# Economic Policy Effectiveness in Hicksian Analysis: An Extension

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## I. Introduction

The possibility that the *IS* curve may be upward sloping has been widely noted. Thus, *Meiselman* [5, 1077] has contended that "under a wide range of circumstances the *IS* curve is best taken to have a positive slope". *Teigen* [9, p. 19] has appealed to the existence of an upward-sloping *IS* curve as confirmation that empirical evidence which shows increases in the supply of money being accompanied by higher interest rates is reconcilable within a Keynesian framework. Additionally, articles by *Silber* [8] and by *Burrows* [2] formally explore the policy implications of an upward-sloping *IS* curve model[1]. The thrust of the latter two articles is that in the context of such a model a low interest-elasticity of the demand for money is unfavorable to the effectiveness of both fiscal policy and monetary policy.

A common denominator of previous formal work on the positively-sloped *IS* curve is that such a model can be obtained if all the propensities to spend with respect to income sum to more than unity. Specifically, the level of income is allowed to appear in the investment relationship (with the reasoning being that investment is a function of profits, which in turn depend on the level of income). The *IS* curve then slopes upward if the marginal propensity to invest out of income exceeds the marginal propensity to save. However, in a more recent contribution, *Cebula* [3] adds a new twist to the upward-sloping *IS* curve literature. In particular, *Cebula* retains the standard assumption that the propensities to spend out of income sum to less than unity. Nevertheless, following suggestions by *Weber* [11] and by *Yarrow* [12] respec-

* I would like to thank William *Silber* and Richard *Sines* for their helpful comments.

[1] See also the discussions in *Dernburg* and *McDougall* [4, 267 - 276] *Ott, Ott,* and *Yoo* [6, 39 - 42] and *Wagner* [10, 1357 - 1388].

tively, *Cebula* considers the possibility that consumption and investment are increasing functions of the rate of interest. Such a possibility also entails a positively-sloped *IS* curve with the following policy implications as stated by *Cebula:*

(1) conventional fiscal policy has its usual effects on the economy's income level,

(2) standard monetary policy has a perverse impact on the level of income. This implies that under conditions where $(C_i + I_i) > 0$ and stability obtains, fiscal policy may be a superior tool for pursuing domestic full employment [3, 1176][2].

This note extends the policy implications of *Cebula's* model. Specifically, it is demonstrated that explicit consideration of the stability conditions of his system leads to the conclusion that fiscal policy works with greater speed the more the interest sensitive is the demand for money (the flatter is the *LM* curve). Moreover, it is also shown that within the context of a *Cebula*-type model there may be little scope for monetary policy at all if such policy is understood to refer to exogenous changes in the nominal money stock. The best the monetary authorities may be able to do in such a model is to peg the level of interest rates. These results are contrasted with the policy implications of previous work on the positively-sloped *IS* curve as formalized by *Silber* and by *Burrows*.

## II. The Upward Sloping I-S Curve: Two Approaches

Following *Cebula,* a closed Hicksian model is assumed. The respective commodity market and money market equilibrium conditions are:

$$Y = C(Y, i) + I(Y, i) + Go \tag{1}$$

$$Mo = L(Y, i) \tag{2}$$

where $Y$ = income, $I$ = investment, $C$ = consumption, $i$ = the rate of interest, $Mo$ = the money supply, $L$ = the demand for money. Differentiating these two equations gives:

$$dY = C_y dY + C_i di + I_y dY + I_i di + dGo \tag{3}$$

$$dMo = L_y dY + L_i di. \tag{4}$$

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[2] $C_i$ and $I_i$ are the respective partial derivatives of consumption and investment with respect to the rate of interest.

Conventional practice imposes the following restrictions on the system:

$$1 > C_y > 0 \ , \quad 1 > I_y > 0 \ , \quad L_y > 0 \ , \quad L_i < 0 \ . \tag{5}$$

The respective slopes of the *LM* and *IS* curves are:

$$\left.\frac{di}{dY}\right|_{LM} = \frac{-L_y}{L_i} > 0 \tag{6}$$

$$\left.\frac{d_i}{dY}\right|_{IS} = \frac{1 - C_y - I_y}{I_i + C_i} \gtrless 0 \ . \tag{7}$$

The slope of the *LM* curve is unambiguously positive. The sign of the slope of the *IS* curve is not so clear. It is usually assumed to be negative, but it may be positive in two cases:

*Case 1* (*Silber-Burrows*): The marginal propensity to spend with respect to income ($C_y + I_y$) is greater than unity, causing the numerator in (7) to be negative. The interest responsiveness of both investment ($I_i$) and consumption ($C_i$) are assumed to be negative, in accordance with standard practice.

