

Reallocation and the Changing Nature of Economic Fluctuations*

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Abstract

We document several important changes in the nature of economic fluctuations that coincide with the onset of the Great Moderation and the Jobless Recoveries phenomenon. Labor productivity turned from strongly procyclical to countercyclical; sectoral reallocation of labor increased and became less temporally concentrated in the initial stages of a recession; much of the reduction in volatility of various aggregate time series was concentrated in the higher frequency component of those series, while the switch in cyclicalities is concentrated in the medium frequency component; the “efficiency wedge” declined in importance relative to the “labor wedge”. We construct a model of labor reallocation that can account for these facts.

Keywords: Reallocation; Great Moderation; Business Cycles

JEL Classifications: E24, E32

1 Introduction

Robert Lucas (1977) famously wrote that “One is led by the facts to conclude that, with respect to the qualitative co-movements among series, *business cycles are all alike*.” This

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general observation has served as a guidepost for modern research on economic fluctuations. Models are typically evaluated in terms of how well they can reproduce a number of empirical moments, under the implicit assumption that these moments themselves are time invariant. However, the facts now lead one to conclude that this assumption is no longer true: key features of business cycles have changed. This paper documents the changing nature of economic fluctuations in the United States, develops a model that can provide a unified account of the various changes.

Some of the changes are more widely known than others. It has been well-documented that the volatility of output, inflation, and other economic aggregates declined substantially in the mid-1980s. This broad-based decline in volatility has been dubbed the “Great Moderation” and has been the focus of a substantial body of research (for example: Kim and Nelson (1999), McConnell and Perez-Quiros (2000), Stock and Watson (2003), Davis and Kahn (2008)). A second well-known change is the “Jobless Recovery” phenomenon: job growth following the last three recessions has been considerably more anemic when compared to earlier post-war recessions (Groshen and Potter (2003), Bachmann (2009), Gordon and Baily (1993), and Aaronson et al. (2004)).

This paper is motivated by several other significant changes in the nature of economic fluctuations that occurred alongside the Great Moderation and the Jobless Recoveries, but which have received little or no attention. First, labor productivity switched from strongly procyclical prior to 1984 to countercyclical in the period since 1984. The co-movements between productivity and labor market aggregates (e.g. hours, employment, and unemployment) also switched signs at the same time. Second, the extent of reallocation of labor across sectors of the economy has increased in post-1984 recessions, while at the same time becoming less concentrated during the initial stages of a recession. That is, recessions in the post-1984 period are characterized by less sharp, but more protracted, episodes of reallocation when compared with recessions prior to 1984.

Third, much of the decline in volatility of various economic aggregates that has occurred since 1984 is attributable to reductions in high-frequency movements rather than medium- to low-frequency movements. In addition, the changing sign of the correlation between labor productivity and other variables appears attributable to movements at medium- to low-frequencies. Fourth, unemployment associated with temporary layoffs, which accounted

for a significant portion of total unemployment prior to 1984, has declined in importance since then. Fifth, the “labor wedges” and “efficiency wedges” obtained from a business cycle accounting exercise have experienced a shift in relative importance, with the “efficiency wedge” declining in importance relative to the “labor wedge.”

As we show below, these changes are stark, and they coincide with the conventional dating of the onset of the Great Moderation. We contend that these changes are related by more than mere temporal coincidence and are in fact united as part of a broader change in the functioning of the economy. As such, they call for a single, unifying explanation.

Understanding and explaining these changes in the nature of economic fluctuations is an important task for macroeconomic research. Leading state-of-the-art DSGE models now in common use for policy analysis are ill-equipped to account for many of these changes. Accounting for the shift from procyclical to countercyclical productivity is particularly important. For example, the highly-touted Smets and Wouters (2007) estimated New Keynesian model yields highly procyclical labor productivity, even when the model is estimated only using post-1984 data. That is, the model is such that when they estimate it, the estimated productivity shocks that can account for the co-movements of the key aggregates are highly procyclical, even though in the data labor productivity has now turned highly countercyclical. This suggests that feeding countercyclical productivity shocks into their model would generate series that fit the data poorly, thus casting doubt on the model.

In many ways, procyclical productivity has been a mainstay of modern macroeconomic models for at least two decades. Indeed, standard one-sector DSGE models in which fluctuations are driven by productivity shocks will, essentially by construction, feature procyclical productivity. More generally, even in macro models with other kinds of shocks, but with standard neoclassical firms, countercyclical productivity is difficult to achieve. With a Cobb-Douglas production function, average labor productivity is proportional to the marginal product of labor and so if firms set the marginal product equal to the wage, then labor productivity can rise during recessions only if wages rise too. But standard models of fluctuations do not feature countercyclical wages, nor is this a feature of the data (either pre- or post-1984; see, e.g., Solon et al. (1994)).

While there has been considerable work aimed at understanding the Great Moderation and the Jobless Recovery phenomenon, there has been little research into the other changes

that we highlighted above. Moreover, attempts to explain the Great Moderation or Jobless Recoveries have implications that are often at odds with the other ways in which economic fluctuations have changed. For example, one of the more popular explanations for the Great Moderation is the so-called “good luck hypothesis” (Stock and Watson, 2003), which holds that there has been a reduction in the magnitude of shocks hitting the economy. However appealing this explanation may or may not be, by itself it is ill-equipped to account for switching signs of the correlations among aggregate variables. Popular explanations for the Jobless Recovery phenomenon often center on labor hoarding stories (e.g. Bachmann (2009)). The difficulty with this explanation is that hoarding tends to make productivity decline in recessions, whereas productivity has clearly increased during each of the last three recessions.

One possible explanation for the declining cyclicalities of productivity is that demand shocks might have become more important relative to supply shocks in the post-1984 period. This story would not, however, be consistent with our frequency analysis nor with the facts concerning reallocation across sectors. Gali and van Rens (2010) propose an explanation of the vanishing procyclicality of productivity based on reduced hiring frictions. The difficulty with this explanation is that reducing hiring frictions is inconsistent with the Jobless Recovery phenomenon. It also leads to only very small reductions in output volatility in a quantitative model. Barnichon (2010), similarly to Gali and van Rens (2010), considers a New Keynesian model in which the conditional correlation between productivity shocks and labor market variables is negative, and argues that productivity shocks have become relatively more important to demand shocks in the post-1984 period. This explanation of the changes we document is inconsistent with our analysis of the time series properties of the labor and efficiency wedges.

We seek a unifying explanation for these new facts. Our hypothesis is that the changing nature of reallocation lies at the heart of the various other changes. The changing importance and changing pace of reallocation can help to explain the shift in the cyclicalities of productivity: as labor moves from less productive to more productive sectors during an economic recovery, all else equal, aggregate productivity will rise through a compositional effect. Since reallocating and re-training workers takes time, the greater, and more protracted, reallocation can also help to account for the Jobless Recovery phenomenon.

Motivated by these observations, we construct a model of labor reallocation that is capable of jointly explaining the facts highlighted above. The model features two islands, or sectors, and island-specific productivity shocks precipitate reallocation of workers from one island to the other. There are frictions associated with reallocating workers that make it a time-consuming activity and result in a pool of “reallocation unemployment.” In addition to island-specific shocks, there are aggregate shocks that are common to both islands. Labor is assumed to be indivisible so that when an aggregate shock hits, some workers on an island become unemployed—not due to frictions or because they are reallocating, but because the disutility of labor effort potentially makes it optimal to reduce labor in response to the aggregate shock. Furthermore, we assume that the island-specific productivity shocks are temporally correlated with negative aggregate productivity shocks, so that when a negative aggregate productivity shock hits, there is also an increase in reallocative activity.

We use this basic model to explore the hypothesis that the above cited changes in the nature of fluctuations resulted from a shift in the relative importance of aggregate and reallocative shocks. In a world in which aggregate shocks are dominant, the model should behave very much like a one-sector neoclassical growth model. While there will be some reallocation across sectors during economic downturns, the aggregate shocks dominate and so productivity will be procyclical and employment declines and recoveries will be sharp and quick. We interpret this environment in which aggregate shocks dominate as a description of the pre-1984 world.

