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The Economic Crisis from a Neoclassical Perspective

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The U.S. recession from 2007–2009 differs considerably from other postwar U.S. recessions and from the parallel recessions in other high-income countries like Canada, France, Germany, Italy, Japan, and the United Kingdom. In the United States, lower output and income is exclusively due to a large decline in labor input. In contrast, lower output and income in many other U.S. recessions, and in the 2007–2009 recession in these other countries, are due to significant productivity declines and much smaller declines in labor input. Figure 1 shows quarterly per capita hours worked in the United States between 1956-Q1 and 2009-Q2, with shading indicating recessions according to the dates assigned by the National Bureau of Economic Research. The figure highlights the abnormally large labor decline in the 2007–2009 recession relative to earlier recession dates.

The analysis presented here indicates that the 2007–2009 recession is not well-understood within current classes of economic models, including both standard real business cycle models and, perhaps surprisingly, also including models in which financial distress reduces economic activity. Specifically, the 2007–2009 U.S. recession and its aftermath requires—much like understanding the Great Depression—a theory for why the marginal rate of substitution between consumption and leisure was so low relative to the marginal product of labor. This means that labor input during the 2007–2009 recession in the United States was far below the level consistent with the marginal product of labor and indicates that the labor input would have changed very little after 2007 in the absence of this deviation.

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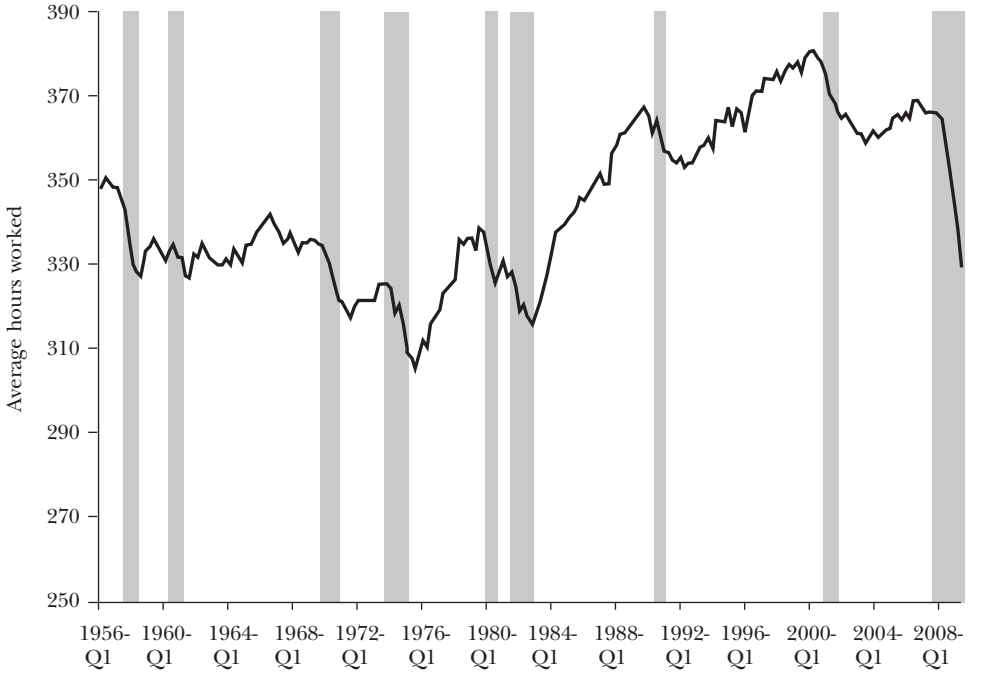
Figure 1
Hours Worked per Capita
(1956-Q1 to 2009-Q3)



Source: Cociuba, Prescott, and Ueberfeldt (2009) ("U.S. Hours and Productivity Behavior Using CPS Hours Worked Data: 1947-III to 2009-III").
Notes: Figure 1 shows quarterly per capita hours worked in the U.S. between 1956-Q1 and 2009-Q3, with shading indicating recessions according to the dates assigned by the National Bureau of Economic Research. Per capita hours represents total hours (civilian and military) per noninstitutional population aged 16 to 64.

Standard business cycle models with financial market imperfections have no mechanism for generating this deviation from standard theory, and thus do not shed light on the key factor underlying the recession of 2007–2009. This does not imply that the financial crisis is unimportant in understanding the recession, but it does indicate that we do not understand the channels through which financial distress reduced labor input.

More broadly, this analysis highlights the importance of developing theories of business cycle shocks, particularly shocks that affect the labor market and that distort the optimization condition that connects the opportunity cost of working to the marginal benefit of working. These findings lead me to conclude that a research program focusing more broadly on understanding the shocks and the details of the channels through which they drive fluctuations will be a major component of business cycle research in coming years.

I begin with a brief summary of the developments and contributions of neoclassical business theory as a backdrop for the essay. I compare the 2007–2009 recession

in the United States to other postwar U.S. recessions and to the recession in other high-income economies. The analysis focuses on identifying the possible shocks and mechanisms that are central for understanding the recession. The essay then integrates the diagnostic findings in a discussion of alternative hypotheses about the recession. I then discuss possible avenues for the development of future business cycle theory and conclude.

General Equilibrium Business Cycle Theory

Neoclassical business cycle theory, also called general equilibrium business cycle theory, was introduced to the economics profession in the models of economic fluctuations in Kydland and Prescott (1980, 1982). This framework was distinct from the predominant earlier approaches to economic fluctuations because it was built on a theoretical framework of explicit optimization problems for the model's economic decisionmakers. In particular, it included a consumption/investment allocation decision to analyze fluctuations between consumption and investment; a time allocation decision to analyze fluctuations in market versus nonmarket time; and a production function in which capital and labor inputs produce output. The approach also included procedures for approximating an equilibrium solution, and for choosing parameter values, including those that govern the shock stochastic processes, within a model environment that is consistent with long-run growth observations.

