

ON THE DESIGN OF PERFORMANCE MEASUREMENT PLANS
IN THE TELECOMMUNICATIONS INDUSTRY

by

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ABSTRACT

We analyze the design of Performance Measurement and Remedy Plans that have been implemented in the telecommunications industry to ensure competitive local exchange carriers are afforded a meaningful opportunity to compete in the provision of local exchange services. We show that the plans typically impose penalties on incumbent local exchange carriers even when the incumbents provide the same level of wholesale service quality to their competitors that they provide to themselves. Simulations are employed to illustrate the magnitude of these penalties.

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1. Introduction.

The Telecommunications Act of 1996¹ (“the Act”) paved the way for competitive local exchange carriers (“CLECs”) to develop a considerable presence in the telecommunications industry.² It did so, in part, by requiring incumbent local exchange carriers (“ILECs”) to: (i) “unbundle” certain elements of their networks³ and allow CLECs to purchase these unbundled network elements (“UNEs”);⁴ and (ii) sell their retail services to CLECs at a wholesale discount, thereby enabling CLECs to sell these services to customers at competitive prices (“resale”). These unbundling and resale requirements were intended to allow CLECs to compete for customers without having to build their own complete, ubiquitous networks.⁵

Because network unbundling and resale operations assist CLECs in their competition with ILECs, an ILEC could benefit financially if these operations did not proceed smoothly. For example, an ILEC could gain if the unbundling process were delayed, or if the level of service quality associated with the delivery of wholesale services to competitors were lower than the corresponding level of service quality enjoyed by the ILEC’s own retail affiliate. To limit the likelihood of such outcomes, state regulators have implemented performance measurement and remedy plans (PMPs). As their name implies, PMPs attempt to measure the performance of ILECs in providing wholesale services to CLECs, and to penalize the ILECs for performance that does not meet the requisite standards. In particular, PMPs attempt to assess whether an

¹ Telecommunications Act of 1996, Pub. L. No. 104-104, 110 stat. 56 (codified at 47 U.S.C. §§ 151 *et seq.*).

² As of 2001, CLECs were estimated to serve as many as 20 percent of lines in some ILEC regions. See *UNE Fact Report 2002*, Prepared by BellSouth, SBC, Qwest, and Verizon. Submitted to the Federal Communications Commission, *In the matter of Review of Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers*, CC Docket No. 01-338; *Implementation of the Local Competition Provisions in the Telecommunications Act of 1996*, CC Docket No. 96-98; and *Deployment of Wireline Services Offering Advanced Telecommunications Capability*, CC Docket No. 98-147. April 2002.

³ The Act directed the Federal Communications Commission to develop an appropriate list of unbundled network elements (UNEs), taking into consideration “whether (A) access to such network elements as are proprietary in nature is necessary; and (B) the failure to provide access to such network elements would impair the ability of the telecommunications carrier to provide the services that it seeks to offer” (47 U.S.C. § 251 (D) (2)).

⁴ For example, ILECs are required to make the loops in their networks available for use by CLECs. A loop is a transmission line that connects a customer’s premise with the central office of the telephone company.

⁵ The Act anticipated three modes of CLEC competition: (1) CLECs might purchase ILEC retail services at a wholesale discount and resell these services (in a process known as resale); (2) CLECs might purchase unbundled network elements and combine them with their own facilities, or use unbundled network elements to provide an end-to-end service which is commonly referred to as the UNE-platform or UNE-P; and (3) CLECs might employ only their own facilities to serve their customers, and simply interconnect with the ILECs. We will use the term “wholesale services” to refer to all of the wholesale services or elements that CLECs might employ when pursuing either of the first two modes of operation.

ILEC is disadvantaging its rivals by delivering a higher level of service quality to “itself” (*i.e.*, to its own retail affiliate) than to its rivals.⁶ If the evidence suggests the ILEC is providing such non-parity service to CLECs, the ILEC is penalized financially.

