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Endogenous Firm Entry and Exit in a DSGE Model: Case Study Iran Economy

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Abstract

Firm life cycle could be considered as a determinant of business cycles since business environment factors inhibit coordination between Business forming and collapsing with the business cycles promptly. In this study, we try to append firms' endogenous entry and exit mechanism in a dynamic stochastic general equilibrium model (DSGE). Regarding previous studies, we establish a better illustration of endogenous exit. Finally, we estimate the model by using Iran macroeconomics data. The simulation results show the endogenous entry and exit affect the business cycle length and magnitude. Also, Firm Endogenous Entry and Exit in the model causes the Demand Shock, absorb in the economy by the intensive margin. It means the firm uses more inputs to produce more output. On the other hand, in responding to the supply side shock, more firm enter to business (extensive margin).

Keywords: DSGE, Ease of Doing business, Firm, Entry, Exit.

JEL Classification: D58, D25, E20, E32, K22, L21.

1. Introduction

DSGE models have come to dominate macroeconomics during the past quarter-century. Stiglitz (2018) highlights bottlenecks of Dynamic Stochastic General Equilibrium (DSGE) models and attributed them to inadequate modeling, in which one of them is insufficient incorporating insights from the firm behavior.

Firms are dynamic phenomena and their life cycles depend on the business environment (Bain, 1949, 1956; Mann, 1966; caves, 1998). So, the business environment could be considered as a friction in analyzing the macroeconomic, which makes the firm entry and exit costly. In other words, a firm couldn't promptly start the business when expecting a profit, rather it involves in institutional and legal terms and the owner would suffer sunk costs. On the other side, when a business is closed, their accumulated capital cannot be traded

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quickly enough in the market so they may lose some part of their investments (e.g. investments in branding, licenses, patents, human capital, ad hoc technologies, and so on). These frictions affect the business cycles and have a significant role in short-run economic fluctuations (North and Thomas, 1973; McLeod, 2006; Acemoğlu, 2009), and it must be considered as a propagation channel, which is neglected in conventional models.

2. Background

In the last two decade, a few papers pay attractive attention to firm entry and exit and try to model it. Casares and Poutineau (2014) organized the scientific literature that considered firm entry and exit in two main strands. A first series of papers such as Hopenhayn (1992), Campbell (1998), Cooley, Marimón and Quadrini (2004), Samaniego (2008), and Clementi and Palazzo (2013) discuss the variability in the number of firms as an important propagation mechanism for business cycle fluctuations. Another group of papers, exemplified by Bilbiee, Ghironi and Melitz (2012), Lewis and Poilly (2012), and Lewis and Stevens (2013) show that the preferences and evolution in the menu of goods available for consumption matter to analyze short-run output fluctuations. The second group, analyzes the macroeconomic behavior by simulating DSGE models, and shows a better performance of their model in compliance with observed moments, the countercyclical behavior of markup, Cost-Push path-through and so on.

3. Economic Problem

To contribute the second way, we developed a DSGE model that incorporates firm endogenous entry and exit as a propagation channel. To do so, we add up the main features of Smets and Wouters (2004), Bilbiee, Ghironi and Melitz (2012) and some ideas from Casares and Poutineau (2014). We also implement a monetary rule, based on the money growth rate. Along with the calibration, the model was estimated for an economy like Iran. After simulating the model, we compared it with a conventional model to answer two main questions. 1) Does the firms' entry and exit propagation mechanism change the business cycles? And 2) how the relative importance of demand and supply side shocks has changed?

The main aspect of the model is relaxing the assumption about the unit mass of production. So the consumption mass lay in the interval between 0 and n_t, in which n_t may be greater, less or equal to one. As in Bilbiie et al. (2012) and Casares and Poutineau (2014), each intermediate firm is specialized in the production of a specific good. At the beginning of a given period t there are n_t intermediate goods. At the end of this period, the production of n_t^X goods is optimally decided to shut down (exit), while the remaining n_t^A firms survive, such that,