The post-1984 version of the model is one in which aggregate shocks are smaller relative to island-specific shocks. This could be due either to good luck or, in a reduced form sense, to more aggressive countercyclical fiscal and monetary policy. With more dampened aggregate shocks, reallocative shocks play a relatively more important role during downturns. Clearly the dampened aggregate shocks will deliver a “Great Moderation.” It is also apparent that productivity could become countercyclical because during downturns, when employment and output are low, labor productivity rises as labor is reduced in the relatively less productive island and gradually increased in the relatively more productive island. Moreover, because a larger fraction of the unemployment during a downturn is “reallocation unemployment”, which is associated with frictions that make the reallocation time-consuming, employment recoveries should be more drawn out (“Jobless Recovery”), as should the level of reallocative

activity. Temporary layoffs should be less important, as a greater fraction of unemployment spells will involve reallocation. Furthermore, we show in the model that reallocation generates a distortion relative to what would hold in a frictional intratemporal first order condition. The reduction in the volatility of the aggregate shock will therefore manifest itself as a reduction in the volatility of the efficiency wedge relative to the labor wedge.

We calibrate the parameters of the model to fit certain long run features of the US data. We then discipline our quantitative analysis in the following way: we pick the magnitude of the aggregate disturbance to match the volatility of output both pre and post 1984. In the pre-1984 calibration aggregate shocks are relatively large; there we show that labor productivity is strongly procyclical and is also positively correlated with labor input. When we reduce the size of the aggregate shock to match the post-1984 output volatility, we observe that productivity switches to countercyclical and that the volatility of the efficiency wedge drops sharply relative to the volatility of the labor wedge. In addition, we show that employment recoveries are relatively more drawn out in the smaller aggregate shock version of the model. Thus, an important conclusion of the paper is that the Great Moderation phenomenon and the switching correlations between productivity and other variables are linked.

The remainder of this paper is organized as follows. Section 2 provides evidence on the three key facts mentioned above. Section 3 lays out the model and section 4 carries out quantitative exercises to show that it can account for the facts. The final section discusses the broader implications of our research and speculates about the potential policy implications of our findings.

2 Evidence on Changes in the Nature of Economic Fluctuations

In this section we provide evidence on the facts discussed above. Because the facts about the Great Moderation and the Jobless Recovery phenomenon are more broadly known, we do not re-state that evidence here. Unless otherwise noted, all of the data used in the analysis here cover the period 1947 to 2010, are publicly available on US government agency websites,

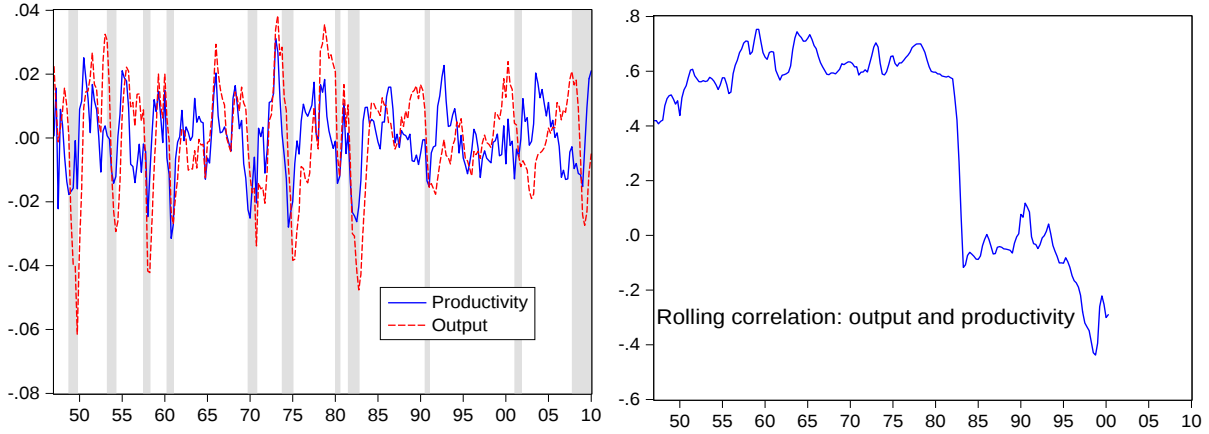


Figure 1: The left panel plots HP filtered real GDP and productivity together, with shaded lines denoting recessions. The right panel plots the 40-quarter forward rolling correlation between HP filtered GDP and productivity.

are quarterly in frequency, are seasonally adjusted, and are expressed in natural logs where appropriate.¹

2.1 The Changing Cyclicity of Productivity

The left panel of figure 1 shows HP detrended average labor productivity and output in the non-farm private business sector. Shaded areas indicate NBER recession dates. It is visually apparent that the two series are positively correlated initially before turning slightly negatively correlated. This visual impression is confirmed in the right panel of figure 1, which shows the rolling 40-quarter forward correlations between output and labor productivity.² Productivity shifts rather suddenly from strongly procyclical to moderately countercyclical. The timing of this abrupt change coincides closely with the conventional timing of the onset of the Great Moderation (i.e. 1984).

The change in the correlation between labor market indicators and productivity is equally, if not more, striking.³ The left panel of figure 2 shows HP detrended labor productivity and

¹For the most part, we isolate the cyclical components of series using the HP filter. Similar results obtain when looking at growth rates.

²A 40-quarter window is fairly standard in the literature on the Great Moderation. A similar picture emerges if we use a wider or narrower window for the rolling correlation. A narrower window leads to a somewhat more gradual decline because with a 40-quarter window the 1980-81 recession, which exhibits positive correlation of the two series, rolls out of the window at the same time that the 1991 recession, which exhibits negative correlation, rolls into the window. Although the decline is slightly more gradual with the narrower window, the magnitude of the decline is the same.

³Hagedorn and Manovskii (forthcoming) have argued that constructing productivity using the employ-

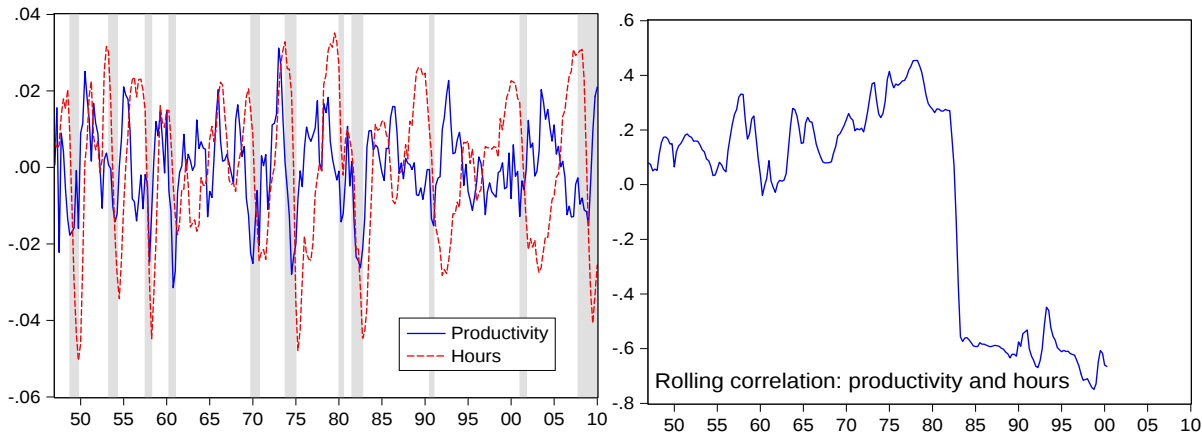


Figure 2: The left panel plots HP filtered total hours and productivity together, with shaded lines denoting recessions. The right panel plots the 40-quarter forward rolling correlation between HP filtered hours and productivity.