The original Kydland–Prescott models offered what, from the vantage point of three decades later, looks like a simplified and stripped down approach. It included a representative agent for households, competitive equilibria that were always Pareto optimal, and the absence of explicit financial, fiscal, and monetary sectors. This very simple model laid the foundation for some important early contributors to the real business cycle approach for exploring issues like labor supply elasticities (Hansen 1985; Rogerson, 1988), endogenous growth and fluctuations (King, Plosser, and Rebelo, 1988), and general equilibrium analysis of open economies (Backus, Kehoe, and Kydland, 1992). However, it became clear in the 1980s that Kydland and Prescott's model could be extended along many dimensions to address elements missing from their analysis that many believe to be important for the study of business cycle fluctuations.

In the three decades since the Kyland and Prescott (1980, 1982) papers, their work has spawned an enormous literature that has substantially broadened the scope of the general equilibrium business cycle program. Specifically, large literatures focus on various forms of heterogeneity, including demographic differences among consumers that affect life-cycle decisions to work and save, and firm heterogeneity. Other research focuses on departures from perfect competition and from complete markets. Still other work looks at fluctuations arising from shocks other than productivity, including monetary shocks, fiscal policy shocks, terms-of-trade shocks, and taste shocks. Still other work in this framework looks at financial market imperfections, imperfectly flexible prices and wages, multiple final goods,

nonconvex adjustments costs, non-expected utility, multiple equilibria, and the application of classical and Bayesian estimation of model parameters.[1]

The literature on general equilibrium business cycle models has made considerable progress in understanding how different model economies respond to what I will call *abstract shocks*: shocks that do not have a precise definition or acknowledged source. This category includes productivity shocks, preference shocks, financial shocks, risk shocks, and markup shocks, among others. However, because the focus of the literature has been on studying the effect of different types of shocks in different types of economies, there has been less progress on developing and testing theories about the nature and sources of these abstract shocks.

How this Recession was Different

The 2007–2009 U.S. recession differs considerably from earlier post–World War II recessions both in the behavior of the key variables like output, consumption, investment, and labor, as well as in the possible candidates for factors that can account for the fluctuations in these variables.

Panel A of Table 1 shows per capita output, consumption, investment, and labor for the 2007–2009 recession and for average peak-to-trough declines over other postwar recessions. Peak values for each variable are normalized to 100. Clearly, the 2007–2009 recession is more severe than the average postwar recession, particularly in terms of labor hours. Per capita hours worked declined 8.7 percent from the fourth quarter of 2007 through the third quarter of 2009, compared to a postwar average peak-to-trough decline of 3.2 percent. While the household survey from which these numbers are derived is not available for all of the post–World War II period, it is reasonable to presume that the current decline in hours worked is the largest since at least the 1946 recession, and perhaps the largest since the 1930s.

The decline in real GDP and its components during the 2007–2009 recession is also considerably more severe than in other recessions. Real per capita GDP declined 7.2 percent from the last quarter of 2007 to the third quarter of 2009, compared to an average peak-to-trough decline of 4.4 percent. Moreover, investment during

[1] Here are some starting points in the literature on these topics: On heterogeneity among working and saving decisions by consumers, see Rios-Rull (1996). On firm heterogeneity, see Ghironi and Melitz (2005) and Alessandria and Choi (2007). On departures from perfect competition, see Rotemberg and Woodford (1992) and Hornstein (1993). On departures from complete markets, see Krusell and Smith (1998) and Kehoe and Perri (2002). On monetary shocks, see Cooley and Hansen (1989). On fiscal policy shocks, see Braun (1994) and McGrattan (1994). On terms of trade shocks, see Mendoza, 1995). On taste shocks, see Bencivenga (1992). On financial market imperfections, see Carlstrom and Fuerst (1997) and Bernanke, Gertler, and Gilchrist (1999). On imperfectly flexible prices and wages, see Chari, Kehoe, and McGrattan (2000). On multiple final goods, see Greenwood, Hercowitz, and Krusell (1997). On nonconvex adjustments costs, see Khan and Thomas (2003). On non-expected utility , see Hansen, Sargent, and Tallarini (1999). On multiple equilibria, see Benhabib and Farmer (1994). On the application of classical and Bayesian estimation of model parameters, see Schorfheide (2000) and Fernandez-Villaverde and Rubio-Ramirez (2007).

Table 1
Changes in per Capita Variables for Each Peak-to-Trough Episode
(*percent*)

	Output	*Consumption*	*Investment*	*Employment*	*Hours*
A: U.S., Postwar Recessions vs. 2007–2009 Recession					
Average postwar recessions	–4.4	–2.1	–17.8	–3.8	–3.2
2007–09 recession (2007-Q4 to 2009-Q3)	–7.2	–5.4	–33.5	–6.7	–8.7
B: 2007–2009 Recession, U.S. vs. Other High-Income Countries					
United States	–7.2	–5.4	–33.5	–6.7	–8.7
Canada	–8.6	–4.6	–14.1	–3.3	–
France	–6.6	–3.4	–12.6	–1.1	–
Germany	–7.2	–2.9	–10.2	0.1	–
Italy	–9.8	–6.6	–19.6	–3.0	–
Japan	–8.9	–3.6	–19.0	–1.6	–
United Kingdom	–9.8	–7.7	–22.9	–2.9	–
Average other high-income countries	–8.5	–4.8	–16.4	–2.0	–

this period dropped 33.5 percent, compared to a 17.8 percent drop in the average postwar recession. Consumption fell more than 5.4 percent, compared to an average decline of about 2 percent.

Panel B of Table 1 compares the 2007–2009 recession between the United States and six other large high-income economies: Canada, France, Germany, Italy, Japan, and the United Kingdom. The average for these six economies is given in the bottom row. This comparison highlights the same striking features. Specifically, the decline in labor in the United States is much larger than in the other countries. The average per capita employment decline (hours worked are not available for the other countries) in these countries is only 2 percent from the fourth quarter of 2007 through the third quarter of 2009, compared to a 6.7 percent per-capita employment decline in the United States.

But despite the much smaller employment decline in the other six countries shown, output declined more in these countries than in the United States. Real output fell by 8.5 percent on average from the fourth quarter of 2007 through the third quarter of 2009 in the other six countries, compared to a 7.2 percent decline in the United States. The fact that other countries had a larger fall in output but a smaller fall in employment indicates large differences in productivity change between the United States and other countries during this recession, which I further discuss below.

