

15

Rethinking the Implications of "Real Options" Theory for the U.S. Local Telephone Industry

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Abstract - Real options theories are an important advance in analyzing the value of various business arrangements. Because incumbent exchange carriers' business arrangements with their new competitors are at the center of regulators' efforts to demonopolize the U.S. local telephone industry pursuant to the Telecommunications Act, it is natural that these new arrangements should be inspected to determine whether they correctly reflect the import of real options' costs. Investors and regulators have recognized these considerations, and to the extent that certain real options models do not reach the same conclusion, it is because they have not been parameterized to reflect accurately the market conditions facing the U.S. local telephone industry.

Accounting for the option value of an investment is not new. Although appropriate mathematical formulations for option values have only been developed within the last twenty-five years, markets, investors and regulatory commissions have long incorporated options effects in valuing and pricing regulated services.² It is thus useful to evaluate whether more recent developments in "real options" theory have uncovered effects and considerations not previously known to or accounted for by markets, investors and regulators.³ Certain analyses by real options proponents have suggested that lack of attention to these considerations in U.S. local telephone markets may possibly have caused prices for some regulated telecommunications services to incorporate less than half of their truly required return.⁴ Given the potential significance of these claims to an industry with over \$100 billion in commerce annually, it is important that the underlying analyses be examined to determine whether:

- (a) Real options theories are simply invalid⁵ or
- (b) Real options theories are valid and have been parameterized by their proponents to model the local telephone industry accurately – with the foreboding implication that the incumbent local exchange companies incumbent local exchange carriers (ILECs) may be on the brink of financial ruin or

- (c) Real options theories are valid, but have not been parameterized to model the local telephone industry accurately.

This paper examines the validity of each of these possible conclusions about real options. Conclusion (c) is the most compelling. When real options models are parameterized to represent the local telephone industry accurately, these models affirm that investors and regulators have incorporated appropriate real options considerations into their investment evaluations and ratemaking decisions for ILEC local telecommunications services.

1. MIGHT THE ENTIRE THEORY BE INVALID?

While it is possible that the entire theory of real options is in error, this seems unlikely. First, this theory is not especially new, and due to its notoriety it has been exposed to substantial scrutiny from professional economists. If the theory is simply wrong, its deficiencies should already have been revealed in the literature. A second reason to doubt the invalidity of real options theory is that when these models are parameterized realistically, they appear to generate predictions that comport with current conditions and expectations. Thus, it seems unlikely that conclusion (a) is correct.

2. MIGHT THE THEORY AND ITS CURRENT PARAMETERIZATIONS BE CORRECT?

If proponents of real options theory such as Hausman have correctly parameterized their models of real options to reflect accurately the conditions of the local telephone industry, the implications are profound. These parameterizations suggest that rather than enjoying rather high and relatively riskless returns, ILECs are actually in grave financial danger; and to ameliorate this, their returns on services incorporating significant options value may need to double, or more.⁶ Thus, given that return and income tax components constitute 30 percent of a typical ILEC's total revenue and depreciation constitutes an additional 22 percent, the return and/or depreciation inadequacies suggested by these real options parameterizations could be as large as half of the affected services' current revenues. Correcting this would require that regulators quickly grant ILEC rate increases of up to 50 percent for these services.

This foreboding view of the current ILEC financials, however, does not appear to be shared by investors, regulators, or by the ILECs themselves. In particular, even recent forward-looking determinations of the major ILECs' cost of capital using

standard discounted cash flow or capital asset pricing model methods confirm that based on current investor expectations, the weighted average cost of capital to the ILECs is in the 9 percent range - and certainly not in the 20 percent to 30 percent range as speculated by certain of the real options models using their proposed parameterizations.⁷ Indeed, if the ILECs' "true" cost of capital is in this elevated range and a substantial portion of their services is subject to real options effects, it is remarkable that ILEC bond ratings remain at the highest investment levels, and that none of the over 1300 ILECs has gone bankrupt in recent memory.⁸

Equally telling is the fact that the ILECs themselves also appear not to believe that their proper cost of capital is in the 20 percent to 30 percent range. In comments they have made to the Federal Communications Commission concerning their authorized rate of return, none suggested that their return should be set at such levels.⁹ Furthermore, no ILEC appears to have pointed toward real options theory as a justification for any increased return level.