	1947-1983	1984-2010
Corr(Output, Productivity)	0.579	-0.127
Corr(Hours, Productivity)	0.211	-0.631
Corr(Employment, Productivity)	0.096	-0.601
Corr(Output, Hours)	0.898	0.862

Table 1: Correlations of productivity with other key aggregates.

total hours in the non-farm business sector. It is visually apparent that the co-movement of these series becomes quite different in the later part of the sample. This is confirmed in the right panel, which shows the analogous rolling 40-quarter forward correlations between the series. The correlation goes from roughly 0.2 pre-1984 to -0.6 post-1984.

Table 1 summarizes these changing correlations between productivity and aggregate variables. We split the sample at the end of 1983 to coincide with the conventional date for the onset of the Great Moderation.

In addition to the contemporaneous correlation between productivity and labor market
 ment level from the CPS, as opposed to total hours from the CES, yields different conclusions about the cyclicity of productivity. In their empirical analysis, however, they fail to exclude government and self-employed workers from the employment measure so as to properly measure the denominator in constructing productivity (they use private sector business output in the numerator). Even though they claim that this adjustment “does not matter,” it clearly does. Properly accounting for workers does yield a correlation between labor input and output that is weakly positive in the later period (as opposed to modestly negative in the CES data) and a weakly negative correlation between labor input and productivity (as opposed to strongly negative in the CES). It is nevertheless true that there is a large break in the correlations in the CPS data. At a more fundamental level, there is little justification for measuring labor input or productivity from the household survey. The CPS is designed to measure labor force participation and unemployment; the CES is designed to gauge actual labor input.

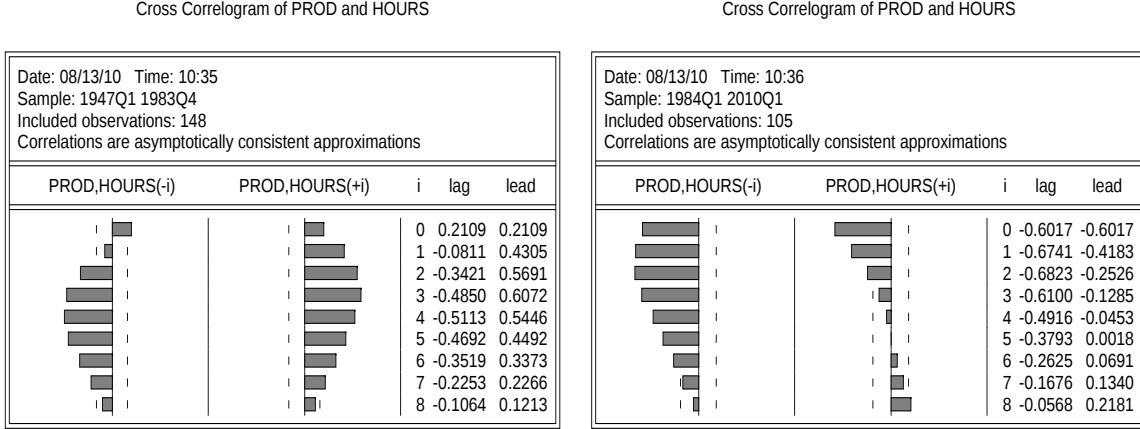


Figure 3: In each panel, the left column shows the correlation between current productivity and lagged hours at different lags. The right column shows the correlation between current productivity and led hours at different leads. The left panel is for the period 1947-1983. The right panel is for 1984-2010.

variables, the dynamic relationships have changed as well. In the earlier period, the onset of a recession was accompanied by a sharp drop in productivity, followed soon after by a sharp decline in hours. In the initial periods following these earlier recessions, productivity and hours typically experienced robust recoveries (with the recovery in hours lagging that of productivity by a quarter or two). In the later period, however, the onset of a recession has been associated with small or non-existent declines in productivity, accompanied by relatively large declines in hours. During the recession and into the recovery, productivity grows robustly, yet hours continue to fall before rebounding slowly.

This marked change can be clearly seen in figure 3, which plots the cross-correlogram between productivity and hours in the two sub-periods. In the pre-1984 period, productivity positively leads hours—high productivity is followed by high hours shortly thereafter. In the post-1984 period, productivity positively leads hours with a delay of nearly two years—peaking productivity is associated with declines in hours that persist for at least a year.

2.2 The Changing Nature of Sectoral Reallocation

The idea that recessions may be associated with elevated levels of reallocation of workers and resources across different sectors of the economy goes back to at least Lilien (1982). Lilien's measure of reallocation is a natural starting point for examining whether the nature of reallocation has changed. Lilien uses the dispersion of employment growth rates across

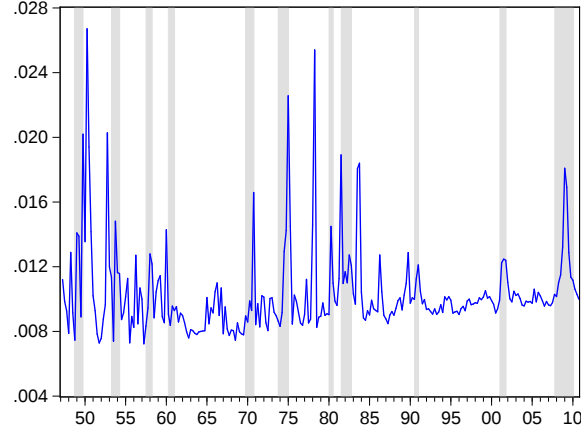


Figure 4: This figure shows the Lilien (1982) measure of reallocation, constructed as described in the text.

sectors as an indicator of the extent of reallocative activity. Specifically, let $g_{i,t} = \ln N_{i,t} - \ln N_{i,t-1}$ be the quarterly growth rate of the level of employment in sector i at time t . Let g_t be defined similarly for aggregate private employment. Further, let $s_{i,t} = \frac{N_{i,t}}{N_t}$ be sector i 's share of aggregate employment at time t and μ_i be the time series average growth rate of sectoral employment relative to aggregate employment growth, $g_{i,t} - g_t$ (e.g., this will be negative for a declining sector like manufacturing). Lilien's measure of reallocation is then the share-weighted standard deviation of net sectoral growth rates:

$$\sigma_t^L = \left[\sum_{i=1}^M s_{i,t} (g_{i,t} - g_t - \mu_i)^2 \right]^{\frac{1}{2}} \quad (1)$$

where M denotes the number of sectors. We take the ten one-digit SIC industries as a benchmark, so $M = 10$. Figure 4 shows this measure using quarterly data.

Lilien argued that if recessions were caused by an increase in reallocative activity then we should expect spikes in this measure of dispersion near recessions. The evidence in figure 4 is consistent with this story, as the dispersion measure is clearly countercyclical. However, subsequent researchers, such as Abraham and Katz (1986), questioned this logic, pointing out that even if recessions were purely the result of aggregate disturbances, with no accompanying reallocation across sectors, the dispersion measure would still spike if some sectors were naturally more cyclically sensitive.

We are not as interested in the question of whether aggregate or reallocative shocks are

the fundamental impulse that drive economic fluctuations. The model outlined below incorporates both aggregate shocks and reallocative sectoral shocks. Even if aggregate shocks are fundamentally what drives economic fluctuations, there is still reason to expect that reallocative activity might increase during downturns when the opportunity cost of undertaking reallocative activity is lower.⁴ Moreover, this reallocative activity can have important implications for the nature of fluctuations.

Thus, what is of interest to us is the question of whether the cyclical properties of reallocation have changed. If we interpret the Lilien dispersion measure as an indicator of reallocative activity, figure 4 suggests that post-1984 recessions have been accompanied by *less* reallocation (the spikes during these later recessions are smaller). We contend, however, that the Lilien measure is a poor indicator of the level of reallocative activity because it does not reflect the *permanence* of changes in sectoral employment. For example, if a sector of the economy contracted sharply in one year and recovered back to its initial employment in the following year, the Lilien measure would be high in each year, even though no lasting reallocation actually took place.

We therefore propose an alternative approach to assessing the extent to which changes in sectoral employment actually represent enduring reallocation of resources across different sectors.⁵ For each post-war recession, we measure the change in each sector's employment share relative to beginning of the downturn, as indicated by the month in which private non-farm business sector employment peaks. We then take absolute values of these changes and sum over sectors. Letting τ denote the number of periods since the employment peak, we calculate:

$$s_{t,\tau} = \sum_{i=1}^{10} |s_{i,\tau} - s_{i,t}| \quad (2)$$

Figure 5 plots this statistic for $\tau = \{12, 24, 36, 48\}$.

