Comment

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Introduction

The United States is just now emerging from the seminal economic event of our postwar experience, the Great Recession. In the wake of this near cataclysm, we are led to ask the Great Questions: What caused the Great Recession? What are the sources of the enormous and persistent declines in output? How much did declines in factors like capital, labor, or total factor productivity (TFP) contribute to the decline in output? Most important to policymakers is: What can we do to hasten the recovery? Most important to researchers is: What class of models are the most useful for thinking about the causes and consequences of the Great Recession?

Robert Hall’s paper has not provided the answer to all these questions, but he has written the “War and Peace” of what actually happened to the real side of the economy during the financial crisis and its aftermath. The primary issue that Hall focuses on is the mechanical sources of the postcrisis decline in aggregate output. Hall uses those results as background for a nuanced discussion of what policy might achieve in terms of getting the United States back to its precrisis trend level of output. That discussion is of independent interest, if for no other reason than the implicit stand that Hall takes on what the best models are to think about this seminal event. Both in this paper and in Hall (2011), Hall embraces a New Keynesian view of the world, that is, the view that aggregate demand matters, at least along the transition path to a neoclassically determined steady-state path.\(^1\) How much it matters is the subject of important ongoing debates.\(^2\) Hall thinks it
matters less, but Hall’s “less” is still a lot and implies an economically significant role for aggregate demand policy.

My comments are organized as follows: First, I summarize Hall’s main conclusions. Second, I provide some complementary calculations on the costs of the Great Recession. I then consider the question of which class of models is qualitatively consistent with key aspects of the data. I argue that, at present, there is precisely one class of theories that has been shown to be quantitatively consistent with Hall-type calculations. That class consists of models that explain the depth and persistence of the Great Recession as the confluence of a fall in aggregate demand and the binding zero lower bound (ZLB) constraint on nominal interest rates (see, for example, Christiano, Eichenbaum, and Trabandt 2014). Frankly, I have seen lots of criticisms of New Keynesian models and some of them are even reasonable. However, I have yet to see a fully articulated non-New Keynesian-type model that comes close to matching the type of facts that Hall documents. It is time for critics of the New Keynesian model to rise to this challenge.

 Decomposing the Shortfall in Output

The key result in Hall’s paper relates to his decomposition of the shortfall in output into TFP, capital and labor input shortfalls. The methodology underlying these calculations begins with the following identities:

\[
\text{Output growth} = \text{productivity growth} + \text{capital contribution} + \text{labor contribution.}
\]

\[
\text{capital contribution} = \text{capital share} \times \text{change in log per capita input.}
\]

\[
\text{labor contribution} = \text{labor share} \times \text{change in log labor input.}
\]

Hall then proceeds as follows: First, he projects factor input values using simple log linear trends calculated over the sample period 1990–2007. Second, he calculates the difference between projected and actual input values through 2013. Third, he adds up the contributions of the inputs and calculates the implied shortfall in output. The contribution of TFP is calculated as a residual so that the decomposition is additive. This method is very similar to the calculations in Christiano et al. (2014), but differs with respect to the dates over which the precrisis trend is calculated and the precise measure of inputs and output. While Christiano and colleague’s numbers are different from Hall’s, the basic picture painted by the two sets of calculations is similar.
A simple way to summarize the magnitude of the havoc wreaked by the Great Recession is to use Hall’s results to calculate the shortfall in current output as a percent of 2007 real output. Table 1 reports these results. The numbers are sobering. For example, as of the end of 2013, the cumulative loss in output from projected trend is almost 69% of 2007 real GDP. Table 2 also reports the results that I obtain when I begin the trend in 1972. See Christiano et al. (2014) for a more thorough robustness analysis with respect to dates over which the precrises trends are estimated.

A key question is how much could demand policy affect the output shortfall, say as of the end of 2013. We can derive one upper bound by assuming that all of the nonpopulation part of the shortfall in labor input could be reversed by expansionary monetary and fiscal policy. Based on Hall’s numbers, that bound is equal to 38% of the output shortfall. If we redo his analysis based on the 1972 to 2007 trend calculations, the bound rises to 45%. Of course if part of TFP movements reflect labor hoarding and capacity utilization, the bound would be higher. Also, if demand policy affected investment rates it would increase the speed with which the capital shortfall is eliminated.

