Discussion of "Quantifying the Lasting Harm to the U.S. Economy from the Financial Crisis" by Robert E. Hall

Martin S. Eichenbaum[*,†]

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[†] Northwestern University, Department of Economics, 2001 Sheridan Road, Evanston, Illinois 60208, USA. Phone: +1-847-491-8232. E-mail: eich@northwestern.edu.

1. Introduction

The United States is just now emerging from the seminal economic event of our post-war 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 importantly to policy makers is the question of what can we do to hasten the recovery? Most importantly to researchers is the question what class of models are the most useful for thinking about the causes and consequences of the Great Recession?

Robert Hall's paper hasn't provided the answer to all these questions. But he has written the 'War and Piece' 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 post-crisis decline in aggregate output. Hall uses those results as background for a nuanced discussion of what policy might achieve in terms of getting the U.S. back to its pre-crisis 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 abut this seminal event. Both in this paper and in Hall (2011), Hall embraces a New-Keynesian view of the world, i.e. the view that aggregate demand matters, at least along the transition path to a neo-classically 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 discussion is 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 which 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 (CET, 2014)). Frankly, I have seen lots of criticisms of NK models and some of them are even reasonable. But I have yet to see a fully articulated non-NK type model that comes close to matching the type of facts that Hall documents. It is time for critics of the NK model to rise to this challenge.

[1] I have no doubt that Hall would venehemently deny being a New Keynesian.

[2] NK 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 (2012), Beaudry and Portier (2013), Farmer (2013), Michaillat and Saez (2013), and Rios-Rull and Huo (2013).

2. Decomposing the Shortfall in Output

The key result in Hall's paper relate 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:

Output growth = productivity growth + capital contribution + labor contribution.

capital contribution = capital share x change in log per capita input.

labor contribution = labor share x 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 CET (2014) but differs with respect to the dates over which the pre-crisis trend is calculated, and the precise measure of inputs and output. While CET's numbers are different than 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 th at I obtain when I begin the trend in 1972. See CET for a more thorough robustness analysis with respect to dates over the pre-crises 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 non-population 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.

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.

3. 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 upwards shift in the Beveridge curve, i.e. 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 which reflects a higher number 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.

3.1. 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 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 sectors of the economy (see her Figure 3).

Next, if firms wanted to hire new workers but couldn't 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.

3.2. 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 five percent. Put bluntly, small firms have voted overwhelmingly against the mismatch hypothesis.

3.3. 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 doesn't necessarily 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 et. al. (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 apparent decline in match efficiency.

Hall and Schulhofer-Wohl (2013, HS) provide a different, complementary explanation for the decline in match efficiency, as measured by exit rates from unemployment. The key observation in HS is that match efficiency differs across workers as a function of why they became non-employed, e.g. permanent job loss versus new entrants into the labor force. Critically, those categories with the lowest normal exit rate from non-employment, i.e.

those categories with the lowest match efficiency, expanded dramatically during the post-2007 period (see Table 2 in Hall's paper). HS 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 re-entry into the labor force.

3.4. 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. CET point out that this view is incorrect.[3] The downward relationship between vacancies and unemployment is typically derived as a steady state property of search models. But 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 CET.

Suppose that the matching function is given by:

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

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, $f_t \equiv h_t/U_t$:

$$f_t = \sigma_{m,t} \left(V_t/U_t \right)^{\alpha}.$$

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

[3] For a much earlier argument to this effect see Pissarides (2000).

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:

$$V_t = \left[\frac{(1-\rho)(1-U_t)}{\sigma_{m,t} U_t^{1-\alpha}}\right]^{\frac{1}{\alpha}} \tag{3.1}$$

This equation clearly implies (i) a negative relationship between U_t and V_t and (ii) 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, α. I refer to equation (3.1) as the 'steady-state' Beveridge curve.

If we don't impose the steady state condition $U_{t+1} = U_t$, we obtain the following relationship between V_t and U_t:

$$V_t = \left[(1-\rho)\frac{(1-U_t)}{\sigma U_t^{1-\alpha}} - \frac{U_{t+1} - U_t}{\sigma U_t^{1-\alpha}}\right]^{1/\alpha} \tag{3.2}$$

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, $\rho = 0.97, \sigma_{mt} = \sigma_m = 0.84$ 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 (3.1) 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 (3.2) 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 can't 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 σ_m. The model considered in CET, which endogenizes the labor force participation rate, does an even better job of matching the empirical Beveridge curve with a constant value of σ than the simple model described above.

4. 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 U.S. output from recovering to pre-Great Recession trend level, it is not policy uncertainty.

5. 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 non-financial 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 don't show up in the form of higher interest rates. But surely if corporations were desperate to make large investments but couldn't 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 U.S. 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 NFIB survey that the percent of firms reporting that their most important problem pertain 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 four percent, and is dwarfed by the percent of firms reporting that sales and taxes are their most important problem.

6. 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's 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's been articulated in an explicit estimated DSGE model that captures the key facts about the Great Recession is the NK version. Those models interpret the current 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 about just 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 CET 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.