Some argue that the financial penalties imposed on ILECs when they are judged to be providing non-parity service to their competitors are insufficient to deter the ILECs from intentionally disadvantaging their rivals. Indeed, some suggest that ILECs view the penalties they pay for delivering non-parity service simply as a cost of doing business and a cost that is outweighed by the associated benefit. These critics cite the persistent stream of penalties that the ILECs pay under PMPs as evidence in support of their claims.⁷

A primary purpose of this article is to assess whether, in fact, an ILEC’s persistent payment of penalties under a PMP is necessarily evidence that the ILEC is disadvantaging its rivals, intentionally or otherwise. We conclude this is not the case. Indeed, an ILEC may be penalized persistently even when it consistently provides parity service to its rivals. This anomaly stems from two related factors. First, the provisioning of wholesale services, like most industrial supply relationships, entails some unavoidable randomness. Therefore, an ILEC’s measured performance in providing wholesale services will not always reflect perfectly its actual performance. Second, many PMPs incorporate an important asymmetry. The plans typically impose financial penalties on the ILEC when its measured performance suggests it is delivering a lower level of service quality to its competitors than to itself. In contrast, the plans typically do not provide any financial reward when measured performance suggests the ILEC is delivering a higher level of service quality to its competitors than to itself.

These two factors imply that even though incidents of higher realized service quality for competitors may offset incidents of lower realized service quality for competitors when an ILEC provides the same (stochastic) quality to its competitors and to itself, there is no corresponding

⁶ As explained further below, PMPs also commonly specify absolute, rather than relative, standards on some performance dimensions. For expositional simplicity, the discussion in this article will focus on relative performance standards (*i.e.*, parity measures). However, our central conclusions apply more broadly.

⁷ See, for example, the Comments of AT&T Communications of Michigan, Inc., TCG Detroit, MCIMetro Access Transmission Services, LLC., Brooks Fiber Communications of Michigan, Inc., and MCI WorldCom Communications, Inc. (page 6 and footnote 8) in response to the Michigan Public Service Commission’s February 25, 2002 Opinion and Order (Case No. U-11830), *In the matter of SBC’s submission on performance measurements, reporting, and benchmarks in compliance with the October 2, 1998 Order in MPSC Case No. U-11654.*

balancing of financial rewards and penalties. For this reason, an ILEC may pay penalties persistently under a PMP even though it consistently delivers parity service to its competitors.⁸

We explain this conclusion more fully as follows. Section 2 describes the PMP that is employed in the state of Michigan (“the Michigan Plan”),⁹ in order to illustrate the basic structure of PMPs more generally. Section 3 simulates the financial penalties an ILEC will incur under the Michigan Plan when it provides parity service to its competitors. Section 3 also illustrates the corresponding penalties when the ILEC provides substantially better and substantially worse service quality to its competitors than it provides to itself. The analysis in Section 3 reveals that an ILEC may incur penalties under the Michigan Plan even when it delivers to competitors a service quality that is, on average, twenty percent higher than the level of service quality it delivers to itself. Conclusions are drawn in Section 4.

2. The Michigan Performance Measurement Plan.

The Michigan Performance Remedy Plan (“the Michigan Plan”) was implemented in 2001 to ensure that CLECs receive wholesale service quality from SBC Michigan that provides them with a meaningful opportunity to compete with SBC in local exchange markets in Michigan.¹⁰ The Michigan Plan is modeled after the PMP contained in the Texas 271 Interconnection Agreement (hereafter referred to as the Texas Plan), which is part of a standard interconnection agreement in many states where SBC operates.¹¹

The Michigan Plan tracks SBC’s wholesale service quality performance in the following areas: (1) pre-ordering/ordering; (2) billing; (3) miscellaneous administrative; (4) provisioning; (5) maintenance; (6) interconnection trunks; (7) directory assistance and operator services; (8) local number portability; (9) 911; (10) poles, conduits, and rights of way; (11) collocation; (12)

⁸ The situation is similar to a setting where the runs that opponents score against a baseball team are recorded faithfully, but the runs the team itself scores are never recorded. Obviously, a team that operates under this scoring rule will never be judged to have won the game. However, the team’s persistent losses do not necessarily reflect poor performance. Rather, they reflect a scoring rule that precludes the team from outscoring its opponents, regardless of its performance on the field.