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$$n_t = n_t^X + n_t^A$$

Simultaneously, n_t^E new goods are created during period t, though their lines of production will begin to operate in the next period, $t+1$. During the period of business creation, new goods may not succeed as in Lewis and Poilly (2012), and Lewis and Stevens (2013). There is a $F_{n.t}(.)$ probability of successful entry, so that only $F_{n.t}(.)n_t^E$ new goods finally enter in period t. So, at the beginning of period$+1$, the number of goods is determined by applying the survival rate,$\frac{n_t^A}{n_t}$, to both the incumbent firm in period t and the successfully entered new firms. In formal terms, we have the law of motion for the total number of firms,

$$n_{t+1} = \frac{n_t^A}{n_t}(n_t + F_{n.t}(.)n_t^E)$$

In the referential setup of Bilbiie et al. (2012), it is assumed a constant death rate. In contrast, Casares and Poutineau (2014) endogenized the death rate. The log-linearized form of their final equation is:

$$\tilde{\tilde{n}}_t^X = \tilde{\tilde{n}}_t + A_1 E_t \tilde{\tilde{z}}_{t+1}^c + A_2 E_t\left(\tilde{\tilde{m}}c_{t+1} - A_3 \tilde{\tilde{y}}_{t+1}\right)$$

Where A_is are extracted coefficients by Casares and Poutineau (2014). To improve their attempt, we solve the firm exit problem in a different way to overcome its shortages, e.g.: the assumption of $E(\frac{1}{z_t}) = \frac{1}{E(z_t)}$, the firm-specific productivity assigned once for all period, invariant entry cost, and dependency of liquidation value to the entry fee. Our final log-linearized firm exit equation is:

$$\tilde{\tilde{n}}_t^X = \tilde{\tilde{n}}_t - \left(\frac{1-n_{ss}^{X*}}{n_{ss}^{X*}}\right)\left(\kappa\left[\left(n_{ss}^A\beta - 1\right)\frac{lv_{ss}}{\tilde{y}_{ss}^p} + 1\right]^{-1}\left[\begin{array}{l} n_{ss}^A\beta\frac{lv_{ss}}{\tilde{y}_{ss}^p}\left(\tilde{\tilde{\pi}}_{t+1}^c - \tilde{\tilde{r}}_t^b + \tilde{\tilde{lv}}_{t+1}\right) \\ -\frac{lv_{ss}}{\tilde{y}_{ss}^p}\tilde{\tilde{lv}}_t + \frac{lv_{ss}}{\tilde{y}_{ss}^p}\left(1-n_{ss}^A\beta\right)\tilde{\tilde{y}}_t^p + \left(\mu_p - 1\right)\tilde{\tilde{n}}_t \end{array}\right] - \kappa\tilde{\tilde{m}}c_t\right)$$

It shows that the exit is a positive function of production marginal cost (MC_t), interest rate (r_t) and liquidation value (lv_t) and a negative function of firms count, output (y_t), expected inflation (π_{t+1}) and expected liquidation value.

4. Estimation Results and Simulation

To estimate the model, we used Iran macroeconomic variables: consumption, GDP, private investment, stock market return, inflation, money growth rate, oil revenue and government expenditures. The model has been estimated in accordance with the Bayesian method by using the Dynare package in Matlab. To reduce the number of estimated parameters, we calibrated some parameters based on previous studies as well as the global sensitivity analysis, introduced by Saltelli, et al. (2008). Log-data-density of the introduced model and base model are 1013 and -287 respectively. By considering it, the new model covers the

actual data better than the conventional one. Then we simulate the model to answer questions.

5. Conclusion

We show that firm entry and exit endogeneity changed the shocks contribution in the fluctuation of key economic variables. Although the variables such as employment and investment are not alerted so much, the others especially economic output and consumption are affected widely. Comparing the impulse response functions (IRFs) in both models shows that the entry and exit propagation channel changes the key variables responses to exogenous shocks. meaning that the business cycles length and magnitude are affected significantly. Also, firm endogenous entry and exit in the model causes the demand shock, to be absorbed in the economy by an intensive margin. It means the firm uses more input to produce more output. Moreover, in response to the supply side shock, more firms enter to business (extensive margin).

Our model has another advantage over the conventional one. It enables us to study the business environment shock or in model-specification terms, the entry fee shock. Increasing the entry fee causes a negative effect on consumption and inflation. So it decreases the representative agent welfare from two sides: declining the consumption and inflating the economy the so-called stagflation.

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