These data also raise an important question about understanding the global nature of the 2007–2009 recession and financial crisis: why are the changes in labor input and productivity so different between the United States and its peer countries, given that all of these countries experienced fairly similar financial crises?

A Diagnostic Approach to the Causes of Recession

The neoclassical business cycle model suggests diagnostic procedures for evaluating the role of productivity and other possible sources and mechanisms that are driving the current recession.[2] These procedures diagnose potential sources of economic fluctuations by constructing a neoclassical business cycle model, feeding in data from cyclical episodes, and then measuring the deviations in the equations that characterize the equilibrium of the model in the absence of any shocks. In this section, I describe how this procedure works and summarize the results.

I begin with a neoclassical business cycle model, using model parameters that are standard for this approach. The production function is Cobb–Douglas production, with factor income shares of one-third for capital and two-thirds for labor. Household preferences over consumption and leisure are logarithmic. A leisure parameter generates the feature that steady-state hours worked are equal to about one-third of the household's time endowment. Household discounting of the future generates a steady state real interest rate of 4 percent. The capital stock depreciates at an annual rate of 7 percent, and exogenous technological growth generates a steady-state growth rate of output, consumption, and investment of 2 percent. These parameters are chosen, or calibrated, so that the model provides a good fit to the long-term path of the U.S. economy.

A combination of maximizing and adding-up means that the neoclassical business cycle model imposes four theoretical model relationships among output, labor, consumption, and investment: first, the *production function*, which imposes a relationship between production inputs and output; second, a *household time allocation decision* between market time and leisure, one that equates the marginal rate of substitution between consumption and leisure to the wage received by the household, which in the basic version of this model is equal to the marginal product of labor; third, a *consumption/investment allocation decision* between consumption and investment in which the shadow price of consumption today in terms of consumption tomorrow is the real return to saving, or the real interest rate. (This decision thus equates the intertemporal marginal rate of substitution between current consumption and consumption one period in the future to the return to investing in physical capital, which in the basic version of the model is equal to the marginal product of capital net of depreciation.) Fourth, a resource constraint shows the allocation of spending across the final demands of consumers, firms, and government, and net exports.

The analysis here is based on quarterly post–World War II data for the United States and the six other high-income countries. For each quarter, I feed in actual output, consumption, labor, and investment data into these four theoretical model relationships described above. With some algebraic manipulation, this data provides measures of all the terms in these four theoretical relationships. For example, data on capital, labor, and output are plugged into the production function so that output is equal to its value from the production function. In the household time

[2] Variants of this procedure have been used in Cole and Ohanian (1999, 2002) and Mulligan (2002), and are fully developed in Chari, Kehoe, and McGrattan (2007a).

allocation decision, a numerical value for the marginal rate of substitution between consumption and leisure can be derived from the household utility function, while the marginal product of labor can be derived from the production function so that the marginal rate of substitution between consumption and leisure equals the marginal product of labor. Similarly, in the consumption/investment allocation decision, a numerical value for the intertemporal marginal rate of substitution between consumption today and in the future is derived from the utility function, and the marginal product of capital can be derived from the production function so that the intertemporal marginal rate of substitution is equal to the return from investing in physical capital.

However, when the numerical values from quarterly economic data are brought into the model in this way, the four theoretical relationships will not be satisfied. Instead, there will be errors or *deviations* between the right-hand and left-hand sides of these equalities. When looking at the production function relationship, for example, there will be a deviation between the output generated from the production function, and the actual output of the economy. This deviation, which measures the difference between actual output and the component of output that can be accounted for by measured labor and capital inputs, forms the basis for Solow's (1957) famous production function residual.

When looking at the household time allocation decision between labor and leisure, there will be a deviation between the numerical value derived for the marginal rate of substitution and the value derived for the marginal product of labor. Note that this deviation in the household's time allocation equation is equivalent to a tax on labor income, as this labor deviation is a wedge between the marginal rate of substitution for households and the marginal product of labor, just as a tax on labor income drives a wedge between the marginal rate of substitution and the marginal product.

Moreover, when looking at the consumption/investment allocation decision between consumption and savings, there will be a deviation between the numerical value derived for the intertemporal marginal rate of substitution and the value derived for the marginal product of capital. Note that this deviation in the household's consumption/investment allocation equation is equivalent to a tax on capital income, as this deviation generates a wedge between the intertemporal marginal rate of substitution for households and the marginal product of capital, just as a capital income tax drives a wedge between these two measures.

The deviations that arise in the first three theoretical relationships provide a diagnostic tool for looking at the underlying causes of recession. I will refer to these as the productivity deviation (the deviation that arises in numerical estimates of each side of the production function), the labor deviation (the deviation that arises in numerical estimates of each side of the household time allocation decision), and the capital deviation (the deviation that arises in numerical estimates of each side of the consumption/investment allocation decision between consumption and investment).

The tax interpretations of the labor and capital deviations are useful in identifying the sources of recessions. Specifically, I will demonstrate below that hours

worked during the 2007–2009 recession are much too low relative to the marginal product of labor. Thus, the key to understanding this recession is finding a factor that works like a large increase in the tax on labor income that depresses the incentive to work relative to the observed marginal product of labor.

Table 2 provides information about these three deviations, which can be used to compare the U.S. experience during the 2007–2009 recession with the average of other post–World War II recessions, as well as comparing the U.S. experience in the 2007–2009 recession with parallel recessions in other high-income countries: Canada, France, Germany, Italy, Japan, and the United Kingdom. Each deviation is constructed by first plugging in actual data into the production function, labor decision, and consumption/investment allocation decision, then taking the ratio of the left- and right-hand sides of each of these three conditions, and then subtracting one from each of those respective ratios. We will be looking for negative deviations in these three conditions to shed light on the 2007–2009 recession. Specifically, a negative productivity deviation means output is below the level generated by the capital and labor inputs and the production function; a negative labor deviation means that employment is below the level consistent with the marginal product of labor; and a negative capital deviation means consumption growth is below the level that is consistent with the marginal product of capital.

The first column of Table 2 refers to the "labor deviation." Again, the theoretical relationship in the household time allocation decision tells us that the marginal rate of substitution between consumption and leisure will be equal to the marginal product of labor. However, the first row of table shows that during the average post–World War II U.S. recession, that the deviation is –2.4 percent, which means the marginal product exceeds the marginal rate of substitution by an average of 2.4 percent. This typical U.S. pattern of an increase in the marginal product relative to the marginal rate of substitution is equivalent to an increase in labor income taxation of the same proportion, as theory otherwise predicts that employment should have been higher.

