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December 24, 2003

Ex Parte

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: *A&T Petition for Rulemaking to Reform Regulation for Incumbent Local Exchange Carrier Rates for Interstate Special Access Services, RM No. 10593*

Dear Ms. Dortch:

BellSouth, Qwest, SBC and Verizon hereby submit a study prepared by the economists Gregory M. Duncan and Mark A. Thoma which responds to the assertions raised by the Special Access Reform Coalition (SPARC) in the above referenced proceeding.

Specifically, as further discussed in the study, rates for interstate special access are at market levels today. Arbitrarily reducing them, as SPARC proposes, would harm consumers and damage the economy. The macroeconomic "benefits" SPARC purports to show are the result of conceptual and methodological errors in the SPARC study.

Should you have any questions, please do not hesitate to contact me.

Sincerely,

A handwritten signature in cursive script, appearing to read "Joseph Mulieri".

Joseph Mulieri

cc: Tamara Preiss
Deena Shetler
Carol Canteen
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**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D. C. 20554**

In the Matter of)	
)	
AT&T Corp.)	RM No. 10593
)	
Petition for Rulemaking to Reform)	
Regulation of Incumbent Local Exchange)	
Carrier Rates for Interstate Special)	
Access Services)	

The Macroeconomic Effects of Changing Special Access Line Prices

by
Gregory M. Duncan
and
Mark A. Thoma

on behalf of
**BellSouth Corporation, Qwest Corporation,
SBC Communications, Inc., and Verizon**

December 24, 2003

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I. QUALIFICATIONS

My name is Gregory M. Duncan and I am a professor at the University of California, Berkeley, and am a special consultant to National Economic Research Associates, Inc. (“NERA”). My business address is the Department of Economics, University of California, Berkeley, CA 94720. My curriculum vitae is included as Appendix D to this report.

My name is Mark A. Thoma and I am a professor at the University of Oregon. My business address is 2888 Taylor Street, Eugene, OR 97405. My curriculum vitae is included as Appendix E to this report.

II. INTRODUCTION

The Special Access Reform Coalition (“SPARC”) has proposed that the Federal Communications Commission (“FCC” or “Commission”) should order a dramatic reduction (42%) in the prices for special access services. In support of its proposal, SPARC submitted a study by Paul N. Rappaport, Lester D. Taylor, Arthur S. Menk, and Thomas L. Brand on special access prices called the “Macroeconomic Benefits from a Reduction in Special Access Prices” (hereinafter called the “SPARC study” or “study”).

The SPARC study purports to demonstrate that an exogenous decrease in special access prices paid to incumbent LECs will dramatically and unambiguously improve economic performance. We will discuss below how the SPARC study's results depend upon a series of errors and misconceptions, any one of which renders the results meaningless.

The most dramatic error in the SPARC study is not in the mechanics, but in its basic premise. The SPARC study simply assumes without evidence that current special access prices are above reasonable market levels. The only argument offered to support this assumption is an inappropriate and inaccurate rate-of-return ("ROR") calculation. In fact, all the available evidence indicates that, through a combination of the Commission's price cap mechanism and competitive pressures, the Regional Bell Operating Companies' ("RBOCs") current prices for special access are already at competitive market levels.¹ This being the case, both economics and common sense tell us that any arbitrary regulatory mandate to reduce prices from these market levels will harm, not benefit consumers and the economy as a whole.

While economic theory leads us to expect that an artificial reduction in the price of a good or service will harm the economy, when the SPARC study introduces such a price reduction into an empirical macromodel, it appears to predict economic gains. The reasons will be explained more fully below, but simply put the macromodel they used, or any other one for that matter, has no way of knowing that the price reduction is

¹ See, for example, the arguments presented in the Matter of AT&T Corp. Petition for Rulemaking to Reform Regulation of Incumbent Local Exchange Carrier Rates for Interstate Special Access Services, RM No. 10593, Declaration of Alfred E. Kahn and William E. Taylor On Behalf of BellSouth Corporation, Qwest Corporation, SBC Communications, Inc., and Verizon ("Kahn and Taylor").

artificial. Since the model is calibrated using real econometric data, it interprets a price reduction as a real phenomenon reflecting some real underlying change, such as new technology that might improve productivity. In fact, it is fair to say that a price reduction for most any good or service, when fed into a macromodel, will appear to produce improvements in output even when, as in this case, it is actually moving the price away from its correct market level. This will be true especially if the item is an input used by many other sectors, like telecommunications. This is not a flaw in the macromodel; the people who developed it never intended it to be misused as it is in the SPARC study. Thus, the fact that the SPARC study produces apparent macro improvements from an arbitrary reduction of special access prices does not provide any justification for Commission intervention to adjust those rates.

The SPARC study makes a series of basic errors, both in its analysis of the *microeconomic* effects of the proposed rate reductions on the market for special access, and in its claims of *macroeconomic* benefits for the economy as a whole.

The errors in the microeconomic analysis include the following:

- The SPARC study uses a crude and badly specified demand model to predict that the demand for special access would nearly double in response to the proposed rate reduction. The many flaws in this demand model, described more fully below, make this estimate meaningless.
- SPARC simply assumes that the supply of special access would expand to meet this predicted doubling of demand. In fact, it is reasonable to expect that supply would contract as the price falls. The result would be

market failure: supply would not equal demand, and the market would not clear.

- If the supply of special access were to double, as the SPARC study assumes, there would be significant cost of producing this additional output. Yet the SPARC analysis makes no allowance for this; it assumes that special access output could be doubled costlessly.
- Non-RBOC providers supply more than one third of the special access market today. The SPARC study ignores them completely. It's reasonable to expect that a 42% reduction in RBOC special access prices would be devastating to these competitive carriers. The SPARC proposal would destroy special access competition, drive competing carriers from the market, and discourage further competitive investment.

In summary, the SPARC study does not begin to present an accurate analysis of the effects of the proposed rate reduction on the special access market. In fact, SPARC appears to have given no thought to how the market would even function.

The errors in the macroeconomic analysis include these:

- SPARC incorrectly feeds its assumed reduction in special access prices into the macromodel. The model is not designed to be used this way. As mentioned above, and discussed more fully below, the result is to “trick” the model into interpreting the price reduction as the result of some real change, such as an improvement in productivity.

- SPARC simply assumes a large increase in investment, which is also fed into the macromodel. In fact, it would be reasonable to expect carriers to make less investment, not more, in the special access market as the price is forced down.
- More fundamentally, distorting prices in one sector of the economy cannot produce long-term macroeconomic benefits. The only result of this exercise will be distortion within the special access market, and misallocation of resources across sectors in the economy. These distortions will push the economy off its optimal growth path, reducing welfare. Our overall conclusion is that the real impact on the macro economy from the proposal is likely to be very negative in the short-run and negligible in the long-run.

We demonstrate this result more fully below by creating a macro model specifically designed around the unrealistic assumptions of the SPARC study. Unlike the GI model, or any other normal macromodel, this two-sector model is designed to accept an arbitrary reduction in special access prices. It also assumes that the output of special access would increase as SPARC predicts. Even with these extreme assumptions – which are plainly wrong -- the model predicts at best, in the short run, an indeterminate change in output and a clear reduction in welfare. In the longer run, the economy will tend to return to its natural path in terms of aggregate output, but the costs of misallocations caused by the proposed price change would persist.

In summary, the macroeconomic “benefits” predicted by the SPARC study are the result of a series of conceptual and methodological errors. The American economy cannot be made to perform better by distorting the price of a particular product or sector. The Commission will most effectively promote efficiency in the special access market by not interfering with the current prices, which the available evidence suggests are already at market-clearing levels. Broader policy to influence the level of macroeconomic activity are best left to other agencies of government, such as the Federal Reserve, and to the standard tools of monetary and fiscal policy.

