What is a "good-fit" and "bad-fit" is not indicated. The results in Table 2a actually show that a better fit is obtained for all the SS unconstrained equations compared with the unrestricted and restricted JKB equations. The only criterion of the SS reports resulted by JKB might be the $t$-statistic on the coefficient of $M_3$ (1.346). The negative coefficients for $M_1$, $M_2$ and $M_3$ in the JKB constrained case are forced by the form JKB used.

Our interpretation of the JKB results is that the effect of imposing the restriction on (1) is to lower the $R^2$ in all equations, providing evidence that the spatial constant returns to scale case of the SS increasing returns CD specification is an incorrect specification on the data used, rather than a counter-example supported by the data.

For example, using the JKB data, for the M1 regression, the overall fit falls from 0.99220 to 0.55146, for M2 from 0.99030 to 0.00452, and for M3 from 0.98960 to 0.04608. Far from the sweeping conclusion (JKB, p. 259), we show that all the evidence produced in support of the Sina-Stocks hypothesis cannot be sustained on theoretical and empirical considerations; what shows is that the constrained three-input CD production function gives an inferior fit compared with the unconstrained form estimated by SS. This JKB conclusion is an incredible overstatement on the results presented.

JKB trusts SS (1972) for not checking on multicollinearity when, in fact, such a check was performed by running all possible variables on the included variables. There are several collinearity variables and checking the $R^2$ calculated using the BIASSTM program, documented in Stoker (1991) and has a number of collinearity tests on the regression calculation, including the Faddioea (1959) procedure, which provides a computational check on the estimated coefficients.

While there was some multicollinearity in the data, the problem was not particularly serious. The Faddioea estimates of the computational error in each coefficient for the OLS form of (1) for $M_1$ and $M_2$ are $(0.59996-1.1, -4.5894-1.1, 0.50640-1.1, 4.3132-1.0, 0.39791-1.0, 0.18092-1.0, 0.83362-1.0, 0.78248-1.0, -0.89111-1.0, 1.15800-1.1)$ for In $A - A_0$, $a$, $b$ and $A$, respectively.

Given that $X$ is the $T$ by $K$ data matrix, the Faddioea procedure calculates the diagonal elements of $(X'X)^{-1}$, which should have an expected value of zero. Substantial deviations from zero provide a computational check on the accuracy of the answers. Since the largest diagonal element found was in the area of 0.4-6-10, accuracy loss due to multicollinearity does not appear to have been a serious problem. Actually, any multicollinearity in the data set, by shifting the diagonal elements in the variance-covariance matrix, would work in the direction of reducing the estimated significance for the coefficient of real money balancers.

Further evidence on whether money balances behaving in the production function awaits implementation of more comprehensive measures for the role of the financial system in production and additional experimentation with functional form issues. While we applaud the development of the "counterexample" methodology as a means by which to test and study the effect of the financial system on the potential supply of real output, such counterexamples must be distinct from the original SS unconstrained CD form in order to have validity. All the JKB paper does is to highlight that the constrained form of the CD production function containing real balances is inferior to the specification on the unconstrained form for the 1929-67 data set used in the estimation. It does not controvert or shed doubt on the original carefully drawn and stated suggestions of the original work.

NOTES
1. Equation 3 comes from taking logs of $Q = A e^{1/v}$, where $v = \ln v$. The constrained system is $Q = A e^{1/v}$, $K^{1/\gamma}$. Taking anti-logs of equation 2 and multiplying by $K$, we get $Q = m A e^{1/v}$, $K^{1/\gamma}$, where $m$ is the anti-log of $v$. Hence, equation 2 is just one of two possible ways to estimate a constrained form of equation 1.
2. Bennet (1989) has recently commented on JKB (1987), who again replied in JKB (1989). Bennet used more recent data that was provided to us. He reports the second-order OLS constrained form of the SS model and finds that the coefficients of $M_1$, $M_2$ and $M_3$ were significant in models without time. With models containing time, the reported significance in the coefficients of money variables, although there was some evidence of multicollinearity,
In order to circumvent some of these problems in the empirical testing of economic theories, we devised an alternative test procedure in our 1978 paper where we distinguished between three levels of assumptions in the literature of empirical, realistic models of theory and focused on isolating the "core" behavioral assumptions (Part A) of the theory from its simplifying assumptions (Part B) and procedural testing conventions (Part C). We then suggested the development of valid counterexamples (logically derived by the maintained hypothesis) at the "core" level and suggested simultaneously testing the maintained hypothesis and its counterexample using the same Part B and Part C assumptions. This implied that we had to develop a counterexample that included all the variables contained in the maintained hypothesis, but which included them in a way which would contradict the maintained hypothesis.3