As Table 2 shows, the labor deviation in the U.S. economy during the 2007–2009 recession was much larger than usual, at –12.9 percent. This deviation is considerably larger than labor deviations in any other postwar U.S. recessions; the second-largest deviation was just under –4.7 percent for the 1973 recession.[3] If this deviation had been zero, hours worked would have been 10 percent higher, which effectively means that the recession would not have occurred.

The size of the labor deviation in the 2007–09 recession in the United States also stands out in comparison to the other six high-income countries. Panel B shows that all of these countries saw much smaller changes in the labor deviation, with an average change of just 0.9 percent. In fact, there are sizable positive deviations in France, Germany, and Japan, which means that employment in these countries

[3] Hall (2009) suggests that pre-2008 U.S. labor distortions can be largely accounted for in a model with nonstandard preferences and some measurement error in consumption and hours, and using a different data filter. It is unclear, however, whether this approach can account for the labor distortions in the 2007–2009 recession.

Table 2
Recession Diagnostic Distortions
(percent changes)

	Labor deviation	*Capital deviation*	*Productivity deviation*
A: U.S., Postwar Recessions vs. 2007–2009 Recession			
Average postwar recessions	–2.4	1.8	–2.2
2007–09 recession (2007-Q4 to 2009-Q3)	–12.9	0.3	–0.1
B: 2007–2009 Recession, U.S. vs. Other High-Income Countries			
United States	–12.9	0.3	–0.1
Canada	–0.9	0.7	–7.0
France	1.7	1.3	–6.1
Germany	4.8	–1.1	–7.0
Italy	–0.8	0.3	–7.2
Japan	2.9	–0.4	–7.1
United Kingdom	–2.3	0.0	–8.2
Average other high-income countries	0.9	0.1	–7.1

Notes: The labor deviation is the percent difference between the marginal rate of substitution between consumption and leisure, and the marginal product of labor when actual data are plugged into that equation. The capital deviation is the percent difference between the intertemporal marginal rate of substitution between consumption and the marginal product of capital net of depreciation when actual data are plugged into that equation. The productivity deviation is the Solow residual.

was in fact higher than the level consistent with the marginal product of labor. By around mid-2008, the labor market deviation for the United States was much different from those in the other six countries, and this difference between the U.S. labor deviation and that in other countries continued to grow.

The second column in Table 2 is the "capital deviation." It arises from bringing quarterly economic data to the consumption/investment allocation decision, the theoretical condition that equates the intertemporal marginal rate of substitution in consumption and the net return to investment. When the actual data is applied to the relationships in the underlying model, a deviation arises between these values.

The capital deviation shows that the net rate of return on investment was about 1.8 percent higher in the average post–World War II recession compared to expansions. This is not only a small deviation, but when discussed as a tax on capital income as described above, it is equivalent to a small tax cut, rather than tax increase that would depress economic activity. Note that there was almost no capital deviation in the 2007–2009 U.S. recession.

Indeed, a more detailed analysis shows that every recession analyzed here—that is, all post–World War II U.S. recessions, and the 2007–2009 recession in all seven economies—has either a large labor deviation or, as I will discuss in a moment, a large productivity deviation. But there are no large, negative capital distortions during these recessions, including the 2007–2009 recession, in any of the countries. To preview the next section for a moment, this absence of a large, negative capital

deviation has implications for the extent to which models with financial market imperfections that drive a wedge between the returns paid to the suppliers of capital and the cost of capital paid by its users, can account for the 2007–2009 recession.

The third column of Table 2 shows the "productivity deviation," which is based on the production function. In a standard real business cycle analysis like Kydland and Prescott (1982), the deviation between output and the inputs from the production function is just the famous Solow residual, which can be viewed as a measure of productivity change. However, the Solow residual picks up all of the change in output that cannot be accounted for by measured inputs, and not just the change in technology. Thus, the productivity deviation will pick up any factors that change the relationship between measured labor and capital inputs, and measured output.

All of the recessions in the non-U.S. economies show substantial productivity declines of 6 percent and more. In the U.S. experience, some post–World War II recessions show a substantial productivity deviation, including the large recessions of 1973–74 and 1981–82. Total factor productivity drops by more than 2 percent during the average postwar U.S. recession, but there is almost no total factor productivity deviation in the U.S. 2007–2009 recession. Other measures of productivity show little change, including real output per hour and real manufacturing output per hour. As in the case of the labor deviation, the U.S. productivity deviation falls considerably less than those in the other six countries beginning around mid-2008 and continues to remain smaller afterwards.

The fact that there is essentially no productivity decline suggests that the sources and mechanisms of the 2007–2009 U.S. recession differ substantially from earlier postwar recessions in the United States, and also from the parallel recessions of 2007–2009 in other high-income economies. Instead, the 2007–2009 U.S. recession appears to be almost exclusively related to a factor that substantially affects the labor market by changing the relationship between the marginal rate of substitution and the marginal product of labor.

To further understand the relative importance of the labor deviation for the 2007–2009 recession, I simulate what would happen in the U.S. economy if this deviation were the only one that occurred, as in Mulligan (2010b). I found that the labor deviation can account for virtually the entire 2007–2009 U.S. recession, with simulated drops in output, employment, and investment that roughly match what actually occurred. Put differently, in the absence of this labor deviation, labor input during this recession was about 10 percent below the level that should have prevailed given the marginal product of labor. In all other post–World War II recessions, however, the labor deviations are only large enough to explain about one-fifth of the peak-to-trough drop in real output and about half of the decline in labor.

These findings suggest that understanding the 2007–2009 U.S. recession requires a theory of the labor market in which employment is well below its normal level. And while the 2007–2009 U.S. recession is unique relative to all other recessions since World War II, it is qualitatively very similar to the Great Depression. Throughout the 1930s, per-capita hours worked and output remained well below normal levels, indicating a very large labor deviation. Like the 2007–2009 recession, the 1930s deviation reflected a marginal product of labor that substantially

exceeded the marginal rate of substitution between consumption and leisure. Specifically, the average labor deviation between 1930–39 calculated the same way as for postwar recessions is about –26 percent, roughly twice as large as the labor deviation of –12.9 percent in the third quarter of 2009.