⁹ The remedy plan as ordered July 25, 2001 in Michigan Public Service Commission Case No. U-11830. See *Ameritech Michigan Performance Remedy Plan Description*, September 12, 2001.

¹⁰ Illinois and Ohio established PMPs as a prerequisite for the merger of SBC and Ameritech in 1999. Other states in Ameritech’s operating territory (*i.e.*, Indiana, Michigan, and Wisconsin) established PMPs subsequently.

¹¹ The relevant states are Kansas, Oklahoma, Arkansas, and Missouri. The other SBC states in the Midwest, Illinois, Indiana, Ohio, and Wisconsin, operate under a PMP that is similar to the Texas Plan.

directory assistance database; (13) coordinated conversions; (14) NXX; (15) bona fide request process; and (16) additional measures.¹² The plan employs 148 different measures to track performance in these areas. These broad measures are further disaggregated into sub-measures,¹³ and the sub-measures are reported in four distinct geographic market areas.¹⁴ This disaggregation implies the Michigan Plan could measure SBC's performance on as many as 963 sub-measures each month for each CLEC in Michigan.¹⁵

The performance measures (and sub-measures) in the Michigan Plan are of two types: parity measures and benchmark measures. *Parity measures* compare the service that SBC provides to a CLEC with the service it provides to its own retail customers or to its retail affiliate.¹⁶ Thus, with parity measures, the service that SBC provides to "itself" becomes the standard by which the performance it delivers to CLECs is measured. In contrast, *benchmark measures* compare the service that SBC provides to CLECs with a specified standard that is not

¹² To provide examples of performance measures in some of these areas, note that when a CLEC places an order, the ILEC's operational support system (OSS) must be available to accept CLEC transactions or data files during scheduled availability. The percentage of the time that the OSS interface is available is an example of a pre-ordering/ordering performance measure. The number of days required to provision a loop is an example of a provisioning measure. The number of trouble reports per 100 access lines is an example of a maintenance measure. The percentage of time that the ILEC misses a due date for collocating CLEC equipment is an example of a collocation measure. The percentage of directory assistance records that are updated inaccurately by the ILEC is an example of a database accuracy measure. See *SBC/Ameritech Performance Measurement User Guide*, Version 1.9, Appendix 1 to the *Ameritech Michigan Performance Remedy Plan*, September 12, 2001.

¹³ Sub-measures are employed to account for the fact that relevant conditions can vary across geographic areas and/or according to the wholesale service being provided, or the nature of the task in question. To illustrate the nature of these sub-measures, consider the percentage of missed due dates caused by SBC/Ameritech in provisioning plain old telephone service (POTS) or a UNE-P. This performance measure (#29) is divided into four sub-measures for POTS and four for a UNE-P: residential service requiring fieldwork, residential service requiring no fieldwork, business service requiring fieldwork, and business service requiring no fieldwork. These sub-measures are tracked for each market area. Hereinafter, we will use the terms "measures" and "sub-measures" interchangeably.

¹⁴ The geographic areas are: (1) Detroit Metro, (2) Grand Rapids - Kalamazoo, (3) Saginaw - Lansing - Jackson, and (4) Traverse City - Upper Peninsula. Some measures are tracked, tested, and reported at the state level instead of, or in addition to, the market area level.

¹⁵ Fewer measures typically will be tracked in practice because the typical CLEC does not operate in all market areas in Michigan and does not make service requests that relate to the entire set of performance measures. The maximum number of performance measures tested for a CLEC in Michigan in January 2003 was 351.

