Adding Bond Funds to M2 in the P-Star Model of Inflation

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Abstract

During the early 1990s, M2 growth has been unusually weak and the P-Star model has underpredicted inflation; at the same time, bond funds have grown rapidly. We find that the P-Star model performs well recently when M2 is adjusted for bond funds.

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The P-Star framework of Hallman, Porter, and Small (1991) models inflation as a long-run function of M2 growth in excess of trend potential output growth. More formally, the P-Star error-correction model is:

$$d[\pi_t] = \beta_1[p_{t-1}-p^*_{t-1}] + \beta_2 d[\pi_{t-1}] + \beta_3 d[\pi_{t-2}] + \beta_4 d[\pi_{t-3}] + \beta_5 d[\pi_{t-4}], \quad (1)$$

where $\pi \equiv$ inflation (GDP implicit deflator), lower case letters denote natural logarithms, $P \equiv$ price level, $P^* \equiv$ the long-run (equilibrium) price level, $p^*_t \equiv m2_t + v^*_t - y^*_t$, $V^* \equiv$ M2's long-run velocity, $Y^* \equiv$ potential real output (Federal Reserve Board data), and $d[\ ] \equiv$ the first difference operator.

A major criticism of the P-Star model is that it assumes that the velocity of M2 is stable, implying that the inflation rate increases one-for-one with M2 growth in the long-run [see Christiano (1989) and Kuttner (1990) for criticisms of the P-Star model]. Recent events have justified this concern, which is the focus of our study. In particular, M2 has recently been unusually weak, giving rise to a case of missing M2 [see Duca (1993)] and leading the Federal Reserve (1993) to de-emphasize M2 as a guide to monetary policy. Anecdotal reports and new evidence [e.g., Duca (forthcoming)] suggest that unusual factors such as shrinkage of the thrift industry and a very steep yield curve have induced shifts from M2 deposits to bond mutual funds, and show that money models better explain bond-fund-adjusted M2 than M2. Since most bond funds invest in low risk bonds and allow shifts of assets into checkable money market mutual fund accounts, bond funds are good substitutes for M2 balances, particularly small time deposits.

Likely reflecting the case of the missing M2, the P-Star model has been underpredicting inflation during the early-1990s. This raises the question, would the P-Star model perform better if M2 were adjusted for bond mutual funds? In addressing this question, this study briefly describes the bond fund data used and then assesses the expanded M2 aggregate using ex post forecasts.

1. Bond Fund Data

The bond fund-adjusted M2 series used (M2B) is that of Duca (forthcoming), which is based on raw data from the Investment Company Institute (ICI). Just as M2 excludes IRA/Keogh assets and institutional holdings of money market mutual funds, M2B excludes IRA/Keogh bond fund assets and institutional holdings of bond fund assets. Details on the data are available upon request from the authors. Because the ICI data are end-day-of-month, data for months t and t+1 were averaged to form a month-average level for month t+1. Month averages were seasonally adjusted using X'11 and were then added to seasonally adjusted M2 month averages to form the series M2B. Quarterly data on M2 and M2B were then used to estimate equation (1).

2. Empirical Results

Implied ex post forecasts of inflation over 1992:Q1-93:Q2 are based on forecasts of changes in inflation from equation (1) using average velocities for M2 and M2B over an in-sample period 1959:Q2-91:Q4. The starting date reflects that money is lagged one quarter and the official M2 series begins in 1959:Q1. As Figure 1 shows, the P-Star model based on M2 implies severe underpredictions of inflation, whereas implied forecasts based on M2B track the GDP implicit deflator quite well. Over 1992:Q1-93:Q3, annualized inflation averaged 2.7% compared to average forecasts of 0.6% from the M2 model and 2.6% from the M2B model. In addition, the forecast using M2B (.0005) has a much smaller S.S.E. than that using M2 (.0043).

The better performance of the P-Star model using M2B in recent quarters is also reflected in the in-sample fits as sample periods are extended to recent quarters. As shown in Table 1, the P-Star model using M2 has a noticeably higher R^2 (.349 versus .319 for M2B) over 1959:Q2-91:Q4. However,

