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Tyler Cowen

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TYLER COWEN

## Should Central Banks Target CPI Futures?

I consider recent proposals that the government should attempt to stabilize the nominal value of a CPI futures contract. Under a variety of conditions arbitrageurs will break the peg and bankrupt the central bank, the central bank ends up in a gaming problem with private traders, or the regime collapses into discretion.

SOME ECONOMISTS RECENTLY HAVE SUGGESTED that the central bank target a comprehensive futures price index. Under these proposals, the central bank would attempt to peg the nominal price of a CPI futures contract, and in doing so, would provide an anchor for the price level. When reduced to their fundamentals, explained in more detail below, these plans require the central bank to trade futures contracts with the private sector and thus to make cash bets on the future course of spot prices. These cash bets supposedly bind the central bank to achieving prespecified spot price targets and institute a regime of rules rather than discretion.

The idea of futures price targeting seems to have originated with Barro (1979), although he does not advocate such a policy. Advocates of futures price targeting include Sumner (1989, 1992, 1995), Glasner (1989), Hetzel (1990), Woolsey (1992, 1994), Dowd (1994), and Sumner and Woolsey (1995). Closer to mainstream practice, central banks have been paying increasing attention to futures prices as indicators of inflation, even if they do not target such prices as a policy rule.<sup>1</sup>

CPI futures price targeting attempts to circumvent the impact and measurement lags associated with stabilizing spot CPI prices. CPI futures prices react immediately to new information and can be read without delay (as we will see below, however, these advantages may be problematic). Sumner (1992, p. 491) notes: “the profession continues to advocate a wide variety of policy proposals that would appear to be dominated by index futures convertibility.”<sup>2</sup>

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1. Glasner (1989) attributes his version of the idea to Earl Thompson of UCLA. The version recommended by Woolsey also incorporates free banking. Sumner (1989) emphasizes that the futures targeting proposal also can be applied to nominal GNP, or any other nominal target, rather than the price level.

2. Sumner (1995, p. 91) provides a comprehensive list of the benefits available from futures price targeting.

TYLER COWEN *is professor of economics at George Mason University.*

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CPI futures targeting avoids some of the drawbacks of commodity bundle standards. Commodity bundle monies are limited to those few commodities that are easily defined, homogeneous in quality, traded in highly liquid markets, and easily stored (Friedman 1951). Futures targeting, in contrast, can cover the entire array of goods found in today's consumer price index without requiring direct convertibility. The futures bundle can be highly diverse, and can measure actual purchasing power closely. The chosen index can include the prices of items that are illiquid or not easily stored, such as services and perishable commodities.

Following many futures contracts today, CPI futures would use "cash settlement." Rather than delivering the CPI bundle itself, traders would deliver a value-equivalent amount of cash, T-Bills, gold, or whatever other settlement asset is specified. The value of the futures contract, at expiration, is defined as equal to the value of the spot index. In this manner the futures contract can be settled without requiring actual delivery. In effect, futures contract traders are making cash bets on the future level of the CPI.<sup>3</sup>

In this essay I wish to flesh out the mechanics of futures price targeting. Specifically, plan proponents have not provided a systematic account of the arbitrage opportunities that private traders may hold against the central bank, and how the central bank must act to limit such opportunities. It turns out that futures price targeting is not sustainable under all conditions. I do not question whether price level stabilization is desirable, or whether the central bank should forsake monetary discretion. I take the implementation and goals of the plan as given, and consider whether the plan provides a feasible monetary regime. Section 1 describes the proposals in more detail. Section 2 presents the core of the critical analysis and considers the gaming problem between traders and the central bank, under a variety of assumptions. Section 3 considers whether the proposal dominates traditional spot price level targeting.

