Review of Economic Dynamics 17 (2014) 474–483

Contents lists available at ScienceDirect

Review of Economic Dynamics

www.elsevier.com/locate/red

Relative price fluctuations in a two-sector model with imperfect competition ☆

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ARTICLE INFO

Article history:
Received 20 August 2010
Received in revised form 24 October 2013
Available online 31 October 2013

JEL classification:
E32
D43

Keywords:
Relative price of investment
Firm entry and exit
Endogenous markups
Multi-sector modeling

ABSTRACT

Counter-cyclical fluctuations in the price of investment in consumption units are often attributed to investment-specific technology shocks. This paper looks at an additional source for such fluctuations: sector-specific markup variations, the idea being that pro-cyclical competition and the higher variability of investment compared to consumption pushes down the relative price of investment during expansions. I find that such endogenous movements in sector-specific markups can account for up to about one quarter of the observed fluctuations in the price of investment.

1. Introduction

Explaining the counter-cyclical fluctuations in the price of investment in consumption units which are observed in U.S. data has been a preoccupation of macroeconomists at least since a seminal paper by Greenwood et al. (2000) on the subject. That paper, as well as a number of more recent ones, explain this counter-cyclicality with the existence of investment-specific technology shocks, the idea being that a positive shock on productivity in the investment sector pushes up output in that sector while pushing down its relative price. A number of authors have concluded that investment-specific shocks play a quantitatively important role in shaping the business cycle: Greenwood et al. (2000) argue that one-third of output fluctuations are due to such shocks, while Fisher (2006) and Justiniano and Primiceri (2008) find that their contribution is more than half.

The present paper looks at another source of investment-price fluctuations: movements in sector-specific price markups. Research (see Rotemberg and Woodford, 1999 and Bloch and Olive, 2001) indicates that competition among firms increases during booms, which results in a fall in output prices relative to factor prices; in other words, markups are counter-cyclical. Given that investment varies much more than consumption over the business cycle, markups will be bound to respond more strongly in the former sector; it follows that during a boom, the price of investment in terms of consumption goods

☆ I thank the editor, the associate editor, and two anonymous referees for very valuable comments and suggestions. I also thank Andres Erosa, Stephan Fahr, Tim Kehoe, Omar Licandro, Salvador Ortigueira, participants at the XI Workshop on Dynamic Macroeconomics (Vigo), the Villa Mondragone Workshop in Economic Theory and Econometrics, and seminar participants at Paris-Jourdan Sciences Economiques and the European University Institute for helpful discussions. The views expressed in this paper do not necessarily reflect those of the Swiss National Bank.

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1094-2025/$ – see front matter
http://dx.doi.org/10.1016/j.red.2013.10.002

will fall, leading to a counter-cyclical movement in the price of investment. The aim of this paper is then to quantify the contribution of this mechanism to the observed fluctuations in the price of investment.

The monopolistic competition framework proposed by Gali and Zilibotti (1995) is adopted, in which each industry is composed of an endogenous number of establishments paying a fixed operating cost and operating under Cournot competition. A positive productivity shock will then result in the entry of new establishments, leading to an increase in competitive pressure and thus a fall in markups. The imperfect competition setup is similar to Jaimovich and Floetotto (2008), except for the fact that in this model markups are sector-specific.[1]

Depending on the assumed average size of markups, I find that sector-specific markups account for between 4 and 25% of the fluctuations in the price of investment. For an average markup over gross output of 10%, which is towards the middle of the range of estimates found in the literature, the contribution of markups to investment-price fluctuations is 15%.

The remainder of the paper is organized as follows: Section 2 describes the model; Section 3 deals with its calibration; Section 4 looks at the implications of the simulated model; and Section 5 concludes.

2. A two-sector model with endogenous markups

The model is a two-sector version of Jaimovich and Floetotto (2008). The economy consists of a consumption sector and an investment sector; each sector contains a measure one of industries. As in Gali and Zilibotti (1995), within each industry, a homogeneous good is produced by an endogenous number of establishments which pay a fixed operating cost and compete à la Cournot.

The reason for having two layers of production is the following: on the one hand, one would like a framework in which the number of firms has an effect on markups. On the other hand, the decisions of individual firms should have no effect on aggregate output, in order to keep the equilibrium conditions as simple as possible. Those two objectives are contradictory, so the solution is to have a "bottom" layer of sub-sectors, within which a finite number firms operate under Cournot competition and free entry, and an intermediate level of sectors, which consist of a measure one of such sub-sectors. In such a setting, firms producing sub-sectoral goods can influence prices within their own sub-sector (which results in time-varying markups), but cannot influence aggregate output (because there is a continuum of sub-sectors).

There are two sectors, indexed by $x \in [C, I]$, a consumption sector and investment sector. In each sector, there is a measure one of sub-sectors, indexed by $m \in [0, 1]$, and in each sub-sector there is a finite number of establishments, indexed by n. Time is discrete, and time subscripts are omitted when appropriate.

Preferences are represented by

$$U = E_0 \sum_{t=0}^{\infty} \beta^t \big[\log(C_t) + \kappa \log(1 - L_t)\big], \tag{1}$$

where L_t denotes hours worked at time t, and β is the discount factor, with $\beta \in (0, 1)$. The endowment of hours is normalized to one.

2.1. Technology

In each of the two sectors, a representative firm operating under perfect competition produces a homogeneous good using a measure one of sector-specific intermediate goods as inputs:

$$Y_C = A\left(\int_0^1 Y_{Cm}^{\frac{\sigma-1}{\sigma}}\, dm\right)^{\frac{\sigma}{\sigma-1}}, \tag{2}$$

$$Y_I = A\left(\int_0^1 Y_{Im}^{\frac{\sigma-1}{\sigma}}\, dm\right)^{\frac{\sigma}{\sigma-1}}, \tag{3}$$

where σ corresponds to the elasticity of substitution between any two intermediate goods, with $\sigma > 1$. A is an aggregate shock to productivity,

$$A_t = \exp(a_t)(1 + \gamma)^t,$$

with $\gamma \geqslant 0$ its growth rate and a_t an uncorrelated covariance stationary shock, with $0 < \varphi < 1$:

$$a_t = \varphi a_{t-1} + \varepsilon_{a,t}, \quad \varepsilon_{a,t} \sim N\big(0, \sigma_a^2\big). \tag{4}$$

[1] In a more recent working paper, Floetotto et al. (2009) also look at the implications of sector-specific markups.