Hypotheses Concerning the 2007–2009 Recession

I now use these diagnostics and other evidence to assess two hypotheses about the 2007–2009 recession: the financial explanation and the policy explanation. In much of this discussion, I will focus primarily on the period from fall 2008 and afterwards, as the recession accelerated substantially around that time, and I will focus on the potential of each view to account for the very large and protracted drop in hours worked that occurred. I then focus more specifically on an explanation rooted in a deeper understanding of what causes labor deviations.

The Financial Explanation

The financial explanation for the 2007–2009 recession holds that declining values of some asset-backed securities and the failure and/or near failure of large financial institutions, among other events and factors, deepened the crisis and accelerated the recession through reduced financial intermediation services that were associated with rising interest rate spreads. There are many narratives of the crisis, including Gorton (2010) and many of the papers in the Winter 2010 "Financial Plumbing" symposium in this journal. These narratives include descriptions of reduced volumes of intermediation services in some markets, including commercial paper, particularly for financial firms, and in repo markets.

But documenting the severity of the financial crisis doesn't establish that the crisis was itself the major factor in the recession. To causally connect the financial crisis with the recession, the financial view emphasizes that in the past, financial crises have been associated with severe downturns, such as the Great Depression. They also point to several theoretical models in which increases in the quantitative importance of financial imperfections, such as balance sheet deterioration, reduce investment, and correspondingly reduce output, consumption, and employment. Such studies include contributions by Carlstrom and Fuerst (1997), Bernanke, Gertler, and Gilchrist (1999), Kiyotaki and Moore (2008), and Gertler and Kiyotaki (2010).

The intuition behind this financial explanation seems powerful, and perhaps even obvious. But this view often omits some key issues that are necessary for quantifying how much the financial crisis depressed aggregate hours and output, and for how long. These issues include documenting how much aggregate lending volumes declined, documenting internal cash positions of firms (as internal cash is a very good substitute for external cash), and determining whether existing models based on financial market imperfections are consistent with the diagnostic accounting evidence presented above. Examining these issues raises a number of questions and challenges about the contribution of financial distress to the recession.

In terms of economic theory, the mechanisms through which capital market imperfections affect the economy in many models of financial shocks are at variance with some of the diagnostic findings presented earlier. Recall that the capital deviation is equivalent to capital market imperfections that drive a wedge between the return paid to the suppliers of capital and the cost of capital paid by the users of capital. The diagnostic findings presented above, however, show that these capital deviations were small in the 2007–2009 recession. Moreover, this measure of capital market imperfections does not affect in any direct way the relationship between the marginal rate of substitution between consumption and leisure and the marginal product of labor, which is the only substantial deviation uncovered by the diagnostic tools.[4]

Or course, one way to reconcile the diagnostic evidence with a financial explanation for the 2007–2009 recession would be to develop theories in which financial distress generates the large observed labor deviation.[5] But if financial market imperfections are the key factor behind the 2007–2009 recession, it still remains unclear why the aggregate labor market appears to be much more distorted than the aggregate capital market in that the labor deviation is consistently larger than the capital deviation. And this capital deviation is a natural measure of aggregate capital market distortions because it measures changes in the relationship between the aggregate opportunity cost of supplying capital, and changes in the aggregate marginal benefit of investing in physical capital. Variations in this relationship between costs and benefits of investment include changes in the cost of financial intermediation services, changes in borrowing and lending spreads, changes in the relative price of investment goods, changes in the costs of adjusting the capital stock, and market imperfections in which either the suppliers or users of capital are constrained and thus unable to satisfy this marginal condition. I will return to the theme of developing alternative models of financial market imperfections at the end of this essay.

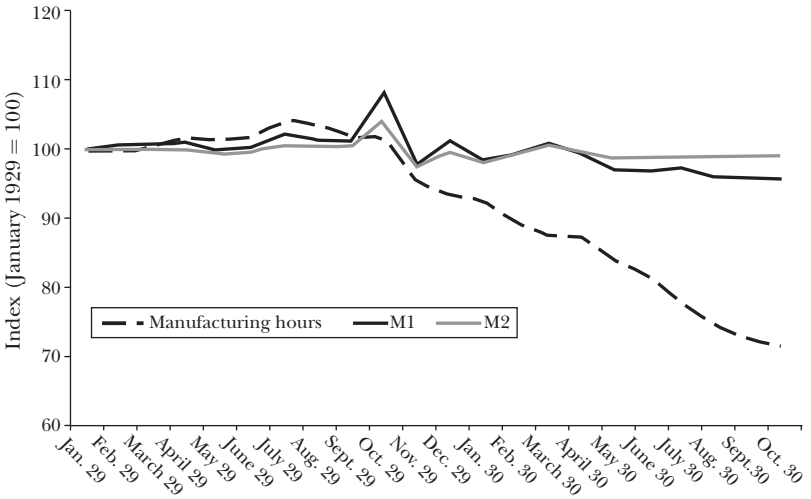
There are also other data that challenge current theories of financial market imperfections. The belief that financial crises are the major factor behind large recessions and depressions partially follows from perceptions that banking crises were a key reason why the Great Depression was so deep and protracted, and many parallels have been drawn between the Depression and the 2007–2009 recession. But several facts about the Depression stand in sharp contrast to these common perceptions.

For example, many cite the fact that the number of U.S. banks declined by about 40 percent between 1929 and 1933 as a central reason why the Great Depression was

[4] Even abstracting from this issue, this class of models is challenged in accounting for at least some of the 2008 crisis episodes. In Fernandez-Villaverde and Ohanian (2010), my coauthor and I show that the Bernanke–Gertler–Gichrist model cannot account for the Spanish 2008 recession without implausibly large equity losses among borrowers.

[5] Chari, Kehoe, and McGrattan (2007a) interpret the fact that investment deviations are close to zero as evidence that financial market imperfections operating through capital deviation are unimportant. Christiano and Davis (2006) argue that incorporating investment adjustment costs in the model induces large investment distortions through this equation, though Chari, Kehoe, and McGrattan (2007b) dispute this finding. While this issue will likely remain an active research area, it is striking to note that investment distortions are roughly zero in all of these recessions, as well as during the Great Depression. This systematic finding across different time periods and across countries raises questions regarding financial imperfections that operate through an investment deviation.