III. SPECIAL ACCESS PRICES ARE AT MARKET LEVELS

All the available evidence indicates that current special access prices are already at market levels. Special access competition has existed since at least the mid 1980s, and has now developed to the point where non-RBOC firms now supply more than one-third of the market. In the early 1990s, facility-based competitors complained that RBOC prices for special access were too low, not too high.² Since that time, rates for some special access services have fallen approximately 32%.³ Further, RBOC prices are comparable to those of competing special access providers with some being higher and others being lower.⁴ As another point of reference, recent data from the

² See, for example, Verizon comments filed on December 2, 2002, at 23, in *AT&T Petition for Rulemaking to Reform Regulation of Incumbent Local Exchange Carrier Rates for Interstate Special Access Services*, RM No.10593.

³ For example, prices for DS1 circuits are approximately 32% lower than they were ten years ago. *Id.*, at 23 and 24. This price comparison is not adjusted for inflation.

⁴ “The best economic evidence that special access services are competitive is the long and continuing history of entry and expansion of competitors and the steady decline in RBOC market share that has occurred.” Kahn and Taylor, p. 25. See also Kahn and Taylor at p. 29: “After airing its claims that RBOC special access prices are too high, AT&T then contends that they are, at least, in some circumstances, also too low.”

Organization for Economic Cooperation and Development (“OECD”) show that current special access prices in the U.S. are among the lowest in the world. For example, the average U.S. price for a DS-1 circuit is roughly one-third lower than comparable rates in Europe (see Appendix C)⁵.

If the government can improve consumer welfare and the economy simply by ordering that a particular price be cut in half, why not do the same thing for the prices of other goods and services—why not cut the price of cars or electricity? The answer is that prices in the marketplace serve the important purposes of matching supply to demand and directing resources to their best use. Generally, the equilibrium price set in the marketplace is also the one that generates the greatest benefits. Artificially changing that price (either up or down) will prevent supply from matching demand, and it will waste resources by misallocating them, ultimately reducing the output of the economy. Since there is reason to believe that current RBOC special access prices are at market levels, it should also be expected that an arbitrary reduction in special access prices would harm consumers and the economy. Some customers may gain first-order benefits in the short-run. However, reducing prices below market levels will artificially expand demand at the same time that it reduces supply. The result will be distortion in customer choices, curtailed investment, the use of non-price mechanisms, such as queuing, to allocate supply, and misdirection of resources among sectors in the

⁵ The OECD data were drawn from a study compiled by Reuters, a worldwide news organization which is a major purchaser of special access in countries worldwide. The data reflects prices paid by Reuters as a large business user of special access. Note that Appendix C compares prices of US DS1 standard bandwidth of 1.5 Mbps to the European standard of 2 Mbps bandwidth by increasing the US price by a factor equal to the ratio of bandwidth of the two services. Since prices of high capacity circuits generally don't increase in direct proportion to their bandwidth, this adjustment is conservative and most likely overstates the equivalent US price.

economy. For this reason, the data manipulations in the SPARC study are simply a meaningless exercise, and have no bearing on the core issue of whether special access prices are at market levels today. Any arbitrary rate reduction could be made to produce illusory “benefits” in the context of an empirical macromodel. Even if the mechanics of the SPARC study’s calculations were done with greater precision, thus correcting some of the obvious errors, the results still would not provide any basis for ordering reductions in special access prices.

IV. THE RATE OF RETURN CALCULATION OFFERED BY SPARC DOES NOT PROVIDE A BASIS FOR ADJUSTING SPECIAL ACCESS RATES

The reduction in special access rates proposed by SPARC is, in essence, arbitrary. The SPARC study does not offer any economic or market analysis to demonstrate that current special access rates are higher than they should be. The only argument the SPARC study advances for setting different special access rates is based on a rate-of-return (“ROR”) calculation that is both conceptually inapplicable and mechanically incorrect. Special access prices have not been set on an ROR basis since 1990; instead they have been constrained by a combination of competitive forces and price caps.

We know from the most basic economics that, with free entry, competition eliminates excess earnings. We know there is free entry (and exit) from the special access market because there are competitors, over one-third of the market is provisioned by non-RBOCs and because competitors have come and gone. Therefore, there are and can be no excess earnings.

A. ROR Cannot be Defined for a Specific Service Such as Special Access

As pointed out by Kahn and Taylor, measures of accounting profit based upon arbitrary cost assignments are not related to economic costs.⁶ It is not possible to define an ROR in a meaningful way for a single service at a particular point in time or for a particular geographic location without extreme forms of economic independence over time, between services, and between locations.⁷ Rate of return must be defined at the firm level and can only be truly defined over the life of the project. It is inappropriate to try to define annual RORs for multi-year projects, for single products, or within geographic subsets. As Kahn and Taylor note:

High or increasing rates of return calculated using regulatory cost assignments for interstate special access services do not in themselves indicate excessive economic earnings reflecting the exercise of market power. Indeed, regulatory rates of return for geographic subsets of single services in multi-product, multi-geographic firms bear no relationship with economic profits and thus can serve no useful purpose in determining whether pricing flexibility has or has not been excessively permissive. ILECs are integrated multi-regional firms and rely on an integrated regional management structure employing the regional physical and human resources to provide a multiplicity of services. The cost allocations required render such a calculation meaningless. (Kahn and Taylor, p. 7.)

Cost allocations allow any value of an ROR to be obtained for a specific service. Simply changing the allocation, sometimes even a small amount, will drastically change a product-specific ROR. Moreover, if a smaller amount of joint and common costs is allocated to special access, the ROR will be higher in the later years.⁸ Further, shifts in

⁶ See Kahn and Taylor, pp. 7-9.

⁷ Formally, the requirement is intertemporal, geographic, and the ability to separate services. This rules out, for example, joint and common costs, shared facilities, other sources of scope economies, and long-lived capital.

⁸ The formula is simple. If α is the allocation proportion to service 1, ρ_1 and ρ_2 , are the calculated ROR for each of two services based on the allocation and ρ the firm ROR, then

relative demand among services can significantly change the apparent ROR attributed to any one service. In this case, special access has grown more rapidly than other RBOC services. For all these reasons, any ROR calculation for special access service would lack economic meaning.

B. Interstate Special Access Rates are not Based on ROR

The Commission has not set interstate access rates on an ROR basis since price caps were adopted in 1990. Even the last vestige of ROR (sharing) was eliminated in 1996 for price cap LECs. The FCC adopted price caps for good reasons; one of which is that it is not possible to define an ROR in a meaningful way for a particular service.

Another reason for adopting price caps in 1990 was that it offered better incentives than rate of return regulation for the RBOCs to minimize costs and become more efficient. After 13 years of price caps, it is not reasonable to apply an ROR standard retroactively. If the RBOCs have responded to incentive regulation by becoming more efficient, then their current operations (investment levels, expenses) are different from what they would have been under ROR regulation.

C. Even from a Purely Methodological Standpoint, the SPARC Calculations are so Deficient as to be Meaningless

Even if one believed that a meaningful ROR calculation could be defined for special access (which we do not), the SPARC study does not provide such a calculation.

$\rho = \alpha \rho_1 + (1 - \alpha) \rho_2$. The calculated ROR for service 1 is $\rho_1 = (\rho - (1 - \alpha) \rho_2) / \alpha$. Depending on the values of α , ρ_1 can be positive and large even if ρ is negative.

