grossman (1981), Engel and Frankel (1984), Pearce and Roley (1985), and McQueen and Roley (1993) showed that the MMS survey data provide approximately unbiased and informationally efficient estimates of news announcements that outperform time-series models.⁷ These MMS survey measures of announcement expectations soon became standard.

Certain sets of U.S. announcements contain highly correlated information, such as the Conference Board and the University of Michigan consumer confidence indices. Doukas (1985) was probably the first researcher to note that timing among related releases matters. He speculated that U.S. monetary announcements were more important than Canadian monetary announcements because they were released 50 minutes earlier. Tandon and Urich (1987) made a similar observation about U.S. PPI and CPI news. Andersen et al. (2003) show that markets typically react most strongly to the surprise component of the earliest release within a set of related U.S. announcements.

Although the vast majority of announcements are backward looking—they pertain to previous economic activity—monetary policy announcements are forward looking: The Federal Open Market Committee (FOMC) considers all available information, including forecasts and the latest announcements, when making decisions about short-term interest rates.⁸ The FOMC meets eight

⁴ There are at least two caveats to this statement: (i) Pre-announcement prices might reflect not only the investor's expectation but also some adjustment for risk; (ii) an announcement whose content matches market expectations can affect prices and volatility by removing uncertainty. These effects are likely to be small in most circumstances, however.

⁵ MMS expectations have been available for other countries for some time.

⁶ The number of survey participants and the dates of the survey have changed over time. Hakkio and Pearce (1985) report that MMS surveyed about 60 money market participants during the early 1980s. MMS conducted the surveys on both Tuesdays and Thursdays before February 8, 1980, and on Tuesdays after that date.

⁷ Although the MMS survey expectations exhibit fairly good properties compared with alternatives, they still surely measure market expectations with some error, both because they are at least a couple days old and because they reflect the views of a small group of money managers. More subtly, any macroeconomic release will surely contain some error about the true state of the economy because it is estimated with finite resources and limited information. Therefore researchers will estimate macroeconomic surprises with error and this error will generally attenuate the estimated market response toward zero in regressions where the surprise is the independent variable. Rigobon and Sack (2008) discuss two methods to compensate for this error. Bartolini, Goldberg, and Sacarny (2008) discuss the application of this methodology.

⁸ Market analysts sometimes assume that a central bank, such as the Federal Reserve, has special knowledge of economic conditions that the public does not share. Faust, Swanson, and Wright (2004), however, show that the unexpected component of the Fed's policy actions does not generally improve private sector forecasts of economic variables, except for industrial production—which the Federal Reserve produces.

Table 1**U.S. Macroeconomic Announcements**

Name of announcement	Units of announcement	Frequency	Release lag	Source	Release time
Average Hourly Earnings	\$ per hour	Monthly	Almost none	BLS	8:30 AM
Beige Book		8 times per year		FRB	2:15 PM
Business Inventories	% m-m	Monthly	~6 weeks	CB	10:00 AM
Capacity Utilization Rate	Index (2002 = 100), % m-m	Monthly	~2 weeks	FRB	9:15 AM
Construction Spending	% m-m	Monthly	~5 weeks	CB	10:00 AM
Consumer Confidence Index	Index (1985 = 100)	Monthly	None	Conf. Board	10:00 AM
Consumer Credit Report	% m-m	Monthly	~5 weeks	FRB	3:00 PM
Consumer Installment Credit	% m-m, % q-q, \$ Billions	Monthly	~5 weeks	FRB	3:00 PM
Consumer Price Index (CPI)	% m-m (1982 = 100)	Monthly	~2 weeks	BLS	8:30 AM
Current Account	\$ Billions	Quarterly	~10 months	BEA	8:30 AM
Domestic Vehicle Sales	Millions of vehicles	Monthly	Almost none	BEA	3:00 PM
Durable Goods Orders	% m-m	Monthly	~3-4 weeks	CB	8:30 AM
Employment Cost Index	% q-q (2005 = 100)	Quarterly	~2-3 weeks	BLS	8:30 AM
Existing Home Sales	No. of sales	Monthly	~4 weeks	NAR	10:00 AM
Factory Inventories	Change in \$ billions	Monthly	~4 weeks	CB	10:00 AM
Factory Orders	Change in \$ billions	Monthly	~4 weeks	CB	10:00 AM
Federal Budget/Deficit	\$ Trillions	Monthly		CBO	2:00 PM
FOMC Minutes		8 times per year	~2-3 weeks	FRB	2:00 PM
GDP-Advance	% q/q	Quarterly	1-month lag	BEA	8:30 AM
GDP-Deflator	% q/q	Quarterly		BEA	8:30 AM
GDP-Final	% q/q	Quarterly	3-month lag	BEA	8:30 AM
GDP-Preliminary	% q/q	Quarterly	2-month lag	BEA	8:30 AM
Housing Starts	No. of units, % m-m	Monthly	~3 weeks	CB	8:30 AM
Humphrey-Hawkins Testimony		Semiannual		FRB Chairman	10:00 AM
Index of Coincident Indicators	m-m	Monthly	~3 weeks	Conf. Board	10:00 AM
Industrial Production	Index (2002 = 100), % m-m	Monthly	~2 weeks	FRB	9:15 AM
Initial Unemployment Claims	No. of claims	Weekly	~5 days	ETA	8:30 AM

NOTE: CPI, consumer price index; GDP, gross domestic product; NAPM, National Association of Purchasing Managers; NFP, nonfarm payroll; PCE, personal consumption expenditures; PMI, Purchasing Managers' Index; PPI, producer price index. The following abbreviations are used for announcement sources: BEA, Bureau of Economic Analysis; BLS, Bureau of Labor Statistics; CB, U.S. Census Bureau; Conf. Board, Conference Board; CBO, Congressional Budget Office; Commerce, U.S. Department of Commerce; ETA, Department of Labor's Employment and Training Administration; FRB, Federal Reserve Board; ISM, Institute for Supply Management; NAR, National Association of Realtors; Treasury, U.S. Department of the Treasury. m-m, Level change from month to month; % m-m, percent change from month to month; % q/q, percent change quarter over quarter; % q-q, percent change from quarter to quarter. All times are eastern standard.

Description of announcement

Average hourly wage of production and nonsupervisory workers on private nonfarm payrolls by industry sector and selected industry detail.

Overviews of the economy by Federal Reserve district.

Value of unsold goods held by manufacturers, wholesalers, and retailers.

Percentage of available resources being utilized by factories, mines, and utilities.

Total amount spent by builders on public, residential, and non-residential construction projects.

Mood of consumers with respect to present and future economic conditions.

Consumer credit outstanding; categorized as auto, revolving, and other and disaggregated by major holders.

Total value of outstanding consumer installment debt, such as credit cards, education, and auto loans. Excludes debt secured by real estate.

The normalized price paid by urban consumers for a representative basket of goods and services using a fixed-weight index. The core CPI excludes prices of food and energy.

Balance of trade + net factor payments + net transfer payments.

Annualized number of domestically produced vehicles sold in the previous month.

Value of new purchase orders placed with domestic manufacturers for goods with a life expectancy of more than 3 years, such as automobiles, computers, appliances, and airplanes.

Total compensation for civilian workers.

Annualized number of existing residential buildings that were sold during the previous month.

Value of inventories of domestic manufacturers for durable and nondurable goods.

Value of new purchase orders placed with domestic manufacturers for durable and nondurable goods.

A review of the state of the economy and budget, and related forecasts on future outlook.

A detailed record of the Committee's interest rate meeting held about two weeks earlier. The minutes provide detailed insights regarding the FOMC's stance on monetary policy, so traders carefully comb them for clues regarding future interest rate shifts.

Initial estimate of GDP, total value of all goods and services produced by the economy.

Annualized quarterly implied rate of inflation for all economic activity. Used to calculate difference between nominal and real GDP.

Final estimate of GDP, total value of all goods and services produced by the economy, revising the preliminary.

Revision to estimate of advance-GDP, total value of all goods and services produced by the economy.

Annualized number of new residential buildings that began construction during the previous month.

Report on monetary policy and U.S. economic performance from the Federal Reserve.

Measure of aggregate economic activity from several series.

Output of industrial firms.

Number of first-time filings of jobless claims, seasonally adjusted.

Table 1, cont'd**U.S. Macroeconomic Announcements**

Name of announcement	Units of announcement	Frequency	Release lag	Source	Release time
International Trade in Goods and Services	\$ Billions	Monthly	~6 weeks	Commerce	8:30 AM
Inventories and Sales Ratio		Monthly	~6 weeks	CB	10:00 AM
ISM Index (formerly the NAPM Survey)	Index	Monthly	Almost none	ISM	10:00 AM
Lagging Indicators	m-m	Monthly	~3 weeks	Conf. Board	10:00 AM
Leading Indicators	m-m	Monthly	~3 weeks	Conf. Board	10:00 AM
M1	Change in \$ billions	Weekly		FRB	4:30 PM
M2	Change in \$ billions	Weekly		FRB	4:30 PM
Merchandise Trade Balance	\$ Billions	Monthly	~6 weeks	CB	8:30 AM
New Home Sales	Thousands	Monthly	~3-4 weeks	CB	10:00 AM
Nonfarm Payrolls	Thousands	Monthly	A few days	BLS	8:30 AM
Personal Consumption Expenditure Index (PCE)	% m-m	Monthly	~4 weeks	BEA	8:30 AM
Personal Income	% m-m	Monthly	~4 weeks	BEA	8:30 AM
Personal Spending	% m-m	Monthly	~4 weeks	BEA	8:30 AM
Producer Price Index	% m-m, Index (1982 = 100)	Monthly	~2 weeks	BLS	8:30 AM
Productivity Costs	Index of output/ index of hours worked	Quarterly	Several months	BLS	8:30 AM
Retail Sales (Advance)	% m-m	Monthly	~2 weeks	CB	8:30 AM
Retail Trade	\$ Millions	Monthly	~6 weeks	CB	8:45 (Sales) and 10:15 (Inventories)
Target Federal Funds Rate	%	8 times a year		FRB	2:15 PM
Trade Balance	\$ Billions	Monthly	~6-7 weeks	BEA	8:30 AM
Treasury Auction Results		Weekly		Treasury	11:00 AM
Unemployment rate	% of labor force	Monthly	A few days	BLS	8:30 AM
U.S. Exports	% m-m (2000 = 100)	Monthly	~5-6 weeks	CB	8:30 AM
U.S. Imports	% m-m (2000 = 100)	Monthly	~5-6 weeks	CB	8:30 AM
Value of New Construction Put in Place	\$ Millions, % m-m	Monthly	~5 weeks	CB	10:00 AM

NOTE: CPI, consumer price index; GDP, gross domestic product; NAPM, National Association of Purchasing Managers; NFP, nonfarm payroll; PCE, personal consumption expenditures; PMI, Purchasing Managers' Index; PPI, producer price index. The following abbreviations are used for announcement sources: BEA, Bureau of Economic Analysis; BLS, Bureau of Labor Statistics; CB, U.S. Census Bureau; Conf. Board, Conference Board; CBO, Congressional Budget Office; Commerce, U.S. Department of Commerce; ETA, Department of Labor's Employment and Training Administration; FRB, Federal Reserve Board; ISM, Institute for Supply Management; NAR, National Association of Realtors; Treasury, U.S. Department of the Treasury. m-m, Level change from month to month; % m-m, percent change from month to month; % q/q, percent change quarter over quarter; % q-q, percent change from quarter to quarter. All times are eastern standard.

Description of announcement

Total exports of goods and services minus total imports.

Inventories/sales ratio.

A national manufacturing index based on a survey of purchasing executives at roughly 300 industrial companies. Signals expansion when the PMI is above 50 and contraction when below.

Lagging measure of aggregate economic activity from several series.

Combining 10 series to measure likely change in economic activity.

A relatively narrow measure of the money supply (M1). The most-liquid forms of money, namely currency and checkable deposits.

A less-liquid measure of money than M1. The non-M1 components of M2 are primarily household holdings of savings deposits, small time deposits, and retail money market mutual funds.

The net difference between imports and exports in an economy.

Annualized number of new residential buildings that were sold during the previous month.

Nonfarm payrolls: change in number of employed people during the previous month, excluding the farming industry, as well as trends in hiring payments and sectors.

Price level of consumers when purchasing goods and services, a Fisher index. The core PCE excludes prices of food and energy.

Income received by individuals.

Amount spent by consumers on goods and services.

Price level of output from domestic producers.

Output, measured net of price change and interindustry transactions, is compared with labor input, measured as hours at work in the sector for the major U.S. economic sectors, including the business sector, the nonfarm business sector, nonfinancial corporations, and manufacturing, along with subsectors of durable and nondurable goods manufacturing.

An advance estimate of the value of sales at the retail level, based on a sample of both small and large firms.

Comprises establishments engaged in retailing merchandise, generally without transformation, and rendering services incidental to the sale of merchandise.

FOMC sets the target interest rate at each of its meetings.

Value of exported less imported goods and services.

The type and value of Treasury securities to be auctioned.

Unemployed workers—those seeking work but never employed during the period—as a percentage of the labor force.

Exports disaggregated by country of final destination and type of good.

Imports disaggregated by country of origin and type of good.

This is part of the total construction spending report released by the Census Bureau.

times per year and since February 1994 has issued a statement about the state of the economy and its federal funds rate decision upon the conclusion of the meetings. Since 1995, these statements have been issued at about 2:15 PM, except for March 1996, when the statement was released at 11:39 AM to avoid a conflict with the Chairman's congressional testimony.⁹ Before 1994, the FOMC did not explicitly announce its target rate but signaled it through open market transactions. FOMC decisions affect the value of the dollar; unexpectedly higher interest rates are thought to raise the value of the dollar by increasing the quantity demanded of U.S. debt instruments.

