Business cycle uncertainty and economic welfare ☆

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A R T I C L E   I N F O

A B S T R A C T

We study the welfare implications of uncertainty in business cycle models. In the modern business cycle literature, multiplicative real shocks to production and/or preferences play an important role as the impulses that produce aggregate fluctuations. Introducing shocks in this way has the implication that fluctuating economies may enjoy higher welfare than their steady state counterparts. This occurs because purposeful agents make use of uncertainty in their favor. The result holds for a range of reasonable parameter values and in various models considered in the business cycle literature. One notable implication is that the welfare cost estimates which have been obtained in the literature using only consumption series may be biased and possibly seriously.

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1. Introduction

Robert Lucas (1987) obtained an upper bound estimate of the welfare gain from eliminating consumption risk by replacing postwar U.S. consumption with a consumption series without fluctuations. He assumed a representative agent with a constant relative risk aversion (CRRA) utility function. His estimates of the welfare cost of consumption fluctuations are very small, no more than 0.008 percent of aggregate consumption assuming logarithmic preferences. The fact that these estimates were so small stimulated interest in the issue of whether other features of the economy would significantly increase the estimated magnitude of the cost of aggregate fluctuations. Imrohoroglu (1989) and Krusell and Smith (1999) introduced incomplete markets and uninsurable individual risk and found higher welfare costs. Cho et al. (1997) calculated the welfare cost of business cycle fluctuations in a model with nominal wage contracts. In their model, the welfare loss derives entirely from labor supply risk and the costs are higher than those found by Lucas. Obstfeld (1994) and Dolmas (1998) introduced non-expected utility type preferences and found much larger welfare costs associated with business cycles.

Recently, Alvarez and Jermann (2004) have obtained much larger estimates for the welfare cost of consumption fluctuations, using asset prices: their estimates range between 0.08 percent and 0.49 percent of lifetime consumption. Barro (2006)

introduced disaster risk including war and obtained welfare costs of around 20 percent of GDP. Even with the usual economic fluctuations, he obtained costs of around 1.5 percent of GDP. Barlevy (2004) looked into the effect of uncertainty on growth and its consequences on welfare. Barlevy's estimates are about two orders of magnitude greater than Lucas' estimates.[1]

This paper considers the welfare consequences of the shocks that generate business cycles. We argue that the technology shock in the real business cycle literature is not always detrimental to economic welfare. Since there are no distortions in prototypical real business cycle models like Kydland and Prescott (1982), Long and Plosser (1983), and Hansen (1985), aggregate fluctuations in these models still result in Pareto optimal allocations. It may seem natural to think that these fluctuating economies obtain lower welfare than their steady state counterparts, because the latter does not suffer from any uncertainty while the former does. We argue that this is not always correct. That is, economies with business cycle fluctuations may enjoy higher welfare than their steady state counterparts.

We understand that the last statement sounds counterintuitive. But, if we think of the way productivity shocks enter real business cycle models, the result is quite natural. The key to understanding how welfare could increase with uncertainty is to realize that the shocks to production are multiplicative and productive inputs like labor are variable. If there is a favorable productivity shock, output increases one-for-one, given the inputs. In addition, firms may employ more inputs with an increase in productivity so output can increase further. In other words, an increase in productivity will raise output more than proportionally and thus the reduced form (equilibrium) production function is convex with respect to the shock. Accordingly, introducing uncertainty through multiplicative productivity shocks *raises* average output.

The conventional way of thinking about the welfare costs of business cycles is this. Imagine that consumers are risk averse and offer these consumers two possible consumption streams, one which is constant and the other which has the same mean but fluctuates around the mean. Risk averse consumers would always prefer the smooth consumption stream and would require some additional average consumption to be indifferent between the two. This is the logic of the Lucas experiment and it is uncontroversial. This effect is the **fluctuations effect** of the uncertainty and it is always detrimental to welfare. But, suppose that consumers can take advantage of the uncertainty by working harder and investing more when productivity is high. In that case, the mean values of equilibrium output and consumption change with the uncertainty because agents try to make use of the uncertainty in their favor. We call this the **mean effect** of the business cycle uncertainty. If the mean decreases with uncertainty, economic welfare worsens and the uncertainty unequivocally lowers welfare. However, if the mean increases, and if the mean effect dominates the fluctuations effect, welfare increases with uncertainty. To correctly measure the welfare cost of business cycles, we have to know something about the size of the two effects. That, in turn, depends on how risk averse the agents are and how the uncertainty enters the model economy. Note, however, that the conventional approach is to look only at the fluctuations effect and that alone will always lead one to conclude that business cycle uncertainty reduces economic welfare.

We emphasize that, for uncertainty to increase the economic welfare, it has to be multiplicative to the choices which can be adjusted in response to it. That is, the mean effect is positive in the case of multiplicative shocks and so there is a possibility of welfare increasing with the shocks. In the case of additive shocks, the mean effect is negative in most of the cases of which we are aware and, thus, there is no possibility of welfare increasing with them. Multiplicative shocks include technology shocks, which are used extensively in the literature, preference shocks, seasonal shocks, investment specific shocks, shocks to income tax rates etc. Examples of shocks that are usually additive encompass monetary shocks, government expenditure shocks etc. In sum, economic welfare may increase with uncertainty because purposeful agents can make use of shocks in their favor, which is possible when the shocks are multiplicative to endogenous choices.

We examine the welfare costs of uncertainty in dynamic general equilibrium models where shocks are a source of fluctuations. In each of the cases considered in the paper we contrast two Pareto optimal economies; one subject to uncertainty and hence fluctuating, and the other one at its steady state. We then see which economy obtains higher utility. We show many cases where the economy with uncertainty has higher utility than the counterpart steady state economy. This result is robust to the range of reasonable parameter values typically considered in the literature.

The next section presents two examples, which illustrate the issue. Section 3 presents the welfare analysis in a prototypical real business cycle model and looks for the range of parameter values that yield welfare gains under business cycle uncertainty. We consider closed and open economies to highlight the effects of adjusting capital and labor separately. Section 4 discusses several related issues. Section 5 concludes.

2. Examples

The welfare cost of uncertainty depends on whether economic agents have some means to make use of the uncertainty in their favor. The first example shows that if there are no such means, uncertainty is certainly detrimental to economic welfare as in Lucas (1987). But the second example shows that if the agents have some endogenous choices that allow them to make use of the uncertainty in their favor, an increase of economic welfare with uncertainty is possible.

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[1] This paper has been circulated since 1999. Since then there have been many important contributions in the cost of business cycle literature. In particular, the cost of individual risk together with the cost of aggregate risk have been studied in depth. Contributions include Heathcote et al. (2008, 2009), Storesletten et al. (2001), De Santis (2007), Krebs (2003, 2007) etc. These contributions are discussed in Section 4.