First, the SPARC calculations are based on ARMIS data. The Commission has found that these data “do not serve a ratemaking purpose.”⁹ Special access rates are established based on price cap formulae that rely little on ARMIS data.

Second, whatever relationship existed at one time between interstate revenues and costs in a particular rate category (which is economically questionable for the reasons given above) has been lost through the course of many subsequent developments. The Commission has chosen to freeze jurisdictional separations. It determined that marketing expenses related to all interstate categories should be recovered predominantly through common line rates. In CALLS, it shifted productivity gains from one rate category to another.¹⁰ These were perfectly sensible things for the Commission to do based on a recognition that rates are no longer determined by category-specific ROR calculations; and, therefore there was no longer any need to preserve even any semblance of alignment between the costs and rates in a given category. However, having proceeded on that basis one cannot go back at this late date and pretend that the ROR in any given category has any meaning.¹¹

Third, a ROR calculation would normally take account of changes in both demand and cost resulting from the proposed rates. The SPARC study does neither. As discussed below, the demand model used in the SPARC study wildly overestimates the likely demand response to the proposed price change. If the amount of special

⁹ Policy and Rules Concerning Rates for Dominant Carriers, Order on Reconsideration, 6 FCC Rcd 2637, 2728, 2730 ¶¶ 194, 198, 199.

¹⁰ See Access Charge Reform, 15 FCC Rcd 12962 (2000).

¹¹ In fact, if ROR results by category were useful, which they are not, then RBOCs would be entitled to a rate increase in service categories such as switched access, where the ROR rates are low.

access produced were to increase, it is reasonable to expect that this would be accompanied by some increase in cost. The SPARC study takes no account of this in its ROR calculation. In effect it assumes that the output of special access could be nearly doubled - an increase of \$5.6 Billion in special access sales - without any additional cost. When combined, these errors dramatically increase the price reduction that SPARC is able to tease from its ROR calculation.¹²

V. THE DEMAND MODEL AND THE ESTIMATED ELASTICITIES

The SPARC study incorporates a demand model that is used to estimate the change in demand that would result from its proposed reduction in special access prices. The study concludes that the price elasticity of demand for special access services is -1.0 ¹³. This is a convenient outcome because it means that any change in the price of special access services will leave total revenue for special access services unaffected. However, this conclusion does not withstand scrutiny.

There are problems with the estimation procedure used to obtain the elasticity in the SPARC study, and with the theoretical interpretation of the assumption that the elasticity of demand is -1.0 . In some cases, these problems are technical in nature and are discussed in depth in Appendix A. First, the estimated elasticity is inconsistent with

¹² It would be beneficial to point that AT&T as well as the FCC assumed that demand was inelastic for telecommunications services, generally about -0.7 . See, e.g., Annual 1988 Access Tariff Filings, 3 FCC Rcd 1281 (1987). Although these elasticities were related to switched access, they show that the FCC assumed that a one percent price reduction would produce less than a 1 percent increase in demand. In addition, the FCC included an estimate of the additional costs caused by the increase in demand, which it called "demand response." See, e.g., Annual 1990 Access Tariff Filings, 5 FCC Rcd 4177 (1990).

¹³ The price elasticity of demand is the percentage change in demand that would result from a one percent change in price. Therefore, if the elasticity is -1.0 , as SPARC claims, then a one percent reduction in price would increase demand by one percent, leaving the company's revenue unchanged.

basic economic theory. Second, the model inappropriately uses ordinary least squares estimation even though there are serious simultaneity problems. The authors ignore this and include endogenous explanatory variables, leading to bias. Moreover, the implied simultaneous equations model is not identified and may not even be identifiable, meaning it would be conceptually impossible with these data to estimate the functions required for the inputs for their GI simulation. Indeed, the estimated model does not estimate demand curves as claimed and may, more reasonably, be thought of as a badly specified supply curve. In other words, the model is so bad that the authors cannot distinguish between a demand curve and a supply curve.¹⁴ Third, there are severe omitted variable problems, which lead to another substantial bias in the estimated results. Fourth, there are functional form specification problems; the study assumes that elasticity is constant at all levels of output, an assumption that is rarely satisfied in practice and that leads to bias if erroneous. Fifth, the model chooses an arbitrary panel data technique that may be inappropriate, without proper specification tests. Sixth, the time-series structure of the data is ignored leading to a potential problem of spurious regression. In addition, the study ignores one-third of the market in its estimation, and uses price and quantity indices that are faulty or unnecessary and in any case nonstandard. This point is discussed in Appendix A, which notes problems with the calculation of the price indices used in the SPARC study and explains that in some cases the calculated indices are not even needed.

¹⁴ As is well known, an estimated slope from a model suffering from the identification problem is utterly uninformative. See Appendix A and the references cited therein.

A. Theoretical Interpretation of Unitary Elasticity Assumption

An estimated elasticity of -1.0 fails the sniff test and is at odds with basic economic pricing theory. Basic economic theory tells us that a price-setting firm would never price where the elasticity is -1.0 unless incremental cost is zero, because this is where marginal revenue is zero. This means that in order to maximize profit (i.e., to set marginal cost equal to marginal revenue) the firm would face zero incremental costs or would be producing extra units but selling them at a loss.

It is interesting to note that the elasticity of demand is assumed to be elastic (smaller than -1.0), inelastic (between 0 and -1.0), or unitary (equal to -1.0), at different points by proponents of the SPARC study, as convenient for the argument being made at the time. When the SPARC study wants to hold the RBOCs harmless from changing special access prices, it asserts that the elasticity is -1.0 (unitary).¹⁵ When it wants to assert its estimates of macroeconomic effects are conservative, it claims that the actual elasticity is smaller than -1.0 (i.e., demand is elastic and equals a number like -1.31).¹⁶ However, when it is convenient to do so, the argument is that demand is inelastic.¹⁷

B. The Demand Elasticity Bias: Lack of Identification, Endogeneity of Prices, and Simultaneity Bias

The study's presumption that the elasticity of demand for special access is -1.0 is based upon an estimated demand model. However, this model is estimated with ordinary least squares even though there is a serious simultaneity problem. Moreover,

¹⁵ See SPARC study, p. 12.

¹⁶ See SPARC study, p. 14.

¹⁷ As Kahn and Taylor note, AT&T infers that special access price increases have increased revenues as a demonstration of market power—this implies inelastic demand. See Kahn and Taylor, p. 12.

even if the usual solution to a simultaneity problem, instrumental variables, were employed, it would fail in this case because the model is not even identified—a technical problem that causes even instrumental variable estimates to be worthless. In order to estimate a demand curve, the structure of a simultaneous system of supply and demand curves must be determined, and these curves must have a property known as identification before they can be estimated at all.¹⁸ If a model is not identified, the slope estimated will not be a demand slope but a hybrid of the demand and supply slopes. The hybrid could even slope up, but in no case would it be the demand slope nor can the demand elasticity be determined from it. As explained fully in Appendix A, this model is not identified, and uses the wrong estimation method which means that the model used in the SPARC study cannot be used to estimate demand curves. Beyond these two fatal problems, since the equations estimated depend upon supply shifters rather than demand shifters, were estimation possible the equations estimated would explain supply responses and not estimate the demand curves at all.

C. Omitted Variables

Relevant variables are missing from the analysis. For example, the model ignores competitive effects from alternative providers. To capture this effect, the price of substitute goods needs to be included in the demand model. However, these variables are not included. In addition, since special access demand is a derived demand (i.e., a demand that exists only if demands for products it helps produce exist), output prices for the goods produced using special access lines must be included, but

¹⁸ Most likely, a well-specified model would use reaction functions. In many imperfect competition models, supply functions in the usual sense do not exist.

are not. Omitted variables when they are correlated with included variables, as these certainly are, result in biased results. Conclusions drawn from biased estimates and forecasts are not reliable.