The first step in applying the alternative test procedure for testing SS's hypothesis was to determine what, if anything, their theory had to say about the real world. Unfortunately, the assertion upon which they based their test that "real money balances are a factor of production" (1972, p. 590) could not be too broadly interpreted. There are some major difficulties with interpreting such a statement. For example, it would be possible to more exactly interpret this type of statement as follows: "There is at least one production function having money as an argument (in some level of inputs, outputs and real money balances) to which inputs and outputs (at this level) always conform." Such a statement, while potentially "testable," is trivial and does not constitute a theory in the sense of implying any meaningful empirical statement. Therefore, it is testable for three reasons. First, the real world suggests that this assertion has the same properties, with regard to establishing its falsity, as an existential statement. Second, specifically, existential statements cannot be refuted. Second, the components ..., to which observed reality always conforms" means that the assertion of a form "from amongst the set X, there is at least one set which has the characteristic property of each member of the set, that is the X's, have characteristic z, and all of those sets having this characteristic also have characteristic y." Obviously, to refute a statement of this type, a set X must be found which does not have the characteristic z but for which all of its member's z have characteristic z. Since "all X's have characteristic z" is a universal statement, a refutation would require that there be a valid inductive logic to prove the truth of this statement. Since there is no inductive logic, the statement concerning z is irreducible. Thence, to show that money is not an argument in the aggregate production function it must be shown that over the entire range of the function, real money balances have no effect on output. Even if we were to find a "true" production function for which real balances do not affect the core level of output, we would still not have necessarily shown that money as a real output and real balances at which output is affected by changes in real money balances (this state of affairs depends upon the production function under consideration).

A counterexample if we had interpreted "real balances are a factor of production" to mean that "for some levels of output and real balances, an increase in real balances will increase output," this would have still meant that the assertion is irreducible. That is, once again, even if we were to find an instance where real balances did not affect the observed level of output, we would still not have shown that for the economy under consideration there is not some other level of output and real balances at which output is affected by changes in real money balances. (Nguyen, 1986 had done this in his 1989 conventionally and predictably, do not treat this as counter-evidence, but instead co-opt Nguyen's work by arguing that his time-periods are too short and reestimate their model with additional parameters over the "full" period 1930-1978).

In fact, if the SS hypothesis were interpreted to mean that there is some level of real money balances and output at which changes of the latter will affect the former, then there is no much motivation for carrying out an empiricist test. Most economists would agree that an economy with a medium of exchange will have a higher level of output and a lower economy (although not necessarily a continuously high). The only way to have a reducible theory is not as pointed by SS where something controversial is at stake is to examine the following statement: "all neoclassical production functions to which inputs and outputs conform for any finite period of time will have real money balances as an argument at all levels of output and real money balances." This statement can be refuted by finding one neoclassical aggregate production function having money as an argument and to which inputs and outputs do not conform as claimed for a period of time. In this formulation, Nguyen's (1986) results would constitute counter-evidence to the SS hypothesis into question.

Accordingly, we took the model SS tested to be the following: "inputs and outputs in the U.S. economy form 1925 to 1967 conform to a relationship in which all neoclassical production functions for the economy had real money balances as an argument at every level of inputs and outputs over this period." Our counterexample (equation (3) in our 1978 paper) was then developed to represent an existentially different allocation of inputs and outputs which is equivalent to "there is at least one level of output Q which does not change when real money balances change in the neoclassical aggregate production function Q=l(k,l,m) in the U.S. economy from 1925-1967." To develop a valid counterexample, we had to meet a major requirement of the alternative test procedure that we use the very same variables and definitions at the Part (A) level but in such a manner that real money balances can be shown not to matter. Using a standard aggregate neoclassical production function without real money balances as an argument, while logically a denial, would not conform to our interpretation above of the SS hypothesis because SS would have claimed that the confirmation of such a counterexample would not refute their hypothesis.