The evidence in figure 5 supports the view that recent recessions have exhibited more

⁴See Ramey (1991), Hall (1991), Caballero and Hammour (1996), Aghion and Saint-Paul (1998) for more on the idea that recessions are similar to the yellow caution flag in auto racing, in that they are the optimal time for a "pit stop."

⁵Groshen and Potter (2003) suggest as a measure of reallocative activity the correlation of sectoral employment growth during recessions with sectoral growth in the first year following the recessions. While this measure does offer some indication of whether the reallocation is enduring, it suffers from the fact that it only looks at employment changes in the one year following the end of a recession. In practice, reallocation is likely to take much longer to play out.

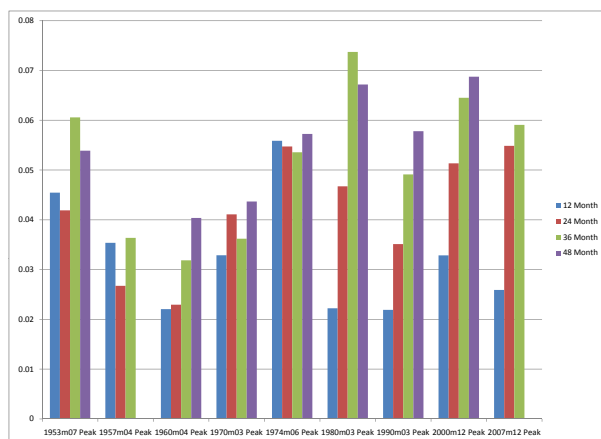


Figure 5: Total change in employment shares at 12 months, 24 months, 36, and 48 months from employment peaks preceding different recessions. The 1957 recession does not have a bar for 48 months because that month 36 marks the onset of the next recession. Likewise, the 2007 recession does not have a bar for 48 months as the data do not yet exist.

gradual and protracted reallocation. In the last three recessions, the changes in employment shares after 12 months represent only a small fraction of the changes that will occur by months 36 or 48. Moreover, the total change in employment shares that occur by months 36 or 48 are significantly larger than during the earlier recessions. In those earlier recessions, a large fraction of the reallocation that is going to take place occurs in the first 12 months. The 1980 recession appears to be an exception to this characterization, as the changing employment shares continue to build for 36 months. However, this must be understood in light of the fact that the 1980 episode actually entails a “double dip” recession. As such, it is not surprising that following the second dip in August 1981 there would be a second surge of reallocation.

In summary, instead of a short burst of reallocative activity, post-1984 recessions exhibit a long, surging wave of reallocation. We conclude from the evidence presented here that the nature of sectoral reallocation changed in a significant way around 1984. In recessions prior to 1984, sharp disruptions to the distribution of employment across sectors were not very long-lasting. In contrast, in recessions since 1984, reallocative activity was gradual and more protracted.

2.3 Frequency Analysis

Figures 1 and 2 show that the pre-1984 period, as compared to the post-1984 period, is marked by more pronounced spikes in employment, output, and productivity. That is, much of the reduction in the volatility of aggregate variables in the post-1984 period has been concentrated at higher frequencies. To demonstrate this more formally, and to examine whether other changes can be associated with fluctuations of either higher or lower frequencies, we use the bandpass filter of Baxter and King (1999) to decompose hours, output, and productivity into components with different periodicities. We take the conventional definition of business cycle frequencies as being between 6 and 32 quarters. We define “high” business cycle frequency movements as those with periodicities between 6 and 19 quarters, and “medium” business cycle frequency movements as those with periodicities between 19 and 32 quarters. Note that the nature of this filter is such that adding these two components together yields the cyclical component with periodicities between 6 and 32 quarters. “Low” frequency movements would be those with periodicity above 32 quarters.

<i>Output</i>	Std. of High Freq. Component	Std. of Medium Freq. Component
1947-1983	0.0129	0.0091
1984-2010	0.0049	0.0056
% Change	-62%	-38%
<i>Hours</i>		
1947-1983	0.0133	0.0095
1984-2010	0.0060	0.0092
% Change	-55%	-3%

Table 2: High and Medium Frequency Volatilities

Table 2 shows the standard deviations of the high- and medium-frequency components of both output and hours, both pre- and post-1984. There has been a very large reduction in the volatility of the high-frequency component of output (62%), and a more modest reduction (38%) at medium frequencies. There is a similar reduction in the volatility of the high-frequency component of hours (55%). Interestingly, there is essentially no change in the volatility of the medium-frequency component of hours. Clearly the reduced volatility

of high-frequency movements accounts for a significant majority of the reduction in macroeconomic volatility post-1984.

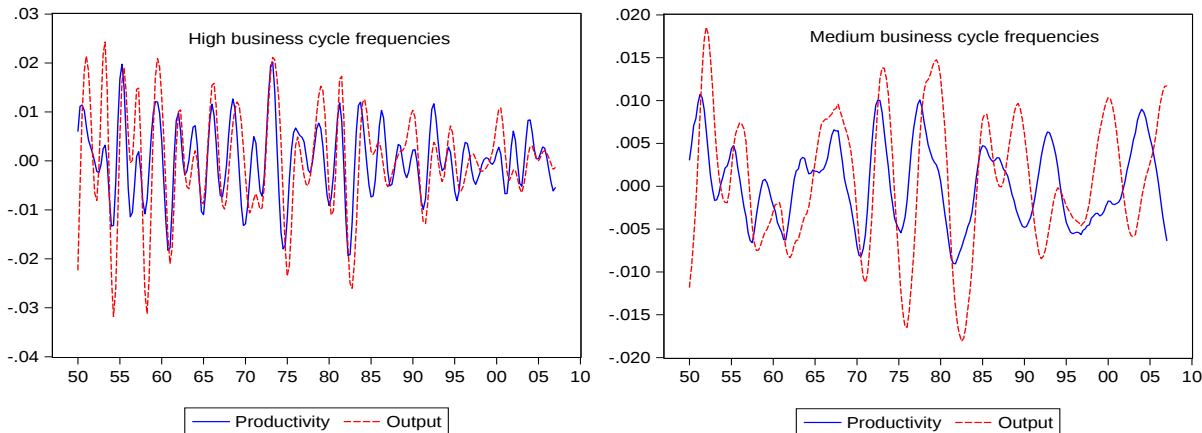


Figure 6: The left panel shows the bandpass filtered series with periodicities between 6 and 19 quarters. The right panel shows periodicities between 19 and 32 quarters.

To assess the role that the different frequencies play in accounting for the changing cyclicity of productivity, figure 6 plots the high- and medium-frequency components of output and productivity together across time. While there is a clear reduction in the volatility of the high-frequency component of both output and productivity in the left panel, there is no discernible change in the co-movement between the series. In contrast, there is a clear break in the correlation between the medium-frequency components of output and productivity in the right panel.

In table 3 we provide quantitative evidence of this changing behavior. Prior to 1984, the correlations between productivity and output were roughly the same at low and high frequencies. Both decline after 1984, but only the correlation of the medium-frequency components of these series declines substantially, switching from 0.58 in the pre-1984 period to -0.24 thereafter. Similar results hold for the relationship between labor market variables and productivity—much of the change in the cyclicity of productivity is driven by the medium-frequency movements.