Table 1
Cumulative Output Shortfall Relative to 2007 Base Level. Calculated Using Hall (2014) Methodology and Data

<table>
<thead>
<tr>
<th>Year(s)</th>
<th>Output</th>
<th>Productivity</th>
<th>Capital Contribution</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>4.9</td>
<td>3.0</td>
<td>0.2</td>
<td>0.3</td>
</tr>
<tr>
<td>2009</td>
<td>12.3</td>
<td>4.7</td>
<td>1.1</td>
<td>0.5</td>
</tr>
<tr>
<td>2010</td>
<td>12.4</td>
<td>3.1</td>
<td>2.1</td>
<td>0.8</td>
</tr>
<tr>
<td>2011</td>
<td>12.9</td>
<td>3.4</td>
<td>2.9</td>
<td>1.2</td>
</tr>
<tr>
<td>2012</td>
<td>12.9</td>
<td>3.5</td>
<td>3.4</td>
<td>1.1</td>
</tr>
<tr>
<td>2013</td>
<td>13.3</td>
<td>3.5</td>
<td>3.9</td>
<td>1.3</td>
</tr>
<tr>
<td><strong>Cumulative output shortfalls</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007 through 2010</td>
<td>29.6</td>
<td>10.8</td>
<td>3.4</td>
<td>1.6</td>
</tr>
<tr>
<td>2007 through 2013</td>
<td>68.6</td>
<td>21.2</td>
<td>13.6</td>
<td>5.2</td>
</tr>
</tbody>
</table>

Table 2
Contribution of Labor to Per Capita Output Shortfall, 2013

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>All trends 1990–2007</td>
<td>38%</td>
<td>36%</td>
<td>45%</td>
</tr>
<tr>
<td>TFP trend 1972–2007</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
I infer that the upper bound for the impact of demand policy is large. A critical issue is how much of the labor shortfall is cyclical and how much reflects low frequency, structural factors. Hall’s paper contains a nuanced discussion of the latter factors, including secular declines in the labor force participation rate, the impact of changes in unemployment and Social Security disability benefits, as well as the impact of implicit taxes associated with programs like food stamps. The role of demographics is undeniably important and accounts for at least a third of the decline in labor-force participation rates. Hall attributes a relatively minor role to the other three categories.

The Mismatch Hypothesis

One of the leading candidate mechanisms for the slow recovery that could limit the potential effectiveness of demand policy is the “mismatch hypothesis.” The primary evidence cited in favor of this hypothesis is the apparent upward shift in the Beveridge curve—the relationship between the unemployment rate and vacancies. Figure 1 displays the Beveridge curve over the period May 2007 to December 2013. Notice the pronounced “hook” in this curve that reflects a higher number

![Fig. 1. US Beveridge curve](source: BLS)
of vacancies associated with a given unemployment rate in the latter part of the sample period. Kocherlakota (2010) interprets these observations as implying that firms had positions to fill, but the unemployed workers were simply not suitable for the positions. That is, there was a mismatch between the types of jobs available and the skills of available workers. Clearly, unemployment due to such a mismatch is not easily amenable to aggregate demand policies.

*Evidence from Shierholz (2014)*

There are many reasons to be skeptical about the quantitative significance of the mismatch hypothesis during the Great Recession. Shierholz (2014) argues that if high unemployment was largely reflected in the mismatches, then some type of workers should be in greater demand than they were before the Great Recession. Granted, people with higher levels of education have significantly lower unemployment rates than less educated workers. But Shierholz notes that as of July 2013, workers with a college degree had unemployment rates that were more than one-and-a-half times as high as they were before the recession began (see her figure 1). There is no evidence that workers at any level of education faced tighter labor markets relative to 2007.

Similarly, the unemployment rate in all occupations during the Great Recession has been consistently higher than it was before the recession (see her figure 2). This fact seems fundamentally inconsistent with the mismatch hypothesis. Also, to the extent that the mismatch hypothesis is important, we would expect to find some sectors where there are more unemployed workers than job openings, and some sectors where there are more job openings than unemployed workers. In fact, unemployed workers dramatically outnumber the number of job openings in all major sectors of the economy (see her figure 3).