Consequently, we developed our counterexample to meet the conditions we had set. If real money balances really mattered, then money deflated values of capital and labor would not meet the conventional test criteria used by SS to test their maintained hypothesis. We felt that a confirming instance for such a speculation would be damaging to the hypothesis that money belongs to the production since this counterexample in fact argues that it is money-deflated values of labor and capital that matter, not real balances. This implies that production is related to money-deflated values of capital and labor and could conceivably be carried on without money. The empirical counterpart of our counterexample (equation (6)) implied that if the coefficients of money-deflated labor and capital added up to one and the coefficient of money was insignificantly different from zero, then this would cast doubt on SS's maintained hypothesis. SS(1992) criticizes us for using a counterexample which is not logically independent of the example. By the requirements of the alternative test procedure, the counterexample must be of a form where the role of real money balances is accounted for but in such a fashion that its presence denies the maintained hypothesis. The counterexample could not be logically independent of the original example(s) hypothesis since it represented an implication that was denied by the original hypothesis and was therefore dependent on it and had to be in so, in order to as far as possible immobilize the effects of Part (B) and Part (C) aspects of the alternative test procedure. This would necessitate the use of money balances in the counterexample in a manner that would minimize the problem of the Ambiguity of Reformulations but which would deny the validity of the original hypothesis if confirming evidence were also to be found for the counterexample. Thus, SS's insistence that the counterexample be logically distinct is based on a complete misunderstanding of the alternative test procedure. The whole purpose of the alternative test procedure is to develop a counterexample as an existential statement independent of but logically denying the original example hypothesis if the counterexample is confirmed by the same data and procedures in Part (B) & (C) level. The counterexample must, by its very nature, be an implication of the original example that is denied by the data and which, by its confirmation with these same test procedures and data, brings into question the original example. Such a logical denial therefore entails that the counterexample be not independent of the example and that is precisely what our counterexample was. Thus our alleged role is a necessary virtue. SS also make a big issue that both our counterexamples are the same counterexample, a proposition we clearly identified in our critique. Specifically, examining the structure of our uncorrelated and reinstated counterexamples and SS's criticisms of them, the following points may be noted:

a) The counterexample specifically constitutes a logical denial of the SS hypothesis, since it directly implies that it is money-deflated values of labor and capital that represent the "true" underlying relationship of the counterexample is confirmed by identical data and procedures since then money can be shown to have a zero influence on output. Consequently, "half money-deflated values i.e. 1 and 2 are all that matter in the neoclassical aggregate production function, if the counterexample meets the test criteria.

b) The validity of the counterexample seems to be implicitly admitted by Siass and Stolten since all they object to is their (inconsistent) perception that it is not logically distinct but constitutes a "special case" of their example. Since this understanding of their is incorrect as explained above and it go on to discuss our results as being poor to their results on the basis of the R' criteria, we can only conclude that they implicitly admit the validity of the counterexample. What constitutes a valid example or counterexample for a researcher is the direct outcome of their
prior regarding the manner in which they envisage 'the world works' and the procedures and evidence they accept as relevant to testing this view. Conventional tests focus on obtaining positive evidence in favor of a theory that islogically flawed and limited (see the literature cited in footnote 1). This engenders an 'advocacy bias' that is methodologically limited and false, given the nature of conventional econometric testing (see Jensen, Kamath, and Bennett, 1987,1989). Consequently, in order to attenuate but not solve these problems, we envisaged our specific counterexample as a denial of the original SS result, so as to refute the theory base and put the original theory 'at stake' thus excluding (but not entirely eliminating) this advocacy bias. This procedure was intended to make explicit 'self-imposed' constraints regarding the original theory on the part of researchers (on this, see Davidson et al., 1978), thus making testing logically more complete and rigorous and testing the theory-consistent (a larger range of tests) to deciding on the truth or falsity of the theory based on his or her own 'prior' and the results of the 'four-way' tests entailed by the procedure. SS's implicit acceptance of our counterexample thus removes the first obstacle to applying the alternative test procedure, since given the insufficiency of their understanding of the logic of finding a valid counterexample and their discussion of our results, a consensus can be seen to exist regarding its admissibility.

c) SS's statement that both versions of the counterexample are the same is, of course, quite correct and we have said to ourselves in our 1987a paper (p. 265). However, their view that the counterexample is a 'special case' of the multiple choice is not a criticism because of the necessary manner in which their original hypothesis has to be interpreted as discussed above. Finding Case II or Case III results for the counterexample implies both that there is at least one level of output Q which does not change when real income aggregate income aggregates and for the U.S. economy from 1929-1967 in the form of the restricted Coint-Douglas function given in our equation 6 and that it is not definable with love 1 and K that matter in aggregate production functions. SS's interpretation of our results therefore highlights the validity of our conclusions.

