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Homework in monetary economics: Inflation, home production, and the production of homes [☆]

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ABSTRACT

We introduce household production and the production of houses (construction) into a monetary model. Theory predicts inflation, as a tax on market activity, encourages substitution into household production and hence investment in housing. In the model, the stock and appropriately-deflated price of housing increase with inflation or nominal interest rates. We document this in data for the U.S. and other countries. A calibrated model accounts for up to 52% (87%) of the relationship between interest rates and housing wealth deflated by nominal output (by the money supply). It also implies the cost of inflation is higher than in models without home production.

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1. Introduction

This paper reports the results of our research in monetary economics applied to the housing market, including some novel data analysis, a new theory, and a calibration exercise. In fact, the theory is not so much new as a combination of three existing literatures. The basic framework follows the now standard approach to the microfoundations of monetary theory, sometimes called New Monetarist Economics, that provides benchmark models of money, credit, banking, over-the-counter financial markets and related phenomena. Into this we introduce household production, since we believe it is best to think about home capital (residential structures and consumer durables) as a factor of production, parallel to the way economists think about market capital (nonresidential structures and producer durables). Then we import features from the literature

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that studies the production of houses, because we are interested in the supply side as well as the demand side of housing markets. Although each of these elements has been studied extensively, they have not been previously interrelated.¹

As one motivation for the project, consider the often-heard view that there is a connection between monetary policy and housing markets. While there may be several ways to think about such a connection, one is the common notion that housing is a good hedge against inflation. That notion is vague, but the interpretation adopted here is this: *the value of housing wealth increases when inflation is higher*. By a hedge, we do not mean that one can use housing to avoid inflation risk, although that may also be interesting; the idea is rather that having more housing allows one to partially avoid some of the effects of anticipated inflation. A goal of the paper is to make this precise, but to get some rough intuition, consider the so-called Tobin effect that says that inflation makes agents want to substitute out of cash and into capital. Our effect is similar, except we focus on household instead of market capital. To put it differently, in most monetary models, inflation makes agents want to substitute out of consumption and into leisure; in our model they substitute into household production.

While part of the objective is methodological – integrating approaches from different literatures into a framework that can be useful in a variety of applications – we also want to discuss some substantive issues. First we check the facts, using various data sources, for the U.S. and other countries. We construct from different sources several measures of housing wealth, scaled by either nominal output or by the money supply (one has to scale by something, obviously, to control for purely nominal effects). We then show these series for housing wealth are positively related to nominal interest and inflation rates. Although one may be able to think of different explanations for this evidence, we pursue the idea that inflation is a tax on market activity. This is surely relevant in high-inflation, cash-intensive economies, but it is also interesting to explore the channel for the U.S. Inflation and nominal rates have been low here for a while, but the 1970s runup and subsequent decline provide plenty of variation in the data. And as regards cash intensiveness, note that inflation impacts not only currency but many other assets.²

By way of example, higher inflation or nominal interest rates provide an incentive to go out for dinner less and eat more meals at home, as long as going out is relatively cash intensive. Now, not all market activity uses cash, but it uses cash more than household activity, since goods like home-cooked meals are not even traded, let alone traded using currency. Thus, inflation increases the demand for home-production inputs, which raises the value of housing wealth, through prices, and through quantities as construction catches up. Quite generally, as long as high inflation or nominal interest rates discourage market activity, and thus encourage household activity, they should affect the demand for housing.

Another reason for integrating these literatures is the following. A classic questions in economics asks about the effect of inflation on welfare. One should think that the answer will be affected by incorporating home production, given that much previous work has shown that adding it to otherwise standard models makes a significant difference for various other quantitative questions.³ Typically, the main impact of incorporating home production is that it changes the amount by which agents respond to changes in policy and other forcing variables. In the standard macro model, agents can substitute between leisure and labor and between consumption and investment. In models with home production, they can substitute between leisure and working in the market or working at home, and between consumption and investment in market capital or home capital. It has been shown that this significantly affects the quantitative impact of fiscal policy (by several of the papers in footnote 3); we want to know how it affects the impact of monetary policy.

To implement these ideas, the model of money and capital in Aruoba et al. (2011) is generalized to include home production and the production of homes (construction). Housing capital, like market capital, is both produced and used in production. Following much of the work on home production, we make home capital a factor of production instead of inserting it directly in the utility function. We stay close to the approach in the earlier papers for the purposes of comparison, and because it allows us to take advantage of some results in the literature, including estimates of certain key elasticities.⁴

After providing analytic results that formalize the economic intuition, we calibrate the model, and ask how well it accounts for the empirical findings. The answer is that, depending on some details, we can account for between 22% and 52% of the relationship between interest rates and housing wealth over nominal output, and between 78% and 87% of the

¹ Since we are combining several different literatures we cannot list every relevant paper. On the microfoundations of monetary economics, we discuss below the work on which we build directly, but see Williamson and Wright (2010a, 2010b) and Nosal and Rocheteau (2011) for recent surveys. On home production, there are surveys by Greenwood et al. (1995) and Gronau (1997), although there has been a lot of work since then, as discussed below. We also review some housing research, but an example of what we have in mind is Davis and Heathcote (2005).

² It obviously affects demand deposits, especially when interest payments on these are quite low, but more generally inflation affects the returns to all liquid assets. See Lester et al. (2012) and Venkateswaran and Wright (2013) for models making this point theoretically and quantitatively.

³ Benhabib et al. (1991) and Greenwood and Hercowitz (1991) put ideas about home production by Becker (1965,1988) into quantitative macro models, and show they match key business-cycle moments better than models without home production. Home production models also better explain consumption (Baxter and Jermann, 1999; Baxter, 2010; Aguiar and Hurst, 2005, 2007a), investment (Gomme et al., 2001; Fisher, 1997, 2007), female labor-force participation (Greenwood et al., 2005; House et al., 2008; Albanesi and Olivetti, 2009), and labor supply generally (Rios-Rull, 1993; Rupert et al., 2000; Gomme et al., 2004; Aguiar and Hurst, 2007b; Ngai and Pissarides, 2008; Rogerson and Wallenius, 2009). These models also give different answers to fiscal policy questions (McGrattan et al., 1997; Rogerson, 2009), and provide novel perspectives on development issues (Einarsson and Marquis, 1997; Parente et al., 2000).

⁴ The issue is similar to the way one handles the value of time. As discussed in the surveys cited in footnote 1, Becker's approach assumes time does not enter utility, but consumption does, and home work is an input into home production; by contrast, Gronau's approach assumes agents value leisure time *per se*, as well as home production. Neither is "better" but we need to pick one. As a benchmark, we assume time enters utility directly while capital does not.

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