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ASSESSING STATE RESERVE REQUIREMENTS: AN OPPORTUNITY COST  
APPROACH — Reply

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In his article, "Assessing State Reserve Requirements: An Opportunity Cost Approach," [5] Professor Lynch contends that in our 1978 article [3] we misspecified the conceptual definitions of the benefits and cost of holding state reserves. As a result, Lynch redefines the cost and benefits of holding reserves, in turn generating a new formula for measuring the optimum level of state reserves. In his critique, Lynch does not directly refute our concept of the benefits and costs of holding reserves either theoretically or empirically. Rather, Lynch criticizes our cost and benefit equations on the basis of what "seems" or does not seem to him to be the logical measure of the benefits and costs of reserve holdings. Consequently, Lynch provides not so much a critique of our model as he does an alternative method for measuring the benefits and costs of holding state reserves. Moreover, in response to this alternative, the question becomes one of which of the two measures is more accurate.

In general, Lynch follows our cost-benefit approach for determining the optimum level of state reserves. The differences in the two formulations lies not in terms of the methodology but rather in terms of the methods of measuring the specific parameters; that is, in measuring, as noted, the cost of holding reserves, the benefits of holding reserves, and the probability of needing (or not needing) reserves.

In the Lynch model, the benefits of holding reserves consist of two components; specifically (1) the interest earned on reserves,  $rR$ , times the regional multiplier (i.e.,  $[1/\text{MPS} + \text{MPM}]rR$ ); and (2) the political opportunity cost that is avoided by having reserves when they are needed,  $A$ , which he implicitly assumed to be proportional to reserves (i.e.,  $A = cR$ ).

Lynch's first benefit component is, in fact, included in our model as a component of our cost equation. That is, in our model, we measured the marginal cost of holding reserves by the foregone rate of return,  $r$ , lost to the state. Empirically, this was measured as the net difference between the long-term rate of return on capital,  $r^k$ , and the actual return obtained from holding reserves in short-term liquid securities,  $r^s$  (i.e.,  $r = r^k - r^s$ ). On the other hand, we measured the benefits of holding reserves in terms of the ability of reserves to

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buffer or protect the state's economy from the necessity of having to adjust to budget deficits. Theoretically, this was measured by the state's income multiplier weighted by the probability of a state reserve unit actually being used (i.e.,  $P[1/MPS + MPM]$ ). Finally, given the expressions for marginal costs and benefits, the optimum level of reserves was determined by equating the two expressions. Alternatively, we could have defined an expression,  $Z$ , which measured total benefit minus cost (i.e.,  $Z = P[1/MPS + MPM]R - [r^k - r^s]R$ ), and solved for the  $R$  which maximizes  $Z$ . Moreover, with this formulation, one can see that the  $r^s R$  term would be positive in the expression for  $Z$ . This, in turn, suggests that as the level of reserves increases, benefits, as measured by interest earned on reserves, will also increase. Hence, it can be stated that we do include the benefits of interest earned in our model.

The difference in Lynch's first benefit component and our  $r^s R$  term is that he multiplies the interest earned times the regional multiplier ( $1/MPS + MPM$ ), while we do not. However, by multiplying the interest earned by the regional multiplier, Lynch overestimates the benefits of holding reserves. That is, if state money was not held in reserves, it would still have to be held by someone. Therefore, even without reserves, such money would still be in the state, presumably in the private sector, working to multiply income. As such, it does not represent an exogenous stimulus to the state economy. The inclusion of the multiplier, therefore, serves to overestimate Lynch's estimate of the benefits of holding reserves.

Lynch's second benefit component, the political opportunity cost,  $A$ , is intended to be an implicit measure of dissatisfied state employees or unhappy taxpayers. However, other than stating that  $A$  is proportional to reserves,  $cR$ , Lynch does not offer any quantitative or objective measure for  $A$ . Moreover, without suggesting a measure for  $c$  or  $A$ , the reader is left with a rather nebulous concept. Thus, Lynch's second benefit component is unclear, primarily because of its level of generality. For example, if Lynch envisions a world where state governments hold reserves in order to avoid adverse political repercussions, then  $A$  could be measured in terms of a utility or disutility type model. In this case, his model could be patterned similar to the ones developed by Kelly [4] and Clark [1] for determining the optimum level of international reserves. This approach, however, would contain parameters which would not be easily quantified. Alternatively, it could be argued that the adjustment cost or our expression for the marginal benefits of holding reserves is a good proxy for quantifying the political opportunity cost. If this argument is maintained, then there would be no difference in our benefit equation and Lynch's second benefit component. The point is that Lynch's benefit expression is so general that either alternative could be applied.

In terms of the cost of holding reserves, Lynch uses as his measure the multiple income that is lost to the state by the fact that the state government is holding reserves and not spending them. However, the fact that many states hold their reserves in state banks suggests that reserves are augmenting state income by an amount dependent on the bank and expenditure multipliers; Lynch's holding cost equation is, therefore, redundant. The deficiency in Lynch's cost definition comes by way of treating reserves as a flow concept as opposed to a stock component. That is, reserves represent a monetary asset and, as such,

should be treated as a stock variable. Consequently, the cost of holding reserves should be in terms of the income foregone by not employing the reserve asset in some alternative use. In this respect, the holding cost should be in terms of  $rR$ .

Finally, Lynch measures the probability of needing reserves by a probability function that follows an exponential form. In our model, we delineated our probability function based on a random walk model. Moreover, the choice of a random walk model was based on evidence [7] which suggested that states use their reserves or surplus funds to meet random and unexpected contingencies such as floods and tornadoes and unexpected economic or political events. Moreover, it can be argued that our use of a random walk model was justified since such events tend to occur in a random fashion. Lynch, on the other hand, only asserts that his probability function follows an exponential form. However, he does not provide any basis for such an assertion.

In summary, there are a number of differences in the two models. However, the measurements for the holding cost of reserves perhaps best typifies the major differences between the two models. In particular, Lynch perceives of reserves as foregone expenditures and, thus, measures the benefits and costs of holding reserves in terms of flow variables. We, on the other hand, have treated reserves as an asset and, thus, we perceive the benefits and costs of reserves as being analogous to those factors which determine the precautionary motive for holding money. Hence, the major difference in the models is how reserves are treated--as either a stock or flow variable.

One final point should be noted. Lynch states that "since the social rate of return is usually measured by the current U. S. government bond rate, which is among the lowest of all interest rates, it is not inconceivable that the state could frequently if not always earn a higher rate of interest on its reserves than the social rate of return." Lynch is suggesting, therefore, that  $r^S > r^K$ . If this is the case, as he correctly notes, our model would be undefined. However, Lynch does not state whether the U. S. government bond rate is for short-, intermediate-, or long-term obligations--this oversight is critical. In particular, one can empirically use the long-term government bond rate for  $r^K$  and the short-term rate for  $r^S$ . Hence, the key to whether  $r(=r^K - r^S)$  is positive or negative depends on the "term structure" of interest rates. Moreover, there are three main theories concerning the maturities and yields of a given issuer's bonds--the Liquidity Premium Theory, the Expectation Theory [6], and the Segmentation or Hedging Theory [2]. Combined, these theories suggest that the yield on long-term securities would be higher, on the average, than short-term yields, but that there are occasional movements, dependent among other things on the level of intermediation or disintermediation, when short-term rates are higher. Thus, Lynch is partially correct in calling attention to the possibility of a negative  $r$ ; but based on the literature on interest rates, he is wrong in suggesting to the readers that this is "frequently if not always" the case.

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