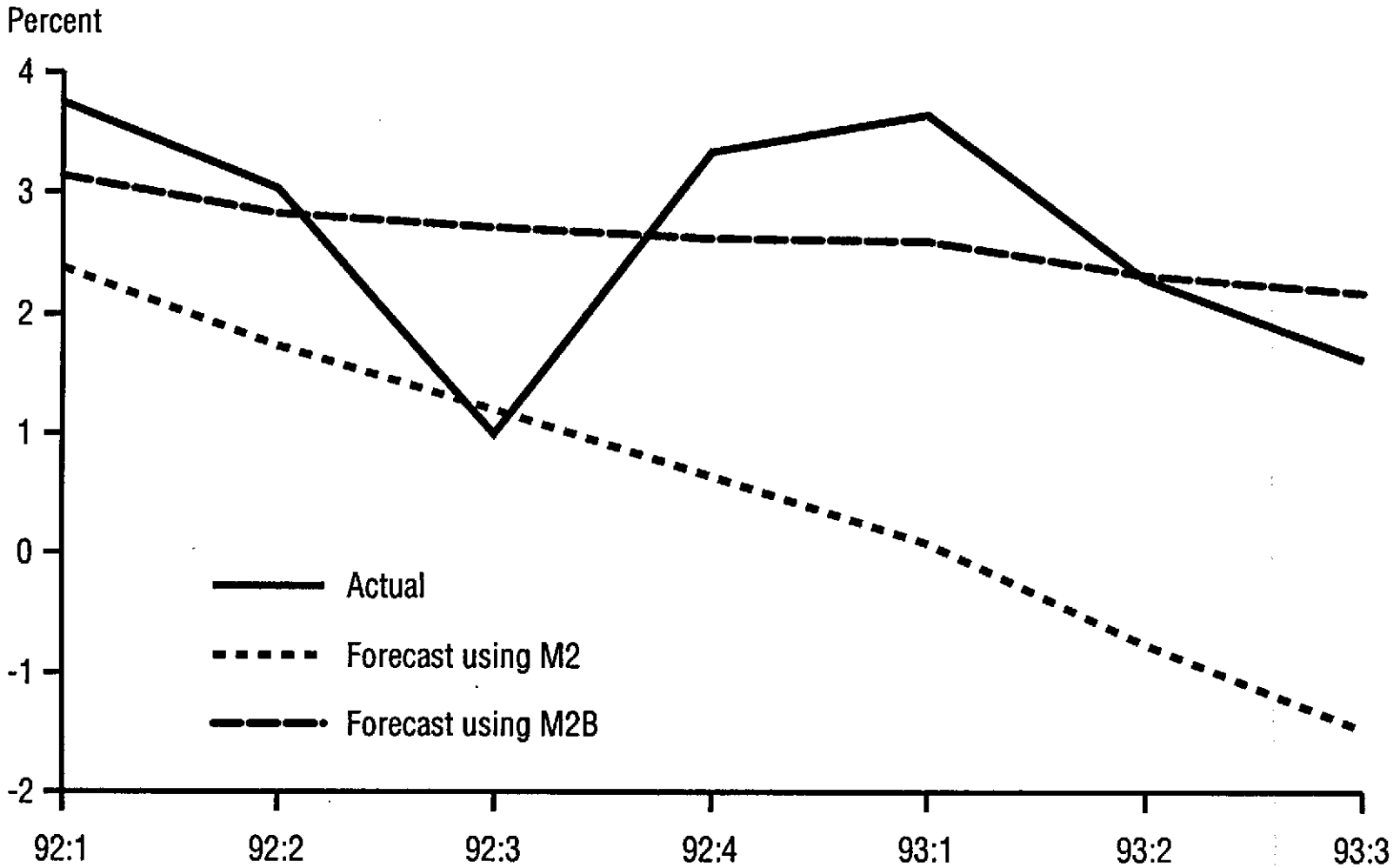

Fig. 1. Actual inflation and inflation forecasts using the P–Star model.

this advantage diminishes as the sample is extended through 1993:Q3, with the corrected R^2 of the M2 model falling to .341 and that of the M2B model rising to .326. Consistent with these results, the error correction coefficient falls noticeably as the sample is extended using M2, suggesting a break in the long-run relationship between prices and M2. [Estimated coefficients for the M2 model over 1959:Q2-91:Q4 are similar to those of Christiano (1989).] By contrast, no decline in the error-correction coefficient occurs for M2B.

The change in the relative fits of the models using M2 and M2B as sample periods are extended reflects differences between the two periods when bond funds grew rapidly (the mid-1980s and early-1990s). Flow of funds data and anecdotal evidence suggest that the surge in bond funds during the mid-1980s reflected shifts more from direct bond holdings than from M2, whereas the rapid growth of the early-1990s primarily reflected substitution out of M2. As a result, the relatively stronger growth of M2B in the mid-1980s causes the P-Star model to overpredict inflation using M2B in the later-half of the 1980s, while the relatively stronger growth of M2B in the early-1990s causes the P-Star model to better track inflation in recent quarters using M2B.

3. Conclusion

Mirroring the recent breakdown in the demand for M2, the P-Star model recently has been underpredicting inflation. Adding bond funds to M2 produces a monetary aggregate which not only is better explained by money models [Duca (forthcoming)], but also yields better forecasts of inflation in recent quarters. These results and past redefinitions of M2 to include new financial instruments (Figure 2) imply that the usefulness of money-based forecasting models (such as P-Star) critically depends on adjusting the models for financial innovations that cause historical relationships to change.

