Effective demand versus profit maximization in aggregate demand/supply analysis: a dynamic perspective [*]

AMIT BHADURI, KAZIMIERZ LASKI and MARTIN RIESE

1. Inconsistency in AD/AS analysis

Although the Keynesian framework assigned unambiguously a central role to aggregate demand for determining output, it was grafted onto the Marshallian microfoundations of profit maximization in the *General Theory* (Keynes 1936, p. 5). This has led to continuing debate, specifically because it could be interpreted to imply that higher output is achieved only through a reduction in the real wage rate to induce profit-maximizing firms to produce more. Such an interpretation gives prominence to the supply-side decisions by the firms, and tends to shift the focus away from the central role played by aggregate demand in the determination of output in the Keynesian scheme.

An interesting case, highlighting the problem, in this respect is the aggregate demand/aggregate supply (AD/AS) analysis. In many recent textbooks it is used to convey allegedly the basics of Keynesian analysis of aggregate demand in conjunction with the profit maximization postulate as characterizing the aggregate supply side (cf. Baumol and Blinder 1998, Mankiw 1998, Stiglitz 1997). It is now recognized widely that this construction suffers from logical inconsistency

□ Jawaharlal Nehru University, New Delhi (India) and Wiener Institut für Internationale Wirtschaftsvergleiche (WIIW), Wien (Austria);
   Johannes Kepler Universität, Linz (Austria) and Wiener Institut für Internationale Wirtschaftsvergleiche (WIIW), Wien (Austria);
   Johannes Kepler Universität, Linz (Austria).

(cf. e.g. Hall and Treadgold 1982; Rao 1991; Bhaduri, Laski and Riese 1994 and 1995; Colander 1995) which arises fundamentally from the fact that the assumption of profit maximization constraining firms through rising marginal costs on the 'supply side' is not easy to reconcile with the Keynesian postulate of output constrained by aggregate demand.[1] The inconsistency manifests itself in two different supply responses by the firms resulting from the two constraints. For instance, as suggested by textbook analysis, at any given price, firms follow the rule of maximizing profit by adjusting output along the AS curve. At the same time, however, they have to follow a different rule if they adjust output exclusively according to demand along the AD curve. This boils down to inconsistent responses yielding two different levels of supply by the firms at each out-of-equilibrium price (Bhaduri, Laski and Riese 1995; Colander 1995). Thus, under the usual assumption ensuring a falling AD and a rising AS curve with given money wage, at all prices except at the intersection point, a higher price and a lower real wage should induce firms to produce more along AS, according to the profit maximization rule; however, it should also induce them to produce less due to lower demand at higher price along AD. Only at the point where the AD and the AS curves intersect this contradiction is hidden: elsewhere it is apparent.

It might be interesting to digress and briefly speculate why such an inconsistency not only crept into the analysis, but proliferated through so many textbooks. At the more obvious level, the temptation must be strong to present the macroeconomy as just any normal market regulated through the price mechanism with a rising supply and a falling demand curve. This temptation might not be merely on account of the pedagogical simplicity of this construction. It also strengthens the comforting thought that the price mechanism works economy-wide in some rough and ready manner told by the textbook parable of AD/AS.

At a deeper analytical level, however, the inconsistency arises from a lack of appreciation as to the role the firms play in sustaining the circular flow of national income. Precisely because of the circular nature of this flow, the expenditure by firms on the wage bill accrues

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[1] For instance, the distinction between 'Classical' and 'Keynesian' unemployment drawn by Malinvaud (1977) depends on treating profit maximization or aggregate demand separately as the binding constraint. The distinction disappears if both the constraints are simultaneously binding, i.e. where AD and AS intersect.

as income to households. Consequently, households consume more out of their higher income through the consumption function to drive the multiplier mechanism, only when the firms offer more employment to generate higher income for the households. As a result the supply response of the firms enters in an essential manner in generating the demand for goods by the households to drive the multiplier mechanism.[2] Since the construction of the AD curve entails this multiplier mechanism, it is a mistake to argue that at any given level of investment, the AD curve concerns exclusively the 'consumers' or households, but not the firms as 'suppliers', which appear only through the AS curve. The dichotomy between demand and supply, typical of partial equilibrium analysis, breaks down in the case of the circular flow in the macroeconomy, because the income the households receive depends on how much firms decide to supply.[3]