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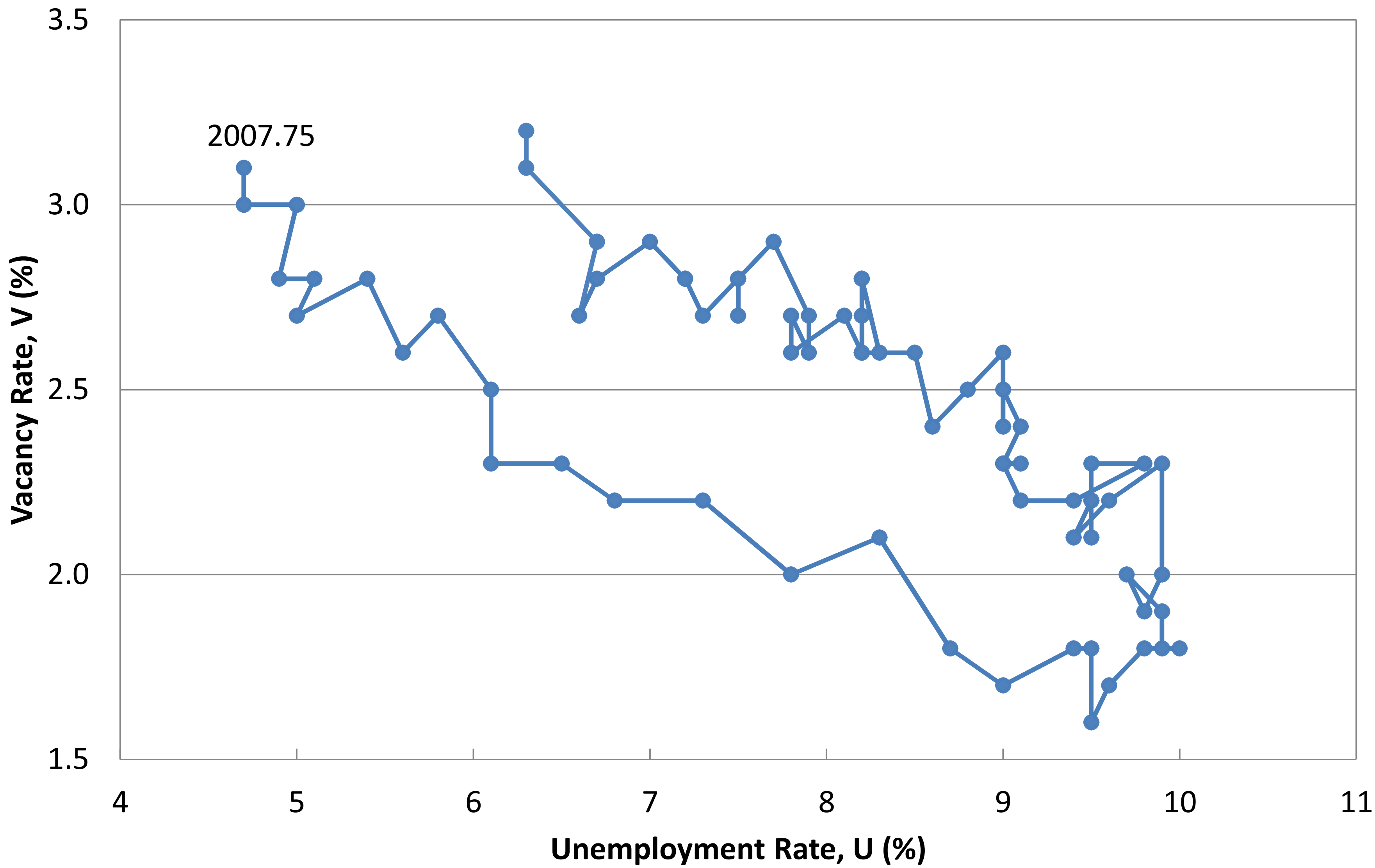
Table 1: Cumulative output shortfall relative to 2007 base level
Calculated using Hall (2014) methodology, data

Year(s)	*Output*	*Productivity*	*Capital contri-bution*	*Popu-lation*
2008	4.9	3.0	0.2	0.3
2009	12.3	4.7	1.1	0.5
2010	12.4	3.1	2.1	0.8
2011	12.9	3.4	2.9	1.2
2012	12.9	3.5	3.4	1.1
2013	13.3	3.5	3.9	1.3
Cumulative output short-falls:				
2007 through 2010	29.6	10.8	3.4	1.6
2007 through 2013	68.6	21.2	13.6	5.2

Table 2: Contribution of labor to per capita output shortfall, 2013

Hall, 2014 All trends: 1990-2007	Hall, 2014 TFP trend: 1972-2007	All trends: 1972-2007
38%	36%	45%

