viewers place on a set of hypothetical programs (i.e., two first run syndicated programs, one network program). Such program valuations makes it possible to calculate the level of viewer welfare for each different combination of programs shown.

In the second step we determine the audience maximizing program choices of broadcast stations in three distinctly different economic environments. The first environment corresponds to the status quo -- the affiliate station is prohibited from carrying network programming (i.e., PTAR exists).[20/] In the second environment, PTAR does not exist and the network forces its affiliate to carry its program (i.e., no station program choice autonomy). In the third environment, PTAR does not exist and the affiliate station is free to choose the program that maximizes its audience share (i.e., station program choice autonomy).[21/]

20/ PTAR contains two provisions. For expositional purposes, we assume it consists of only the network provision. The analysis presented by Williamson and Woroch suggests that the type of programs contained in the "program portfolio" available to stations differs depending upon which PTAR provision is being analyzed. Specifically, in contrast to the off-network provision, they believe that the network provision promotes program diversity. However, as stated earlier, it is not clear whether the distinction between the economic effects of the network and off-network program provision is significant. See supra discussion at note 19.

21/ Uncertainty regarding whether network affiliates possess program autonomy dictates the use of two No PTAR environments. Program clearance rates, defined as the number of hours of network programming cleared divided by the number of hours of network programming offered, for 446 network affiliates average .977 for prime time. See Economists Incorporated, supra note 13, Appendix D. at 89. It is impossible to determine whether such a high clearance rate is due to the lack of program autonomy or high program quality.

The third step involves calculating viewer welfare in each of these different environments based upon the program choices made by the competing television stations. The final step involves ranking the different environments according to the extent to which they promote consumer welfare. This step includes a discussion of whether the rank order is sensitive to the analysis's underlying assumptions.

2. Analysis

a. Scenario #1 - "Market Failure" and Welfare Benefits of No Program Autonomy

Suppose the U.S. television market consists of four viewers (i.e., A,B,C, and D) and that two broadcast stations, one of which is a network affiliate and the other an independent television station, serve this market. To simplify matters further, suppose each station provides only one hour of prime time programming per day and that there is a list of three one hour programs (i.e., program #1, program #2, and program #3) from which to choose.[22/] Program #1 is the network program, while programs #2 and #3 are first run syndicated programs. Finally, suppose that advertisers place the same value on each viewer and that the cost of each program is the same.[23/] Tables 1 presents the valuations each

---

22/ More technically, it is best to interpret each "program" as a unique class of programs. Programs within each class are considered perfect substitutes.

23/ This final assumption simplifies the welfare analysis. While it is inconsistent with existing evidence, it does not alter the analysis' conclusions.

viewer places on these three different programs.

Program	Viewer A	Viewer B	Viewer C	Viewer D
#1	10	9	7	18
#2	15	10	9	6
#3	6	12	8	7

Table 1: Television Viewer Valuations

According to viewer valuations, program #1 is the "best" program, followed by programs #2 and then #3.[24/] Viewer welfare would be maximized if the program mix (1,2) was shown (i.e., welfare = 52).[25/] More specifically, any

24/ "Best" can be defined in two ways. Program #1 is said to be better than or "strongly dominate" program #2 if all viewers strictly prefer the former program to the latter. Alternatively, program #1 is said to be better than or "weakly dominate" program #2 if the sum of the valuations that viewers place on program #1 exceeds the sum of the valuations that viewers place on program #2. Consistent with the realities of the program supply market, we have used the latter definition in defining the term "best."

25/ Throughout the analysis the first number refers to the affiliate's program choice, while the second number refers to the independent station's program choice. We assume that program mix (3,2) produces the same viewer welfare as program mix (2,3). We also assume here that because program #1 is a network program, program mixes (1,1) (2,1), and (3,1) are not feasible. This assumption is based on the observations that: (1) network-quality programming is, in general, more popular than first run syndicated programs; and (2) such popular programs are, in general, not available to independent stations. The effect on the analysis of eliminating this assumption is discussed later.

other pair of shown programs yields a value for viewer welfare less than 52. To determine viewer welfare in each of the three environments, it is necessary to determine each station's best program choice given the expected program choices of its broadcast competitor. This is accomplished by considering the "viewer payoffs" for the respective stations in each of the markets. These "payoffs" or audience counts, which are based upon the viewer program valuations in Table 1, are shown in Table 2.

