BEFORE THE
POSTAL RATE COMMISSION
WASHINGTON, D.C. 20268-0001

POSTAL RATE AND FEE CHANGES, 2000   )   Docket No. R2000-1

RESPONSE OF ASSOCIATION OF PRIORITY MAIL USERS, INC.
WITNESS JOHN HALDI TO FOLLOW-UP INTERROGATORIES OF
UNITED PARCEL SERVICE (UPS/APMU-T1-25-27)
(July 7, 2000)

Association of Priority Mail Users, Inc. ("APMU") hereby provides the following

responses of witness John Haldi to the following follow-up interrogatories of United Parcel

Service: UPS/APMU-T1-25-27, filed on June 23, 2000. Each interrogatory is stated verbatim

and is followed by the response.

Respectfully submitted,
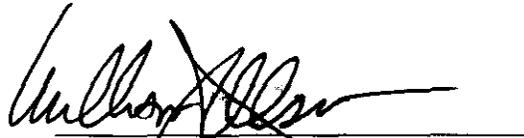
William J. Olson
John S. Miles
WILLIAM J. OLSON, P.C.
8180 Greensboro Drive, Suite 1070
McLean, Virginia 22102-3860
(703) 356-5070

Counsel for Association of Priority Mail Users, Inc.

CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document upon all participants
of record in this proceeding in accordance with section 12 of the Rules of Practice.

William J. Olson

July 7, 2000

**Response of APMU Witness John Haldi to Interrogatory
of United Parcel Service**

UPS/APMU-T1-25.

     Provide citations to leading economic journals that provide support for the "turbulence theory" that you cite in your response to interrogatory UPS/APMU-T1-15.

<u>Response</u>:

     The phrase, or term, "turbulence theory" does not occur in any of my responses to previous questions by United Parcel Service. My response to UPS/APMU-T1-15 did contain the following passage:

> [M]any commonplace market phenomena apparently are characterized by more complex behavior, comprised of both competitive and restrictive elements, that arise as the result of nonlinear spatio-temporal interactions among a large number of components or subsystems. Six features of such systems include: (i) dispersed interaction; (ii) absence of a global controller; (iii) cross-cutting hierarchical organization with many channels of communication and tangled interactions; (iv) continual adaptation; (v) perpetual novelty; and (vi) system adjustment through out-of-equilibrium dynamics. [Footnote omitted.] Of particular importance for the question posed here is the finding that market responses in complex economic systems may have critical points in between stable zones where convergent behavior dominates, and **turbulent zones** where search behaviors and "bandwagon" effects lead to more complicated dynamics. [Footnote omitted, emphasis added.]

     My response further refers to "assumptions that are likely to break down at the boundary of the **turbulent zone**." [Emphasis added.] I also state that "[i]f the rate increase carries the system into the **turbulent zone**, however, all bets are off." [Emphasis added.] And I state: "[t]o be sure, no one knows at precisely what point a Priority Mail rate increase will cross the boundary into the **turbulent zone**." [Emphasis added.]

     For the purposes of my answer to UPS/APMU-T1-15, I devised the metaphor "turbulent zone" as a succinct way to refer to the range of variables where the complex

behavior identified above occurs, characterized by some or all of the six features listed by

Rosser,[1] and also by "search behavior" and "bandwagon effects," terms he uses. I am not

aware of sources that have used precisely this metaphor in an economic context. However,

it carries over into the economic sphere a well-known concept from fluid dynamics, namely

the sudden transition, at a critical point, from (i) smooth "laminar" flow to (ii) the eddies

and whorls of "turbulent" flow. Nonlinear dynamics in economic systems is well

established at the leading edge of the literature. Some references to nonlinear dynamics in

leading economic journals (which are taken primarily from the bibliography referenced in

footnote 2 to my initial response to UPS/APMU-T1-15) follow.

Brock, W.A., and C.A. Hommes (1997), "A rational route to randomness,"
Econometrica 65, pp. 1059-1095.

Föllmer, H. (1974), "Random economies with many interacting agents," *Journal of
Mathematical Economics* 1, pp. 51-62.

Holland, J., and J. Miller, "Artificial adaptive agents in economic theory,"
American Economic Review Papers and Proceedings 81 (1991), pp. 365-370.

Lipman, B, "How to decide how to decide to ... : Modelling limited rationality,"
Econometrica 59 (1991), pp. 1105-1125.

Young, P, "The evolution of conventions," *Econometrica* 61 (1993), pp. 57-84.

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[1]   J. Barkley Rosser, Jr. (1999) Review of *The Economy as an Evolving
Complex System II*, edited by W. Brian Arthur, Steven N. Durlauf, and David A. Lane,
Santa Fe Institute Studies in the Sciences of Complexity Proceedings, Vol. XXVII,
Addison-Wesley, Reading, Massachusetts, 1997; in *Discrete Dynamics in Nature and
Society*, vol. 3, no. 1, pp. 71-74.

**Response of APMU Witness John Haldi to Interrogatory
of United Parcel Service**

UPS/APMU-T1-26.