The recognition of this logical inconsistency of the conventional AD/AS analysis has attracted considerable attention (cf. *inter alia* Hall and Treadgold 1982, Rabin and Birch 1982, Fields and Hart 1990, Perry 1991, Rao 1991, Allen and Stone 1993, Dalziel 1993, Colander 1995 and 1997). It is not the aim of the present paper to discuss this literature in any detail; instead, in the rest of the paper we begin by analysing one prominent line of reasoning followed by several authors (Fields and Hart 1990, Colander 1995), viz. to abandon the conventional AD curve altogether and replace it by a construct which seeks to remedy the inconsistency. As we will show, this is achieved by assigning the central role to profit maximization on the supply side, while the role of effective demand in output determination is pushed to the background. Moreover, by studying the dynamic implications of this approach, and contrasting it to an alternative dynamic interpretation which we believe to be more in line with original Keynesian ideas, we are able to highlight the contrasting roles assigned to the real wage rate in the alternative interpretation of the

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[2] In other words, except for the initial impulse of a higher level of investment, all the successive rounds of the multiplier in the convergent geometric series are driven by higher expenditure out of higher incomes received by the households as wage, and by the firms as profits. Consequently, at each round of demand expansion it is being assumed that the firms are responding simply to that higher demand, without assigning any clear role to profit maximization.

[3] The idea that AD/AS is just a scaled-up version of partial equilibrium demand and supply analysis is most transparent in the exposition of Baumol and Blinder (1998, pp. 519-20).

output and employment determination through the dynamic interaction between effective demand and profit maximization.

2. Alternative dynamics of adjustment in output and price

A group of authors mentioned above (Fields and Hart 1990, Colander 1995) propose a construct which shows the level of demand that would result at each price due to profit maximization by the firms. This could conveniently be called the 'derived aggregate demand' (DAD) curve, which emphasizes that aggregate demand is derived entirely from profit-maximizing output at each price (Bhaduri, Laski and Riese 1994). With a relatively weak Pigou or real-balance effect this curve will be positively sloped, because it is derived from the profit-maximizing (positively sloped) AS curve in the (Y, P) plane, but steeper than the AS curve.[4] Figure 1 uses this device, where the

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[4] While the details of this geometric construction in an elementary textbook fashion are given in Bhaduri, Laski and Riese (1994 and 1995), the main reasoning can be restated briefly. In a closed economy without a government sector, the DAD curve is defined as:

$$Y_{dad}(P) = \bar{I} + \tilde{C}(P) + cY_s(P) \tag{A}$$

with $\bar{I}$ autonomous given real investment. Consumption in this formulation consists of two parts:
  — one proportional (with $0<c<1$) to $Y_s(P)$, which is the output that maximizes profit at price level P for any given nominal wage rate;
  — the other part of consumption is related negatively to price via the Pigou effect.
  So long as the real-balance effect is relatively weak, Y_{dad} can be seen to be positively sloped and less responsive than Y_s to variations in the price level. From (A)

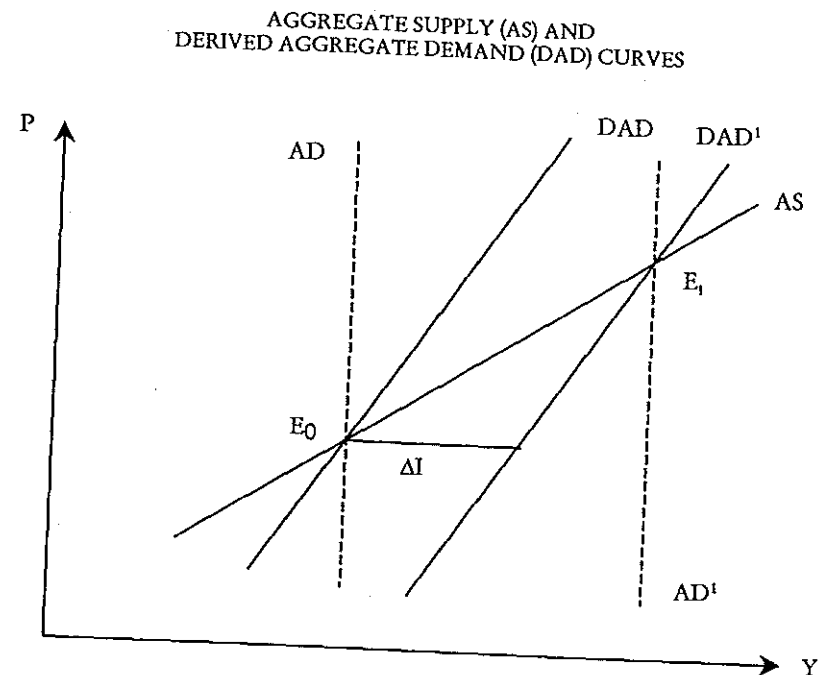$$\frac{dY_{dad}}{dP} = \frac{d\tilde{C}(P)}{dP} + c\frac{dY_s}{dP} \tag{B}$$