In addition, the demand model is estimated over a period of years when special access demand grew rapidly. This outward shift in the demand curve was probably related to several factors, including a long boom in the economy generally, the growth of the Internet, and a telecom expansion that constitutes one of the biggest bubbles in the history of American business.¹⁹ Yet, the SPARC study model does not include variables to explain this expansion in demand and leaves the price variable to capture this effect.

D. Problems with the Functional Form of the Empirical Model

The SPARC study assumes that the elasticity of demand is constant at all levels of output. Theoretically, this is a very special case and rarely occurs. As a first approximation and for small price changes, the constant elasticity assumption can be valid. Here, however, the price changes envisioned are large so the constant elasticity specification needs to be tested. No such tests were presented and since a linear specification, which allows a variable elasticity, would yield different results, one must view the functional-form specification skeptically.

¹⁹ Additional factors shifting the demand for special access would include such things as the build-out of wireless networks, which use special access to link call sites, and the increase in the intensity of data use in companies throughout the economy. For example, not only did the output of automobiles increase, but with the shift to computer-aided design, testing, manufacture, and inventory control, the amount of special access used as an input to the production of each car increased as well.

E. The Panel Data Structure of the Data is Ignored

The dummy-variable form of the empirical model chosen by SPARC is only one of many possible forms. If the SPARC specification is wrong, additional biases are the result. Among the possible better specifications are random-coefficients panel models, random-effects models, and mixed-effects models, all of which are special forms of panel data models. Specification tests to verify the models have been available for at least 20 years. Again, standard practice requires performing and reporting the results of such tests. If the model fails the test, there is even more bias than has been identified.

F. The Spurious Regression Problem

A serious problem that often appears in time-series and panel models is the spurious regression problem, a problem the SPARC authors have ignored. A spurious regression occurs when a group of unrelated variables grows together because of a common factor. Regression of any one of the group on any group of the others will often show a strong correlation, but this correlation simply picks up the fact that many variables grow together, not that they cause one another. The effects are multifaceted. There may or may not be biases in such cases depending on the underlying structure of the errors; but, even if there are not, the test statistics may be all wrong. Again, tests to rule out these problems exist and have for years, but have not been used by the SPARC authors.

In this case, because important variables have been omitted, and because of the trends in the few variables that are included, it is reasonable to expect that significant biases have occurred. Special access prices trended continuously downward during

the period over which the model is estimated, following the price cap productivity formula, while, as noted above, special access demand increased rapidly, largely because the demand curve shifted to the right as the economy, the Internet, and the telecom sector boomed. Because the demand curve in the model is not properly specified, there are no variables in the model to explain this shift in the demand curve. Because of the apparent correlation between falling special access prices and increasing demand, the model incorrectly identifies the increase in demand as a price effect (movement along the demand curve) rather than the effect of other changes in the economy (a shift in the demand curve).

In summary, the SPARC demand model is so badly specified and constructed that the estimates it produces are useless. It greatly overstates the demand response that could reasonably be expected from SPARC's proposed reduction in special access prices.

VI. SPARC GIVES NO THOUGHT TO HOW THE SPECIAL ACCESS MARKET WOULD ACTUALLY FUNCTION

Although SPARC proposes a dramatic reduction in special access prices, the SPARC study does not consider any of the effects of that proposal on the special access market itself. SPARC simply estimates a price change (incorrectly, for the reasons given above), and then feeds that change into the GI model, purportedly to measure the resulting macro "benefits." Any possibility for such macro benefits would depend upon having the special access market perform in ways that SPARC implicitly assumes, but never explicitly acknowledges. That is, SPARC expects the special

access market to nearly double output while prices are nearly halved. The SPARC study does not explain how this would occur, and the authors do not appear to have devoted any thought to how, or even whether, the special access market would actually function if their proposal were adopted.

A. SPARC Takes No Account of the Effect of Prices on Supply

Generally, economists expect that supply curves are upward sloping. That is, increasing the price increases the amount firms are willing to supply (or, put another way, the amount of resources the market is willing to provide to those firms.) SPARC assumes that a large reduction in the price of special access will result in a huge increase in the supply of special access – exactly the opposite of what one would expect if, as is the case here, special access prices are already at market levels.

B. SPARC Takes no Account of Competitive Providers

Today, more than one-third of the supply of special access is provided by non-RBOC providers. Yet the SPARC study takes no account of these firms at all. It is reasonable to expect that a 42% reduction in RBOC special access prices would severely harm these competitive providers, who would be hard pressed to match such steep reductions. Many of the competitors would be forced from the market. This is a concern for several reasons. First, the proposed policy could destroy the vigorous competitive market for special access that has developed over the last fifteen years. Second, it could disrupt supply arrangements for customers who have depended on those carriers, and restrict their choice of suppliers. Third, even if the RBOCs could be

compelled by regulation to increase their special access supply in the face of reduced prices, this expansion may be completely offset by reductions in the output of competing providers who would face no such compulsion to offer non-economic prices.

C. SPARC Does not Explain How Supply Would Equal Demand

Generally, one of the most important roles played by prices is to match supply and demand in each market. By greatly reducing the price of special access, SPARC would cause demand to increase, while supply would contract. SPARC does not explain how the special access market would function in these circumstances. The likely outcome would be market failure, in which the available supply would be insufficient to meet demand. Markets that fail in this way are generally characterized by disruption and uncertainty, with alternative means, such as queuing, used to allocate the limited supply. In any event, it is not clear how creating market failure in the market for a vital input used by many other sectors would be beneficial to the economy as a whole.

VII. THE SPARC STUDY MISUSES THE MACROMODEL

The SPARC study purports to measure the “benefits” of its proposed price reduction for the economy as a whole using the GI macromodel. In fact, the SPARC exercise represents a misuse of the model. Both economic theory and common sense tell us that an arbitrary reduction in special access prices, below their market-clearing levels, will actually harm consumers and the economy.

Why then does the macromodel, in the hands of SPARC, appear to show macroeconomic benefits from the proposal? The use of the model in the SPARC study is deficient both in design and execution, leading to a result that is contrary to economic reality.

A. The SPARC Study Incorrectly Manipulates Prices That Should be Endogenous

The SPARC study introduces as an exogenous input to the GI macromodel a reduction in telecommunications prices corresponding to its proposed reduction of special access rates of 42%. As we will discuss more fully below, even the mechanics of this rate change are not calculated correctly. More broadly, however, the manipulation of the telecommunications price in this way is inconsistent with the design of the GI model.

The GI model, like most macromodels, is built to model a macro economy in which each market finds its equilibrium price. It is not designed to accept an exogenous input in the form of a regulatory mandate reducing the price in one market from its market-clearing level.

The GI model assumes that price changes arise from a change in productivity or some other real underlying economic change. Thus, the macroeconomic effects in the SPARC study arise because the GI model assumes that there is some positive economic force, such as technologically driven enhanced productivity, producing the change in input prices. The GI model is not designed to accept policy-induced price distortions as an input, and it is misleading to use the model in this way

Further, as we will show below, even when a model is specifically designed to accept as an input an exogenous price change, driven by regulation, the results are not those predicted by SPARC.

B. SPARC Arbitrarily Assumes an Increase in Investment

The SPARC study also feeds into the GI model a large increase in investment, which the SPARC authors simply assume, without any economic basis.