Several important news releases pertain to real economic activity in the labor, housing, consumption, and production markets. Because the Federal Reserve usually raises short-term interest rates in response to unexpectedly strong real activity, such a positive shock usually raises expected future U.S. interest rates relative to foreign interest rates and therefore strengthens the dollar immediately.¹⁰

Although it is not the first employment report released, market participants view the Bureau of Labor Statistics (BLS) Employment Situations report, which includes nonfarm payrolls, as the most influential employment release. The Department of Labor releases a timelier but less watched—per conventional wisdom in the financial press—weekly report on initial unemployment claims on Thursdays at 8:30 AM eastern time.

Market participants likewise closely watch housing news because of the cyclical sensitivity of the housing market. The Census Bureau releases monthly Housing Starts—the number of new houses started, expressed at an annual rate—about two or three weeks into the month that follows

the announcement; New Home Sales (single-family) about 30 days after the end of the month; and Construction Spending on the final day of the second month that follows the activity to which the announcement pertains. Finally, the National Association of Realtors releases the monthly Existing Homes Sales report about five weeks after the end of the month. The Existing Home Sales report has limited predictive power, however, because its information is dated; sales of existing homes are counted only at the end of the home-buying process. In contrast, Housing Starts is timelier because it records the start of new home construction.

Gross domestic product (GDP) is the most comprehensive measure of real economic activity and, as such, is important to financial markets. The Bureau of Economic Analysis (BEA) releases quarterly advanced GDP reports in the final week of January, April, July, and October, with two revision rounds—preliminary and final—following one and two months later, respectively.

Several releases pertain to consumer behavior: monthly retail sales, monthly personal income, monthly personal spending, and monthly consumer confidence. Retail sales (of goods) is the first monthly announcement on consumer spending—the Census Bureau releases it about two weeks into the following month—and it often contains a large surprise component. Both the Conference Board and the University of Michigan release survey data on consumer confidence. Each month the Conference Board surveys 5,000 households about labor market conditions, typically receiving 3,500 responses. It summarizes the results in a Consumer Confidence survey on the last Tuesday of the month. The University of Michigan surveys 500 people about their financial situation and their views of the U.S. economy and then releases a study on Consumer Sentiment on the second Friday of each month, with final revisions released on the last Friday of the month. The Michigan study has a broader perspective than the Conference Board survey, which concentrates on labor market conditions.

At least three monthly announcements focus on production: the Institute for Supply Management (ISM) Manufacturing Survey, the Durable

⁹ The federal funds rate is an overnight interbank interest rate. The Open Market Desk of the Federal Reserve Bank of New York buys and (rarely) sells Treasury bills to control the federal funds rate, which strongly influences other short-term interest rates. Mizzrach and Neely (2009) detail Federal Reserve procedures and institutional details regarding trading in U.S. Treasuries. Fleming and Piazzesi (2005) nicely document the recent history of FOMC policy announcement times and market reactions.

¹⁰ Faust et al. (2007) and Evans (2010) each detail their own preferred views of the relation of exchange rates to fundamentals and how macro announcements could affect exchange rates through interest rates and risk premia.

Goods Orders report, and the Business Inventories report. The ISM Manufacturing Survey—formerly the NAPM survey—is very timely, released on the first business day of the following month. Its new export orders series is most directly relevant to currency markets. The Federal Reserve Board simultaneously releases the monthly Industrial Production and Capacity Utilization reports about two weeks following the business month. The Census Bureau’s Durable Goods Orders report is less timely, coming three or four weeks into the following month, but is still influential: It describes orders for cyclically sensitive items that last more than 3 years, such as capital goods, computers, and steel. The Factory Orders report, released weeks later by the Census Bureau, includes non-durable goods but lacks additional forecasting value. The Census Bureau also publishes the Business Inventories Report—formerly the Manufacturing and Trade Inventories and Sales Report—six weeks after the relevant month. Currency traders usually interpret a rising inventories-to-sales ratio as indicative of a weaker economy, lower interest rates, and a weaker dollar.

The BLS releases three monthly inflation announcements around the middle of the following month: Import and Export Prices, the Producer Price Index (PPI), and the Consumer Price Index (CPI). The PPI measures the price inflation of initial (crude), intermediate, and final goods, and presages the CPI release.¹¹ Although one might think that unexpectedly high inflation would reduce the value of the dollar through purchasing power parity (PPP), the effect depends on the expected Federal Reserve reaction to inflation pressures. If inflation pressures create expectations of higher interest rates, then the dollar could appreciate.

The Census Bureau releases the highly relevant but untimely monthly trade balance report 1½ months after the trading month. Similarly, the BEA releases the quarterly current account

balance—with a Merchandise Trade Balance section, matching the Census Bureau release—2½ months after the end of the quarter. These announcements are formally called the International Trade in Goods and Services and the International Transactions Account (Current Account), respectively.¹² A positive (negative) trade balance surprise implies a smaller (larger) U.S. trade deficit and generally dollar appreciation (depreciation).

The Conference Board publishes indices for the Leading Economic Indicators, Coincident Indicators, and Lagging Indicators about three weeks after the reviewed month. These indicators do not generally influence the foreign exchange market because the components are essentially known by the time that they are released.

THE LITERATURE ON ANNOUNCEMENTS AND FOREIGN EXCHANGE

This section describes the literature that studies the effect of announcements on conditional mean exchange rate returns. The appendix shows summary information—an abbreviated abstract, the type of exchange rate, sample period, announcements, etc.—for these papers.

Methodology

To compare coefficients on announcement surprise series with different magnitudes, recent researchers have typically followed Balduzzi, Elton, and Green (2001) in standardizing surprises by subtracting the MMS expectation from the release and dividing those differences by the standard deviation of the series of differences. For example, the standardized surprise for announcement j is as follows:

¹¹ Initial goods include raw materials such as oil, coal, and wheat. Intermediate goods encompass papers, fabrics, cogs, and any other materials in the process of becoming a final good. Final goods are those goods used directly by consumers and businesses, rather than inputs to production.

¹² The current account also includes international factor payments—e.g., dividend or coupon payments—from past asset purchases. In addition, there are technical differences in how these statistics are constructed. The BEA uses quarterly chaining on annualized data, as well as underlying NIPA current dollar data. The Census uses monthly chaining with monthly data and Census current dollar data.

$$(1) \quad S_t^j = \frac{R_t^j - E_t^j}{\hat{\sigma}_j}$$

where R_t^j is the realization of announcement j at day t , E_t^j is the MMS market expectation, and $\hat{\sigma}_j$ is the estimated standard deviation of the series of the differences. Thus, researchers use announcement surprises that are close to mean zero and have a unit standard deviation.

Because causality runs one way—exchange rates should react rapidly to the surprise component of announcements—the determination of the effect of announcement surprises on exchange rate returns is simple in a traditional “event study.” Specifically, the most common method to study the effect of announcements on exchange rate returns is to simply regress exchange rate returns on J announcement surprises—perhaps with leads and lags of the surprises to characterize information leakage or delays in response—and other variables (\mathbf{X}_t), such as interest rates, that may affect exchange rate returns:

$$(2) \quad R_t = \alpha + \sum_{j=1}^J \alpha_j S_t^j + \beta \mathbf{X}_t + \varepsilon_t.$$

Researchers interpret the coefficient, α_j , as the change in the return as a result of a one-standard-deviation surprise in the j th type of news.¹³

Efficient Markets and the Earliest Announcement Studies

Researchers began assessing the role of macroeconomic news on foreign exchange rates in the early 1980s. Fama’s (1970) EMH and the uncovered interest rate parity (UIP) hypothesis motivated the methods of these early papers. Specifically, efficient markets implied that “news” should explain any deviations of exchange rates from UIP. Several similar papers—Dornbusch (1980), Frenkel (1981), and Edwards (1982a,b)—explored this issue. Generally, they regressed monthly interest rate–adjusted foreign exchange returns—i.e., deviations from UIP—on “news” about various macro fundamentals related to monetary conditions, output, trade balances, and

such. Edwards (1982a), for example, applied Zellner’s (1962) seemingly unrelated regressions (SUR) to a system of UIP equations augmented with the difference between U.S. and foreign news about money supplies, income, interest rates, and monthly returns from July 1973 to September 1979. The author found mixed evidence that these news differentials predict deviations from UIP. Finding the “news” that moves exchange rates would require further investigation.

Unfortunately, the monthly data used in these early studies hindered precise estimates of announcement effects because noise from unrelated effects or other announcements would obscure true relations in the data (Hakkio and Pearce, 1985). In the 1980s the increasing availability of high-frequency data and more powerful computers allowed researchers to investigate foreign exchange reactions to macroeconomic announcements with much greater precision. High-frequency data produce inherently more precise estimates because they enable the econometrician to analyze price movements in a short interval around the announcement, which isolates the announcement’s effect on the exchange rate.

Early Studies of the Effect of U.S. Monetary Policy on Foreign Exchange Returns

Early announcement studies focused on money supply releases because money was key to the exchange rate models of the 1970s and the Federal Reserve targeted nonborrowed reserves to achieve a desired path for M1 from October 1979 to October 1982. Several papers studied the impact of U.S. monetary news on foreign exchange markets, including the stability of such reactions in the presence of changes in Federal Reserve operating procedure.

A puzzling positive correlation between weekly money supply (M1) shocks and interest rate changes motivated some of this research. The correlation was puzzling because it seemed counter to the presumption that a liquidity effect should produce a negative correlation between money supply shocks and interest rates. Two possible explanations for the negative correlation

¹³ We will see later that microstructure researchers would prefer a more complex system that includes order flow.

were (i) positive money supply shocks increased interest rates through a Fisher effect or (ii) positive money supply shocks raised interest rates by creating expectations that the Federal Reserve would reverse those positive shocks in the future by raising interest rates.¹⁴ These explanations could alternatively be interpreted as a market expectation of a persistent money supply shock or a market expectation that the Fed would counter a money demand shock with higher rates.

Two very similar, approximately contemporaneous studies—Cornell (1982) and Engel and Frankel (1984)—attempted to resolve this puzzle with evidence from the foreign exchange market.¹⁵ These studies regressed daily exchange rate changes on money supply announcement surprises, determining that positive M1 shocks increased the value of the USD. Cornell (1982) and Engel and Frankel (1984) argue that these results support the notion that a rising money supply produces expectations of future monetary tightening. The latter authors described this notion as “Keynesian,” but it is not clear why it should be specifically associated with Keynesian thinking.¹⁶ Cornell (1983) added evidence from stock and long-term interest rate markets, considered more explanations for the puzzle, and concluded that the data were not fully consistent with any one model.

Later papers considered two questions: How do reactions vary in response to policy changes? How do exchange rates react to a broader set of macroeconomic surprises?

Hardouvelis (1984) studied the October 1979 shift in Fed operating procedures from interest rate targeting to control of the money supply. Using Friday-to-Monday spot exchange rates from February 15, 1980, to June 25, 1982, and UIP to measure expected future exchange rates,

Hardouvelis (1984) found that positive M1 surprises appreciate the spot value of the dollar but reduce its expected future value.¹⁷ He concluded that the liquidity effect dominates in the short run—markets expect higher real rates in response to M1 growth—but that the inflation premium (the Fisher effect) reduces the expected future value of the dollar.¹⁸ In contrast, positive M1 shocks tended to depreciate the dollar in 1977-79. Although the Fed did not have complete inflation-fighting credibility in either sample, results from the foreign exchange market indicate that its credibility was much higher in the second subsample, after October 1979.

Hardouvelis (1988) followed up on his earlier study by examining how the importance of monetary and macro announcements changed in response to the end of Federal Reserve monetary targeting in October 1982. Using daily data from October 11, 1979, through August 16, 1984, he showed that markets responded significantly to trade deficit, inflation, and business cycle news. But exchange rate reactions to news about reserves displayed some instability. Sheehan and Wohar (1995) found that U.S. money supply announcements stopped affecting USD rates in 1986 or 1987. This date is consistent with Meulendyke’s (1998) estimate of when the FOMC switched to interest rate targeting but later than Thornton’s (2006) assessment of 1982. Sheehan and Wohar (1995) also found some evidence of asymmetry: Only bad news affects exchange rates.

Hakkio and Pearce (1985) researched the effect of M1, CPI, PPI, unemployment, and industrial production shocks on seven exchange rates with three exchange rate observations per day over three subsamples that were defined by perceived changes in Federal Reserve operating procedures: (i) federal funds targeting, September 29, 1977, to October 5, 1979; (ii) reserves targeting, October 6,

¹⁴ This line of research helped to illuminate the distinction between uncertainty about the long-run inflation rate and short-run liquidity. This distinction is featured in recent New Keynesian models such as Smets and Wouters (2007), Ireland (2007), and Cogley and Sbordone (2008).

¹⁵ Engel and Frankel (1984) was written in 1982.

¹⁶ Engel and Frankel (1984) associated the idea that tighter money market conditions would raise interest rates with Keynesian IS/LM modeling.

¹⁷ With the benefit of hindsight, the persistent failure of the UIP relation to predict exchange rates makes it seem inappropriate to equate interest-adjusted exchange rates (i.e., forward or future rates) with “expected spot rates.” In the early 1980s, such evidence was just beginning to emerge, however.

¹⁸ Culbertson and Koray (1986) investigate the correlation between money growth and interest rates through regressions of the forward premium on money shocks, but this does not shed light directly on foreign exchange responses to money supply changes.

1979, to October 4, 1982; and (iii) federal funds targeting, October 6, 1982, to March 2, 1984. Only unexpected changes in M1 consistently affected exchange rates, the changes in exchange rates occurred rapidly, and those effects were significant only after October 1979, confirming the results of Hardouvelis (1984). After October 1979, the foreign exchange market began to behave as though it believed that the Federal Reserve would reverse positive M1 shocks by raising interest rates.