so that $d\tilde{C}(P)/dP$ as a relatively small (negative) term is dominated by the positive term $c(dY_s/dP)$ to make the derivative positive, while $0<c<1$ ensures

$$\frac{dY_s}{dP} > \frac{dY_{dad}}{dP} > 0$$

or equivalently in terms of the customarily used inverse functions:

$$\frac{dP}{dY_{dad}} > \frac{dP}{dY_s} > 0.$$

FIGURE 1

AGGREGATE SUPPLY (AS) AND
DERIVED AGGREGATE DEMAND (DAD) CURVES

profit-maximizing AS curve is coupled with a 'derived aggregate demand' (DAD) curve. If the original equilibrium E_0 is disturbed by, say, an increase in investment ΔI, the DAD curve is shifted to DAD^1 by exactly the same amount. In its dynamic interpretation the resulting gap between investment and savings would drive prices up, inducing profit-maximizing firms to produce more, while the process of price adjustment would continue until the narrowing investment-savings gap is eliminated at the new equilibrium E_1. The adjustment described here heuristically resembles only superficially the rounds of the multiplier process. In contrast to the original Kahn-Keynes multiplier where quantity adjustment is driven directly by excess demand, the process here is driven by profit-maximizing supply responses of the firms which adjust output to the changing real wage, arising from a constant money wage rate coupled with the level of price changing according to excess demand.[5]

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[5] See also footnote 2. Since the changing price level affects output adjustment by changing the real wage rate, the argument is considerably simplified by assuming a

The formal dynamics of this process of adjustment, in accordance with the DAD model outlined above, in which output and employment are driven by profit maximization at variable real wage and the price level is driven by excess demand for goods at constant money wage, can be represented as:

$$X = f(L) \qquad\qquad f' > 0, f'' < 0 \qquad (1)$$

$$\frac{dL}{dt} = a[pf'(L) - \bar{w}] \qquad a > 0 \qquad (2)$$

$$\frac{dp}{dt} = bp[I - sf(L)], \qquad 1 > s > 0, b > 0 \qquad (3)$$

where equation (1) represents the production function in the short period, with capital stock given, and output (X) is a function of employment (L) only, with the usual properties. Equation (2) shows how employment is driven by profit maximization, with p as the price level, $w = \bar{w}$ the given money wage rate and a some arbitrary positive constant speed of adjustment. Equation (3) describes how price responds to excess demand for goods created by a discrepancy between investment (I) and saving, sf (L), where s is the constant average (and marginal) propensity to save, and b is some arbitrary positive constant speed of adjustment.[6] Assuming a non-trivial equilibrium – i.e., $L^* \neq 0$, $p^* \neq 0$ – to exist for this system (1) to (3), it can be shown by routine calculation that the equilibrium is locally stable (see Appendix, section 1).

In contrast to the above system, we believe that a more faithful interpretation of the Keynesian system requires excess demand to play a direct role in driving output, i.e.

$$\frac{dX}{dt} = f'(L)\frac{dL}{dt} = \alpha[I - sf(L)], \qquad \alpha > 0 \qquad (4)$$

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constant money wage rate, following most textbook expositions. However, this assumption is not strictly necessary, and section 3 of the appendix shows how the relative adjustment between a variable money wage rate and the price level affects the argument through 'money illusion' or 'unanticipated inflation'.