## 1. HOW THE SYSTEM WORKS

The central bank promises to open up long or short positions in CPI futures at a preannounced nominal price. With the central bank willing to take either side of the contract at a given price, no trader will contract for any other price. Traders either will contract with the central bank, or will contract with each other at the central bank's price.<sup>4</sup>

Ongoing maintenance of the futures peg implies that the bank periodically pegs

3. On the rich menu of contracts available with cash settlement, see Rubinstein (1989). Yeager and Greenfield (1989) use cash settlement to support a commodity bundle unit of account, although they do not specify the inclusion of futures in the bundle. On indirect convertibility in commodity bundle systems, see Schnadt and Whittaker (1993) and Cowen and Kroszner (1994, chapter 3). Barro (1979) seems to have traditional delivery-based commodity futures in mind for his peg; to that extent his plan does not stabilize the CPI. Webb (1988) provides evidence that commodity prices are relatively poor predictors of CPI inflation.

4. The central bank must promise to create new trading positions; buying and selling existing contracts does not suffice to peg the price. Buying a long position, for instance, need not push up the price of the contract, but only transfers the right to eventual settlement from one party to another. If the market for the contract is perfectly liquid, as in standard financial theory, the demand curve for the contract will be horizontal. Buying and selling already existing contracts will not influence market price at all.

the level of spot CPI prices. The central bank will try to periodically (by each contract expiration) push spot prices to the prespecified level of the futures peg. Otherwise the futures contract, at expiration time, will be defined to equal some level other than the specified peg. (Cash settlement contracts require a definitional convergence of the futures price to the spot index, as explained above.) The maintenance of the first peg, the futures peg, therefore depends upon the success of the second peg, the periodic targeting of spot prices.

Although CPI futures targeting involves periodic attempts to peg spot prices, the futures component of the plan is not superfluous. First, the futures contract ostensibly creates a self-regulating money supply, based on market expectations about the forthcoming price level. Second, the presence of futures trading affects the incentives of the central bank. Both of these points will be discussed in further detail below.

CPI futures targeting does *not* require that market participants have an independent demand to trade futures based on a broad commodity bundle. Under the proposed regime the demand for contracts can be zero in equilibrium, that is, when the central bank is expected to meet its periodic price level target. The central bank announces a “ghost” futures peg and pegs the spot price level periodically to that same level. The spot price level peg insures determinacy, even if volume in the CPI futures market is zero.<sup>5</sup>

The CPI futures market plays a critical role when the expected future price level deviates from the announced peg. Net private sector demands for long or short positions arise when traders expect the bank to miss its spot price target in a particular direction. CPI futures trading will be motivated by arbitrage profit. Assume, for instance, that spot prices suddenly are expected to come in below the announced target at the time of contract expiration. The futures price is expected to fall in nominal value, and at the time of contract expiration the futures peg will be broken. Traders will demand short positions and the central bank must take the corresponding long position at the prespecified price. If the price level falls short of the target, the futures peg breaks at contract expiration and shorts make money at the expense of the central bank.

The converse case holds if traders expect the bank to produce a spot price level above the announced futures target. Traders will go long at the prespecified futures prices and the central bank will be required to take the corresponding short position. If the spot price level comes in above the target, long positions will profit at the expense of shorts, as the futures contract rises in value at expiration.

### *Money Supply Mechanics*

CPI futures targeting attempts to create a self-regulating money supply (Sumner 1989, Dowd 1994). Traders, when they contract short positions, receive due funds from the central bank immediately, thereby expanding the money supply. Similarly,

5. CPI futures contracts have been proposed numerous times by economists (for example, Friedman 1984), but have not caught on with market participants. Various attempts at CPI or inflation futures have been started and then abandoned for lack of trading interest. See Horigan (1987) and “Price Index Futures: In the Grave of Academe?”

longs must make full immediate payments to the central bank, thereby contracting the money supply. These changes in the money supply last until outstanding positions are settled, at which point the payments made at contract settlement reverse the initial contraction or expansion.<sup>6</sup>

According to plan proponents, market expectations determine changes in money supply growth and thus the price level. If traders believe that the bank is too tight with money (that is, the bank will undershoot the spot target), they will take short positions, causing the money supply to expand. If traders believe that the bank is too loose with money (that is, the bank will overshoot the target), the demand for long positions will cause the money supply to tighten. These expansions and contractions of the money supply continue until traders believe that the central bank is on target to achieve the prespecified price level. (Further below I argue that central bank discretion will in fact remain, but I am expositing the system as it has been proposed.)