<i>High Frequency</i>	1947-1983	1984-2010
corr(output, productivity)	0.63	0.37
<i>Medium Frequency</i>		
corr(output, productivity)	0.58	-0.24

Table 3: Medium- and High-frequency Correlations

2.4 Temporary vs. Permanent Unemployment

Data from the BLS Household Survey sheds additional evidence on the nature of reallocation. The BLS asks unemployed respondents to report their reason for unemployment. The responses allow one to identify “temporary” unemployment, which typically counts furloughed workers, and so-called “permanent” unemployment, which measures workers who have lost jobs and do not expect to be re-hired by the same firm. These data are available from the BLS beginning in 1967 and are shown in figure 7 below. The striking feature of figure 7 is the near disappearance of the cyclicalities of temporary layoffs in the post-1984 sample period (Faberman (2008) makes a similar point). In the early part of the sample, both temporary and permanent layoffs spike during recessions. After 1984, there is virtually no spike in temporary layoffs around recessions, while there remain large and persistent increases in the level of permanent layoffs. The increases in permanent layoffs around the time of the 1990-1991 and 2001 recessions are large relative to past recessions given the relative mildness of the output declines.

The near disappearance of temporary layoffs and the increasing importance of permanent layoffs in the post-1984 recessions are consistent with the above evidence regarding the increased, and more persistent, sectoral reallocation. It could also reflect reallocation of workers across firms within sector or the reallocation of workers across geographic regions; the aggregate data make it difficult to discriminate between these possibilities. In future work, we plan to examine the CPS micro data in detail to help evaluate these competing hypotheses.

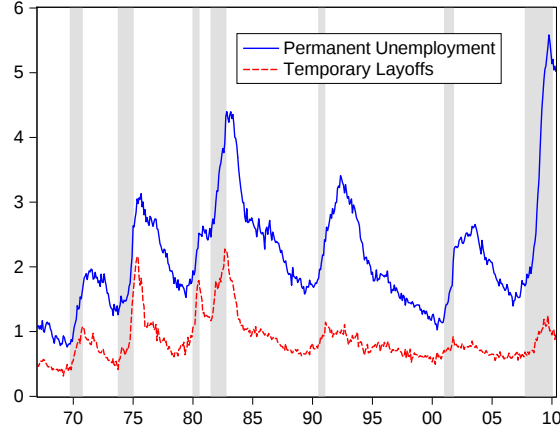


Figure 7: “Temporary” and “Permanent” unemployment. Shaded areas indicate recessions.

2.5 The Changing Nature of Fluctuations Through the Lens of “Business Cycle Accounting”

Chari, Kehoe, and McGrattan (2007) propose a “business cycle accounting” approach to understanding economic fluctuations that can serve as a guide for helping to refine and develop quantitative models. Their procedure is essentially to take the first-order conditions from a stochastic neoclassical growth model with variable labor and to calculate residuals from the first-order conditions in the data. These residuals in the first-order conditions are called “wedges”. The wedges can then be fed back into the model as a driving force to help determine which shocks and frictions are quantitatively the most important. Given that the second moments of the data have changed substantially since the mid-1980s, it is worthwhile to examine how the times series properties of the wedges have changed.

Because the stochastic growth model that forms the basis for the procedure is well known, we eschew a detailed exposition of the underlying prototype model; instead, we just focus on the first-order conditions that emerge as the solution to the decentralized equilibrium. We assume that preferences are logarithmic and separable over consumption and leisure, with the time endowment normalized to unity, and that production takes place with a constant returns to scale Cobb-Douglas technology. We abstract from trend growth. The first-order

conditions are as follows:

$$\frac{\theta}{1 - n_t} = \psi_{l,t} \frac{1}{c_t} (1 - \alpha) \frac{y_t}{n_t} \quad (3)$$

$$\psi_{I,t} \frac{1}{c_t} = \beta E_t \left(\frac{1}{c_{t+1}} \left(\psi_{e,t+1} \alpha \frac{y_{t+1}}{k_{t+1}} + (1 - \delta) \psi_{I,t+1} \right) \right) \quad (4)$$

$$y_t = \psi_{e,t} k_t^\alpha n_t^{1-\alpha} \quad (5)$$

$$y_t = c_t + I_t + \psi_{g,t} \quad (6)$$

Equation (3) is the static first order-condition for labor supply; (4) is the dynamic consumption Euler equation; (5) is the production function; and (6) is an accounting identity. The ψ s are the “wedges”— $\psi_{e,t}$ is the “efficiency wedge” and resembles a standard TFP shock; $\psi_{l,t}$ is the “labor wedge” and resembles a distortionary tax on labor income; $\psi_{g,t}$ is the “spending wedge” and resembles a shock to government spending; and $\psi_{I,t}$ is the “investment wedge” and can be interpreted as a tax on investment.

We pick the following standard parameter values $\alpha = 0.33$, $\delta = 0.025$, $\beta = 0.99$, and $\theta = 2.5$. Given data on output, consumption, and total hours, we can recover an estimate of $\hat{\psi}_{l,t}$ as the residual from (3). Given data on output, hours, and the capital stock, we can recover $\hat{\psi}_{e,t}$ as the Solow residual from (5). We can recover times series for the other two wedges in a similar fashion.

We focus on the efficiency and labor wedges, ψ_e and ψ_l , as these by far the most important sources of variation in the data. Table shows the volatilities and autocorrelations of these two (HP detrended) wedges for the full sample and for the two sub-samples. We observe that there was no change in the unconditional volatility of the labor wedge, nor were there substantial changes in the autocorrelation of either the efficiency or labor wedges. The only large change that can be seen is that the efficiency wedge is about half as volatile in the post-1984 period as in the earlier period.

	Full sample	1947-1983	1984-2010
Labor wedge std. deviation	0.016	0.016	0.016
Labor wedge autocorrelation	0.745	0.714	0.780
Efficiency wedge std. deviation	0.012	0.016	0.008
Efficiency wedge autocorrelation	0.765	0.788	0.718

Table 4: “Wedges” Moments

Figure 8 below plots the HP filtered time series of the wedges.

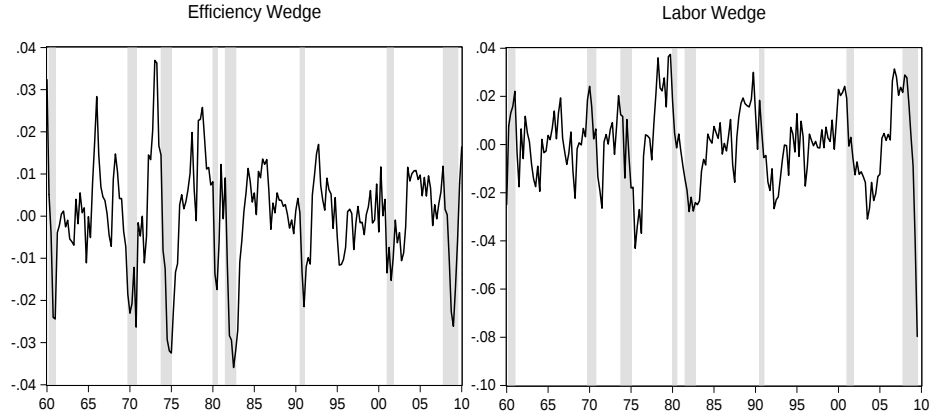


Figure 8: HP Filtered Time Series of the Efficiency and Labor Wedges

Three important things are visibly apparent from the figure. First, both of these wedges are countercyclical. Second, the reduction in the volatility of the efficiency wedge is apparent after 1984. Finally, there is no apparent reduction in the volatility of the labor wedge. Indeed, the largest absolute decline in this wedge occurs in the most recent recession.

We next estimate AR(1) processes on each of the observed time series of wedges, including a deterministic linear time trend in the efficiency wedge specification to allow for trend growth in technology. That is, we estimate (abstracting from constants):

$$\begin{aligned}\hat{\psi}_{e,t} &= at + \rho_e \hat{\psi}_{e,t-1} + \varepsilon_{e,t} \\ \hat{\psi}_{l,t} &= \rho_l \hat{\psi}_{l,t-1} + \varepsilon_{l,t}\end{aligned}$$

The coefficients for the autoregressive parameters and innovation variances are shown in the table below. Standard errors are in parentheses:

	Full sample	1947-1983	1984-2010
ρ_e	0.97 (0.013)	0.97 (0.016)	0.96 (0.025)
σ_e	0.009	0.010	0.0067
ρ_l	0.98 (0.014)	0.90 (0.048)	0.96 (0.025)
σ_l	0.012	0.012	0.011

Table 5: “Wedges” Regressions

We observe from table 5 that the persistence parameter for the efficiency wedge is the same in both sub-samples, but the innovation variance to the efficiency wedge process is about 1/3 smaller. There is some increase in the autoregressive parameter for the labor wedge process, with essentially no change in the innovation variance.