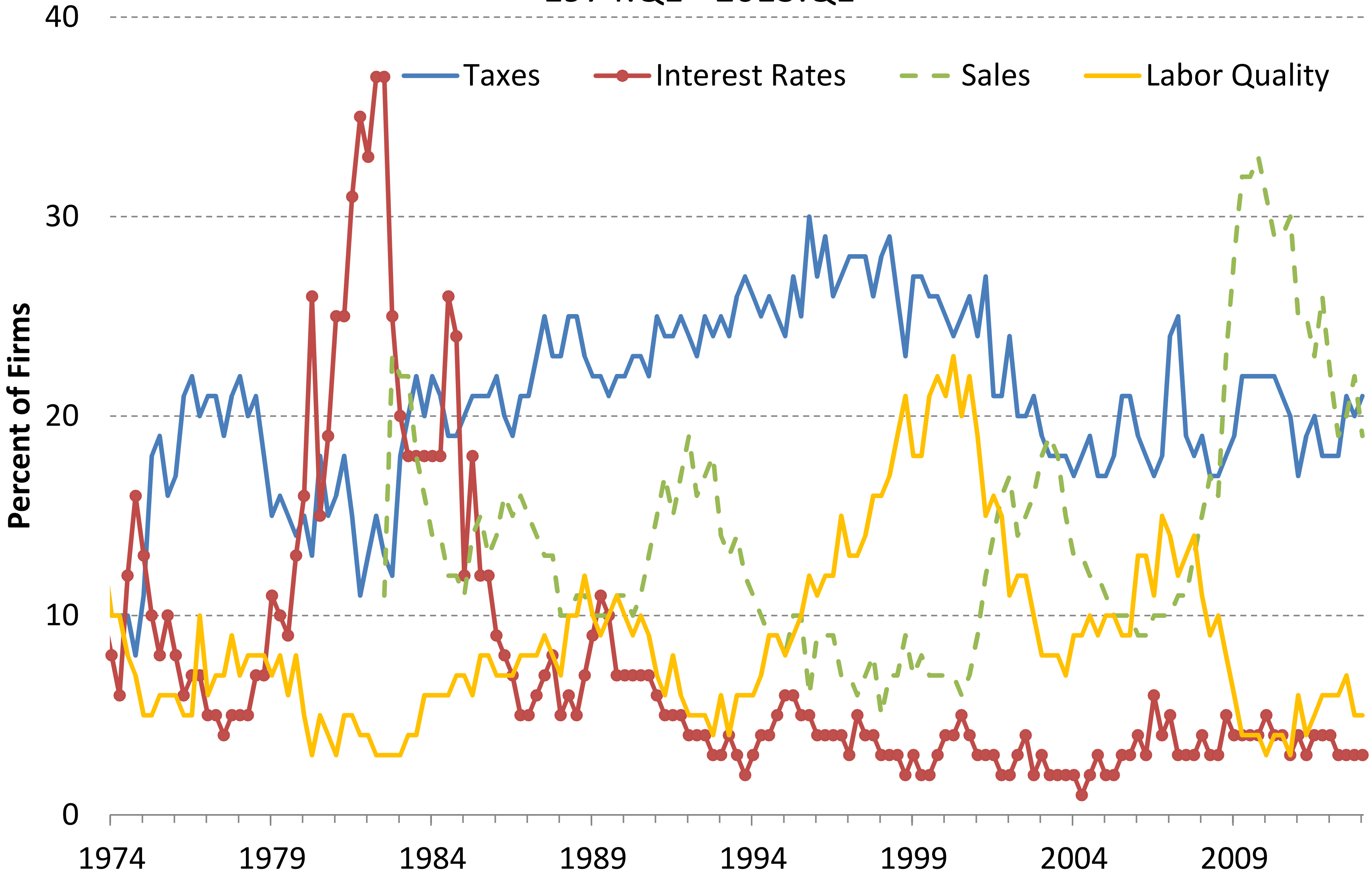
Figure 1: U.S. Beveridge Curve



Source: BLS

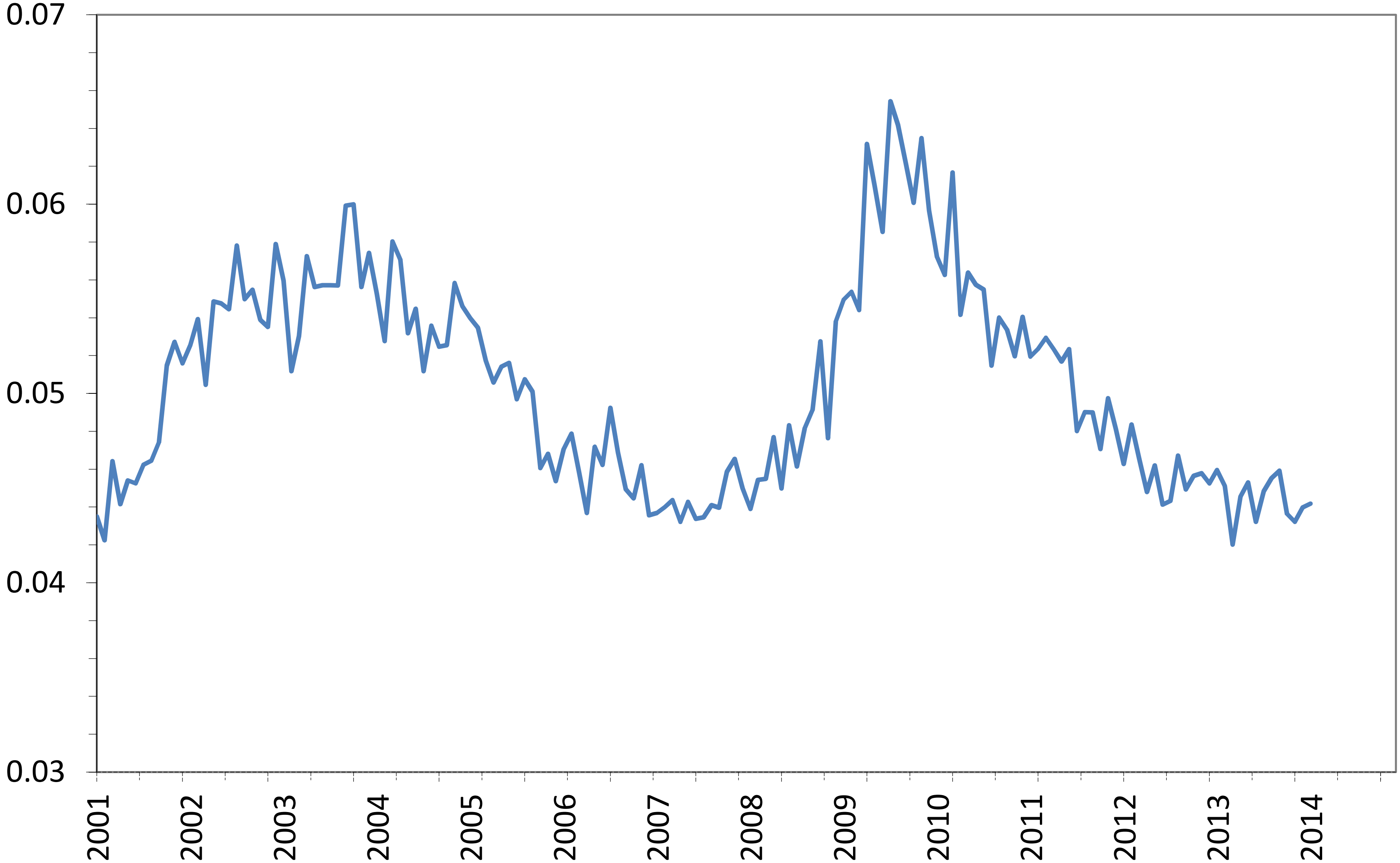
Figure 2: Single Most Important Problem

1974:Q1 - 2013:Q1