Next, if firms wanted to hire new workers but could not find the right kind of workers, they would increase hours worked of their current employees. Shierholz (2014) documents that in almost all occupations the average weekly hours of existing workers is lower now than they were before the recession started (see her figure 4). Finally, if the mismatch hypothesis was quantitatively important, wages of workers with the “right” type of skills should rise. In fact, wages across most occupations have been rising at modest rates roughly equal to the growth of average labor productivity.
Survey Evidence

Since the early 1970s, the National Federation of Independent Business, a small business association, has surveyed its members to find out what their “top problem” is. Respondents are asked to select an answer from among the following 10 categories: taxes, inflation, poor sales, finance and interest rates, cost of labor, government regulations and red tape, competition from large businesses, quality of labor, cost and/or availability of insurance, and other. Figure 2 displays the top four answers cited by firms. Note that since 2008, “poor sales” has surged to the problem selected by the largest number of firms. The number of firms reporting “labor quality” as their top problem has collapsed to less than 5%. Put bluntly, small firms have voted overwhelmingly against the mismatch hypothesis.

The Decline in the Job-Filling Rate

Figure 3 displays the daily job-filling rate from January 2001 to February 2013. This rate has clearly declined, but that does not necessarily re-
reflect a decline in the matching technology between workers and firms. Davis, Faberman, and Haltiwanger (2013) show that the job-filling rate rises strongly with the gross hiring rate in a cross-section of establishments. They argue that one can reconcile this empirical relationship with standard search theory by assuming that recruiting intensity per vacancy covaries positively with the vacancy rate. Davis, Faberman, and Haltiwanger (2012) apply this idea to aggregate time series, parameterizing the recruiting intensity function to be consistent with how the finding rate varies with gross hires in the cross section. Figure 4, using updated data from these authors, shows a sharp decline in their measure of job recruiting intensity during the worst of the recession followed by prolonged weakness. Based on this evidence, Davis et al. (2012) argue that this decline accounts for most of the apparent decline in match efficiency.

Hall and Schulhofer-Wohl (2013) provide a different, complementary explanation for the decline in match efficiency as measured by exit rates from unemployment. The key observation in Hall and Schulhofer-Wohl is that match efficiency differs across workers as a function of why they became nonemployed, for example, permanent job loss versus new entrants into the labor force. Critically, those categories with the lowest normal exit rate from nonemployment, that is, those categories with the
lowest match efficiency, expanded dramatically during the post-2007 period (see table 2 in Hall’s paper). Hall and Schulhofer-Wohl construct a composition-adjusted measure of matching efficiency (see figure 12 in Hall’s paper). The evidence is compelling. Virtually all of the apparent decline in match efficiency simply reflects a dramatic shift in the percent of unemployed people due to individuals who experienced a permanent job loss, and a drop in the percent of people who were unemployed for other reasons such as reentry into the labor force.

Does Theory Imply a Downward-Sloping Beveridge Cure?

Recall that the hook-shaped Beveridge curve observed in figure 1 is often interpreted as reflecting a deterioration in match efficiency. This interpretation reflects the mistaken view that search models imply a stable downward relationship between vacancies and unemployment, and that this relationship can only be affected by a change in match efficiency. Christiano et al. (2014) point out that this view is incorrect. The downward relationship between vacancies and unemployment is typically derived as a steady-state property of search models. It is not appropriate to use such a relationship to interpret quarterly data, certainly not during episodes like the Great Recession when the rate at which the
unemployment rate changes varied dramatically over time. To explain this point, I repeat the simple example from Christiano et al. (2014).

Suppose that the matching function is given by:

\[ h_t = \sigma_{m,t} V_t^\alpha U_t^{1-\alpha}, \quad 0 < \alpha < 1, \]

where \( h_t, V_t \) and \( U_t \) denote hires, vacancies, and unemployment, respectively. Also, \( \sigma_{m,t} \) denotes a productivity parameter that can potentially capture variations in match efficiency. Dividing the matching function by the number of unemployed, we obtain the job finding rate, \( f_t \equiv h_t/U_t \):

\[ f_t = \sigma_{m,t} (V_t/U_t)^\alpha. \]

The simplest search and matching model assumes that the labor force is constant so that:

\[ 1 = l_t + U_t, \]

where \( l_t \) denotes employment and the labor force is assumed to be of size unity. The change in the number of people unemployed is given by:

\[ U_{t+1} - U_t = (1 - \rho) l_t - f_t U_t, \]

where \( (1 - \rho) l_t \) denotes the employed workers that separate into unemployment in period \( t \) and \( f_t U_t \) is the number of unemployed workers who find jobs. In steady state, \( U_{t+1} = U_t \), so that:

\[ U_t = (1 - \rho) / (f_t + 1 - \rho). \]

Combining this expression with the definition of the finding rate and solving for \( V_t \), we obtain:

\[ V_t = \left[ \frac{(1 - \rho)(1 - U_t)}{\sigma_{m,t} U_t^{1-\alpha}} \right]^{1/\alpha} \]

This equation clearly implies (a) a negative relationship between \( U_t \) and \( V_t \) and (b) the only way that relationship can shift is with a change in the value of \( \sigma_{m,t} \) or in the value of the other matching function parameter, \( \alpha \). I refer to equation (3.1) as the “steady-state” Beveridge curve.

