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Production chains and general equilibrium aggregate dynamics ☆

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Abstract

Recent empirical studies reveal that monetary shocks can cause persistent fluctuations in aggregate output. In this paper, we propose a mechanism to help generate such persistence. Our dynamic stochastic general equilibrium model features a vertical input–output structure, with staggered price contracts at each stage of production. Working through the input–output relations and the timing of firms' pricing decisions, the model generates persistent fluctuations in aggregate output and the observed patterns of price dynamics following a monetary shock. Output responses are more persistent, the greater

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the number of stages of production, and the larger the share of intermediate inputs. With a sufficient number of stages, the persistence is arbitrarily large if the share of intermediate inputs is one at all but finitely many stages. © 2001 Elsevier Science B.V. All rights reserved.

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1. Introduction

An order for a new computer often initiates a chain of orders for parts. When the order arrives at a computer vendor's desk, the vendor will start contacting suppliers of microchips, processors, hard-drives, monitors, and operating systems. The monitor maker will then contact suppliers of plastic, glass, and electronic components; and the plastic maker will respond by sending out orders to its own suppliers, and so on. The computer itself, once made, is frequently used as an intermediate input in the production of other goods.

The production of a final good typically goes through multiple stages of processing. A thesis of this paper is that the multi-stage structure of production can be important for explaining the relationship between money and aggregate economic activity. We show that the vertical input–output structure helps generate persistent fluctuations in aggregate output and the observed patterns of price dynamics following a monetary shock.

It is an old idea that, in an industrialized economy the relationship between money, prices, and output is tied to the interdependence of firms at different stages of production. The idea has been presented at least since Means (1935). Here we quote Basu (1995):

> [Means] presented evidence that different industries had very different patterns of price changes versus quantity changes in the Great Depression. Means showed that simple goods, such as agricultural products, declined heavily in price, while their quantity was almost unchanged. Complex manufactured goods, on the other hand, showed the opposite pattern, with small price changes and consequently huge declines in the quantity of sales. Crude manufactured goods fell somewhere in between.

The evidence presented by Means (1935) has led many to conjecture that there are connections between an input–output structure and aggregate fluctuations. For example, Gordon (1990) considers "the input–output table as an essential component in the description of price stickiness". There is a growing literature of multi-sector models which are intended to explain the transmission of business cycle shocks through a horizontal roundabout input–output structure within a single stage of production. This literature includes Long and Plosser

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