Figure 2
Manufacturing Hours and Money Supply During the Great Depression before the First Banking Crisis



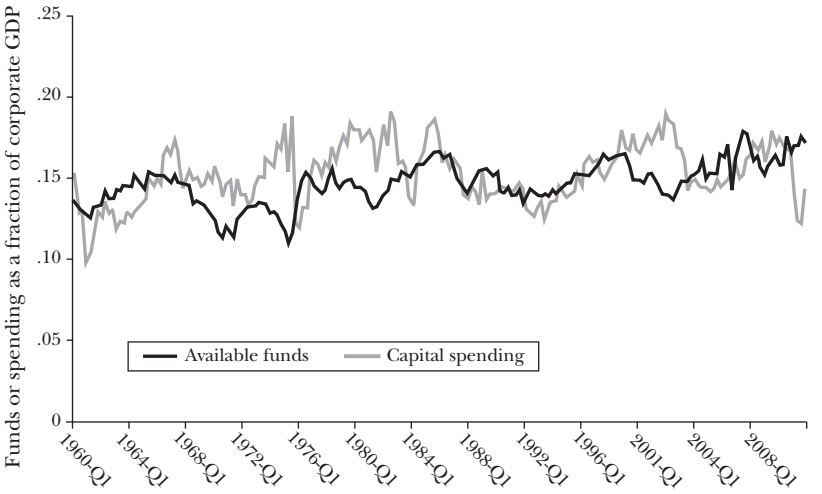
Source: Ohanian (2009).

"Great," and draw inferences from this fact for the potential effect of financial crises more generically (for example, Reinhart and Rogoff, 2009). But most of the Depression-era banks that closed were either very small or merged, which indicates that the decline in banking capacity resulting from bank closings during the Depression was small. In fact, the share of deposits in banks that either closed or temporarily suspended operations for the four years from years 1930–1933 was 1.7 percent, 4.3 percent, 2 percent, and 11 percent, respectively (Cole and Ohanian, 2001).

Moreover, the Depression was indeed "Great" before any of the monetary contraction or banking crises identified by Friedman and Schwartz (1963) occurred. Figure 2 shows that industrial hours worked had declined by 29 percent between January 1929 and October 1930, which is not only before the first Friedman and Schwartz–identified banking crisis (November 1930 to January 1931), but is also before the money stock fell. Finally, Friedman and Schwartz (1963) did not consider this first banking crisis to have significant macroeconomic consequences. Similarly, Wicker (1996) notes that during this first episode there was little effect on interest rates outside of Memphis, where much of the crisis was centered, and measures of the volume of financial intermediation services did not decline much in Memphis or elsewhere at this time.

The small decline in banking capacity in the 1930s and the timing of banking panics indicate that the Great Depression would have been "Great" even in the absence of the banking and financial crises. These facts also indicate that the impact of banking crises on the Depression remains an open question and that it is premature to draw firm conclusions about Depression-era financial crises for other episodes.

Figure 3
Corporate Available Funds and Investment, 1960-Q1 to 2009-Q2



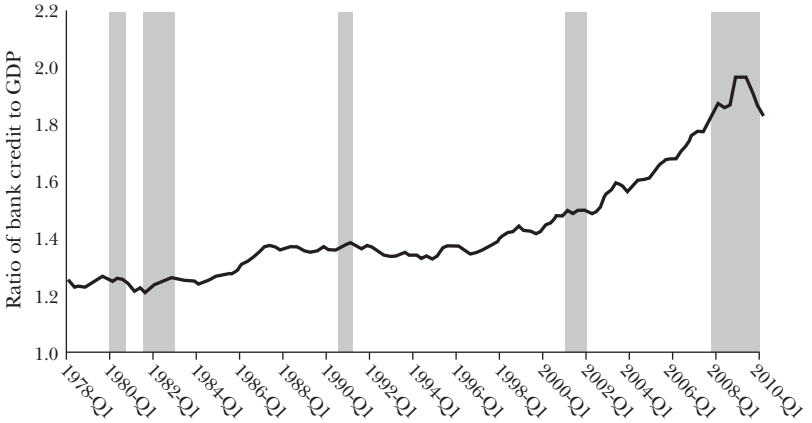
Source: Flow of Funds Accounts of the United States (Z.1 Release for March 2010).
Notes: Figure 3 shows available corporate funds, which is the sum of retained earnings, dividends and depreciations, graphed alongside gross investment, both of which are measured as a fraction of corporate GDP.

I now turn to more recent data that have implications for the financial explanation. Discussions of financial market factors often ignore the cash positions of firms. This omission is important, because internal cash is a very good substitute for external finance. Figure 3 shows that the corporate sector typically has substantial cash reserves and thus can be largely self-financing. The figure shows available corporate funds, which is the sum of retained earnings, dividends, and depreciations, graphed alongside gross investment, both of which are measured as a fraction of corporate GDP. The corporate sector typically has nearly as much cash as they invest in plant and equipment, and cash is relatively high during the last few years.

One possible issue with Figure 3, however, is that perhaps the cash reserves displayed in the figure are only being held in certain sectors while other sectors have little or no cash. To address this issue, Chari and Kehoe (2009, in progress) examine firm-level data from Compustat to compare firms that use external finance to those that do not. These data indicate that on average about 84 percent of investment is financed internally. Indeed, about two-thirds of investment is undertaken by firms not using external funds, and slightly more than half of the investment undertaken by those using external funds is still financed internally. The fact that these firms have sufficient cash to finance capital spending stands in sharp contrast with the assumptions in models of financial market imperfections. In several of these models, firms have no cash reserves, and thus reduced access to financial markets necessarily reduces investment in these models considerably.

Another assertion often made in the financial explanation is that small firms have much less access to capital markets, and thus small firms decline much more

Figure 4
Ratio of Bank Credit to GDP, 1978-Q1 to 2010-Q1



Sources: Figure 4 is updated from Chari, Christiano, and Kehoe (2008). The data is from the Board of Governors of the Federal Reserve System (H8 Release) and the Bureau of Economic Analysis.
Note: Shaded areas indicate recessions according to the dates assigned by the National Bureau of Economic Research.