Thus, because none of these groups, which have significant interest in the financial status of the ILECs, appears to believe that current returns are inadequate to provide ILECs with a profitable, sustainable financial future, it appears unlikely that conclusion (b) is correct.¹⁰

3. MIGHT THE THEORY BE CORRECT, BUT ITS PARAMETERIZATION BE WRONG?

It is not a necessary feature of real options theories that they should project overall ILEC rates of return to be inadequate. This projection is critically sensitive to the parameterization of the real options model in question. Among the parameter values that appear to be necessary to support a conclusion that current ILEC returns are inadequate are:

- ◆ Most ILEC investment is sunk and irreversible, and regulator-set price and sales conditions are irreversible, too.
- ◆ The effect of technical progress is always to devalue earlier investments.
- ◆ There is a competitive gain to "waiting" before deciding to make investments and enter the product market.
- ◆ The terms and conditions that the Telecommunications Act specifies for the provision of network elements and interconnection are fundamentally different and less favorable to the ILECs than the terms and conditions under which the ILECs currently market local and access services.¹¹

A closer examination will reveal that each of these suppositions is inaccurate.

3.1 Irreversibility?

The vast majority of ILEC investments are not sunk and/or irreversible. In the event of a local demand insufficiency, a large portion of telecommunications equipment can be physically moved to locations where market conditions are more favorable. Furthermore, even outside-plant facilities that cannot be physically moved can be transferred to buyers who find these facilities more valuable than the ILEC. Indeed, the ILECs have transferred several million customer lines from one to another over the last five years.¹² That such transfers may still be infrequent should not be construed as evidence that these investments are irreversible. Rather, they reflect both the facts that telecommunications demand has uniformly been growing at a substantial rate throughout the country (with this growth projected to continue, if not accelerate), and that the depreciation lifespans of most telecommunications equipment have been relatively brief.¹³ Indeed, ILECs have refused to dispose of even what they claim are their least-profitable investments.¹⁴ But if ILEC investments are reversible from a financial perspective, they do not incorporate significant real options value.

Any analysis of the effects of reversibility on options value and risk would be incomplete if it focused solely on the physical reversibility of investments. Many important financial aspects of the provision and sale of regulated monopoly network elements and interconnection are more reversible than comparable aspects of unregulated competitive markets. For example, regulators frequently allow their decisions about prices or permitted uses for a network element to reverse equally earnest earlier decisions. The risks generated by such reversibility commonly have a chilling effect on the likelihood that a new entrant local carrier will be able to assemble the capital required for successful market entry. Examples of these effects of reversibility include public utility commissions abrogating contractually agreed-to prices for unbundled loops in favor of higher prices supported by their own cost "studies," or permitting ILECs to renege on supplying special-access transport services for resold Centrex lines after it became apparent that this permitted new-entrant carriers profitable and efficient use opportunities.¹⁵ Thus, it is by no means clear whether the overall effects from the reversibility or irreversibility of investment and regulatory decisions favor or disfavor the ILECs.

3.2 Technological Progress?

While it is true that technological progress may have devalued certain earlier ILEC investments in central-office switching and interoffice transmission, this is not a representative example. Only about 20 percent of all forward-looking ILEC investment is for these network elements, whereas 60 percent to 70 percent of their

investments are in outside-plant facilities. Because of increased congestion and urbanization, outside-plant investments commonly have appreciated in value, not depreciated.

