Keynes's *Treatise*: Aggregate Price Theory for Modern Analysis?*

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ABSTRACT

The paper explores the theory of the aggregate price, profit, and business fluctuations in Keynes's *Treatise* for its implications for modern macroeconomic analysis. As in the *Treatise*, profits are first defined within a theory of the aggregate price level, as aggregate investment minus saving. Deriving aggregate total revenue and aggregate total cost from this price theory, the paper shows how to construct a version of the Keynesian cross diagram. The cross construction suggests an important qualification for fiscal policy, that total cost does not shift. Then, using a neoclassical definition of profit and the total-cost/total-revenue approach, the paper derives aggregate supply, and then adds aggregate demand in an integrated framework. Comparative statics of the AS-AD analysis and the central role of profit in the *Treatise* suggest that a focus on profit might be useful in identifying exogenous technology shocks of real business cycle theory.

Keywords: price, revenue, cost, cross, profit, AS-AD, cycles

JEL: E12, E13, B2, A22.

1. The Treatise's theory of the aggregate price

Keynes's (1930) *Treatise on Money* contains an interesting although flawed theory of the aggregate price. The flaw, relative to neoclassical theory, is its definition of profit. By showing the implications of the theory, both with and without the flaw, the analysis suggests a qualification to fiscal policy results, a clarification of AS-AD analysis, and a possible direction for current aggregate analysis. This gives a modern resonance for Keynes's price theory.

Keynes (1930) begins his *Treatise's* analysis of the aggregate price level with Fisher's (1911) quantity theory. Use of this theory found precedence in Keynes's (1923) *Tract on Monetary Reform.* There he recommends a policy of price stability on the basis of the quantity theory, whereby anticipated velocity movements are offset by changes in money supply growth rates. However, as a theory of the aggregate price level, Keynes in the *Treastise* expresses dissatisfaction with the quantity theory[1]. He proceeds explicitly to replace its determination of the price with a Marshallian cost-of-production approach. This approach can also be thought of as a real, cost-based, rather than a nominal, money-based, approach. Keynes develops and rationalizes this theory in a dynamic context, linking fluctuations in the aggregate price level to the fluctuations in the aggregate business cycle. The main "propagation mechanism", to borrow a real business cycle term that originates with Ragner Frisch, is changes in the exogenous, "windfall" profit residual.

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1. "The fundamental problem of monetary theory is not merely to establish identities or statical equations relating (e.g.) the turnover of monetary instruments to the turnover of things traded for money. The real task of such a theory is to treat the problem dynamically, analysing the different elements involved, in such a manner as to exhibit the causal process by which the price level is determined, and the method of transition from one position of equilibrium to another. The forms of the quantity theory, however, on which we have all been brought up- I shall give an account of them in detail in chapter 14- are but ill adapted for this purpose. … they do not , any of them, have the advantage of separating out those factors through which, in a modern economic system, the causal process actually operates during a period of change" (Keynes, 1930, vol.1, p.133). Or as Patinkin 1976, p.18) put it "In the *Treatise* … he continued to maintain the quantity theory in a macroeconomic (though not microeconomic) context, but critized it as being restricted in its validity to comparative-statics analysis; accordingly Keynes considered its supplementation by an appropriate dynamic analysis to be one of his major objectives in the book."

The *Treatise* posits that the aggregate price of output is the average cost of aggregate output plus the average aggregate "windfall" profit. This can be viewed as an aggregation based on the Marshallian theory of the firm.[2] And in fact, besides applying it to the aggregate, the only *prima facie* difference in the *Treatise*'s price theory from standard neoclassical price theory is the definition of profit. This definition follows an involved discussion of profit in the *Treatise*, that is defended against critics in the *General Theory*.[3] In particular, aggregate "windfall" profits are defined to equal aggregate investment minus savings, and per unit "windfall" profit is the aggregate profit normalized by output.[4] Within this definition, Keynes's concept of windfall profit might be viewed as the amount of earnings above the competitive return to capital. Keynes sometimes drops the term "windfall" and uses just the term "profit", and this convention will be used in this paper (with further discussion of profit below in Section 6).[5]

Consistent with the price theory Keynes defines long- run equilibrium and how departures from it describe business cycle fluctuations. In long-run equilibrium, profit is zero when investment equals savings. In the short run, when investment demand exceeds savings supply profit is positive and so output expands. When savings supply exceeds investment demand profit is negative and so output contracts.[6] This theory is developed as a business

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2. Contemporaneously Marshall (1920, pp.264-265) also could be said to have ventured towards aggregate analysis on the basis of the theory of the firm with his discussion of the representative, or average, firm: "We shall have to analyse carefully the normal cost of producing a commodity, relatively to a given aggregate volume of production; and for this purpose we shall have to study *the expenses of a representative producer* for that aggregate volume" (italics in original).