Independent Station

		1	2	3
Network Affiliate	1	2 / 2	3 / 1	2 / 2
	2	1 / 3	2 / 2	2 / 2
	3	2 / 2	2 / 2	2 / 2

Table 2: Station Viewer Payoffs

The columns and rows of this matrix represent the program options (i.e., strategies) available to the respective stations. The numerical values in each cell

represent each station's payoff -- total number of viewers -- as a result of each pair of program choice strategies. The lower left number represents the network affiliate's payoff, the upper right number represents the independent station's payoff. According to Table 2, if the affiliate and independent stations exhibit programs #1 and #2, respectively, the former will attract one viewer, while the latter will attract three viewers.

~ No PTAR/Program Autonomy

Consider the viewer welfare effects of eliminating PTAR in an environment where the network affiliate has "program choice autonomy" (i.e., the affiliate is "free" to select the program that maximizes its audience share). It is easily shown that program pairs (2,2), (2,3), (3,2), and (3,3) are possible solutions to the programming game (e.g., all are "Nash Equilibria").[26/] Viewer welfare will range

---

26/ A "Nash equilibrium" exists if no player has an incentive to change its current strategy given the strategies adopted by the other players. See Roger B. Myerson, supra note 15, at 91-98. We restrict our discussion to "pure" as opposed to "mixed" strategies.

It is not uncommon for a game to have multiple equilibria. One method of choosing among competing equilibria involves solving the game through the iterative elimination of "dominated" or" weakly dominated" strategies. The following examples involve games that contain weakly dominated strategies. Unfortunately, the outcome of such games often depend, as they do here, on the order in which such strategies are eliminated. Finally, no attempt was made to impose restrictions on the "acceptable" class of Nash Equilibria.

Finally, note that two of the four potential equilibria involve stations selecting the "same" (i.e., perfect substitutes) programs. This outcome is

from 33 - 43, depending on the game's outcome. Assuming that each outcome is equally likely, the average or expected value of the viewer welfare is 39.75. Interestingly, the viewer welfare maximizing program pair (1,2) is not one of the possible solutions to this game. According to the matrix, if the affiliate and independent stations exhibit programs #1 and #2, respectively, the former will attract one viewer, while the latter will attract three viewers. However, the affiliate can unilaterally improve its payoff by exhibiting program #2 or #3. Consequently, based on the valuations described in Table 1, programs #1 and #2 will not be shown and, therefore, television station program choices will fail to maximize viewer welfare.[27/]

The result occurs because the valuations viewers place on programs are imperfectly accounted for when stations select programs. Stations are in the business of providing advertisers access to viewers. Advertisers, in turn, are concerned with maximizing the total number of viewers (with the appropriate demographics). If two programs have the same audience share, a television station is not more inclined to broadcast the program that is more valued by viewers because the advertising rates they charge are not sensitive to this greater

---

consistent with empirical evidence that stations sometime exhibit the "same" or nearly the same programs during the same time period.

