Journal of Economic Dynamics & Control 51 (2015) 318–340

Contents lists available at ScienceDirect

Journal of Economic Dynamics & Control

journal homepage: www.elsevier.com/locate/jedc

New-Keynesian Phillips curve with Bertrand competition and endogenous entry

Federico Etro [a,1], Lorenza Rossi [b,*]

[a] Department of Economics, University of Venice Ca' Foscari, Sestiere Cannaregio, 30121, Fond.ta S.Giobbe 873, Venice, Italy
[b] Department of Economics and Management, University of Pavia, Via San Felice, 5, I-27100 Pavia, Italy

ARTICLE INFO

Article history:
Received 30 May 2014
Received in revised form
15 October 2014
Accepted 21 October 2014
Available online 12 November 2014

JEL classification:
E3
E4
E5

Keywords:
Bertrand competition
Endogenous entry
New Keynesian Phillips curve
Staggered prices
Inflation
Optimal monetary policy

ABSTRACT

We derive a New Keynesian Phillips curve under Calvo staggered pricing and endogenous market structures with Bertrand competition. Both strategic interactions and endogenous business creation strengthen the nominal rigidities. Price adjusters change their prices less when there are more direct competitors that do not adjust, which reduces the slope of the Phillips curve. Current and future firms entering in the markets decrease current inflation because they reduce markups and the welfare-based price index. Endogenous entry amplifies the impact of both monetary and supply shocks. We also characterize the optimal social planner allocation, that can be replicated with a labor subsidy and a dividend tax (both decreasing in the number of firms) and zero producer price inflation. The optimal Ramsey allocation implies zero inflation tax in steady state.

1. Introduction

We examine the role of strategic interactions between a small and endogenous number of firms in the New Keynesian model with sticky prices *à la* Calvo (1983).[2] Firms produce differentiated goods and compete *à la* Bertrand in each market rather than ignoring strategic interactions as under monopolistic competition.[3] Moreover, following the recent literature on dynamic entry (Ghironi and Melitz, 2005; Bilbiie et al., 2008, 2012, 2014; Etro and Colciago, 2010; Faia, 2012) we endogenize the number of firms active in each market. We find that both strategic interactions and endogenous business creation

* Corresponding author.
E-mail addresses: federico.etro@unive.it (F. Etro), lorenza.rossi@unipv.it (L. Rossi).
[1] Tel.: +39 0412349172.

[2] The standard version of the model with a continuum of firms and monopolistic competition was developed in Yun (1996), King and Wolman (1996) and Woodford (2003). Recent extensions concern nominal wage rigidities (see Galì, 2008), firm-specific capital (Altig et al., 2011), open economies (Galì, 2008; Lagoa, forthcoming) and more.

[3] A large body of empirical evidence in industrial organization (Campbell and Hopenhayn, 2005), trade (Feenstra and Weinstein, 2010) and macroeconomics (see the discussion in Rotemberg and Woodford, 1999 and Faia, 2012) suggests that common markets are characterized by relevant competition effects due to imperfect competition.

http://dx.doi.org/10.1016/j.jedc.2014.10.009
0165-1889/

modify the standard New Keynesian Phillips curve (NKPC) and the reaction of the economy to shocks in a way that is more in line with the empirical evidence.

Thanks to the strategic complementarities between price-setting firms, the modified NKPC is characterized by a smaller elasticity of inflation with respect to changes in the marginal costs[4] compared to the standard New Keynesian model: under Bertrand competition price adjusters change their prices less when there are more firms that do not adjust. Accordingly, the slope of the NKPC decreases in the level of concentration of the markets and in the inter-sectoral elasticity of substitution between goods. Thanks to this lower slope, our model contributes to reconcile the micro-evidence of frequent price adjustments (Bils and Klenow, 2004; Nakamura and Steinsson, 2008) with the macroeconomic data indicating that inflation is rather inertial (see Altig et al., 2011). By endogenizing the evolution of the number of firms active we introduce an additional source of inflation inertia. We show that the impact of aggregate shocks is much stronger when taking into account endogenous business creation and that high substitutability between goods and high inter-sectoral concentration are essential for strategic interactions to amplify monetary shocks. On one side, the process of endogenous entry magnifies the effect of technology shocks by attracting more entry and strengthening competition, which in turn promotes consumption and labor supply and induces a hump-shaped pattern of inflation. On the other side, in front of an expansionary monetary shock both the real rigidities due to strategic interactions and the gradual creation of new differentiated varieties contribute to stabilize inflation so as to magnify the real effects beyond what happens in the baseline New Keynesian model.