¹⁶ The service that SBC provides to a CLEC is compared to the better of the service that SBC provides to its retail affiliate(s) and to its retail customers. In Michigan, SBC delivers some services (e.g., data services) to retail customers through affiliates. SBC does not employ affiliates to deliver retail services in Texas. Consequently, under the Texas Plan, the service that SBC provides to a CLEC is always compared to the service that SBC delivers to its retail customers.

explicitly linked to the service that SBC provides to itself (typically because SBC does not provide this service to itself).¹⁷

Almost three quarters (72%) of the *paying measures* tracked in the Michigan Plan are parity measures, while approximately one quarter (28%) are benchmark measures.¹⁸ Paying measures are measures on which SBC is required to pay penalties if its performance is judged to be inadequate.¹⁹ The judgment process is relatively simple for benchmark measures in the Michigan Plan: SBC is judged to have provided adequate performance if and only if the observed performance meets or exceeds the established benchmark standard.²⁰ In contrast, the judgment for parity measures involves a statistical comparison of the mean performance that SBC provides to its competitors and the mean performance that SBC provides to itself on each measure. If the mean performance that SBC provides to a competitor is found to be below the mean performance that SBC delivers to itself by an amount that is statistically significant, SBC is liable for penalty payments on the measure in question. The observed performance difference is deemed to be statistically significant if the probability that the difference could have occurred by chance is 5% or less. Thus, the Michigan Plan admits a 5% chance of a Type I error on each performance measure that is tested.²¹

¹⁷ As an example, consider the no fieldwork sub-measure for provisioning POTS for performance measure #29 discussed earlier (*i.e.*, the percentage of SBC/Ameritech caused missed due dates). The benchmark for the no fieldwork sub-measure is 97 percent (for both residential and business) which means that SBC/Ameritech must complete orders by the due date at least 97% of the time. In contrast, the fieldwork sub-measure uses a parity comparison, meaning that the performance provided to the CLEC is compared to SBC/Ameritech retail performance.

¹⁸ These are the percentages for January 2003, which is not an atypical month. For the three month-period from November 2002 to January 2003, for example, 71% of the paying measures in Michigan were parity measures and 29% were benchmark measures.

¹⁹ SBC tracked and tested 7,381 paying sub-measures in January 2003: 5,311 parity sub-measures and 2,070 benchmark sub-measures. This number represents an average of 59 sub-measures for each of the 126 CLECs that operated in Michigan in January 2003. Again, January is not an atypical month. During the three-month period from November 2002 to January 2003, SBC tracked and tested an average of 56 sub-measures per CLEC each month. The Michigan Plan also includes some non-paying measures. Such measures often are new measures that the plan requires during a diagnostic period, or measures that the ILEC or the CLECs choose to monitor.

²⁰ In contrast, the Texas Plan employs statistical tests to determine whether SBC's performance meets established benchmark standards.

²¹ A Type I error occurs on a parity measure when SBC is judged to have provided lower mean performance to a competitor than to itself when, in fact, this is not the case. The statistical analysis employed in evaluating performance on parity measures takes explicit account of the fact that the provisioning of wholesale services entails some unavoidable randomness, and so measured performance does not always reflect actual performance perfectly.

Notice that a 5% chance of a Type I error on each measure that is tested can introduce a large probability that some Type I error will occur when many measures are tested. For example, if there is a 5% chance of a Type I error on each of ten measures, the likelihood that at least one Type I error will occur when ten measures are tested may be as high as 50%.²² The Michigan Plan employs a “K table” to reduce toward 5% the likelihood that one or more Type I errors will occur for each CLEC.²³ The K table does so in part by forgiving a specified number of failed measures.²⁴ The extent of the forgiveness for each CLEC depends on the number of measures tested for the CLEC.