Tandon and Urich (1987) evaluate the effects of both U.S. money supply and PPI and CPI inflation announcements on interest rates and exchange rates for seven industrialized countries from 1977 to 1982. Regrettably, they did not allow for structural breaks during the sample to reflect the October 1979 changes in Federal Reserve operating procedures, as they did for some of their work on interest rates. Nevertheless, the authors found that the value of the USD significantly appreciated with respect to the GBP and CAD in response to a positive PPI shock, possibly because markets expected the Federal Reserve to reverse such a price level shock with higher interest rates in the future.¹⁹ CPI announcements, which are released later than PPI, had no effect on exchange rates or interest rates. It is not clear why Tandon and Urich (1987) found significant effects for PPI shocks on the GBP and CAD when Hakkio and Pearce (1985) had not, but Hakkio and Pearce's (1985) relatively short subsamples might have contributed by reducing the power of their tests. On the other hand, Hakkio and Pearce's (1985) three observations per day should have provided better power to reject the null of no effect.

One should note that it is not necessary for the FOMC to respond directly to PPI shocks for such shocks to influence expectations of future policy. Shocks can move exchange rates if the market thinks that either the FOMC does pay attention to the shock or the FOMC (or another central bank) pays attention to something that

PPI predicts, such as shocks to the CPI or shocks to PCE. It is also possible that the results were simply spurious.

Early Studies of Non-U.S. Monetary Policy and Foreign Exchange Returns

Several papers studied exchange rate reactions to non-U.S. money supply/monetary policy announcements. A common theme was that market reactions to money supply or macroeconomic announcements depended on market expectations of the central bank's response to the surprise.

Doukas (1985), for example, used daily data to compare the reactions of the CAD/USD exchange rate to U.S. and Canadian money supply announcements from 1974 to 1978. Using an ARIMA model to compute expectations, he found that U.S. money surprises were more influential on foreign exchange markets than were their Canadian counterparts, speculating that this was because the weekly U.S. figures were released 50 minutes before the analogous Canadian numbers.²⁰ Alternatively, Canadian monetary policy announcements might have been perceived as less important because markets believed that the Bank of Canada was following the Federal Reserve's policy actions to maintain stable exchange rates.

Ito and Roley (1987) investigated whether tight monetary policy or the underlying strength of the U.S. economy was responsible for the strong appreciation of the USD in the early 1980s. Using five observations per day over several subsamples of 1980-85, Ito and Roley (1987) examined responses to U.S. and Japanese money, industrial production, and price announcements. Positive shocks to the U.S. money supply had the largest positive effect on the value of the dollar, which probably reflected expectations that the positive shocks would be reversed in the future with higher interest rates. This effect confirms findings by Hardouvelis (1984) and Hakkio and Pearce (1985).

¹⁹ Clarida and Waldman (2008) show that the domestic currency can appreciate in response to a higher-than-expected inflation shock if the domestic central bank follows a Taylor rule. They also provide some empirical evidence on the effect of inflation shocks on the exchange rates of 10 countries over the 2001-05 period.

²⁰ Gilbert et al. (2010) investigate the importance of three factors—ability to forecast FOMC decisions and current GDP, timeliness, and revision noise—in explaining the differential impact of news on interest rates, equities, and exchange rates. They find that timeliness is the single most important factor, followed by ability to forecast FOMC decisions and current GDP.

Very similarly, MacDonald and Torrance (1988) used exchange rate reactions to U.K. money supply announcements to determine that a higher-than-anticipated money supply induced expectations of future reversals of the money supply, higher interest rates, and exchange rate appreciation rather than the depreciation that would be induced by expectations of higher inflation.

Almeida, Goodhart, and Payne (1998) used two years of 5-minute DEM/USD data to determine the effects of U.S. and German macroeconomic news. Markets reacted less strongly and more slowly to German announcements than U.S. announcements, perhaps because—according to Almeida, Goodhart, and Payne (1998)—the former were unscheduled during 1992-94. Of course, another explanation for the weaker reaction is that the reaction occurred gradually as information leaked prior to the official announcement. While other papers have presented evidence of information leakage prior to German announcements, Almeida, Goodhart, and Payne (1998) argue that this explanation is unlikely: There was no evidence of systematic reaction to the announcement surprise in the minutes prior to the release.²¹ As with many other papers in the literature on monetary policy news and exchange rates, the authors concluded that expectations of the respective central bank's reaction function determine market reaction to announcements.

Budget Deficits and Foreign Exchange Returns

Deravi et al. (1989) define three subsamples—similar to those defined by Hakkio and Pearce (1985) according to Federal Reserve operating procedures—in finding that neither anticipated nor unanticipated U.S. Treasury debt announcements (1975:Q3–1985:Q3) affect foreign exchange returns. The authors suggest that some combination of Federal Reserve interest rate–targeting policies, an incorrect expectations specification from ARIMA models, or a lack of power could explain their negative results. Indeed, the short length of their subsamples (3 to 4 years) with

quarterly announcements suggests that the tests probably had very little power to reject the null hypothesis that debt announcement shocks did not influence foreign exchange markets.

Later work by Beck (1993) and Kitchen (1996) on debt announcements suggests the sample might have been part of the problem. Using data from January 1980 through July 1990, Beck (1993) considered whether M1 shocks, U.S. federal budget balance shocks, and spending projections influenced exchange rates. Beck's results emphasized the importance of international capital flows: Unexpectedly large budget deficit surprises raised real U.S. rates, which caused capital inflows and USD appreciation.²² Government deficits did not crowd out real investment so much as they imported investment from abroad. As with the findings for money supplies, Beck (1993) found some evidence that market perceptions of policy changed the impact of deficit shocks. That is, foreign exchange markets seemed to stop reacting to deficit shocks after the passage of the Gramm-Rudman-Hollings bill in 1985, which was widely perceived to limit future deficits. In short, exchange rates react to budget deficit news when that news is viewed as indicating persistent, unsustainable deficits.

Early Work on the Trade Balance and Employment Effects

Just as monetary policy issues strongly influenced research in the late 1970s and early 1980s, the emergence of very high unemployment rates in the early 1980s and record U.S. trade deficits in the mid- to late 1980s prompted a surge in research on the effects of those announcements on foreign exchange markets. During the late 1980s, anecdotal reports indicated that the large U.S. trade deficit heavily influenced currency markets: Geiger (1989) notes that “the dollar finished stronger yesterday, lifted by the report of the smallest monthly U.S. trade deficit since December 1984.”

²¹ Andersson, Hansen, and Sebastyén (2009) find evidence that markets obtain information about German unemployment data prior to the official announcement.

²² With a somewhat longer sample, 1981 to 1994, Kitchen (1996) confirmed Beck's (1993) results that the larger deficit projections tend to raise the value of the USD. Interestingly, Kitchen notes that the degree of international financial integration influences the strength of the response of foreign financial markets to U.S. news.

Traders presumably feared either (i) that U.S. policymakers would respond to high deficits with protectionist measures or contractionary monetary policy or (ii) that natural equilibrating mechanisms—associated with dollar depreciation—would tend to reduce deficits.

Even the earliest researchers noticed that market reactions to trade deficit news varied through time, as trade deficits became too large to be sustainable. Deravi et al. (1988) and Irwin (1989) found evidence that the trade balance had significant effects, but only after 1985 and June 1984, respectively. Larger U.S. trade surpluses (deficits) were associated with USD appreciation (depreciation). Hogan, Melvin, and Roberts (1991) examine reasons for the increasing sensitivity and conclude that unexpectedly large trade deficits create expectations of U.S. foreign exchange intervention and/or protectionist trade measures. Klein, Mizrahi, and Murphy (1991) and Aggarwal and Schirm (1992) both argue that increased policy cooperation—the 1985 Plaza accords—increased the influence of balance of trade announcements on currency returns. Karfakis and Kim (1995) discover two significant breaks in the effect of U.S. trade deficit news on the AUD/USD exchange rate from 1985 to 1992. The breaks occurred in October 1987 and January 1990, which coincided with a major worldwide stock market crash and a shift in Australian monetary policy, respectively. It is not clear why these events would have prompted a change in currency markets' reactions to trade deficits.

Returns might react asymmetrically to trade deficit news, as they do to other announcements. For example, if the U.S. trade deficit is viewed as nearly unsustainable, an unexpected rise in that statistic could have large effects on the expected (and thus current) value of the dollar, whereas an equally sized unexpected decline in that statistic could lead to almost no change in the dollar's value. This possibility motivated study of the symmetry of response to trade balance releases. Sultan (1994) finds that positive/negative balance of trade announcements have asymmetric influences on exchange rates and that the impact of that news can differ across spot and futures markets. No subsequent research confirmed this latter

pattern.²³ Aggarwal and Schirm (1998) find both asymmetry and nonlinearity in exchange rate reactions to U.S. trade balance announcements. Curiously, smaller surprises have a proportionately larger impact on exchange rates. Fatum, Hutchison, and Wu (2010) studied asymmetric effects for a wide variety of announcements with a fairly long sample but found no asymmetry for U.S. trade balance announcement effects on the JPY/USD.

In addition to the trade balance and monetary policy announcements, early researchers such as Harris and Zabka (1995) and Moorthy (1995) recognized the importance of the employment report. Unexpectedly strong employment in the United States increased the foreign exchange value of the dollar, perhaps because it increased expected short-term interest rates. Consistent with this interpretation, Moorthy (1995) documents that U.S. employment news that raised the value of the dollar also raised short-term U.S. interest rates. Ederington and Lee (1993, 1995) support the claim that employment news affects foreign exchange returns through expectations of future interest rates.

Curiously, Payne (1996) finds that U.S. trade balance and employment releases produce large effects that persist for over an hour. The reason for the delay is not clear and the finding could be spurious. The next section describes the event study results on the speed of market reactions to announcements.

How Fast Do Markets Adjust?

As discussed previously, the semi-strong form of the EMH predicts that any systematic reaction to public news should be very rapid, to preclude abnormal profit opportunities. Ederington and Lee (1993) investigate how the release of macroeconomic news affects absolute 5-minute USD/DEM returns. Serial correlation tests indicate that the mean exchange rate adjusts to scheduled news within one minute. Ederington and Lee (1994) confirm these results using USD/JPY data. Ederington and Lee (1995) use tick-by-tick data

²³ Puffer (1995) studies the dynamic behavior of successive balance of trade announcements and their relation to exchange rates.

to refine estimates of the speed of adjustment. The currency market begins to adjust its prices within 10 seconds of a news release and completes the change within 40 seconds. The authors also argue that prices overreact in the first 40 seconds and then retreat over the next couple of minutes.

With a sample similar to that of Ederington and Lee (1993), Tanner (1997) finds that although DEM/USD markets react rather quickly to trade balance announcements, the response to U.S. CPI announcements is insignificant from 9 to 10 AM but becomes significant for several periods later in the day. Tanner suggests that market participants require hours to digest the complexity of the CPI report. This explanation is difficult to reconcile with the fact that the delayed systematic response is to a simple object (i.e., the surprise component of the CPI). It is also inconsistent with other studies of the CPI, such as Hakkio and Pearce (1985), Tandon and Urich (1987), and Faust et al. (2007), who all found no significant effect of the CPI. These facts suggest that Tanner's finding is most likely spurious. The systematic reactions of markets to scheduled news are very rapid when measured with conventional event study methods.²⁴

Joint Modeling of Mean Returns and Volatility

Andersen et al. (2003) use high-frequency (5-minute) data to comprehensively study the responses of both the conditional mean and the conditional volatility of DEM/USD, USD/GBP, JPY/USD, CHF/USD, and USD/EUR exchange rates to a large set of U.S. and German announcements. The authors reason that the conditional volatility cannot be modeled without correctly modeling the conditional mean, although they do not explore the practical significance of this methodological care. The authors estimate the model in two stages: (i) They estimate the model by ordinary least squares; (ii) then, with the residuals from the first stage, they reestimate the conditional mean by weighted least squares (WLS),

permitting the variance weights to depend on the intraday calendar, news, and conditional volatility effects. WLS more efficiently estimates the announcement surprise coefficients than would unweighted estimates with heteroskedasticity-corrected standard errors.

Andersen et al. (2003) confirm and elaborate on some previous findings. Exchange rates react quickly—"jumping" to a new value and then showing no systematic movement. Also, the first release among a group of related announcements tends to be the most influential. U.S. payroll employment, orders of durable goods, the balance of trade, initial unemployment claims, the NAPM index, retail sales, consumer confidence, and advance GDP significantly affect all exchange rates studied. In addition to these universal effects, CPI, PPI, industrial production, leading indicators, housing starts, construction spending, the federal funds rate, new homes sales, and preliminary and final GDP influence the DEM/USD exchange rate. Among German announcements, only M3 and industrial production significantly influence exchange rates; the authors attribute the relative lack of significance to the unscheduled timing of German announcements. In addition, Andersen et al. (2003) note that markets react asymmetrically to positive/negative announcement surprises, where bad news moves exchange rates more than good news. Generally, positive (negative) U.S. announcement news induces dollar appreciation (depreciation).

Andersen et al. (2003) produced a comprehensive and careful event study of the effect of U.S. and German announcements on exchange rate returns and also documented asymmetry of responses and found that bad news produced more dispersion in analysts' expectations of events. In their conclusion, they discussed the importance of future investigations into how "order flow" actually translates news into price changes. The next section reviews how the microstructure literature considered this issue.

Order Flows and Announcement News

The microstructure literature studies the way that order flows—i.e., signed transaction flows—

²⁴ Evans and Lyons (2005), however, argue that persistent effects can be found by jointly analyzing order flow and returns data.

impound private information into asset prices.²⁵ For example, commercial firms make investments based partly on the basis of their privately known cost structures, and asset managers reallocate holdings based on their preferences and existing portfolio.²⁶ These trading decisions impound private information into prices. And private information can interact with public information in informing trading decisions. For example, investment decisions depend not only on private information but also on the information in macroeconomic releases, which might change judgments about the state of the economy or asset (co)variances.