[6] Whereas the DAD framework views the investment-savings gap to influence price via a Walrasian adjustment mechanism, it does not make a fundamental difference if this influence is modelled along Marshallian lines as in Dutt (1997). Thus, firms may decide upon output by maximizing profit under the assumption that an *expected* price prevails. If the produced output cannot be sold at this expected price, price adjusts and this new price governs price expectations for the next period.

This alternative interpretation leaves no room for a DAD-type construction. However, the profit maximization condition may be satisfied in this competitive system by price adjusting to equate marginal cost to marginal (and average) revenue, i.e.

$$\frac{dp}{dt} = \beta\left[\frac{\bar{w}}{f'(L)} - p\right], \qquad \beta > 0 \qquad (5)$$

Again, assuming a non-trivial equilibrium to exist for the system (1), (4) and (5), routine calculation shows this equilibrium to be also locally stable (see Appendix, section 2).

Although the assumption of profit maximization is maintained in both systems depicted by equations (1), (2) and (3), and alternatively by equations (1), (4) and (5), it implies very different economic causation in the two systems. In the neoclassical interpretation of Keynes, encapsulated in equations (1) to (3), profit maximization drives output adjustment (equation 2) through a reduction in the real wage rate which is assigned the role of causal variable. In contrast, in the alternative system, profit maximization is ensured through price adjustment in (5) by covering marginal cost, which increases due to decreasing returns to labour as output rises in response to higher effective demand for goods in equation (4). In this sense, in the alternative Keynesian system of equations (1), (4) and (5), variation in the real wage is not a cause, but the consequence of output adjustment, despite the condition of profit maximization being satisfied.

That the adjustment in the real wage rate emerges not as the cause, but as the *consequence* of output adjustment is of central importance for understanding and applying Keynesian theory.[7] The point can be highlighted further by considering other rules of price adjustment which would all share the common characteristic as being broadly 'cost-determined' (Kalecki 1971), but leave room for output to be determined directly by aggregate demand. These rules may or may not entail *precise* profit maximization; instead, some may look upon profit seeking as a 'satisficing' behaviour consistent with 'bounded rationality' (Simon 1979, Conlisk 1996). The essential point of the alternative Keynesian system is

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[7] It may be recalled that in his debate with Pigou, Keynes repeatedly emphasized this distinction. Moreover, when faced with empirical data which did not show any systematic negative relation between the real wage rate and the level of economic activity, Keynes emphasized again the unimportance of the real wage rate as a causal factor for his theory of output determination through aggregate demand.

that all such rules of cost-based price adjustment, with or without precise profit maximization, have to be compatible with, but secondary to the more fundamental principle of output determined by aggregate demand (e.g. in equation 4). Thus, instead of equation (5), the adjustment in price may be postulated to either cover average variable cost with a constant mark-up m on it (equation 5a), or maintain a fixed proportional mark-up on marginal cost (equation 5b).

$$\frac{dp}{dt} = \beta \left[\frac{(1+m)\,\bar{w}\,L}{f(L)} - p \right], \qquad \beta > 0 \qquad (5a)$$

$$\frac{dp}{dt} = \beta \left[\frac{(1+m)\,\bar{w}}{f'(L)} - p \right], \qquad \beta > 0 \qquad (5b)$$

Again, routine calculations would show that equations (1) and (4) combined with either (5a) or (5b) yield locally stable equilibria, provided such equilibria exist (see Appendix, section 2).

3. Implications of the analysis

A discussion focussing on the logical inconsistency that arises in the elementary textbook construction of the aggregate demand/supply (AD/AS) analysis also provided us with a convenient basis to demonstrate how the assumption of profit maximization is used in the 'modern' neoclassical interpretation of Keynesian economics to underplay the role of aggregate demand in determining the level of output. If the assumption of profit maximization is to be used as the driving mechanism behind output adjustment (e.g. equation 2), excess demand in the commodity market, caused by investment-savings disequilibrium, has to affect the price level (equation 3), which in turn affects output only indirectly through profit maximization. The consequences of setting the Keynesian analysis in this particular dynamic mode are twofold. First, it leaves little room for aggregate demand to influence output, except indirectly through changing the price signal (given money wage) received by the firms. Second, it makes real wage rate the causal variable in the adjustment of employment and output.[8]

