Hangover Without the Party: The Impact of Threatened Drug Price Controls on Pharmaceutical Investment

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Specialization and investment are the engines of economic growth and the economics profession spends considerable energy towards promoting these activities and defending them against perverse policies. Although price controls are perennially popular with policy-makers who confuse price with cost, they are almost universally panned by professional economists. The economist=s analysis of price controls typically focuses on the harmful effects of thwarting specialization and exchange. This typical analysis describes how the controls distort the price signals that coordinate specialization and exchange, and thus hobble markets, reducing efficiency while creating shortages and queues. Price controls also reduce the profitability of providing a service or product.

Since profits are the reward that motivates the investment that generates economic growth, price controls can reduce the investment necessary for this economic growth. An interesting difference in the case of investment effects is that current investment can be affected not only by current price controls but by future price controls as well. The prudent investor would try to anticipate price controls in making the investment. This leads to a possibility that investment could be reduced by threatened price controls even if they are ultimately rejected.

An example of just such a scenario occurred in the pharmaceutical industry in the mid-1990s. From 1980 to 1992 the nominal annual growth of domestic research and development expenditures for the research-based pharmaceutical companies varied from 13 percent to more than 20 percent. In the two years following

President Clinton=s 1992 election, the health-care task force headed by First Lady Hillary Rodham Clinton generated a serious threat of stringent price controls for many health-care products and services. This threat receded after the 1994 mid-term electoral gains by Republicans in the House and Senate.

During the period when the threat was most credible, the growth rate of expenditure on research and development dropped to the 6-7 percent range (Figure 1). After the threat receded, growth in R&D returned to its double-digit levels. Had R&D growth remained at least 12 percent during the threat period, cumulative investment for the years 1994-1998 would have been nearly $7 billion greater. Figure 2 shows how real R&D flattened out during the period of the threat.

Development costs and lags

It takes more than a decade to develop and bring a new drug to market..[1] Figure 3 shows that time from start to market has grown to over 14 years. In addition to the long delay before any revenues are generated, most of the drugs fail to cover their development costs, with many washing out along the way (PhRMA, 1998). These costs are far from trivial. The Boston Consulting Group estimated that the pre-tax cost of developing a new drug was $500 million for drugs introduced in 1990 (PhRMA, 1998, p. 20). The rewards can be significant for investment in drug research, but drug development requires a firm

[1]The Tufts Center for the Study of Drug Development estimated that the average development time from synthesis to approval was 14.9 years for those drugs brought to market during the years 1990-1996 (Ph RMA 1998).

belief by investors that they will reap the rewards of their patience and their capital.

A static monopolistic competition model suggests an attractive, but deceptive, case for price controls. The monopolistic competition model would seem to apply because products are differentiated, not homogeneous, and marginal cost is below price. Whether it is due to differentiated products or to the economies of scale caused by the very large R&D costs, the fact that drug prices are above marginal cost can have an important effect on the short-run impact that price controls might have.

In the short run, price ceilings below average total cost but above marginal cost can lead to larger output. Any time there is a downward-sloping firm demand curve, marginal revenue will be below price. A binding price ceiling will make the firm=s demand perfectly elastic at the ceiling price. This, of course, means that marginal revenue will now be whatever is the ceiling price.

In Figure 4, we see that there can be a long-run price of OA without any economic profit. Even though there is no economic profit and the market is in equilibrium, a binding price ceiling (between prices OA and OB) can lead to larger output. This assumes that OB is above average variable cost, which is plausible with the extremely large fixed costs associated with R&D.

So far in this price-control story, the consumers are having funB lower prices and higher consumption. The hangover, so to speak, comes later. The price ceiling reduces profits. (In Figure 4 any price below OA would lead economic losses.) With reduced profits, there is reduced motivation to pursue new product-creating investment. As was noted in 1993, the result of price controls on drugs may be Ashorter lives instead of longer lines@ (Kreutzer, 1994).

Since the Clinton health-care plan was not implemented, there were no price controls. However, in 1993 and 1994 the possibility of price controls was very real. It would have been perfectly rational to reduce investment in drug research.

The empirical model

One method of investigating threatened price controls calls for a model that accurately characterizes sales, augmented with a dummy

variable that is used to check for a downward shift during the years of the threat. We used a simple and durable model that characterized R&D as a function of sales and of R&D lagged one year.

Sales clearly would affect research and development in pharmaceuticals. Sales can be considered as both a budget constraint and a crude proxy for future sales. Since firms can borrow, they need not finance their own investment expenditures. However, most firms find it cheaper to finance investment out of their own earnings than to borrow. Sales are therefore important as a measure of ability to finance research and development, in addition to being a rough predictor of future sales.

Although sales are important, the effect is not entirely contemporaneous. With the long development time for bringing a new drug to market, at any particular time there will be considerable sunk costs involved with most of the drugs under development. Since a large portion of R&D costs are sunk, there can be a considerable deterioration in future sales without affecting the decision to continue with development for many drugs. More likely, the burden of funding cuts would fall on new drug ideas and those in the early stages of development. To account for persistence in the R&D series, we included R&D lagged one year as an explanatory variable.

