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Firm dynamics, markup variations, and the business cycle ☆

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ABSTRACT

We present a model in which net business formation is endogenously procyclical. Variations in the number of operating firms lead to countercyclical variations in markups that give rise to endogenous procyclical movements in measured total factor productivity (TFP). Based on this result, the paper suggests a simple structural decomposition of variations in TFP into those originating from exogenous shocks and those originating endogenously from the interaction between firms' entry and exit decisions and the degree of competition. The decomposition suggests that around 40% of the movements in measured TFP can be attributed to this interaction. Moreover, the paper analyzes the effects on (i) the measurement of the volatility of exogenous shocks in the U.S. economy and (ii) the magnification of shocks over the business cycle.

1. Introduction

The interaction between firms' entry and exit decisions and variation in the degree of competition can lead to endogenous procyclical movements in measured total factor productivity (TFP). Three basic stylized facts motivate this paper: (i) the existence of monopoly power in the U.S. economy, (ii) procyclical variations in the number of competitors and (iii) markups being countercyclical and negatively correlated with the number of competitors.

To account for these empirical observations, the paper formulates a dynamic general equilibrium model, where variations in the level of technology give rise to changes in the number of operating firms. These in turn lead to endogenous countercyclical markup variations. To model the interaction between firms' entry/exit decisions and markup variations, it is assumed that the economy contains a large number of sectors. Each sector is comprised of a finite number of differentiated, monopolistically competitive intermediate firms. Within a given sector, each firm takes into account the effect that the pricing and production decisions of other firms have on the demand for its goods. The price elasticity of demand faced by the typical firm is thus positively related to the number of firms in the sector. As a result, markups are set at a lower level in response to an increase in the number of competitors. The number of firms in a sector is determined by the equilibrium

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condition that all firms earn zero profits in every period. This condition is enforced by firms' decisions to either enter or exit an industry.[1]

The setup of this model is used to show two quantitative results. First, one can derive a simple structural method for decomposing variations in TFP into those originating endogenously from the interaction of entry and exit decisions and markup variations and those originating from exogenous shocks. Based on this decomposition, the paper finds that around 40% of the movements in measured TFP can be attributed to the impact of firm entry and exit decisions on optimal markups. Second, the paper shows that the interaction between variation in the number of competitors and variation in the degree of competition provides a powerful internal magnification mechanism for shocks to agents' environments. Specifically, the strength of these magnification effects is evident in the estimated volatility of technology shocks and in statistics that summarize the quantitative properties of the magnification mechanism.

Before presenting the results in more detail, it is worth emphasizing that the model represents a minimal perturbation of the prototype perfect competition real business cycle (RBC) model. This greatly simplifiescomparison with existing work and allows for a simple structural decomposition of TFP. However, this simplicity comes at the cost of descriptive realism, and several empirical caveats should be highlighted.[2] First, the model here is symmetric implying the same number of firms in all sectors. One might be worried that the procyclicality in the number of firms in the data is really driven by only a few industries. To address this issue, we assemble a data set that documents the number of failing firms in the U.S. economy in 46 industries over more than 40 years. All of these industries are characterized by countercyclical exit rates, which indicates that the aggregate result is not driven by just a few industries. Second, firms enter the model economy at the same size as existing firms. It is well known, however, that smaller firms constitute the majority of entrants and exits. This may imply that variations in their number are potentially less important and that entry rates should be weighted by the size of entrants. However, it is noteworthy that variations in the number of firms are only one of the channels that generate actual changes in the number of competitors, which is the key driving force in the model. For example, a new establishment or franchise by an existing firm increases the number of competitors without affecting the number of active firms. It turns out that the number of establishments and franchises are both strongly procyclical. Moreover, using the business employment dynamics (BED) data set one can show that a third of the cyclical volatility in job gains (losses) is explained by opening (closing) establishments. Additional evidence can be found in recent work by Broda and Weinstein (2007) who emphasize that most product turnover occurs within the boundaries of the firm. They find that net product creation is strongly procyclical. Hence, if one adopts a loose interpretation of entry and includes new establishments and franchises, as well as the introduction of new products by existing firms, this work provides evidence for a sizable variation in the number of competitors at the business cycle frequency.

The following paragraphs will discuss the main quantitative results of the model starting with the measurement of TFP. Any shock that induces net business formation leads to a fall in markups and a rise in measured TFP. Depending on the exact specification of the model, a positive 1% technology shock induces a rise in TFP between 1.45% and 1.80%. Based on a variance–covariance decomposition, it is estimated that in post-war U.S. data, around 40% of the variation in measured TFP is due to the endogenous mechanism embedded in the firms' entry/exit decisions. In contrast, if the number of firms does not vary, and/or if the markup is held constant, measured TFP moves one-to-one with the level of technology and all of the variation in measured TFP is due to exogenous technology shocks. These results are related to the seminal contributions of Hall (1986, 1988, 1990) who finds evidence that variations in measured TFP co-vary with exogenous instruments. He interprets these results as evidence in support of the existence of market power and increasing returns. The theoretical framework of this paper captures this effect. Here, the cyclicality of TFP is a result of variations in the number of operating firms and their effect on optimal markup pricing. Two key elements of the theoretical model that drive this effect are, indeed, imperfect competition and the presence of a fixed cost, which gives rise to increasing returns to scale at the firm level.[3] However, the model suggests that the mere presence of monopoly power and a fixed cost does not impart a bias in the measurement of TFP. Instead, those are only necessary conditions for the mismeasurement in TFP, but alone they are not sufficient. The third necessary condition is that monopoly power is time variant.

Consider now the magnification of fundamental shocks. As is well known, the standard RBC model does not embody a quantitatively important magnification mechanism.[4] In order to account for the observed fluctuations in aggregate economic activity, the RBC model must rely on exogenous aggregate technology shocks that are highly variable.[5] This paper suggests that the interaction between variation in the number of operating firms and variation in the degree of competition

[1] The entry decision in the baseline model is static. An extensive appendix studies the richer dynamic problem with sunk entry costs following Bilbiie et al. (2007). The results in the dynamic model are somewhat mitigated, but the key magnification mechanism remains quantitatively significant. The appendix can be found at www.stanford.edu/~njaimo/papers/entryexit_jme_appendix and as supplementary material to the article on Science Direct.

[2] See Section 2 for a more detailed discussion of these issues and a description of the data we use.

[3] In the theoretical model a key element is the zero-profits equilibrium. Again, this formulation is consistent with Hall (1990), who writes: "A second explanation for the failure of invariance (of the Solow residual) is that entry is free but technology has increasing returns. Then the equilibrium will involve just enough market power to pay for the inputs."

[4] See, for example, Burnside et al. (1993), Cooper and Chatterjee (1993), Cogley and Nason (1995), Burnside and Eichenbaum (1996), Devereux et al. (1996), Andolfatto (1996), Hall (1999), King and Rebelo (2000), and Den Haan et al. (2000).

[5] The measurement of these types of shocks builds upon the interpretation of variations in the Solow residual as reflecting exogenous stochastic movements in the aggregate production technology. However, this interpretation is valid only under certain restrictive assumptions. See e.g., Hall (1988), Burnside et al. (1993), Cochrane (1994), and Burnside and Eichenbaum (1996).