To summarize: shocks to the efficiency wedge have become smaller in the post-1984 period, with virtually no change in parameters governing the processes for the labor wedge. Put differently, the post-1984 period is one in which the labor wedge has become, *in relative terms*, more important than the efficiency wedge. In light of the changing correlational patterns observed in the aggregate data, this conclusion should not be too surprising. In particular, the conditional correlation of productivity and output in response to an efficiency wedge shock in the prototype model is positive, whereas it is negative in response to a labor wedge shock. Thus, a declining relative importance of the efficiency wedge will automatically lead to a lower unconditional correlation between productivity and output. As such, a reduction in the volatility of efficiency wedge shocks can simultaneously explain the reduced volatility of output as well as the changing correlational structure among productivity and other variables.

3 Modeling the Changing Nature of Fluctuations

This section introduces an island model of labor reallocation, in the spirit of Lucas and Prescott (1974), that features both island-specific productivity shocks and aggregate pro-

ductivity shocks. Though somewhat stylized, the model is nevertheless able to account for the changes we documented above.

There are two islands, which represent different sectors of the economy. The output produced on island i is given by $y_{i,t} = A_t z_{i,t} L_{i,t}^\alpha$, where A_t is an aggregate shock that is common to both islands, $z_{i,t}$ is the island-specific productivity shock on island i , and $L_{i,t}$ is employment on the island. A_t and $z_{i,t}$ both follow Markov processes, to be discussed in more detail below. There is a continuum of infinitely lived households of measure 2. The households consume and supply labor. For simplicity, there are no intertemporal assets.

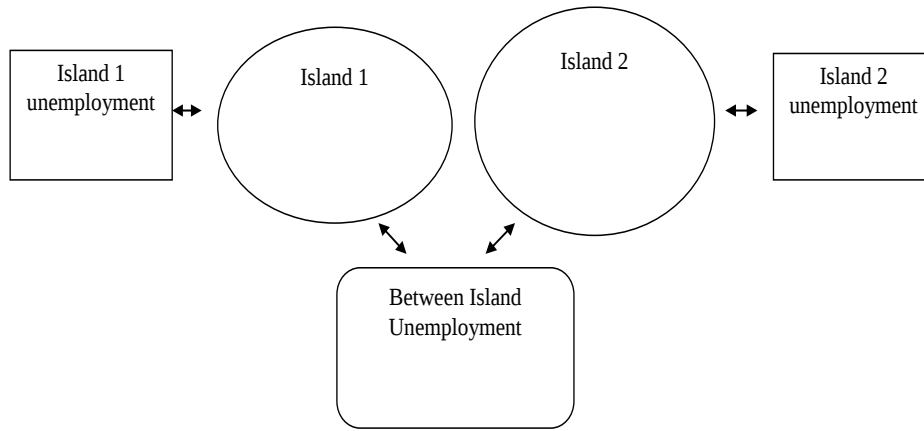


Figure 9: Graphical depiction of the “island” model

The basic structure of the model economy is depicted graphically in Figure 9. There are frictions that impede the reallocation of workers from one island to the other. An example of such a friction is the need for re-training in sector-specific skills. We model these types of frictions and the time-consuming nature of reallocation by assuming that when workers move from one island to the other, they must pass through a period of “reallocation unemployment” while engaged in activities that make them employable in the other sector. Workers stochastically escape this reallocation process at the exogenously given rate λ , and we assume that when they escape they can choose which island to move to (this simplifies the model by eliminating the need to keep track of which island each worker in the reallocation process originally came from).⁶

⁶Workers will move in response to island-specific shocks, and will move from the less productive to the more productive island, but it is possible that the island-specific shocks will reverse again before the worker

To keep the model tractable, and to focus more clearly on labor market dynamics, we assume that there are no means of transferring resources across time. Households discount the future with discount factor $\beta < 1$. Moreover, we assume that there are complete asset markets that allow households to insure perfectly against the idiosyncratic risks that they face (due to shocks to the productivity of the island on which they work, loss of income while reallocating, etc.). Moreover, we assume that there are employment lotteries as in Rogerson (1988). These assumptions allow us to identify the optimal allocation as the outcome of a social planner problem in which the social planner has preferences:

$$u(c_t, l_t) = \frac{c_t^{1-\sigma} - 1}{1-\sigma} - \phi l_t$$

The planner faces the same frictions that households face—reallocating workers from one island to the other is time-consuming. Note that the planner may choose not to employ some workers on an island, while also not reallocating those workers to the other island. That is, holding island-specific productivities constant, if aggregate productivity is temporarily low, then it is optimal to reduce employment on each island (due to the disutility associated with work) without initiating any reallocation.

In this environment, workers at a point in time are in one of three states: (i) working on an island, (ii) on an island but unemployed, with frictionless transitions between working and not working, and (iii) in the state of “reallocation unemployment,” where frictions make the transition from one island to another a time-consuming process.

If we let $N_{i,t}$ be the number (measure) of workers allocated to island i , and $L_{i,t}$ be the

escapes the reallocation process, in which case the worker would like to return to the original island.

number of workers who are employed on island i , then the social planner's problem is:

$$\begin{aligned}
& \max_{L_{1,t}, L_{2,t}, N_{1,t}, N_{2,t}} \sum_{t=0}^{\infty} \beta^t u(c_t, l_t) \\
& \text{s.t.: } c_t = A_t(z_{1,t}L_{1,t}^{\alpha} + z_{2,t}L_{2,t}^{\alpha}) \\
& \quad L_{1,t} \leq N_{1,t} \\
& \quad L_{2,t} \leq N_{2,t} \\
& \quad N'_1 \leq N_1 + \lambda(2 - N_1 - N_2) \\
& \quad N'_2 \leq N_2 + \lambda(2 - N_1 - N_2) \\
& \quad N_{1,t} + N_{2,t} \leq 2
\end{aligned}$$

The first constraint is the resource constraint, the second and third constraints require that employment on an island not exceed the number of workers allocated to that island, and the fourth constraint simply states that the total number (measure) of workers on the two islands must be less than the total number of workers. Note that there will be three different types of unemployed workers: workers located on island 1, but not employed ($U_{1,t} = N_{1,t} - L_{1,t}$), workers located on island 2, but not employed ($U_{2,t} = N_{2,t} - L_{2,t}$), and workers in “reallocation unemployment” ($U_{r,t} = 2 - N_{1,t} - N_{2,t}$).

This planner's problem can be expressed as a straightforward dynamic programming problem. The state variables are the number of workers allocated to the two islands at the beginning of the period, N_1 and N_2 , as well as the values of the aggregate and idiosyncratic shocks. To simplify notation, let $x_t = \{A_t, z_{1,t}, z_{2,t}\}$ denote the vector of shocks. The Bellman

equation can then be expressed as:

$$\begin{aligned}
V(N_1, N_2, x) = & \max_{L_1, L_2, N'_1, N'_2} \frac{(A(z_1 L_1^\alpha + z_2 L_2^\alpha))^{1-\sigma} - 1}{1 - \sigma} \\
& - \phi(L_1 + L_2) + \beta EV(N'_1, N'_2, x') \\
\text{s.t.: } & L_1 \leq N_1 \\
& L_2 \leq N_2 \\
& N'_1 \leq N_1 + \lambda(2 - N_1 - N_2) \\
& N'_2 \leq N_2 + \lambda(2 - N_1 - N_2) \\
& N'_1 + N'_2 \leq N_1 + N_2 + \lambda(2 - N_1 - N_2)
\end{aligned}$$

We solve this problem numerically using standard techniques. Specifically, we create a grid of values for $N_{1,t}$ and $N_{2,t}$ and then iterate on the Bellman equation above until it converges. Evaluating the value function at points between the gridpoints for $N_{1,t}$ and $N_{2,t}$ requires interpolation. We use a simplicial 2-D linear interpolation (see Judd (1998), p. 242).

