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Abstract: The use of modern microeconomics in policy is illustrated by the markets for spectrum, electricity, greenhouse-gas reductions, defense procurement, and Treasury bills. Further examples are antitrust divestiture rules, market-based redistribution, fishery conservation, and privatization. The limits of the use of theory are also discussed, by reference to China's economy-wide reforms. Lessons on the policy use of theory are drawn.

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Herbert Stein, advisor to presidents, noted that “most of the economics that is usable for advising on public policy is about at the level of the introductory undergraduate course.” My subject is the remainder of usable economics: the part that is not elementary. Frontier theory has been put to good use in some recent policy-making.

Asymmetric information and strategic behavior, the core of modern micro-theory, are highlighted by the financial scandals of 2001-02. The misdeeds of WorldCom and Enron would have been averted if shareholders could see what managers were up to. Even before the scandals broke, Congressman Paul Kanjorski called for disclosure rules “to end the problems of *asymmetric information*.” The jargon has spread. A novel set in Wall Street is aptly entitled *Moral Hazard*. High executive pay, said the *Bismarck Tribune*, signifies *principal-agent problems*. The bidders for Britain’s mobile telecoms licenses, said the *Times*, fell to the *winner’s curse*. Promises that deregulation would cut electricity prices, said the *Australian*, were *cheap talk*. Game theory crops up often—though a headline in the *Jerusalem Post* hints it may not last intact: “Zero-Sum Game Has Only Losers.”¹

New lingo is not all that theory offers policy. The design of government auctions and of mechanisms for assigning ownership (Sections I and II) exemplify the economist as engineer (Alvin Roth, 2002). The limits of theory are illustrated by China’s economy-wide reforms (Section III). Lessons on the policy use of theory are drawn in Section IV.

¹ Sources: Stein: Lee Hamilton (1992, p. 62); Kanjorski: Congressional Testimony, May 17, 2001; *Bismarck Tribune*, August 17, 2001; *Times*, April 18, 2001; *Australian*, January 9, 2002; *Jerusalem Post*, May 16, 2002. *Moral Hazard* is by Kate Jennings (2002).

I. Allocating by Auction

A. Spectrum and Electricity

The two big policy applications of theory are the auctioning of spectrum licenses and the deregulation of electricity markets. Both have been extensively studied and I will add little to those familiar stories.

The spectrum auctions are the outstanding success of theory in policy (McMillan, 1994, Ken Binmore and Paul Klemperer, 2002, Paul Milgrom, 2003). Interrelationships among the licenses for sale meant the tried-and-true auction forms would not work well, so theorists invented a new mechanism, the simultaneous ascending auction. The mechanism matched licenses to firms well and brought billions in revenue.

In electricity, theory helped in designing sale procedures for wholesale power and in setting the post-reform regulatory rules (Robert Wilson, 2002). The economics was sometimes overruled, however. In California's botched deregulation, impartial experts had too little impact and interest groups too much, according to Paul Joskow (2000, p. 119). "Sometimes it was ignorance, but more often it was private financial interests that were at work to steer design decisions in the wrong direction."

B. Pricing Global Warming

In March 2002, the British government ran the world's first auction of greenhouse-gas reductions.² Participating companies could choose to cut their carbon-dioxide emissions in return for incentive payments. The government's aim was to get as much emission reduction as its budget, \$350 million, would buy.

² Information from www.defra.gov.uk/environment/climatechange/trading.

The incentive payments were set by competition. A descending clock auction was devised by Market Design Inc. The government posted a price per tonne of carbon dioxide and the firms bid quantities of emission reductions. In successive rounds, the government lowered the price and the firms revised their bids, until the total emission-reduction bids multiplied by the price equaled the budget. When the bidding stopped, the firms had committed to four million tonnes of pollution cuts.

C. *Gaming the Pentagon*

Diagnosing defects in existing mechanisms is another role for theory in policy. During the 1980s, the Pentagon tried to drive down its weapons-procurement costs by using competition rather than negotiating each deal with a single firm. Defense Secretary Casper Weinberger promised to “bang heads together and get all these low bids to save money” (Andy Pasztor, 1995, pp.121-123). To this end, the Pentagon devised dual sourcing. It lined up two rival firms to manufacture, say, a particular class of nuclear submarine. It assured each of some orders and used the bids to set the shares. The high bidder in some cases received as much as 40% of the total order.

Unfortunately, the “competition” under dual sourcing was counterproductive. Each firm’s best strategy often was to bid *higher* than its rival, for a firm could earn more by getting the smaller share at a high price than by being the low bidder (James Anton and Dennis Yao, 1992). Theorists pointed out the flaw in dual sourcing at a 1986 Rand Corp. conference on defense procurement. In 1989, the Pentagon’s Inspector General concluded that dual sourcing had failed because it was “conducive to price gaming.”