27/ This market failure has been identified in the station program choice literature. For an excellent summary of this literature, see Bruce M. Owen and Steven S. Wildman, Video Economics, Chapter 4, at 101-150 (1992).

valuation. The end result is a market outcome that may fail to maximize viewer welfare.[28/]

~ PTAR

The inability of station program choices to, in such instances, maximize viewer welfare is an important element in analyzing PTAR's viewer welfare effects. While the possibility of a market failure is present whether PTAR exists or not, an important issue is whether such a failure is more likely to occur with PTAR than without it. We can shed light on this issue by examining each station's likely program choices, and the welfare consequences of such choices, assuming the existence of PTAR. Because program #1 is assumed to be the network program, we ignore the game's possible outcomes contained in the first row of each matrix.[29/] It is easily shown that program pairs (2,2), (3,2), (2,3), and (3,3) are all possible solutions to this programming game. Depending upon the outcome of

---

28/ One is tempted to suggest that the market failure would be corrected if the stations alternate the exhibition of programs #1 and #2. By alternating the exhibition of such programs each station would have an expected viewership equal to their respective viewerships at the pure strategy equilibrium solutions. However, given that the respective stations' audience shares would not change, the stations would not have any incentive to adopt this mixed strategy.

29/ The analysis assumes that network programming is superior to first run syndicated programming but is not available to independent stations. See supra discussion at note 25. Because of this assumption we can ignore the first column. Changing this assumption does not alter the results of this analysis. However, there are instances (e.g., the following example) where the results are changed by altering this assumption.

the game, viewer welfare can range from a low of 33 to a high of 43. Assuming that each outcome is equally likely, the average or expected welfare is 39.75.

~ No PTAR/No Program Autonomy

Finally, consider the level of viewer welfare in an environment where PTAR does not exist and where the network forces its affiliate to carry the network program. Concerns over the networks' ability to dictate the programming choices of their affiliates -- to the detriment of television viewers -- was one of the original justifications for PTAR.[30/] The examination of the outcome of this game is trivial. The affiliates's exhibition of program #1 will cause the independent station to show program #2. The program pair (1,2) will yield a value of 52 for viewer welfare, the highest value possible.

Table 3 presents the viewer welfare total for each of the three environments. In this example, PTAR and No PTAR/Program Autonomy environments yield the same expected viewer welfare outcome. PTAR's existence does not change, compared with the No PTAR/Program Autonomy environment, either the number or the identity of the equilibria in the programming game

---

30/ See Review of the Prime Time Access Rule, Section 73.658(k) of the Commission's Rules, MM Docket No. 94-123, Notice of Proposed Rulemaking, 9 FCC Rcd 6328, 6352-53, para. 40 (1994). "[T]he rule was intended to increase the chances that the programming appearing on an affiliated station would reflect true viewer preferences. The view was that while the network would dictate one program for the access period, the rule would permit the affiliate to choose from a range of choices."

between the two stations. All of these equilibria involve the exhibition of programs that fail substantially to maximize viewer welfare however, thereby raising the possibility that the No PTAR/No Program Autonomy environment may yield the best viewer welfare outcome.

Economic Environment	Viewer Welfare
PTAR	33 - 43 (mean =39.75
No PTAR (No Program Autonomy)	52
No PTAR (Program Autonomy)	33 - 43 (mean = 39.75)

Table 3: Viewer Welfare Comparisons

Interestingly, viewer welfare is highest -- actually maximized -- in the No PTAR/No Program Autonomy environment. This result occurs because, in this environment, the affiliate's inability to freely select its own programming (i.e., no autonomy) eliminates entirely the possibility of a market failure. Because the market would not select that set of programs that maximize viewer welfare in the other two environments, the No PTAR/No Program Autonomy environment yields the best viewer welfare outcome.

This result indicates that one of PTAR's initial justifications -- the reduction of control networks exercised over affiliate program decisions -- may be inconsistent with viewer welfare in some television markets. While the exercise of such dominance would have left the affiliate worse off than if it were not exercised, it would have nonetheless maximized viewer welfare. The FCC should therefore give careful weight to arguments that PTAR should be maintained because of the network's ability to force affiliates to exhibit network programs.[31/]

b. Scenario #2 - Importance of the "Dominance" Assumption

The above result is not driven by the assumption that the network program weakly dominates all other programs. Indeed, this same result can occur when first run syndicated programming weakly dominates network programming. Table 4 presents an environment in which program #2 (i.e., a syndicated program) is superior to program #1 (i.e., network program) and where the results are nearly the same as the results in the previous example. In this example, viewer welfare is maximized (i.e., viewer welfare = 44) when program mix (2,3) is shown.[32/]

31/ The analysis does not suggest that such forced carriage always benefits viewers. Rather, it is indicates that, under some conditions, forced carriage may yield a program choice outcome that is superior to the possible outcomes in the other two environments. Later we present an example where a No PTAR/No Program Autonomy environment yields a viewer welfare outcome that is inferior to the outcomes generated in the other two environments.

