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Trend growth and optimal monetary policy ☆

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ABSTRACT

This paper analyzes the optimal behavior of the Central Bank in an economy characterized by balanced growth. We show how trend-growth affects the dynamics of inflation, the preferences of a welfare-maximizing Central Bank and optimal monetary policy. In particular, we show that the optimal monetary policy response to cost-push shocks is not invariant to trend growth, and that countries with lower trend growth have substantially higher incentives to commit to simple rules, both from a welfare and price-stability perspectives.

1. Introduction

Modern dynamic macroeconomic theory, both in the original real business cycle version and in the more recent New Keynesian framework, views business cycles as fluctuations around a constant linear trend, which are produced by short-run, persistent shocks of various nature. The trend is meant to capture the "balanced growth property" of the neoclassical growth model, according to which, when technology is represented by a constant returns production function with labor augmenting technical progress, macroeconomic variables like output, consumption and the stock of physical capital display a similar average rate of growth over sufficiently long periods of time.

Although trend growth is an essential characteristics of dynamic macroeconomics, however, theoretical models usually abstract from it and set it to zero.[1] New Keynesian models, in particular, tend to focus on monetary policy and on the tradeoff between inflation and short-run deviations of output from its potential level, without worrying about the long-run evolution of potential output. Is this an innocuous simplification?

Indeed, the recent debate on monetary policy suggests that the question of how Central Banks should respond to technological progress is an important issue. Until the burst of the "dot.com" bubble and the recent financial crisis, the ability

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[1] The use of trend growth, instead, is becoming increasingly popular in the estimation of quantitative DSGE models, such as Smets and Wouters (2007), Justiniano and Primiceri (2008) and Castelnuovo and Nisticò (2008), among the others. These papers, however, introduce trend growth mainly to allow for a model-consistent de-trending of data, but do not explore the consequences of trend growth for the system dynamics and the policy design.

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of monetary policy to accommodate the impressive growth in productivity that occurred during the period of the New Economy, was praised as a very important achievement of the Greenspan's Fed.[2] Recently Orphanides (2000, 2001, 2002, 2003) has argued that the "great inflation" of the 1970s can be explained by the failure of the Federal Reserve to understand the productivity slowdown that characterized the US economy in those years. According to this hypothesis, that challenged the traditional interpretation provided by Barro and Gordon (1983) the over-expansionary policy undertaken by the Fed was due to the underestimation of the output gap rather than to the unwillingness of the Fed to fight inflation in order to avoid a recession.[3]

In light of these considerations, in this paper we study the relationship among trend growth, inflation dynamics and monetary policy within an otherwise standard New Keynesian model, in which productivity follows a trend-stationary process. Are the implications of the standard Dynamic New Keynesian (DNK) model affected by trend growth? Should the Central Bank explicitly consider the rate of productivity growth in formulating monetary policy? Should a Central Bank behave differently in countries (or time periods) characterized by low productivity growth than they should when the productivity growth is very fast?

We find that once trend growth is allowed for, it affects the slope of the Phillips curve and the preferences of a welfare maximizing Central Bank. Moreover, trend growth is also important for the design of optimal monetary policy: when trend growth is high and cost-push shocks are very persistent, optimal monetary policy requires a lower sterilization of these shocks. Interestingly, this effect becomes most important under commitment. Indeed, trend-growth affects the inflation elasticity to expectations by affecting the effective discount factor, and we show that this effect can be quantitatively sizable. This channel makes the equilibrium under commitment – in which monetary policy is able to affect expectations – more sensitive to trend growth than the one under discretion – in which expectations are, instead, taken as given. Specifically, we show that the lower the rate of productivity growth, the greater the improvement in the tradeoff a Central Bank obtains by committing to a simple policy rule, and therefore the stronger the incentive to commit to such simple rule. Moreover, we find that also the gains from commitment, both in terms of inflation stability and welfare, are a decreasing function of trend growth. In the calibration exercise we perform at the end of the paper we show that these effects may be relevant from a quantitative point of view.

The paper is structured as follows. Section 2 discusses the modeling of trend growth in DSGE models. Section 3 describes the theoretical model and the effects of trend growth on the dynamic system. Section 4, then, derives our main results in terms of implied inflation dynamics and optimal monetary policy, providing also a quantitative assessment. Section 5 finally summarizes and concludes.

2. Modeling trend growth in DSGE models

There are two main ways in which the literature usually introduces secular growth in DSGE models.

One way, as in Nelson and Plosser (1982), is by assuming that technology follows a random walk with a constant drift. If we let $\mathscr{A}_t$ denote the index of labor-augmenting productivity, the system displays secular growth whenever in the steady-state $\mathscr{A}_t$ grows at the constant (gross) rate γ, greater than one. The *random-walk hypothesis*, then, implies a general specification of the kind

$$\begin{aligned} &\mathscr{A}_t \equiv A_t, \\ &\Delta \ln A_t = \delta + \rho_a \Delta \ln A_{t-1} + \varepsilon_t^a. \end{aligned} \tag{1}$$

Under this formulation the productivity $\mathscr{A}_t$ is driven by a difference-stationary process, and the steady-state gross rate of growth is a function of the drift $\delta \geqslant 0$ and the persistence parameter $\rho_a \in [0,1)$,[4] i.e.

$$\gamma \equiv \exp\left\{\frac{\delta}{1-\rho_a}\right\}. \tag{2}$$

Indeed, many papers in the literature analyzing monetary policy in New Keynesian economies (see Galì (2003) and Galì et al. (2003), among the others) have chosen this first specification. However, by normalizing δ to zero, they typically disregard secular growth, while still accounting for the unit root in the data. The vast majority of the papers analyzing monetary policy, instead, use an even greater shortcut by assuming a fully stationary model and considering the implied dynamics as the result of a filtering process (like the HP-filter) that removes both trend growth and unit roots.

The number of papers that, instead, explicitly consider trend growth in DNK model is relatively low. In one of the original contributions to the NK literature, Yun (1996) considers the specification above with $\rho_a = 0$, and shows how the shape of the Phillips Curve if affected by trend growth. Analogously, Sbordone (2002) also considers a pure random-walk specification and therefore derives the Phillips Curve as a function of trend growth. However, while these papers do not disregard trend growth altogether in their setups, they still do not focus on the implications that it has for inflation dynamics and monetary policy making. The only paper that, to our knowledge, studies the effects of a change in trend growth on inflation is Bullard and Eusepi (2005). In a model with capital accumulation and adaptive learning, they show that the "great inflation" might have been caused by a misperceptions of trend productivity growth; monetary policy is implemented by a simple Taylor rule reacting to deviations of output growth from the trend rate.

[2] See for example Woodford (2003).

[3] Ireland (1999) provides some evidence in favor of the Barro-Gordon interpretation of the "great inflation".

[4] For $\rho_a = 0$ we get a pure random walk with drift. See Sbordone (2002) and Yun (1996).