For measures where SBC is judged to be non-compliant after application of the K table, the Michigan Plan requires SBC to make penalty payments directly to the affected CLEC. The penalty for non-compliance is \$75 per occurrence for each performance measure.^{25,26} In addition to CLEC-specific payments, the Michigan Plan requires SBC to make payments to the Michigan State Treasury for persistent non-compliance across all CLECs.²⁷ Importantly, while SBC is penalized for sub-standard performance in both of these ways, it is not rewarded for above-standard performance in any way. The implications of this asymmetry are examined in Section 3.

²² This upper bound is achieved if the performance measures are mutually exclusive, reflecting the special type of dependency in which a Type I error on one measure implies that a Type I error cannot occur on another measure. To illustrate the likelihood of one or more Type I errors when the performance measures are independent, consider the simple case where there are only two performance measures. The probability of at least one Type I error in this case equals 0.0975 (compared to the corresponding probability of 0.10 when the two measures are mutually exclusive). This probability is the sum of: (1) the probability that a Type I error occurs on the first measure only ($= 0.05 \times 0.95 = 0.0475$); (2) the probability that a Type I error occurs on the second measure only ($= 0.95 \times 0.05 = 0.0475$); and (3) the probability that a Type I error occurs on both measures ($= 0.05 \times 0.05 = 0.0025$).

²³ The Critical Z-Statistic Table in the *Ameritech Michigan Performance Remedy Plan Description*, Sections 8 and 9, provides the K values and the associated critical Z values. We refer to this table as the K table.

²⁴ A “failed” parity measure is a measure for which the mean performance that SBC provides to a CLEC is below the mean performance that SBC delivers to itself by an amount that is statistically significant. A failed measure is “forgiven” when the SBC is not required to pay the penalty associated with the observed failure.

²⁵ For persistent sub-standard performance to a CLEC, the per-occurrence penalty increases over a six month period from \$75 in the first month to \$600 in the sixth and following months. For measures that are subject to a cap (*e.g.*, many of the pre-ordering/ordering measures), the total monthly penalty payment to a CLEC cannot exceed \$10,000 on any particular measure in the first month. The cap increases over a six month period from \$10,000 in the first month to \$60,000 in the sixth and following months. In January 2003, SBC paid \$657,250 in penalties to CLECs in Michigan.

²⁶ In the Texas Plan, penalties take on three distinct values -- low, medium, or high -- depending on the measure in question.

²⁷ These payments are required when SBC delivers sub-standard performance to all CLECS, in aggregate, for three consecutive months.

3. Simulations.

To illustrate the likely effects of the combined influence of performance randomness and the asymmetric reward structure in a PMP like the Michigan Plan, we conducted an exercise based upon actual recent experience under the Michigan Plan. The exercise is designed to approximate a setting in which an ILEC engages in 30 transactions on each of 35 measures with 100 representative CLECs.²⁸ Furthermore, and most importantly, the distribution of service quality that the ILEC provides to the CLECs in this initial exercise has the same mean and variance as does the service quality that the ILEC delivers to itself. This mean and variance reflect the actual performance of the ILEC that operates in Michigan (SBC Michigan). Therefore, the exercise permits an estimate of the number of failed performance measures and the resulting penalties that an ILEC will incur under a PMP like the Michigan Plan when it delivers to its competitors the same distribution of service quality that it delivers to itself.²⁹

Formally, the exercise consists of the following nine steps. First, 35 performance measures are chosen randomly from among the parity measures that are monitored under the Michigan Plan.³⁰ Second, the mean and variance of the service quality that SBC Michigan delivered to its retail affiliate or to its own retail customers (hereinafter “to itself”) in the Detroit Metropolitan Market Area during January 2003 on each of these measures are calculated.³¹ Third, a “CLEC quality distribution” is constructed for each of the 35 measures, using this same mean and variance.³² Fourth, 30 observations (representing 30 transactions) are drawn randomly

²⁸ A transaction is a response by an ILEC to a request for wholesale service provisioning by a CLEC.