The self-regulating money supply requires that the central bank be willing to take an unlimited number of either long or short positions. If the central bank limited the number of positions it was willing to take, private demands for long or short positions beyond that level would no longer call forth the appropriate money supply adjustments. Furthermore, without unlimited central bank willingness to trade contracts at the par price, the futures peg would collapse and the system could not meaningfully be described as CPI futures targeting. The central bank also would be vulnerable to speculative attack if traders knew that a temporary peg would not last.

CPI futures targeting attempts to bring the knowledge of the private sector to bear on price level targeting. If the private sector expects the bank to miss the target, the private sector trading behavior induces the money supply to expand or contract. If the central bank unexpectedly misses the target the self-regulating money supply does not induce an adjustment, but neither can the private sector trade against the central bank for arbitrage profit (by definition the central bank "mistake" is unexpected).

The self-regulating money supply provides a corrective mechanism only if temporary increases (decreases) in the money supply do in fact induce inflationary (deflationary) pressures. According to Modigliani-Miller approaches to monetary theory, a temporary issue of new money, combined with a retirement obligation, places no upward pressure on the price level (Smith 1984, 1988). The issue of money is saved to pay off the future repurchase liability, as in Barro (1974). CPI futures targeting requires that the traditional quantity theory, rather than the Modigliani-Miller approach, applies to this kind of "repurchase money."<sup>7</sup>

The postulated arbitrage equilibrium may be problematic for another reason as well. Even if traders expect spot prices to deviate from the announced target, they still may not perceive available arbitrage profits. When traders pursue arbitrage profits, they (collectively) prompt money supply changes that eliminate those profits. Even the first trader to take an initially favorable long or short position will earn

6. Sumner (1989) calls for expansionary open market operations to accompany private sector demand for short positions, rather than paying shorts immediately. This suggestion produces money supply behavior similar to the self-regulating case.

7. For some relevant defenses of the quantity theory, see McCallum (1983), Hoover (1988), and Cowen and Kroszner (1994, chapter 3).

no profits, once other traders follow. Why, then, should any single trader pursue an apparent arbitrage opportunity?

When the costs of trading are zero, pursuing the apparent arbitrage profits may represent a Nash equilibrium. If no one pursues the profits, an individual can gain by deviating and trading with the central bank. Equilibrium becomes more problematic, however, if we consider trading costs, even if they are small. With positive costs of trading potential arbitrageurs might stay away altogether, might choose a mixed strategy with some probability of trading against the central bank, or might trade only when the potential arbitrage profits exceed the costs of trading.

None of these strategies guarantees a self-regulating money supply that will produce the appropriate spot price level target. If all traders stay away, no arbitrage occurs at all. The mixed strategy equilibrium is sustainable only if traders (rationally) expect some probability that arbitrage profits will not be competed away, that is, some probability that the self-regulating money supply will fail to work. The third alternative, partial arbitrage entry, places costs on the central bank. Assume that trading a contract costs one dollar. If the peg is set at 100 and the expected level of spot prices falls to 98, traders might take short positions, inducing a money supply expansion, until expected spot prices rise to 99. At expiration time traders' capital gains will cover the costs of trading, giving traders the going rate of return. The central bank, however, suffers capital losses and in effect picks up the costs of trading. If the number of traders is large, the central bank could face an onerous fiscal burden.

Proper operation of the self-regulating money supply also requires that the central bank set appropriate fees for futures transactions. The central bank must offer compensatory interest payments for long positions, and extract compensatory fees for short positions. Consider the situation of contract longs, remembering that the longs pay the full price of the contract to the central bank up front. The futures long position offers a nominal return of zero, replicating the pecuniary risk-return position of currency. Unless the futures are as liquid as currency (unlikely), the demand for long positions will not materialize without a compensatory *ex post* interest payment at market levels (Dowd 1994, pp. 829–30). Conversely, fees must be applied to short positions, otherwise the central bank would be offering unlimited loans at a zero nominal rate of interest.