Any change in the level of investment, whether positive or negative, should arise endogenously from within the model as a result of changes in interest rates and other prices. The SPARC study's authors already are using the GI model incorrectly by proposing a special access price lower than its market-clearing value. Including investment as an exogenous input introduces an additional macroeconomic effect that is spurious. Indeed, in accord with basic economics, a reduction in special access prices should lead to a reduction in investment within the special access market—exactly the opposite of what the SPARC study assumes. The assumption of a sharp increase in investment is especially puzzling given the recent telecom meltdown, the resulting contraction in investment in the industry, and the reluctance of Wall Street to commit new funding. To the extent that the SPARC study means to capture investment in other sectors prompted by the reduction in prices, then it is double counting since these effects would already be represented within the model. This is potentially very important because it seems that the macroeconomic effects predicted by the SPARC study arise mainly from the erroneous change in investment input into the GI model and

not from the change in prices at all. Removing the double-counted investment input would diminish, and possibly even eliminate, the SPARC effect.²⁰

C. SPARC Ignores the Effects of Microeconomic Events within the Special Access Market on the Macro Economy

As explained above, the SPARC study does not consider the effects of the proposed rate reduction on the operation of the special access market. For this reason, the macroeconomic effects predicted by SPARC are entirely unrealistic, since they are based on assumptions about output and investment that are completely at odds with economic reality. While SPARC assumes that other sectors of the economy would benefit from increased supply of special access at lower prices, the reality is that lower prices would reduce supply. Lower RBOC prices would drive competitive providers from the market, and deter further investment in non-RBOC providers. This is a reduction in macroeconomic activity that SPARC does not recognize. Lower prices would also reduce returns to RBOC investors, another macro effect which is not captured. Financial markets would redirect investment from all special access providers (both RBOC and non-RBOC) into other sectors and less productive uses, a misallocation whose cost is ignored. If special access output were actually to rise, as SPARC predicts, then the production of an additional \$5.6 Billion in output would give rise to additional costs, which SPARC does not recognize. If, as is more likely, special access markets are disrupted, then that market failure would create costs for all sectors

²⁰ Unfortunately, the SPARC study does not report the proportion of the changes in the macroeconomic variables attributable to price changes and to investment changes.

that depend on special access as an input. Again, SPARC fails to account for these costs.

In summary, SPARC's vision of expansion for the economy as a whole is based on nonexistent gains in the special access market. At the same time, SPARC resolutely ignores the many macroeconomic costs that its proposal would generate.

D. It Is Not Possible to Improve Macroeconomic Performance by Distorting Prices in a Particular Market.

More fundamentally, SPARC simply ignores the equilibrium nature of the GI model, and of the macro economy it represents. It is not possible to improve the performance of the economy as a whole by distorting the prices within a particular market. This is true in the short run, which is the sole focus of the SPARC analysis. We conclude that, instead of the benefits SPARC predicts, in the short run the proposed rate reductions would cause a reduction in economic welfare. It is equally true in the long run, which SPARC fails to consider. In the long run, the economy would return to its natural growth path, and the effects of the proposal would be negligible.

In the short run, the effect of the SPARC proposal would be a loss of efficiency caused by misallocation of resources. If an economy is at full employment (as the U.S. economy was during most of the period analyzed, 1993–2001), lowering the price of a good cannot change aggregate employment in the long-run; it will only distort the mix of goods produced in the short-run as labor and other inputs shift among sectors. Thus, implementing the SPARC proposal would result in an inefficient mix of goods in the short-run. More goods are produced in sectors using special access as an input and

less in other sectors. However, because the price of one good is fixed at a non-market clearing level, the resulting allocation of labor and the mix of goods across sectors would not be efficient. Thus, the result of the SPARC proposal would be to generate inefficient allocations of labor and other inputs along with an inefficient mix of goods in the short-run. This inefficiency would waste scarce resources, causing the aggregate economic welfare generated by the economy to be lower.

In the long run there will be no effects at all, as the prices of unregulated goods will adjust, in a very costly manner, to eliminate the relative price distortions. Modern macroeconomic theories are based upon the idea that the economy has a long-run or natural rate of output.²¹ This is the long-run, sustainable level of output for the economy. If, in the short-run, the economy is above or below the natural rate of output, economic well-being is lower. In such situations, there are mechanisms that cause the economy to adjust back to the natural rate of output over time, though adjustment may be slow in some circumstances. Thus, it is well-accepted in the macroeconomics literature that any change in aggregate demand, including those induced by policy, can have a short-run, but not long-run impact on real variables such as output and employment.

All of the results described so far have been for the short-run, the time period during which relative prices are distorted due to a policy of reducing the price of special access lines. However, a distortion in relative prices will not persist. In economic

²¹ See, for example, N. Gregory Mankiw, *Macroeconomics*, 5th edition (Worth Publishers: New York, 2003) pp. 307–311 (“Mankiw”). This book is one of the leaders in this area and is used at many universities including the University of California, San Diego, to teach intermediate macroeconomics.

decisions, what is important is the price of one good relative to another, because that measures what is foregone when a good is purchased. If the money price of one good is artificially distorted, as in the SPARC proposal, other prices in the economy will adjust over time in order to restore relative prices to their original market-clearing levels. Thus, if policymakers lower a particular price artificially below the market-clearing level, economic well-being will fall and the reduction in well-being will accumulate until relative prices are restored through the adjustment of other prices.

For this reason, any policy change will have short-run but not long-run effects.²² In the long-run, after the economy has had time to fully adjust to the reduction in special access prices and eliminate the distortion, there will be no change in output or employment. However, in the interim, as long as the price of special access lines differs from the market-clearing level, the distribution of resources across sectors will be inefficient resulting in the wrong amounts of goods produced in each sector and well-being will be lower.

VIII. METHODOLOGICAL ERRORS RENDER THE SPARC MACROECONOMIC ESTIMATES UNRELIABLE

As discussed above, SPARC's use of the macromodel to estimate the effects of its proposed price reduction is fundamentally wrong. In addition to these conceptual problems, the SPARC study also makes a number of straightforward methodological

²² However, if policymakers continuously adjust the money price of a good or input to maintain the distortion in relative prices over time, then the loss of well-being will continue to accumulate so long as the distortion is maintained.

errors which would render the results unreliable, even if they had any conceptual validity.

A. SPARC's Calculation of the Change in Prices is Incorrect.

The GI model, like any other macro model, operates at a relatively high level of aggregation. The model generally has one equation to describe each major sector of the economy, one of which is telecommunications. Thus the model does not specifically model the market for special access, but simply includes the broader telecommunications sector. This is why the GI model has no way to reflect the effects of the proposed rate reduction on the dynamics of the special access market itself.

For reasons discussed above, it is not conceptually sound to introduce an exogenous adjustment in the price of a specific service, such as special access, into the GI model. From a purely mechanical standpoint, the only way to do so is to adjust the price term in the aggregate sector equation for telecommunications. This price variable is itself a price index – a weighted average of all the prices in the telecom sector (local, long distance, wireless, and so on). Having arrived at an arbitrary reduction of 42% in the price of special access, the SPARC authors must then decide what percentage change that would represent in the overall price index for the sector. This, in turn, depends on the relative weight assigned to special access within the broader price index. Quite aside from the conceptual problem with this procedure, there are two specific methodological problems.

First, the SPARC authors appear to have constructed their own indices for the price of special access, to create a weighted average of prices within the special access

market. Appendix A discusses the technical problems with their approach, which constitute yet another infirmity in the SPARC demand model.²³

Second, SPARC calculates a percentage change in the aggregate price of telecommunications that a 42% change in special access prices would represent. Unfortunately, for the purposes of this calculation, the SPARC authors do not use the same index of telecom prices that is used to construct the telecommunications price in the GI model. Since the weighting of the index used by SPARC does not match the weighting of the index in the GI model, it follows that the price change introduced into the GI model does not correctly reflect the 42% reduction in special access prices proposed by SPARC.