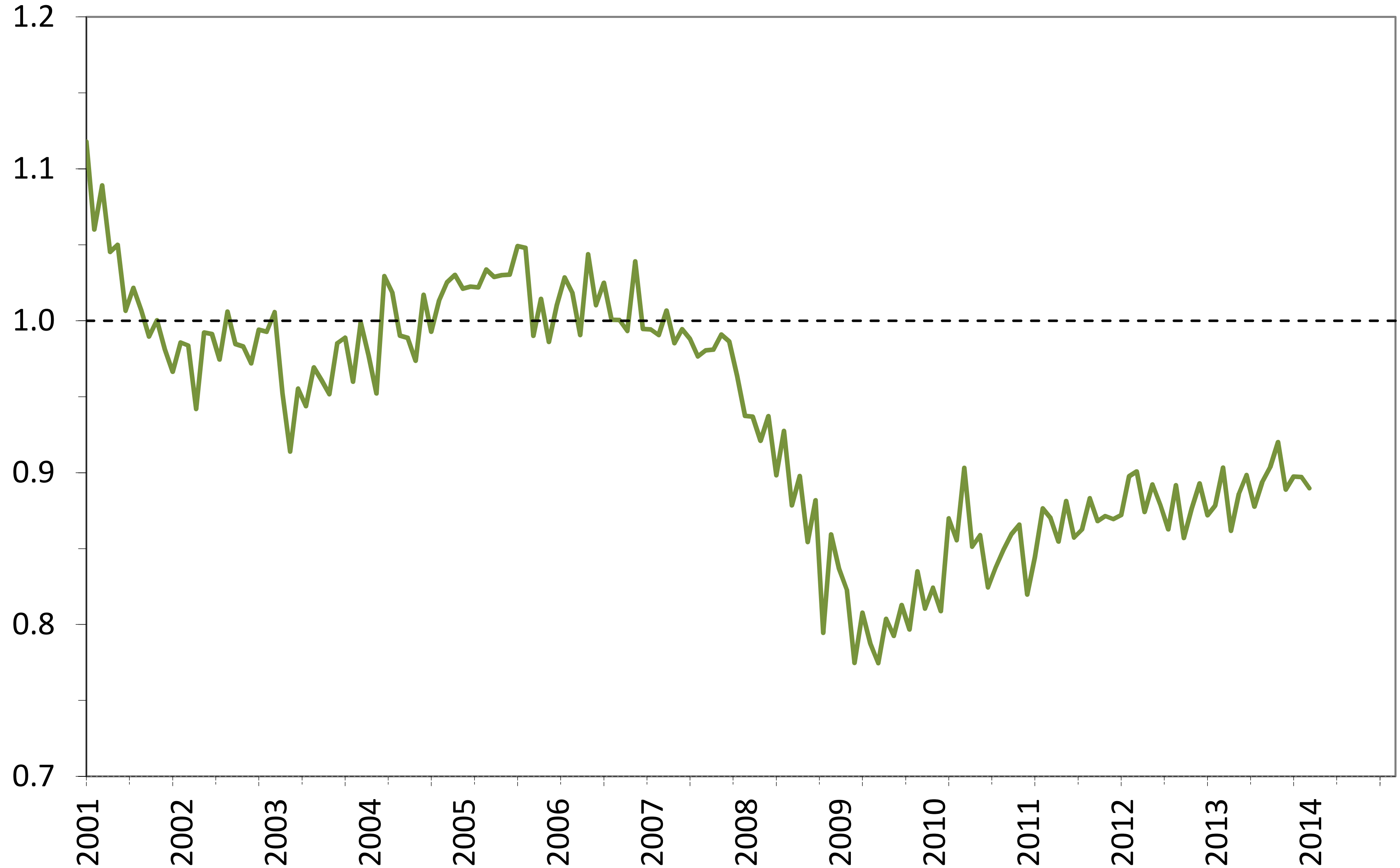
Source: NFIB Survey

Figure 3: Daily Job-Filling Rate



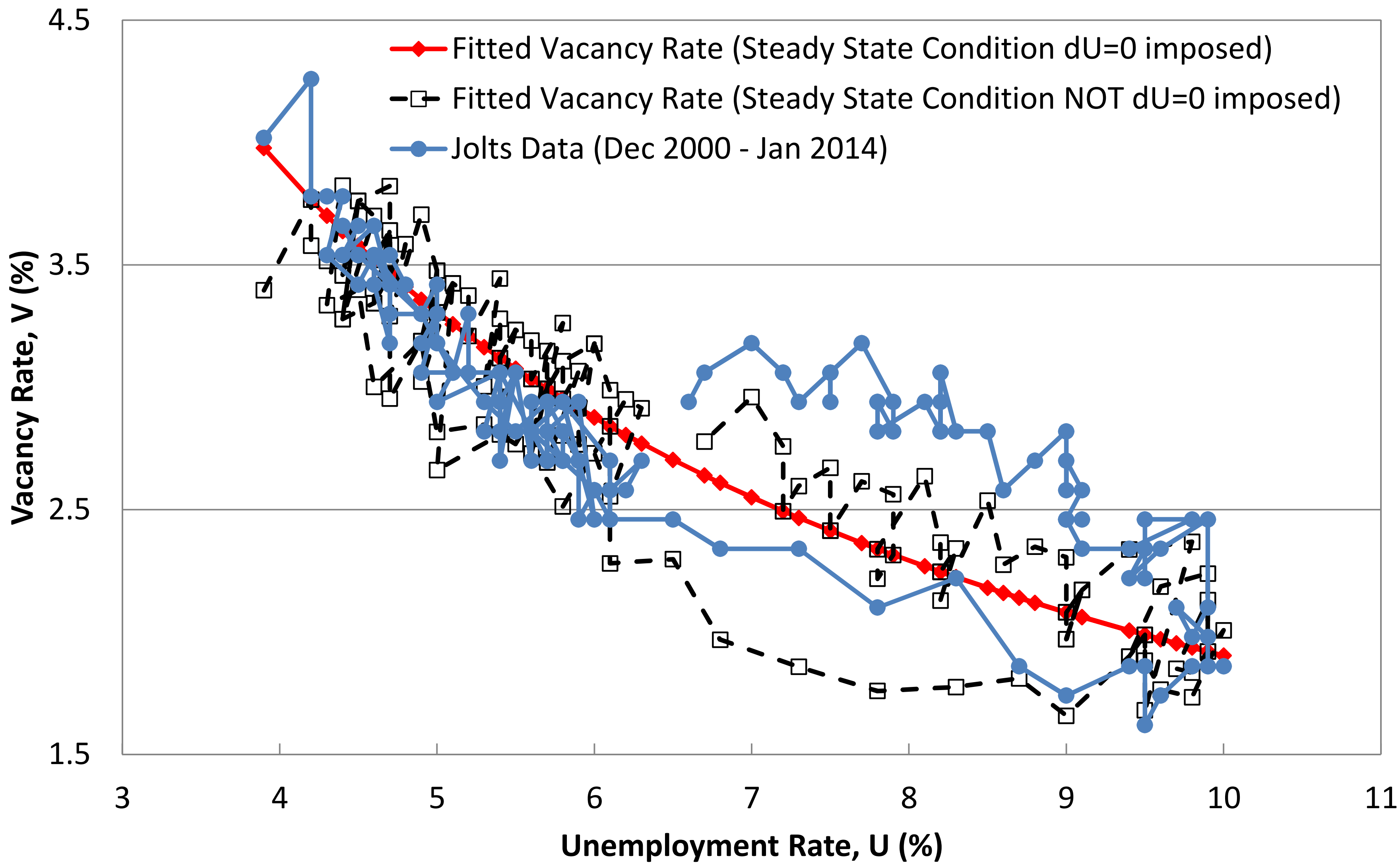
Source: Davis, Faberman and Haltiwanger

Figure 4: Recruiting Intensity Per Vacancy