If we do not impose the steady-state condition \( U_{t+1} = U_t \), we obtain the following relationship between \( V_t \) and \( U_t \):

\[ V_t = \left[ (1 - \rho) \frac{(1 - U_t)}{\sigma U_t^{1-\alpha}} - \frac{U_{t+1} - U_t}{\sigma U_t^{1-\alpha}} \right]^{1/\alpha} \]

During large recessions, the steady-state condition, \( U_{t+1} = U_t \), will not be satisfied. The variable \( U_{t+1} - U_t \) is a large positive number in the
downturn of a severe recession, and then becomes negative as the economy recovers. This effect can easily generate what looks like a shift in the “standard” Beveridge curve.

To assess the empirical importance of this argument, I assume that, for monthly data, \( \rho = 0.97, \sigma_m = \sigma_{mt} = 0.84 \) and \( \alpha = 0.6 \). I then proceed as follows: First, I feed in the observed values of \( U_t \) over the sample 2000:1 to 2014.1 into relationship (1) and calculate the implied values of \( V_t \). The graph of the corresponding values of \( U_t \) and \( V_t \) are displayed as the diamonds in figure 5. Second, we feed in the observed values of \( U_t \) over the sample 2007.5 to 2013.12 into relationship (2) and calculate the implied values of \( V_t \). The corresponding values of \( U_t \) and \( V_t \) are displayed as the squares in figure 5. Finally, the circles in that figure are the actual values of \( U_t \) and \( V_t \) over the sample period. Not surprisingly, the steady-state Beveridge curve cannot match the “fish-hook” pattern observed in the data. But once we abandon counterfactual assumption that \( U_{t+1} = U_t \), the simple DMP model has no problem accounting for the fish-hook pattern, even with a constant value of \( \sigma_m \). The model considered in Christiano et al. (2014), which endogenizes the labor-force participation

Fig. 5. US Beveridge curve

Source: BLS; Christiano, Eichenbaum, and Trabandt (2013).
rate, does an even better job of matching the empirical Beveridge curve with a constant value of $\sigma$ than the simple model described above.

Is the Recovery Slow Because of Policy Uncertainty?

An important claim—at least in the public media and blogosphere—is that policy uncertainty is an important cause of the slow recovery. In an innovative paper, Baker, Bloom, and Davis (2013) construct a measure of economic policy uncertainty. Figure 6 displays this index over the period January 1985:1 to March 2014. This index was at a highly elevated level during the Great Recession and peaked in the summer of 2011, during the debt ceiling debate. So there is clearly a correlation between the value of the index and slow growth. But there is very little formal evidence documenting a systematic causal role running from policy uncertainty to economic growth. I personally suspect that the fiscal ceiling debate did in fact seriously slow the recovery. But it seems quite incredible to claim that policy uncertainty is now an important determinant of the output shortfall. Figure 6 shows that policy uncertainty has declined dramatically from its 2011 high and is now roughly equal to its average post-1985 value. Whatever it is that is preventing US output from recovering to pre-Great Recession-trend level, it is not policy uncertainty.

![Fig. 6. US economic policy uncertainty index](source: Baker, Bloom, and Davis.)
Is the Recovery Slow Because of Credit Constraints?

