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On the welfare costs of business-cycle fluctuations and economic-growth variation in the 20th century and beyond ☆

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ABSTRACT

The main objective of this paper is to propose a novel setup that allows estimating separately the welfare costs of the uncertainty stemming from business-cycle fluctuations and from economic-growth variation, when the two types of shocks associated with them (respectively, transitory and permanent shocks) hit consumption simultaneously. Separating these welfare costs requires dealing with degenerate bivariate distributions. Levi's Continuity Theorem and the Disintegration Theorem allow us to adequately define the one-dimensional limiting marginal distributions. Under Normality, we show that the parameters of the original marginal distributions are not affected, providing the means for calculating separately the welfare costs of business-cycle fluctuations and of economic-growth variation.

Our empirical results show that, if we consider only transitory shocks, the welfare cost of business cycles is much smaller than previously thought. Indeed, we found it to be negative – −0.03% of per-capita consumption! On the other hand, we found that the welfare cost of economic-growth variation is relatively large. Our estimate for reasonable preference-parameter values shows that it is 0.71% of consumption – US$ 208.98 per person, per year.

1. Introduction

The main objective of this paper is to propose a novel setup that allows estimating separately the welfare costs of the uncertainty stemming from business-cycle fluctuations and from economic-growth variation, when the two types of shocks associated with them (respectively, transitory and permanent shocks) hit consumption simultaneously. Permanent shocks arise naturally in the consumption literature – e.g., Hall (1978) and Flavin (1981) – where it is shown that consumption should follow a martingale. It also arises in the stochastic discount factor literature – e.g., Alvarez and Jermann (2005) and

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Hansen and Scheinkman (2009). Indeed, as stressed by Alvarez and Jermann, "for many cases where the pricing kernel is a function of consumption, innovations to consumption need to have permanent effects." Thus, we model the trend in (log) consumption as a martingale process to accommodate this need. Fluctuations about the trend (the cycle) are modelled as a stationary and ergodic zero-mean process, and can have a variety of sources, e.g., monetary policy; see the discussion on the nature of both shocks in Issler and Vahid (2001).

Separating the welfare effects of permanent and transitory shocks requires dealing with degenerate bivariate distributions. Levi's Continuity Theorem and the Disintegration Theorem allow us to adequately define the one-dimensional limiting marginal distributions. Under Normality, we show that the parameters of the original marginal distributions are not affected, providing the means for calculating separately the welfare costs of business-cycle fluctuations and of economic-growth variation. We measure welfare costs using the *equivalent variation* in consumption, a common practice in this literature. Despite that, in computing equivalent variation, we employ a novel counter-factual exercise, where consumption sequences are devoid of the effects of either permanent or transitory shocks, one at a time. Our solution is consistent with two usual assumptions on the bivariate distribution for transitory and permanent shocks—when their innovations are independent and when they are dependent with a general correlation coefficient.

From the perspective of a representative consumer, who dislikes systematic risk, it makes sense for macroeconomic policy to try to reduce the variability of pervasive shocks affecting consumption. The best known approach to this issue was put forth by Lucas (1987, p. 3) who calculates the amount of extra consumption a rational consumer would require in order to be indifferent between an infinite sequence of consumption under cyclical uncertainty alone (aggregate consumption under deterministic growth) and a consumption sequence with the same deterministic growth and no cyclical variation. In his setup, business-cycle shocks are the only source of randomness for aggregate consumption. Thus, Lucas' measure is known as the *welfare cost of business cycles*. For 1983 figures, using a reasonable parametric utility function (CRRA), and post-WWII data, the extra annual consumption is about US$ 8.50 per person in the U.S., a surprisingly low amount.

Several papers have been written just after Lucas first presented his results. For example, Imrohoroglu (1989) and Atkeson and Phelan (1995) recalculated welfare costs using models with specific types of market incompleteness. Van Wincoop (1994), Pemberton (1996), Dolmas (1998), and Tallarini (2000) have either changed preferences or relaxed expected utility maximization. In some of them, welfare costs of business cycles reached up to 25% of per-capita consumption. Regarding preferences, Otrok (2001) notes that "it is trivial to make the welfare cost of business cycle as large as one wants by simply choosing an appropriate form for preferences." To avoid this critique, we keep preferences as in Lucas, but allow for an additional source of uncertainty—randomness on the growth rate of the economy.

Regarding the original setup, as in Zellner's (1992) version of the KISS principle, Lucas *Keeps It Sophisticatedly Simple*: if only transitory shocks hit consumption, the best a *macroeconomist* can hope to achieve in terms of welfare improvement is to eliminate completely its cyclical variation, which is equivalent to eliminating all systematic risk. Of course, the implicit counter-factual exercise being performed is rather limited in scope. First, no one expects that this trained *macroeconomist* can indeed eliminate all cyclical variation in consumption. Second, it dismisses any sources of uncertainty affecting long-term growth. Regarding the latter, Lucas recognizes that the setup could also include permanent shocks, which has lead Obstfeld (1994) to compute welfare costs in this context; see also Dolmas (1998), Tallarini (2000), Issler et al. (2008) and Reis (2009).

Making the counter-factual exercise more realistic to the representative consumer is the object of study in Alvarez and Jermann (2004) – a very interesting paper in this literature. The consumer is offered a convex combination of observed consumption and its conditional mean, but not a deterministic sequence *a priori*. Because they consider the conditional mean, they can deal with non-stationary consumption. Their setup encompasses the *total* and the *marginal* welfare costs. Total costs are obtained using the method in Lucas, while marginal welfare costs are a first-order approximation of total costs when we consider small changes in welfare costs in the neighborhood of observed consumption.

More recently, the welfare-cost literature in macroeconomics has focused on rare disasters – Barro (2009); on the effects of model uncertainty on the welfare cost of business cycles – Barillas et al. (2009); on how the stochastic properties of aggregate consumption affects welfare cost estimates – Reis; on the distinction between individual and aggregate consumption risk in computing welfare costs – De Santis (2009); and on the difference between welfare costs based on preference-parameter values that fit or not asset-pricing data – Melino (2010).

In our view, despite the existence of a seemingly mature body of work, separating the effects of permanent and transitory shocks in welfare-cost analysis is an important issue still to be addressed in this literature. Simply compare it with the macroeconometrics literature, where separating the effects of these shocks is standard, allowing the implementation of impulse-response-function and variance-decomposition exercises. In welfare analysis, this is important because the nature and sources of these shocks are completely different. Permanent shocks are usually associated with the productivity process in aggregate supply, while transitory shocks are often associated with demand factors such as monetary policy. So far, what some authors have done (e.g., Issler, Franco and Guillén) was to lump all uncertainty together, computing the welfare costs of what we have labelled *macroeconomic uncertainty*. Others have computed inconsistent estimates of the welfare cost of business cycles due to the lack of an appropriate method for separating the effects of permanent and transitory shocks. Indeed, the dichotomy between shocks with short- and long-run effects on economic variables has been key in macroeconomics since the seminal work of Phelps (1967, 1968) and Phelps et al. (1970).

This paper has also two other minor contributions. First, we show how to implement *marginal* welfare cost analysis using the consumption process itself – recall that Alvarez and Jermann implement it based on asset prices. Second, almost all of