d) Given the structure of our counterexample, confirming evidence for our money-deflated equation 5 and an insignificantly different from zero coefficients for m in regressing equations 6, precisely establishes that money does not matter in the Coint-Douglas production function (i.e., + 1 = 0). The data could have showed up some other result (cf., Benning, 1989) and SS's hypothesis would not have been questioned if it had been found that 9 with a statistically significant coefficient.

e) SS criticizes our cautious (rather than 'sweeping') conclusion raising questions about the inclusion of money balances in the neoclassical production function, by comparing the goodness-of-fit of the original SS and our counterexample regressions. As clearly identified in our 1987a paper, the alternative test procedure does not attempt to choose between alternative regression models but instead attempts to test for the appropriateness of the original hypothesis and some implication it desires (i.e., the counterexample) to see which case the point result favored. The objection is delineated not one of choosing the equation with the higher "but rather realizing how the example and counterexample perform relative to some test criteria. In Coint, Thos of both of the counterexamples provide 'GOOD FITS' relative to some pre-assigned minimum "level" (say .50), then the original example is cited into question. Clearly, in the specific case of the SS hypothesis and its counterexample, both meet the minimum criteria and therefore the original hypothesis was brought into question. Only if the results had fallen into the Case I pattern would we have been able to claim that their hypothesis was (formally and correctly) overemphasized. Choosing one hypothesis over the other on the basis of goodness of fit would invalidate the purpose of the alternative test procedure and completely misunderstand its structure and intent.

f) With regard to the issue of multico linearity, that issue is irrelevant from the point of applying the alternative test procedure (as pointed out in our 1989 comment on Beizinger's paper). The test required none of the same procedures and specifications at the levels of (B) and (C) and consequently we used the original SS data. In any case, as Kennedy (1985) and others have gone (in 1972 paper) and a broader instrument matrix that would be of Coint-Douglas production functions even when multicollinearity may be present. Even considering all the points raised above, the original contention regarding the 'questionableness' of the original SS hypothesis raised in our 1987 paper holds. SS's (1992) criticisms of our application of the alternative test procedure are thus found to be invalid and the original contention maintained. The major conclusion that emerges is that serious doubts remain regarding the exclusion of real balances in the neoclassical aggregate production function. Our and Benzing's (1989) (and Nguyen's, 1996) results use the alternative test procedure point toward the inappropriateness of this procedure and to the need for eliminating other econometric hypotheses using the alternative procedure. Such a strategy is a likely to make economists live up to the rhetoric of their econometric tests. The propriety of postulating aggregate production functions also remains moot.

We also find it surprising that white S&S (1992) 'approves' of our approach (and presumably our methodological criticisms on conventional econometric tests of the type used by them) 'appropriate,' they do not attempt to apply our procedure or address the criticisms of the conventional econometric testing procedure raised in our various papers on the subject. Perhaps, this points toward the critical comments raised by Boland, 1982, 1989 that for most mainstream neoclassical economics methodology does not matter since they take the 'apprenticeship' of their own method for granted.

NOTES

1. The sub-problems of conventional confirmation-testing testing are centered in the Problem of Induction and Include the Problem of No Relevant Modus Ponens, the Consequence Problem, the Problem of the Limits of Observation, the Doleman-Quine Problem, the Problem of the Adequacy of Refutations and the Single-Edged Sword Problem of Conventional Testing (see Jensen, Kamath and Bennett, 1987 for a summary). For detailed discussion of these problems see Boland (1977, 1982), Popper (1972 and S assay et al. 1985) for the first, Bennett (1981) for the next three (Coint 1982), Of course (1960, 1969 and Jensen, Kamath and Bennett (1987)) for the third, and Kamath, Jensen and Benne (1984) for a discussion of the last two problems. Mayer (1980), Ruzo (1976), Reuben (1976) and Sway (1983) each present comprehensive critiques of the foundations and practice of econometrics. We have briefly discussed some of the major issues in our 1989 reply to Beisinger (1989) and in our most recent methodology (see the next, Kamath, Jensen and Beining, 1989).

2. See Hill, Judge and Fimley (1958), Kendel and Stuart (1960), McClosky (1985a, 1985b) and Morrison and Henkel (1976) for discussions of the importance of specifying long functions in econometric testing.

