Summary of the Papers

THIS ISSUE CONTAINS papers presented July 18 and 19, 1996, at the tenth meeting of the Brookings Microeconomics Panel. The papers address economic and policy issues in five different industries. The Alfred P. Sloan Foundation's Industry Studies Program sponsored the industry studies by Timothy Bresnahan and Shane Greenstein and by Ernest Berndt, Iain Cockburn, and Zvi Griliches. Bresnahan and Greenstein examine the migration of corporate computer users from massive mainframes to distributed computing platforms. Berndt, Cockburn, and Griliches explore the measurement of drug prices, in particular the prices of drugs used to treat depression. The other papers examine similar industry-level issues. Steven A. Morrison and Clifford Winston identify the causes and consequences of airline fare wars in the United States. Matthew White identifies factors that are likely to shape the deregulated markets for electricity generation. Frank Wolak projects how future changes in local and long-distance telephone call rates will affect consumer welfare.

Bresnahan and Greenstein on Changes in Large-Scale Computing

Bresnahan and Greenstein examine the ongoing migration of corporate computer users from large mainframes to decentralized client-server systems. They base their analysis on an extensive database that describes individual computer ownership from 1988 to 1994. Using this database, they first chart the migration of corporate users from mainframes to networked computer systems. The authors investigate several different theories of technological adoption with their data. Their main theme is that adoption of large systems entails large "co-invention"

costs. These costs depend on the complexity of corporate computer tasks, the idiosyncracies of users, and the market-supplied solutions for reducing co-invention costs.

The authors find that the switch from mainframe to client-server platforms has been gradual, with corporations slowing investments in mainframes before switching, and with many organizations adopting mixes of mainframes and client-server platforms. There is little evidence that adopters abruptly change their investments in computer systems. The authors next provide an empirical model of the timing of adoption. The model includes controls for the types of users, corporate computing applications, the costs of adoption, and the returns to adoption. The results show that computing applications help predict the timing of adoption decisions. These applications proxy for the complexity of the computing at the establishment. The author of software also accelerates or slows the retirement of the old system, depending on the idiosyncracy of the application on the host. In contrast to prevailing views, the authors find little evidence that vendor lock-in, economies of scale, or labor obstructionism slows the diffusion of new platform technologies.

Morrison and Winston on Airline Fare Wars

Morrison and Winston analyze airline fare wars in U.S. city-pair markets from 1979 to 1995. Using quarterly samples of tickets compiled by the Department of Transportation, they first construct estimates of average fares for more than 500 city-pair routes. They then develop several measures of fare wars based upon changes in these average fares. Their preferred definition is that a fare war begins when prices fall 20 percent or more in a quarter and ends when prices rise by any amount. Applying this definition to their data, Morrison and Winston conclude that on average about 5 percent of all routes per quarter experience a fare war, these wars last about six months, and it often takes a long time for fares to return to their prewar level.

Morrison and Winston next develop an empirical model that attempts to explain the incidence of fare wars as a function of U.S. macroeconomic variables and airline industry competitive conditions. The economic variables include the unpredictability of gross domestic product

(GDP), cost indexes, and a Gulf War dummy variable. On the industry side, the authors control for characteristics of routes such as endpoint populations, endpoint personal incomes, and airport congestion. The authors also include variables that measure the effect of competition, including market structure, entry, carrier bankruptcies, and intermarket contact variables. The authors find that the unpredictability of GDP and competitive factors play an important role in triggering fare wars. A greater number of carriers in the market and more carriers at the endpoint cities increase the likelihood of a war. Carrier presence dummy variables also explain variation in fare wars, with the presence of carriers such as Alaska, America West, and Braniff significantly increasing the likelihood of a war. Somewhat surprisingly, bankruptcies have mixed effects on the likelihood of a fare war. Finally, some route characteristics, such as previous fare wars and the absence of airport congestion, are likely to increase the likelihood of a fare war.

Using their empirical model, Morrison and Winston estimate that fare wars have significantly lowered industry profits. They calculate that during the 1980s, profits were reduced about $300 million a year. These losses have risen in the 1990s, peaking at $1.5 billion in 1992. The authors estimate that fare wars lowered industry profits by roughly $8 billion between 1979 and 1995. They conclude that the unpredictability of GDP accounted for 25 percent of the losses arising from fare wars, while route and intermarket competition accounted for 28 and 13 percent, respectively.

Berndt, Cockburn, and Griliches on Drug Prices

The Berndt, Cockburn, and Griliches paper provides an audit on the reliability and accuracy of the Bureau of Labor Statistics (BLS) producer price index (PPI) for one particular health care market class, that for antidepressant drugs. This therapeutic market is a rapidly changing one, with considerable entry by new patent-protected products and additional entry by generic firms as patent protection expires.

Berndt, Cockburn, and Griliches use monthly wholesale transactions data from IMS America, 1980:1–1996:2, in calculating a number of price indexes. The IMS data comprise the universe of antidepressant drugs, whereas the BLS employs only a sample; moreover, while the BLS ex-

cludes Puerto Rican production of drugs wholesaled into the United States, Berndt, Cockburn, and Griliches include these transactions.