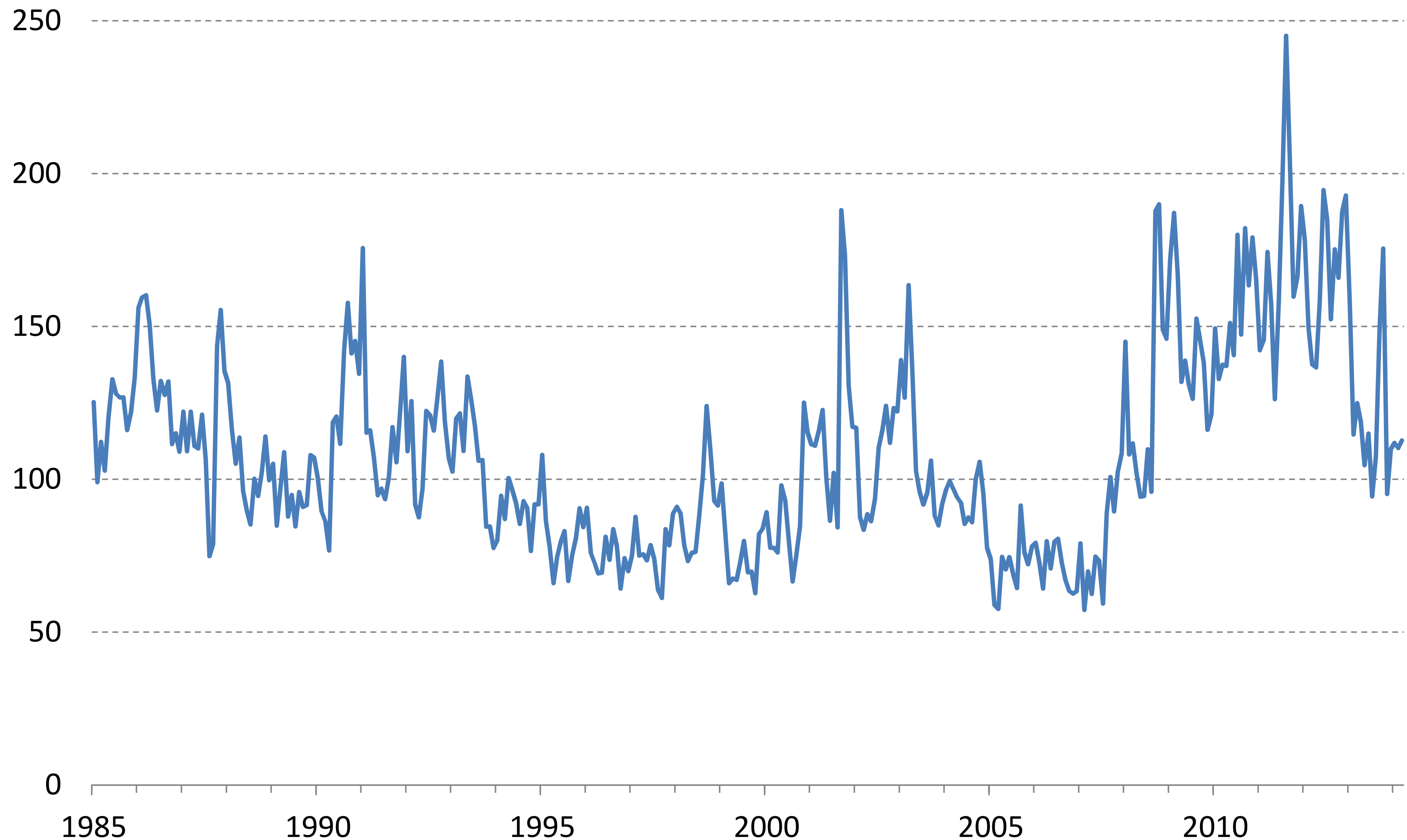
Source: Davis, Faberman and Haltiwanger

Figure 5: U.S. Beveridge Curve



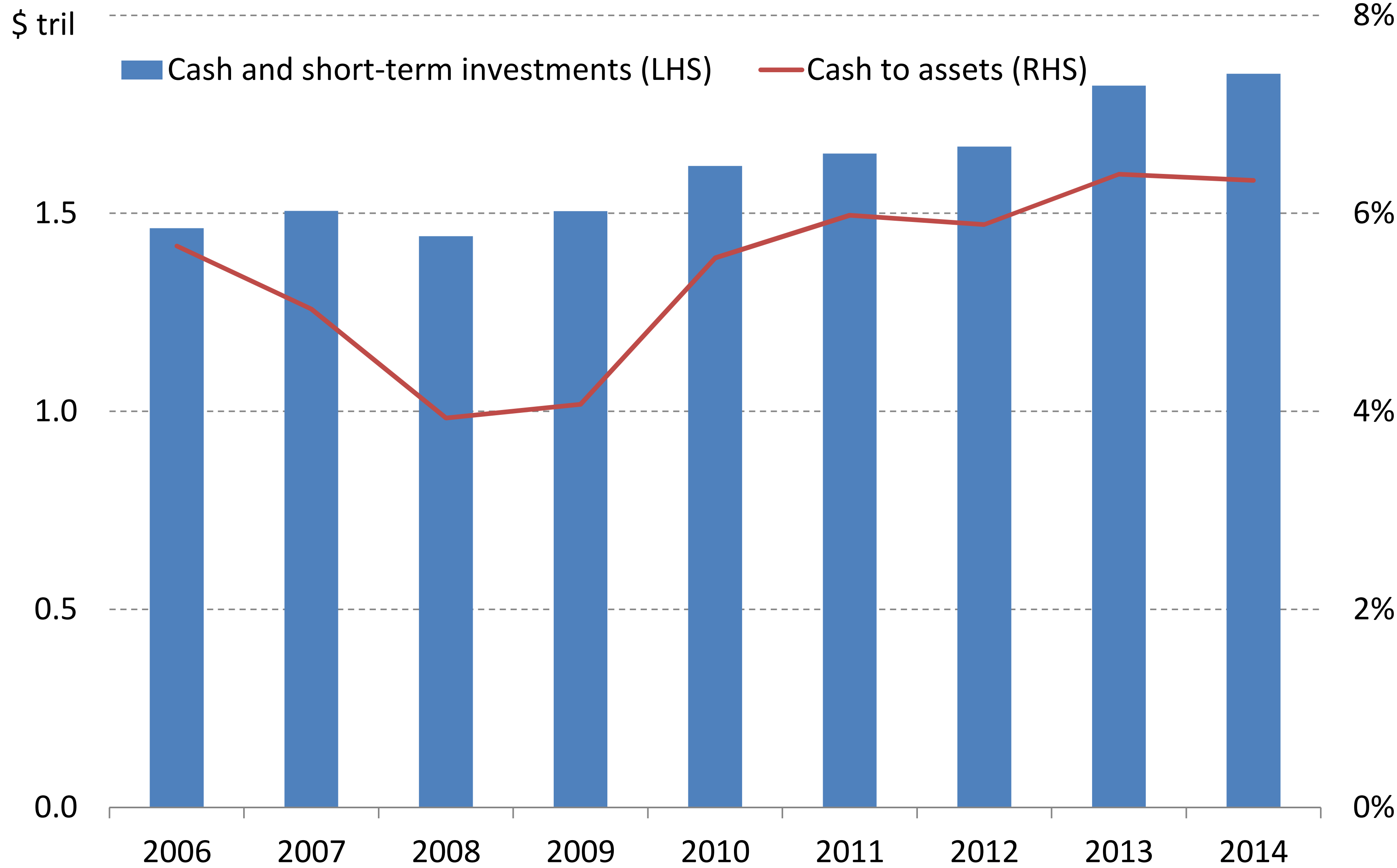
Sources: BLS; Christiano, Eichenbaum, and Trabandt (2013)

Figure 6: U.S. Economic Policy Uncertainty Index



Source: Baker, Bloom, and Davis

Figure 7: Cash and Short-term Investments to Assets
of Non-Financial Corporations



