Setting the Wrong Price for the Right Reason: Consequences for Inflation and Monetary Policy*

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We provide a new characterization of the welfare costs of different levels of inflation when firms make mistakes in setting prices. We study three inter-related questions: how consumer welfare varies with the rate of inflation, how costly disinflation can be once high inflation has taken root, and how monetary policy, operating under a Taylor rule, should respond to variations in output and inflation, in a model with endogenous price rigidities. We use an errors-in-pricing model in which firms' incentives to set accurate prices are moderated by a combination of menu costs and information costs. We argue that policymakers need to consider the precision with which firms set their prices when assessing the costs of inflation in the economy and the potential impact of monetary stabilization policies.

*The title of this paper is inspired by Hellwig & Venkateswaran (2009), who showed that under some conditions, even if firms are uncertain about the sources of shocks, they still adjust, resulting in aggregate flexibility. Here, instead, we consider an environment in which firms set incorrect prices, but with good reason, balancing the benefit of more accurate decisions against the cost of that accuracy. The views expressed in this paper are solely the responsibility of the authors and should not be interpreted as reflecting the views of the Board of Governors of the Federal Reserve System or of anyone else associated with the Federal Reserve System. Contact: camilo.moralesjimenez@frb.gov, stevens7@umd.edu, hw2688@umd.edu.

1 Introduction

The rise in inflation experienced around the world in 2021-2022 revived longstanding debates concerning the costs of inflation and the trade-offs associated with stabilizing or reducing it. Whatever the source of inflation's initial impulse in 2021, an ongoing concern has been its entrenchment. This concern reflects the view that once inflation takes root, it can be strongly distortionary and costly to uproot. But how distortionary and how costly?

Conventional models of price-setting give us conflicting answers. While Calvo models generate welfare losses from inflation that grow rapidly with the level of steady state inflation, menu cost models yield tiny and virtually flat losses. While the former can generate a high sensitivity of output to inflation, even at modest levels of trend inflation, the latter generate negligible monetary non-neutrality (unless enhanced with Calvo-like features). And while Calvo models generate clear prescriptions for how optimal monetary policy should respond to different types of shocks, menu cost models often do not concern themselves with optimal monetary policy and indeed mostly use exogenous money supply rules rather than endogenous Taylor rules.[1] While the Calvo model remains dominant in the theory and practice of monetary policy, it imposes the nominal friction on price setting exogenously. Hence, is not clear that it provides accurate assessments of the costs of inflation or prescriptions for monetary policy that are robust to richer models that endogenize price rigidities. Moreover, while the Calvo model can be shown to match well the aggregate dynamics of inflation and output, such as their comovement in response to aggregate demand shocks, it is inconsistent with the dynamics of pricing moments in micro data, such as the positive correlation of the average frequency of price changes with inflation.

This paper uses a model with endogenous price rigidities to study three inter-related questions: how consumer welfare varies with the rate of inflation, how costly disinflation can be once high inflation has taken root, and how monetary policy, operating under a Taylor rule, should respond to variations in output and inflation driven by different shocks. We use

[1] In addition to the textbook treatment in Woodford (2003), the large literature on the welfare costs of inflation and monetary policy in New Keynesian and menu cost models includes Ascari (2004); Ascari, Phaneuf & Sims (2018); Burstein & Hellwig (2008); Nakamura, Steinsson, Sun & Villar (2018) among many others.

an errors-in-pricing model in which firms' incentives to set accurate prices are moderated by a combination of menu costs and information costs. The model builds on Woodford (2009), Stevens (2020), Khaw, Stevens & Woodford (2017), Costain & Nakov (2015) and Costain & Nakov (2019) to nest the main classes of time-dependent and state-dependent pricing models that have been considered in the quantitative monetary literature: the Calvo (1983) model of exogenous, staggered price adjustment, the menu cost model of state-dependent price changes subject to a fixed adjustment cost (*e.g.*, Golosov & Lucas Jr, 2007), and noisy pricing models (*e.g.*, Maćkowiak & Wiederholt, 2009; Woodford, 2002). As shown by Morales-Jiménez & Stevens (2024) (MJS henceforth), the model matches well U.S. pricing dynamics in recent decades.

We calculate the welfare loss associate with a particular level of steady state inflation as the consumption equivalent variation: the change in consumption that would be required to make the representative consumer indifferent between that steady state and the steady state with zero inflation. We then calculate the associated cost of disinflation from that level of steady state inflation as the cumulative output loss that is associated with reducing inflation by one percentage point. We provide not only estimates of the *average* welfare cost of inflation and associated sacrifice ratio, but also a *range* of estimates that depend on the nature and severity of pricing frictions. This is useful since, as shown by MJS, both the nature and the severity of pricing frictions have changed over time in the U.S. Of note, the Calvo model implies that an increase in price flexibility can *reduce* welfare, even in response to efficient shocks, because the welfare costs of inflation variability are so large (Bhattarai, Eggertsson & Schoenle, 2018). Our the model suggests a strong role for the endogeneity and state-dependence of pricing frictions. As a result, the incentives for accuracy in pricing change with aggregate inflation. To better understand how consumer welfare varies with inflation, we also report how exogenous vs. endogenous increases in price flexibility affect consumer welfare, in the spirit of De Long & Summers (1986) and Bhattarai et al. (2018).