3. Keynes (1936, pp. 77-81).

4. "profits (Q) are … $Q = I - S$ so that entrepreneurs make a profit or a loss according as the money value of current investment exceeds or falls short of current savings" (Keynes, 1930, vol. 1, p.151); "the reader will appreciate that the condition of zero profits means that *aggregate* profits are zero" (italics in original, Keynes, 1930, vol.1, p152).

5 "It has been suggested to me… that it might be better to employ *Windfalls* for what I call here *Profits*. It may help some readers mentally to substitute this term; but for my own part I prefer the term *Profits* as carrying with it on the whole the most helpful penumbra of suggestion" (Keynes, 1930, vol.1, p.125).

6. "If producers as a whole are making a profit, individual producers will seek to enlarge their output so as to

cycle description that is consistent with the *Treatise*'s theory of the aggregate price.[7]

Formally the *Treatise*'s price theory can be stated as the following. With *P* denoting the

aggregate price level, *y* denoting real aggregate output, *I* denoting nominal aggregate

investment, *S* denoting nominal aggregate savings, and *AC* denoting the average cost of

aggregate output,

(1) $$P = AC + [(I - S) / y].\,[8]$$

At the long run equilibrium, *P=AC*. During departures from this, there is a mark-up from

positive profit with *I>S*, and a mark-down from negative profit with *I<S*, giving a procyclic

aggregate price. Thus the Marshallian, market-clearing, scarcity rent from demand in the

short run here takes the form of investment in excess of savings.[9]

The next section shows that the *Treatise'*s price theory forms a basis for one way to

construct and interpret the so-called "Keynesian cross". Standard fiscal policy results within

the cross reconstruction, as developed in Section 3, require the assumption that the total cost

schedule does not shift when total revenue does shift. Then the paper replaces the *Treatise*'s

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make more profit…by employing more of the factors of production…Thus we may conclude that, as a rule, the existence of profit will provide a tendency toward a higher rate of employment and of remuneration for the factors of production; and *vice versa*". (italics in original, Keynes, 1930, vol.2, p.163). See also Keynes (1930, vol.1, pp.136-165).

7. Patinkin (1976) and Dimand (1988) both criticize the *Treatise* for not going further in bringing out its theory of output and employment, which they argue the *General Theory* remedies.

8. In the book III, *The Fundamental Equations,* Keynes (1930, vol.1, pp.136-138) describes the equation $\Pi=(E/O)+[(I-S)/O]$, where Π is "the price level of output as a whole", O is "the total output of goods" E is the "earnings of the community" or the factors of production, E/O is "rate of earnings of the factors of production", and (I-S)/O is "the rate of profits per unit of output". Note that O is real output rather than nominal output as Keynes (p.135) also uses it in the Fisher (1911) equation that he writes as "$PO=M_1V_1$." Meltzer (1988, pp.63-64) also interprets this equation of Keynes, stating that "The point of the fundamental equations is to show that when prices differ from costs of production, investment and saving differ.…The deviation of prices from long-run equilibrium is equal to the difference between investment *I* and saving *S* per unit of real product." However Patinkin (1976; pp.45-46) also notes how Keynes views his price theory as reducing to Fisher's (1911) quantity theory when I=S; this requires that total costs equal M_1V_1, which can conceivably hold with a constant returns to scale production function within a cash-in-advance economy, but with zero profits at all time.

9 A modern version of this scarcity rent can be found in Topel and Rosen (1988) in which the price of housing services equals the long run marginal cost plus a short run factor due to costly adjustment of the stock of housing.

definition of profit with the Marshallian definition in Section 4 and again it is necessary to assume no total cost shift in order to get standard fiscal policy results. The Marshallian version is consistent with the representative agent, neoclassical, theory of aggregate supply and demand that underlies modern real business cycle theory, as shown in Section 5. In turn this suggests that the role of profit in the *Treatise* may be a valuable way to analyze cyclic shocks to productivity, as discussed in Section 6. The last section 7 qualifies the conclusions and speculates in a *Treatise* motivated way about identifying shocks to business cycles.

