

A Review of the Literature of Real Business Cycle theory

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Abstract: The following paper reviews five articles concerning Real Business Cycle theory. First, the review compares the various methodologies and assumptions of the five papers in order to understand the theoretical grounds upon which each paper is based. Next, the paper analyzes several of the central features of RBC theory: technological shocks, the Robinson Crusoe model, the neutrality of money, and intertemporal substitution of labor. The analysis of each section suggests that there are a number of problems with some RBC models. Finally, the conclusion suggests research areas to further validate or disprove RBC theory models.

Introduction

Real Business Cycle theory represents an exciting new theoretical paradigm for business cycle research and theory. Real Business Cycle theory attempts to unite a theory of economic growth, representative agent utility maximizing behavior derived from micro-economics, and an explanation of the business cycle. Unlike traditional business cycle theories, Real Business Cycle theory does not explain business cycle fluctuations using factors such as the money supply or aggregate supply and demand. Instead, Real Business Cycle Theory states that the fluctuations of the business cycle are optimal responses to unexpected changes in total factor productivity, such as a technological shock. Because Real Business Cycle theory asserts the neutrality of money and that business cycle fluctuations are optimal responses to changes in productivity, it is very controversial and there are many devastating criticisms that can be made of the Real Business Cycle model. This paper will analyze five articles that discuss Real Business Cycle in order to judge both the internal consistency of the theory and the theory's ability to explain the empirical data of the business cycle. This paper will first focus on the methodology and assumptions of each article, comparing and contrasting methodological elements when there is an overlap between papers. Then this paper will analyze various unique features of the Real Business Cycle theory such as technology shocks, the representative agent framework, the neutrality of money, and intertemporal substitution of labor in order to judge the validity of RBC theory.

Methodology and Assumptions

Many of the papers reviewed by this summary have similar methodologies because each paper discusses the same model. But an analysis of the methodologies and

assumptions reveals the subtle differences between each paper.

The most methodologically simple paper to be reviewed by this summary is “Real Business Cycles: A Legacy of Countercyclical Policies” by Satyajit Chatterjee. This paper uses graphs which compare the actual growth rate of output and investment to RBC model generated data from the Charles I. Plosser paper, “Understanding Real Business Cycles”. Chatterjee uses the graphs from the Plosser paper to prove that Real Business Cycle models can accurately represent business cycle data. Chatterjee’s thesis is that government counter-cyclical policy allows the Real Business Cycle to represent the business cycle by getting rid of the credit channel overreactions to business downturns. To prove this thesis, Chatterjee uses a number of graphs that measure the cyclical changes in the ratio of bank loans to the monetary base, cyclical changes to the monetary supply, and cyclical changes to real GNP. It should be noted that all the original graphs created by Chatterjee are filtered using the Hodrick Prescott filter. A very strong assumption that Chatterjee makes in his paper is that the United States economy operates as if perfect competition existed.

The paper “Understanding Real Business Cycles”, by Charles I. Plosser, is a great example of the methodology used by proponents of Real Business Cycle theory. The model used by Plosser is similar to those used by King, Plosser, and Rebelo in the paper “Production, Growth, and Business Cycles: Part I The Neoclassical model”. The model consists of a utility function for a single representative agent who faces a trade off between consumption and leisure; a Cobb-Douglas production function that determines how much output can be created in a single period; an equation that determines what the stock of capital will be for the next period, which is based on the current amount of

capital; and various parameters that represent tastes and technology. The parameters are based on the King, Plosser, and Rebelo paper. The solutions for the various equations are calculated by using the approximation method, which consists of choosing values for various variables such as consumption, capital, and employment, and using those approximations to transform the nonlinear first order conditions into linear equations which can then be solved with greater ease. Plosser uses this method to compare the RBC model generated data with actual measures of the US economy from 1954 to 1985. A major assumption that the Plosser paper makes is equating the Solow Residual with the exogenous technological growth described by Real Business Cycle theory. Another assumption held by the paper is that Robinson Crusoe representative agent perfectly reflects the behavior of all producers and consumers.