32/ Note that program #3, despite being the least desirable program, is included in one of the two welfare maximizing solutions.

Program	Viewer A	Viewer B	Viewer C	Viewer D
#1	10	9	10	7
#2	15	10	9	5
#3	6	14	8	6

Table 4: Television Viewer Valuations

The viewer payoff associated with the different programming options available to the stations are shown in Table 5.

		Independent Station		
		1	2	3
Network Affiliate	1	2 / 2	2 / 2	1 / 3
	2	2 / 2	2 / 2	2 / 2
	3	3 / 1	2 / 2	2 / 2

Table 5: Station Viewer Payoffs

Table 6 summarizes the viewer welfare total for each environment, based on the assumption that program #2 (i.e., first run syndicated program) is superior to program #1 (i.e., network program).

Economic Environment	Viewer Welfare
PTAR	34 - 44 (mean = 40.25)
No PTAR (No Program Autonomy)	42
No PTAR (Program Autonomy)	39 - 44 (mean = 41.66)

Table 6: Viewer Welfare Comparisons

In this example, viewer welfare is highest in the No PTAR/No Program Autonomy environment, despite the fact that a first run syndicated programming weakly dominates network programming. As in the previous example, a number of potential equilibria with unfavorable viewer welfare outcomes are eliminated when PTAR does not exist and when stations lack program choice autonomy. Because of this effect, the No PTAR/No Program Autonomy environment is superior to the other two environments in this example.

In addition, viewer welfare is greater, on average, in the No PTAR/Program Autonomy environment than in the PTAR environment. This occurs because PTAR's absence creates a more favorable array of potential equilibria. For instance, its absence makes a relatively favorable outcome (i.e., (1,2)) a potential equilibrium. Moreover, on the other hand, the existence of PTAR makes a relatively unfavorable outcome (i.e., (3,3)) possible. Combined, these two effects cause the No PTAR/Program Autonomy environment to be superior to the PTAR environment.[33/]

c. Scenario #3 - Superiority of Program Autonomy Environment

In Scenario #1, where it is assumed that the network program is superior to both first run syndicated programs, viewer welfare is highest in the No PTAR/No Program Autonomy environment. The result is consistent with the view of some that PTAR reduces necessarily viewer welfare because it prevents the exhibition of the most highly valued programs. The following example demonstrates that this proposition is not necessarily correct. In particular, the validity of this proposition depends upon the distribution of valuations viewers possess for the different

---

33/ There exists one off-setting factor. The existence of PTAR makes program mix (2,3) a possible equilibrium. While this equilibrium would maximize viewer welfare, it does not completely offset the expected viewer welfare effects from the elimination of equilibria (1,2) and the addition of equilibria (3,3).

programs. Table 7 presents an environment in which program #1 (i.e., network programming) is superior to first run syndicated programming.[34/]

Program	Viewer A	Viewer B	Viewer C	Viewer D
#1	10	10	11	9
#2	17	13	4	5
#3	3	11	12	10
#4	12	7	7	6

Table 7: Television Viewer Valuations

Under these program valuations, the network program weakly dominates all the first run syndicated programs. However, viewer welfare is maximized when program mix (2,3) is offered (i.e., viewer welfare = 52). Indeed, despite being the most highly valued program, the network program is not contained in the viewer welfare maximizing program mix. The viewer payoffs associated with the different programming options available to the stations are shown in Table 8.