*Case 2* (*Cebula*): The marginal propensity to spend out of income is less than one, which gives the usual positive numerator in (7). However, the interest responsiveness of both consumption and investment are assumed to be positive, allowing the denominator in (7) to be positive as well.

*Cebula* has shown that the fiscal and monetary multipliers in his model are:

$$\frac{dY}{dGo} = \frac{Li}{(1 - C_y - I_y) L_i + (C_i + I_i) L_y} \tag{8}$$

$$\frac{dY}{dMo} = \frac{C_i + I_i}{(1 - C_y - I_y) L_i + (C_i + I_i) L_y} \ . \tag{9}$$

The numerator in (8) is negative while the numerator in (9) is assumed to be positive. The denominators are both the same — hence the qualitative impacts of fiscal and monetary policies act in opposite directions. *Cebula* derives the *Routh-Hurwitz* condition for his model which imposes the following restrictions if stability is to obtain:

$$(1 - C_y - I_y) > 0 \tag{10}$$

$$| L_i (1 - C_y - I_y) | > | L_y (C_i + I_i) | \ . \tag{11}$$

If these are satisfied, the denominators in (8) and (9) will be negative. As a result, expansionary fiscal policy will cause income to expand while monetary ease causes income to contract.

The stability condition of *Cebula*'s model may be alternatively derived in a manner which allows for consideration of the *timing* aspect of policy. Thus, assume that the time derivative of Y is a function of the excess demand in the commodity market and that the monetary sector adjusts instantaneously[3] to external shocks so that the *LM* equation is always satisfied during the process of adjustment from one equilibrium to another:

$$\frac{dY}{dt} = I(Y, i) + C(Y, i) - Y \tag{12}$$

$$0 = L(Y, i) - Mo\,. \tag{13}$$

Equations (12) and (13) are a pair of nonlinear differential equations. Using *Taylor*'s theorem, the system can be put into linear and homogeneous form by defining the variables as deviations from their equilibrium values and by taking linear approximations in the neighborhood of equilibrium. Such a procedure can be shown to yield a single characteristic root for the entire system as follows:

$$K = (I_y + C_y - 1) - \frac{L_y}{L_i}(I_i + C_i)\,, \tag{14}$$

where $K$ is the characteristic root. Stability requires that the system approach equilibrium following an exogenous shock. Deviations from equilibrium can be shown to be in the general form $Ae^{kt}$, where $A$ = a constant, $K$ = the characteristic root, and $t$ = time. Hence stability requires that the characteristic root, (14), be negative so that $Ae^{kt}$ can approach zero with the passage of time.

In *Cebula*'s model (Case 2), $I_y + C_y - 1$ is taken to be negative, and $I_i + C_i$ is assumed positive. The characteristic root is negative, therefore, if

$$|I_y + C_y - 1| > \left|\frac{-L_y}{L_i}(I_i + C_i)\right| \tag{15}$$

which is equivalent to the *Routh-Hurwitz* condition derived by *Cebula* in (11). On the other hand, the *Silber-Burrows* model (Case 2) has been shown to assume that $I_y + C_y - 1$ is positive and that $I_i + C_i$ is negative. Thus, in this case the characteristic root is negative if

[3] This is the usual assumption made in the literature. In this context, see *Dernburg* and *McDougall* [4] and *Teigen* [9]. It should be noted that this assumption does not affect the stability conditions of the system in any way, but it does facilitate graphical presentation.

$$\left| \frac{-L_y}{L_i} (I_i + C_i) \right| > \left| I_y + C_y - 1 \right| . \tag{16}$$

Alternatively, the respective stability conditions for the two models can be illustrated via graphical analysis. The stability condition (15) of a *Cebula* system necessitates that the (positive) slope of the *IS* curve exceeds the slope of the *LM* curve. The *Silber-Burrows* condition (16), however, can be shown to require that the (positive) slope of the *IS* curve is less than the slope of the *LM* curve.

