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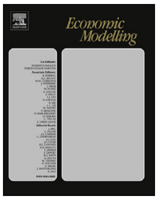

On the sources of the Great Moderation: Role of monetary policy and intermediate inputs

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ABSTRACT

Although the volatility of the U.S. economy has considerably decreased since the mid-80s, known as the Great Moderation, data shows a concomitant rise in the volatility of the hours worked and labor productivity relative to output. Interestingly, the sign of the correlation between employment and labor productivity has also changed from positive to negative. We develop a calibrated business cycles model in the New Keynesian tradition, featuring a Taylor-type monetary policy rule, and an input-output production structure. This approach fully explains changes in the volatility and comovement among output, employment and labor productivity, without the need to invoke the good luck hypothesis. By combining efficient monetary policy with structural change in the economy, we have succeeded in addressing the issue. We find that monetary policy, by itself, is able to account for the bulk of the changes in the data. Over time, however, it will be necessary to increase the share of intermediate inputs in gross output, to insure full match with data.

1. Introduction

A sizeable body of empirical literature suggests that the macroeconomic volatility of the U.S. economy, exemplified by the growth rate of real GDP has decreased considerably since the mid-1980s, a phenomenon, referred to as the Great Moderation. This phenomenon was first documented by Kim and Nelson (1999), Stock and Watson (2003), among others.[1] Curiously, this has been accompanied by an increase in the relative volatility of hours worked and labor productivity with respect to output, along with a change in the sign of the correlation between hours worked and labor productivity from positive to negative. Dunlop (1938), and Tarshis (1939) find the correlation between the two series close to zero, which has since been used as an assessment test for the empirical performance of general equilibrium models. Galí and Gambetti (2009) revisit the Dunlop-Tarshis observation and provide further evidence of a change of the sign of this correlation.

It appears that the literature has thus far failed to adduce a single explanation for the Great Moderation, instead, the three main sources have been advanced to explain the observed phenomenon. First, structural changes such as, changes in consumers' preferences, or firms' behavior; second, good macroeconomic policy; and finally good luck. Even so, the profession has not reached a consensus on the relative importance of the three explanations, far less identifying the dominant one. This fact makes the Great Moderation a topic of further academic inquiry. We take up each of these explanations in turn below.

First, examples of structural changes include increase in the share of services in the economy; advances in inventory management practices; and innovations in financial markets. McConnell and Perez-Quiros (2000), and Summers (2005) provide evidence in favor of improved inventory management systems, while Blanchard and Simon (2001), Stock and Watson (2003), and Enders and Ma (2011) dispute the claim by pointing out that the role of the latter has been minor in the Great Moderation. Regarding financial deregulations, Blanchard and Simon (2001) argue that decreases in residential investment volatility can be explained by removing the Regulation Q (interest rate ceilings on several types of bank deposits), put in 1986.

The second source is a good macroeconomic policy in the form of an improvement in the conduct of monetary policy. The Federal Reserve has adopted notable changes in its policy regime since October 1979. Among them are, dealing more aggressively with changes in inflation in

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[1] See also Ahmed et al. (2004), McConnell and Perez-Quiros (2000), and Sensier and van Dijk (2004).

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the post-1980 period compared to those in the pre-1980 period, which explains much of the decrease in the inflation variability over time.[2] Given the existence of a policy trade-off between output and inflation stabilization, caution is warranted in assigning too much credit to improved monetary policy alone for the reduction in output volatility.[3] A number of studies including Bernanke (2004), Summers (2005), and Enders and Ma (2011), for example, point out that improvements in monetary policy have played an important role in the Great Moderation. However, Stock and Watson (2003) document that the improved monetary policy has played only a minor role in achieving macroeconomic stability.

Third, the decline in the volatility of the shocks hitting the economy is referred to as the good luck hypothesis. Several empirical studies lend credence to this hypothesis. Stock and Watson (2003) and Ahmed et al. (2004) provide evidence that the bulk of the drop in output growth variability is accounted for by a reduction in the volatility of shocks in the post-84 period. Blanchard and Simon (2001) present evidence in support of the claim that the decline in the volatility of shocks as well as the infrequency of recessions during the Great Moderation played a major role in the decline of output volatility. Ireland (2004), and Smets and Wouters (2007) perform sub-samples estimations of DSGE models. They find that the volatility of macroeconomic shocks is smaller during the Great Moderation era.