34/ This example assumes that stations have four programs from which to choose. Programs #2-#4 are assumed to be first run syndicated programs. Expanding the range of programs available made it easier to create an example where the No PTAR/No Program Autonomy environment is inferior to the other two environments.

Independent Station

Network Affiliate	1	2	3	4
1	2 / 2	2 / 2	3 / 1	1 / 3
2	2 / 2	2 / 2	2 / 2	2 / 2
3	1 / 3	2 / 2	2 / 2	1 / 3
4	3 / 1	2 / 2	3 / 1	2 / 2

Table 8: Station Viewer Payoffs

Table 9 summarizes the viewer welfare total for each regulatory environment, based on the viewer valuations presented in Table 7.

Economic Environment	Viewer Welfare
PTAR	36-52 (mean = 44.75)
No PTAR (No Program Autonomy)	43
No PTAR (Program Autonomy)	36-52 (mean = 44.75)

Table 9: Viewer Welfare Comparisons

In this example, viewer welfare is greater in both the PTAR and No PTAR/Program Autonomy environments than in the No PTAR/No Program Autonomy environments. This outcome occurs because of a number factors. First, despite being the most valued program, the network program is not contained in the program pair that maximizes viewer welfare. Second, while the affiliate is forced to carry the highly valued network program in the No PTAR/No Program Autonomy environment, the independent station's optimal response is to exhibit program #3, a relatively undesirable program. The resulting mix of programs shown (i.e., (1,3)) yields a viewer welfare value that is substantially below the mix of programs that maximizes viewer welfare (i.e., (2,3)). Third, the mix of programs that maximizes viewer welfare is one of the possible equilibria in the both the No PTAR/Program Autonomy and PTAR environments.

Each of these outcomes is driven by the distribution of valuations viewers place on different programs. In this instance, the distribution of such valûations is inconsistent with the view that PTAR reduces necessarily viewer welfare because it prevents the exhibition of the most highly valued programs.

IV. Summary

This paper evaluates PTAR with a simple program choice model using basic game theoretic principles. The purpose of this model is to identify the factors that determine whether PTAR enhances viewer welfare. This analysis indicates that PTAR's viewer welfare effects depend, among other things, on the valuations viewers place on television programs and whether, for instance, network programming "weakly dominates", or is "weakly dominated" by, first run syndicated programming. Absent information regarding the valuations viewers place on different program types, it is difficult to determine PTAR's viewer welfare effects. The absence of such data makes even the simplest of propositions difficult to assess in an analytical fashion. For instance, some have argued that PTAR reduces viewer welfare because it prevents network affiliates from exhibiting highly valued programs. This analysis indicates (i.e., Scenario #3) that this is true only in certain situations. For instance, an affiliate's exhibition of a network program may induce an independent station, driven by its desire to maximize audience share, to show a relatively undesirable programming. Such a program mix may leave the viewers worse off than if PTAR existed.

This analysis also shows that the program choice marketplace, with or without PTAR, will in certain situations fail to maximize viewer welfare and enhance program diversity. This feature of the television market is well-documented in the program choice literature. This analysis has shown that PTAR's existence may, in some instances, increase the likelihood that such a failure will occur. Moreover, in some instances, the likelihood of market failure is less when networks dictate the programming choices of their affiliates. In such a situation, viewer welfare is enhanced if the networks dictate such programming choices. This is a surprising result and it casts a different light on one of PTAR's original objectives -- the reduction in the control networks exercise over their affiliates.

Some believe that PTAR promotes economic efficiency. For instance, they believe that the networks possess excessive market power in the national advertising sales market. They further state that additional television networks would reduce such power. Finally, they state that PTAR's elimination would jeopardize the ability of two parties to develop such networks.

There has been substantial discussion over whether the networks have such market power. This discussion may be beside the point. The elimination of PTAR may have little or no effect on the emergence of new broadcast networks. An entity's decision to develop a network hinges, in part, on its expected profits which, in turn, depends in part on the profitability of "independent" stations after

they become network affiliates. Because no obvious connection exists between the station's pre-affiliation and post-affiliation profits, PTAR's elimination may have little, if any impact, upon a firm's ability to create a new network.