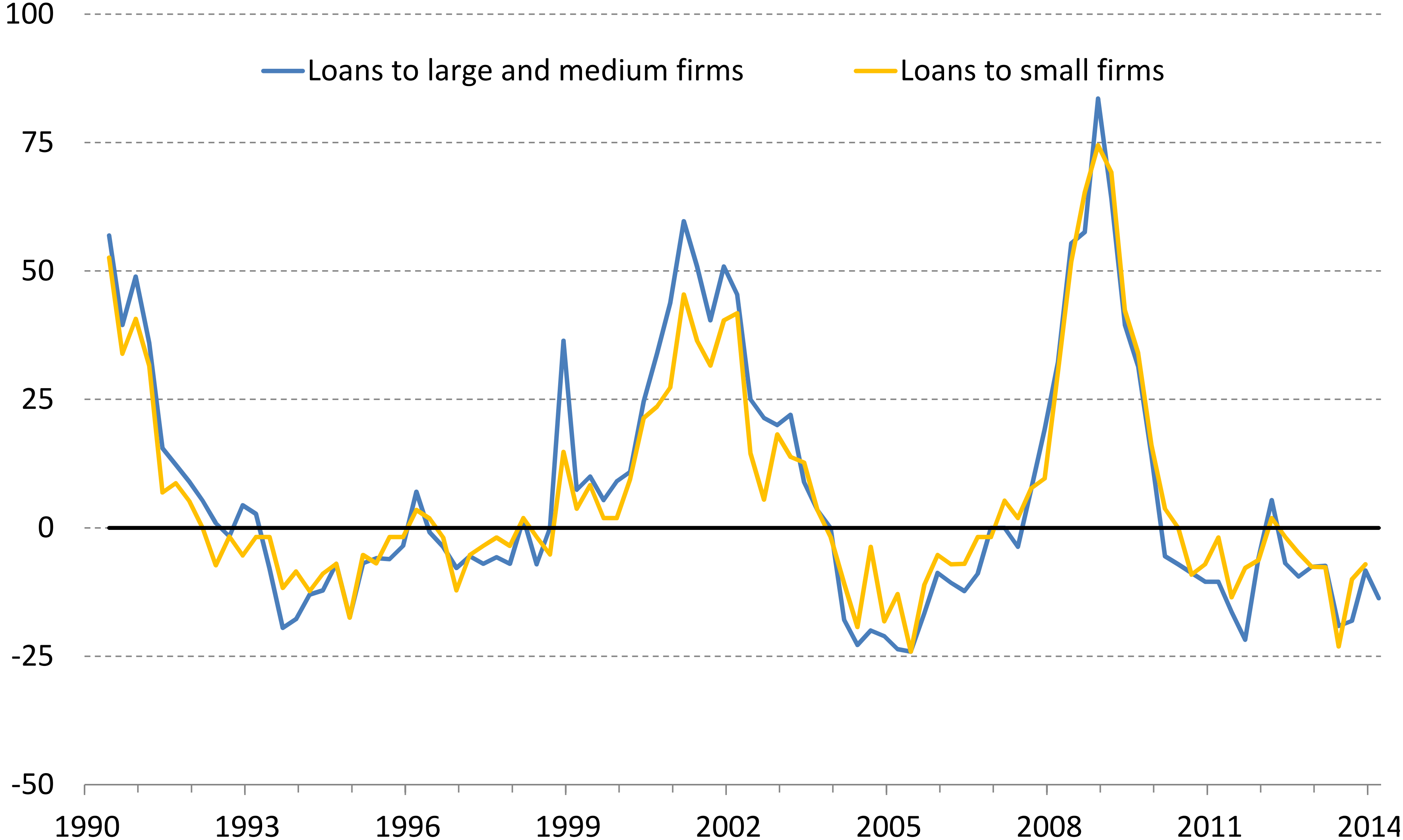
Source: Board of Governors of the Federal Reserve System

Figure 8: U.S. Corporate Bond Spread (Aaa-Baa)

Percentage points

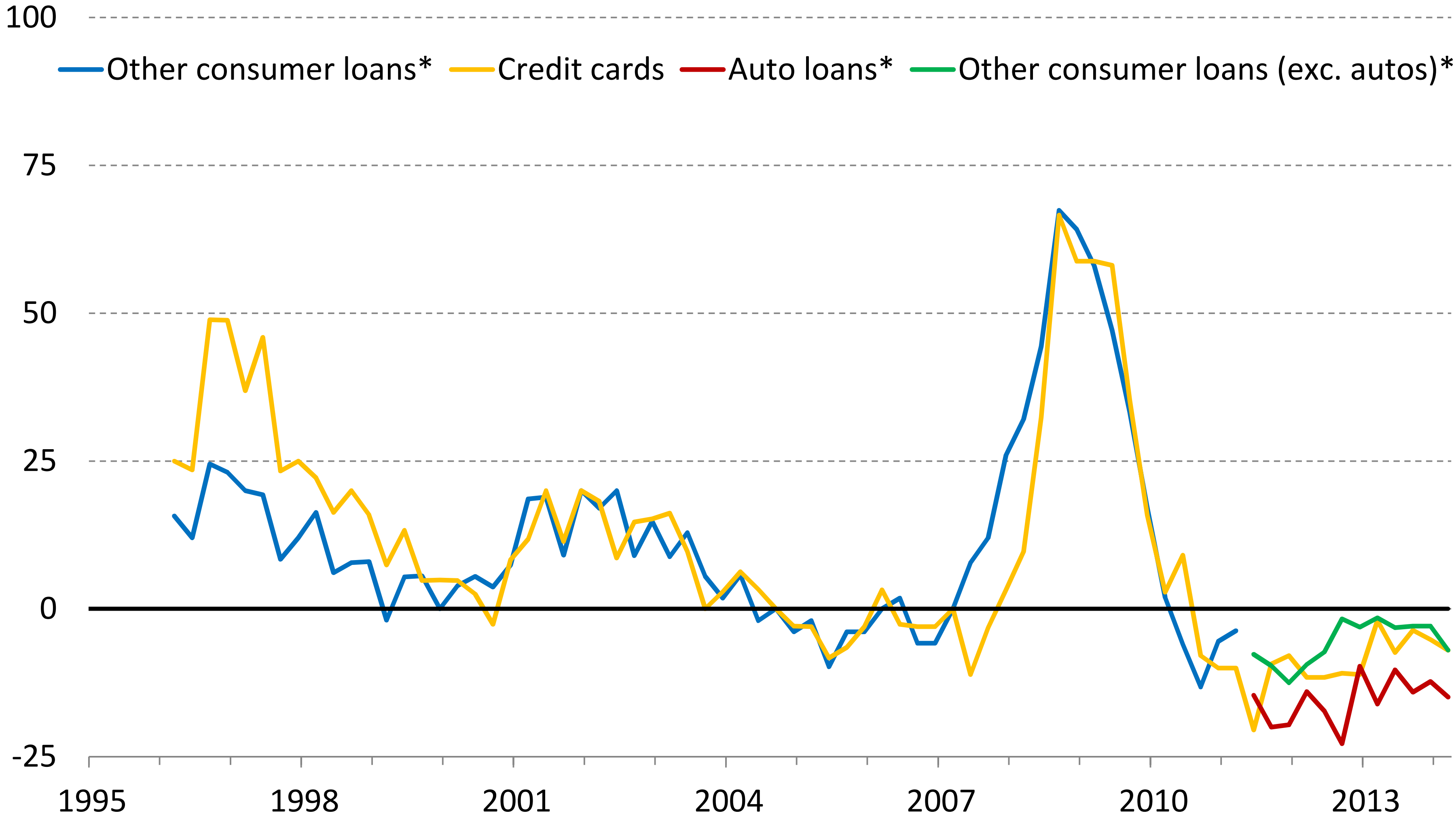
Source: Board of Governors of the Federal Reserve System

