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Inventory growth cycles with debt-financed investment

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Abstract

We propose a continuous-time stock-flow consistent model for inventory dynamics in an economy with firms, banks, and households. On the supply side, firms decide on production based on adaptive expectations for sales demand and a desired level of inventories. On the demand side, investment is determined as a function of utilization and profitability and can be financed by debt, whereas consumption is independently determined as a function of income and wealth. Prices adjust sluggishly to both changes in labour costs and inventory. Disequilibrium between expected sales and demand is absorbed by unplanned changes in inventory. This results in a five-dimensional dynamical system for wage share, employment rate, private debt ratio, expected sales, and capacity utilization. We analyze two limiting cases: the long-run dynamics provides a version of the Keen model with effective demand and varying inventories, whereas the short-run dynamics gives rise to behaviour that we interpret as Kitchin cycles.

Keywords: macroeconomic dynamics, business cycles, inventories, disequilibrium analysis

JEL: C61, E12, E20, E32

1. Introduction

Inventory fluctuations have been known for a long time to be a major component of the business cycle [1]. According to [2], even though investment in inventory accounts for a very small fraction of output (about 1 percent in the U.S.), changes in inventory investment account for a disproportionately large fraction of changes in output over the cycle (about 60 percent on average for seven postwar recessions in the U.S.). Nevertheless, inventory dynamics has received relatively little attention in the theoretical literature. A review of earlier models is provided in [3], where it is observed that, whereas “the prevailing micro theory viewed inventories as a *stabilizing* factor”, the data shows that output is more volatile than final sales (namely output less inventory investment), suggesting a destabilizing role for inventories in macroeconomics. The landscape has not changed significantly since then, with a few recent papers focussed on incorporating inventories in fully micro founded general equilibrium models [18, 19]. As remarked in these papers, explaining inventories in a frictionless general equilibrium model is as challenging as explaining money, forcing this type of analysis to rely on frictions, such as delivery costs and stockout-avoidance motives, akin to the attempts to incorporate a financial sector into DSGE models. In this paper, we follow an alternative approach based on disequilibrium models where sluggish adjustment, adaptive expectations, and sectoral averages replace market clearing, rational expectations, and representative agents [7].

Our starting point is the growth cycles model proposed in [6] along the lines originally formulated in [13]: investment in inventory adjusts to a desired inventory-to-expected-sales ratio, whereas expected sales themselves adapt taking into account fluctuating demand. As shown in [6], the interplay between the long-run growth trend and short-run adjustment of inventory stock and expected sales determine the stability of the model. Whereas sufficiently sluggish adjustments promote stability, the model exhibits dynamic instability if the adjustment speeds exceed certain thresholds. Moreover, a flexible inventory adjustment speed can lead to persistent cyclical behaviour. The model in [6] is described by means of a two-dimensional dynamical system with normalized expected sales and inventory levels (or equivalently, capacity utilization) as state variables and therefore necessarily neglects several other macroeconomic dynamic feedback channels. In particular, the model takes the wage share of the economy as constant, so that endogenous cycles arising from distributional conflict *à la* Goodwin [8] are not considered. Moreover, in the absence of an explicit financial sector, there is no role in the model for the kind of Minskyan instability [14] arising from debt-financed investment.

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