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[8] Thus, in this (DAD) framework, if we consider an arbitrary increase in aggregate demand *without* any change in the price-money configuration (i.e. given the real

To make room for output to be influenced *directly* by aggregate demand (equation 4), which we believe to be the central feature of Keynesian analysis, firms may be viewed as responding to various non-price signals like changes in the reported inventory levels or longer order books through adjustment in output. This implies moving away from a framework in which variations of the price level provide the sole signal for adjustment in output. However, it can still be reconciled with a profit-maximizing equilibrium if an increase in aggregate demand makes not only individual firms' expected demand rise, but also induces them to produce more to capture this larger market. The effects that individual firms' decisions have collectively on the price level and on the real wage rate depend on the assumptions about the short period returns and the market forms. Under the assumption made both by Keynes in the *General Theory* and in standard neoclassical analysis, decreasing returns to labour in the short period (see equation 1), coupled with competitive market conditions (see equations 2 or 5), would necessarily entail higher marginal cost and price at a higher level of output, and in consequence a lower real wage rate. However, unlike in standard neoclassical theory, neither constant marginal cost nor even increasing returns seem incompatible with the Keynesian theory of demand-determined output, once the assumption of *precise* profit maximization is dispensed with. This also implies that the real wage is no longer the causal variable driving output, but an outcome of the adjustment in the price level in relation to marginal cost. This is almost certainly the causation Keynes himself had in mind in the *General Theory*.[9] And, it comes out more sharply in Kalecki's formulation of the theory of effective demand (Kalecki 1971), in which marginal cost remains constant for any given money wage rate over the relevant range, and price is set as a constant proportional mark-up on that constant marginal cost. Thus, any proportional change in price, associated with a corresponding proportional change in the money wage rate (and *vice versa*), leaves the real wage rate unaffected. In this starkest formulation of the principle of aggre-

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wage rate), firms would have no incentive in terms of profits to move from their initial profit-maximizing equilibrium. The neoclassical story of adjustment in output can only be told through a change in the price level in relation to the money wage rate.

[9] On this point, Keynes (1936, p. 270) writes, "the price level will only change in the short period to the extent that changes in the volume of employment affect marginal prime cost".

gate demand, the real wage rate, being a constant, plays no role in determining output, and precise profit maximization is dispensed with.[10] However at a constant profit margin total profit increases with higher output produced in response to higher aggregate demand, which may be signalled by inventory change or longer order books.

It must be insisted that the difference between the dynamic perspectives implied in the two contrasting models (equations 1, 2 and 3 versus equations 1, 4 and 5) is not merely or even primarily a matter of the correct textual interpretation of the Keynesian theory. Its ramifications are wider, and permeate through several controversial areas of modern macroeconomics. To take only one important instance, all recent monetarist reinterpretations of the Phillips curve in its earlier or later versions (Friedman 1968, Phelps 1970, Tobin 1972, Barro 1993, Lucas 1981) accept the real wage rate as the causal variable determining the level of employment.[11] These reinterpretations and economic explanations may become open to question if the real wage rate is treated as the consequence, but not the cause of movements in output as suggested by the alternative Keynesian dynamic perspective advocated in this paper.

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[10] With constant marginal (and average) labour productivity, $f'(L) = k > 0$ some arbitrary constant, equation (5b) becomes

$$\frac{dp}{dt} = \beta\left[\frac{(1+m)\,\bar{w}}{k} - p\right].$$

Consequently, an initial equilibrium price level p^* is also defined entirely with respect to the given money wage rate, $\bar{w}$, at constant mark-up m, i.e.

$$p^* = \frac{(1+m)\,\bar{w}}{k}, \text{ for } dp/dt = 0.$$

The implied real wage, $\dfrac{\bar{w}}{p^*} = \dfrac{k}{(1+m)}$, remains constant, so long as the mark-up m is constant, although price and money wage may change by the same percentage.