The necessity for these payments and fees introduces an additional discretionary element to the system. The self-regulating money supply will depend not only on traders' expectations of the future price level, but also on the level of payments and fees set by the central bank. Only if these payments and fees exactly track market interest rates, after the appropriate adjustments for risk, can the central bank take a fully neutral position with regard to the money supply. More likely, the central bank would hold some discretionary power over these payments and fees, and would use that discretion to protect itself against successful private traders (more on this below).

## 2. ARBITRAGE AND GAMING PROBLEMS

Monetary policy typically operates with lags and does not deliver its full effect on prices immediately. The presence of these lags creates a problem for CPI futures

targeting. At some point the self-regulating money supply can no longer influence the value of a given CPI futures contract. (At the end of this section I consider whether sufficient drastic money supply adjustments might eliminate the lag.) Therefore even a single central bank mistake—if the private sector can recognize that mistake *ex post*—can cause the system to break down. The central bank can use trading suspensions to protect itself against such mistakes, but only at the cost of creating a gaming problem between itself and private traders.

*The Cost of Central Bank Mistakes: Who Moves Last?*

To specify some implementation and reporting lags, assume that the central bank offers a contract every quarter, that it takes one month to measure the CPI, and that monetary policy takes six months to influence the price level. When the September contract expires at the end of the month, we are measuring the CPI from the end of August, and we are observing the effects of monetary policy up to and approaching March 1, six months before the end of August.<sup>8</sup>

At any time after March 1, the central bank, and the self-regulating money supply, cannot influence the value of the September contract. Traders can exploit this lag to their profit if they can see where the price level is heading. Between March 1 and September 31 the revelation of new information may suggest that the central bank will exceed (or undershoot) the stated target. Speculators will attempt to forecast the CPI measurement due for announcement at the end of September, for instance.

If traders can see that the CPI will come in low, they will have an unbounded demand to take short positions and the central bank will be required to take the corresponding long position. Once the CPI announcement arrives and the futures contract settles below par, all traders will gain at the expense of the central bank. The central bank either must declare bankruptcy or cease to operate the system.<sup>9</sup>

Traders may not always outguess the central bank, but traders need only catch a single (uncorrectable) central bank mistake for this problem to arise. By March 1 the bank must make a final stab at hitting the CPI measurement announced in September. After that point the central bank is vulnerable to the arbitrage activities of private traders.

To avoid this problem, the central bank might suspend contract trading once monetary policy can no longer influence the price level (Woolsey, personal correspondence). In the example given we could assume the central bank suspends trading in the September contract on February 1. We are allowing the central bank to “move last” and to conduct its final and decisive acts of monetary policy while contract trading is suspended.<sup>10</sup>

8. I specify these numbers for the purpose of constructing an example. A more realistic choice of parameter values would probably involve longer lags, but longer lags would not favor CPI futures targeting. According to Bernanke and Gertler (1995, p. 31), money has virtually no influence on prices for at least a year.

9. A third possibility arises if the central bank or government can peg all other real rates of return in the economy to the rate offered by private arbitrage against the central bank. I assume such a peg is not possible, or at the very least is undesirable.

10. Along related lines, Dowd (1994, personal correspondence) suggests that for a given contract

Allowing the central bank to move last, however, allows the bank to take advantage of traders and returns us to policy discretion. Taking a single contract, consider the constraints on monetary policy in each segment of time. After March 1 the September contract peg clearly does not constrain the central bank; monetary policy after that date does not even affect September prices. Between February 1 and March 1 the central bank also can act without facing constraints from CPI targeting. Trading in the September contract has ceased, and the central bank need not worry about failing to meet spot and futures targets for that month.<sup>11</sup>