2.   *Construction of a Keynesian Cross*

Darity and Young (1995) discuss generations of the Keynesian 45 degree diagram, with the name "Keynesian cross" attributed to Fusfeld (1985). A version of the cross, perhaps most similar to Bishop (1948)[10], can be constructed from equation (1) in combination with other assumptions. Consider simply multiplying the price equation through by real output y. The product of the price of output and the quantity of real output is an aggregate version of total revenues (*TR*), or nominal output, and equation (1) gives this as

(1')
$$TR \equiv Py = (AC)y + (I - S).$$

Now consider adding an accounting proposition in which the total firm revenues Py, or "proceeds", are defined as equal to nominal consumption C plus investment: [11]

(2)
$$TR \equiv Py = C + I.$$

Equations (1') and (2) imply that $C+I=Py=(AC)y+I-S$. Solving for total costs (*TC*),

(3)
$$TC \equiv (AC)y = C + S.$$

In sum, assuming that aggregate total revenues (*TR*) are given as in equation (2), and

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10. I thank anonymous referees for pointing this out.
11. Keynes (1930, vol.1, p.135) has an equation similar to this, whereby real output equals the sum of the "volume of liquid consumption goods and services" plus " the net increment of investment"; also arguably found in the Keynes (1936, p. 29).

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combining this with the *Treatise*'s price theory of equation (1), implies the aggregate total cost formula of equation (3).

A cross diagram can be constructed from the aggregate total revenue and cost equations with additional assumptions. On the nature of C and I, the *General Theory* has been widely interpreted as letting C be a line with a slope positive but less than one in magnitude, and with a positive vertical-axis intercept. This will be assumed here for C. And investment I will be assumed to be independent of y, as is typical for the cross diagrams. Then the aggregate total revenue line of $C+I$ is also a line with a slope positive but less than one, and with a positive vertical-axis intercept.

On the nature of total cost, assume that this cost reflects the long run. Taking the *Treatise*'s case of a long run with zero profit as in classical theory, the horizontal, coinciding, marginal and average cost curves are plausible choices for this representation. And these imply a simple upward-sloping total cost line. More precisely, to go from the production function of the representative firm to an aggregate linear total cost curve requires particular assumptions not only about production but also about factor markets. A constant returns to scale production function in capital and labor, and no adjustment cost to adding capital or labor, gives an individual firm a flat marginal and average cost schedule, assuming factor prices are given as a constant. But in aggregate, factor supplies tend to be limited. Thus an important assumption for the linearity of the total cost curve is that factors remain in relatively unlimited supply around the neighborhood of the equilibrium. This is not innocuous but can be taken as a qualified assumption for now. (Section 5 relaxes this assumption.) Then, aggregating the firm's cost under unlimited factor supply conditions, the total cost curve indeed is a straight, upward-sloping line, out of the origin. To get a 45 degree line, the aggregate price is assumed equal to one. More formally, the aggregate real output

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can be described as the aggregate consumption basket, where this basket is the numeraire good. With CRS, constant factor prices, and $P=1$, the constant slope of the total cost curve is one: $[(Wl+Rk)/y]=Py/y=1$, where Wl and Rk denote the nominal aggregate costs of labor and capital.

The resulting standard-looking cross diagram is shown in Figure 1. The difference is that here the cross lines are interpreted as aggregate total cost and total revenue. Further, the relationship between these schedules is consistent with the relationship between the aggregate total cost and total revenue equations that are derived from the equation (1). Because of the additional *General Theory*-type assumptions for total revenue, and the CRS and factor supply assumptions for total cost, the total cost line cuts the total revenue line from below.[12]

Examining Figure 1, the question of equilibrium immediately arises. At the intersection, *Treatise*-defined profit of *I-S* is zero since at that point *TR=TC*. Is it correct to interpret this as the equilibrium? Through equations and discussion the *Treatise* argues specifically that when *I=S* the economy is at its long run equilibrium. This suggests the same concept for the crossing point of Figure 1. This means that when the economy is not at the crossing point, it is in "disequilibrium", or on some short run transition part to the long run equilibrium, as in the *Treatise*. The cross diagram and equation (1) in particular can mutually support such an explanation of the dynamics of the contraction and expansion of output, based on exogenous-type shocks to profit. When *I>S*, the aggregate price *P* is higher than in the long run equilibrium. And aggregate profit is, by definition, positive and above that of the long run equilibrium. The *Treatise* argues that the incentive motive of firms turns the profit into the force that pushes output upwards. And this profit is simply a market outcome that

