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HOW CAN REGULATORS SET NONARBITRARY INTERIM RATES? THE CASE OF LOCAL LOOP UNBUNDLING IN IRELAND

ABSTRACT. During a period of substantial regulatory change, as in the case of network unbundling in telecommunications, regulators often face the challenge of setting "interim" rates for services. How, in the face of inherently imperfect information and the need to proceed according to what is invariably an expeditious plan of deregulation or industry restructuring, can the regulator select an interim rate that is the least arbitrary? In this Article, we answer that questions using, as a case study, local loop unbundling (LLU) in the Republic of Ireland in 2001. We analyze the interim prices set by the Office of the Director of Telecommunications Regulation (ODTR) for access by competitors to the local network of the incumbent carrier, eircom. The ODTR's interim prices are based on a simple average of the prices in ten European Union countries for the same service. That methodology is flawed because, with minimal effort, the regulator could have used publicly available data to produce a considerably less arbitrary interim rate. A simple average does not produce good in-sample predictions when the sample variance is large relative to the sample mean – as is the case with the prices of unbundled loops in the EU countries. Using a simple multiple regression model, we find that the ODTR's methodology ignores relevant information, such as population, wage rate, population density, and the degree of urbanization, which, in a sample of the fifty U.S. states and ten European countries, explains roughly 25 percent of the cross-sectional variation in unbundled loop prices over and above that which can be explained by the sample mean alone. The regression model would produce an interim rate that is 42 percent higher than the rate set by the ODTR. Finally, we observe that interim rates that impose artificially low pricing of unbundled network elements will discourage facilities-based investment, to the long-run detriment of consumers.

I. INTRODUCTION

During a period of substantial regulatory change, as in the case of network unbundling in telecommunications, regulators often face the challenge of

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setting "interim" rates for services. These interim rates supposedly are – as the word "interim" clearly connotes – merely temporary. They are not intended to harden into precedent, either in terms of their ultimate level or in terms of the methodology by which regulators have calculated them. Experience may prove otherwise. Consequently, interim rates during a period of competitive transformation in a network industry may tip the regulator's hand as to the level and methodology for the permanent rates to follow.

How does a regulator set interim rates that are not arbitrary? He or she cannot. The proper question is: How, in the face of inherently imperfect information and the need to proceed according to what is invariably an expeditious plan of deregulation or industry restructuring, can the regulator select an interim rate that is the least arbitrary?

We address that question in this Article by examining the experience circa 2001 in the Republic of Ireland with the interim pricing of competitor access to the unbundled loop metallic paths (ULMPs) of the incumbent carrier, *eircom plc.* Such unbundling is commonly called local loop unbundling (LLU). We analyze the interim prices set by the Office of the Director of Telecommunications Regulation (ODTR) in 2001 for access by competitors to *eircom*'s local access network. The ODTR's interim prices are based on a simple average of the prices in ten European Union countries for the same service. That interim pricing methodology cannot be defended in theory or reconciled with prevailing regulatory practice.

In Part II of this Article, we review the theory and practice of cost-based access pricing. We explain the costing methodology employed by the U.S. Federal Communications Commission (FCC) to price unbundled network elements. International regulators from Canada to the United Kingdom have embraced the cost-based pricing standard for LLU. Next, we explain the state-level pricing outcomes in the United States. Given the consistent pricing methodology employed across the American states, the significant variations in LLU prices across (and even within) states is largely attributable to variations in the underlying costs of providing access.

In Part III, we examine as a case study the ODTR's interim pricing methodology for LLU in Ireland. We explain why the simple average adopted by the ODTR does not comply with the Local Loop Unbundling Regulation adopted by the European Parliament and Council. We demonstrate why a simple average does not produce good in-sample predictions when the sample variance is large relative to the sample mean – as is the case with the prices of unbundled loops in the EU countries. We show that the ODTR's methodology ignores relevant information, such as population, wage rate, population density, and the degree of urbanization,

which, in a sample of the fifty U.S. states and ten European countries, explains roughly 25 percent of the cross-sectional variation in unbundled loop prices over and above that which can be explained by the sample mean alone. The regression model would produce an interim rate that is 42 percent higher than the rate set by the ODTR.

In Part III, we examine the social cost of deviating from a cost-based approach for pricing unbundled loops. Any such deviation will lead to a misallocation of resources. Moreover, artificially low pricing of unbundled network elements will discourage facilities-based investment. Facilities-based competition should be the long-run objective of the ODTR and other national regulatory authorities when they set interim rates for LLU.

II. Cost-Based Access Pricing

Telecommunications regulators in the industrialized nations traditionally have based their pricing methodologies for LLU on the costs of providing the underlying service. For example, to promote competition in the provision of local telecommunications services in the United States, the Telecommunications Act of 1996[1] provides for three different forms of competitive entry in local exchange markets: (1) self-supply, or facilities-based entry; (2) resale of the services of the incumbent local exchange provider (ILEC); or (3) leasing unbundled network elements (UNEs) from the ILEC. With respect to the pricing of UNEs, the 1996 legislation requires that prices be "based on the cost" of providing the network element.[2] In its *First Report and Order* on local interconnection, the FCC introduced the concept of total element long-run incremental cost (TELRIC) to set UNE prices.[3] At the service level, that cost measure is called total service long-run incremental cost (TSLRIC). Because LRIC only considers incremental costs of a long-run nature, the total UNE price is the sum of the forward-looking long-run incremental cost of efficient network reconstruction *and* a reasonable[4] portion of forward-

[1] Pub. L. No. 104–104, 110 Stat. 56.

[2] 47 U.S.C. §252(d)(A)(i).

[3] Implementation of the Local Competition Provisions in the Telecommunications Act of 1996, Interconnection between Local Exchange Carriers and Commercial Mobile Radio Service Providers, First Report and Order, CC Dkt. Nos. 96–98, 95–185, 11 F.C.C. Rcd. 15,499 (1996) [hereinafter *First Report and Order*], *rev'd in part and aff'd in part*, Iowa Utils. Bd. v. FCC, 120 F.3d 753 (8th Cir. 1997), *rev'd in part and aff'd in part sub nom.* AT&T Corp. v. Iowa Utils. Bd., 119 S. Ct. 721 (1999).

