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On imperfect competition with occasionally binding cash-in-advance constraints

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ABSTRACT

We provide a theoretical demonstration of the link between imperfect competition and the cash-in-advance constraint, not previously considered in the literature. In a general equilibrium framework, we show that imperfect competition affects the proportion of times that the cash-in-advance constraint binds. As the market becomes more competitive it is certainly no less likely that the cash-in-advance constraint will bind. Therefore, economic welfare changes not only because of the direct effect of the change in the distribution of aggregate consumption but also because of the indirect effect of the cash-in-advance constraint. Other implications are also demonstrated.

1. Introduction

In this paper, we depart from the assumption of perfect competition in the final output sector, commonly used in cash-in-advance (CIA) models, and show that imperfect competition affects the proportion of times that the cash-in-advance constraint binds.[1] It follows that the degree of imperfect competition has both direct and indirect implications on aggregate welfare. While the distribution of consumption between profits and wages is affected directly, the level of output and work effort are affected indirectly via the CIA constraint. We demonstrate that for a given level of technology, as the market becomes more competitive not only the share of workers in aggregate consumption increases, it is also certainly no less likely that the CIA constraint will bind. As a result, the degree of imperfect competition indirectly affects aggregate welfare given that an equilibrium that occurs at a binding CIA constraint is always welfare inferior to an equilibrium that occurs at a non-binding CIA constraint for any given level of technology. These results are obtained in a general equilibrium framework with endogenous production, fully flexible prices and general assumptions about the velocity of money.

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[1] Cash-in-advance models continue to be widely used in monetary economics, e.g. Evans et al. (2007), Devereux and Siu (2007), Díaz-Giménez et al. (2008), Hromcová (2008), Alvarez et al. (2009), Giraud and Tsomocos (2010), Adão et al. (2011), Telyukova and Visschers (2011) and Burkhard and Maußner (2015). Some of these papers mainly focus on the case of a binding CIA constraint and constant velocity of money.

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As is well known, the cash-in-advance (CIA) constraint creates a transactions demand for money even though money provides no direct utility.[2] In most papers, the CIA constraint on consumption is assumed to be always binding.[3] This assumption is justified if the empirical correlations between consumption and money are relatively high.[4] The empirical evidence however suggests that these correlations are relatively low (e.g. 0.3 for Italy – Ragot, 2014).[5] In this paper, we develop a general *theoretical*framework where the periods where the CIA constraint binds and the periods where it does not are determined *endogenously*. In the existing literature, there are only a few papers which allow for endogenously occassionally binding CIA constraints, and these are all numerical simulations (e.g. Devereux and Siu, 2007). Whether the CIA constraint binds in a particular period depends on expectations of risk-averse consumers about the future relative value of money as well as the degree of imperfect competition. We allow for a very general set of possibilities about how the velocity of money is determined, and show that velocity always has a specific upper bound which depends on the markup of the marginal product of labor over the real wage. Money can have real effects without requiring the presence of other physical assets or restrictions on how assets are used for transactions.[6] Although nominal wages and prices are fully flexible, there are cases where prices exhibit a sluggish response to a change in money supply.

In section II we illustrate the scope of the model by looking at the case of perfect foresight: although it removes the precautionary/buffer-stock demand for money, there is still a potential role for money over and above the *current* transactions demand. We are able to provide conditions relating to whether the current CIA constraint binds or not in terms of the current growth in the money supply or inflation and productivity growth. Among others, we show that in a zero-inflation steady state, the CIA constraint always binds. Since utility is higher in the steady-state with the nonbinding CIA constraint, it follows that the optimum inflation rate here is negative which has obvious similarities to the Friedman (1969) argument for a negative inflation rate made in the context of a money in the utility function approach.

We argue that a monetary authority would not necessarily avoid expanding the money supply because there are cases where it might be welfare improving. The monetary authority decides the transfer of money prior to the realization of technology and velocity shocks, and thus, the transfer may be optimal ex-ante but not optimal ex post. To keep our analysis simple and tractable since the focus is the effect of monopolistic competition, we abstract from the presence of physical assets such as capital. Focusing on an economy with primitive financial structure also enables us to demonstrate the direct effects of money, rather than those arising from portfolio choice.[7] In section III, we provide a discussion about how the introduction of real assets such as capital and bonds might influence the results.

Here we establish analytically the argument of Cooley and Hansen (1989), that "... the most important influence of money on short-run fluctuations are likely to stem from the influence of the money supply process on expectations of relative prices". When the CIA constraint is nonbinding, the economy is at its efficient output with the *Classical* feature that money is neutral. This happens when the expected value of money equals its current value, so that consumers are indifferent between spending a unit of money today and holding it for one period. However, when particular state vectors occur, the CIA constraint binds because the agents expect that the relative value of money will decrease. As a result, they rush to spend all their money holdings the current period which leads to an increase in the velocity of money to the extent that it hits its upper bound. In this case, there is a unique equilibrium where money induces real effects. The transmission mechanism for money to have real effects is the presence of the CIA constraint, through which the level of the price has a direct effect on consumer demand. This can be viewed as a type of *Keynesian effective demand* mechanism. Furthermore, we show that (for given technology) the level of output, hours worked and consumption is less when the CIA binds. This inefficiently low level of output occurs because the binding CIA constraint distorts the intra-temporal work-leisure decision and discourages work.

Alvarez et al. (2009), consider a CIA economy where production is exogenous and output is modelled as a stochastic endowment process. Their assumption that households are restricted from using funds from interest-bearing accounts for consumption purposes in every period prevents the CIA constraint from binding at all times thus allowing the velocity of money to vary. A direct implication of this is that prices respond sluggishly to changes in money supply because aggregate velocity decreases after an injection of money. They motivate this feature by presenting correlations between velocity and measures of money that exhibit a negative relationship. Chiu (2007), on the other hand, provides evidence that cross-country correlations between money and velocity for the OECD countries are all significantly positive. We argue that by merely

[2] This was the rationale behind the first general formulation of the CIA constraint in Grandmont and Younes (1972).

[3] Among others, see Cooley and Hansen (1989), Evans et al. (2007), Chen and Li (2008) and Díaz-Giméneza et al. (2008).

[4] Burkhard and Maußner (2015) assume that only a fraction of nominal consumption is subject to the CIA constraint. Their calibration suggests that this fraction is 82%.

[5] Binding financial constraints for R&D investment may indicate weak empirical support to binding CIA constraints on consumption. It is reasonable to expect that if the latter were binding then it is likely that the former would have been binding as well. The empirical literature provides inconclusive evidence of the link between R&D investment and financial constraints (see Hall and Lerner, 2010 for a summary). A recent paper by Brown et al. (2013), find little evidence of binding financial constraints on R&D.

[6] Chamley and Polemarchakis (1984) note that a standard argument for money non-neutrality in general equilibrium lies on the existence of other real assets. Changes in the money supply affect the price level which in turn affects the return of money as an asset relative to the other physical assets. As a result, individuals realign their portfolios and the equilibrium holdings of physical assets change. Within this framework general equilibrium models require heterogeneous beliefs or other frictions.

[7] The assumption that money is the only asset in the economy is not an unusual one in the literature: e.g. Lagos and Wright (2003) and Lagos and Rocheteau (2005).