Provide citations to any other journals that provide support for the "turbulence theory" that you cite in your response to interrogatory UPS/APMU-T1-15.

Response:

See my response to UPS/APMU-T1-25. Some references to nonlinear economic

dynamics in other journals (which are taken primarily from the bibliography referenced in

footnote 2 to my initial response to UPS/APMU-T1-15) follow.

Arifovic, J., "Genetic algorithm learning and the cobweb model," *Journal of Economic Dynamics and Control* 18 (1994), pp. 3–28, October 1989.

Arifovic, J., J. Bullard, and J. Duffy, "The transition from stagnation to growth: An adaptive learning approach," *Journal of Economic Growth* 2 (1997), pp. 185–209.

Arthur, W. Brian, "On designing economic agents that behave like human agents," *Journal of Evolutionary Economics* 3 (1993), pp. 1–22.

Bullard, J. and J. Duffy, "A model of learning and emulation with artificial adaptive agents," *Journal of Economic Dynamics and Control* 22 (1998), pp. 179–207.

Bullard, J. and J. Duffy, "Learning and the stability of cycles," *Macroeconomic Dynamics.* 2 (1998), pp. 22–48.

Huberman, B. and T. Hogg, "Distributed computation as an economic system," *Journal of Economic Perspectives* 9 (Winter 1995), pp. 141–152.

Marimon, R. E. McGrattan, and T. J. Sargent, "Money as a medium of exchange in an economy with artificially intelligent agents," *Journal of Economic Dynamics and Control.* 14 (1990), pp. 329–373.

Marks, R., "Breeding hybrid strategies: Optimal behavior for oligopolists," *Journal of Evolutionary Economics* 2 (1992), pp. 17–38.

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Rosser, J. Barkley, Jr., (1999) Review of *The Economy as an Evolving Complex System II*, edited by W. Brian Arthur, Steven N. Durlauf, and David A. Lane, Santa Fe Institute Studies in the Sciences of Complexity Proceedings, Volume XXVII, Addison-Wesley, Reading, Massachusetts, 1997; in *Discrete Dynamics in Nature and Society*, vol. 3, no. 1, pp. 71-74.

Rosser, J. Barkley, Jr., "Complex dynamics and systemic change: How things can go very wrong," (with Marina V. Rosser) *Journal of Post Keynesian Economics*, Fall 1997, vol. 20, no. 1, pp. 103-122.

UPS/APMU-T1-27.

Provide citations to any journals or studies which apply the "turbulence theory" that you cite in your response to interrogatory UPS/APMU-T1-15 to the market in which Priority Mail participates.

Response:

See my response to UPS/APMU-T1-25. Some references to studies of applications

of nonlinear economic dynamics (which are taken primarily from the bibliography

referenced in footnote 2 to my initial response to UPS/APMU-T1-15) follow.

Albin, Peter S., *Barriers and Bounds to Rationality: Essays on Economic Complexity and Dynamics in Interactive Systems*, Princeton University Press, 1998.

Allison, Mary Ann and Susanne Kelly, *The Complexity Advantage: How the Science of Complexity Can Help Your Business Achieve Peak Performance*, McGraw-Hill, 1999.

Anderson, P. W., K. J. Arrow, and D. Pines, eds., *The Economy as an Evolving Complex System*, Santa Fe Institute, 1988. [Proceedings of the Global Economy Workshop held at the Santa Fe Institute in September, 1987.]

Arthur, W. Brian, "Self-reinforcing mechanisms in economics," pp. 9–27 in P. W. Anderson et al., *op. cit.*

Brenner, Thomas (ed.), *Computational Techniques for Modeling Learning in Economics*, Kluwer Academic Publishers, New York, 1999.

De Vany, A., "The emergence and evolution of self-organized coalitions," pp. 25-50 in M. Gilli, ed., *Computational Economic Systems: Models, Methods, and Econometrics*, Kluwer Scientific Publications, New York, 1996.

Guriev, S. and M. Shakhova, "Self-organization of trade networks in an economy with imperfect infrastructure," in F. Schweitzer (ed.), *Self-Organization of Complex Structures: From Individual to Collective Dynamics*, Gordon and Breach Scientific Publishers, London, 1996.

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Rosser, J. Barkley, Jr., *Comparative Economics in a Transforming World Economy* (with Marina V. Rosser), Chicago: Irwin, 1996.

Shapiro, Carl, and Hal R. Varian, *Information Rules: A Strategic Guide to the Networked Economy*, Harvard Business School Press, November 1998.

Sherman, Howard J., and Ron Schultz, *Open Boundaries: Creating Business Innovation Through Complexity*, Perseus Books, 1998.

Simon, Herbert A., *Models of Bounded Rationality, Volume 3: Empirically Grounded Economic Reason*, MIT Press, Cambridge, Mass., c. 1997.

Witte, U., *Evolutionary Economics*, London: Edward Elgar, 1993.

DECLARATION

I, John Haldi, declare under penalty of perjury that the foregoing answers are true and correct, to the best of my knowledge, information, and belief.

John Haldi

Dated: July 7, 2000