In the period before February 1 the equilibrium is either indeterminate or is characterized by central bank discretion. Consider the favorable position held by the central bank vis-à-vis private traders. Traders know that the central bank possesses a final, unfettered period in which to manipulate the price level (the month of February). Prior to February, private traders may be reluctant to bet against the central bank. Assume that it appears in early January that the central bank will overshoot the September target. If all traders take long positions, they face the danger that the central bank will contract the money supply sharply in February, leading to heavy central bank gains and private sector losses. The central bank could even attempt to trick the private sector into believing that it will miss the periodic spot target in one direction, encourage a net private sector position, and then overshoot the spot target in the other direction, profiting at the expense of traders. In short, party A may be reluctant to trade against party B when party B has the final control over the settlement price. Central banks do not always behave dishonestly, but CPI futures targeting was motivated by the view that discretionary central banks are untrustworthy.

Contract suspension opens up a discretionary window to the central bank and raises the question of the bank's incentives. If the bank has independent residual claimant motivations [the free banking scenario of Woolsey (1994)], or if the central bank seeks to maximize its budget, the private sector will be wary of trading prior to February.

Even if the central bank can credibly forsake the possibility of deliberate manipulation, CPI futures prices prior to February 1 no longer perform their desired role. In the original conception of the plan, CPI futures prices signaled the private sector's expectations of how well the central bank is doing its job in targeting spot prices, and provide valuable information about the expected course of the spot price level. When we create a discretionary period by contract suspension, pre-February CPI futures prices will instead signal what kind of discretionary monetary policy the pri-

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cycle the peg be applied at only a single point in time, again presumably before March 1 in the example under question.

11. The reader may wonder whether *future* contract cycles, after September, may constrain the behavior of the central bank in these periods. The role of these future contract cycles is analogous to the role of the September contract cycle in influencing the pre-February 1 period, which is discussed directly below. We can imagine a modified version of CPI futures targeting where the central bank faces additional constraints during these contract suspensions; the government, for instance, could impose a money supply or price rule on the bank. Three points then apply. First, the true constraints come from the supplementary rules and the policy regime should be evaluated as such. Second, overlapping contract cycles could make these supplemental rules perpetual rather than temporary. Third, CPI futures targeting presumably is motivated by the inadequacies of such rules.

vate sector expects to occur in February. The central bank will be looking at no more than the private sector's estimation of its own subsequent discretionary actions.

Alternatively, we might constrain central bank discretion by other means, such as by price or money supply rules. In this case the relevant stability comes from these external constraints, and not from CPI futures targeting. The case for maintaining CPI futures targeting is not strong. We could keep the external constraint to limit central bank discretion, and dispense with the complexities of CPI futures targeting. The informational benefits of futures targeting could be reaped by indexed bonds, as discussed in the final section below. CPI futures targeting is motivated by the view that price level and money supply rules do not work well, but we cannot have it both ways. If such rules cannot halt discretion in normal circumstances they also cannot halt discretion when CPI futures trading is suspended.

To sum up the example, partial suspension of contract trading creates three relevant periods: after March 1, between February 1 and March 1, and before February 1. The first two periods involve no constraints on central bank behavior at all, and the third period creates undesirable problems of gaming, without eliminating central bank discretion.

We might try to limit central bank discretion by allowing neither traders nor the central bank to move last. Trading in the contract could cease at exactly that moment when the final effective dose of monetary policy is applied; in the above example, trading would cease on March 1. The two players, traders and the central bank, would then move last simultaneously. Such a proposal, however, involves serious practical difficulties. First, the lag time of monetary policy usually cannot be identified with certainty. In practice either the central bank or the traders will end up with the last move. Second, contract trading can be halted instantaneously but a given series of monetary policy maneuvers takes some time for implementation. Again, one party or the other will end up moving last. Third, the system will collapse if private traders outguess the central bank even occasionally in the final period. Contract demand will be unbounded in the final instant of trading if the private sector has superior ex ante information.