Much of the literature on announcement effects on the foreign exchange market has implicitly assumed that markets react directly to surprises, without specifying the manner in which markets translate surprises to price changes. Starting around 2000, however, researchers began to consider how trading and news interact to influence exchange rates. Specifically, researchers asked two types of questions: (i) Does order flow itself react to news? (ii) Does order flow help impound news into prices? If so, does news influence the price impact of trading?

The issue of order flow reaction to news requires some explanation. In the context of the stock market, Hasbrouck (1991) reasoned that news surprises should not directly affect order flow under rational expectations. News should cause an immediate price adjustment to a new equilibrium price but should not cause systematic orders; otherwise, the price effects from those predictable orders would themselves be predictable, creating a profit opportunity. While the Hasbrouck reasoning has strongly influenced the microstructure literature, Evans (2010) lays out

two microstructure models in which such reasoning fails because announcements can affect order flow through dealers' risk management practices. Dealers adjust their quotes to produce predictable patterns in order flow to better manage their inventory risk.

Four papers do study the effects of news on order flows (or trading flows). Evans and Lyons (2005) find that coefficients on standardized news surprises clearly explain order flow in reduced-form vector autoregressions (VARs). In fact, even lagged news significantly determines order flow, implying a prolonged impact of news on order flow. Rime, Sarno, and Sojli (2010) find a reduced-form effect on interdealer order flow for the USD/EUR, USD/GBP, and JPY/USD exchange rates. Similarly, Gradojevic and Neely (2009) find clear reduced-form effects on CAD trading flows from U.S. macroeconomic news. These reduced-form impacts are potentially consistent with Hasbrouck's (1991) claim that news should not systematically cause order flows if expectations are rational, however. For example, if order flows react systematically to exchange rate changes, then any announcement that changes the exchange rate will also predict order flow. The results of Love and Payne (2008) are not consistent with Hasbrouck's reasoning, but Evans' (2010) inventory management models could explain them. Love and Payne (2008) find both reduced-form and systematic structural effects of macro releases on order flow using identified bivariate VARs with macro surprises as regressors.

More papers have studied the second issue: How does order flow mediate the impact of news on exchange rates? Evans and Lyons (2002) pioneered the study of this question with actual order flows. Their paper does not directly study announcement effects on exchange rates but rather finds that macro announcements increase the price impact of order flow using four months of DEM/USD transactions from May 1 to August 31, 1996.

Evans and Lyons (2005) use all Citibank USD/EUR customer trades from April 11, 1993, to June 30, 1999, to reinvestigate the speed with which currency market returns and order flows

²⁵ Order flow is related to trading volume as the latter is the sum of absolute order flows. Some previous work, such as Fleming and Remolona's (1999) bond market studies, observed that announcement releases actually reduce trading volume in asset markets.

²⁶ Unfortunately, the nature of order flow data does not reveal the specific nature of the private information that prompts the order and researchers have not—to our knowledge—pursued this issue. It is unlikely that even the banks that collect the order flow data generally know the nature of the reason for the order. The closest that one can come to inferring the private information is to obtain order flow that is classified into various categories such as commercial or financial.

respond to news.²⁷ They define the *average news effect* as the direct effect of macroeconomic news releases on foreign exchange currency rates, while the sum of the direct effect and the indirect effect of order flows comprises the *total news effect*.²⁸ Evans and Lyons (2005) argue that the total news effect of a news release on foreign exchange rates should include not only the immediate price response but also the response to delayed trades. Using a reduced-form VAR model to examine the joint dynamics of returns and order flows, Evans and Lyons (2005) find substantial effects of macro surprises on both returns and order flows. In addition, they claim that announcements produce a delayed systematic reversal of the initial price impact, over the course of several days. This contrasts with Ederington and Lee (1995), who find that price movements are completed within 40 seconds of an announcement. Evans and Lyons (2005) explain the delay by arguing that end users do not constantly monitor currency markets and must take time to evaluate price changes and transact, presumably because they are rationally inattentive (Sims, 2005). While it is not immediately clear how to reconcile this systematic retrenchment from the initial price impact with an efficient market response, Evans and Lyons (2005) explain that the persistent effect is small and would be difficult to detect in returns alone; but analyzing the joint behavior of returns and order flows enables one to find the persistent effect. Evans (2010) discusses how dealer risk management might contribute to this persistent response. Evans and Lyons (2005) also argue that the inclusion of order flow makes the daily responses of returns to announcements relatively stable.

Evans and Lyons (2008) consider a broad measure of macro news—Reuters Money Market Headline News—rather than a small group of specific announcements and study how this news influences exchange rates through order flow using a four-month sample of daily and intraday

interdealer order flow and DEM/USD exchange rates from 1996 (see Evans and Lyons, 2002).²⁹ The authors estimate a complex, nonlinear model of intraday exchange rate returns and interdealer order flow with the generalized method of moments. The arrival of news increases trading intensity and the price impact of order flow, which indicates that news disperses private information through trading activity. The authors go on to identify the contemporaneous relationship between daily exchange rates and order flow with the heteroskedasticity-dependent methods of Rigobon and Sack (2004) and estimate a simpler model on daily data with the generalized method of moments. Macro news generates about 36 percent of daily exchange rate variance: The direct impact creates about 14 percent and the order flow channel about 22 percent. Evans and Lyons (2008) note that 36 percent is an unusually large proportion of variance to attribute to public news, compared with previous studies, and they argue that the inclusion of order flow effects produces this more-credible level. Announcements fail to affect daily order flow's explanatory power.

With 10 months of 1-minute data on the USD/EUR, GBP/EUR, and USD/GBP exchange rates and Rigobon's (2003) "Identification Through Heteroskedasticity" procedure, Love and Payne (2008) use a structural VAR to show that Reuters' interdealer D2000-2 order flow partially impounds U.S., U.K., and euro-area aggregated macro news into prices.³⁰ Treating standardized and signed news surprises from different series as a single news variable, the authors find that order flow accounts for about one-third of the price adjustment produced by announcements. Despite the mediating role of order flow, prices adjust very quickly, within two minutes of the news release. Love and Payne (2008) also reconfirm the traditional finding that announcement effects depend on policy expectations. For example, a rise in U.S. inflation tends to cause the USD to depreci-

²⁷ Prior to 1999, the authors used the aggregated order flow of all the euro-area currencies as USD/EUR order flow.

²⁸ In the language of structural econometrics, the average effect is a pseudo-structural effect of news while the total news effect is a reduced-form effect.

²⁹ The authors also use alternative measures of macro news, including aggregated signed surprises for 28 U.S. and 12 German announcements.

³⁰ The identification scheme assumes that the exchange rate and order flow structural errors have zero covariance with each other and with news and follow GARCH(1,1) processes.

ate, consistent with PPP, but a rise in U.K. inflation tends to cause the GBP to appreciate. The authors conjecture that the latter result is consistent with expectations that the Bank of England—which is an explicit inflation targeter—will raise interest rates to bring inflation back down to the target. Alternatively, Beechey's (2007) work suggests that U.S. inflation expectations are well anchored and the Love and Payne findings could be explained if U.S. inflation shocks have a bigger effect on risk premia than do U.K. inflation shocks.

Order flow also responds to news—in the same direction as the exchange rate changes—with a slight delay. Love and Payne (2008) label this finding as “entirely novel.” The authors speculate that news systematically influences order flow because heterogeneous agents disagree on the implications of announcements for rates and such disagreement induces order flow.

Carlson and Lo (2006) have an unusual announcement study in that they examine the reaction of the Reuters D2000-2 electronic order book on foreign exchange transactions to a single announcement—an October 9, 1997, surprise interest rate hike by the Bundesbank, aimed at heading off inflation pressures. Markets initially responded to this unscheduled and surprising news with high trading volume, volatility, and a fall in the DEM/USD rate.

Savaser (2006) uses proprietary order book data from the Royal Bank of Scotland over two subperiods during the September 1999 to September 2002 sample to show that investors substantially increase their use of limit orders—stop-loss and take-profit orders—prior to news releases and that accounting for this behavior increases the econometrician's ability to explain exchange rate changes, especially large ones.³¹ Some of the exchange rate reaction to scheduled news might be independent of the release's information content.

Rime, Sarno, and Sojli (2010) use one year of high-frequency USD/EUR, USD/GBP, and JPY/USD data—February 13, 2004, to February 14,

2005—to investigate the ability of Reuters' interdealer D2000-2 order flows to predict daily exchange rates. In doing so, they find that macro announcements are important determinants of order flow. Consistent with Love and Payne (2008), good news for the U.S. (foreign) economy increases (decreases) order flow for the USD. In a novel contribution, Rime, Sarno, and Sojli (2010) find that order flow in the days just prior to the news announcement reflects recent revisions in MMS expectations after the day of the survey.

Gradojevic and Neely (2009) investigate the interaction of CAD/USD trading flows—net bank trades in the foreign exchange market—exchange rates, and macro news surprises with a vector error correction model. Although the authors focus on forecasting, the paper shows that GDP, housing starts, PCE, CPI, and the U.S. balance of trade all affect the CAD/USD exchange rate significantly. Curiously, exchange rates and trading flows exhibit a strong pattern in response to macro news surprises. Announcements that increase the value of the USD also tend to increase foreign financial demand for USDs and decrease commercial demand for USDs. Thus, the total impact of news on trading flows depends on the type of trading flow. One interpretation of the Gradojevic and Neely (2009) results is that non-Canadian financial traders react most strongly to news announcements, their trades drive the exchange rate, and price-sensitive commercial traders then tend to buy the currency that became cheaper as a result of the news release.

The announcement/order flow literature considers how announcements might affect exchange rates by releasing private information through order flows. Although private agents generally have incentives to keep their own information private, policymakers usually have an incentive to reveal their information to the public to ensure smooth functioning of markets. The following section reviews studies of the release of monetary policy information.

Recent Research on Monetary Policy, Announcements, and Exchange Rates

Several trends and events in the late 1990s renewed attention on monetary policy announce-

³¹ A stop-loss (take-profit) order instructs dealers to liquidate an agent's position in the event that asset prices move to specified levels against (in favor of) the agent's position. For example, a stop-loss order on a long position would be triggered if the price fell below a specified level.

ments. First, the U.K. government gave the Bank of England operational independence in the conduct of monetary policy in 1998. Second, as of January 1, 1999, the European Central Bank (ECB) began to conduct a common monetary policy for the original members of the European Monetary Union: Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal, and Spain. Third, policymakers and researchers began to seriously consider the importance of communication and central banks responded by increasingly explaining their policy actions.³² Naturally, researchers began to investigate the effects of policy expectations, policy actions, and communications more carefully.

Soon after the ECB began to conduct monetary policy in 1999, researchers began to study its effect on foreign exchange markets and its influence on how these markets react to announcements. Galati and Ho (2003), for example, compare the influence of U.S. and European macroeconomic announcements on daily USD/EUR exchange rates in the first two years of the European Monetary Union. Using rolling regressions, they find that the geographic origin of news and its “sign” (i.e., whether it is good or bad news) determine the response of the USD/EUR exchange rate.³³ The authors interpret their result to indicate that markets became pessimistic about the euro’s prospects near the end of 1999 and reacted strongly to any bad news from the euro area.

Cagliesi and Tivegna (2005) study scheduled and unscheduled U.S. and euro-area announcements—policy statements, market events, market beliefs, terror-related events—using twice-daily data. Scheduled news affects U.S. trading more, whereas unscheduled news dominates in European trading. After dividing their 1999-2004 sample into three subperiods, the authors find

lagged effects of news on exchange rates, which lead them to reject the semi-strong form EMH. Other research has not confirmed this curious finding.

Conrad and Lamla (forthcoming) study the separate effects of the ECB’s interest rate decision, press conference, and question-and-answer session on the level and volatility of the EUR/USD exchange rate. The authors find that the press conference is most relevant for exchange rate returns. The EUR appreciates in response to communications about increasing risks to price stability, consistent with market beliefs that the ECB will respond strongly to inflation.³⁴ In contrast, communications about the real economy or monetary aggregates do not generate significant reactions.

Each month since 1997, the Bank of England’s Monetary Policy Committee has met to decide interest rate policy.³⁵ Melvin et al. (2009) study the effect of these Bank of England announcements on currency markets from 1997 to 2007. Surprisingly, the noon interest rate announcement does not systematically affect returns but does raise exchange rate volatility for 60 to 90 minutes and such effects are particularly likely to be large when the announcement content is unexpected.

Hayo and Neuenkirch (2008 and 2009) use daily GARCH-in-mean models to analyze the effect of U.S. macro announcements and monetary policy communications on Argentinean and Canadian stock, bond, and foreign exchange market returns and volatility, respectively. Both sample periods are from 1998 to 2006. The particular sample period is useful because it contains important breaks in both Argentinean and Canadian policy. That is, Argentina operated a currency board until 2002, tightly linking domestic money markets to those in the United States. The Bank of Canada introduced “fixed announcement days”—scheduled interest rate announce-

³² For example, the FOMC began to contemporaneously announce policy actions in 1994 and adopted this as formal policy in 1995. Starting in August 1997, each FOMC policy directive has included the quantitative value of the “intended federal funds rate.” And since 1999, the FOMC has issued a press release after each meeting with the value of the “intended federal funds rate” and, in most cases, an assessment of the balance of risks (Poole, Rasche, and Thornton, 2002).

³³ Edison (1996) mentions asymmetry between responses to good and bad news.

³⁴ This result supports the arguments of Engel and West (2006) and Clarida and Waldman (2008).