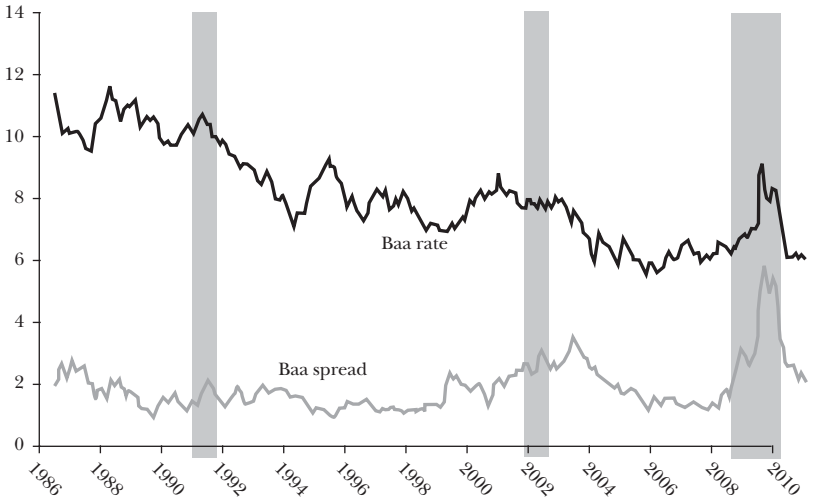
than large firms during crises. However, Cravino and Llosa (2010, in progress) show that there is virtually no change at all in the relative sales performance of small versus large firms during the 2007–2009 recession. They compare the share of sales accounted for by small, medium, and large firms during the fourth quarters of 2007, 2008, and 2009. The shares are virtually identical in these periods, indicating that firm sales growth was unrelated to firm size. This fact is thus inconsistent with a central assumption in the financial explanation.

The financial explanation also argues that the 2007–2009 recession became much worse because of a significant contraction of intermediation services. But some measures of intermediation have not declined substantially. Figure 4, which is updated from Chari, Christiano, and Kehoe (2008), shows that bank credit relative to nominal GDP rose at the end of 2008 to an all-time high. And while this declined by the first quarter of 2010, bank credit was still at a higher level at this point than any time before 2008.[6] Similarly, flow of funds data show that borrowing levels of households and of the nonfinancial businesses that households own, are virtually unchanged since 2007, and that the composition of those liabilities across mortgages and other liabilities are also unchanged. These data suggest that aggregate quantities of intermediation volumes have not declined markedly.

But perhaps the most challenging issue regarding the financial explanation is why economic weakness continued for so long after the worst of the financial crisis passed, which was around November 2008 as reported by Ivashina and Scharfstein (2010),

[6] Ivashina and Scharfstein (2010) present data that show that syndicated loans, which are loans originated by a bank and which then are sold to others, declined substantially during late 2008. It remains an open question on how to reconcile this evidence with that of Chari, Christiano, and Kehoe (2008).

Figure 5
Baa Bond Interest Rate and Spread between Baa Rate and 10-Year Treasury Rate
(percent monthly, January 1986 to April 2010)



Source: FRED database, Federal Reserve Bank of St Louis.
Note: Shaded areas indicate recessions according to the dates assigned by the National Bureau of Economic Research.

and which is also consistent with changes in the pattern of interest rates. Specifically, rates on risky assets rose considerably during September and October of 2008 but fell afterwards.

Figure 5 shows the Baa bond rate and the spread between this rate and the 10-year U.S. Treasury rate between January 1986 and April 2010. I include both the Baa rate and the spread since both are widely reported. The Baa rate, which measures the cost for borrowers in this risk category, rises about 250 basis points to about 9.5 percent between mid-September and late October of 2008, when financial markets were absorbing news about AIG, Lehman Brothers, the Troubled Asset Relief Program (TARP), and other financial events. The Baa rate declines by about 300 basis points afterwards back to the level that prevailed before the recession in 2005 and 2006. In terms of the spread, the Baa rate relative to the Treasury rate rises more in September and October of 2008 than the Baa rate, reflecting a flight to quality resulting in large declines in the rates on Treasury securities. But like the Baa rate, this spread also declines considerably after the worst of the crisis passes in the late fall 2008. Despite declining interest rates, hours worked recovers very little, even through mid-2010.

From the perspective of the financial explanation, the continuation of recession long after the worst of the crisis passed raises an important puzzle about why employment did not recover sooner. This question is not resolved simply by noting that economies often remain below trend for years following a significant financial crisis (Cerra and Saxena, 2008; Blanchard, 2009). In many of these cases, output remains below trend because productivity is far below trend (Ho, McGrattan, and

Ohanian, 2010, in progress). But as documented above, the productivity deviation during the 2007–2009 U.S. recession was very small, which means that low productivity is not the reason why U.S. macroeconomic weakness continued.

I do not interpret the evidence here as indicating that the financial crisis did not contribute significantly in some way to the recession. However, the diagnostics and other data presented here, and the mechanisms through which financial market imperfections impact economic activity in several leading models, reveal a number of questions about the financial explanation. Considerably more research is required to address the issues raised here before trying to quantify the contribution of financial factors for the 2007–2009 recession and the subsequent failure of employment to recover. That research should also address why the U.S. recession was so different from the recessions in peer countries in terms of productivity and labor deviations when the financial crises affecting these countries were quite similar.

The Policy Explanation of the Recession

A policy explanation for the 2007–2009 recession is that economic policies, including the 2008 tax rebate, the Troubled Asset Relief Program (TARP), the American Recovery and Reinvestment Act (ARRA), Cash for Clunkers, Treasury mortgage modification programs, and other policies significantly contributed to the recession. The common argument here is that these policies distorted incentives through their deficient design and also increased uncertainty about the underlying economic environment. Different aspects of this argument have been articulated by Taylor (2010a, 2010b), Cochrane and Zingales (2009), Jagannathan, Kapoor, and Schaumberg (2009), and Mulligan (2010a), among others.