4 Quantitative Analysis

In this section, we undertake some preliminary quantitative analysis of the model and show that it is capable of replicating many features of actual US data documented above.

We begin by specifying stochastic processes for the exogenous state variables. We simply assume that aggregate productivity takes on two values: $A^H > A^L$. Loosely speaking, one can think of these two states governing the “regime” of the aggregate economy, with A^H interpreted as “normal” times and A^L interpreted as a “recession”.

We assume that island-specific productivities follow a three-state Markov process, with values $\{z^H, z^M, z^L\}$, and that the two islands’ productivities being perfectly negatively correlated. That is, when island 1 has idiosyncratic productivity $z_{1,t} = z^H$, island 2 has idiosyncratic productivity $z_{2,t} = z^L$, and vice-versa. With two aggregate exogenous states and three island-specific ones, there are a total of six configurations, or states, for the vector of

productivities, x :

$$x = \begin{bmatrix} A^H, z^H, z^L \\ A^H, z^M, z^M \\ A^H, z^L, z^H \\ A^L, z^H, z^L \\ A^L, z^M, z^M \\ A^L, z^L, z^H \end{bmatrix}$$

There will be a 6×6 transition matrix, P , that will describe the probabilities of moving between states. In particular, $P_{i,j}$ denotes the probability of transitioning from state i to state j . We impose the following structure on the transition matrix: the idiosyncratic productivities can only change when the economy transitions to the “low” aggregate state. That is, the onset of a recession is a mix of aggregate and reallocative shocks. This assumption is meant to capture the fact that some sectors typically fare better than others during downturns in the actual data, and is necessary to capture the observed cyclicalities of the Lilien (1982) measure of sectoral reallocation. Under these assumptions, the transition matrix takes the following form:

$$P = \begin{bmatrix} p_{1,1} & 0 & 0 & p_{1,4} & p_{1,5} & p_{1,6} \\ 0 & p_{2,2} & 0 & p_{2,4} & p_{2,5} & p_{2,6} \\ 0 & 0 & p_{3,3} & p_{3,4} & p_{3,5} & p_{3,6} \\ p_{4,1} & 0 & 0 & p_{4,4} & 0 & 0 \\ 0 & p_{5,2} & 0 & 0 & p_{5,5} & 0 \\ 0 & 0 & p_{6,2} & 0 & 0 & p_{6,6} \end{bmatrix}$$

The upper right 3×3 matrix denotes the probabilities of leaving the high aggregate state. It is only when entering a recession that the island-specific productivities can change. Hence, only the “upper right block” of the transition matrix is non-diagonal.

With this structure in place for the stochastic processes, we turn to selecting parameter values. Although the model is highly stylized, we parameterize the model in such a way as to match particular features of the US economy. We take the unit of time to be one quarter. As such, we set the household’s subjective discount factor to $\beta = 0.99$. We set the curvature parameter in the Cobb-Douglas production function to $\alpha = 0.67$. The parameter

σ is set to 1, so that the flow utility function from consumption is the natural log. Given the assumed separability between consumption and leisure, this parameterization is necessary to be consistent with balanced growth. The parameter ϕ is set to $\frac{\alpha}{2}$, or 0.33, which ensures that in a non-stochastic version of the model, with A_t , $z_{1,t}$ and $z_{2,t}$ all set to their mean values, employment on each island would be 1 and hence there would be “full” employment in aggregate.

The Markov transition matrix for the exogenous states is specified as follows:

$$P = \begin{bmatrix} 0.95 & 0 & 0 & 0 & 0.025 & 0.025 \\ 0 & 0.95 & 0 & 0.025 & 0 & 0.025 \\ 0 & 0 & 0.95 & 0.025 & 0.025 & 0 \\ 0.2 & 0 & 0 & 0.8 & 0 & 0 \\ 0 & 0.2 & 0 & 0 & 0.8 & 0 \\ 0 & 0 & 0.2 & 0 & 0 & 0.8 \end{bmatrix}$$

This parameterization implies that the economy is in the low aggregate state about 15 percent of the time, while the average duration of “recessions” is about five quarters. Both of these durations are loosely consistent with recessions and expansions in post-war US data. The zeros on the “upper-right” diagonal mean that, whenever the economy enters a recession, there must be a change in island-specific productivities. Conditional on entering a recession, we assume that there are equal probabilities of going to each of the two possible new island-specific productivity configurations.

We parameterize the magnitudes of the z^i $i = L, M, H$ states to match the increase in the observed cross-sectional standard deviation of share-weighted employment growth during recessions (i.e. the Lilien, 1982, measure). If $z^H = z^M = z^L$, then the cross-sectional standard deviation of sectoral employment growth would be zero. Values of $z^H = 1.0367$, $z^M = 1.00$, and $z^L = 0.963$ generate dispersion similar to that seen in the aggregate data.

Finally, given the other parameterizations, we calibrate A^H and A^L (centered around 1) to match the observed volatility of output. We consider two separate calibrations – one for the pre-1984 period and one for the post-1984 period. Our thought experiment is to see how much other changes in business cycle moments can be accounted for by a reduction in volatility driven by a reduction in the volatility of the aggregate shock. We remain agnostic

on what exactly the gap between A^H and A^L represents – in a reduced-form sense, one could interpret a reduction in this gap either as “good luck” (smaller shocks) or “better policy”.

4.1 Some Results

We first consider how a change in the relative magnitudes of the shocks to idiosyncratic productivity and to aggregate productivity affect the key macro aggregates of interest, to determine whether the change in the relative importance of the two shocks can explain the changes in the nature of economic fluctuations that were highlighted above. Specifically, we consider two separate parameterizations of the aggregate state, one of which is meant to capture the pre-1984 period and the other the post-1984 period. For the early period, we impose that the aggregate productivity series takes a value of 1.02 in good times and 0.98 in bad times. As we will show, this parameterization yields output volatility similar to that observed in the US between 1947-1983. In the post-1984 period, aggregate shocks are smaller. In particular, $a^H = 1.007$ and $a^L = 0.993$ generates output volatility similar to that observed in this sub-period.

The table below presents some statistics from a simulation of the model described above. The bottom half of the table presents statistics from actual US data, both pre- and post-1984. We HP filter the logs of the quarterly series with smoothing parameter of 1600. As noted previously, in the early part of the sample output and hours are about as volatile as one another and productivity is strongly correlated with both employment and output. In the later part of the sample, the volatility of output falls relative to that of employment, and productivity switches from positively to negatively correlated with both output and hours. The absence of a decline in the volatility of hours in the post-1984 period is an important feature of the “Great Moderation” phenomenon, which has not been associated with declining volatility in labor markets.

The top half of the table shows analogous statistics from a simulation of the model. For the simulation we generated 30,000 observations from the parameterized model as described above. We then took logs and HP filtered (smoothing parameter 1600) the relevant series.

Qualitatively, the model does a very good job of matching most of these statistics. With large aggregate shocks, the model yields output that is slightly more volatile than employment and correlations between productivity and output that are positive, with the correla-

	Large Agg. Shock	Small Agg. Shock	Change
s.d.(output)	0.019	0.011	-42%
s.d.(output)/s.d.(employment)	1.458	0.941	-35%
corr(output, productivity)	0.781	-0.034	-0.805
corr(employment, productivity)	0.326	-0.340	-0.66
	pre-1984 Data	post-1984 Data	Change
s.d.(output)	0.020	0.011	-45%
s.d.(output)/s.d.(employment)	1.00	0.590	-41%
corr(employment, productivity)	0.579	-0.126	-0.705
corr(employment, productivity)	0.210	-0.601	-0.811

Table 6: Comparison of the simulated model with the data.

tion between output and productivity larger than the correlation between productivity and employment.