3. See Sway (et al., 1985) for a careful and fundamental critique of conventional, elemental econometric testing.

4. See Beining (1989), Boland, (1982), Popper (1972) and S assay et al. (1985) for a discussion of this asymmetry and its consequences for theory testing. The commonly used Neumann-Pearson Theory (NPT) approach to testing attempts to utilize this asymmetry but fails to do so. See Gillies (1971) Hacking (1965) and Spiegelman (1973) for criticisms of NPT.

5. It will not always be possible to use the same ancillary assumptions in the model of the counterexample as are used in the model of the theory. However, in using the Bennett Test Procedure one should attempt to maintain their coherence.

6. All models or theories are quasi-component statements in which the components are joined by a conjunction and at least one of the components is a universal statement of the form "all x have characteristic y" (e.g., "all democracies are characterized by a free press", "any man can be president", ...). One can show that this type is only true if each and every x, past present and future, has this characteristic. Clearly, to establish the empirical truth of a statement is an impossible task given the Problem of Induction.

7. This does not mean that the assertion is a tautology or that it is completely uninteresting. It only means that while the assertion can be conceded false, its falsity cannot be established on the basis of a finite number of observations or tests.

8. An existential statement is of the form "at least one has it (or does not have the characteristic y (e.g., "at least one demand curve is downward sloping"). This type of statement can be verified, at least conceptually, by establishing that one or more of the assertions (if not all or does not have it).

9. By "true", we mean a production function for which inputs and outputs will always conform to the norm contained.

10. What is meant by "home finite period of time" of course remains a controversial issue. We took this to mean the same finite period of time (1929 or 1967) that SS considered in their 1972 paper but a broader instrument matrix that would be of the model for the period for which the market, market-capitalist exchange economy has existed.

11. Note that the asymmetry in testing theories pointed out in footnote 4 requires that a valid counterexample for a universal theory be an existential statement in its logical denial and should be subject to the same tests as the tests of (B) and (C) of our schematic or the original example (see Jensen, Kamath and Bennett, 1987a). The issue raised regarding the irrelevancy of an existential statement mentioned earlier with regard to the maintained hypotheses are circumvented because (a) the asymmetry in testing refutations for us to find a single instance of the confirmation of the maintained hypothesis logical denial and (b) because we regularize the other parts of the maintained hypothesis while testing the counterexample by using the same simplifying assumption, proportional rates and hunting procedures for the same time period and location. Consequently, simultaneity restrictions of the conventional type are not available for use to detect the failure of the counterexample if indeed it fails.

12. Nguyen's (1985) raises more further doubts about the SS hypothesis, even though he does not use the alternative procedures since he finds that real balances (defined variously as M1 or M2) are not significant in regressions run for the 1947-67 and 1978-86 period using what he terms a 'correct specification' of the SS model. SS's (1989) defense of
their original hypothesis such the modified specification is weak and reveals their strong advocacy bias so that they are not willing to doubt the tenability of their hypothesis even when there is evidence to the contrary. This further emphasizes the need to bring back the missed data function (see McChesney, 1985 a) and devise a test procedure where something is put 'at risk' as we have attempted to do with our alternative test procedure.

13. For the problems associated with selecting hypotheses on the basis of goodness of fit, completely avoid in the case of the alternative test procedure, see Aiger (1975), Dihyman (1984), Kennedy (1985) and Mayer (1975). As McChesney (1985a,b) and Peasants (1985) point out, the use of *as a criterion in conventional econometric tests is seriously flawed even on the terms of its own logic since no loss function is ever specified, so that the applied econometrician or researcher can invent himself from having to put at stake the truth or falsity of the hypothesis being considered. For example, to overcome this problem, the set of variables may be chosen so as to minimize some sort of expected loss associated with prediction errors. Our alternative test procedure attempts to do just that by indirectly setting up a loss function, while avoiding the problems of the appropriateness of using the "criteria without specifying a loss function.

14. Our original reply to SR (1992) also discussed the major methodological and theoretical problems associated with the existence of aggregate production functions, the insufficiency of defining and including variables like capital and real money balances in such production functions and misspecification problems. These have been omitted for reasons of brevity. The discussion can be made available on request.

References

Grush, A., 1980, "Can We Ascertain the Falsity of a Scientific Hypothesis?" *Studium Generale, pp. 1061-1093.*