[4] In the *First Report and Order*, the FCC suggested that one "reasonable" cost allocation method "would be to allocate common costs using a fixed allocator, such as a

looking common costs.[5] Embedded or historical costs, a second cost-based approach, can serve as a validation check on proposed TSLRIC estimates.

There is no reason why TSLRIC should always be less than embedded costs. For example, TSLRIC may exceed embedded costs if loops must be placed underground in the future (as required in many U.S. locations).[6] Two factors that can cause TSLRIC and embedded costs estimates to diverge are (1) changes in investment costs (decreasing investment costs can cause embedded costs to exceed TSLRIC), and (2) changes in depreciation schedules (protracted regulatory depreciation periods can cause embedded costs to exceed TSLRIC).[7] The FCC's cost proxy model, which was used as an interim measure until the state public utilities commissions (PUCs) could set final prices for unbundled loops, produced forward-looking cost estimates close to embedded costs (the mean difference was 0.07 percent).[8] The subsequent unbundled loop rates set by the state PUCs in arbitration proceedings were based on forward-looking cost estimates that were far below embedded costs.[9]

Incumbent carriers in Europe have looked to the U.S. regulatory regime for guidance in setting access prices. For example, in its February 2001 report to the ODTR, *eircom* embraced the LRIC approach to pricing unbundled loops and outlined seven major costing principles that it would

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percentage markup over the directly attributable forward-looking costs." *First Report and Order*, *supra* note 3, at 15,853 §696. For example, the Illinois Commerce Commission ordered GTE and Ameritech to offer unbundled network elements at TELRIC plus 28.86 percent. *See* Illinois Commerce Comm'n v. Illinois Bell Telephone Co. Order, at ∗46, *available at* 2000 WL 562306 (Ill. Comm. Comm'n Mar. 29, 2000). The California Public Utilities Commission ordered Pacific Bell to offer its UNEs at TELRIC plus 19 percent. *See* Governing Open Access to Bottleneck Services, 197 P.U.R.4th 369 (Cal. Pub. Util. Comm'n Nov 18, 1999).

[5] There is continuing debate in the United States as to whether the incumbent provider should be required to base its costs on a hypothetical network that is "superior" to its own or, alternatively, on its actual forward-looking costs of providing the network element. For a comprehensive review of that debate, see J. Gregory Sidak & Daniel F. Spulber, Deregulatory Takings and the Regulatory Contract: The Competitive Transformation of Network Industries in the United States (Cambridge Univ. Press, 1997); Dale E. Lehman & Dennis L. Weisman, The Telecommunications Act of 1996: The "Costs" of Managed Competition (Kluwer Academic Publishers 2000); Alfred E. Kahn, Letting Go: Deregulating the Process of Deregulation (1998); Alfred E. Kahn, Whom the Gods Would Destroy, or How Not to Deregulate (AEI-Brookings Joint Center on Regulatory Reform 2001).

[6] Lehman & Weisman, *supra* note 5, at 65.

[7] *Id.* at 70; *see also* Sidak & Spulber, *supra* note 5, at 200.

[8] Lehman & Weisman, *supra* note 5, at 78.

[9] *Id.*

apply to any LRIC estimation.[10] Regulators in other industrialized nations have used similar pricing methodologies.[11] For example, the Regulatory Authority for Telecommunications and Post (RegTP) in Germany,[12] the Australian Competition and Consumer Commission (ACCC),[13] the Canadian Radio-television and Telecommunications Commission,[14] and the Office of Telecommunications in the United Kingdom (Oftel)[15] each rely on LRIC to determine prices for LLU.

Even within countries or states, prices for LLU should vary in accordance with local changes in underlying costs. For example, in the relatively small country of Ireland, population dispersion and geographical condi-

[10] Comments of *eircom*, Access to *eircom* Local Unbundled Metallic Path: Charging principles and indicative charge structures (filed Feb. 2, 2001) [hereinafter *eircom Principles*].

[11] There has been an independent European impetus for national regulatory agencies (NRAs) to adopt such a standard. *See* Recommendation (EC) No. 2000/417, Official J.L. 156/44 (released May 20, 2000) at Art. 1 §6 (recommending the forward-looking LRIC method for LLU); *see also* Damien Geradin, *Institutional Aspects of EU Regulatory Reforms in the Telecommunications Sector: An Analysis of the Role of National Regulatory Authorities*, 1 J. Network Indus. 5 (2000).

[12] Regulatory Authority for Telecommunications and Post, An Analytical Cost Model for the Local Network, §2.1.1 (Mar. 4, 1998) ("The Telecommunications Act in conjunction with the Telecommunications Rates Regulation Ordinance of 1 October 1996 calls for rates to be based on the costs of efficient service provision, derived from the long run incremental costs of providing service plus an appropriate mark-up for non-volume-sensitive common costs").

[13] Australian Competition and Consumer Commission, Pricing of unconditioned local loop services (ULLS) and review of Telstra's proposed ULLS charges, at Ch. 3 (Aug. 2000) ("The Commission . . . has accepted that pricing based on total service long run incremental cost (TSLRIC) determined to recover the efficient costs of a 'forward-looking' network will satisfy the broad criteria, including the reasonableness criteria under section 152AH of Part XIC of the *Trade Practices Act*").

[14] Canadian Radio-television and Telecommunications Commission, Local Competition Decision, Telecom Decision CRTC 97-8, §124 (May 1, 1997) ("The Commission notes the [Bureau of Competition's] characterization of TELRIC as an approach in which all costs are variable, including fixed costs specific to the 'element', so that all are part of long run incremental costs. The Commission also notes that, in the context of Phase II, fixed costs are not included with incremental costs and must be recovered through a mark-up. In principle, therefore, essential facilities and other facilities, to which mandated pricing is applied in this Decision, should be priced to recognize fixed common costs in addition to Phase II costs. These facilities should also be priced so as not to unduly deter facilities-based competitive entry").