With smaller aggregate shocks, the model’s moments move in the same direction (and in similar magnitudes) as observed in the actual data. The changing magnitude of the aggregate shock induces a very similar drop in output volatility to that which is observed in the data. Importantly, the volatility of output falls substantially relative to that of employment, in a manner similar to that observed in the actual data. Further, the correlations of productivity with output and hours both switch to negative, with the productivity/employment correlation more negative than the productivity/output correlation. As the “change” column indicates, the quantitative magnitude of the changes in all of these moments in the model are very similar to the US data.

The parameterized model has other features which closely align with the changes observed in aggregate US data. First, when the magnitude of aggregate shocks becomes smaller, the extent to which employment lags output increases. That is, the correlation between employment and output lagged several periods increases. This features aligns well with the “jobless recovery” phenomenon. Second, smaller aggregate shocks are accompanied by a slight reduction in the volatility of the Lilien (1982) style measure of reallocative activity and a slight increase in the extent to which that measure is negatively correlated with aggregate output. Both of these features are apparent in the data (see figure 4 above). Since in our model with smaller aggregate shocks we know that reallocative activity is relatively more

important, this reinforces our contention, above, that the Lilien (1982) style measure is not a good metric for the importance of reallocation over the business cycle.

The model also has the desirable features that it matches the changing behavior of the measured efficiency and labor wedges. We construct the efficiency wedge as $\hat{\psi}_{e,t} = \ln y_t - \alpha \ln n_t$, where y and n are aggregate output and employment, respectively (the model has no capital). Similarly, we construct the labor wedge as the difference between the household's marginal rate of substitution between consumption and leisure and the (aggregate) marginal product of labor: $\hat{\psi}_{l,t} = \ln \phi + \ln y_t - \ln \alpha - \ln y_t + \ln n_t = \ln \phi - \ln \alpha + \ln n_t$.⁷ In the “large shock” model, the standard deviation of the (HP filtered) measured efficiency wedge is 0.0123; in the “small aggregate shock” simulation, the standard deviation is 0.0044. This is approximately a 60 percent drop in the volatility. Looking at Table 4, we see that this drop is similar to the 50 percent drop in the volatility of the measured efficiency wedge in the actual data. The standard deviation of the measured labor wedge in the “large shock” model is 0.0131; in the small shock model it is 0.0119. The fact that the volatility of the labor wedge hardly declines also fits with evidence in Table 4. In addition, both wedges are strongly negatively correlated with output, which is also consistent with the data (see Figure 8).

We conduct a number of robustness checks using different values for some of the parameters. Figure 10 below shows how some of the simulated moments of the model change when (i) the parameter λ changes and (ii) the amount of dispersion in the aggregate shock varies. The labeling is such that “ ξ ” means that the “high” aggregate state is $A^H = 1 + \xi$ and the “low” aggregate state is $A^L = 1 - \xi$.

⁷In the model, the labor wedge is just equal to aggregate employment (up to a constant). This results because of (i) log preferences over consumption; (ii) separability between consumption and leisure; and (iii) no capital. Given these specifications, the income and substitution effects of an aggregate shock always cancel, and aggregate employment would be constant in the absence of the friction impeding labor reallocation. In ongoing work, we plan to add capital to the model, which will allow employment to fluctuate for reasons other than reallocation.

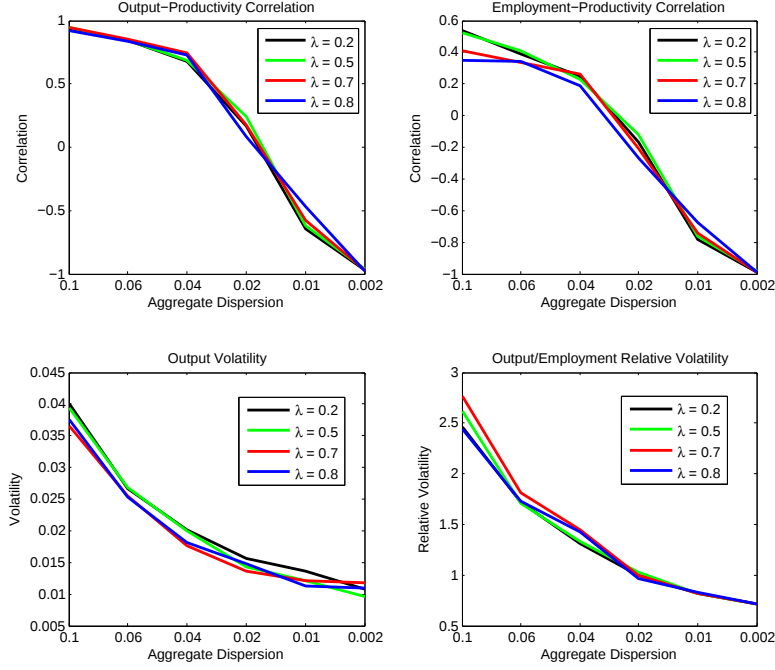


Figure 10: This figure shows various statistics of interest for different parameterizations of the model. The horizontal axis refers to the magnitude of the dispersion in the aggregate shock.

We see that the productivity-output correlation, the productivity-employment correlation, and output volatility relative to employment volatility are all clearly decreasing in the magnitude of aggregate shocks. Moreover, there is almost no difference in the mean and volatility of aggregate unemployment in the samples for different levels of aggregate dispersion holding λ fixed. This also roughly consistent with the aggregate data, since in the data the mean and standard deviation of unemployment do not differ significantly across the two time periods.

Figure 10 also reveals that the parameter λ , which loosely governs the “cost” of reallocating workers across sectors, has only small impacts on these statistics. Different values of λ mainly contribute to different levels of average unemployment in the simulations. The value of λ will mainly influence the pace and nature of reallocation activity.

A realistic addition to the model would be to endogenize the job-finding rate, λ . In particular, it seems plausible that λ would be a decreasing function of total reallocation unemployment—the greater the number of workers in the process of reallocation, the harder it is for them to find a job. This feature would slow down the reallocation process since

it would become optimal to spread out the inflow of workers into reallocation. This would allow the model to better capture the long surging wave of reallocation shown above in figure 6. When aggregate shocks are large and most of the employment decline during recessions is “island-specific”, employment will recovery quickly following a downturn. When aggregate shocks are smaller and more of the employment decline is due to reallocative motives, an endogenous λ would work to slow down the reallocative process in much the same manner we observe in the data. An endogenous λ would also likely lead to an increase in the relative cyclical of reallocation unemployment relative to island-specific unemployment, which is a feature of the data (see figure 7) but not readily apparent in the current version of the model.

The model as currently specified is too stylized to be able to capture some of the other facts documented in the empirical part of the paper. In particular, the absence of productive capital does not allow the model to speak well to the frequency analysis nor the role of jobless recoveries. The intuition for this is reasonably straightforward (see also Footnote 7). Without capital, employment in the model would be constant in the absence of the frictions associated with reallocation. Hence, essentially all of the employment fluctuations in the model are driven by reallocative forces. Thus, when making the aggregate shock smaller, there is very little difference in the behavior of employment, particularly at higher frequencies. In ongoing work we are adding capital to the model and suspect that it will be able to match these features of the data as well.

5 Concluding Thoughts

The business cycle has changed in dramatic ways in the last twenty-five years. This paper has (i) document the various important dimensions along which the business cycle has changed and (ii) developed a model of labor reallocation for understanding those changes.

The facts documented here should be of particular interest to macroeconomists. Macro models are typically calibrated or estimated to fit US data for the entire post-war period. When modeling exercises do attempt to account for the Great Moderation, the objective is usually only to match the reduced volatility of output and/or inflation. Our analysis suggests that models should also be judged on how well they can replicate the changing

co-movements and frequency properties. Leading state-of-the-art macro models of which we are aware do not account for these new facts. For example, in the estimated Smets and Wouters (2007) New Keynesian model of the US economy labor productivity is procyclical and strongly correlated with hours worked.

Our analysis has important implications for economic policy. If recessions are increasingly about reallocation, then this raises the question of how aggressive countercyclical demand management policies should be. Stimulating demand through aggressive monetary easing or fiscal expansion may only serve to postpone the necessary reallocation of resources; it could also have longer term adverse consequences concerning productivity growth and human capital accumulation.

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