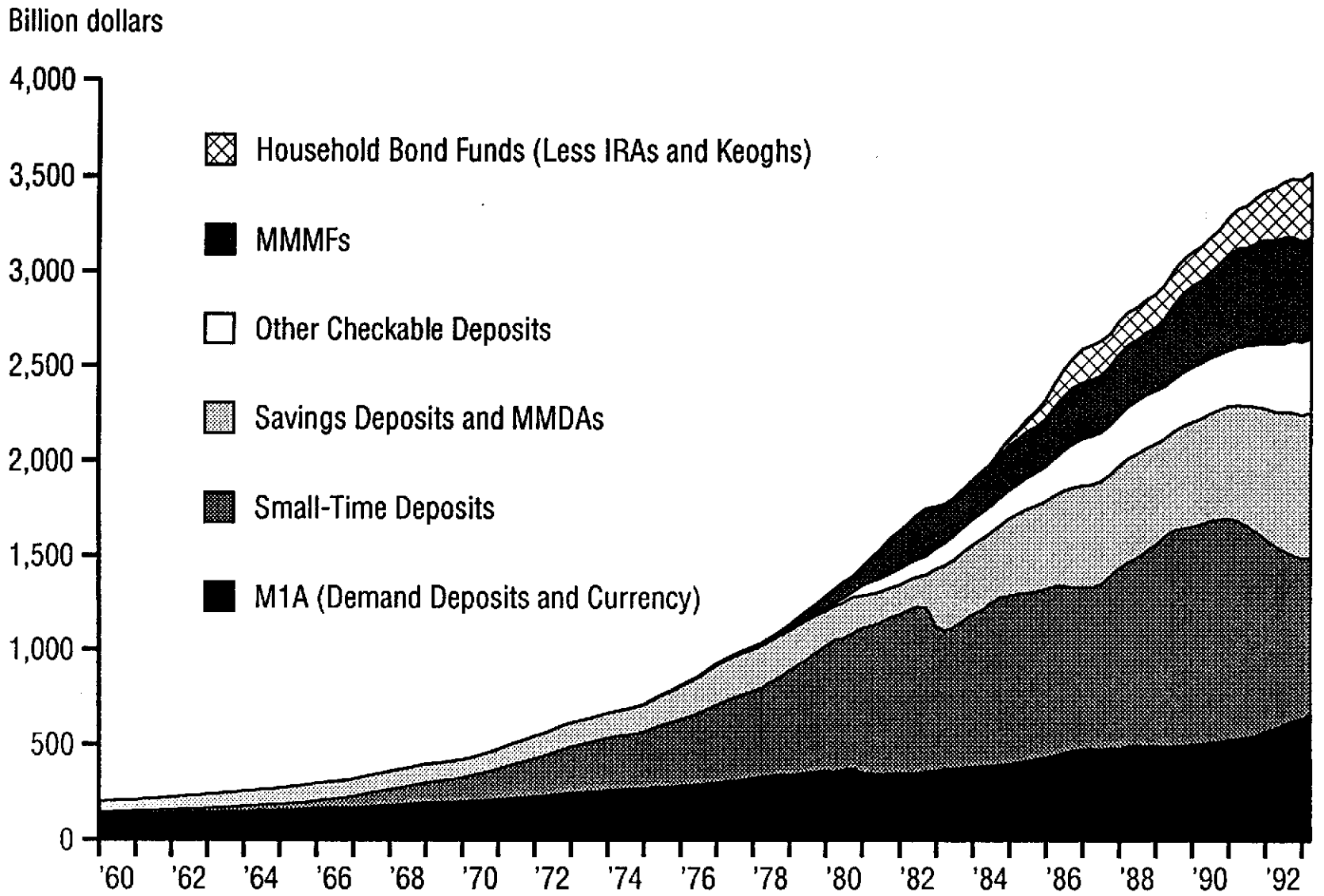

Fig. 2. Major M2 components, including bond funds which currently are not in M2.

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Table 1: Estimating the change in inflation ($d\pi_t$, implicit GDP deflator) (P-Star model using sample periods: 1959:Q2-93:Q3 and 1959:Q2-91:Q4)

	Model (Sample)			
Variables	M2 (59:2-93:3)	M2 (59:2-91:4)	M2B (59:2-93:3)	M2B (59:2-91:4)
$[p-p^*]_{t-1}$	0.0301**	0.0356**	0.0261**	0.0257**
	(4.18)	(4.42)	(3.76)	(3.62)
$d[\pi_{t-1}]$	-0.6714**	-0.6784**	-0.6554**	-0.6500**
	(-8.07)	(-7.98)	(-7.84)	(-7.55)
$d[\pi_{t-2}]$	-0.4247**	-0.4197**	-0.4045**	-0.3827**
	(-4.39)	(-4.24)	(-4.17)	(-3.83)
$d[\pi_{t-3}]$	-0.1875	-0.1869	-0.1655	-0.1563
	(-1.96)	(-1.91)	(-1.72)	(-1.58)
$d[\pi_{t-4}]$	0.0093	0.0078	0.0281	0.0264
	(0.11)	(0.09)	(0.34)	(0.31)
$\bar{R}^2$	0.341	0.349	0.326	0.319
Durbin-h	-0.279	-0.260	-0.206	-0.019
Q(12)	10.74	9.97	7.47	7.50
Q(24)	20.67	21.88	17.17	18.09

** indicates significance at the 1% level.
Notes: The figures in parentheses are t-ratios.

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