[15] Office of Telecommunications in the United Kingdom, Statement on the implementation of shared access to the local loop in the UK, §3.3 (Dec. 2000) ("Accordingly, Oftel will use the following set of high level principles to establish the initial price of shared loops and any ongoing adjustments: (i) The price of the loop will be cost-oriented and set on the basis of reasonably and necessarily incurred long run incremental costs (LRIC) . . .").

tions vary greatly across regions. The sharp contrast between densely populated areas, such as Dublin, and remote areas, such as western Ireland, necessitates different network architectures and hence costs in different parts of *eircom*'s access network. Urban areas likely will have a higher cost per line than do major cities because urban areas require more extensive use of (entirely new) underground ducts with longer route lengths than those of major cities.[16] It would be arbitrary, in the sense of ignoring obvious cost differences, to assign the same price for LLU across those differing areas.

The notion that access prices should conform to local circumstances is well documented in U.S. regulatory history. In the *First Report and Order* on local interconnection, the FCC empowered state PUCs to arbitrate "geographically deaveraged"[17] UNE rates to meet the 1996 Act's mandate that rates for interconnection and unbundled elements be "based on the cost . . . of providing the interconnection of network elements."[18] After surveying the state PUCs' different costing methods for geographically deaveraged "zones", the FCC concluded that "three zones are presumptively sufficient to reflect geographic cost differences in setting rates for interconnection and unbundled elements, and that states may, but need not, use these existing density-related rate zones."[19]

The FCC recognized that UNE costs must be assessed in light of states' varying population densities and geographical conditions. Most American states have established three density-based zones for access pricing.[20] Table I shows the deaveraged monthly unbundled loop rates established by the state PUCs in the United States, according to a report released in 2001 by the National Regulatory Research Institute, an organization created and supported by all of the independent public utility regulators in the country.

As Table I shows, the average monthly price for an unbundled loop in areas with comparatively high population densities (zone 1) was $13.49. The average monthly access price for zone 2 regions was $17.97. The average access price for the least densely populated regions (zone 3) was $29.25.

Elsewhere, one of us has written at length that the FCC's regulatory practices in general, and the TELRIC methodology in particular,

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16 *See eircom*, Bottom-up Access Costing Model for *eircom*'s Unbundled Local Loop 23 (Dec. 2000).

17 *First Report and Order*, *supra* note 3, §764.

18 47 U.S.C. 252(d)(1)(a)(i).

19 *First Report and Order*, *supra* note 3, §765.

20 Eleven states have created four zones, and one state created five.

TABLE I

Monthly unbundled loop rates, 2001 ($ US).

State	Zone 1	Zone 2	Zone 3	Zone 4
Alabama	15.24	24.75	44.85	
Arkansas	18.75	31.60	71.05	
Arizona	21.98			
California	10.03	13.51	25.53	
Colorado	19.65	26.65	38.65	84.65
Connecticut	8.95	12.03	13.28	19.69
District of Columbia	10.81			
Delaware	10.07	13.13	16.67	
Florida	13.76	20.13	44.40	
Georgia	14.21	16.41	26.08	
Idaho	25.52			
Illinois	2.59	7.07	11.40	11.40
Indiana	8.03	8.15	8.99	
Iowa	20.15			
Kansas	11.86	13.64	23.34	
Kentucky	17.44	22.23	25.84	
Louisiana	19.35	22.84		
Massachusetts	7.54	14.11	16.12	20.04
Maryland	12.11	12.85	18.40	25.96
Maine	12.67	15.59	23.00	
Michigan	8.47	8.73	12.54	
Minnesota	8.81	12.33	14.48	21.91
Missouri	12.71	20.71	33.29	18.23
Mississippi	16.71	21.45	29.75	38.59
Montana	26.69	27.62	31.36	33.95
North Carolina	16.71			
North Dakota	16.41	27.66	62.66	
Nebraska	13.56	27.12	54.24	
New Hampshire	14.01	15.87	24.09	
New Jersey	11.95	16.02	20.98	
New Mexico	17.75	20.30	26.23	
Nevada	11.75	22.66	66.31	
New York	11.83	12.49	19.24	
Ohio	5.93	7.97	9.52	
Oklahoma	12.14	13.65	26.25	
Oregon	13.95	25.20	56.21	

TABLE I

Continued.

State	Zone 1	Zone 2	Zone 3	Zone 4
Pennsylvania	10.25	11.00	14.00	17.50
Rhode Island	12.05	16.62	20.59	
South Carolina	18.48	27.87	36.91	
South Dakota	7.01	18.54	24.37	
Tennessee	13.19	17.23	22.53	
Texas	12.14	13.65	18.98	
Utah	14.41	17.47	24.14	
Virginia	10.74	16.45	29.40	
Vermont	7.72	8.35	21.63	
Washington	7.91	14.13	15.90	17.85
Wisconsin	10.90			
West Virginia	14.99	22.04	43.44	
Wyoming	19.05	31.83	40.11	58.43
Average ($)	13.49	17.97	29.25	33.16

Source: Billy Jack Gregg, A Survey of Unbundled Network Element Prices in the United States, Table I (National Regulatory Research Institute Working Paper) (Spring 2001).

are far from perfect.[21] The TELRIC methodology excludes incumbent firms' shared and common costs, discourages facilities-based investments, and effectively subsidizes inefficient competition.[22] However, despite TELRIC's shortcomings, it is far superior to the LLU pricing methodology proposed by some European regulators. In the following section, we outline and explain the errors in the interim LLU pricing of one such regulator, Ireland's ODTR.

[21] *See, e.g.*, J. Gregory Sidak & Daniel F. Spulber, *The Tragedy of the Telecommons: Government Pricing of Unbundled Network Elements Under the Telecommunications Act of 1996*, 97 Colum. L. Rev. 1081 (1997); J. Gregory Sidak & Daniel F. Spulber, *Givings, Takings, and the Fallacy of Forward-Looking Costs*, 72 N.Y.U. L. Rev. 1068 (1997).

[22] Sidak & Spulber, *Tragedy of the Telecommons*, *supra* note 21, at 1107–1110. Alternatively, one of us has advocated the combination of the market-determined efficient component-pricing rule (M-ECPR) with a system of competitively neutral end-user charges. Such a system would establish a cost-based pricing environment that compensates incumbents and creates present and future incentives for efficient competitive entry. *Id.* at 1093 *et seq*.