³⁵ On May 6, 1997, Chancellor of the Exchequer Gordon Brown announced that the U.K. government would grant the Bank of England operational independence over monetary policy. The Bank of England Act 1998 formalized this arrangement.

ments—in September 2000. Hayo and Neuenkirch (2008) find that, although U.S. announcements had a significant impact on Argentine markets, their influence (unsurprisingly) diminished after the end of the currency board, which was never completely credible.³⁶ Hayo and Neuenkirch (2009) determine that while both U.S. and Canadian macroeconomic announcements influence foreign exchange returns, the Canadian interest rate announcements mattered most when U.S. and Canadian interest rate policies diverged in 2002-04. This is intuitively sensible: As Canadian announcements imparted more independent information about relative fundamentals, markets would pay more attention to them.

Hayo, Kutan, and Neuenkirch (2008) study FOMC effects on several financial markets, including the USD/EUR market, from 1998 to 2006. They find that formal communications have a greater influence than informal communications and that the importance of FOMC members' statements depends on their role on the Committee. The Chairman and Vice Chairman have the greatest effect on financial markets, governors' statements have greater importance than Reserve Bank presidents, and voting presidents have greater impact than non-voting presidents. Financial markets react more to newswire reports than to the actual speeches.

With the onset of the financial crisis in 2007, central banks began to consider alternative monetary policy tools, including asset purchases. Although work on the effects of these new policy tools has been limited, Neely (2010a) used event study methods to find that announcements of the Federal Reserve's large-scale asset purchases (LSAP) of agency debt, MBS, and long-term U.S. Treasuries substantially reduced long-term U.S. and foreign bond yields as well as the foreign exchange value of the dollar. The exchange rate effect was roughly consistent with that implied by a UIP-PPP-based model. The author argues that the LSAP's success in reducing long-term

interest rates and the value of the dollar shows that central banks are not toothless when short rates hit the zero bound.

In summary, relatively recent research indicates that the effect of monetary policy communications on foreign exchange markets depends on the nature of the communication. That is, who is the communicator? What sort of news (i.e., type and geographic origin) do markets perceive as influencing the particular central banks? What are the stated and unstated goals of the central banks? In other words, news influences exchange rates to the extent that it changes market expectations of central bank actions.

Recent Research on Announcements and Larger Exchange Rate Issues

Researchers have continued to characterize the exchange rate reactions to macroeconomic surprises while often attempting to link those reactions to larger questions. Simpson, Ramchander, and Chaudhry (2005) consider what the effects of announcements imply for the speed of adjustment to several equilibrium foreign exchange conditions. Ehrmann and Fratzscher (2005) reconnect the announcement literature with forecasting, while Faust et al. (2007) study the implications of the joint movement of exchange rates and interest rates for expected depreciation and risk premia. Finally, Andersen et al. (2007), Pearce and Solakoglu (2007), and Fatum, Hutchison, and Wu (2010) investigate whether the state of the business cycle influences the impact of macro announcements on exchange rate returns.

Simpson, Ramchander, and Chaudhry (2005) investigate the implications of macro surprises for several "theories of exchange rate determination"—PPP, covered interest parity, the international Fisher effect, balance of payments, and portfolio balance effects—that might be better termed equilibrium conditions. The authors calculate the effect of 23 types of U.S. macroeconomic surprises on a 10-year sample (January 1, 1990, to September 7, 2000) of daily spot and forward returns for five exchange rates: CAD, DEM, JPY, CHF, and GBP per USD. The authors interpret

³⁶ A lack of complete credibility simply means that there is evidence that people believe that it is possible—even if very unlikely—that the currency board could break down. One can usually reject complete credibility for fixed exchange rate arrangements (Neely, 1994 and 1996).

announcements that reflect consumer demand, such as the trade balance, as affecting the dollar's value through balance of payments equilibrium. As in other studies, positive shocks to U.S. inflation do not reduce the dollar's value, which is inconsistent with continuous adjustment to PPP, but is consistent with stable long-run inflation expectations.

Ehrmann and Fratzscher (2005) attempt to combine the literatures on exchange rate forecasting and macro surprises. Using daily data from 1993 to 2003 and a WLS procedure similar to that of Andersen et al. (2003), Ehrmann and Fratzscher (2005) estimate the impact of macro surprises from the United States, Germany, and the euro area. Echoing the findings of Doukas (1985) on U.S. and Canadian monetary policy announcements, Ehrmann and Fratzscher (2005) find that U.S. surprises have a larger effect than euro-area surprises because the U.S. announcements are released earlier in the month; exchange rates respond more strongly to negative or large shocks or when market uncertainty—measured by volatility—is high. These authors then argue that the in-sample fit of the macro announcements effectively tracks the directional changes in the exchange rate.

Faust et al. (2007) formalize the point that the source of the shocks determines the effect of the macro announcements. The change in asset prices directly around a macro announcement should depend on how the release changes the public's perception of the economy's state. In particular, Faust et al. (2007) describe an example in which lower-than-expected inflation might result from either weak demand or high productivity growth. The former shock should decrease expected future interest rates, whereas the latter might increase them. Reminiscent of Cornell's (1983) methods, Faust et al. (2007) argue that one should jointly study the effects of announcements on multiple asset prices to distinguish which source of shocks is most likely. Using a 16-year span (January 1987 through December 2002) of 5-minute exchange rate and interest rate data, the authors find that 10 U.S. macroeconomic announcement surprises strongly affect exchange rate returns. Stronger U.S. real activity or over-

night higher interest rates appreciate the USD and raise (reduce) U.S. (foreign) interest rates at all horizons.

Nyblom (1989) tests of parameter constancy generally fail to reject the null of constant parameters over the sample, but random coefficients estimation do detect a definite decline in the trade balance coefficients and some decline in the nonfarm payroll coefficients for the exchange rate equations.³⁷ This paper generally rejects parameter instability, concluding that time variation “does not seem to have been a first order issue.” But its sample coincides fairly closely with the well-known “Great Moderation,” a period of very low macroeconomic volatility (Blanchard and Simon, 2001). Therefore one might think that parameter instability is not a first-order issue when macroeconomic conditions and policies are stable.

Reasoning from a risk-augmented UIP relation, Faust et al. (2007) argue that if stronger-than-expected U.S. economic data immediately appreciate the USD, then they must also produce some combination of expected future USD depreciation or a lower risk premium (i.e., higher prices) for foreign assets. The authors conclude that because existing models of risk cannot explain the necessary declines in the risk premium, expected depreciation seems to be a more plausible consequence of the announcement-induced exchange rate changes.

Andersen et al. (2007) also emphasize the use of multiple assets in investigating larger issues, including the impact of announcements conditional on the state of the business cycle and comovements among asset prices. Using their previously developed two-step WLS procedure, Andersen et al. (2007) study the effect of 25 U.S. macro announcements on USD exchange rate futures, as well as U.S., British, and German stock and bond futures, using 5-minute data. They measure the effects for periods of U.S. expansions, contractions, and the full sample, from January 2, 1992, through December 31, 2002. As in previous work, positive real shocks to the U.S. economy

³⁷ Nyblom (1989) proposes a test that parameters are constant versus the alternative that they follow a random walk.

tend to cause USD appreciation. Although they focused on stock and bond returns, the authors also documented cross-country linkages in the U.S. Treasury bond, the S&P500, and the USD/EUR futures returns over both U.S. expansions and contractions, identifying the conditional correlation with Rigobon's (2003) heteroskedasticity-based methods. The U.S. announcements cannot explain all the cross-country linkages.

Two recent papers have considered whether announcement effects are symmetric and dependent on the business cycle. Pearce and Solakoglu (2007) find apparently linear, symmetric, and rapid effects of 11 types of U.S. shocks on 10 years of high-frequency DEM/USD and JPY/USD exchange rates but do argue that the effects depend on the state of the economy. Fatum, Hutchison, and Wu (2010) investigate the impact of 19 U.S. and 16 Japanese announcements on 5-minute JPY/USD returns during Japan's period of zero interest rates, breaking down the responses by the state of the business cycle in the two countries and permitting asymmetry. They conjecture that the exchange rate is more likely to respond asymmetrically to news when the zero bound restricts Japanese policy reactions. This preliminary work finds some evidence of asymmetries but would benefit from more formal tests for such behavior that account for the multiplicity of simultaneous tests on similar hypotheses.

DISCUSSION AND CONCLUSION

This article has surveyed the large literature examining how exchange rate returns react to economic announcements. Such announcements furnish a virtual "controlled experiment," in the words of Hardouvelis (1988), that permits researchers to investigate which announcements influence foreign exchange markets, how markets perceive policies, how quickly markets react to new information, and how this information is impounded into prices.

The fundamental finding of the literature is that a number of macro announcements—from several countries—influence exchange rate returns in consistent ways. Researchers have consistently

found that interest rates, employment, output, and—though declining in importance—the trade balance are among the most important U.S. announcements to the foreign exchange markets. German monetary announcements and Japanese manufacturing, industrial, and spending announcements are also influential. Early researchers used the response of exchange rates to money supply shocks to illuminate the relation between money supplies and interest rates (see Cornell, 1982 and 1983; and Engel and Frankel, 1984). This line of research highlighted the distinction between uncertainty about short-term liquidity provisions and long-run inflation objectives.

UIP implies that announcements that raise (lower) current domestic or expected future domestic interest rates relative to foreign interest rates tend to immediately appreciate (depreciate) the domestic currency. Thus, market reactions to shocks vary over time, between countries, and with the state of the business cycle because the response depends on how the macro shock causes participants to revise their views of the current and future state of the economy. As a central bank gains inflation-fighting credibility, for example, markets will assume that it will reverse a positive inflation shock with higher interest rates and thus positive inflation shocks will appreciate the domestic currency.

Researchers have exploited this variation over time and between countries to discern market perceptions of policy reactions. Hardouvelis (1984) and Hakkio and Pearce (1985) used foreign exchange reactions to macro announcements to document the Federal Reserve's growing inflation-fighting credibility after October 1979. Other researchers investigated how markets reacted to similar announcements across countries. For example, Almeida, Goodhart, and Payne (1998) argue that differences in the likely responses of the respective monetary authorities drive differences in reactions to U.S. and German announcements. Kim (1998) finds that Australian macro releases produce qualitatively similar impacts on the AUD as U.S. macro releases do on the USD.

Foreign exchange responses to macro news can also depend on the shocks or the state of the business cycle. For example, Andersen et al.

(2003) and Fatum, Hutchison, and Wu (2010) both consider asymmetry based on the sign of shocks and the latter paper extends the analysis to the relative state of the business cycle between countries. Similarly, Faust et al. (2007) argue that the source of an inflation shock—demand or productivity—matters for how markets will interpret its effect.

Because announcement effects in foreign exchange markets are not structural—they depend on market expectations of policy and other factors—they can be unstable; but researchers disagree on how prevalent or important such variability is. Bartolini, Goldberg, and Sacarny (2008) emphasize that only a few types of announcements have consistently large and stable effects on asset prices over time. Bacchetta and van Wincoop (2009) and Sarno and Valente (2009) provide similar perspectives on the reasons for this instability. Bacchetta and van Wincoop (2009) argue that small but persistent changes in structural parameters of the economy can produce very unstable expectations that create unstable reduced-form relationships between macro surprises and exchange rates over time. Similarly, Sarno and Valente (2009) show that modeling selection strategies for exchange rate forecasting might perform poorly because shifting market expectations changes the relative importance of fundamentals over time. Faust et al. (2007) dispute the practical importance of instability, however. Ignoring measurement error in surprises, they find that nine announcements are statistically significant determinants of either the USD/DEM-EUR or USD/GBP in a 14-year sample. They argue that coefficient instability is not “a first order issue.” The relative macroeconomic stability of their sample period might contribute to this conclusion, however.

Although the announcement literature originally studied macroeconomic relations, it has also taught us about microstructure, in particular the role of order flow, announcement order/timing, the speed of market reaction, and how information is transmitted. One important contribution of the microstructure literature is to reveal additional—indirect—channels through which announcements can affect exchange rate returns. Love and Payne (2008) and Evans and Lyons

(2008) take different econometric approaches but both conclude that macro news substantially affects exchange rate returns both directly and indirectly, through order flow. Evans (2010) emphasizes that this finding of substantial indirect effects on returns helps to resolve (partially) the puzzle that announced news directly explains only a very small portion of exchange rate variation.

The importance of an announcement surprise depends on how it changes the market’s view of the state of the economy. Because some groups of announcements provide correlated information, the order of announcements’ release is important. Doukas (1985), Tandon and Ulrich (1987), Andersen et al. (2003), and Ehrmann and Fratzscher (2005) have all presented evidence that earlier announcements within a correlated group have a bigger impact on returns.

The initial research on the speed of price adjustment confirmed the prediction of the EMH that exchange rates should adjust very rapidly to scheduled releases (Ederington and Lee, 1995). Such a very rapid change will show up as a price discontinuity (or jump), as found by Andersen et al. (2003 and 2007) and Lahaye, Laurent, and Neely (2009). On the other hand, reactions to unscheduled announcements can be slower. Almeida, Goodhart, and Payne (1998) found that markets reacted more quickly and strongly to scheduled U.S. announcements than to unscheduled German announcements. Reactions to scheduled announcements might be quicker because agents have made contingent plans to respond to the news.

In contrast to Ederington and Lee’s (1995) findings of very rapid adjustment to scheduled news, Evans and Lyons’ (2005) study of order flows and exchange rates suggests that there are delayed systematic responses as announcements prompt sustained trading that gradually recovers part of the initial price impact. Evans and Lyons (2005) argue that such effects would be small and difficult to find with returns data alone; only joint analysis of returns and order flow reveals it. Evans (2010) discusses the possible role of risk management in producing persistent responses of exchange rates and order flow to macro surprises.