D. *The Treasury and the Winner's Curse*

In government bond auctions, bidders submit demand curves stating how many bonds they wish to buy at each price. The Treasury computes the clearing price, at which total demand equals the number of bonds for sale, and allocates the bidders the amount they demanded at or above that price. Alternative pricing rules are discriminatory (bidders pay their own bids) and uniform (all pay the clearing price). Most countries use discriminatory pricing, but India, Korea, the United States, and others have switched to uniform, reasoning that it would make the bidding more aggressive.

Theory led these governments to adopt uniform pricing—but its support is not decisive. That uniform pricing brings higher prices is extrapolated from the theory of single-unit auctions. Out of fear of the winner's curse, bidders underbid. They underbid more in the first-price auction (the single-unit equivalent of discriminatory), because they pay their own bids, than in the second-price auction (analogous to uniform), where the price reflects others' bids. The multi-unit case, however, has an extra effect (Ausubel and Cramton, 2002). Aware that they could set the clearing price, bidders in a uniform-price auction shade their bids to lower the price of their inframarginal units. This means the ranking of uniform and discriminatory auctions can go either way.³

II. Assigning Ownership

A. *Divesting Lemons*

Competition policy shows the influence of information economics. Before the U.S. government approves a merger, if it estimates the combined firm would have too

³ The US Treasury's experiment of selling some securities by uniform and others by discriminatory auction was inconclusive (Paul Malvey et al., 1998), whereas in Mexico a switch to uniform auctions brought increased competition (Steven Umlauf, 1993).

much market power, it may request that some assets be divested. Which should be sold? Should the Federal Trade Commission (FTC) decide, or leave it to the firms? Current policy is to specify the assets (FTC, 1999). When Pearson Inc. acquired Viacom's educational publishing arm, for example, the FTC, judging there would be undue concentration of textbooks in certain college courses, specified 55 titles to be sold off (like Salvatore on international trade and Browning and Zupan on microeconomics).

This may appear to be overzealous micromanagement, but it is based on theory. Knowing less than the firms about the business, the FTC is at risk of adverse selection (Akerlof, 1970). Divestiture is intended to foster post-merger competition. If the merging firms chose what to sell, they could undermine this by picking low-quality assets.

B. *Free-Lunch Redistribution*

In the spectrum sale, Congress directed the Federal Communications Commission (FCC) to ensure minority-owned and other designated firms received some licenses. One of the ways the auction designers met Congress's request was with price preferences. The FCC would add a specified percentage to any minority-owned firm's bid before choosing the winner. Some FCC auctions had preferences of as much as 40%, meaning a minority firm won if its bid was up to 40% lower than the highest non-minority firm's bid.

Theory underlay the FCC's adopting price preferences. (The idea is a corollary of a theorem of Roger Myerson, 1981, drawn out by McAfee and McMillan, 1987.) Like a handicap in a horse race, a price preference stimulates the competition. The minority-owned firms, let us assume, have a lower value for spectrum than the others, from a lack of industry experience or access to capital. If so, they would put weak competitive pressure on the non-minority firms, who could, given little competition among

themselves, bid low. A price preference pushes the non-minority firms to bid higher. The price-raising effect (from the higher bids by the non-minority firms) could outweigh the price-lowering effect (if a minority firm wins and pays a low price). The preferences should not much lower revenue and could actually increase it.⁴

C. Privatizing State Firms

The 1980s and 1990s saw shifts to markets on an astonishing scale. Over a hundred countries privatized state-owned enterprises. A billion and a half people under communism saw their lives abruptly transformed. Creating new markets and new incentive systems, these changes are what modern microeconomics is all about. While theory has been valuable in analyzing privatization after the fact, however, it was little used in designing the procedures, certainly far less than with the spectrum auctions.

In Britain's privatization, economist Stephen Littlechild devised a price-cap rule to induce the privatized British Telecom to control its costs where it retained a monopoly: it could raise prices each year by, at most, the inflation rate minus a fixed percentage. Russia's mass privatization was planned by a team of economists (Boycko, Shleifer, and Vishny, 1995). In the Czech Republic's privatization, the mechanism for setting the share prices mimicked Walras's tâtonnement. Even given examples like these, however, state-firm privatization mostly had little input from theory. Politics more than economics drove the techniques of privatization.

⁴ For evidence that price preferences can increase prices, see Ian Ayres and Peter Cramton (1996) and

III. Pragmatic Restructuring

In economy-wide reform, economic theorists have had still less impact than in state-firm privatization. The most successful of the transition countries, measured by economic growth, is China. Its reform policies were pragmatic and adaptive.