III. THE ODTR'S INTERIM PRICING METHODOLOGY

We examine now as a case study the ODTR's pricing methodology for LLU in Ireland. The ODTR's interim pricing methodology is flawed in three fundamental respects. First, because it is not based on relevant costs, the simple average adopted by the ODTR contravenes established EU law. Second, a simple average does not produce good "in-sample" predictions – let alone reliable "out-of-sample" predictions – when the sample variance is large relative to the sample mean. Third, the ODTR's methodology does not incorporate relevant information, such as the population density and the degree of urbanization, which can explain a significant amount of the variation in the LLU prices that regulators have set across the EU countries.

A. *The Failure of Simple Averages to Conform with the Regulatory Mandate of the European Union*

On December 18, 2000, the European Parliament and Council adopted Regulation 2887/2000 on unbundled access to the local loop, known as the LLU Regulation.[23] The LLU Regulation aims at "intensifying competition and stimulating technological innovation on the local access market through the setting of harmonised conditions for unbundled access to the local loop."[24] Article 3 of the LLU Regulation addresses the provision of unbundled access in general, and section 3 of Article 3 explains the relationship between pricing and costs: "Without prejudice to Article 4(4) [specifying the conditions for relief from regulation], notified operators shall charge prices for unbundled access to the local loop and related facilities set on the basis of cost-orientation."[25] Although the price of an unbundled loop is to be based on costs, the LLU Regulation does not provide any detail as to how those costs should be estimated. Finally, the LLU Regulation does not mention alternative methodologies, such as international benchmarking. *Only* cost-based pricing is embraced.[26]

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[23] Regulation (EC) No 2887/2000 of the European Parliament and of the Council of 18 December 2000 on unbundled access to the local loop, Official J.L. 336, 0004 – 0008 (released Mar. 12, 2000) [hereinafter *LLU Regulation*].

[24] *Id.* at Article 1, §1.

[25] *Id.* at Article 3, §3.

[26] To be fair, nothing binds the NRAs as to their short-term intervention on access pricing. The European Commission followed a similar approach for interconnection prices. *See* Recommendation (EC) 98/195, Official J.L. 73/42. After cost-accounting systems were in place, the Commission decided to discontinue its benchmarking approach for interconnection pricing. *See* Seventh Report on the Implementation of the Telecommunications Regulatory Package: Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee, and the Committee of Regions, COM

In April 2000, the ODTR nonetheless justified the use of international benchmarking as a means to facilitate competition:

> The application of LRIC is new to the Irish market and it will take time to apply LRIC to access network costs. As a temporary measure to facilitate the speedy rollout of LLU, the Director believes it may be necessary to set interim prices with regard to other relevant information such as appropriate historic costs, current costs, and international benchmarking.[27]

The ODTR suggested that benchmarking, rather than being applied in isolation, would be used in conjunction with cost-based methodologies to ensure that cost estimations conformed to European standards. Indeed, the ODTR undertook a comprehensive internal research program, which included "modelling of access costs based on LRIC, the use of current and historic cost information, international benchmarking, and review of *eircom*'s pricing proposals" as relevant factors.[28,29] The ODTR did not suggest that international benchmarking would be used if *eircom* failed to produce relevant costing data.

In April 2001, the ODTR imposed the use of international benchmarks in lieu of *eircom*'s cost-based proposal, "principally because of the difficulty of assessing an appropriate price for line rental, at this time, on the basis of the current information available from *eircom*."[30] According to the ODTR, its authority to impose interim pricing was grounded in Article 4 of the LLU Regulation:

> The LLU Regulation ... obliges the National Regulatory Authority (NRA), under Article 4(1), to ensure that charging for unbundled access to the local loop fosters fair and sustainable competition. In the case of Ireland, the ODTR is the NRA. Furthermore,

(2001) 706 at 15 ("Benchmarks have proved very useful in the transition to full verification of costs of regulated services. However, the continuation of formal benchmarking in relation for example to interconnection through recommendations could be counterproductive, since it sends the signal that cost oriented tariffs can to a certain extent be achieved without imposing cost accounting principles"). In that report, the Commission noted the Irish decision on LLU pricing, and it did not express any disapproval of it. *See id.* at Annex 199.

[27] Office of the Director of Telecommunications Regulation, Report on the ODTR consultation on local loop unbundling, Decision Notice D6/00, Doc. No. ODTR 00/30 at 27 (released Apr. 2000).

[28] *Id.* at 27.

[29] The setting of rates using LRIC requires caution. The setting of LLU rates on a basis of the estimated costs of a hypothetical, most-efficient network can be an exercise divorced from reality and lacking a proper foundation in economic theory. For a detailed review of the dangers of applying LRIC models, see Sidak & Spulber, *supra* note 5, at 403–426.

[30] Office of the Director of Telecommunications Regulation, Local Loop Unbundling – *eircom*'s Access Reference Offer (ARO), Decision Notice D8/01, Doc. No. ODTR 01/27 at 16 (released Apr. 2001) [hereinafter *ARO Decision*].

Article 4(2)(a) provides that the NRA shall have the power to impose changes on the Reference Offer, including prices, where such changes are justified; and under Article 4(2)(b) require notified operators to supply information relevant for the implementation of the Regulation. Under Article 4(3) the NRA may intervene on its own initiative in order to ensure non-discrimination, fair competition, economic efficiency *and* maximum benefit for users.[31]

The ODTR conceded that it could impose its own standard unless its alternative methodology promotes *each* of the four objectives contained in Article 4(3) of the LLU Regulation, including economic efficiency (the other three objectives being non-discrimination, fair competition, and maximum benefit for users). Economic efficiency can be broadly defined as the absence of waste, and an efficient economy uses all of its available resources to maximize overall output to the extent technological constraints permit.[32]

To justify its interim pricing solution, the ODTR argued that an interim access price based on a simple average of a handful of European states is a necessary and sufficient condition to achieving its three objectives: fair competition, economic efficiency, and maximum benefit for users.[33] In particular, the ODTR claimed that the interim prices (1) will "ensure" the three goals, and (2) are "necessary for fair competition, economic efficiency, and maximum benefit for ends users."[34] To an economist, the terms "necessary" and "sufficient" have serious implications. If prices based on a simple averaging were indeed sufficient to achieve the three stated objectives, as ODTR asserts, then why would ODTR (or any regulator for that matter) incur the high costs of estimating the incremental costs of a network with complex tools such as LRIC or historic cost models? Moreover, if prices based on a simple averaging were indeed necessary to achieve fair competition, economic efficiency, and maximum benefit for users, as ODTR asserts, then it must be the case that any regulator that has not relied on a simple average (such as the FCC in the United States or Oftel in the United Kingdom) must have failed to achieve these three objectives.