Very high-frequency data help to pin down the direct response of exchange rates to announcements because one can attribute almost all of an exchange rate's movement to the announcement in a sufficiently small window around the announcement.³⁸ There is, however, a little-discussed, practical tradeoff between data frequency and sample length. Both higher-frequency data and longer samples allow one to estimate announcement effects more precisely, so longer samples might substitute for high-frequency data.

Conversely, as the forecast horizon goes to infinity, the uncertainty about the exchange rate in the absence of an announcement becomes arbitrarily large and therefore uncertainty about

the announcement effect likewise becomes arbitrarily large. Therefore one cannot know whether announcement surprises have long-run effects.

In summary, researchers have learned a great deal about how exchange rate returns react to various announcements and how these reactions vary with market policy expectations and institutional details such as scheduling. A number of unresolved issues remain, however. What is the extent of asymmetric reactions, by sign of shock and by state of the business cycle, and what economic behavior induces this asymmetry?

More recently, economists have begun to investigate how public announcements precipitate the release of private information that trading impounds into prices. This line of research is still in its early stages and many unresolved issues remain. One area of potential progress would be to use the data from announcement effects on asset prices to inform more realistic structural models of the macro determinants of asset prices.

³⁸ The conditional variance of a foreign exchange rate rises with the forecast horizon, starting arbitrarily low at the shortest horizons but eventually becoming arbitrarily high at long horizons. The rise is linear for a homoskedastic variable.

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APPENDIX
Summary of the Literature on Estimating Announcement Effects on the Conditional Mean of Exchange Rate Returns

Reference	Abstract/Description*
Dornbusch (1980)	The main lessons that emerge from the analysis concern the inadequacy of the monetary approach as a complete theory of exchange rate determination, the central role of the current account in influencing exchange rates...and finally, the conclusion that an interest rate policy not oriented toward the external balance has aggravated exchange rate instability.
Frenkel (1981)	This paper...analyzes the efficiency of the foreign-exchange market and the volatility of exchange rates, as well as the relationships between exchange rates and interest rates. A key distinction is made between anticipated and unanticipated events, and it is shown that the key factor affecting exchange rates has been "news."
Cornell (1982)	This paper presents a test of the joint hypothesis that money supply announcements affect the real interest rate and that changes in the real interest rate affect the exchange rate in the short run. The test results are consistent with the joint hypothesis. For example, it is found that announcement of an unexpected jump in the money supply is accompanied by an increase in interest rates and an appreciation of the dollar. If the rise in interest rates was entirely due to higher inflationary expectations, the dollar should not appreciate.
Edwards (1982a)	A multi-currency model is established to investigate the relationship between spot rates, forward rates, and new information. In a world with more than two countries, the error term will be correlated across rates. Exchange rates can be expressed as a function of factors known in advance, and "news."
Edwards (1982b)	This paper uses a multi-currency approach to analyze the relationship between forward exchange rates, future spot rates and new information. The empirical results tend to support the hypothesis that the exchange rate can be expressed as a function of factors known in advance and "news."
Cornell (1983)	...[M]oney supply announcements have an impact on the real rate, but they do not allow us to conclude that monetary shocks affect the real rate. This apparent paradox arises because the announcements also function as signals which reveal information about real variables such as expected future output and risk preferences. Further tests, using data in addition to money supply announcements, are required to separate those hypotheses that rely on the signaling effect from those which assume that money affects the real rate.

NOTE: *Excerpts are directly from the original sources. Unless stated otherwise, announcements are for the United States.

Asset	Moment/Effect	Sample	Data frequency	Macro announcement(s)
USD/JPY USD/DEM USD/TW index	Conditional mean	July 1973– December 1979	Monthly	U.S.: CA, GDP Canada: CA, GDP France: CA, GDP Germany: CA, GDP Japan: CA, GDP U.K.: CA, GDP
USD/GBP USD/FRF USD/DEM	Conditional mean and volatility	June 1973–July 1979	Monthly	Changes in interest rates proxy for news
USD/GBP USD/CAD USD/DEM USD/JPY USD/CHF	Conditional mean	October 1979– December 1981	Daily	M1
USD/GBP USD/FRF USD/DEM USD/ITL	Conditional mean	July 1973– September 1979	Monthly	U.S.: CPI, M1, IP U.K.: CPI, M1, IP France: CPI, M1, IP Germany: CPI, M1, IP Italy: CPI, M1, IP
USD/GBP USD/FRF USD/DEM USD/ITL	Conditional mean	June 1973– September 1979	Monthly	U.S.: GDP, M1 U.K.: GDP, M1 France: GDP, M1 Germany: GDP, M1 Italy: GDP, M1
USD/DEM	Conditional mean	January 1978– December 1981	Daily	M1

The following abbreviations are used for announcements: BI, Business Inventories; CA, Current Account; CC, Consumer Credit; CCI, Consumer Confidence Index; CPI, Consumer Price Index; CS, Construction Spending; CU, Capacity Utilization; DG, Durable Goods Order; FB, Federal Budget; FF, Federal Funds Target; FI, Factory Inventories; FO, Factory Orders; FOMC, Federal Open Market Committee; GB; Government budget; GD, Government Deficit; GDP, Gross Domestic Product; GNP, Gross National Product; HS, Housing Starts; IC, Installment Credit; Ifo Index; Ifo Business Climate Institute; INSEE, French International Institute for Statistics and Economic Studies; IP, Industrial Production; ISM, Institute for Supply Management Manufacturing index; IUC, Initial Unemployment Claims; LI, Index of Leading Indicators; M1; M2; M3; M4; MI, Michigan Sentiment; MO, Manufacturing Orders; MPC, Monetary Policy Committee (UK); MTB, Merchandise Trade Balance; NAPM, National Association of Purchasing Managers Survey; NFP, Nonfarm Payroll Employment; NHS, New Home Sales; PCE, Personal Consumption Expenditures; PI, Personal Income; PMI, Chicago Purchasing Managers' Index; PPI, Producer Price Index; RPIX, Retail Prices Index excluding mortgage interest payments; RS, Retail Sales, TANKAN, quarterly poll of business confidence reported by the Bank of Japan; TB, Trade Balance; UR, Unemployment Rate; WPI, Wholesale Price Index. The following abbreviations are used for currencies: ARS, Argentinean nuevo peso; AUD, Australian dollar; CAD, Canadian dollar; CHF, Swiss franc; DEM, Deutsche Mark; EUR, euro; FRF, French franc; GBP, British pound sterling; ITL, Italian lira; JPY, Japanese yen; TW, trade-weighted; USD, U.S. dollar.

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Summary of the Literature on Estimating Announcement Effects on the Conditional Mean of Exchange Rate Returns

Reference	Abstract/Description*
Engel and Frankel (1984)	When the Fed announces a money supply greater than had been expected, interest rates rise. Why? One explanation is that the market raises its estimate of the future rates of money growth and inflation, and bids up nominal interest rates. We offer contrary evidence: on such days the dollar appreciates, not depreciates. An alternative explanation is that the market perceives the change in the money stock as a transitory fluctuation that the Fed will reverse in the future. The anticipated future tightening raises today's real interest rate, causes a capital inflow, and appreciates the dollar, the result in fact observed.
Hardouvelis (1984)	...[T]he Fed did gain credibility [after October 1979], but was unable to establish full credibility. The market reactions are consistent with the hypothesis that market participants attached a positive probability to the event that the Fed may at some point in the future abandon its money stock targets.
Doukas (1985)	The aim of this paper is to determine if the observed volatility in the exchange rate of Canadian and U.S. dollars (C\$/US\$) is consistent with the information content of weekly money supply announcements... The results obtained support the hypothesis that money supply announcements do contain important new information for the foreign exchange market and that it is only the unanticipated component of the money supply changes which affects the exchange rate immediately after the announcements. The most interesting finding is that the current exchange rate is more sensitive to U.S. than Canadian money supply announcements.
Hakkio and Pearce (1985)	The results indicate that exchange rates are systematically related to unexpected money announcements after the October 1979 switch in Federal Reserve operating procedures but not before. This response does not appear to have changed, however, after the October 1982 Federal Reserve regime change. Short-run exchange rate movements are not systematically related to news on inflation or real activity.
Ito and Roley (1987)	The results indicate that the dollar tended to appreciate in the New York segment and depreciate in the European segment...The volatility of the exchange rate also differed across markets. Finally, in examining the relative effects of news from the United States and Japan explicitly, U.S. money announcement surprises had the most consistent effects.
Tandon and Urich (1987)	This paper presents empirical evidence relating the announcement effects of U.S. money supply and inflation (CPI and PPI) to Eurocurrency interest rates and the foreign currency markets (both spot and forward) for seven industrial countries over the period 1977-82...unanticipated components of announced changes in money supply have a significant positive effect on Eurocurrency interest rates and a negative effect (implying dollar appreciation) on the spot exchange rates...Unanticipated changes in PPI have a positive significant effect on interest rates, a small surprisingly negative impact on spot exchange rates, and a positive effect on gold prices. The CPI has no effect on either market.
Deravi, Gregorowicz, and Hegji (1988)	We believe three conclusions clearly emerge...First, during the early subsample, that is prior to 1985, there is little evidence of response in foreign exchange markets to the monthly balance of trade announcement. Second, during the post-1985 period there is strong evidence of market response to trade deficit announcements. The response was a depreciation of the dollar in both the spot and forward markets. Finally, the widening of the forward premiums in response to the trade deficit announcements in the post-1985 period suggests that part of the market reaction to these announcements is an anticipation of changing U.S. foreign interest rate differentials

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Asset	Moment/Effect	Sample	Data frequency	Macro announcement(s)
USD/DEM	Conditional mean	October 1979– August 1981	Daily	M1
USD/GBP USD/CAD USD/DEM USD/JPY USD/CHF USD/FRF	Conditional mean	October 1977– October 1979 and February 1980– June 1982	Daily	M1
USD/CAD	Conditional mean	January 1974– December 1978	Daily	US: M1 Canada: M1
USD/DEM USD/GBP USD/FRF USD/CHF USD/CAD USD/ITL USD/JPY	Conditional mean	September 1977– March 1984	3 Prices per day	M1, CPI, PPI, UR, IP
USD/JPY	Conditional mean	January 1980– September 1985	5 Prices per day	Japan: Augmented M2, IP, Wholesale Price Index US: M1, IP, PPI
USD/GBP USD/CAD USD/DEM USD/FRF USD/JPY USD/CHF	Conditional mean	July 1977– December 1982	Daily	M1, CPI, PPI
USD/FRF USD/GBP USD/DEM USD/CAD USD/JPY USD/CHF	Conditional mean	February 1980– July 1987	Daily	MTB

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Summary of the Literature on Estimating Announcement Effects on the Conditional Mean of Exchange Rate Returns

Reference	Abstract/Description*
Hardouvelis (1988)	Markets respond primarily to monetary news, but also to news about the trade deficit, domestic inflation, and variables that reflect the state of the business cycle. For all fifteen macroeconomic variables, an increase (decrease) in interest rates is accompanied by an appreciation (depreciation) of the dollar, which is consistent with models that stress price rigidity and absence of purchasing power parity.
MacDonald and Torrance (1988)	The main aim of this paper was to test whether the policy anticipation or the Fisher hypothesis held sway for the U.K.'s experience with monetary targeting in the period 1981-1985. The evidence fairly convincingly suggested that the policy anticipation hypothesis was the dominant market belief about monetary overshoots for this period: excess monetary growth was expected to be reversed in the future. This finding concurs with the U.S. experience with monetary targeting over roughly the same period of time.
Deravi, Gregorowicz, and Hegji (1989)	...[T]here is a general lack of response in financial markets to the Treasury's debt funding announcements... the Treasury's immediate financing needs over the post announcement quarter may not provide as much important information to market participants as other types of announcements, e.g., money supply announcements or the announcements of the Federal government budget projections. Monetary announcements provide information about future monetary policy, while Federal budget projections provide information about anticipated new issues of Treasury debt over the next one- or two-year horizon. Both types of information are linked to possible future policy moves that might signal large market adjustments.
Irwin (1989)	The effect of U.S. trade deficit announcements on the dollar exchange rate from 1980-1988 is examined. The announcement is found to affect the dollar only after mid-1984. Central bank intervention does not appear to have had a consistent impact on the dollar on the day of the announcement.
Hogan, Melvin, and Roberts (1991)	Contrary to earlier studies, surprisingly large US trade deficits are shown to have a significant effect on exchange rates throughout the 1980s. Three possible reasons for the time-varying effect are considered. The evidence presented yields the following inference: deficit news is likely to have changed expectations of Fed intervention that moved exchange rates; deficit news probably has an effect on revisions of future deficit expectations and exchange rates change as a result; and deficit news may change expectations regarding US trade policy that is reflected in exchange rates.
Klein, Mizrach, and Murphy (1991)	...[W]e analyze daily data on U.S. dollar exchange rates vis-à-vis the West German deutsche mark and the Japanese yen over the period 1980 to 1988. We employ an event-study methodology in order to determine the response of exchange rates to unexpected movements in the U.S. trade balance...[P]rior to the Plaza Agreement (September 1985) there is no systematic response of dollar exchange rates to unexpected movements in the trade balance, whereas following the Agreement there is a strong contemporaneous response. This evidence...supports the conclusions of Dominguez (1989) and Obstfeld (1988) that the period following the Plaza Agreement has represented a shift in the policy regime among the industrial countries.
Aggarwal and Schirm (1992)	...[P]rior to the 1985 "Plaza Agreement" for international economic cooperation, information in trade balance announcements seem to have influenced only interest rates. However, in the 1985- 87 period such announcements also influenced stock prices and currency values. These influences intensify further in the 1987-88 period. Thus, asset prices are sensitive to news in trade balance announcements and this sensitivity seems to have increased significantly in recent years.