The agricultural communes were broken up into individual plots, at once boosting productivity. This reform was spontaneous: the farmers took things into their own hands (Zhou, 1996). The government relaxed restrictions on nonstate production, after which new firms—owned and run by village governments—entered and flourished. This reform was inadvertent: even the reformers were surprised by the vigor of entry. Later, the government introduced market incentives into the state-owned enterprises. This reform was trial and error. Economists at the Chinese Academy of Social Sciences debated various incentive mechanisms for the state firms, ranging from freed prices to shareholding to contractual incentives, some of which were run experimentally in certain cities (Cai, 1998). What carried the day in state-firm restructuring, however, was not theory but the precedent of agriculture's post-reform boom.

Reforming an entire economy is immensely difficult: it has the same kind of complexity as planning the economy. What will work is hard to predict. Theorists can dream up a variety of suggestions, but finding out which policies are best needs experimentation. What works may be nonstandard. The centerpiece of China's reforms turned out, unexpectedly, to be the new firms owned and run by village governments. To propose that particular organizational innovation would have taken a brave theorist.

Theory's role in China's reforms was limited because change was more from the bottom up than the top down. The new economy arose from the initiatives of the Chinese

people, who built new ways of doing business. In this, China is not unique. Top-down design, which is what theorists contribute as policy advisors, is only a part of any deep restructuring. Any economy relies not just on formal rules but also informal norms like reciprocity (McMillan, 2002). Since informal rules simply emerge, they cannot be set by theorists, but only by the market participants' trial and error.

IV. Lessons on Using Theory

A. Theory Matters

The Pentagon's dual-sourcing muddle arose from a pre-game-theory view that competition is always and automatically a good thing. Navy Secretary John F. Lehman said dual sourcing was "common sense" (Pasztor, 1995, p. 121). But as auction theory shows, the rules of the game must be designed well. Common sense can be overrated.

With the FCC's spectrum-auction price preferences, theory devised a free lunch. Price preferences not only met the policy goal of helping minority-owned firms enter the telecommunications industry but also probably increased government revenue. Theory can create mutual gains. The FTC's merger policy, dictating which assets to divest, helps the merging firms. Any buyer faces asymmetric information about asset quality, so if instead the firms picked what to sell, buyers might bid low from lemons-market concerns.

B. Context Matters

Politics constrains policies. Policy advice does not go into a political vacuum. This is obvious but nontrivial, for the influence of politics varies. Sometimes it crowds

out the economics, as in electricity deregulation and state-firm privatization. Sometimes its impact is limited, as in the U.S. spectrum auctions.⁵

Market solutions call for rules to be enforced. Emissions trading needs constant oversight. In 2002, the state of New Jersey ended its six-year-old trading of smog-forming emissions, declaring it “an experiment that failed.”⁶ Monitoring was absent, as the state had cut back on inspections by air-quality officials. The state asked the polluters to measure and report their own emissions. Some underreported, cynics alleged.

C. Information Is a Constraint

Effective policy design recognizes that firms usually know more about their business than policy makers. This is the basis of the FTC’s divestiture policy.

Markets reveal information. Auctions are useful in policy because, instead of bureaucrats picking winners, the bidding picks them. Before its greenhouse-emissions auction the UK government predicted, based on what the firms had told it, that emissions would be cut by two million tonnes. The actual cut was twice that. The obstacles to cleanup had been exaggerated (as environmentalists doubtless suspected). The cost, as revealed by the bids, was half what the firms had claimed.

D. Using Theory Means Extrapolating

The use of theory to justify uniform pricing for government-debt auctions has been criticized. The existing theory is not general enough to prescribe the optimal mechanism, so judgment is needed. But this is to be expected (it was also the case with

⁵ Politics did affect the spectrum auctions in one respect. Another way of favoring the designated firms was to allow them to pay in installments. The C-block auction, open only to small firms, was a debacle. The generous installment provisions led to speculative overbidding, and all the major winners defaulted. The auction designers recognized that delayed payments could lead to default, but politics forced the FCC to adopt them.

⁶ *Electricity Daily*, October 9, 2002; *New York Times*, September 18, 2002.

the spectrum auctions). The world is more complicated than our models. If we are to use theory in policy we must learn to live with a bit of extrapolation.

Theory isn't always usable. The outstanding policy success of theory, the sale of spectrum rights, is a special case. Subtle as it is, the spectrum market demands far less of rules to underpin it than, say, an equity or a labor market. As China's reforms illustrate, sometimes the extrapolation from simple theory to complex reality is just too big.

E. Policy Feeds Back into Theory

New theory of multi-unit auctions has come out of the spectrum auctions (Milgrom, 2003), so a smaller extrapolation will be needed in future applications of auctions. New theory of informal contracting under inadequate laws has arisen from observing various countries' reforms (Avinash Dixit, 2001, Joel Sobel, 2002). That theory might in future help other countries in revamping their legal and economic institutions. A fruitful feedback links theory to policy to theory.

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