Article 4(2) of the LLU Regulation grants the ODTR the power to "impose changes on the reference offer for unbundled access to the local loop and related facilities, including prices, where such changes are justi-

[31] *Id.* at 6 (emphasis added).

[32] *See, e.g.* William J. Baumol & Alan S. Blinder, Microeconomics: Principles and Policy 59 (Dryden 7th ed. 1997).

[33] Statement of Opposition, filed on behalf of the Director of Telecommunications Regulation before the High Court Judicial Review, No. 539JR (Oct. 31, 2001).

[34] *Id.* at §§25, 29.

fied."[35] The most sensible economic interpretation of the regulation is that the ODTR's exercise of that power must be justified by reference to some positive failure by the incumbent carrier to base its prices on cost orientation. Furthermore, having regard to the specific provisions of Article 1(1) of the Regulation, any changes should aim not only at intensifying competition, but also at stimulating technological innovation. In Part III below, we will explain how the ODTR's deviations from the principles of economic efficiency exacerbate its failures to meet the LLU Regulation's mandate to promote "fair Competition" and "maximum benefit[s] for users."[36]

B. *The Poor Predictive Power of Simple Averages When the Sample Variance Is High*

In choosing its interim unbundled loop prices for Ireland, the ODTR used a simple average of the unbundled loop prices for ten EU nations.[37] In the language of statistics, the ODTR used an in-sample average to predict an out-of-sample value. A simple average is the most basic statistical methodology to predict out-of-sample observations. Indeed, more advanced statistical methods, such as regression analysis, use the simple average as a benchmark to measure the predictive power of more sophisticated methods.[38] As the following example illustrates, a simple average serves as a poor in-sample predictor whenever the variance of the sample is large relative to the sample mean.

To determine the goodness of fit for *any* predictor, statisticians typically rely on the residual sum of squares (RSS), which is the summation of the squared differences between the actual value and the predicted value.[39] The differences are squared before summing to treat negative and positive residuals the same. As an illustration, Table II presents two samples of ten observations each.

As Table II shows, when the variance of the sample values is small, the simple average is a good predictor – the RSS is only six. By contrast,

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[35] LLU Regulation, *supra* note 23.

[36] *ARO Decision*, *supra* note 30, at 6.

[37] Office of the Director of Telecommunications Regulation, Information Notice: Implementation of local loop unbundling in Ireland – 1 January 2001, Doc. No. 00/99 at Table 1 (released Dec. 2000).

[38] When performing regression analysis, variation of the dependent variable is defined in terms of deviations from its mean. The goodness of fit, which is referred to as R^2, is measured by the extent to which variations in explanatory variables explain the variation in the dependent variable relative to its mean. *See*, *e.g.*, William H. Greene, Econometric Analysis 252 (MacMillan 2d ed. 1993).

[39] *Id.* at 250–253.

TABLE II

Illustration of sample variance and goodness of fit.

Observation	Case 1			Case 2		
	Value	Residual*	Residual squared	Value	Residual*	Residual squared
1	4	–1	1	1	–4	16
2	5	0	0	5	0	0
3	6	1	1	9	4	16
4	4	–1	1	1	–4	16
5	5	0	0	5	0	0
6	6	1	1	9	4	16
7	4	–1	1	1	–4	16
8	5	0	0	5	0	0
9	6	1	1	9	4	16
10	5	0	0	5	0	0
Mean	5	0	0.6	5	0	9.6
Sum	50	0	**6**	50	0	**96**

*Difference between actual value and sample mean.

when the variance of the sample values is large, the simple average is a poor predictor – the RSS is 96.

This simple illustrative example demonstrates the first flaw of the ODTR's interim pricing methodology. Because the sample variance of the monthly prices for unbundled loops from the EU nations was large (8.91) relative to the sample mean (13.53), a simple average is a poor in-sample predictor. Table III shows the in-sample RSS when the simple average is used as a predictor of the LLU rental rate.

As Table III shows, the in-sample predictive power of the simple average appears to be low – the RSS is 80.42. The residual for individual observations is high, because the sample variance across EU states is high. The ODTR should have recognized that, because the simple average of monthly unbundled loop rates is a poor in-sample predictor (for the ten EU countries), the simple average would not provide a good out-of-sample predictor (for Ireland). As we demonstrate in the following section, there are better ways to predict the price of an unbundled loop for an out-of-sample country.

TABLE III

In-sample predictive power of simple average of prices of an unbundled loop across European countries.

Observation	LLU Monthly Rental Rate (€)	Residual	Residual* squared
Austria	12.48	–1.05	1.10
Belgium	19.51	6.00	36.00
Denmark	8.23	–5.30	28.09
France	16.00	2.47	6.10
Germany	12.90	–0.63	0.40
Italy	11.63	–1.90	3.61
Netherlands	12.50	–1.03	1.06
Spain	12.55	–0.98	0.96
Sweden	14.50	0.97	0.94
United Kingdom	15.00	1.47	2.16
Average	*13.53*		
Variance	8.91		
Sum			**80.42****

Source: Office of the Director of Telecommunications Regulation, Local Loop Unbundling – *eircom*'s Access Reference Offer (ARO), Doc. No. 01/27 (released Apr. 2001) at Figure 1.

*Difference between actual value and sample mean.

**Because the sample size is too small to conduct a regression, we cannot normalize the RSS. That is, we cannot produce the standard R^2 statistic.