B. The Forecast Horizon is too Long and There are no Standard Errors

The forecast horizon of two years used in the study is too long. It is well-known that macroeconomic forecasts are highly unreliable for horizons longer than approximately six months.²⁴ To account for the escalating uncertainty as the horizon increases, most studies report standard errors around the forecasts, which are a measure of the reliability of the forecast. Unfortunately, the SPARC study ignores standard practice and does not report forecast errors.

²³ The authors' price indices are undocumented, differ from those widely used, and do not account for the fact that special access prices are highly nonlinear. See Appendix A.

²⁴ See James Stock and Mark W. Watson, "New Indexes of Coincident and Leading Indicators," in O. Blanchard and S. Fischer editors, *NBER Macroeconomics Annual* (MIT Press: Cambridge, Mass, 1989) pp. 351-93. See also James Stock and Mark W. Watson, "A Procedure for Predicting Recessions with Leading Indicators: Econometric Issues and Recent Experience," J. H. Stock and M. W. Watson eds., *New Research on Business Cycles, Indicators, and Forecasting*, (University of Chicago Press: Chicago, 1993) pp. 95-153.

IX. EVEN IN A MODEL THAT ACCEPTS SPARC'S ASSUMPTIONS, THE PROPOSED PRICE REDUCTION DOES NOT LEAD TO MACROECONOMIC BENEFITS.

We have explained above how the SPARC study makes a series of conceptual and methodological errors in its representation of the effects of its proposed price reduction on the economy. We have also explained that, as a general matter, distortion of the price in a particular market cannot improve the performance of the economy. In this section, we construct a model designed to reinforce this latter, and more basic, point. To that end, we develop a specialized macro model that simply accepts, and incorporates, several of the erroneous assumptions of the SPARC study. Even in this stylized world in which we grant SPARC its basic assumptions -- and these assumptions are most assuredly *not* correct in the real world -- it is *still* the case that the reductions in special access rates proposed by SPARC harm, rather than help, the economy in the short run, and have no effect in the long run.

Appendix B presents a macroeconomic model in which there are only two sectors. This model, in effect, divides the economy between those activities that use special access and those that don't. In the first sector, output is produced using two variable inputs, labor and special access lines. "Labor" in this context is really shorthand for all inputs other than special access and capital, which is assumed to be fixed. The price of special access lines is assumed to be determined exogenously by regulators while the demand for special access lines is determined endogenously from within the model. In the second sector, output is produced using labor as the only variable input. The model examines how macroeconomic conditions overall as well as

within the individual sectors are affected by a change in the regulated price of special access services.

To the extent possible, the model is built to conform to the assumptions – both explicit and implicit -- in the SPARC study, even though we disagree with them.

- Unlike the GI model, our two-sector model is specifically designed to accept special access as an exogenous input.
- The model assumes that all special access is produced by the firms whose prices are regulated. This is not realistic, but it conforms with the assumptions of the SPARC study.
- The two-sector model assumes away any of the microeconomic problems in the special access market, caused by the price decrease, that we have discussed above. Instead, it assumes that supply simply expands to provide whatever amount of special access is demanded, no matter what the price. Again, this is not reasonable, but it conforms with SPARC's assumptions.²⁵
- The model avoids the question of where any new investment would come from in the special access market by simply assuming that capital is fixed, and that no new investment is required to increase the supply of special access.

²⁵ As described in greater detail in Appendix B, the model assumes that the marginal cost of producing special access is constant at all levels of output. This creates a supply curve that is horizontal. This assumption is less extreme than the one SPARC makes, which is that the marginal cost is zero, thus making the expansion of special access output costless. However, our assumption here at least allows the two-sector model to function with an arbitrary special access price.

While these assumptions are unrealistic, they allow us to predict exactly the direction of the results found in the empirical analysis in the SPARC study and to illuminate potential important distributional issues between sectors that the SPARC study does not address. The model is useful because it gives a detailed list of the assumptions necessary to reproduce the SPARC study's results theoretically. The model is also a useful device for illuminating the loss of economic well-being associated with the SPARC proposal. Under the SPARC proposal, relative prices are distorted from their market-clearing levels resulting in a misallocation of inputs across sectors and inefficiencies in the mix of goods produced.

A. Short-Run Effects of a Special Access Line Price Reduction Under the Assumptions in the SPARC Study

The results of the two-sector model demonstrate that, even if we grant SPARC their most unrealistic assumptions, the macroeconomic "benefits" SPARC predicts still do not result. This simply demonstrates the basic point that the economy as a whole cannot be improved by distorting prices in a particular market. The main results, which are discussed in greater detail in Appendix B, are as follows:

- Resources are shifted among sectors in the economy in a manner that is inefficient. As a result, scarce resources are wasted, the wrong mix of goods and services is produced, and overall economic welfare is reduced.
- The effect on output, even with all of the assumptions favorable to SPARC that have been incorporated into the structure of the model, is ambiguous. Thus the most basic claim of the SPARC study, that reducing special

access prices would increase output, cannot be supported even using a model that accepts all of the unusual assumptions hidden within SPARC's analysis.²⁶

- What is not ambiguous is that American consumers and businesses would be worse off. It is important here to distinguish between output, which is the focus of the SPARC study, and economic benefits. People are made better off not simply by producing more things, but by producing the right things, the things people want.²⁷ Although the effect on output in the model is indeterminate, the effect on welfare is clear. By distorting prices, SPARC would move the economy away from producing the optimal mix of goods and services, leaving us with less of the goods and services we value most.

B. The Long-Run Effects of a Special Access Line Price Reduction Under the Assumptions in the SPARC Study

The long-run effects of the SPARC proposal in the context of our specialized two-sector model are exactly the same as those we discussed above in the more general case. In the long run, the economy would correct for the distortions caused by SPARC and would return to its normal long-run path. This could happen because regulators

²⁶ It is possible, by making a long list of additional assumptions, to force the two-sector model to yield an increase in output. As with the structural assumptions, these are not realistic. Appendix B shows in detail all of the assumptions that would be necessary. It is important to emphasize that, even in this extreme case, the aggregate economic welfare produced by the economy has been reduced.

²⁷ To illustrate this, imagine a case in which the Gross National Product increased slightly, but three-quarters of that product was in the form of paper clips. In some abstract sense the total output has increased, but people have been made worse off, because there is less of all the goods and services they would actually want, such as food, housing, and so on.

rescind the price change, allowing special access prices to return to their market-clearing levels. Or, failing that, other prices in the economy would adjust over time until, in terms of relative prices, the same result had been achieved.

In either case, there would be short-run losses in economic welfare for as long as the price distortion persists. Once the economy has returned to its optimal path, the long-run effect of the SPARC proposal would be zero. It is important to note, however, that the losses incurred in the short run would be permanent in the sense that the welfare lost during that period would never be recovered.

Thus, even granting SPARC all of its unrealistic assumptions, it is still not possible to improve the performance of the American economy, either in the short run or the long run, by distorting the price of special access services.

There are really only two ways to improve macroeconomic performance, and SPARC is not a reasonable means for accomplishing either of them. One way to improve performance is to improve efficiency: that is, to allow the economy to produce more benefits from a given set of resources. If the economy starts at full employment, this is the *only* way to improve macroeconomic performance. SPARC does just the opposite: by distorting prices, it reduces efficiency.