The paper “Production, Growth, and Business Cycles: Part I The Neoclassical Model” by King, Plosser, and Rebelo has a similar methodology to the paper “Understanding Real Business Cycles” by Charles I. Plosser because the Plosser solo paper borrows the methodology of his previous paper. The King, Plosser, and Rebelo paper uses the same model as the solo paper to simulate the business cycle. But there are a number of differences between the two papers. For example, while the solo Plosser paper starts with various first order conditions for solving, the King, Plosser, and Rebelo paper begins with a steady state model that slowly incorporates factors such as work effort and uncertainty due to productivity shocks. The King, Plosser, and Rebelo paper also studies the effects of the intertemporal substitution of labor by adjusting the preference rate for substitution and observing how consumption and savings. The King, Plosser, and Rebelo paper also experiments with various values of capital depreciation in

order to make the parameters of the model more realistic. Once the model is completed, the model generated data is compared to actual business cycle data. The major assumption of this paper is the assumption of the validity of the Robinson Crusoe model.

The next paper, “Real Business Cycles: A New Keynesian Perspective” by N. Gregory Mankiw, is a relatively methodologically simple paper that is critical of Real Business Cycle theory. The only empirical tool used by Mankiw is a graph that compares output growth and the Solow Residual from 1948 to 1985. Mankiw makes a number of assumptions because of the largely theoretical nature of his paper. The fundamental assumptions of the paper are New Keynesian assumptions about the economy, Mankiw’s defense of the role of money to explain business cycles, his assertion that Real Business Cycle views toward government counter-cyclical policies are dangerous, and his belief in sticky prices are all reflections of a pre-existing New Keynesian viewpoint. Another interesting assumption made by Mankiw’s paper is that technological shocks can not be the source of recessions because people would be aware of a technological downturn causing a recession just as people are already aware of how supply shocks can cause a recession.

The final paper whose methodology will be analyzed by this summary is “Real Business Cycles” by George W. Stadler. Stadler uses a simplified version of the RBC model used by King, Plosser, and Rebelo to compare model generated data to actual data that had been detrended using the Hodrick Prescott Filter. In addition to the basic RBC model, Stadler analyzes RBC models that incorporate factors such as workers who are constrained to work a fixed amount of time, non-Walrasian economies, and nominal wage contracts. Because the paper cites so many other papers and studies it is hard to tell

which statements are assumptions and which statements are building upon the works of other economists.

Technology Shocks

One of the central issues of Real Business Cycle theory is the existence and the nature of technology shocks. While according to Real Business Cycle any shift in total factor productivity can cause a positive or negative shock to the economy capable of replicating the business cycle, the focus of RBC papers in explaining the business cycle lies in technology shocks. Mankiw suspects that the focus on technology shocks comes from Real Business Cycle theory's inability to explain business cycles. In the *Journal of Economic Perspectives*, Mankiw writes, "The reason [that technological disbranches are focused on] is that other sorts of disturbances are unlikely to generate fluctuations in real business cycle models that resemble actual economic fluctuations" (Mankiw 1989).

Since the issue of total factor productivity has become an issue primarily concerning technological shocks, the new issues for consideration become: 1) what evidence exists to prove the existence of technological shocks and 2) what kind of technological shocks can replicate business cycle trends. One possible way proponents of Real Business Cycle theory can prove the existence of exogenous technological shocks is to compare the Solow Residual to business cycle data. Plosser noted how his graphing of the Solow Residual resembles noted business cycles, saying "The picture corresponds to most observers' impressions that productivity growth was on average higher in the 1960's than the 1970's" (Plosser 1989). The Solow Residual should theoretically be a valid measure of technological development and productivity, but there are many factors that question the validity of that measure. First, the Solow Residual assumes perfection

competition, which is not a realistic assumption to make in the current economy. Also, as Stadler points out, the Solow Residual does not accurately reflect the amount of labor in the economy because it does not reflect the practice of labor hoarding. Stadler also suggests that aggregate demand factors such as government spending can affect the Solow Residual, suggesting that the residual does not solely measure technology or productivity. Therefore, we have no evidence for the technological shocks described by Real Business Cycle theory.

If we ignore the debate over the existence of technological shocks, we are left with the question of propagation mechanics such as how lasting are the effects of a temporary technology shock and are technology shocks able to replicate business cycle data? In “Understanding Real Business Cycles”, Charles I. Plosser takes a strong position on productivity shocks stating that even purely temporary shocks can have permanent effects on the economy. In contrast, the King, Plosser, and Rebelo paper asserts that a temporary technology shock will not have permanent effects because, “The change in the capital stock induced by the initial period technology shock is ‘worked off’ via a combination of increased consumption and reduced effort.” (King, et al 1988). The King, Plosser, and Rebelo paper suggests that only serially correlated shocks can mimic the behavior of business cycles. Stadler agrees with the assertions made by King, Plosser, and Rebelo concerning the effects of temporary shocks, but Stadler goes further in his critique of the propagation mechanics of Real Business Cycle theory. Stadler states that the only reason RBC models seem to replicate business cycles is because they use the Hodrick Prescott filter, which alters the data to establish a correlation that does not exist in reality.

