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DISCUSSION

FRANKLIN R. EDWARDS*: The principal objective of this paper is to investigate the effects that innovations in information technology have on security markets, and, in particular, to determine the effects of these innovations on market integration. The authors argue that the availability of more timely information should result in security prices that more consistently and accurately reflect intrinsic values.

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In general, the paper is interesting and well-done. However, I am troubled by two aspects of the paper. First, I believe the authors overstate their case with respect to the consolidated ticker tape; and second, they exaggerate the policy significance of their findings.

Garbade and Silber study three innovations: the use of the Trans-Atlantic cable in 1866 to speed the flow of information between New York and London; the use of the domestic telegraph in the 1840's between New York and New Orleans; and the adoption of the consolidated stock market ticker tape in 1975. The authors postulate that to the extent that these innovations integrated previously distinct and separate financial markets they should have significantly diminished inter-market price differentials.

After a statistical analysis of the relevant (time-series) inter-market price differentials immediately before and after the innovations, Garbade and Silber find that the adoption of both the domestic telegraph and the Trans-Atlantic cable significantly reduced inter-market price differentials from immediately before to immediately after the innovation. Thus, they conclude that these innovations improved market integration. On the other hand, they find that the consolidated ticker tape had no observable impact on inter-market price differences, and therefore conclude that this innovation did not improve market integration, and that it had no "measurable economic benefits..." (p. 18). The authors argue that the absence of such benefits is not unexpected, since the consolidated tape was a "regulatory-induced" innovation, and not a private sector innovation like the telegraph and the Trans-Atlantic cable. Their conjecture is "that the tape would not have been innovated by private sector initiative (even if an innovator could have captured the externalities associated with the production and dissemination of information)." (p. 18).

In my view this last finding is the most provocative aspect of the paper, and certainly the most challengeable (which may also explain why, as a critic, I think it is the most interesting). This finding is of interest not only because of its obvious relevance for current policy, but because it focuses our attention on a weakness in the authors' general procedure. The authors' first two findings, with respect to the Trans-Atlantic cable and the domestic telegraph, are considerably less interesting: these were adopted by the private market presumably because they afforded profit opportunities, and they clearly speeded the flow of information between markets that were almost certainly not well integrated prior to the innovations. Had the authors found that these innovations did not improve market integration, our only choice would have been to question their analysis. In contrast, the consolidated ticker tape was not an innovation of the private sector but arose out of government intervention, and, while it undoubtedly did improve the flow of information, its effect is debatable because it was used in markets that were already highly integrated.

The authors' conclusion with respect to the consolidated tape is not convincing for two reasons. First, their supporting argument that adoption of the consolidated tape was unlikely to produce benefits because it was regulatory-induced is obviously overstated. As the authors seem to recognize, any innovation that improves market information is a clear case of a "public good," and in such cases

there is no reason to expect that the private sector will always adopt the innovation, even if it has a net welfare benefit. Indeed, the externalities associated with the production and dissemination of information provide one of the clearer rationales for government intervention. Thus, there is certainly no obvious *a priori* reason to believe that government-induced innovations in information technology will not result in welfare benefits.

Second, this finding (as well as all of their other findings) turns on the meaningfulness and the definitiveness of their measure of welfare benefit, and the authors make no attempt to justify their use of changes in “*mean absolute price difference*” to represent this benefit. This measure is only one of several plausible indices that they could have employed. In specific, this measure implies a linear welfare loss function. But the true loss function might, conceivably, be quadratic, cubic, or something else. There is also no reason to think that one of these loss functions is more plausible than the others. Thus, before the authors can reasonably conclude that there were no “measurable economic benefits” due to the consolidated ticker tape they must investigate the more obvious alternative measures of welfare benefits. Examining the change in the variance and perhaps some skewness measures of price differentials, for example, would seem to be the minimum required. If after analyzing these measures as well the authors can find no measurable economic benefits, I would be willing to accept their negative conclusion.

Finally, even if the authors are right about the consolidated tape, what generalizations can be drawn from such a finding? In their concluding sentence the authors say: “The automation of the trading processes itself is the next logical step in market integration, and is currently under active consideration by the exchanges and the SEC. Will it produce significant economic benefits? Perhaps, but one of the lessons of our story is that it might be best to leave that decision to the instincts of the private sector.” Are the authors saying that if you can identify one instance of a public good where the government has intervened and failed to produce any economic benefits that this shows the futility of having government provide public goods? I doubt it. More likely, they mean to restrict themselves to the argument that the U.S. security markets are already so highly integrated that any further automation of the trading processes will have little or no economic benefits. Maybe. But until I know exactly what the authors have in mind by the “automation of the trading processes,” I am reluctant to draw such a conclusion. In my mind the logical next step is to institute a composite *quotation* system, where all investors will be able to have simultaneous access to bid and ask quotations in all markets, just *before* they make a trade. This kind of information may be more effective in reducing inter-market price differentials than the publication of *ex post* price information, especially for the less actively traded stocks. Finally, there may be other (non-efficiency) grounds on which to base a decision to fully automate the trading processes. In particular, we may wish to assure that everyone has equal access to timely information, and not just some people.