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Non-separability and sectoral comovement in a sticky price model

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ABSTRACT

This paper resolves the sectoral comovement problem between nondurable and durable outputs that arises in response to a monetary shock in a two-sector sticky price model with flexibly priced durable goods. We analytically demonstrate that the non-separability between aggregate consumption and labor can generate the comovement between nondurable and durable outputs in response to a monetary policy shock. We then estimate the degree of non-separability, together with other parameters, using a Bayesian approach. We find that the non-separable preferences are supported by the data and our estimated model generates the sectoral comovement in response to a monetary shock.

1. Introduction

Durable goods feature prominently in discussions of monetary policy. According to the data, the durable goods sector responds most procyclically to monetary policy.[2] However, as demonstrated by Barsky et al. (2003, 2007), it is difficult to match this feature of the data by simply incorporating durable goods into sticky price models with separable preferences. In particular, if durable goods have flexible prices, but nondurable goods prices are sticky, then an expansionary monetary policy leads to an *increase* in nondurable goods production but a *decline* in durable goods production, so that aggregate output may not change at all. The comovement problem arises.

This paper seeks to resolve the comovement problem that arises in response to a monetary shock in a two-sector sticky price model with flexibly priced durable goods. First, we analytically demonstrate that the two-sector sticky price model, if modified to feature the non-separability between aggregate consumption and labor in household preferences, can generate

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[2] Erceg and Levin (2006) document that an exogenous increase in the interest rate, estimated through a structural VAR, reduces consumer durables and residential investment spending nearly three times more than nondurable consumption. Barsky et al. (2003) also report similar results using the Romer dates as indicators of exogenous changes in monetary policy. Following the Romer date, the production of durables falls far more than that of nondurables.

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the response of durable spending to a monetary policy shock documented in empirical studies. The key mechanism to generate this result is the complementarity between nondurable consumption and labor implied by the non-separable preferences, absent in the separable preferences. We also show that variable capital utilization with imperfect capital mobility helps expand the threshold level of the non-separability required for the model to generate the sectoral comovement in response to a monetary shock.

Second, we show that the non-separable preferences are indeed supported by the data. To this end, we estimate the intertemporal elasticity of substitution that controls the degree of non-separability, together with other parameters, using a Bayesian approach. Since DiCecio (2009) and Iacoviello and Neri (2010) demonstrate that the introduction of sticky nominal wages helps resolve the comovement problem,[3] we incorporate sticky wages into our estimation to avoid the concern that the degree of non-separability might be over-estimated if they are not included. Our estimates of the intertemporal elasticity of substitution are well below unity suggesting that the data favor non-separable preferences. Furthermore, the Bayesian model comparison favors the model with the non-separable preferences over the one with the separable preferences, unless one has an extremely strong prior belief about the separable preferences. This implies that non-separable preferences should be seriously considered an important ingredient to a two-sector sticky price model.

Finally, we demonstrate that non-separable preferences alone successfully resolve the comovement problem associated with monetary shocks in our estimated model without relying on sticky wages. The estimated degree of non-separability is strong enough to produce an expansion in the durable sector as well as the nondurable sector in response to an expansionary monetary shock.

Our empirical results complement the previous studies by Basu and Kimball (2002) and Guerron-Quintana (2008), who also report evidence against the separable preferences. However, our empirical specification differs from theirs in two ways. While their empirical specifications abstract from durable spending in estimating the intertemporal elasticity of substitution, we explicitly incorporate durable spending in the estimation. The earlier studies use the limited information approach. Basu and Kimball (2002) employ a method of moments on the Euler equation and Guerron-Quintana (2008) uses a minimum distance estimator. Instead, we employ the full information approach that explores the full range of empirical implications conveyed by the model. The full information approach enables us to investigate whether non-separable preferences not only generates a realistic response of the model in response to a monetary shock, but also improves the overall fit of the model.

Why is the complementarity between nondurable consumption and labor, implied by non-separable preferences, a key for the model generating the comovement in response to a monetary shock?[4] This stems from the fact that the complementarity significantly affects the reaction of a nominal wage to a monetary expansion. Following such an expansion, the nominal wage tends to rise because nondurable-goods producing firms raise the demand for labor inputs to meet their increased demands due to sticky prices. For producers in the flexibly priced durable sector, the increase in factor price is merely an adverse cost shock. Unless there are forces offsetting the rise in the cost of production, the flexible-price sector contracts. However, the complementarity between nondurable consumption and labor supply mitigates the rising pressure on the nominal wage since the increase in nondurable consumption shifts the labor supply curve out. Hence, if the degree of complementarity is large enough, production in the durable sectors could rise.[5] Variable capital utilization in turn strengthens the effects of the complementarity on offsetting a rise in the nominal wage, so that it expands the range of the non-separability consistent with the sectoral comovement.

The remainder of the paper is organized as follows. Section 2 describes a two-sector sticky price model that includes nondurable and durable goods. Section 3 presents an analytical treatment that provides insight into why the non-separable preferences can solve the comovement problem. Section 4 estimates a two-sector sticky price model using a Bayesian approach to show that non-separable preferences are supported by the data and significantly improves the overall empirical performance of the model. It also demonstrates that our estimated model with non-separable preferences generates the sectoral comovement in response to a monetary shock. Section 5 concludes.

2. The model

In this section, we extend the two-sector sticky price model of Barsky et al. (2003, 2007) by incorporating non-separability between aggregate consumption and labor, and by introducing variable capital utilization.

The economy is populated by a constant number of identical, infinitely-lived households, continua of firms in two sectors that respectively produce differentiated durable and nondurable goods, perfectly competitive final goods firms in two sectors, and a monetary authority.

[3] Barsky et al. (2003, 2007) and Carlstrom and Fuerst (2006) also suggest the introduction of a sticky nominal wage as one possible solution to the comovement problem.

[4] The non-separability between aggregate consumption and labor also implies that the service flow from durable goods and labor are complementary. However, the complementarity between the consumption of durable services and labor has little impact on the behavior of the model. It is because the stock of durable goods changes so slightly following the monetary shock as Barsky et al. (2003, 2007) show.

[5] Barsky et al. (2003, 2007) briefly discuss the possibility that the complementarity between nondurables and labor might temper the negative comovement problem, but have never explored it formally.