In addition, technologies may arise that make "old" investments appreciate in value. A useful example is xDSL, or digital subscriber line. In the early 1990s, the received wisdom was that copper loop distribution plant in local telephone networks was economically obsolete. Because it would not support the high-speed services that customers were beginning to demand, no more of it would be installed, and the installed base would be replaced rapidly by fiber optic or coaxial distribution cables. Instead, these latter distribution technologies have turned out to be much more expensive than previously anticipated, and xDSL technologies have arisen that allow the embedded copper loop distribution cables to be used efficiently to provide high-bandwidth services. Thus, because of the great cost of replacing these cables, they are now more valuable than when they were initially installed.

3.3 Gains from Waiting?

Another key parameter in real options models is whether there are gains from waiting to invest.¹⁶ If such gains are assumed to exist, then ILEC prices for network elements and interconnection may yield insufficient returns because they fail to incorporate the value of the "free option" of waiting to invest that they offer purchasers. But in the telecommunications industry, gains typically do not flow to those who wait, but rather are reaped by those who can become "first movers."¹⁷ Even if investment costs are expected to decline in the future, it is typically more profitable to enter a market quickly, accumulate customers and experience, and then, because of the flexibility inherent in telecommunications networks, transition these customers to the newer, lower-cost technologies that may have been developed subsequently.

3.4 Different Terms and Conditions?

Many of the real options analyses suggesting that new unbundled network elements or interconnection prices may be set too low to allow ILECs to earn adequate returns appear to assume that the terms and conditions under which the ILECs must sell these items are more disadvantageous to the ILECs than the terms and conditions under which they sell their current local or access services. As an example, it is alleged that purchasers of network elements or interconnection will receive a unique options advantage because they may discontinue their purchases.

However, the requirement to offer services on a month-to-month basis is typical for all services offered by the ILECs. Thus, purchasers receive no distinct options value from new interconnection services vis à vis purchasers of traditional ILEC access services. Indeed, because the sale of new interconnection services pursuant to the Telecommunications Act permits the use of negotiated contractual arrangements, the ILEC likely has more ability to appropriate the value of the real options aspects of these sales than sales of its traditional local and access services. This is because the latter type of services frequently can only be offered pursuant to regulator-approved tariffs incorporating specific terms and conditions.¹⁸

4. CONCLUSIONS

Real options theories are an important advance in analyzing the value of various business arrangements. Because ILEC business arrangements with their new competitors are at the center of regulators' efforts to demonopolize the U.S. local telephone industry pursuant to the Telecommunications Act, it is natural that these new arrangements should be inspected to determine whether they correctly reflect the import of real options' costs. This report finds generally that investors and regulators have recognized these considerations, and to the extent that certain real options models do not reach the same conclusion, it is because they have not been parameterized to reflect accurately the market conditions facing the U.S. local telephone industry.

NOTES

- ¹ The opinions expressed here are solely the author's, and do not necessarily represent those of AT&T.
- ² The first rigorous development of the mathematical theory of financial option values was provided in Black, F. and M. Scholes. 1993. "The Pricing of Options and Corporate Liabilities," *Journal of Political Economy*, No. 81, pp. 637-659.
- ³ Major contributions to real options theory include: Dixit, A. and R. Pindyck. 1994. *Investment Under Uncertainty*, Princeton University Press. McDonald, R. and D. Siegel. "Investment and the Valuation of Firms When There is an Option to Shut Down," *International Economic Review*, Vol. 28, No. 2, pp. 331-349; Pindyck, R. "Irreversible Investment, Capacity Choice and the Value of the Firm," *American Economic Review*, Vol. 78, No. 5, pp. 969-985. Hubbard, R.G. "Investment Under Uncertainty: Keeping One's Options Open," *Journal of Economic Literature*, Vol. 32, pp. 1816-1832, provides a useful summary.
- ⁴ See, for example, Jerry Hausman, "The Effect of Sunk Costs in Telecommunications Regulation," in this volume, which states, "A ... calculation which ignores the sunk cost feature of telecommunications network investments would thus be off by a factor of two."
- ⁵ If these theories are invalid, it makes no difference whether they have been parameterized accurately – their results are simply irrelevant.
- ⁶ Hausman, op. cit.