Representative Agent Framework/Robinson Crusoe Model

Proponents of Real Business Cycle theory state that one of the major advantages of RBC theory is that it contains accurate micro-foundations that reflect how real world economic agents maximize utility. In “Understanding Real Business Cycles”, Charles I. Plosser cites two papers, one by Debreu and one by Lucas and Prescott, to confirm his assumption that the Robinson Crusoe model accurately reflects the behavior of a competitive economy. A strong challenge to the representative agent framework is made by Stadler. Stadler criticizes the Robinson Crusoe model because it is a single sector model and this is an incredibly unrealistic assumption. The representative agent can be changed to reflect the multi-sectored nature of the economy. However, Stadler points out this multi-sector model has problems as well because it is unrealistic to expect technological shocks to occur in every sector. If shocks only occur in certain sectors, then the shocks have to be much larger to average out with the sectors which experience no shocks. In addition, Stadler raises the problem of the heterogeneity of economic agents. For example, the Robinson Crusoe model assumes that the preferences of a single consumer/producer can accurately reflect the heterogeneous preferences of all economic agents within an economy. Stadler asserts that even the smallest amount of heterogeneity introduced into a RBC model, such as unequal incomes, can devastate the model. Finally, Stadler cites two empirical papers that tested the RBC model first order assumptions concerning utility functions and found the restrictions that the conditions impose to be lacking.

The Neutrality of Money

Most papers by proponents of Real Business Cycle theory do not discuss the

money or how monetary effects could affect the economy because Real Business Cycle theory seeks to explain the business cycle without any monetary factors. In “Understanding Real Business Cycles”, Plosser admits he is unsure of how monetary factors could play into the RBC model. But the papers by Satyajit Chatterjee and George W. Stadler offer some interesting possibilities concerning the role of money within the Real Business Cycle framework. Stadler’s discovery that the Solow Residual captures aggregate demand factors suggest Real Business Cycle models have monetary factors implicitly written into the model. Another aspect of the Stadler paper that suggests that monetary factors play a significant role in the economy are the empirical studies Stadler cites that real shocks only cause one third of all output fluctuations. Satyajit Chatterjee’s paper also suggests that the reason Real Business Cycle theory can reflect business cycles so well is that counter-cyclical policies prevent monetary distortions. But the methods Chatterjee uses to prove his thesis are suspect because when he measures monetary factors all his data is filtered with the Hodrick Prescott filter, which makes any trends observed by the data suspect to falsehood. These findings cast doubt on the Real Business Cycle theorists’ claim that they can explain the business cycle completely without the use of monetary factors.

Intertemporal substitution of labor

Under the Real Business Cycle theory, all unemployment is voluntary because as wages drop workers have a greater incentive to substitute labor for leisure. A major problem with this model is that the labor supply is much less elastic than Real Business Cycle theorists assume. N. Gregory Mankiw comments on this fact stating, “Econometric evidence on labor supply typically finds that the willingness of individuals to substitute

leisure over time is slight” (Mankiw 1989). In Stadler’s paper, he tries to introduce a number of measures to make the RBC model reflect the inelasticity of labor, such as fixed work hours and minimum wages, which create involuntary unemployment. But every adjustment Stadler makes to the RBC theory makes the model much less Walrasian, which violates Real Business Cycles theory’s assumption that our current economy exists under market clearing conditions.

Conclusion

This literature review suggests no definitive consensus viewpoint concerning the validity of Real Business Cycle. There seems to be an unresolved conflict between the conclusions of the Real Business Cycle theorists and those made by New Keynesian theorists. The attacks that George W. Stadler made against Real Business Cycle were very impressive and it would be interesting to see how Real Business Cycle theorists responded to his numerous criticisms. The paper by Satyajit Chatterjee may suggest that advocates of Real Business Cycle are more willing to incorporate aspects of traditional business cycle theories into their framework. Possible avenues for further research on this subject include econometric studies concerning technology shocks, studies involving real non-technology related productivity shocks, and studies concerning the relationship between monetary and real shocks.

References organized alphabetically by last name:

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