Consider Figure 1 which illustrates a *Silber-Burrows* world. Assuming instantaneous money-market adjustment, an increase in the money stock which causes a rightward shift in the *LM* curve from $LM_0$ to $LM_1$ results in a movement from point *A* to point *B*. By assumption the money market is in equilibrium, but at the new (lower) interest rate, investment exceeds savings and income must rise. In order for the system to approach point *C*, it is necessary that the interest rate which maintains money market equilibrium must rise faster than the interest rate which maintains equilibrium in the commodity market. This is tantamount to requiring that the slope of the *LM* curve exceeds that of the *IS* curve, and if so, the system moves up along $LM_1$ until $Y_1$ is reached.

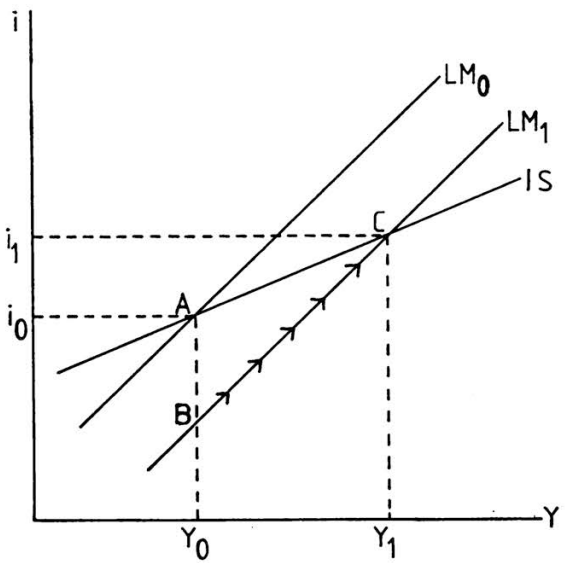


*Figure 1*

Monetary policy, therefore, has its usual impact on income. A *Cebula*-type world is shown in Figure 2. A rightward shift in the *LM* curve from $LM_0$ to $LM_1$ again entails instantaneous money market equilibrium and thus a movement from point *A* to point *B*. At point *B*, however, both consumption and investment fall because the interest rate is lower. Accordingly, there is an excess of saving over investment and income must fall. The new equilibrium — point *C* — is reached if the rate of interest which maintains money-market equilibrium falls more slowly than the interest rate which maintains equilibrium in the product market. This is the same thing as saying that the slope of the *IS* curve must exceed that of the *LM* curve, and if so, the system moves downward along $LM_1$ until income level $Y_2$ is attained. Monetary policy has a perverse effect on the level of income.

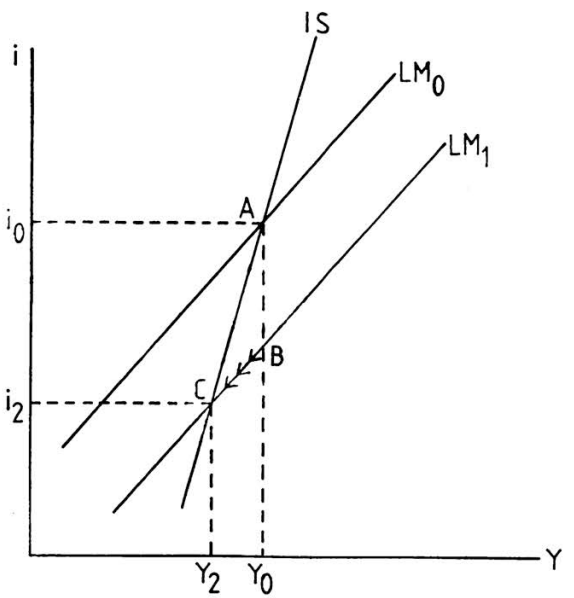


*Figure 2*

## III. Implications for Policy

The respective stability conditions (15) and (16) entail differing implications concerning how quickly the system reacts to changes in policy variables. This can be demonstrated by examining the consequences for both stability conditions — first as the interest elasticity of the