- ⁷ See, *Direct Case of the General Services Administration* ("GSA calculates the weighted cost of capital as 9.27 percent"), filed January 19, 1999 in Federal Communications Commission CC Docket No. 98-166; or *Responsive Submission of AT&T Corp.* with its accompanying *Affidavit of Bradford Cornell and John I. Hirschleifer* ("applying established financial economics principles to the market data on the publicly-traded firms that operate local telephone networks yields a weighted average cost of capital range of no higher than 8.5% to 9.5%"), filed March 16, 1999 in the same proceeding.
- ⁸ The absence of bankruptcy among such a large group of industry members is unprecedented. Rather than revealing an industry in a precarious financial position, it suggests that the earnings currently available to ILEC monopolies are both high and stable -- or that few ILEC services are subject to significant real options effects.
- ⁹ See, for example the *Comments of GTE* ("there is no basis to alter the current prescribed authorized rate of return of 11.25%"), filed January 19, 1999 in Federal Communications Commission CC Docket No. 98-166; or the *Comments of Bell Atlantic* ("the Commission should not adjust the prescribed rate of return") filed in the same proceeding.
- ¹⁰ Indeed, if conclusion (b) is correct and a significant portion of ILEC services is affected, then the people privy to these real options analyses and their import should be shorting ILEC stocks in anticipation that once this information is assimilated by the larger financial markets, there will be a significant drop in ILEC stock prices.
- ¹¹ This note focuses only on the terms and conditions that are explicit in the Telecommunications Act and that are relevant to real options issues. It does not address ancillary complaints that are sometimes included in presentations on real options that claim, incorrectly, that the Telecommunications Act somehow requires regulators to blind themselves to economic factors such as risk or technological obsolescence in the setting of appropriate prices or depreciation rates.
- ¹² While many of these sold lines were in rural exchanges owned by large ILECs and sold to smaller ILECs, many also were transfers between large ILECs, e.g., Sprint/Centel to Ameritech, GTE both to and from Alltel.
- ¹³ The average depreciation life for telecommunications equipment is just over 14 years. In contrast, electric power generating and transmission equipment may frequently have lifespans of 30 years and more. See U.S. Department of Energy, Energy Information Administration, Form EIA-412, "Annual Report of Public Electric Utilities," demonstrating that in 1997, the average life of electrical plant was 32.5 years.
- ¹⁴ As an example, in the early 1990s, NYNEX claimed that only its midtown and downtown Manhattan exchanges were profitable, and that its other New York City exchanges generally "lost" money. But when Teleport then offered to purchase any of these "unprofitable" exchanges at their net book value, NYNEX refused to sell. See "The Local Call Goes Up for Grabs," *New York Times*, December 29, 1991, Section 3, p. 1.
- ¹⁵ See "In the matter of U S West Tariff F.C.C. Nos. 3 and 5," FCC Common Carrier Bureau *Order on Transmittal 629*, September 28, 1995.
- ¹⁶ In addition to gains from waiting to invest, there may be other advantages in managerial flexibility that incorporate real options value. See L. Trigeorgis. 1996. *Real Options: Managerial Flexibility and Strategy in Resource Allocation*, MIT Press.
- ¹⁷ Witness the first mover value of "1-800-COLLECT" in MCI's establishment of the dial-around market, or "Digital One Rate" in AT&T's establishment of the seamless wireless services market. In contrast, it is difficult even to identify the secondary entrants such as AT&T's "1-800-OPERATOR" or Bell Atlantic's "DigitalChoice SingleRate USA" or Sprint PCS' "Free and Clear" offerings.
- ¹⁸ For example, local service tariffs often prohibit offering volume or term discounts.