Information rigidities and asymmetric business cycles

Anton Cheremukhin [1], Antonella Tutino [*,2]

Federal Reserve Bank of Dallas, 2200 N Pearl St, Dallas, TX 75201, United States

A B S T R A C T

We study the link between asymmetries of markups and firm exit rates and asymmetries in information acquisition along the U.S. business cycle. We argue that a model of optimal firm exit under rational inattention produces lagged, counter-cyclical and positively skewed markups together with counter-cyclical exit rates, consistent with the empirical evidence. Our model also predicts counter-cyclical information rigidities consistent with survey evidence.

© 2016 Elsevier B.V. All rights reserved.

1. Introduction

A recurring feature of business activity in the U.S. economy is the asymmetry between slow expansions and fast contractions.[3] We document three main features of the U.S. business cycle that motivate our theory. First, real GDP shows a negative growth asymmetry with the decline occurring faster than recovery. Second, markups show the opposite asymmetry: they rise steeply following recessions and fall gradually in expansions. Finally, firms' exit rates are strongly countercyclical and spike in recessions. Taken together, these features suggest a link between the asymmetry of business cycles, markups and firms' exit decisions.

These business cycle asymmetries seem to be closely connected with asymmetries in information rigidities over the business cycle. As shown by Coibion and Gorodnichenko (2012, 2015), information rigidities slowly rise in expansions and drop abruptly in the aftermath of recessions.

In this paper we provide a theoretical framework based on the rational inattention theory of Sims (2006) that reconciles these facts. The paper's main contribution is to show theoretically that rationally inattentive decisions of entrepreneurs to

---

* Corresponding author.
   E-mail addresses: cheinrtosha@gmail.com (A. Cheremukhin), tutino.antonella@gmail.com (A. Tutino).
   [1] Tel.: +1 214 922 6785.
   [2] Tel.: +1 214 922 6804.
   [3] According to the NBER's business cycle dating committee, since 1900 the average length of expansions (11 quarters) has been three times longer than the average length of contractions (3.6 quarters).

keep producing or exit the market may be an important source of business cycle asymmetry and that information frictions may play a role in the business cycle by amplifying these asymmetries.

Our model is built on the idea that entrepreneurs have limited cognitive ability to process all available information about the markets in which they operate. This information involves both economywide markup and demand for their business's output. Firms choose signals to monitor market conditions. Based on these signals and conditional on expected profits, they decide whether to exit. Entrepreneurs' choice of signals influences their perception of market conditions and, in turn, their exit decisions. Individual exit decisions affect the number of market participants and through competitive pressure the economywide markup. Thus, individuals' information-processing choices affect aggregate outcomes.

However, information choices are influenced by aggregate markups as well. When the economy is in an expansion and markups are slowly declining, firms choose to process little information and delay exit. The presence of slim markups and many firms that are no longer profitable in the economy leads to a recession during which a lot of firms exit the market simultaneously. In the aftermath of the recession, markups rise sharply and so does the attention of the incumbent firms. The model predicts lagged, counter-cyclical and positively skewed markups.

Information frictions based on rational inattention theory are the source of an endogenous skew in our model. Different from standard filtering techniques, which by and large can only handle a second order approximation of the model and Gaussian innovations, the rational inattention model is capable of producing skewed growth dynamics of interest. Different from other information-based theories, rational inattention postulates a cost of processing information about economic conditions whose nature is cognitive. There are no frictions preventing firms from knowing their economic environment other than the information they are capable of processing. This friction is modelled as a fixed marginal cost of processing information associated with a Shannon's channel. The latter regulates the informativeness of signals about economic conditions that a firm chooses. The more information the signal contains, the greater the overall cognitive cost the firm incurs to process it. The key mechanism of the model exploits the fact that a firm's attention varies with the value of information relative to its cost. In economic expansions, when economywide markups are low, the benefit of choosing precise signals is low and firms optimally choose relatively uninformative signals. In economic contractions, when economy-wide markups are high, firms find it optimal to process progressively more information as the benefit of being relatively well informed is high.

The specification of the cognitive nature of the attention cost together with the endogenously varying amount of attention is at the core of our model. This specification is strongly supported by experimental evidence in economics, psychology and neurology.[4] Our model also uncovers a novel mechanism through which information frictions affect the business cycle. This mechanism is at the core of the prediction that the amount of attention to economic conditions and the precision of forecasts increase sharply in recessions and fall slowly in expansions. Empirical studies of information rigidities support this prediction. Coibion and Gorodnichenko (2012, 2015) find that economic agents process more information about macroeconomic conditions in the aftermath of a recession rather than at its onset.

Moreover, our model has the potential to explain asymmetries in macroeconomic variables such as GDP, markups, firm entry and exit. Two main caveats are in order here. The first concerns the computational strategy, the second the noisy nature of the data on markups in the U.S.

Using a rational inattention model implies solving a problem where the state variable, its evolution and the choice variable are all distributions. This computational complexity limits the number of firms we can analyze. However, evidence on the U.S. firm size distribution shows that it has fat tails, corroborating the modeling assumption of a finite set of firms. Moreover, we show that the granularity of the U.S. economy, as documented by Gabaix (2011) allows us to meaningfully capture the skewness of individual perceptions of shocks and to relate it to the observed asymmetric behavior of output growth, markup growth and exit rates.

Unfortunately, the data on markups for the U.S. are extremely noisy and many of their properties are very sensitive to background assumptions and data revisions. Thus, we leave a thorough quantitative comparison of the model's outcomes with U.S. empirical evidence for future research.

In a series of recent papers, Coibion and Gorodnichenko (2012, 2015) have pointed out that information rigidities vary along the business cycle. They document that information rigidities have asymmetric dynamics: they rise when the economy is in an expansion and drop in the aftermath of a recession. The authors further show that the degree of information rigidity is large and economically significant across time and countries for firms and households alike.

Despite its importance, leading models of information frictions such as exogenous noisy-information and sticky-information,[5] fail to reconcile these dynamics of information rigidities. The rationale for this failure hinges upon the fact that these models postulate agents updating information about aggregate economic conditions infrequently. Without explicit consideration for reasons why firms may want to process information and allocate attention differently along their life cycle, these models cannot rationalize how the degree of information rigidities varies along the business cycle.

A prominent exception is Gorodnichenko (2008) which builds a model with state-dependent information acquisition where the degree of attention varies according to the volatility of macroeconomic conditions. In this paper we propose a

---

[4] For experimental evidence on rational inattention, see Woodford (2013) and Cheremukhin et al. (2015).
[5] Exogenous noisy-information models are those that treat noise as exogenous, which is most models in the literature. See, e.g. Lucas (1972). For models of sticky information see, e.g., Mankiw and Reis (2002).