See NOTE on pp. 446-47.

Asset	Moment/Effect	Sample	Data frequency	Macro announcement(s)
USD/DEM USD/JPY USD/CHF USD/GBP USD/FRF USD/CAD USD/ITL	Conditional mean	October 1979– August 1984	Daily	M1, Bank Reserves, FF, Fed Surcharge Rate, PPI, CPI, UR, IP, PI, DG, RS, LI, CC, HS, TB
GBP/DEM GBP/FRF GBP/JPY GBP/CHF GBP/USD	Conditional mean	October 1981– August 1985	Daily	UK: M3
USD/JPY USD/DEM USD/CHF USD/FRF USD/GBP USD/ITL USD/CAD	Conditional mean	July 1975– September 1985	Daily	Treasury Debt Issues
USD/TW index	Conditional mean	January 1980– June 1988	Daily	TB
USD/GBP USD/JPY USD/DEM	Conditional mean	February 1980 –March 1989	3 Prices per day	TB
USD/JPY USD/DEM	Conditional mean	January 1980– April 1988	Daily	TB
USD/CAD USD/DEM USD/JPY	Conditional mean	February 1980– December 1988	Daily	TB

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Summary of the Literature on Estimating Announcement Effects on the Conditional Mean of Exchange Rate Returns

Reference	Abstract/Description*
Beck (1993)	...Conclusive evidence of a relationship between large budget deficits and high interest rates has not been found. Two competing explanations are tested by examining the impact of government budget announcements on foreign exchange rates. The Ricardian equivalence proposition that deficits have no crowding-out effects is compared to the conventional open economy hypothesis that capital mobility transfers these effects to foreign exchange rates. The results support the open economy hypothesis over the Ricardian equivalence proposition.
Ederington and Lee (1993)	...[A]nnouncements are responsible for most of the observed time-of-day and day-of-the-week volatility patterns in these markets. While the bulk of the price adjustment to a major announcement occurs within the first minute, volatility remains substantially higher than normal for roughly fifteen minutes and slightly elevated for several hours.
Ederington and Lee (1994)	We find that these announcements are responsible for most intraday and day-of-the-week volatility patterns in this market and we identify the most important announcements. The initial reaction to a major 8:30 announcement begins around 8:30:10 and lasts until about 8:30:50. A partial price correction is normally observed between 8:31 and 8:32. Price movements after 8:32 are basically independent of those observed earlier although volatility continues to be higher than normal until about 8:55.
Sultan (1994)	The objective of this study is to analyze the effects of trade deficit announcements on the joint distribution of the spot and futures price changes. In addition, this study examines whether or not trade deficits and trade surpluses have asymmetric effects on the currency price changes and volatility.
Ederington and Lee (1995)	We examine how prices in interest rate and foreign exchange futures markets adjust to the new information contained in scheduled macroeconomic news releases in the very short run. Using 10-second returns and tick-by-tick data, we find that prices adjust in a series of numerous small, but rapid, price changes that begin within 10 seconds of the news release and are basically completed within 40 seconds of the release. There is some evidence that prices overreact in the first 40 seconds but that this is corrected in the second or third minute after the release. While volatility tends to be higher than normal just before the news release, there is no evidence of information leakage.
Harris and Zabka (1995)	Specifically, we compare the data announced in the report to the consensus forecasts of market practitioners and quantify how surprises in the report affect the major exchange markets over the trading day.
Karfakis and Kim (1995)	[T]he Australian dollar depreciated and interest rates rose as a result of an announcement of a larger than expected current account deficit...[M]arket participants expected a foreign exchange market intervention sale of the Australian dollar by the Reserve Bank of Australia...In addition, significant structural breaks were found.
Moorthy (1995)	1) [E]xchange rates display a large response to the unanticipated component of the [monthly employment] news 2) [T]here is evidence of delay in the exchange rate response after a news release, although not strong enough to suggest a violation of market efficiency
Puffer (1995)	A surprisingly large trade deficit is associated with expectations of larger future trade deficits. Unexpected bilateral trade balances and revisions of previous overall balances which are released at the same time as the overall trade deficit significantly influence the Canadian dollar.

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Asset	Moment/Effect	Sample	Data frequency	Macro announcement(s)
USD/DEM USD/GBP USD/CAD USD/JPY USD/CHF USD/FRF USD/ITL	Conditional mean	January 1980– July 1990	Daily	GD, M1
USD/DEM	Conditional mean and volatility	November 1988– November 1991	5-minute	CPI, DG, NFP, GNP, HS, MTB, LI, PPI, RS, IP, CU, BI, CS, FI, NAPM, NHS, PI, FB, IC
USD/JPY	Conditional mean and volatility	November 1988– June 1993	10-second, 5-minute, 30-minute	CPI, DG, NFP, GNP, HS, LI, MTB, PPI, RS, IP, CU, BI, CS, FI, NAPM, NHS, PI, Summary of International Transactions, U.S. Import and Export Price Indexes, FB, IC
USD/CHF USD/CAD USD/DEM USD/JPY USD/GBP	Conditional mean and volatility	February 1980– April 1989	Daily	TB
USD/DEM	Conditional mean and volatility	November 1988– October 1992	10-second	CPI, DG, NFP, UR, GNP, HS, LI, MTB, PPI, RS, IP, CU, BI, CS, FI, NAPM, NHS, PI, PCE, FB
USD/DEM USD/GBP USD/FRF USD/ITL USD/CAD USD/JPY	Conditional mean	January 1986– March 1995	Daily	NFP, UR
AUD/USD AUD/DEM AUD/JPY AUD/GBP AUD/CHF	Conditional mean	July 1985– December 1992	Daily	Australia: CA
USD/DEM USD/JPY	Conditional mean	January 1985– September 1992	Daily	NFP, UR
USD/CAD USD/DEM USD/JPY USD/GBP	Conditional mean	February 1980– December 1992	Daily	TB

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Summary of the Literature on Estimating Announcement Effects on the Conditional Mean of Exchange Rate Returns

Reference	Abstract/Description*
Sheehan and Wohar (1995)	...[W]e extend and update the prior literature by examining whether recent money supply announcements have an impact on exchange rates and whether recent impacts differ from those found through 1985. The results suggest the impact of money announcements may have diminished marginally. Third, we extend the analysis to exchange rate currency futures. Comparing the reactions of spot and futures rates yields further evidence on the “policy anticipation” versus the “expected inflation” effects. And fourth...we test for asymmetry of money announcement effects.
Edison (1996)	The results suggest that dollar exchange rates systematically react to news about real economic activity—a surprise of 100,000 on non-farm payroll employment leads to a 0.2 percent appreciation of the exchange rate. In general, exchange rates do not react systematically to news on inflation.
Kitchen (1996)	This study examines the response of domestic and international financial variables to announced changes in Federal deficit projections over the 1981-94 period...The exchange value of the dollar tends to be positively related to announced changes in deficit projections, but that result appears to be related to the degree of insulation of foreign financial markets from US financial markets...Taken together the results suggest that higher projected deficits raise real interest rates in part because of an increase in an inflation risk premium.
Tanner (1997)	The market’s reaction to the 8:30 am trade deficit announcement was complete by 9 am, but the market’s response to the CPI announcement was not as immediate. No significant reaction had occurred by 9 am, and the spot price did not fully digest the information until 1 pm.
Almeida, Goodhart, and Payne (1998)	This paper studies the high frequency reaction of the DEM/USD exchange rate to publicly announced macroeconomic information emanating from Germany and the U.S....The direction of the exchange rate response...are driven by the likely operations of monetary authorities in domestic money markets. Further, we detect influences of German monetary policy decisions on the reaction of the exchange rate, and also differences between U.S. and German announcements in the exchange rate reaction time pattern.
Kim (1998)	A higher than expected Australian current account deficit announcement depreciated the AUD while an unexpectedly higher Australian GDP growth rate appreciated it on the announcement day during the Australian market trading...The US announcements, in general, had little effect during the US market trading, however.
Aggarwal and Schirm (1998)	This study documents significant asymmetrical impact of information in trade balance announcements on prices of assets such as equities and foreign exchange rates. Interestingly, foreign exchange rates and equity prices were less responsive to large surprises in the trade balance but more responsive to surprises within one standard deviation of the average. This asymmetry in market reaction to trade balance news seems consistent with the asymmetric nature of central bank intervention policy commitments during the late 1980s.
Evans and Lyons (2002)	This paper addresses whether currency trades have greater price impact when public information is flowing rapidly. We develop an optimizing model to account for why public news should increase the price impact of trades. Using transaction data made available by electronic trading, we test whether trades following macroeconomic news have higher price impact. They do: price impact per dollar traded is about 10 percent higher per news announcement in the previous hour.
Andersen et al. (2003)	Announcement surprises produce conditional mean jumps; hence high-frequency exchange-rate dynamics are linked to fundamentals. The details of the linkage are intriguing and include announcement timing and sign effects. The sign effect refers to the fact that the market reacts to news in an asymmetric fashion: bad news has greater impact than good news.

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Asset	Moment/Effect	Sample	Data frequency	Macro announcement(s)
USD/CAD USD/JPY USD/DEM USD/CHF USD/GBP	Conditional mean	December 1980– August 1990	Daily	M1
USD/DEM USD/JPY	Conditional mean	February 1980– February 1995	Daily	CPI, PPI, IP, RS, UR, NFP
USD/CAD USD/DEM USD/JPY USD/GBP	Conditional mean	March 1981–July 1994	Daily	GD
USD/DEM	Conditional mean	October 1987– November 1991	Daily, hourly	M1, TB, UR, CPI, PPI, IP
USD/DEM	Conditional mean	January 1992– December 1994	5-minute	U.S.: NFP, UR, MTB, PPI, CPI, RS, DG, CCI, LI, NAPM, IP, CU Germany: CPI, Industrial output, M3, Industrial orders, PPI, RS, TB, UR, WPI
USD/AUD	Conditional mean and volatility	February 1985– April 1995	Daily	Australia: CPI, GDP, UR, RS, CA US: CPI, GDP, UR, RS, TB
USD/CAD USD/FRF USD/GBP USD/JPY USD/DEM	Conditional mean	October 1985– November 1993	Daily	MTB
USD/DEM	Conditional mean and order flow	May 1996–August 1996	Hourly	Reuters Money Market Headline News
USD/CHF USD/DEM USD/EUR USD/JPY USD/GBP	Conditional mean, volatility, and jumps	January 1992– December 1998	5-minute	US: GDP, NFP, RS, IP, CU, PI, CC, PCE, NHS, DG, CS, FO, BI, GD, TB, PPI, CPI, CCI, NAPM, HS, LI, FF, IUC, M1, M2, M3 Germany: NFP, RS, IP, Manufacturing Output, Manufacturing Orders, TB, CA, CPI, Producer Prices, Wholesale Price Index, Import Prices, M3

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Summary of the Literature on Estimating Announcement Effects on the Conditional Mean of Exchange Rate Returns

Reference	Abstract/Description*
Galati and Ho (2003)	...[M]acroeconomic news has a statistically significant correlation with daily movements of the euro against the dollar. However, this relationship exhibits considerable time variation. There are indications of asymmetric response, but to different extents at different times. Our results also provide evidence that the market seemed to ignore good news and remain fixated on bad news from the euro area, as often claimed in market commentaries, but only for some time.
Cagliesi and Tivegna (2005)	Coefficient stability tests suggested to divide our 1999-2004 sample into three sub-periods roughly corresponding to the three phases of recent Euro history. The main finding of our analysis is the rejection of the semi-strong EMH once we move from the estimation over the entire sample to the three sub-periods. Here we find many lagged news variables to be significant, contrary to what EMH posits. The distribution of lagged news across time zones (ETZ [European time zone] and ATZ [American time zone]) and among the three sub-periods, indicates a substantial heterogeneity in the way news are decoded by market participants in the two trading zones and that exchange rates in ATZ react almost exclusively to American news...Scheduled news play a much bigger role in ATZ than in ETZ, especially the creation of new jobs in the US (the Non-farm Payroll). Exchange rate dynamics in ETZ is determined mostly by unscheduled news.
Ehrmann and Fratzscher (2005)	We find that economic news in the United States, Germany and the euro area have been a driving force behind daily US dollar–euro/DEM exchange rate developments in the period 1993–2003. The larger importance of US macroeconomic news is at least partly explained by their earlier release time compared to corresponding German and euro area news. The exchange rate is also shown to respond more strongly to news in periods of large market uncertainty and when negative or large shocks occur.
Evans and Lyons (2005)	News arrivals induce subsequent changes in trading in all of the major end-user segments. These induced changes remain significant for days. Induced trades also have persistent effects on prices. Currency markets are not responding to news instantaneously.
Simpson, Ramchander, and Chaudhry (2005)	This paper evaluates the effects of surprises in 23 types of macroeconomic announcements on foreign exchange rates, and on the forward premium...[A]nnouncements that convey a decline in consumer demand increase foreign exchange rates...[T]he PPP hypothesis is rejected in favor of portfolio balance effects in determining exchange rates...[E]xchange rates respond to announcements related to consumer demand, inflation, and interest rates, but not to the announcements directly related to the general strength of the economy...[S]urprises in the Treasury budget, trade balance and capacity utilization have the strongest influence in the currency market.
Carlson and Lo (2006)	...A surprise announcement of an increase in German interest rates coupled with concurrent transactions data enables us to study in detail dealers' reactions. The patterns observed are consistent with dealers' practice to book targeted profits immediately if possible in the face of uncertainty. Evidence also shows that the speculative activity by traders in initial reaction to the news destabilized the market for the next 2 hours.
Savaser (2006)	I find that price-contingent orders can enhance our ability to explain post-release exchange-rate returns by half. Furthermore, the estimated effect of orders is orthogonal to the news surprises.