#### *Drastic Money Supply Adjustments and No Monetary Policy Lag*

Under an alternative equilibrium, sufficiently drastic money supply adjustments might eliminate the lag of monetary policy. Assume, for instance, that the price level is expected to undershoot the relevant target for next month, inducing arbitrageurs to contract with the central bank. The resultant money supply adjustment might be sufficiently large to offset the lag of monetary policy. Even if the money supply lag is normally six months, a money supply increase of 50 or 100 percent might bring a substantial increase in prices over a shorter time horizon.

This alternative equilibrium does not eliminate the fundamental problems with CPI futures targeting. First, some lag will always remain, if only because of delays in reporting prices and constructing the CPI. The above arguments do not require

any particular length of time for the monetary policy lag. Second, extreme money supply adjustments over short time horizons would bring considerable short-term volatility in real and nominal interest rates and in financial liquidity. If we take seriously the idea of a volatile monetary policy with no lag on prices, the economy will experience comparable short-run volatility in the price level as well, with prices fluctuating above and below the final target level before the onset of contract expiration.

### 3. COMPARISON WITH STANDARD SPOT PRICE TARGETING

The problems faced by CPI futures price targeting exceed those faced by standard spot price targets. Standard price targeting allows that monetary policy may have long and variable lags, and that the target will be achieved only roughly. The central bank expects to miss the spot target by some amount, and faces no negative repercussions from arbitrage in a futures market. Private traders cannot profit at the expense of the central bank, given that the central bank has made no commitment to trade in CPI futures.<sup>12</sup>

CPI futures targeting supposedly creates useful information about the future course of the price level and applies financial incentives to the central bank, but upon closer examination neither mechanism works as promised. CPI futures, by creating a mechanism for bringing private information to bear on monetary policy, also create a mechanism for the private sector to exploit central bank mistakes. The financial incentives of the central bank, rather than inducing price level stabilization, instead give the bank an incentive to manipulate the expectations and trades of the private sector, as discussed above.

Traditional spot price targeting can apply pecuniary incentives to the central bank if such incentives are found to be desirable. The central banker could receive a pay increase for hitting the appropriate target, the central banker could lose his or her job for missing the target (as in New Zealand), or the bank could be given a fixed nominal budget to discourage inflation. Each of these contracts applies incentives to the central bank without opening the bank up to unlimited arbitrage losses or giving the bank the power to manipulate private trading.<sup>13</sup>

The informational advantages of CPI futures trading also can be replicated by less complicated and less precarious institutions. Indexed bonds, as we find in the United Kingdom and perhaps shortly in the United States, allow the central bank to capture the market's expectations of inflation, without creating the gaming and arbitrage problems involved with CPI futures targeting.

I do not intend these concluding remarks as a plea for spot price targeting or for indexed bonds. Spot price targeting and indexed bonds involve well-known costs

12. There is one case when private arbitrageurs might profitably trade against a central bank intent on stabilizing the price level. If real rates of return in the economy turn negative, the central bank is offering an asset, currency, with an above-market real rate of return. See Cowen and Kroszner (1994, chapter 3).

13. See Cowen (1991) for a further consideration of such incentive contracts.

and benefits, and I do not address the relevant debates in this paper. The weight of the arguments, however, does indicate that spot price targeting, combined with indexed bonds, dominates the CPI futures plan.

Implementation of CPI futures price targeting would most likely collapse into a regime of monetary policy discretion. First, the central bank holds considerable discretion once we allow for discretionary fee-setting (see section 1) and suspensions of contract trading (see section 2). Central bank discretion will increase even more if private traders treat contract trading as a gaming problem rather than as a straight-forward equilibrating mechanism.

Second, if central bank mistakes are caught by the private sector, the central bank must sooner or later refuse to honor its futures contracts commitments. The bank, for instance, might adjust settlement prices or its compensatory fees ex post to protect itself from trading losses. Over time regulatory conventions likely would evolve to limit the ability of private traders to trade with the bank, for the protection of *both* parties. CPI futures targeting, when viewed in this evolutionary perspective, still represents a viable policy option, but such a system would not eliminate monetary discretion or cure the perceived problems with current institutions.

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