demand for money becomes infinite, and second, as that elasticity approaches zero. Thus, as $L_i$ approaches $-\infty$, the right-hand side of (15) approaches zero. Since $\left|\frac{-L_y}{L_i}(I_i + C_i)\right|$ in (15) is positive by the assumptions of *Cebula*'s model, as $L_i$ approaches $-\infty$ the (positive) right-hand side of (15) is swamped by the (negative) left-hand side and the characteristic root becomes more negative. Since stability requires that the characteristic root of the system (14) be negative, the more negative is the root the sooner the system reaches equilibrium following a shock. Accordingly, as the demand for money becomes more interest elastic (the *LM* curve becomes flatter) in a *Cebula*-type model, the system reacts with greater speed to policy changes. Correspondingly, as $L_i$ approaches zero (the demand for money becomes less interest elastic) in *Cebula*'s framework, the right-hand side of (15) becomes more positive and the characteristic root (14) becomes less negative (assuming that stability continues to hold). Thus, as the *LM* curve becomes more verticle, the system reacts more slowly following an exogenous shock[4].

The opposite occurs in a *Silber-Burrows* framework. As $L_i$ approaches $-\infty$ in (16) the left-hand side of (16) approaches zero. But the left-hand side of (16) must be negative for stability to obtain, and, therefore, as the absolute value, $\left|\frac{-L_y}{L_i}(I_i + C_i)\right|$, becomes smaller the system reacts with less speed to exogenous policy changes. Alternatively, the system reacts more quickly the less the interest elasticity of the demand for money (the more verticle the *LM* curve).

The foregoing analysis can be extended a step further. Thus it can be argued that a system with a wider stability range is better suited to withstand shocks. It has been demonstrated, however, that as $L_i$ approaches $-\infty$, $\left|\frac{-L_y}{L_i}(I_i + C_i)\right|$ approaches zero. In *Cebula*'s system the term $\frac{-L_y}{L_i}(I_i + C_i)$ is positive. Therefore as $L_i$ approaches $-\infty$, the characteristic root (14) approaches $K = I_y + C_y - 1$, which represents its most negative value, and the stability range of the *Cebula* system is widened. In contrast, for a *Silber-Burrows* system the stability range

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[4] Alternatively, $\frac{\partial K}{\partial L_i} = \frac{(I_i + C_i)\, L_y}{(L_i)^2} > 0$. Thus the lower the interest sensitivity of demand for mony the greater the value of $K$ and the longer it takes the system to reach equilibrium. Note that as $L_i$ becomes less interest elastic it is increasing in value from some given negative number to a number which is less negative.

in (16) is widened as the demand for money becomes less interest elastic (as $L_i$ approaches zero). In such a system, where $L_i$ to approach $-\infty$, the left-hand side of (16) would approach zero and the characteristic root (14) would approach $I_y + C_y - 1$, which is assumed to be positive. In such a case the system would be rendered unstable.

From the preceding discussion we can summarize the following two propositions concerning the effects of the interest elasticity of the demand for money in the event that the *IS* curve has a positive slope:

*Proposition 1:* If the *IS* curve slopes upward because all the propensities to spend with respect to income sum to more than unity *(Silber-Burrows)*, then the less the interest-sensitive is the demand for money, the sooner does the system react to exogenous policy shocks. In the event where the *IS* curve slopes upward due to a positive association of investment and consumption to the interest rate *(Cebula)*, the more interest elastic is the demand for money the faster the system reacts to exogenous shocks.

*Proposition 2:* In a *Silber-Burrows* framework, the stability range of the system reaches its maximum value as the interest elasticity of the demand for money approaches zero. In a *Cebula* framework, however, the system attains its maximum stability range as the interest elasticity of the demand for money approaches minus infinity.

These propositions entail important consequences for the role of monetary policy within the framework of a *Cebula*-type model. We first note that *Cebula* defines "monetary policy" as "exogenous changes in the nominal money stock" [3, 1175]. We also note that in his paper *Cebula* demonstrates that standard monetary policy has a perverse effect on income. What then becomes the role of monetary policy within his system?