Figure 9: Net Percent Reporting Tightening Standards for Commercial and Industrial Loans



Source: Board of Governors of the Federal Reserve System

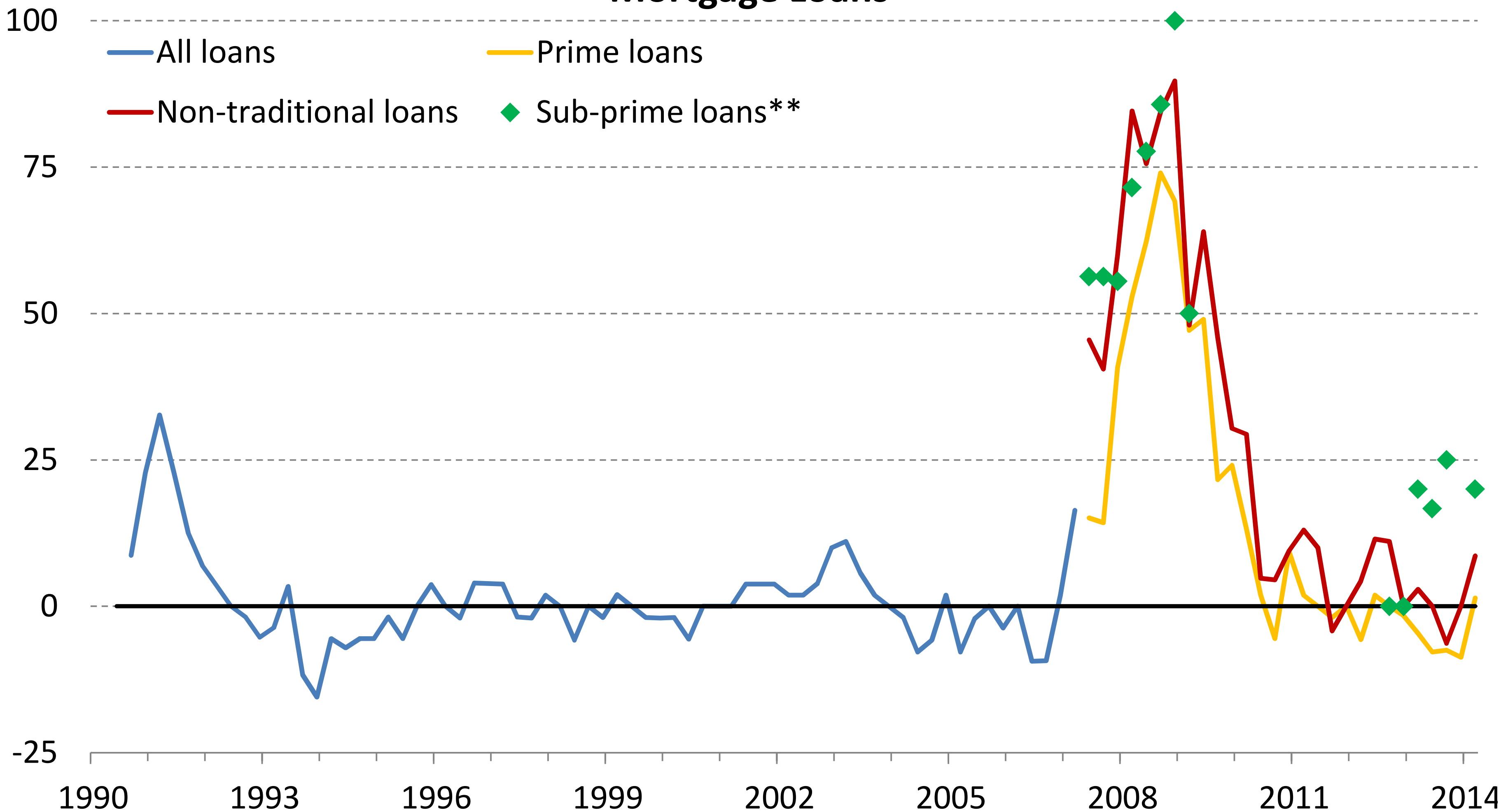
Figure 10: Net Percent Reporting Tightening Standards for Consumer Loans



* From 2011Q2, auto loans are split out from the other consumer loans category.

Source: Board of Governors of the Federal Reserve System

Figure 11: Net Percent Reporting Tightening Standards for Mortgage Loans



* From 2007Q2, loans are split into prime, sub-prime and non-traditional loans.

** Sub-prime series is not reported when the number of respondents is three or fewer.

Source: Board of Governors of the Federal Reserve System