A Model-Free Estimate of the Production Inefficiency in the Gold Market

Any aggregate sequence of outputs can be produced at smaller discounted cost by postponing the extraction of higher cost ore as long as there remains ore equivalent from the viewpoint of buyers which can be extracted at lower cost. Current gold policy results in a production inefficiency since it keeps official reserves out of private hands although they are costless to extract and instead leaves the private sector no alternative but to spend \$300 for each ounce of gold extracted.

The purpose of this brief note is to estimate the magnitude of the resulting production inefficiency. We do so by suggesting, as a thought experiment, an alternate policy which would correct the inefficiency without affecting any private agent. All benefits would accrue to officials. The efficiency gains are achieved by postponing extraction of high-cost ore until all zero-cost reserves have been depleted.

Suppose governments committed to providing gold to mine owners whenever they requested it in exchange for (1) title to an equal amount of underground ore and (2) payment equal to the cost of extraction (minus ϵ). Suppose governments also committed to extracting the gold to which they had gained title on the period after the aboveground official stocks were depleted, thus completely replenishing their aboveground reserves.

This hypothetical policy would have no effect on any private agent. Consider first a mine owner. Whether he extracted his own ore on the one hand or acquired official gold on the other hand, he still would lose title to one ounce of underground ore for each ounce of gold he sold. Moreover, the cost to him of acquiring official gold would be virtually the same as the cost of extracting his own gold. Since official gold would be trivially cheaper, the mine owner would have a trivial preference for the official gold. Since mine owners would be acquiring gold on essentially the same terms as before, their pricing behavior would not be affected by the change in the source of the gold they sold. Therefore, the hypothetical policy would not affect any purchaser.

Consider matters now from the viewpoint of the officials. *The magnitude of their reserves would remain constant under the hypothetical policy.* Initially, all reserves are above ground. As time passes, these stocks would be relinquished to mine owners in exchange for title to an equal amount of underground reserves. Eventually, all the aboveground official reserves would be depleted and, although the magnitude of the official reserves would be unchanged, all would be underground. Suppose the sales took place over T years. Assume that in the $T+1^{\text{st}}$ year, governments would extract the gold to which they had gained title. This would leave governments (and mine owners) with exactly the same aboveground (respectively, belowground) reserves as in the absence of the policy.

Officials would benefit because the interim receipts earn interest while the expense of any extraction is deferred until $T+1$. Let h (troy ounces per year) denote current global extraction and c (dollars per troy ounce) denote the real cost of this extraction. Under the proposed scheme, official would receive hc in revenues each year. Let $I \in (0,1)$ denote the real annual discount factor. Then the present discounted value

of the official receipts over T years is $hc\left(1+I+I^2+\ldots+I^{T-1}\right)=hc\left(\frac{1-I^T}{1-I}\right)$. Since the present discounted value of the cost of extraction in year $T+1$ is $hcTI^T$, the net gain in welfare is:

$$\Delta W = hc\left(\frac{1-I^T}{1-I} - TI^T\right).$$

It would take approximately twenty years of replacing all underground mining for the aboveground official stocks to be completely exhausted ($T=20$). Assuming the interest rate is $2.5\%, I=.97561$—implying $\Delta W = hc(3.773472)$. Assuming that extraction costs are \$300 per troy ounce and $h=64$ million troy ounces, governments would gain \$72.5 billion from the hypothetical policy.

This constitutes a rough, *model-free* estimate of the production inefficiency which currently exists. In "Can Government Gold be Put to Better Use" (IFDIP #582) we develop a simulation model which permits us to *refine* this estimate of the gain from eliminating the production inefficiency and to calculate the additional gain from correcting the "use inefficiency."

The model predicts that, in the absence of government auctions, mining will decline from its current rate. When this declining mining sequence replaces the constant mining sequence in the foregoing thought experiment, our estimate of the production inefficiency drops to \$48 billion.

The simulation model also permits us to estimate the gain from correcting the "use inefficiency." In the socially optimal plan, depletion *declines* monotonically when demand is stationary whereas, under current policy, depletion is initially curtailed but will jump up when the announcement eventually comes that official reserves are to be liquidated. Correcting this "use inefficiency," unlike the "production inefficiency," does require a change in the price path and, therefore, does have distribution effects. If *both* inefficiencies are eliminated immediately rather than in 20 years, we estimate the social welfare gain from this earlier elimination to be \$130 billion.