There has been an explosion of research on credit constraints and their impact on aggregate economic activity. I have no doubt that financial market frictions and credit constraints played an extremely important role during the crisis and its immediate aftermath. But there is little evidence that these factors are now playing a quantitatively large role in holding back the recovery. Figure 7 displays the cash and short-term investments of nonfinancial corporations as well as the ratio of cash to assets of these corporations. Both values now exceed their values as of the end of 2006. Of course, there is substantial heterogeneity across sectors in these values. Standard and Poor’s (2012) argues that a disproportionate amount of the cash is held by investment-grade corporations and specific industries (technology and health care). That said, the spread between AAA and BAA bond rates are very low (see figure 8). Granted, one can write down models of credit constraints where binding constraints do not show up in the form of higher interest rates. But surely if corporations were desperate to make large investments but

![Fig. 7. Cash and short-term investments to assets of nonfinancial corporations](#)

*Source: Board of Governors of the Federal Reserve System.*
could not obtain the financing to do so, that desperation would show up in some interest rate. Absent any evidence, I infer there is no obvious reason to think that a significant fraction of US corporations currently face binding finance constraints.

One might think that small firms (not represented in the data displayed in figure 7) are more likely to be credit constrained than large firms. No doubt some small firms (and households) do face credit constraints. That said, there are important reasons to think that these constraints are not playing a major role in preventing these firms from expanding. To begin with, data from the Federal Reserve’s Senior Loan Officer Survey report dramatic declines in the percent reporting tightening standards for commercial and industrial loans to large, medium, and small firms (see figure 9), consumer loans (figure 10), and mortgage loans (figure 11). Finally, it is true that in the National Federation of Independent Business (NFIB) survey that the percent of firms reporting that their most important problem pertains to finance and interest rates is still elevated relative to the 2006 numbers (see figure 2). But, the percent of such firms is still less than 4% and is dwarfed by the percent of firms reporting that sales and taxes are their most important problem.

Fig. 8. US corporate bond spread (Aaa-Baa) percentage points

Source: Board of Governors of the Federal Reserve System.
Fig. 9. Net percent reporting tightening standards for commercial and industrial loans
Source: Board of Governors of the Federal Reserve System.

Fig. 10. Net percent reporting tightening standards for consumer loans
Source: Board of Governors of the Federal Reserve System.
*From 2011:Q2, auto loans are split out from the other consumer loans category.
Lessons

We are not in slow recovery because of a mismatch between workers’ skills and the kinds of jobs that are vacant. Nor are we in a slow recovery now because of policy uncertainty or binding financial constraints on many firms and consumers. So what is left? The obvious answer—which the NFIB survey says is the one that small firms give—is low aggregate demand. No doubt there are lots of ways to articulate why aggregate demand is low and how that impacts on aggregate economic activity. But as far as I know, the only version of that story that has been articulated in an explicit estimated dynamic stochastic general equilibrium (DSGE) model that captures the key facts about the Great Recession is the New Keynesian version. Those models interpret the recent recession as the collision of low aggregate demand with a binding ZLB on the nominal interest rate. Along with his quantitative analysis of factor input shortfalls, that view is the basis of Hall’s table 10.

There is substantial uncertainty about exactly how big the output shortfall is and how much of it is amenable to aggregate demand policy. The key lesson I take from Hall’s paper and my own work...
in Christiano et al. (2014) is that the shortfall is large and the gains from aggregate demand policy are large. That said, the gains are smaller now than they were in 2010 because the output gap is lower and the ZLB on interest rates is less binding. Looking forward, fiscal policy will have to be much better designed for aggregate demand policy to achieve its potential in alleviating downturns associated with a binding ZLB. Sadly, the constraints imposed by political reality may always keep fiscal policy from reaching that potential. My hunch is that by being more responsible fiscally in normal times, it will be easier politically to use fiscal policy in rare emergencies like the Great Recession.

In sum, let me conclude with an enthusiastic recommendation of Hall’s paper. It is a must read for anyone interested in understanding the aftermath of the financial crisis. It provides a valuable decomposition of the output shortfall into the shortfall in factors of production. It provides an insightful discussion of cyclical versus secular movements in labor input and a useful discussion of the impact of different government programs on employment. Perhaps most importantly, it provides an interesting estimate of the upper bound of what demand policy could do to eliminate the output shortfall in the short run. I take from it the view that there is a limited but very real role for aggregate demand policy to play in eliminating some of our current output shortfall.

**Endnote**

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1. I have no doubt that Hall would vehemently deny being a New Keynesian.
2. New Keynesian models stress the importance of nominal rigidities. There are, of course, alternative ways of modeling why aggregate demand matters. Some recent examples include Angeletos and La’O (2013), Beaudry and Portier (2013), Farmer (2013), Michaillat and Saez (2013), and Huo and Rios-Rull (2013).
3. For a much earlier argument to this effect see Pissarides (2000).

**References**