If the economy is not at full employment, there may be a second means of improving performance, at least in the short run. Stimulating the economy may make it possible to allow more of the available resources to be used. This is the role of traditional fiscal and monetary policy. Part of the effect produced by SPARC's manipulation of the GI model may be that the model interprets the arbitrary reduction in

price as having a stimulative effect on aggregate demand. However, the SPARC proposal does not represent a reasonable policy for adjusting aggregate demand. For one thing, both monetary and fiscal policy are already extremely expansive at this time. We are running a large deficit, and interest rates are at historic lows. More fundamentally, these traditional instruments of macroeconomic policy are designed to stimulate the economy without distorting prices, misallocating resources, or favoring one sector over another. Manipulating the price of special access, as SPARC would have us do, would be a very unfortunate way in which to attempt macroeconomic stimulus, because it would lead to all of these negative effects. Simply put, Alan Greenspan does not need any help from the FCC in managing the overall level of the economy.

X. CONCLUSION

Rates for special access are at market levels today. Arbitrarily reducing them, as SPARC proposes, would harm consumers and damage the economy. The macroeconomic “benefits” SPARC purports to show are the result of conceptual and methodological errors in the SPARC study.

ATTACHMENT A

A Critique of the SPARC Demand Model

The Identification Problem

A quick inspection of the SPARC model reveals elementary errors so great as to make the results not useable for any purpose except as an example of how not to do an econometric study. Prices and quantities are jointly determined in standard market models. They are here in this price cap environment as well (to see this note that even if price caps are binding, flexibility within baskets is permitted). Thus, a price cap firm chooses prices and quantities in order to maximize profit subject to the price cap constraint. Moreover, whether the cap is binding, the joint determination makes the prices and quantities simultaneous and endogenous. Thus, in these cases, we also have endogeneity and simultaneity.

In this context, the first problem is that the SPARC study's authors cannot tell us whether they have estimated a demand curve, a supply curve, or simply connected points that lay on no common curve. In the parlance of Working (1927) or Wooldridge (2003), they have fallen victim to the identification problem—arguably the problem whose solution defined econometrics as a field separate from statistics.¹ In modern

¹ Holbrook Working and Elmer Joseph Working were both distinguished statisticians who made seminal contributions to the early development of econometrics. Holbrook Working was an agricultural economist at the Stanford Food Research Institute whose early work on demand (1925) was one of the earliest demonstrations of the "identification" problem, although he saw it merely as a data problem and not a theoretical one. Elmer Joseph Working was the real discoverer of true nature of the "identification" problem in econometrics and the first to suggest that the solution to it is at least partly theoretical. His specific suggestion was that theory be used to pre-adjust the data. See <http://cepa.newschool.edu/het/profiles/working.htm>. Jeffrey M. Wooldridge was named *Fellow of the Econometric Society* in December 2002 and was named *6th worldwide among econometric theorists*, 1989-1999 (source: Table 4, Badi Baltagi, "Worldwide Institutional Rankings in Econometrics 1989-1999: An Update," *Econometric Theory*, 2003). See <http://www.msu.edu/user/ec/departments/newsletters/Nov%2003%20Newsletter.pdf>.

terms, they have included endogenous explanatory variables (namely prices) as regressors, and failed to include demand and supply shifters to identify their equations.

To illustrate these points, we quote and paraphrase liberally from Wooldridge:

Another important form of endogeneity of explanatory variables is simultaneity. This arises when one or more of the explanatory variables is jointly determined with the dependent variable, typically through an equilibrium mechanism (as we will see later).²

Wooldridge goes on to describe a system with a supply curve and a demand curve. We modified his labor example to make it relevant here.³ The demand curve is

$$q = \alpha_1 P_l + \beta_1 z_1 + u_1$$

where q is special access, P_l is the price, and z_1 is a variable that shifts demand but not supply. The supply curve or curve giving supply response is given by

$$q = \alpha_2 P_l + \beta_2 z_2 + u_2$$

and z_2 is a variable that shifts supply but not demand. The variables z_1 and z_2 are respectively called a demand shifter and a supply shifter. The u_1 and u_2 are random error terms. To paraphrase Wooldridge (p. 527), q and P_l are the endogenous variables.

² Jeffery M. Wooldridge, *Introductory Econometrics: A Modern Approach*. 2nd edition (South-Western: Marion, Ohio, 2003) p. 525 ("Wooldridge"). This is a book used at many universities including the University of California, Berkeley, to teach first and second year Economics majors their first course in econometrics.

³ This is not the model we would use here; it is merely an example to illustrate a point. We believe a game theoretic model would be more accurate. If the equilibrium in the special access market is indeed a Nash equilibrium to some game, it is unlikely the approach used by the SPARC study's authors could ever be augmented so as to allow identification.

Quoting again: “A second important point is that, without including z_{1i} and z_{2i} in the model, there is no way to tell which is the supply function and which is the demand function.”⁴ When z_1 appears in an equation, we know that it is a demand function, which we are trying to estimate. When z_2 is in an equation, we know that it is a supply relationship. Per Wooldridge: “If z_{1i} and z_{2i} are the same . . . then the equations look identical, and there is no hope of estimating either one. In a nutshell, this illustrates the identification problem in simultaneous equations models . . .”⁵

Arguably, the SPARC study does not estimate demand at all but supply behavior on the part of the ILECs. All of the variables used would shift supply and not demand or shift both supply and demand. The dummies for the firm identities certainly are supply related. The time dummies affect both supply and demand; and, the change in technology supposedly picked up by the ratio of digital to total channels also is supply-related and maybe related to both.

Further, recall that, if one is measuring demand, the natural unit of observation is either demand by the **users** or **demanders** of special access either at the individual-unit-end-user, firm, or at the aggregate-market level. In contrast, in order to study production or supply response, the natural units of observation are the **suppliers** of the product, in this case, the ILECs or the quantity supplied at the market level. The SPARC authors’ unit of measurement is an ILEC, so they are modeling the behavior of ILECs *not* the behavior of the end-user firms. Since many competitive firms are not

⁴ Wooldridge, p. 527.

⁵ Wooldridge, pp. 527–528.

required to report their data to the FCC, data do not exist to estimate a market demand from market-level data.

Even if the equation in question were an identified firm demand equation, the SPARC study still would be in error for when there are endogenous variables on the right-hand side of the equation, ordinary least squares (the method used by the SPARC authors) gives biased results. Per Wooldridge: “It is useful to see . . . that an explanatory variable that is determined simultaneously with the dependent variable is generally correlated with the error term.”⁶ Further, “[when P_i is correlated with] u_i because of simultaneity, we say that OLS [ordinary least squares] suffers from simultaneity bias.”⁷ What should have been done (if the model is identified and we doubt that it is), is two-stage least squares. Quoting Wooldridge again: “Once we have determined that an equation is identified, we can estimate it by two-stage least squares.”⁸

The Market Definition Problem

Because the SPARC study bases its analysis on data from the ILECs, it ignores roughly one-third of the market, which prevents direct estimation of a market demand curve. It also prevents the indirect estimation where individual ILEC demand curves are aggregated into a partial market demand. Consider the following scenario, the price the ILECs charge falls 30% so that the demand for ILEC services increases 30% (assuming

⁶ Wooldridge, p. 530.

⁷ Wooldridge, p. 531.

⁸ Wooldridge, p. 538.

unitary elasticity as in the SPARC study). Because the alternative provider response goes unmodeled, that 30% increase for ILEC special access services may come totally from a reduction in alternative provider demand. The true net aggregate effect would be small but SPARC would find 30% because it only uses part of the data for the market.

