

The Cross-Sectional Distribution of Price Stickiness and Inflation Stability

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Extended abstract

This paper shows that the requirement for monetary policy to generate equilibrium determinacy is substantially loosened when the cross-sectional distribution of the price change frequency is taken into account. Specifically, we extend a simple New Keynesian (NK) model to allow for heterogeneous price change frequencies across firms and study how it changes the condition for equilibrium determinacy. Three specifications are considered: 1) a model with the constant-elasticity of substitution (CES) aggregator and zero trend inflation; 2) a model with the CES aggregator and positive trend inflation; and 3) a model with the Kimball-type aggregator and zero or positive trend inflation.

In the first specification, as the price change frequency becomes more heterogeneous in a sense that its standard deviation becomes larger while its mean is preserved, the boundary between the determinacy and indeterminacy region shifts downward in the space of the coefficients on inflation and the output gap in the monetary policy rule. In other words, the determinacy region expands so the central bank can achieve equilibrium determinacy with weaker responses to inflation in the heterogeneous-frequency economy than in the homogeneous-frequency economy with the same mean price change frequency. The mechanism is the dispersion of the sectoral relative prices coupled with a larger weight on the marginal cost in the Phillips curve, which leads to a larger long-run trade-off between inflation and the output gap or a flatter long-run slope of the Phillips curve. A strategic interaction between the strategic complementarity in price setting and the heterogeneity in the price change frequencies amplifies the effect of the latter on the equilibrium determinacy condition.

In the second specification where trend inflation is positive (and greater than a close-to-zero bound), the result is reversed. As the price change frequency becomes more heterogeneous, the boundary between the determinacy and indeterminacy region shifts to the right. In other words, the determinacy region shrinks so the central bank has to respond more strongly to

inflation to achieve equilibrium determinacy in the heterogeneous-frequency economy than in the homogeneous-frequency economy. The reason for this reversal is that the long-run slope of the Phillips curve now turns negative and becomes larger with the heterogeneity in the price change frequencies. Price-updating firms raise their prices more than in the first specification with zero trend inflation. They are worried that they may not update prices again in the future while their prices are eroded by trend inflation. Their output declines substantially, which leads to a decline in aggregate output.

The second specification however does not permit trend inflation at the historical level in the US. As acknowledged in the literature, trend inflation in a New Keynesian model is subject to an upper bound so that the profit maximization problem of the firms is well defined. The upper bound does not usually bind in the homogeneous-frequency economy with the usual value of the price change frequency. However, in the heterogeneous-frequency economy where some firms may change their prices very infrequently, the upper bound for trend inflation could be so low that even 2% of inflation targeted by the Federal Reserve is not allowed.

Therefore, in the third specification, we replace the CES aggregator with the Kimball-type aggregator proposed by Kimball (1995), which leads to a kinked demand curve for goods. It features a variable elasticity of substitution and thus a variable elasticity of demand. It gives firms an incentive to keep their prices toward the aggregate price level so addresses the problem due to the upper bound. In the third case, as the price change frequency becomes more heterogeneous, the boundary between the determinacy and indeterminacy region shifts downward so the determinacy region expands. The central bank can achieve equilibrium determinacy with weaker responses to inflation in the heterogeneous-frequency economy than in the homogeneous-frequency economy. As price-updating firms raise their prices, the demand they face becomes more elastic and their profits deteriorate quickly. So, they do not raise prices as much as with the CES aggregator. It follows that their output does not decline as much and the long-run trade-off between inflation and the output gap stays positive and becomes larger as in the first specification.

We use a simple NK model with two sectors with different price change frequencies to illustrate the change in the boundary between the determinacy and indeterminacy region and inspect the mechanism driving the result. We then parameterize the model with the price change frequency estimates by Nakamura and Steinsson (2008). The main results hold in this realistic model with 272 sectors. We consider the first and third specification in this model but not the second one since the sample average of inflation during the sample period of Nakamura and Steinsson (2008) is greater than the implied upper bound for trend inflation.

Lastly, we take the monetary policy rule estimates for the pre-Volcker period by Clarida, Galí, and Gertler (2000), Coibion and Gorodnichenko (2011), and Carvalho, Nechio and Tristao (2019) and investigate if their estimates lead to equilibrium indeterminacy in the heterogeneous-frequency economy parameterized with the price change frequency estimates by Nakamura and Steinsson (2008). Clarida, Galí and Gertler (2000) and Coibion and Gorodnichenko (2010) estimate a forward-looking monetary policy rule where the central bank reacts to expectations of inflation while Carvalho, Nechio and Tristao (2019) estimate a contemporaneous monetary policy rule where the central bank reacts to contemporaneous variables. Once we take into account a realistic price change frequency distribution, the evidence in favor of the possibility that the US economy was subject to equilibrium indeterminacy and suffered from self-fulfilling expectations-driven fluctuations is not strong at all. In other words, we do not have strong empirical evidence that the change in the monetary policy stance around the tenure of Paul Volcker as the chairperson of the Federal Reserve got the US economy out of equilibrium indeterminacy and led it to have a unique stable equilibrium.

References

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