²⁹ Only CLEC-specific penalties are included in this exercise. (These penalties are referred to as Tier 1 penalties in the Michigan Plan). Penalties payable to the Michigan State Treasury for persistent non-compliance are not included in this exercise.

³⁰ Appendix A lists the selected parity measures. Parity measures were chosen because benchmark measures are not subject to statistical testing in Michigan. On average, 36 parity measures were tested for each CLEC in Michigan in January 2003. Between November 2002 and January 2003, the average number of parity measures tested monthly for a CLEC ranged from 32 to 36. The exercise was limited to 35 measures for computational convenience.

³¹ Data from January 2003 was employed because it represented the most recent data to which we had access while preparing an affidavit and supplemental filings for SBC. Data from the Detroit Metropolitan area was employed because this is the geographic area in SBC Michigan’s operating territory in which SBC received the most CLEC service requests in January 2003.

³² The 35 measures consist of binary measures and non-binary measures. Binary measures (*e.g.*, whether an order was completed or not completed) are recorded as either 1 or 0, and are assumed to follow a binomial distribution. Non-binary measures (*e.g.*, the number of days required to complete an order) reflect the actual level of performance, and are assumed to follow a log-normal distribution.

from each of the 35 CLEC quality distributions.³³ Fifth, the mean of each of the thirty observations is calculated. Sixth, the difference between this mean and the mean service quality that the ILEC delivered to itself on the measure in question during the sample period is calculated (for each of the 35 measures). Seventh, the statistical test called for in the Michigan PMP is employed to determine whether the difference between the means is statistically significant.³⁴ If so, and if the difference constitutes a lower level of service quality for the representative CLEC than for the ILEC, the ILEC is deemed to have “failed” the relevant parity test. Otherwise, the ILEC is deemed to have “passed” the test. Eighth, the random sampling of the 30 observations and the testing of the 35 measures is repeated 100 times (representing the ILEC’s interaction with 100 CLECs), providing a total of 3,500 parity tests. Ninth, the penalties associated with the observed failures of the parity tests are calculated according to the terms of the plan.³⁵

The total number of times (out of a possible 3,500 times) that the ILEC’s simulated performance failed a parity test in this exercise is recorded in the first row of data in Table 1. The corresponding percentage of failures is presented in the second row of data in the table. The associated penalty payments that the ILEC would be required to make under the Michigan Plan (despite providing parity service) are displayed in the last row of data in Table 1.

Two features of the data in Table 1 are particularly noteworthy. First, even though the ILEC delivers to each CLEC the same distribution of service quality that it delivers to itself in this exercise, the ILEC is judged to have “failed” the parity test approximately 5.2% of the time under the Michigan Plan with no K table, and is required to make payments of \$10,904. Second, the K table reduces substantially (from 5.2% to 0.4%) the probability that the ILEC will be judged to have failed a parity test despite providing the same distribution of service quality to

³³ Thirty transactions are used in the simulation for testing each performance measure because the sampling distribution of the sample mean approaches a normal probability distribution as the sample size becomes large. Typically, a sample size of 30 is relatively large. In January 2003, 29 percent of all parity measures tested in Michigan included 30 or more transactions, 15 percent included between 10 and 29 transactions, and 56 percent included fewer than 10 transactions.

³⁴ The critical Z value is 1.645 in the Michigan Plan with no K table and 1.68 (corresponding to 35 performance measures) in the Michigan Plan with the K table. Recall that the K table specifies the number of measures to “forgive” and the associated critical Z value.

³⁵ Under the Michigan Plan with no K table, no observed failed measures are forgiven. Under the Michigan Plan with the K table, a maximum of three failed measures are forgiven for each of the 100 simulated CLECs.

itself and to its competitors. The K table also reduces substantially (by approximately 94%, from \$10,904 to \$643) the associated financial penalties imposed on the ILEC.³⁶

	Michigan Plan With No K Table	Michigan Plan With The K Table (K = 3)
Number of “Failures”	183	15
Percent of “Failures	5.2%	0.4%
Penalty Amount	\$10,904	\$643

Table 1. The ILEC Provides Parity Service Quality to CLECs.