The Omitted Explanatory Variables Problem

This points to the second problem with the empirical analysis—competitive effects are completely ignored leading to an omitted explanatory variables problem and the well-known biases associated with this problem. In an appropriately specified model, the firm demands would depend on the prices of substitutes; in this case, the prices charged by the alternative providers. The SPARC study does not include or test for these and failing to do so constitutes the second major error, which is leaving out a relevant explanatory variable causing a bias.⁹ If a regression is well-explained by two variables and one is left out, then a bias occurs unless the two variables are totally independent. However, it makes no sense to say that alternative provider prices do not affect ILEC demand. It also makes no sense to say that ILEC prices and alternative provider prices are unrelated. The firms compete on price as well as other attributes. Were alternative providers to lower prices significantly, ILECs would have to follow.

There is a second omitted variable bias. Derived demands (i.e., demand for inputs used to produce other things) also depend on the prices of the items produced.

⁹ Wooldridge, pp 91-94.

The true industry demand curve is steeper (less elastic) than the horizontal summation curves that represent the aggregate of firm's factor demands (under the artificial assumption of constant product price). An economic analyst, then, might be led astray if he surveyed firms' intentions in attempting to assess increased industry employment that would ensue from a lower factor price. For, the firms are all calculating in terms of the present product price. The analyst should discount the firms' intentions by allowing for the anticipated fall in product price that will result from increased industry output.¹⁰

That is, the demand for special access depends on the prices of services produced by using special access. If demand for long distance were to fall because prices for long distance increased or because prices for long distance substitutes fell, then demand for special access would fall as well even if the price of special access remained constant. Thus, a correctly specified model must account for the demand of the products produced using special access. Depending on the structure of the market, this means including the prices of such things as long distance services and Internet prices, variables that capture shifts in the demand for services produced using special access. No such effects are included or tested for, so there is another omitted variable problem. In addition, the omitted variables lead to biased estimates. Thus, omitting these variables is doubly damaging. Further, with two or more omitted variables, there is little hope of determining the direction of the bias.

In addition, the SPARC study's demand model is estimated over a period when the demand for special access grew very rapidly. This outward shift in the demand curve was probably related to several factors, including a long boom in the economy generally, the growth of the Internet, and a telecom expansion that constitutes one of

¹⁰ Jack Hirshleifer, *Price Theory and Applications* (Prentice-Hall: Englewood Cliffs New Jersey, 1976) pp. 367–368.

the biggest bubbles in the history of American business. Yet, the SPARC study model includes no variables to explain this explosion in demand nor does it test for their exclusion.

A final set of obvious omitted variables includes the prices of special access for other bandwidths. Thus, DS-0s, DS-1s, and DS-3s are all substitutes. The demand for DS-1s should contain the prices of DS-0s and DS-3s.

To summarize, many variables are omitted that should be entered in the model. These variables are needed to identify the demand curve, prevent omitted variable biases, and serve as instruments in a two-stage least squares estimation to correct the biases. If these variables do not belong, then tests that demonstrate this must be provided. The omitted variables are so standard that one would find it surprising were the tests that should have been performed were to show all of them should be omitted.

There is another problem with the model used to perform the analysis. The double logarithmic form implies constant elasticities. However, constant elasticity is a special case that is best used when proposed price changes are small, unless specification testing supports it. Many other functional forms where elasticity is allowed to vary with output may be better; however, no others seem to have been examined. Given the impossibly high elasticities produced by the SPARC study, a form that allows the elasticity to vary should have been used.

The Data Problems

Additionally, the SPARC study has data problems. First, no actual demand data or actual price data are used. It appears that the authors created their own price and quantity indices. We are told almost nothing about these indices or the sources of the data. Ordinarily, when price indices are created for use in empirical work, a standard index is employed or the details of the construction provided. Even then, one cannot simply replace a missing variable with a proxy index except under very special conditions. There is no discussion of whether these conditions are met.

Of special concern is the construction of the special access price indices. We know of no accepted method of creating price indices for nonlinear price schedules. A price list, tariff, or agreement with quantity discounts is a nonlinear price schedule. We believe that many, if not most, special access agreements have such discounts and are not linear. Even without resorting to indices, such nonlinear schedules cause another endogeneity problem that the authors completely ignore.¹¹

The Implicit Attribution of Endogeneity and Exogeneity to the Variables

The next problem with the SPARC study is the implicit attribution of endogeneity and exogeneity to the variables. Endogenous variables are those whose changes are caused within the system; exogenous variables are those determined outside of the system. In large macromodels and in aggregate sectoral models, it is very hard to find

¹¹ Jerry A. Hausman, "The Econometrics of Nonlinear Budget Sets," Fisher-Shultz lecture for the Econometric Society, Dublin: 1982; *Econometrica*, 53, 1985.

exogenous contemporaneous variables. In the SPARC study, the authors make this very elementary mistake. If prices of special access adjust to clear the market, then they are endogenous. If there is market power and firms price at what the market will bear, then the prices are endogenous. If during the period when price caps were operative, but the price caps were not binding, then prices are endogenous. Only when prices caps are binding can prices conceivably be exogenous, and then only for the price cap firms. At best, special access prices are for some firms sometimes exogenous and perhaps sometimes for the same firms endogenous. This is a more complicated form of simultaneity, but it has the same effect. Its solution is simply more complicated. Having endogenous right-hand side variables is another obvious source of error and not an obscure or obtuse source, but one of the most common sources of error in regressions.

Indeed, econometrics was initially identified as being able to solve the problem of the failure of regression models to correctly estimate demand and supply curves. Simple methods and tests exist. It is disappointing that half of a century after they became part of the canon of econometrics and a quarter of a century after the tests for endogeneity became common, a study claiming to be serious would eschew them.

The Specification of the Statistical Error Structure of the Model Problem

An additional problem, although one that pales in comparison to the aforementioned problems, is the specification of the statistical error structure of the model. Here we primarily mean the choice of pooled cross-section and time-series

representation. The dummy variable form chosen by the SPARC authors is only one of many candidates. If their choice is wrong, biases are the result. Again, specification tests to verify the models are available and have been available for at least 20 years. Again, the authors fail either to perform or to report the tests supporting their specification.

The Spurious Regression Problem

An additional and very serious problem that often appears in time-series and panel models is the spurious regression problem. The SPARC study's authors have ignored this as a possible problem. A spurious regression occurs when a group of unrelated variables grows together because of a common factor. Regression of any one of the group on any group of the others will often show a strong correlation, but this correlation simply picks up the fact that many variables grow together, not that they cause one another. Modern time series has developed tools for identifying cases where such spurious regressions have occurred. These tests and how to use them appear in undergraduate econometrics textbooks.¹² The effects of error here are multifaceted. Not only may there be biases, but even if there are not, the test statistics may be all wrong. Therefore, one cannot rely on the test statistics to determine statistical significance. Given the period under analysis and the lack of control variables, there is reason to believe that the SPARC study does suffer from a spurious regression problem.

¹² See James H. Stock and Mark W. Watson, *Introduction to Econometrics*, (Pearson Addison Wesley: 1st edition, 2002).

Conclusion

We find the SPARC study fatally flawed on many levels. The model is unidentified and probably incorrectly estimates a supply rather than a demand curve. At a minimum, there are omitted relevant explanatory variables, variables that theory suggests should be present; ordinary least squares was employed where there were endogenous explanatory variables. All these cause biases; all these have simple, well-known solutions and/or tests. Because the study is clearly inconsistent with basic econometric theory and because it does not use state of the profession tools, it should not be taken seriously.