Yet, the relevance of the last explanation has come under challenge in a number of papers. Summers (2005) questions the good luck explanation, based on results from cross-country evidence. Enders and Ma (2011) challenge the good luck theory. They document that the break in the volatility did not occur simultaneously across all sub-sectors of the economy. Benati and Surico (2009) show that structural VAR techniques might confuse the shift in monetary policy with good luck. Furthermore, they contend that the existing VAR-based evidence is compatible with the monetary policy improvement explanation. According to Bernanke (2004), some of the effects of monetary policy may have been misidentified as exogenous structural changes in the economy or as exogenous shocks. On the other hand, Higgins (2017), shows that, in the context of general equilibrium models, change in monetary policy might be misspecified (discretely vs. slowly over time). Introducing stochastic volatility in the model will lead to support the good luck explanation even though the data has constant volatility shocks. Moreover, the emphasis on smaller shocks under the rubric of good luck does not quite fit the observed realities. One clearly can see that the economy has witnessed several stints with major shocks before and during the time of the Great Moderation. These include, the oil embargo imposed by the OPEC, 1973; the Iranian revolution, 1979; the Latin American debt crisis of the early 1980s; the stock market crash, 1987; and the dot-com crash, 2000. The large shocks during the post-84 period certainly cast serious doubt about the validity of the good luck hypothesis.

In this paper, we pursue this line of inquiry to challenge the good luck explanation. Our argument is as follows. Even if we accept the premise that reduction in the size of shocks leads to reduced volatility of output and employment, as measured by hours worked, it still cannot explain the observed change in the relative volatility of employment and labor productivity with respect to output; as well as in the correlation between employment and labor productivity. Looking for alternative avenues to explain the phenomenon might appear appealing, something we explore in this paper.

One potential candidate for explanation is a change in the degree of returns to scale, and precisely, a change of returns to labor from increasing to decreasing.[4] Galí and Gambetti (2009) suggest that a decrease in the degree of labor hoarding provides a theoretical explanation for the increase in the relative volatility of hours as well as for the decrease in the correlation between hours and labor productivity. A decline in labor hoarding practices may stem from a decrease in labor adjustment costs over time. The lack of conclusive evidence suggests that a decrease in labor hoarding, impairing its pertinence, denies it as a potential candidate within the analytical framework.

The paper contributes to the literature in several ways. The following questions are examined: How can we explain a simultaneous drop in absolute volatility and increase in relative volatility of employment and labor productivity over time? Why does the correlation between hours worked and labor productivity change over time? This study is one of the first attempts to address these issues. We develop a New Keynesian model featuring variable labor effort, and an input-output production structure. We assume that the monetary authority systematically adjusts its nominal interest rate in response to aggregate shocks through a time varying inflation target. We propose a different channel that works by decreasing the returns to labor to account for the change in relative volatility as well as the change in comovement between employment and labor productivity. The channel we identify is the change in the share of intermediate inputs in gross output over time. The model is calibrated using empirically plausible parameter values.

Our main results can be summarized as follows: the calibrated model fits the data very well. It succeeds in producing the decline in output variability over time - consistent with the Great Moderation thesis. It also replicates the increase in relative volatility of hours worked and productivity over time. The model accounts for the shift in the sign of correlation between hours worked and labor productivity. We find that most of the change in the second moments of the key macroeconomic variables are attributable to a more efficient monetary policy rule. Although the role of structural change in the economy may not be significant, nonetheless, it helps to match the size of the empirical second moments. The key element of the structural change in the economy is the increase in the share of intermediate inputs in gross output over time, a well-documented empirical fact.[5]

The remainder of the paper is organized as follows. Section 2 documents the change in the volatilities of output, hours worked, and labor productivity; and also the correlations between these variables beginning from the mid-80s. Section 3 sketches the model and describes the methodology. Section 4 discusses the aspects of calibration. Section 5 analyzes the main results while Section 6 offers concluding remarks.

2. Documenting the Great Moderation

McConnell and Perez-Quiros (2000) provide evidence of a structural breakpoint in the volatility of GDP growth around the first quarter of 1984. Besides the dramatic decline in volatility, Galí and Gambetti (2009) document that a change in the relative volatility of hours worked and productivity with respect of output as well as a change in the comovements among these variables. We use quarterly data from 1948:Q1 to 2011:Q2.

We restrict our sample to the second quarter of 2011 because the Federal Reserve has adopted an unconventional monetary policy in the years following the Great Recession in 2007–2009 while we assume a conventional interest rate policy throughout our analysis. Such unconventional policy mainly consists of quantitative easing, i.e., purchase of long-term Treasury securities, and mortgage-backed securities, in order to reduce long-term interest rates to stimulate aggregate demand. Moreover, Mallick et al. (2017) provide empirical evidence that an increase

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[2] See e.g., Taylor (1999a), Clarida et al. (2000), Romer and Romer (2002), and Estrella and Fuhrer (2003).

[3] Justiniano et al. (2013) find that the trade-off between output and inflation variability is trivial when wage markup shocks are not significant factors in business cycles.

[4] One way to influence returns to labor is to introduce labor hoarding through a variable labor effort, as in Galí and Gambetti (2009), so firms can adjust effective labor without inducing large fluctuations in the extensive margin.

[5] See Hanes (1996, 1999).

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