This initial exercise was designed to examine the penalties that an ILEC would incur under a PMP like the Michigan Plan when the ILEC delivers to its competitors the same distribution of service quality that it delivers to itself. Two additional exercises were conducted to examine the penalties that an ILEC would incur under the plan when it delivers higher and lower levels of service quality to its competitors than it delivers to itself.

Table 2 illustrates the penalties that an ILEC would incur under the Michigan Plan if it delivered to its competitors a level of service quality that, on average, was 20% higher than the level of service quality it delivered to itself. Table 3 presents the corresponding penalties when the ILEC delivers to its competitors a level of service quality that, on average, is 20% lower than the level of service quality it delivers to itself. The 20% higher level of service quality for competitors was simulated by increasing by 20% the mean of the CLEC quality distribution for each of the selected 35 measures. The 20% lower level of service quality was simulated by implementing a corresponding 20% reduction in the mean of each of the CLEC quality distributions.³⁷

³⁶ The K table also reduces the number of CLECs to which the ILEC must make penalty payments despite providing parity service to all CLECs. The ILEC makes payments to 86 (of the 100) CLECs in the exercise under the Michigan Plan with no K table. In contrast, 11 CLECs receive payments under the Michigan Plan with the K table. Thus, the K table reduces the likelihood that one or more Type I errors will occur from 86 percent to 11 percent in this exercise.

³⁷ The 20% increase and the 20% decrease on each measure are defined relative to the mean level of service quality that the ILEC delivered to itself on the measure during the sample period. In cases where a 20% increase in quality would exceed the feasible upper bound on quality (e.g., 100% of orders completed on time), the upper bound on quality was employed.

	Michigan Plan With No K Table	Michigan Plan With The K Table (K = 3)
Number of “Failures”	92	1
Percent of “Failures”	2.6%	0.0%
Penalty Amount	\$3,890	\$53

Table 2. The ILEC Provides 20% Higher Service Quality to CLECs.

	Michigan Plan With No K Table	Michigan Plan With The K Table (K = 3)
Number of “Failures”	770	470
Percent of “Failures”	22.0%	13.4%
Penalty Amount	\$132,490	\$120,285

Table 3. The ILEC Provides 20% Lower Service Quality to CLECs.

Four elements of the data in Tables 2 and 3 are particularly noteworthy. First, the ILEC continues to pay penalties under the Michigan Plan (with and without the K table) even when it delivers to its competitors a level of service quality that is 20% higher than the level of service quality it delivers to itself. Second, the K table reduces these penalties substantially (*i.e.*, by more than 98%, from \$3,890 to \$53). Third, if the ILEC were to deliver substantially (20%) lower service quality to its competitors than to itself, the ILEC would incur relatively large penalties under the Michigan Plan with no K table (\$132,490). Fourth, the K table decreases these penalties by approximately 9% (to \$120,285), far less than the 98% reduction the K table provides when the ILEC delivers better than parity service.

4. Conclusions.

We have explained why the asymmetry embedded in many PMPs can force an ILEC to pay penalties persistently even when it provides the same or better wholesale service quality to its competitors than to itself. We have also illustrated the magnitude of these penalties, and demonstrated how the penalties vary with the relative quality of the wholesale services that the ILEC provides to its competitors.

Future research might analyze changes in PMPs that can continue to provide CLECs with a meaningful opportunity to compete against ILECs while avoiding undue punishment of ILECs when they meet or exceed established quality standards. More symmetric penalty and reward structures might be analyzed in this regard. PMPs that allow credits for superior performance to offset penalties for sub-standard performance may better ensure that CLECs are not disadvantaged while limiting the penalties imposed on ILECs when they provide parity service to their competitors. Combining individual performance measures to form an index of overall wholesale service quality performance might also be evaluated. PMPs that employ an index of service quality across multiple dimensions of performance can admit trade-offs between superior and sub-standard performance within the index while ensuring that a desirable level of overall service quality is achieved.

