



EXECUTIVE SUMMARY

Many economists believe that prices are “sticky”—they adjust slowly. This stickiness, they suggest, means that changes in the money supply have an impact on the real economy, inducing changes in investment, employment, output and consumption, an effect that can be exploited by policymakers.

In this essay, we argue that price stickiness doesn’t necessarily generate an exploitable policy option. We describe a model in which money is neutral (that is, growth or reduction in money supply doesn’t impact real economic activity) even in a context of sluggish price adjustment.

Are Prices Sticky and Does It Matter?

Even if prices are slow to adjust, this doesn’t necessarily mean that monetary policy can be used to stimulate or slow economic activity

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Introduction

Here are two venerable questions in macroeconomic theory and policy analysis: Are prices sticky? Does it matter?

By “sticky” prices, we mean the observation that some sellers set prices in nominal terms that do not adjust quickly in response to changes in the aggregate price level or to changes in economic conditions more generally. Some macroeconomics as taught in the classroom and used in practice makes the assumption that nominal prices are sticky and then proceeds to derive policy implications. In this essay, we want to challenge the idea that these policy implications are necessarily correct (even if prices *are* sticky).

Classical macroeconomics embodied the idea that money is neutral—that is, increasing or decreasing the quantity of money in an economy has no impact on real economic activity such as investment, production, consumption or hiring. If money is neutral, it is not clear what monetary policy can do.¹

Some economists dispute classical neutrality. They argue that nominal prices are sticky, at least in the short run, and that this

has significant consequences for the real economy.² The exact consequences depend on details, but many models of this school of thought have this effect: If buyers have more money and sellers keep their prices the same, the former will demand more goods and services and the latter (by assumption) will supply them. This generates an increase in investment, employment, output and consumption.

The counterargument is that putting more cash in people's hands is like adding a zero to every bill; that is, a one-dollar bill becomes a 10-dollar bill, a 10 becomes a 100 and so on. Some economists say that this ought not have a real impact, any more than changing the way temperature is measured from Fahrenheit to Celsius would—it's just units!

Many economists point out, however, that sticky prices are what we observe empirically and, indeed, there is an element of truth in their argument (see Klenow and Malin 2010 for a survey of empirical work). Then we might ask, why do some sellers set prices in nominal terms that do not adjust in response to changes in economic conditions? This seems to fly in the face of elementary economic theory. Shouldn't every seller have a unique target relative price, depending on real factors, so that when the aggregate price level increases due to an increase in the money supply, every seller necessarily adjusts his or her nominal price by the same amount?

In many popular macro models, including those used by most policymakers, prices are sticky by assumption, in the sense that there are either restrictions on how often they can change, following Taylor (1980) or Calvo (1983), or there are real resource costs to changing them, following Rotemberg (1982) or Mankiw (1985). It is true in principle that a cost is incurred in changing a price—the so-called menu cost—even if this cost is merely a piece of chalk. A notable feature of these models, though, is that at their core they require a cost only for price changes, but ignore all other potential transaction costs such as changing one's quantity, password, clothes or mind. Or they simply impose by decree that a seller can adjust price only at a few points in time determined by pure chance.

Stickiness as a result, not assumption

Here we describe a theory that generates price stickiness as a result, not an assumption, even if sellers can change price whenever they like at no cost. But in strong contrast with theories assuming sticky prices, this theory implies that money is neutral, so a central bank cannot engineer a boom or end a slump simply by printing currency. Our main goal in describing this theory is not, however, simply to establish that prices are sticky or that money is neutral. Rather, our point is that the observation of sluggish price adjustment does not logically imply that money

is nonneutral. Nor does it imply that we need to focus predominately on macro models that incorporate menu costs or related devices.³

In two recent papers, Head et al. (2012) and Liu et al. (2014), we propose simple models with the following features. Due to frictions in credit, including lack of commitment and imperfect monitoring or record keeping, buyers sometimes need to use money. (This part of the theory is based on Lagos and Wright 2005.⁴) For the market in which buyers and sellers trade, we borrow the classic model of frictional good markets developed by Burdett and Judd (1983). That model, based on search frictions, delivers price dispersion and has proved useful in many other applications, including the large literature on labor markets following Burdett and Mortensen (1998).⁵

To understand the Burdett-Judd model, it helps to first review the earliest search models, where buyers sampled sellers sequentially until they found one selling at a price below the highest price buyers were willing to pay. Burdett and Judd modify Diamond's (1971) classic search model, which, problematically, had no price dispersion.⁶ Burdett and Judd's one (ostensibly minimal) change to the Diamond model is this: Rather than sampling prices one at a time, as Diamond had it, buyers in the Burdett-Judd model have a positive probability of sampling two or more prices at the same time. If all sellers set the same price, a buyer is indifferent to choosing one over another and must use some tie-breaking rule to pick. This, of course, gives an individual seller a huge incentive to shave his or her price to get the sale. In fact, Burdett and Judd find that, in the model's equilibrium, all sellers charge different prices: price dispersion.