C. *The Failure of Simple Averages to Explain the Variation in the Prices of Unbundled Loops Across Countries*

Economists have long recognized that simple averages are not the best out-of-sample predictors because they fail to incorporate all available information. Using the same data from our earlier example in Table II, suppose that the values are test scores and that five of the ten students took a class to prepare for the test. The five students who took the class are marked in bold in Table IV.

As Table IV shows, the mean of the students who took the class was 7.4, while the mean of the students who did not take the class was 2.6, and the mean for all students was 5.0. Using the simple average across *all* students to predict the value of each student – both those who took the class and those who did not take the class – yields an RSS of 96.0. Using the separate means of the students who took the class and did not take the class to predict their scores, respectively, yields an RSS of 38.4. Failing to

TABLE IV

In-sample predictive power of simple average.

Observation	Value	Residual*	Residual squared	Residual**	Residual squared
1	1	–4.0	16.00	–1.6	2.56
2	5	0.0	0.00	–2.4	5.76
3	9	4.0	16.00	1.6	2.56
4	1	–4.0	16.00	–1.6	2.56
5	5	0.0	0.00	–2.4	5.76
6	9	4.0	16.00	1.6	2.56
7	1	–4.0	16.00	–1.6	2.56
8	5	0.0	0.00	2.4	5.76
9	9	4.0	16.00	1.6	2.56
10	5	0.0	0.00	2.4	5.76
Mean for all students	5	0.0	9.60	0.0	3.84
Sum	50	0.0	**96.00**	0.0	**38.40**
Mean without class	2.6				
Mean with class	7.4				

*Difference between actual value and sample mean of all students.

**For students who took the class, difference between actual value and sample mean of students who took the class. For students who did not take the class, difference between actual value and sample mean of students who did not take the class.

incorporate this critical piece of information (whether or not the student took the class) results in less accurate in-sample prediction.

One can apply this lesson to the task of setting interim rates.[40] By taking the simple average across all EU countries, the ODTR failed to incorporate vital information that might explain the variation in the prices of unbundled loops across countries. Table V presents data for the individual countries that might be correlated with the price of unbundled loops.

As Table V shows, Ireland's total population, population density, degree of urbanization, and wage rate index are less than the corresponding averages for the other countries used in the ODTR benchmark. Those facts are highly relevant to the costs of a local telecommunications network because the supply of local telephone service exhibits strong economies of density

[40] In an ideal world with perfect information, an engineering-based approach is preferable to a regression model when setting access rates. In a world with imperfect information, however, where the regulator must devise a short-term solution that makes best use of limited information, a regression model is preferable to a simple average of access rates.

TABLE V

Characteristics of European countries.

Country	Population (1,000s)	Population density (people/sq. mile)	Degree of urbanization	Wage Rate Index (United States, 1999 = 100)	LLU Monthly Rental Rate (€)
Austria	8,092	253.3	64.6	114	12.48
Belgium	10,226	807.0	97.2	119	19.51
Denmark	5,326	325.1	85.3	120	8.23
France	58,620	276.0	75.4	94	16.00
Germany	82,100	608.8	87.3	136	12.90
Italy	57,646	507.7	66.9	86	11.63
Netherlands	15,805	1,206.8	89.3	109	12.50
Spain	39,410	204.4	77.4	63	12.55
Sweden	8,857	55.7	83.3	112	14.50
UK	59,501	637.9	89.4	86	15.00
Average	34,558	488.3	81.6	104	13.53
Ireland	3,752	141.1	58.8	71	???

Sources: World Development Indicator Data Query; population, population density, and degree of urbanization data downloaded from the World Bank's web site at http://devdata.worldbank.org/data-query/ at Oct. 24, 2001. Wage Rate Index from U.S. Department of Labor, Bureau of Labor Statistics (Sept. 2000). Figures are based on data from 1999.

and scale.[41] For example, densely populated areas or areas with a high degree of urbanization should have lower costs, which in turn produce lower access prices. Hence, we expect population density and urbanization to be negatively correlated with the access charge. Because the wage rate is an important component in the cost of building telecommunications networks, we expect the access charge to be positively correlated with

[41] *See*, *e.g.*, Laurits R. Christensen, Diane C. Cummings & Philip E. Schoech, *Econometric Estimation of Scale Economies in Telecommunications*, in Economics Analysis of Telecommunications (Léon Courville, Alain de Fontenay & Rodney Dobell eds., North Holland 1983); Jean-Michel Guldmann, *Economies of Scale and Density in Local Telephone Networks*, 20 Regional Sci. & Urb. Econ. 521 (1991); Roberto Roson & Jeroen C.J.M. van den Bergh, *Network Markets and the Structure of Networks*, 34 Annals Regional Sci. 197 (2000); John S. Ying & Richard T. Shin, *Costly Gains to Breaking Up: LECs and the Baby Bells*, 75 Rev. Econ. & Stat. 357 (1993); Thomas Kiessling & Yves Blondeel, *Effective Competition in European Telecommunications: An Analysis of Recent Regulatory Developments*, 1 Info 419 (1999); David Gabel & Mark D. Kennet, *Economies of Scope in the Local Telephone Exchange Market*, 6 J. Reg. Econ. 381 (1994).

the wage rate. Other technical factors not considered here, including the number of local exchanges in proportion to the population, could have explanatory power as well. The point of the exercise, however, is not to maximize the explanatory power of the model. The point is simply to show that *any* explanatory variable could improve the predictive power of the model relative to the average of the dependent variable.

In a regression analysis, the goodness of fit is measured by the extent to which the independent variables explain the variation in the dependent variable relative to the mean of the dependent variable. Because the ODTR benchmark is based on a sample of only ten European countries, it is difficult to measure the predictive power of the model by running a regression on the European data and producing the standard R^2 statistic. Therefore, we included data from each of the fifty U.S. states (and the District of Columbia) in a regression model to (1) determine the reduction in the residuals that can be explained by the independent variables and (2) predict the LLU monthly rental rate in Ireland based on total population, population density, degree of urbanization, and the wage rate index in Ireland. Although there might be institutional differences in the way that access rates are set in the United States and in Europe, the relationship between *demographic* variables and the access rate should be consistent across the two regimes. Hence, it is appropriate to combine the U.S. and European data. Thus, the monthly rental rate for local loops can be explained by the following equation:

$$LLU\ Rate = \alpha + \beta_1 P + \beta_2 D + \beta_3 U + \beta_4 W,$$

where P is the total population, D is the population density, U is the degree of urbanization, and W is the wage rate index. Coefficients are represented by the various beta terms, and the alpha term is a constant. The results of our regression model appear in Table VI, and the regression statistics appear in Table VII.