[11] In the earlier monetarist version, it is the real wage rate perceived by the firms that governs output adjustment through profit maximization, more or less in the manner described in this paper. In the later monetarist version, it is the real wage rate perceived by the households that determines their labour supply decisions, blurring the distinction between 'voluntary' and 'involuntary' unemployment.

APPENDIX

Section 1

Assuming an equilibrium to exist at (L^*, p^*), the Jacobian of partial derivatives of the system (1) to (3), evaluated at equilibrium, yields

$$J_{1,2,3} = \begin{bmatrix} apf'' & af' \\ -bpsf' & 0 \end{bmatrix}$$

which has trace

$$T = apf'' < 0 \qquad (1.1)$$

and determinant

$$D = abps(f')^2 > 0 \qquad (1.2)$$

Hence, the system is locally stable.

Section 2

Again, assuming an equilibrium to exist at (L^*, p^*), and evaluating at equilibrium the Jacobian of partial derivatives of the system (1), (4) and (5), we have

$$J_{1,2,3} = \begin{bmatrix} -\alpha s & 0 \\ -\dfrac{\beta\bar{w}f''}{(f')^2} & -\beta \end{bmatrix}$$

with trace

$$T = -(\alpha s + \beta) < 0 \qquad (2.1)$$

and determinant

$$D = \alpha\beta s > 0 \qquad (2.2)$$

Hence, the system is locally stable. It can be checked by similar routine calculation that, although the relevant Jacobian is slightly different for the systems (1), (4), (5a), and (1), (4), (5b), they have exactly the same trace and determinant as (2.1) and (2.2) guaranteeing local stability.

Section 3

Finally, it should be noted that all the relevant Jacobians in the text are calculated on the assumption of a constant money wage rate, $w = \bar{w}$. If this assumption is relaxed to permit feedback from price to money wage, the local stability conditions would be modified accordingly. For instance, so long as 'money illusion' or 'unanticipated inflation' operates as a mechanism depressing the real wage rate, the system would be stable. Formally, on simple manipulations, the Jacobian matrix of the system (1) to (3), evaluated at equilibrium, would yield

FIELDS, T.W. and W.R. HART (1990), "Some pitfalls in the conventional treatment of aggregate demand", *Southern Economic Journal*, vol. 56, no. 3, January, pp. 676-85.

FRIEDMAN, M. (1968), "The role of monetary policy", *American Economic Review*, vol. 58, no. 1, pp. 1-17.

HALL, P.H. and M.L. TREADGOLD (1982), "Aggregate demand curves: a guide to use and abuse", *Australian Economic Papers*, vol. 21, June, pp. 37-48.

KALECKI, M. (1971), *Selected Essays on the Dynamics of the Capitalist Economy*, Cambridge University Press, Cambridge.

KEYNES, J.M. (1936), *The General Theory of Employment, Interest and Money*, vol. VII of *Collected Writings of John Maynard Keynes*, ed. Royal Economic Society, 1973.

LUCAS, R. (1981), *Studies in Business Cycle Theory*, MIT Press, Cambridge, Mass.

MALINVAUD, E. (1977), *The Theory of Unemployment Reconsidered*, Basil Blackwell, Oxford.

MANKIW, M.G. (1998), *Economics: Principles and Policy*, 1st edition, The Dryden Press, Hinsdale, Ill.

PERRY, L.J. (1991), "A comment on aggregate demand", *Australian Economic Papers*, vol. 30, December, pp. 278-86.

PHELPS, E. (1970), "The new macroeconomics in employment and inflation theory", in E. Phelps ed., *Microeconomic Foundations of Employment and Inflation Theory*, Norton, New York.

RABIN, A. and D. BIRCH (1982), "A clarification of the IS curve and the aggregate demand curve", *Journal of Macroeconomics*, vol. 4, pp. 233-38.

RAO, B.B. (1991), "What is the matter with aggregate demand and aggregate supply?", *Australian Economic Papers*, vol. 30, December.

SIMON, H.A. (1979), "Rational decision making in business organizations", *American Economic Review*, vol. 69, pp. 493-513.

STIGLITZ, J.E. (1997), *Economics*, 2nd edition, W.W. Norton, New York.

TOBIN, J. (1972), "Inflation and unemployment", *American Economic Review*, vol. 62, no. 1, pp. 1-18.