The authors' computations with these data reveal several problems with the PPI for antidepressants that have led to a marked upward bias in official estimates for inflation rates for these products over the 1980–96 time period. First, the BLS sample has poorly represented the universe of antidepressant drugs, oversampling branded and undersampling generic drugs. Because prices of branded drugs rose while those of generics fell, this resulted in an upward bias. Second, when branded drugs lost patent protection, they lost significant market share to lower-priced generic versions. Until very recently, however, BLS pricing procedures neglected to link generic prices to those of their patented antecedents. Failure to link prices of these generics to branded versions resulted in a further substantial upward bias. Third, although new antidepressant drugs embody quality improvements (such as reduced side effects or less potential for fatal overdose), these quality improvements are not fully reflected in higher prices. The authors find that nonpriced quality improvements also result in an upward bias in the official PPI, but this quality bias is considerably smaller that those due to nonrepresentative sampling and the failure to link generics to branded prices. Finally and most generally, to track price changes in a rapidly changing marketplace such as that for antidepressant drugs, it is essential that sample frames and weights be updated and revised frequently. The authors conclude that current BLS fixed samples and fixed-weight procedures are modified much too infrequently to provide accurate estimates of price inflation.

White on the Deregulation of Electricity Generation

White examines the prospects for deregulation in the electric utility industry. He argues that although many industries have recently been deregulated by federal legislation, regulatory reform to admit retail competition in the electric power industry will proceed at the state level. White uses utility price and cost data to calculate the potential gains and losses to consumers and utilities in each state and offers several arguments to explain why some states and not others are pursuing deregulation.

White begins by chronicling how recent developments in electric power generation have altered the distribution of gains between consumers and electricity producers. In particular, he focuses on changes in technology and the gap between regulated electricity prices and the costs of efficient generators. He argues that this price gap has raised the opportunity cost of not allowing new entrants to compete with incumbent producers. Using firm-level data on incumbent electric utilities and entrants, White finds that the states implementing reforms are those with the largest difference between regulated utilities' prices and the prices expected to prevail in a deregulated marketplace. Moreover, the substantial variation across states in the magnitude of these potential gains to consumers is consistent with widespread heterogeneity in the degree to which different states' regulators are pursuing reform.

White concludes by examining why some regulators have chosen to extend or delay reforms. In some instances, such as California, regulators are pursuing costly restructuring processes that will not yield benefits to consumers for years. White argues that while the emergence of low-cost generators creates a demand in high-cost states for competition, it also provides regulators with an opportunity to reduce the political risk they face under cost-of-service regulation. Specifically, by moving to allow competitive entry and market pricing of electricity, regulators reduce the chances that consumers will bear the impact of bad utility investment decisions. The value of shifting this risk away from consumers and toward financial markets is greatest in states that have historically experienced cost overruns, and that is precisely where these regulatory changes are taking place.

Wolak on Telecommunications Demand

Wolak's paper forecasts what will happen to consumer welfare if competition among telecommunications providers eliminates cross-subsidies between long-distance and local service. Presently, approximately forty-five cents of every dollar spent on a long-distance call is paid to the endpoint local exchange providers. A substantial portion of this transfer exceeds the cost of local access. Wolak evaluates how telephone demand and consumer welfare will change if competition in combination with regulatory changes eliminates most or all of this cross-subsidy.

Wolak begins by formulating an empirical model of household consumption of telephone service. This model recognizes that consumers substitute between local and long-distance calls as relative call rates change. Wolak also models how changes in the prices of other goods, including food, clothing, and other nondurables, affect consumption of telephone services. An important feature of Wolak's model is that some consumers may choose to use phone service at lower prices but not at high prices.

Wolak estimates his model using household-level data from the BLS's *Consumer Expenditure Survey*. This survey includes information on telephone usage, purchases of other items, and household characteristics. Using two versions of his model, which differ in how they account for the household's decision to consume any local or long-distance service, Wolak simulates how household welfare would change as the cross-subsidy from long-distance to local service is eliminated by either increasing the price of local service alone or increasing the price of local service while decreasing the price of long-distance service. He finds that raising the price of local service is increasingly burdensome to lower income (expenditure) households. This burden is not reduced much, however, when it is coupled with an equal percentage decrease in the price of long-distance service. He also finds that the combination of local and long-distance price changes increase the welfare of high income (expenditure) households.

How much overall U.S. household welfare is likely to change depends on the price changes considered and the model of household demand used. For what he considers the most likely price scenario and using the econometric model that provides a richer description of the household's purchasing decisions, Wolak finds an aggregate welfare loss to the U.S. household sector, although averaging welfare losses over all households in the United States yields a very small per-household loss. The small magnitude of these welfare changes is borne out by the fact that Wolak estimates that no households decided to disconnect their local service as a result of any of the price change scenarios that he considered. Nevertheless, this finding of a small per-household welfare loss associated with eliminating these cross-subsidies suggests that regulators may face tough choices if they wish to guarantee universal service in an increasingly competitive telecommunications environment.