As the R^2 in Table VII shows, our regression model explains 25.8 percent of the variation in the LLU rate *over and above that which can be explained by using the mean LLU monthly rental rate alone*. Moreover, had the ODTR incorporated the total population, population density, degree of urbanization, and the wage rate index into its pricing model, the ODTR would have set *eircom*'s LLU monthly rental rate at €19.22.[42] This rate is approximately 42 percent *higher* than the interim rate that the ODTR set in

[42] LLU Rental Rate (Ireland) = 26.90949 + (–0.000029 ∗ 3,752) + (0.000203 ∗ 141.1) + (–0.09095 ∗ 58.8) + (–0.06582 ∗ 71) + (0.30101) = \$17.11∗ (€1.00 / \$0.89) = €19.22. Exchange rate information was downloaded from Yahoo Finance at http://finance.yahoo.com/m3 on October 26, 2001.

TABLE VI

LLU Regression Model summary.

	Coefficients	Standard error	t-statistic
Intercept	26.90949	4.377194	6.147658
Population	–0.000029	0.0000446	–0.6525
Pop. density	0.000203	0.000536	0.379018
Deg. Of urbanization	–0.09095	0.029519	–3.08119
Wage index	–0.06582	0.04269	–1.54175
Euro dummy	0.30101	1.903237	0.158157

TABLE VII

Regression statistics.

R^2	0.258242
Adjusted R^2	0.19081
Standard error	4.047051
Observations	61

April 2001 of €13.53.[43] Stated differently, with a model that made better in-sample predictions, the ODTR could have made a better out-of-sample prediction of the appropriate price for *eircom* to charge for an unbundled loop. That superior predication would have compelled the ODTR to set a higher price for *eircom*'s unbundled loops than it did. The adverse social consequences of the ODTR's miscalculation are significant, as we shall next explain.

In is filings before the High Court, the ODTR admitted that it "recognised that country specific factors would influence a cost-oriented price."[44] Although the ODTR conceded the importance of such factors, ODTR ignored those factors in its interim pricing analysis, arguing in the same paragraph that "it was doubtful that these [country-specific factors] would be sufficient to resolve the differences in prices."[45] Next, the ODTR argued that "the sample data underpinning eircom's LRIC model was far too small and unrepresentative and, consequently, fundamentally undermined

[43] *See ARO Decision, supra* note 30, at Figure 2.

[44] Affidavit of Gerard Woods, filed on behalf of the Director of Telecommunications Regulation (Oct. 31, 2001) at §14.

[45] *Id.*

the credibility of the results produced by the model."[46] Ironically ODTR's interim pricing model, which also samples from a handful of countries, would flunk the standard by which the ODTR criticized *eircom*, and thereby "fundamentally undermine" the credibility of the ODTR's own results.

IV. The Harm from the ODTR's Deviation from a Cost-Based Approach

The ODTR's underestimation of the true resource costs of supplying unbundled network access can harm both consumers and producers.[47] An unbundled loop price that was based on the ODTR's errant cost estimations would create and perpetuate an inefficient allocation of resources by discouraging network owners, such as *eircom*, from investing in efficiency-enhancing upgrades to their capital stocks, while encouraging entrants to delay investments in new innovative technologies. The ODTR's pricing policy would retard facilities-based competition and efficiency-enhancing innovation.

A. *Resource Misallocation*

The concept of economic efficiency can be understood through the principles of Pareto optimality. The theory of "potential Pareto superiority" dictates that public policies and regulations should promote aggregate social welfare by ensuring no one producer or consumer benefits at the expense of another.[48] Article 4 of the LLU Regulation effectively codifies the principles of Pareto optimality by directing the national regulatory authority to promote "fair competition, economic efficiency and maximum benefit[s] for users."[49] When prices for unbundled loops are set below actual costs, rival telecommunications providers receive the wrong signals, and thus overuse the incumbent's unbundled loops and underin-

[46] *Id*. at §20.

[47] *See*, *e.g.*, William J. Baumol & J. Gregory Sidak, Toward Competition in Local Telephony 93-110 (MIT Press & AEI Press 1994); William J. Baumol & J. Gregory Sidak, *The Pricing of Inputs Sold to Competitors*, 11 Yale J. on Reg. 171 (1994); William J. Baumol, Janusz A. Ordover & Robert D. Willig, *Parity Pricing and Its Critics: A Necessary Condition for Efficiency in the Provision of Bottleneck Services to Competitors*, 14 Yale J. on Reg. 145 (1997).

[48] *See*, Sidak & Spulber, *supra* note 5, at 219–220; Richard A. Posner, Economic Analysis of Law 13–14 (Little, Brown & Co., 4th ed. 1992).

[49] *ARO Decision*, *supra* note 30, at 6.

vest in their own network facilities, thus violating the principles of Pareto efficiency.

By prescribing an artificially low price for the use of *eircom*'s assets, the ODTR's methodology would discourage investment in network infrastructure. The ODTR's interim price of LLU precludes *eircom* from recouping the full market value of its investments, while simultaneously inviting competitors to demand the use of *eircom*'s assets at the ODTR's artificially low prices.

The ODTR argued that it was reasonable to impose penalties on *eircom* in response to *eircom*'s alleged failure to provide sufficient cost documentation. This logic was flawed for two reasons. First, even if *eircom* did not provide information to the ODTR in a timely manner, it does not necessarily follow that the ODTR produced a reasonable interim price.

Second, although the ODTR has a legitimate interest in obtaining information on a timely basis, we reject the *form* of *eircom*'s punishment. Unfortunately, the costs of mispriced inputs are borne by other members of society, including all consumers of telecommunications services. If the ODTR needed a stick to induce *eircom* to produce documentation in a timely fashion, then it could have imposed fines, which would have been incurred by *eircom* alone. Imposing a penalty in the form of artificially low access price causes third parties – namely, telecommunications consumers – to incur costs. Stated differently, there are other forms of penalties that would allow the ODTR to achieve its important objective of obtaining information in a timely fashion. The interim price for LLU is too blunt an instrument for that purpose.