Appendix A: Performance Measures Employed in Simulations

	Measure Number	Sub Measure Name
1	29	% SBC/Ameritech Caused Missed Due Dates - POTS - Res - FW
2	29	% SBC/Ameritech Caused Missed Due Dates - POTS - Bus - No FW
3	35	% Trouble Reports w/in 30 Days of Install - POTS - Res - FW
4	35	% Trouble Reports w/in 30 Days of Install - POTS - Res - No FW
5	41	% Repeat Reports - POTS – Bus
6	45	% SBC/Ameritech Caused Missed Due Dates - UNE - BRI Loop With Test Access
7	45	% SBC/Ameritech Caused Missed Due Dates - UNE – DS1 Loop With Test Access
8	59	% Installation Trb Reports Within 30 Days (I-30) of Installation - UNE - 8.0 dB Loop W/out Test Access
9	52	Mean Time to Restore – UNE - 8.0 dB Loop without Test Access (Hrs)-Dispatch
10	40	% Out Of Service (OOS) < 24 Hrs - POTS – Residence
11	40	% Out Of Service (OOS) < 24 Hrs - POTS – Business
12	33	% SBC/Ameritech Caused Missed Due Dates > 30 Days - POTS - Bus - No FW
13	50	% SBC/Ameritech Caused Missed Due Dates > 30 Days - UNE - 8.0 dB Loop Without Test Access
14	50	% SBC/Ameritech Caused Missed Due Dates > 30 Days - UNE - BRI Loop With Test Access
15	30	% SBC/Ameritech Missed Due Dates Due To Lack of Facilities - POTS - Res
16	47	% SBC/Ameritech Missed Due Dates Due to Lack of Facilities - UNE - BRI Loop With Test Access
17	60	% SBC/Ameritech Missed DDs (>30 Days) Due to Lack of Facilities-UNE-8.0 dB Loop Without Test Access
18	60	% SBC/Ameritech Missed DDs (>90 Days) Due to Lack of Facilities-UNE-8.0 dB Loop Without Test Access
19	60	% SBC/Ameritech Missed DDs (>30 Days) Due to Lack of Facilities - UNE - BRI Loop With Test Access
20	28	% Installations Completed Within Customer Requested Due Date - UNE-P - Res - FW
21	28	% Installations Completed Within Customer Requested Due Date - UNE-P - Res - No FW
22	28	% Installations Completed Within Customer Requested Due Date - UNE-P - Bus - FW
23	28	% Installations Completed Within Customer Requested Due Date - UNE-P - Bus - No FW
24	29	% SBC/Ameritech Caused Missed Due Dates - UNE-P - Res - No FW
25	29	% SBC/Ameritech Caused Missed Due Dates - UNE-P - Bus - No FW
26	30	% SBC/Ameritech Missed Due Dates Due To Lack of Facilities - UNE-P Res
27	30	% SBC/Ameritech Missed Due Dates Due To Lack of Facilities - UNE-P Res - >30 Calendar Days
28	30	% SBC/Ameritech Missed Due Dates Due To Lack of Facilities - UNE-P Res - >90 Calendar Days
29	35	% Trouble Reports Within 30 Days of Install - UNE-P Res - FW
30	38	% Missed Repair Commitments - UNE-P Bus - Dispatch
31	39	Receipt to Clear Duration - UNE-P Res - No Dispatch - Out of Service (Hrs)
32	40	% Out Of Service (OOS) < 24 Hrs - UNE-P Bus
33	33	% SBC/Ameritech Caused Missed Due Dates > 30 Days - UNE-P - Res No FW
34	55.1	Average Installation Interval - DSL - With Line Sharing - Without Conditioning
35	59	% Installation Trouble Reports Within 30 Days (I-30) of Installation - UNE - DSL Loops - Line Sharing