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Asset	Moment/Effect	Sample	Data frequency	Macro announcement(s)
USD/EUR	Conditional mean	January 1999– December 2000	Daily	US: NFP, UR, Employment Cost Index, DG, NAPM, RS, IP, CPI Germany: UR, IP, CPI Europe: Ifo index, PPI, INSEE Industrial Trends
USD/EUR	Conditional mean	January 1999–April 2004	2 Prices per day	Europe: European Central Bank's Statements and Forex Interventions, Miscellaneous Unscheduled News and Events Relating to Politics, Monetary and Fiscal Policy and/or Market Events, German Business Confidence Index US: Federal Reserve Board of Governors' Statements, Miscellaneous unscheduled news and events relating to politics, monetary and fiscal policy, and/or market events, 9/11, GDP, ISM, NFP
USD/EUR	Conditional mean	January 1993– February 2003	Daily	US: Monetary Policy, NAPM, NFP, IP, GDP, CCI, RS, CPI, UR, HS, PPI, TB, Average Workweek Germany/euro area: Monetary Policy, CPI, M3, UR, Ifo Business Climate, IP, MO, RS, PPI, GDP, TB, Business Confidence
USD/EUR	Conditional mean, volatility, and order flow	April 1993–June 1999	Daily	US: BI, CU, IUC, CCI, CS, CPI, CC, DG, FO, FF, GDP, Earnings, HS, IP, LI, M1, M2, M3, NAPM, NHS, NFP, PCE, PI, PPI, RS, GB, TB, UR Germany: GDP, NFP, RS, IP, Manufacturing Output, Manufacturing Orders, TB, Current account, Cost of Living, WPI, PPI, Import Prices, M3
USD/CAD USD/DEM USD/JPY USD/CHF USD/GBP	Conditional mean	January 1990– September 2000	Daily	Auto Sales, BI, CU, PCE, PI, RS, TB, CPI, Hourly Earnings, NFP, PPI, UR, CC, FB, CS, DG, FO, HS, IP, LI, NHS, GDP, NAPM
USD/DEM	Conditional mean	October 1997	Tick-by-tick	Bundesbank Interest Rate Hike
USD/GBP	Conditional mean, volatility, order flow, and jumps	September 1999– April 2000 and June 2001– September 2002	5-minute	GDP, NFP, RS, DG, BI, TB, PPI, CPI, HS, LI, PCE, PI, IUC

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APPENDIX, cont'd

Summary of the Literature on Estimating Announcement Effects on the Conditional Mean of Exchange Rate Returns

Reference	Abstract/Description*
Faust et al. (2007)	The joint movements of exchange rates and U.S. and foreign term structures over short-time windows around macro announcements are studied using a 14-year span of high-frequency data. For several real macro announcements, a stronger than expected release appreciates the dollar today, and must either (i) lower the risk premium for holding foreign currency rather than dollars, or (ii) imply net expected dollar depreciation over the ensuing decade.
Pearce and Solakoglu (2007)	This paper examines the relationship between macroeconomic news and the dollar-Mark and dollar-Yen exchange rates...We examine the linearity and symmetry of the responses to news and also allow the effects of the news announcements to vary across states of the economy...news indicating a stronger U.S. economy causes an appreciation of the U.S. dollar, that the responses are essentially complete within 5 min, and that measuring the responses over 6-h intervals eliminates the statistical significance of the news. The effects of news appear linear and symmetric but there is some evidence that the effects depend on the state of the economy.
Andersen et al. (2007)	...We characterize the response of U.S., German and British stock, bond and foreign exchange markets to real-time U.S. macroeconomic news...[N]ews produces conditional mean jumps; hence high-frequency stock, bond and exchange rate dynamics are linked to fundamentals...when conditioning on the state of the economy, the equity and foreign exchange markets appear equally responsive...[W]e also document important contemporaneous links across all markets and countries, even after controlling for the effects of macroeconomic news.
Bartolini, Goldberg, and Sacarny (2008)	...[O]nly a few announcements—the nonfarm payroll numbers, the GDP advance release, and a private sector manufacturing report—generate price responses that are economically significant and measurably persistent...The authors' analysis of the direction of these effects suggests that news of stronger-than-expected growth and inflation generally prompts a rise in bond yields and the exchange value of the dollar.
Evans and Lyons (2008)	Macro news can affect currency prices directly and indirectly via order flow. Past research shows that the direct effects of scheduled macro news account for less than 10% of daily price variance. This paper shows that the arrival of macro news can account for more than 30% of daily price variance. Two features of our analysis account for this finding: (1) We consider the broad spectrum of macro news...not just scheduled announcements. (2) We allow the arrival of news to affect prices indirectly via...order flow. Our analysis shows that order flow variations contribute more to currency price dynamics following the arrival of public macro news than at other times. This is not consistent with news effects being common knowledge that is impounded in price directly. Roughly two-thirds of the total effect of macro news on the DM/\$ exchange rate is transmitted via order flow.
Hayo and Neuenkirch (2008)	Argentine markets have become less dependent on U.S. news after the abandonment of the currency board...[T]he currency board was not completely credible...U.S. central bank communication helps to reduce money market volatility during the financial crisis in Argentina.
Hayo, Kutan, and Neuenkirch (2008)	This paper studies the effects of FOMC communication on U.S. financial markets' returns and volatility using a GARCH model over the period from 1998 to 2006. We build a new data set that includes information on all FOMC speeches, post-meeting statements, monetary policy reports and testimonies...We show that central bank communication has a significant impact on financial market returns, in particular on bond markets and much less so on stock and foreign exchange markets, which are affected rather unsystematically.
Love and Payne (2008)	The main result of the paper is that even information that is publicly and simultaneously released to all market participants is partially impounded into prices via the key micro-level price determinant—order flow. We...find that nearly one third of price relevant information is incorporated into prices via the trading process.

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Asset	Moment/Effect	Sample	Data frequency	Macro announcement(s)
USD/GBP USD/EUR	Conditional mean	January 1987– December 2002	5-minute	CPI, FF, GDP, HS, IUC, NFP, PPI, RS, TB, UR
USD/DEM USD/JPY	Conditional mean and volatility	December 1986– December 1996	5-minute	CPI, PPI, M2, TB, UR, IP, CCI, DG, NAPM, RS, NFP
USD/GBP USD/JPY USD/EUR	Conditional mean and volatility	January 1992– December 2002	5-minute	GDP, NFP, RS, IP, CU, PI, CC, NHS, PCE, DG, FO, CS, BI, FB, TB, PPI, CPI, CCI, NAPM, HS, LI, FF, IUC
USD/EUR USD/JPY	Conditional mean	January 1998– July 2007	30-minute and daily	NFP, UR, CPI, PI, PCE, GDP, ISM, HS, CCI, MI, RS
USD/DEM	Conditional mean and order flow	May 1996–August 1996	5-minute and daily	Reuters Money Market Headline News
USD/ARS	Conditional mean and volatility	January 1998– December 2006	Daily	Federal Reserve Board of Governors’ Statements, GDP, IP, TB, ISM, CCI, HS, NFP, UR, RS, CPI, PPI
USD/EUR	Conditional mean and volatility	January 1998– December 2006	Daily	Speeches, congressional hearings, FOMC post-meeting statements, and monetary policy reports from the Federal Reserve
USD/EUR USD/GBP GBP/EUR	Conditional mean and order flow	September 1999– July 2000	1-minute	US: CPI, PPI, UR, TB Europe: IP, M3 UK: RPIX, RS, Global Trade, M4

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Reference	Abstract/Description*
Gradojevic and Neely (2009)	Several types of U.S. macroeconomic announcements—GDP, housing starts, PCE, CPI, and trade balance— influence the CAD/USD exchange rate or trading flows to a statistically significant degree. There are strong patterns in the reduced form responses to macro surprises. Surprises that raise foreign financial trading flows also tend to raise the CAD/USD but reduce commercial trading flow. This pattern might arise because announcement surprises substantially drive exchange rate responses through their effect on foreign financial trading flows and elicit a liquidity provision response from commercial order flow.
Hayo and Neuenkirch (2009)	Canadian and U.S. price shocks and monetary policy news are less important than shocks relating to the real economy...Canadian central bank communication is more relevant than its U.S. counterpart, whereas in the case of macro news that originating from the United States dominates...[T]he impact of Canadian news reaches its maximum when the Canadian target rate departs from the Federal Funds target rate (2002–2004) and thereafter.
Lahaye, Laurent, and Neely (2009)	Nonfarm payroll and federal funds target announcements are the most important news across asset classes. Trade balance shocks are important for foreign exchange jumps. We relate the size, frequency and timing of jumps across asset classes to the likely sources of shocks and the relation of asset prices to fundamentals in the respective classes.
Melvin et al. (2009)	We find evidence for non-linear regime switching between a high-volatility, informed-trading state and a low-volatility, liquidity-trading state. MPC surprise announcements are shown significantly to affect the probability that the market enters and remains within the informed trading regime.
Fatum, Hutchison, and Wu (2010)	...We investigate whether the 5-minute intraday JPY/USD exchange rate response to macroeconomic news announcements depends on the state of the business cycle. Our analysis employs a broad set of comparable news surprises from both the U.S. and Japan...[T]he state of the business cycle is important when assessing the impact of news on exchange rates. We also demonstrate the importance of distinguishing between “good” versus “bad” news. Lastly, we show that while the JPY/USD exchange rate responds to both U.S. and Japanese news, a different set of U.S. than Japanese news moves the exchange rate.
Rime, Sarno, and Sojli (2010)	Using one year of high frequency data for three major exchange rates, we demonstrate that order flow is intimately related to a broad set of current and expected macroeconomic fundamentals. More importantly, we find that order flow is a powerful predictor of daily movements in exchange rates in an out-of-sample exercise.

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Asset	Moment/Effect	Sample	Data frequency	Macro announcement(s)
USD/CAD	Conditional mean and order flow	January 1990–December 2004	Daily	BI, CU, CCI, CS, CPI, CC, DG, FO, FF, GDP, HS, IUC, IP, LI, manufacturing composite index, NFP, NHS, PCE, PI, PPI, RS, TB, GD
USD/CAD CAD/EUR	Conditional mean and volatility	January 1998–December 2006	Daily	US: Federal Reserve Board of Governors' Statements, GDP, IP, TB, ISM, CCI, HS, NFP, UR, CPI, PPI, RS, FF Canada: Canadian Governing Council's Statements, GDP, CU, CA, MTB, Ivey Purchasing Managers Index, HS, NFP, UR, RS, CPI, Industrial Product Price Index, Raw Materials Price Index, Central Bank Target Interest Rates
USD/EUR USD/GBP USD/JPY USD/CHF	Conditional mean and jumps	January 1987–October 2004	5-minute	GDP, NFP, RS, IP, CU, CC, PI, PPI, CPI, DG, BI, CS, FO, PCE, NHS, TB, GD, Manufacturing Composite Index, HS, CCI, LI, FF
USD/GBP	Conditional mean and volatility	June 1997–October 2007	Daily, 5-minute	MPC Meeting
USD/JPY	Conditional mean	January 1999–October 2006	5-minute	US: GDP, NFP, IP, CU, PI, CC, PCE, NHS, DG, FO, BI, TB, PPI, CPI, CCI, NAPM, HS, LI, FF Japan: GDP, IP, CU, Construction Orders, Overall Spending, Large Retail Sales, TB, CA, Retail Trade, CPI, CCI, TANKAN Large Manufacturing Index, TANKAN Non-Manufacturing Index, Leading Economic Index, M1
USD/GBP USD/EUR USD/JPY	Conditional mean and order flow	February 2004–February 2005	Daily	US: CA, GDP, BI, CU, PMI, CS, CCI, CC, CPI, DG, FO, HS, LI, IP, ISM, MI, NHS, NFP, PCE, PI, Philadelphia Fed Index, PPI, RS, TB, UR, IUC Europe: GDP, Labor Costs, Business Climate Index, Consumer Confidence Balance, CPI, CA, Industrial Confidence Balance, IP, M3, PMI, PPI, RS, Sentiment Index, TB, UR UK: CA, GDP, Average Earnings, Budget Deficit, CC, CPI, IP, Manufacturing Output, Manufacturing Wages, Producer Input Price Index, Producer Output Price Index, Retail Price Index, RS, TB

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Reference	Abstract/Description*
Conrad and Lamla (forthcoming)	We investigate the impact of the European Central Bank's monetary policy communication during the press conference held after the monthly Governing Council meeting on the EUR-USD exchange rate in high-frequency. Based on the method of Content Analysis we construct communication indicators for the introductory statement and find that communication with respect to future price developments is most relevant. In response to statements about increasing risks to price stability the EUR appreciates on impact. To the contrary, communication about economic activity and monetary aggregates does not generate significant exchange rate reactions.
Neely (2010a)	The Federal Reserve's large scale asset purchases (LSAP) of agency debt, MBSs and long-term U.S. Treasuries not only reduced long-term U.S. bond yields but also significantly reduced long-term foreign bond yields and the spot value of the dollar. These changes were much too large to have been generated by chance and they closely followed LSAP announcement times. These changes in U.S. and foreign bond yields are roughly consistent with a simple portfolio choice model. Likewise, the exchange rate responses to LSAP announcements are roughly consistent with a UIP-PPP based model. The success of the LSAP in reducing long-term interest rates and the value of the dollar shows that central banks are not toothless when short rates hit the zero bound.

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Asset	Moment/Effect	Sample	Data frequency	Macro announcement(s)
USD/EUR	Conditional mean and volatility	January 1999–October 2006	5-minute	European Central Bank Press Releases
USD/AUD USD/CAD USD/GBP USD/EUR USD/JPY	Conditional mean	November 25, 2008 – November 4, 2009	10-minute	8 large-scale asset purchase announcements by the Federal Reserve, along with 13 FOMC announcements used as controls



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