B. *Disincentives for Facilities-Based Investment*

In addition to promoting "fair competition" and "economic efficiency", Article 4 of the LLU regulation also directs the national regulatory authority to encourage innovations that provide "maximum benefit for users."[50] However, technological innovations that maximize consumer welfare require producers continuously to upgrade their capital stocks to provide efficiency-enhancing services.

In addition to deterring *eircom*'s facilities-based investments, the ODTR's price for *eircom*'s unbundled loops would give *eircom*'s competitors incentives to delay or forgo investments in new network facilities. Investment decisions in the telecommunications industry are particularly risky because new innovations in differing and competing technologies continually leapfrog one another. In a technologically dynamic industry,

[50] *Id.*

an incumbent firm has already sunk enormous amounts of capital into its extant network; consequently, incumbents bear the brunt of risky investments into uncertain technologies. In contrast, competitive local carriers retain the freedom to choose between (1) investing in uncertain facilities-based technologies to compete with incumbent carriers on their own terms and (2) delaying their investment decisions indefinitely to gain more information regarding the relative success of the incumbent firm's investment decisions.[51] The ODTR's pricing of *eircom*'s unbundled loops would reward competitive carriers for waiting to make their own facilities-based investments. An entrant's freedom to wait to make sunk investments is a "second-mover" advantage that is, in the jargon of financial economics, a real option having substantial value.[52]

Hence, the ODTR would discourage both *eircom* and its competitors from making new facilities-based investments. By deviating from *eircom*'s cost-based pricing methodology, the ODTR would preclude *eircom* from generating fair and efficient returns on its investments. Moreover, *eircom*'s competitors would also lose their incentives to invest in new facilities of their own, preferring instead to shift the risk of new investments to the incumbent firm and exploiting instead the option to lease artificially cheap unbundled loops.[53] Because it perpetuates a system of asymmetric risk and unequal terms of competition between *eircom* and its competitors, the ODTR's method for calculating interim rates violates the LLU regulation's mandate to promote "fair competition."[54]

This retardation of investment in facilities by entrants into local telephony is significant. Recent research based on the U.S. experience with LLU shows that competitive local exchange carriers (CLECs) that invested in their own network facilities after the Telecommunications Act of 1996

[51] CLECs in the United States have recognized the importance of delaying their investment decisions to wait for new information. *See, e.g.*, Intermedia Communications, Inc., 1999 SEC Form 10-K, at 7 (1999) ("Utilizing leased facilities enables Intermedia to (i) meet customers' needs more rapidly; (ii) improve the utilization of Intermedia's existing network; (iii) add revenue producing customers before building out its network, thereby *reducing the risks associated with speculative network construction or emerging technologies*; and (iv) subsequently focus its capital expenditures in geographic areas where network construction or acquisition will provide a competitive advantage and clear economic benefit") (emphasis added).

[52] *See* Jerry A. Hausman & J. Gregory Sidak, *A Consumer-Welfare Approach to the Mandatory Unbundling of Telecommunications Networks*, 109 Yale L.J. 417, 463 (1999); Jerry A. Hausman, *Valuing the Effect of Regulation on New Services in Telecommunications*, Brookings Papers on Economic Activity: Microeconomics 1997.

[53] *See* Thomas M. Jorde, J. Gregory Sidak & David J. Teece, *Innovation, Investment, and Unbundling*, 17 Yale J. on Reg. 1 (2000).

[54] *ARO Decision*, *supra* note 30, at 6.

were less likely to go bankrupt than CLECs that relied on total-service resale or leasing of unbundled loops.[55] It is unlikely that the failures of CLECs in the United States that did not build their own facilities can be attributed to ULL prices being too high, for American regulators have set ULL rates at TELRIC-based levels that the incumbent carriers have asserted in court are so low as to be uncompensatory. Rather, the CLECs' business strategies, and the execution of those strategies by their management, appear to have been more successful when the entrant could offer customers the assurance that it operated its own network. These concerns about network reliability can only grow in importance after the terrorist attacks of September 11, 2001. The relevance of this American experience for Ireland is that, incorrectly low ULL prices that discourage investment by entrants in Ireland may have the secondary effect of thwarting Ireland's goal of "effective competition" by inducing entrants to choose a business strategy that carries greater risk of customer rejection and possible bankruptcy.

Finally, because the ODTR's rule would deter future facilities-based investments, it would deviate from the long-term goal of deregulation by propagating an uneven playing field between *eircom* and the competitive local providers. The long-term goal of deregulation of telecommunications should be facilities-based competition between multiple companies. But, as AT&T's chief executive officer has recognized: "No company will invest billions of dollars to become a facilities-based ... services provider if competitors who have not invested a penny of capital nor taken an ounce of risk can come along and get a free ride on the investments and risks of others."[56]

V. CONCLUSION

Underestimation of access prices distorts the investment decision-making processes of both the incumbent local exchange provider and its competitors and threatens to retard the long-term growth of the telecommunications industry. Interim prices for LLU based on a simple average of the prices in European Union countries is flawed because the regulator could

[55] *See* Robert W. Crandall, *An Assessment of the Competitive Local Exchange Carriers Five Years After the Passage of the Telecommunications Act*, Criterion Economics Working Paper 01-03, June 27, 2001; *see also* Robert W. Crandall & J. Gregory Sidak, *Is Mandatory Structural Separation of ILECs the Remedy for Failing CLECs?*, Criterion Economics Working Paper 01-04, Sept. 21, 2001.

[56] C. Michael Armstrong, Address before the Washington Metropolitan Cable Club (Nov. 2, 1998) <http://www.att.com/speeches/98/981102.maa.html>.

have used publicly available data to produce a considerably less arbitrary interim rate. In contrast, the simple econometric approach presented here is a reasonable method to satisfy the LLU Regulation's directive to provide the incentives necessary to encourage future network investments, efficiency-enhancing upgrades, and facilities-based competition.