The dummy variable of particular interest to this investigation (POLICY) is zero for 1979 through 1993, then one in 1994 and 1995 because of the credible threat of price controls. By the middle of 1995, price controls in the health-care industry were no longer a significant threat. The variable returns to zero for 1996 to the end of the sample.

The model and data

Based on this discussion, our estimating model is:

$$(1) \qquad RD_t = \beta_0 + \beta_1 SALES + \beta_2 RD_{t-1} + \varepsilon_t$$

where SALES represents current period sales in millions of dollars; RDL1 is R&D expenditure in millions of dollars lagged one year; POLICY is a dummy that takes a value of one for the years 1994 and 1995 and a value of zero for all other years; and ε_t is a classical error term.

The data on industry sales and R&D come from Industry Profile, 1998, a publication of the PhRMA (Pharmaceutical Research and Manufacturers of America), a trade association. The data cover the member companies and run from 1970 to 1998 (estimated). The data are annual and expressed in millions of current-period dollars.

Ordinary least squares results

The results of the OLS estimation are:

Variable	Estimated Coefficient	Standard Error	t-ratio	p-value
Intercept	-132.34	51.98	-2.546	0.017
Sales	0.037	0.009	3.903	0.0007
RDL1	0.940	0.049	19.08	0.0001
Policy	-549.93	96.91	-5.675	0.0001

n = 29
R^2 = 0.9996
AIC = 341.5744
Durbin=s t = 0.285

All of the coefficients are statistically different from zero at the .01 level. Although autocorrelated errors are often a problem in time-series work of this type, Durbin=s t (the small-sample counterpart of Durbin=s h) did not detect first-order autocorrelation. Therefore no correction of OLS results was necessary.

The results suggest that for this sample period, a one-dollar increase in a given year=s sales would increase current R&D by $0.037, other things equal. The coefficient on lagged R&D suggests that, other things equal, each additional dollar of R&D the preceding year leads to an additional $0.94 of R&D in the current period. The policy dummy indicates that in each of the years of interest, 1994 and 1995, R&D expenditure was reduced by $550 million.

This total of $1.1 billion for two years represents a substantial reduction. Using the $500 million per drug estimate of development costs, it would imply that two drugs would not be developed as a result of the threat of price controls.

Impressive as the $1.1 billion figure is, by itself it would be a significant underestimate of the overall impact because it does not account for the lagged effects on years after 1995. The huge inertia in R&D (coefficient of 0.94 on lagged R&D) means that reducing R&D for one year will have substantial echoing effects in the following year. A policy that causes a one-dollar drop this year will lead to a $0.94 drop next year, a $0.88 ($.94^2$) drop the following year, and continuing effects until 0.94^t becomes negligible. For 1994 through 1998, the cumulative effect is $7.19 billion. This corresponds well with the rough estimate made earlier using growth rates.

To test whether there was a rebound in R&D following the expiration of the price-control threat we ran the regression adding a second dummy (labeled REBOUND) equal to one for the years 1996-1998 and zero for the rest of the sample years. If the regression relationship shifted sharply upward after the expiration of the price-control threat, it would show up as a statistically positive coefficient on REBOUND. The results of this regression are:

Variable	Estimated Coefficient	Standard Error	t-ratio	p-value
Intercept	-134.19	53.66	-2.501	0.020
SALES	0.039	0.011	3.401	0.002
RDL1	0.932	0.063	14.862	0.0001

POLICY	-527.24	140.5	-3.752	0.001
REBOUND	28.99	127.5	0.227	0.822

n = 29
R^2 = 0.9996
AIC = 343.5116
Durbin=s t = 0.406

The coefficient for REBOUND is positive but small and not statistically different from zero. Any rebound effect present in the data was swamped by the size of the POLICY variable, representing the reduction in R&D for 1994-95.

Conclusion

While price controls generally create shortages, there are some industries where binding price controls may lead to a market-clearing increase in output. Such controls are not without costs to consumers. It is just that these costs take the form of a reduction of future product availability rather than immediately visible queues.

If the ceilings are low enough, even in these industries the ceilings can cause shortages. An interesting aspect of this sort of market is that negative impact of ceilings depends on the expected level of the price controls. That is, if the controls are threatened but not actually implemented there can still be a harmful impact.

We estimated the impact from the price-control threats of the Clinton health-care proposal to be a reduction of more than $7 billion in pharmaceutical research and development for 1994 through 1998. Using the estimated 1990 cost of bringing a new drug to market ($500 million) we see that the resources sufficient to develop 14 new drugs were diverted. Whether we will actually lose 14 drugs or any drugs we cannot know for sure. Still, a multi-billion dollar reduction in drug research and development cannot have a positive impact on the nation=s health care.

References

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