For example, Mulligan (2010a) studies the possible effect of U.S. Treasury mortgage modification programs on the low employment rate by evaluating how the eligibility requirements for these programs implicitly raised income tax rates on some households to levels of more than 100 percent. Taylor (2010a, 2010b) argues that a broad set of policies substantially contributed to the recession. Taylor (2010a) uses a variety of high-frequency data in an effort to separate financial explanations from policy explanations. For example, Taylor shows that some interest rates spreads, and both U.S. and foreign stock prices, deteriorated much more rapidly around the time of the TARP announcement and the time of President Bush's warning of the possibility of a Great Depression than they did around the time of the Lehman bankruptcy or other significant financial events.

Moreover, Taylor (2009) tracks daily sales at Target department stores during fall 2008. The data show little immediate impact of the Lehman bankruptcy of September 15, 2008, a key event from the perspective of the financial explanation of the crisis. But sales do begin to drop substantially around September 19, immediately following the announcement of TARP, and continue to decline quickly thereafter. Taylor concludes from this and related analyses that government policies contributed significantly to the recession, perhaps because policymaker communications concerning the underlying strength of the economy increased uncertainty.

This uncertainty factor also may be informative for understanding why the recession deepened and persisted into 2009, even after the worst of the purely financial

aspect of the crisis was over. Specifically, higher uncertainty increases the option value of delaying decisions in models with fixed costs, which can depress economic activity. Bloom (2009) discusses a model in which uncertainty can generically induce recessions, while in Llosa, Ohanian, and Phelan (2010, in progress), my coauthors and I construct a model in which the possibility of incorrect government announcements about the state of the economy impair households' ability to infer the actual state, and lead households to reduce market hours until they can more clearly deduce the state of the economy.

Research in this area is very much in its early stages, and consequently much more work is needed before trying to more broadly test whether the policy explanation was a major factor in contributing to the 2007–2009 recession.

Understanding Labor Deviations

The large labor deviation that appears in the neoclassical business cycle diagnostics, which is equivalent to higher tax rates on labor income, suggests that a deeper exploration of labor markets is necessary for understanding the 2007–2009 recession, irrespective of the class of theoretical models considered.

Recent research has sought to develop theories of labor distortions during earlier crises. In Cole and Ohanian (2004) and Ohanian (2009), we present theory and evidence that the very large labor deviation throughout the 1930s was due to cartelization and unionization policies advanced by Presidents Hoover and Roosevelt. In these models, policies raised relative prices and wages in some sectors far above competitive levels, which reduced employment and consumption and created a large gap between the marginal product of labor and household's marginal rate of substitution between income and leisure. This research shows that these policies can account for about 60 percent of the drop in economic activity in the 1930s, and also shows that these policies began to reverse when the economy began to expand in 1940.

Theories of labor distortions that fit the 2007–2009 recession are under development. Some of these efforts seek to make connections between events in financial markets and the observed labor deviation. For example, Arellano, Bai, and Kehoe (2010) develop a model with incomplete markets in which firms must choose the scale of a project before the shock is fully realized. In this model, higher shock volatility distorts the relationship between the marginal rate of substitution and the marginal product of labor as firms act through precautionary motives. Jermann and Quadrini (2009) study a model in which variations in the amount of debt that firms can use to finance operations, including financing the firm's wage bill, implicitly drives a wedge between the marginal product of labor and the wage rate paid to workers.

A challenge for this class of models, however, is that it predicts no deviation between the marginal rate of substitution between consumption and the wage received by workers, but in the data, there is a large deviation between these variables during the recession that is roughly as large as that with the marginal product of labor. In contrast, Lopez (2010) develops an incomplete markets model in which variations in the cross-sectional dispersion of consumption, together with variations in how binding borrowing constraints are, generates a quantitatively

large deviation between the marginal rate of substitution and the wage received by workers.

In terms of government policies and the labor deviation, Mulligan (2010a) estimates implicit income tax rates arising from Treasury mortgage modification programs that drive a large implicit wedge for affected households between the marginal rate of substitution and the wage. This distortion results in lower employment than otherwise would occur.[7]

Other models have sought to build connections between financial market distortions and productivity change, which is intriguing in that the productivity deviation accounts for much of the 2007–2009 recession in non-U.S. high-income countries listed earlier. Buera, Kaboski, and Shin (forthcoming) show how financial market imperfections affect steady state productivity by distorting resource allocation across entrepreneurs. A similar mechanism may be relevant for understanding cyclical fluctuations in productivity during financial crises.

Another possibility for why productivity deviations were much larger in Europe than in the United States is that larger European labor market rigidities, including firing costs, lead to more labor hoarding in Europe. Labor hoarding refers to the process of keeping workers on the payroll despite the fact that they may produce very little, which in turn reduces measured productivity. This represents another avenue for future research.

Conclusion

Understanding economic crises and depressions, particularly in countries with typically well-functioning economies, is highly challenging. It is understandable that a range of competing explanations emerge.

I have emphasized here that advancing our understanding of the U.S. recession of 2007–2009 will require theories that generate what appear to be large labor market distortions. Given that a financial crisis clearly did occur, one important question is why the financial crisis, at least from the perspective of aggregate data as reflected in the neoclassical business cycle model, seemed to affect the labor market much more than the capital market. Developing theories along these lines is not only important for testing and quantifying the contribution of financial factors on this recession, but also for understanding what types of policy reforms would be useful.

More broadly, neoclassical business cycle research has established a significant base of knowledge on how model economies respond to a variety of abstract shocks. However, we know less about the specific sources and nature of these shocks, particularly about cyclical distortions to productivity and to labor markets. Thus, we do not as yet have satisfactory answers to a number of questions, including why labor market deviations were so much larger in the U.S. economy in the 2007–2009 recession than in earlier

[7] Shimer (2009) discusses the potential of search models to analyze cyclical labor deviations. Cheremukhin and Restrepo-Echevarria (2009) analyze how shocks to job creation and job destruction within a Mortensen–Pissarides framework can generate this distortion.

recessions, why labor market deviations seem so much larger in the United States than in other high-income countries, why productivity deviations seem to play such a large role in other high-income countries than in the United States, how to model real-world financial and policy events in order to determine their impact on the economy, and why macroeconomic weakness continued for so long after the worst of the crisis passed.

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