In this framework we also characterize the optimal monetary policy under different conditions. First, we characterize the unconstrained social planner problem and determine the required inflation and subsidies/taxes (financed with lump sum taxation) necessary to replicate such an efficient allocation: the first best allocation can be obtained through (1) a countercyclical labor subsidy that neutralizes the distortions associated with strategic interactions, (2) a countercyclical dividend tax that optimizes the process of business creation and (3) a countercyclical consumer price inflation which implies zero producer price inflation eliminating the distortion associated with price dispersion (the last results matches the one obtained under monopolistic competition and Rotemberg pricing by Bilbiie et al., 2008). Given the complexity of this optimal policy, we move to consider the Ramsey problem where the monetary authority can control only one instrument, the inflation rate, and none of the fiscal instruments above is available. Following the methodology proposed by Schmitt-Grohé and Uribe (2011) we focus on the steady state of such a constrained optimal allocation and confirm that zero producer price inflation remains optimal in the long run (as in Faia, 2012, under Rotemberg pricing).[5]

Other works, at least since Ball and Romer (1990), have already stressed the role of strategic complementarities between firms' prices as a source of real rigidities (see Nakamura and Steinsson, 2013, for a survey), but we are not aware of any formalization of Bertrand competition with price staggering as the natural source of strategic complementarities. A first approach to microfound real rigidities, due to Basu (1995), relies on the fact that each firm employs all the other goods as intermediate inputs. A second one, adopted by Woodford (2003) and Altig et al. (2011), relies on firm-specific inputs. In both cases marginal costs depend on firms' own relative prices, so as to generate optimal prices increasing in the price index. A third approach, advanced by Kimball (1995), relies on a demand elasticity that is increasing in the relative price, generating again strategic complementarity between prices. Recent applications of this approach by Dotsey and King (2005), Levin et al. (2007) and Sbordone (2007) have been based on a generalization of the Dixit–Stiglitz aggregator to obtain elasticities increasing in prices and in the number of goods, but ignoring strategic interactions between price-setters.[6]

The recent research on dynamic entry has been mostly focused on standard monopolistic competition (Bilbiie et al., 2008, 2012, 2014). Strategic interactions and Bertrand competition have been explicitly introduced in a flexible price model by Etro and Colciago (2010), and the first applications in the NK framework have been developed by Faia (2012) to analyze the choice of the optimal state contingent inflation tax rates and Lewis and Poilly (2012) for estimation purposes.[7] However, all these models neglect price staggering and adopt a price adjustment cost *à la* Rotemberg (1982), which implies that all firms (rather than a fraction of them) adjust prices simultaneously and identically in each period without price dispersion.[8] Introducing time-dependent staggered pricing *à la* Calvo we obtain a different form of real rigidity associated with the substitutability between goods: if few firms in a market do not change prices after a cost shock, the price adjustment of the others are smaller the more substitutable are the goods. Contrary to this, Rotemberg pricing delivers higher adjustments when substitutability increases, in the same way under monopolistic and Bertrand competition.[9]

The paper is organized as follows. Section 2 presents the DSGE model with Bertrand Competition and endogenous business creation deriving the modified NKPC and the main results on the dynamics of the model. Section 3 discusses optimal monetary policy issues. Section 4 concludes.

[4] Notice that this elasticity is proportional to the elasticity with respect to the output gap in this class of models.

[5] See also Bilbiie et al. (2014) on monopolistic competition with different homothetic preferences.

[6] Bergin and Feenstra (2000) have replaced CES preferences with translog preferences, that are homothetic and deliver an elasticity of demand increasing in a (finite) number of goods. Nevertheless, they focus on different issues and, again, neglect the role of strategic interactions.

[7] See also Cecioni (2010) for an empirical assessment of the Bertrand model and Benigno and Faia (2010) on open economy issues. Colciago and Rossi (2011) have introduced labor market rigidities, while Colciago and Etro (2010) is about Cournot competition.

[8] See also Auray et al. (2012). Cavallari (2013) has adopted Calvo pricing but focusing on monopolistic competition and ignoring strategic interactions.

[9] Notice that the empirical analysis of Lewis and Poilly (2012) has found a small competition effect in their model with Rotemberg pricing, but this is not surprising since, besides various differences between setups, they have focused on a relatively high number of firms and low inter-sectoral substitutability.