How does inflation affect consumer welfare? In this paper, we focus on the effect of inflation on welfare through relative price dispersion. This is the key channel in the New Keynesian models that have become workhorses of monetary policy (Woodford, 2003). In these models, due to the infrequent, staggered adjustment of prices, higher inflation generates

larger price dispersion and an inefficient allocation of resources across firms that lowers aggregate output and welfare. Empirical work has shown that once inflation exceeds high single digits, price rigidity starts to decline with inflation, rapidly reaching near-flexibility (Alvarez, Beraja, Gonzalez-Rozada & Neumeyer, 2019; Gagnon, 2009). Our model generates this state-dependence through an endogenous increase in information acquisition, hence it is suitable for addressing welfare costs at high and variable inflation rates.

The baseline model features an exogenous form of wage rigidity, in which the wage is a weighted average of the steady state wage and the currently optimal flexible wage. Ascari et al. (2018) show that the welfare costs of low-to-moderate inflation increase fourfold when adding Calvo wage rigidity to a model with Calvo price rigidities. Hence, an important extension that we leave for future work is the integration of equilibrium wage dispersion in the model with pricing mistakes.

For simplicity and for comparability with some of the prior literature, our cost assessments abstract from considerations pertaining to the lower bound on nominal interest rates. Recent work has studied how a higher inflation rate might reduces the likelihood and costs associated with the economy entering the ELB (*e.g.*, Andrade, Gali, Le Bihan & Matheron, 2019; Coibion, Gorodnichenko & Wieland, 2012). We leave an assessment of the ELB in the context of the dispersed pricing model for future work. We also omit from our calculations other drivers of welfare losses arising from inflation, such as imperfectly indexed taxes or nominal debt contracts (Fischer & Modigliani, 1978). These remain important frictions to integrate in the Heterogeneous Agent New Keynesian paradigm.

References

Alvarez, Fernando, Martin Beraja, Martin Gonzalez-Rozada & Pablo Andrés Neumeyer (2019), "From hyperinflation to stable prices: Argentina's evidence on menu cost models," 134(1): 451–505.

Andrade, Philippe, Jordi Gali, Herve Le Bihan & Julien Matheron (2019), "The Optimal Inflation Target and the Natural Rate of Interest," *Brookings Papers on Economic Activity* (2 (Fall)): 173–230.

Ascari, Guido (2004), "Staggered prices and trend inflation: some nuisances," *Review of Economic Dynamics* 7(3): 642–667.

Ascari, Guido, Louis Phaneuf & Eric R Sims (2018), "On the welfare and cyclical implications of moderate trend inflation," *Journal of Monetary Economics* 99: 56–71.

Bhattarai, Saroj, Gauti B Eggertsson & Raphael Schoenle (2018), "Is increased price flexibility stabilizing? Redux," *Journal of Monetary Economics* 100: 66–82.

Burstein, Ariel & Christian Hellwig (2008), "Welfare costs of inflation in a menu cost model," *The American Economic Review* 98(2): 438–443.

Calvo, Guillermo A (1983), "Staggered prices in a utility-maximizing framework," *Journal of Monetary Economics* 12(3): 383–398.

Coibion, Olivier, Yuriy Gorodnichenko & Johannes Wieland (2012), "The optimal inflation rate in New Keynesian models: Should central banks raise their inflation targets in light of the zero lower bound?" *Review of Economic Studies* 79(4): 1371–1406.

Costain, James & Anton Nakov (2015), "Precautionary price stickiness," *Journal of Economic Dynamics and Control* 58: 218–234.

Costain, James & Anton Nakov (2019), "Logit price dynamics," *Journal of Money, Credit and Banking* 51(1): 43–78.

De Long, J Bradford & Lawrence H Summers (1986), "Is Increased Price Flexibility Stabilizing?" *The American Economic Review* 76(5).

Fischer, Stanley & Franco Modigliani (1978), "Towards an understanding of the real effects and costs of inflation," *Review of World Economics* 114(4): 810–833.

Gagnon, Etienne (2009), "Price setting during low and high inflation: Evidence from Mexico," *The Quarterly Journal of Economics* 124(3): 1221–1263.

Golosov, Mikhail & Robert E Lucas Jr (2007), "Menu costs and Phillips curves," *Journal of Political Economy* 115(2): 171–199.

Hellwig, Christian & Venky Venkateswaran (2009), "Setting the right prices for the wrong reasons," *Journal of Monetary Economics* 56: S57–S77.

Khaw, Mel Win, Luminita Stevens & Michael Woodford (2017), "Discrete adjustment to a changing environment: Experimental evidence," *Journal of Monetary Economics* 91: 88–103.

Maćkowiak, Bartosz A. & Mirko Wiederholt (2009), "Optimal sticky prices under rational inattention," *The American Economic Review* 99(3): 769–803.

Morales-Jiménez, Camilo & Luminita Stevens (2024), "Price rigidities in U.S. business cycles," *Working paper, University of Maryland* .

Nakamura, Emi, Jón Steinsson, Patrick Sun & Daniel Villar (2018), "The elusive costs of inflation: Price dispersion during the US Great Inflation," *The Quarterly Journal of Economics* 133(4): 1933–1980.

Stevens, Luminita (2020), "Coarse pricing policies," *The Review of Economic Studies* 87(1): 420–453.

Woodford, Michael (2002), "Imperfect common knowledge and the effects of monetary policy," in *Knowledge, Information, and Expectations in Modern Macroeconomics: In Honor of Edmund S. Phelps*, J. Stiglitz P. Aghion, R. Frydman & M. Woodford, eds., pp. 25–58, Princeton University Press, Princeton, NJ.

Woodford, Michael (2003), *Interest and prices: Foundations of a theory of monetary policy*, Princeton University Press Princeton, NJ and Oxford.

Woodford, Michael (2009), "Information-constrained state-dependent pricing," *Journal of Monetary Economics* 56(S): 100–124.