*Poole* [7] has demonstrated that the monetary authorities can peg the interest rate at any particular level by adjusting the money supply so as to offset any changes which occur in the demand for money. Such as policy has the effect of making the money supply endogenous and causes the *LM* curve to become horizontal. *Poole* also shows that within the confines of a stochastic *IS-LM* model, a policy of pegging the interest rate becomes desirable only if the *LM* curve shifts (due to stochastic factors) more than the *IS* curve. But we have also demonstrated that a horizontal *LM* curve in *Cebula*'s non-stochastic framework: (a) allows the system to react with more speed to exogenous shocks: and, (b) maximizes the stability range. Hence, in *Cebula*'s non-stochastic upward-sloped *IS* curve framework, as in *Poole*'s stochastic model where the *LM* curve shifts more than the *IS* curve, the money supply process should

become endogenous allowing the *LM* curve to become horizontal. The level of income would, therefore, be manipulated entirely through fiscal policy. Furthermore, with the *LM* curve made horizontal in *Cebula*'s model fiscal policy actions would work with greater speed.

## References


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## Zusammenfassung


### Die Wirksamkeit der Wirtschaftspolitik in der Hickschen Analyse: Eine Vertiefung

Die Schnelligkeit, mit der die Makropolitik Einfluß auf die Konjunktur ausübt, ist eine Schlüsselbetrachtung in gegenwärtigen politischen Diskussionen. Bliner und Solow argumentieren: „Die Hauptstreitpunkte der (makro-)ökonomischen Debatte dürften bald überholt sein." (1, 88)

Diese vorliegende Studie betrachtet die politischen Konsequenzen von zwei ansteigenden IS-Kurven-Modellen, die in der Literatur diskutiert werden.

Insbesondere wird gezeigt, daß die Zinselastizität der Geldnachfrage — oder das Ansteigen der LM-Kurve — unterschiedliche Konsequenzen für den Zeitaspekt eines jeden Modells und auf die jeweilige Fähigkeit der Modelle, exogene Stöße zu absorbieren, zur Folge hat. Das empirische Beweismaterial vermittelt den Eindruck, daß in der Realität die IS-Kurve ansteigt; deswegen ist es wichtig, die zugrundeliegenden Mechanismen zu identifizieren.

Schließlich wird gezeigt, daß die Rolle der Geldpolitik in einem Modell vom „Cebula-Typ" darauf beschränkt ist, das Geldangebot auf eine Weise zu regulieren, die den Zinssatz auf einem bestimmten Niveau hält.

## Summary

**Economic Policy Effectiveness in Hicksian Analysis: An Extension**

The speed with which macro policies exert their impact upon economic activity is a key consideration in current policy discussion. As *Blinder* and *Solow* argue: "The main issues of [macro] econometric debate for the near future appear to be over timing" [1, 88]. This note has considered the policy implications of two upward-sloping *IS* curve models which have appeared in the literature. Specifically, it has been shown that the interest elasticity of the demand for money —or the slope of the *LM* curve — involves differing consequences for the timing aspect of each model and the respective ability of each model to absorb exogenous shocks. Therefore should empirical evidence suggest that in the real world the *IS* curve slopes upward, it is important to identify the underlying mechanism. Finally, it has also been demonstrated that in a *Cebula*-type model the role of monetary policy would be limited to adjusting the money supply in a manner which pegs the interest rate at a certain level.

## Résumé

**L'efficacité de la politique économique dans l'analyse de Hicks: un approfondissement**

La rapidité avec laquelle la macropolitique exerce son influence sur la conjoncture est une considération-clé du débat politique actuel. Bliner et Folow argumentent: "Les points litigieux majeurs du débat (macro)économétrique devraient être rapidement dépassés."

La présente étude examine les conséquences politiques de deux modèles de courbes IS ascendantes que discutent de nombreux auteurs.

L'on y expose en particulier que l'élasticité des taux de la demande monétaire — ou la hausse de la courbe LM — a pour résultat des répercussions différentes sur le facteur durée d'un modèle et sur la capacité des modèles d'absorber les chocs exogènes. Les preuves empiriques donnent l'impression

qu'en réalité la courbe IS est ascendante; c'est pourquoi il importe d'identifier les mécanismes qui ont servi de base.

Il est en conclusion démontré que le rôle de la politique monétaire dans un modèle de type "Cebula" se borne à régulariser l'offre de monnaie de telle manière que le taux d'intérêt se maintienne à un certain niveau.