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12. Bishop (1948) does not construct his cross diagram in this fashion, and uses the terms "aggregate demand" and "aggregate supply"; nonetheless, he does appear to be using the concepts analogous to total revenue and

was not anticipated a priori. In this way it acts as an exogenous factor relative to the firm that in aggregate acts to force the economy back towards its long run equilibrium. It is an equilibrium process similar in ways to the transition to the balanced growth path in neoclassical growth theory, whereby high marginal products of capital induce an increase in capital stock.[13]

Moving along both total cost and total revenue lines in Figure 1, when starting to the left of the crossing point, the profits begin to decrease as output expands and I becomes closer in magnitude to S. The output increase causes the economy to move towards the intersection of TC and TR, thereby creating a type of dynamic equilibrium, or disequilibrium, adjustment. When $S>I$, the aggregate price is below it's long run equilibrium. The economy's output is to the left of the intersection, total cost exceeds total revenue, and profit is negative. By the same reasoning, the *Treatise* argues that this creates an incentive for firms to exit the market or reduce output while staying in the market. The unanticipated losses again create an exogenous type of effect that causes output to decrease. As output contracts, the economy symmetrically moves towards the intersection of TC and TR as in a dynamic equilibrium adjustment.

Put differently, not only can the *Treatise*'s theory of the aggregate price be used to construct the cross-type diagram of Figure 1, but also this diagram can be used to construct a

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total cost.

13 "Thus - generally speaking - every change towards a new equilibrium price level is initiated by a departure of profits from zero", Keynes (1930, vol.1, p.158). "Thus when I say that the disequilibrium between saving and investment is the mainspring of change, I do not mean to deny that the behavior of entrepreneurs at any given moment is based on a mixture of experience and anticipation." Keynes (1930, vol.1, p.160). "It must be enough to repeat here the indication already given on p.125, that we do not require for the purposes of the present analysis to make any particular assumptions as to the time which has to elapse before losses (or profits), actual or anticipated, produce their full reaction on the behavior of entrepreneurs. It is sufficient that the general tendency of a disequilibrium between saving and investment is in the sense described, and that, if the cause persists, the tendency must materialise sooner or later. Nor do any of the qualifications of this section affect in any way the rigour or the validity of our conclusions as to the quantitative effect of divergences between saving and investment on the price levels ruling in the market." Keynes (1930, vol.1, p.161).

Treatise- type theory of an equilibrium business cycle. This suggests an internal consistency. It also presents a way in which the profit acts as an exogenous "propagation mechanism" at the firm level that causes a disequilibrium adjustment or transition to the long run aggregate equilibrium, as an interpretation of the *Treatise*'s theory of business fluctuations. This marks quite a cohesive theory so far.

3. A Qualification about Fiscal Policy from this Interpretation

The *Treatise*'s postulate of how investment can be different from savings in a closed economy model as part of a disequilibrium was taken up by contemporaries of Keynes in building the blocks of the IS-LM framework. Hicks (1950) creates an accounting identity between *S* and *I* that still preserves a way in which cyclic investment can fall short of savings. Hicks posits that there is long-term investment that is not designed to yield profit in the current business cycle and that fills the so-called savings-investment gap. With *A* denoting some type of "autonomous", long-run, investment, and *I'* denoting shorter term investment, Hicks considers the equation

(4) $$S=I'+A=I.$$

Such a definition, of $S-I' \equiv A$, is not exactly the same as defining the gap between savings and investment as losses. But it may not be entirely inconsistent with a profit/loss definition if the argument is that long run investment of savings can yield a loss in a downturn (for example, high fixed costs), a gain in the upturn, and no profit over the competitive long run.[14]

However consider the changes, to my interpretation of the theory of the *Treatise,* that this approach makes when it is framed within the constructed cross diagram of Figure 1. If $S=I'+A=I$ and $Py=C+I$, then $Py=C+I'+A$, and we have the ability to shift up the total revenue line in Figure 1 by increasing autonomous investment. However, the effect of an

increase on total costs from an increase in *A* must also be considered. If it is assumed *ad hoc*

that total costs do not shift per unit of output, then the total revenue curve shifts up along the

stationary total cost curve. The total-revenue/total-cost construction of equations (1) to (4),

plus the assumption that total costs do not change when *A* increases, allows for the fiscal

policy result that output increases if the government increases long term *A*. Setting $A \equiv G$,

letting *G* denote government expenditure, keeping *G* independent of *y*, and suppressing the

total-revenue/total-cost concepts, gives a version of the cross diagram that is usually found in

modern textbooks, starting as early as Samuelson (1951). The total revenue line might be

called the income line, and the total cost might be called just the 45 degree line, or the words

"aggregate demand" and "aggregate supply" might be used. Regardless, an increase in

government spending causes output to increase, as in the standard Keynesian cross analysis of

fiscal policy.