When Burdett-Judd pricing is embedded into a monetary model, sellers post prices in dollars, since this is how buyers are paying. At any date, there is a range of posted prices for which sellers will get the same profit. While the model pins down the distribution of prices, it does not set the price for any *individual* seller. Why not? A low price generates less profit per sale, but makes up for that low profit generation through sales volume, because a sale is more likely from any buyer who samples a low price.

If the money supply increases, the equilibrium price distribution shifts up, but this new distribution can overlap with the previous range of prices. This means that some (but not all) sellers must change their prices. If an individual seller's price falls outside the range of prices that sellers will charge after the increase of money supply, it must adjust; but if it is still in the range of new prices, it may not.

Now, recall the question posed earlier: Shouldn't every seller have a target real price and, therefore, when the money supply increases, shouldn't every seller adjust his or her nominal price by the same amount? The answer is no. Sellers do not have a unique target price. The model's equilibrium requires a distribution of prices, all of which yield the same profit. If sellers do not change their price when money supply increases, they indeed earn less profit per unit, but again they make it up on the volume. Hence, sellers can change prices infrequently in the face of continuous movements in economic conditions, even though they are allowed to change whenever they like at no cost.

But the crucial point is this: Policy cannot exploit this price stickiness because the distribution of relative prices is pinned down uniquely. The level of the money supply and the aggregate price level are irrelevant—it is simply a choice of units. This is classical neutrality.

Conclusion

Our point is that money is not necessarily nonneutral just because prices are sticky. Moreover, a calibrated version of the model can match quite well the empirical behavior of price changes. These points are not widely known (or accepted, by those who are aware of them). Ball and Mankiw (1994), to provide a view representative of a wide segment of the economics profession, say: “Sticky prices provide the most natural explanation of monetary nonneutrality since so many prices are, in fact, sticky.” They add, moreover, that “based on microeconomic evidence, we believe that sluggish price adjustment is the best explanation for monetary nonneutrality,” and “as a matter of logic, nominal stickiness requires a cost of nominal adjustment.”⁷

We interpret these claims by Ball and Mankiw to contain three points related, respectively, to empirics, theory and policy, and our responses to the claims encapsulate our argument regarding monetary neutrality, or lack thereof.

Their first claim is that price stickiness is a fact. We agree.

Their second claim is that price stickiness implies “as a matter of logic” the existence of some technological constraints to price adjustment. The theory outlined above proves this wrong by displaying equilibria that match not only the broad observation of stickiness, but the detailed empirical findings, with no such constraints.

Their third claim is that stickiness implies that money is not neutral and that this justifies certain policy prescriptions. This is again proved wrong. The theory we've just discussed is consistent with the relevant observations, but money is neutral. Thus, sticky prices do not constitute definitive evidence that money is nonneutral or that particular policy recommendations are warranted.

Endnotes

¹ To state this notion with simple math: Suppose the economy starts in an equilibrium with money supply M , nominal price level P and real allocation (consumption, investment, employment and so on) X . Then change M to M' . There is now an equilibrium with price level P' , in which $M'/P'=M/P$ and X is unchanged. Hence, the change in M has no effect on anything real.

² Stated mathematically: When M changes to M' , it is not possible for P to change to P' at least in the short run. Therefore M/P will not stay the same, and that has real consequences for X .

³ Our argument is somewhat analogous to that made by Robert Lucas in his famous 1972 paper. He describes a model consistent with the empirical observation that there is a positive correlation between the aggregate price level (or money supply) and output (or employment), but policymakers in this model cannot systematically exploit the relationship: Increasing inflation by printing money at a faster rate will not increase average output or employment. Similarly, we argue that one can design a model consistent with observations concerning nominal price adjustment, but it is not possible for policymakers to systematically exploit this.

⁴ See Lagos et al. (2015) for a recent survey of the literature on monetary economic theory.

⁵ See Mortensen and Pissarides (1999) for a survey of this literature.

⁶ In Diamond's model, firms post prices, taken as given the prices of others, and then buyers search as described above. This model doesn't generate price dispersion—problematic for a theory depending on buyers and sellers searching for one another. This finding set off a wave of research to generate endogenous price dispersion.

⁷ Somewhat similarly, Golosov and Lucas (2003) say that “menu costs are really there: The fact that many individual goods prices remain fixed for weeks or months in the face of continuously changing demand and supply conditions testifies conclusively to the existence of a fixed cost of repricing.” Our point here is not to pick on any particular individuals, but to provide some representative views in the profession.

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