It could be argued PTAR's elimination could impede the growth of new national networks by forcing independent stations to "go dark." However, there is nothing to prevent stations that went "dark" from reappearing as affiliates of a new network. Importantly, when a station goes out of business, its sunk capital -- and its broadcast license -- remain. Prospective station owners may be able to acquire such capital at a bargain rate, perhaps acquiring a cost advantage over incumbent stations. While existing owners of independent stations may be adversely affected by PTAR's elimination, this may not reduce the likelihood of new broadcast networks.

In the final analysis, a regulation should only exist if there is a strong basis for believing that it promotes the public interest. The establishment of this basis requires a clear understanding of the regulation's effects. While it is admittedly difficult to know, a priori, all the effects of an existing or proposed regulation, a minimum confidence threshold must be achieved. This analysis indicates that the range of potential viewer welfare outcomes of PTAR is greater than many currently believe. While this analysis has not estimated the likelihood of each potential outcome in that range, it suggests that the probability that PTAR enhances viewer

welfare is certainly less than its advocates claim. Moreover, it has shown that standard thinking regarding the viewer welfare effects of a network's ability to dictate the program choices of its affiliated stations may be wrong. Based on the research conducted and the distortions that PTAR obviously introduces in the programming market, viewer welfare would likely be enhanced following PTAR's elimination.

Notation

Let w(i,j) define viewer welfare for program mix (i,j).

Then, according to Table 1:

w(1,2) = w(2,1) = 52

w(1,3) = w(3,1) = 48

w(2,3) = 43

w(1,1) = 44

w(2,2) = 40

w(3,3) = 33

* General Assumption - Independents can not exhibit the network program.

Scenario #1

Assume No PTAR/Program Autonomy

Nash Equilibria:

(2,2) = 40

(2,3) = 43

(3,2) = 43

(3,3) = 33 mean = 39.75

Table 1 (cont.)

Assume No PTAR/No Autonomy

Nash Equilibrium:

w(1,2) = 52.

Assume PTAR exists

Nash Equilibria:

(2,2) = 40

(2,3) = 43

(3,2) = 43

(3,3) = 33 mean = 39.75

All the results would be exactly the same if we relaxed the assumption that the independent station can not show program #1 (i.e., network program)

Scenario #2

According to Table 4:

w(1,2) = w(2,1) = 42

w(1,3) = w(3,1) = 41

w(2,3) = 44

w(1,1) = 36

w(2,2) = 39

w(3,3) = 34

Assume No PTAR/No Autonomy

Nash Equilibrium:

w(1,2) = 42

Assume No PTAR/Autonomy

Nash Equilibria:

w(1,2) = 42

w(2,2) = 39

w(3,2) = 44 mean = 41.66

Table 4 (cont.)

Assume PTAR Exists

Nash Equilibria:

w(2,2) = 39

w(2,3) = 44

w(3,2) = 44

w(3,3) = 34 mean = 40.25

* Results would have changed if we relaxed the assumption regarding whether independents could exhibit network programming.

Scenario #3

According to Table 7:

w(1,2) = w(2,1) = 50

w(1,3) = w(3,1) = 43

w(2,3) = 52 w(2,4) = 43

w(1,1) = 40 w(3,4) = 45

w(2,2) = 39

w(3,3) = 36

w(4,4) = 32

w(1,4) = 42

Assume No PTAR/No Autonomy

Nash Equilibria:

w(1,3) = 43

Assume No PTAR/Autonomy

Nash Equilibrium:

w(2,2) = 39

w(3,3) = 36

w(2,3) = 52

w(3,2) = 52

mean = 44.75

Assume PTAR Exists

Nash Equilibrium:

w(2,2) = 39

w(3,3) = 36

w(2,3) = 52

w(3,2) = 52

mean = 44.75