Generally, if the government increases long term investment in physical or human

capital, for example a new highway system or education system, the taxes must be raised to

finance this. Barring lump sum taxes and imposing Ricardian equivalence of debt into future

taxes, the cost of production must rise because of increased taxes on exchange, output, and/or

labor and capital inputs. This would cause the total cost curve to shift (or pivot) up for a

given level of output. For example, initially let *TC=C+S* and *TR=C+I+G*. Then increase *TR*

by $\bar{G}$, so that $TR=C+I+\bar{G}$. Also let this government spending be financed by taxes that add

to the total factor cost of production by an equal amount $\bar{G}$. Then $TC=C+S=rPk+wPl+\bar{G}$

and the average cost, *TC/y*, becomes $1+\bar{G}/y$ as the *TC* line pivots up. Bishop (1948) shows

how such a balanced budget experiment implies no change in output.[15]

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14. Closer to the *Treatise*, Dimand (1988) interprets this equation as $I \equiv S + Q$, where *Q* is windfall profit.
15. Bishop (1948) analyses this case of a "balanced increase in government expenditures and taxes" and finds "a

In a general equilibrium with rational expectations, no shift up in the total cost curve would appear very difficult to maintain. The cross reconstruction clarifies that its fiscal policy result, that of an increase in output from an increase in government spending, rests on no shift in the cost of production. That total cost does not shift up when deriving the standard fiscal policy result is an important qualification raised by the cross reconstruction.

There may be other ways to justify the assumption of no cost schedule shift. It might be said that there exists excess saving that has already been incurred as part of total cost, but has not been turned into investment, which is a part of total revenue. For example, if the private banking system collapses, saving already allocated to financial intermediation sector cannot be easily processed into intertemporal investment. And if the government can somehow act as the intermediary of this unallocated saving in place of the private intermediaries, then the investment schedule may shift up while the saving schedule remains fixed. Some might suggest that this is the case that occurred during the Great Depression. It is true that internalizing a bank contagion externality through the establishment of federal deposit insurance may involve little cost. But long-term government programs like re-capitalization of banks during a prolonged banking crisis, "public works" infrastructure construction, unemployment insurance, or even a war that results in opening up markets all have significant costs.

Accepting that government spending replaces the profit definition of *I-S*, and accepting that this spending does not shift up in the cost curve, the analysis becomes different from that of the *Treatise*. Before the model was of profit and loss, of disequilibrium readjustment along the total cost and total revenue lines, and of reestablishment of an equilibrium price with no extra profit, all within the private sector. Now the model becomes

peculiarly precise conclusion" of no change in output, in his cross construction.

that increased government spending can shift up the total revenue line, move the equilibrium to a new position along the total cost line, and raise output, with the profit-induced dynamic adjustment within a business cycle no longer a part of the model. This also results in a jump in the analysis from positing temporary losses that coincide with savings in excess of investment in a downturn, to finding that an increase in output can result through long-term government spending at any time.

The qualification that total cost does not shift up in the fiscal policy exercise with the cross is a qualification that also can be viewed as applying to the IS-LM analysis, despite having discarded the direct link to the total-cost/total-revenue framework. To see this, consider construction of the standard IS-LM analysis, starting from equations (2) and (4). Denote Py as nominal income Y instead of as total revenue (TR), so that $Y \equiv Py = C+I'+A$. Then an *IS* model can be constructed by letting R denote the interest rate, letting C be specified for example as $C=a+bR+cY$, with $b<0$ and $c<1$, and letting $I'=d+eR+fY$, with e<0 and f=0. The last restriction of $f=0$ is consistent with the modern cross diagram in which I' does not depend on Y, and it guarantees a downward sloping IS curve under the assumption that S is dependent on income.[16] With $S=I'+A$ of equation (4) as the only other equation, S is not specified but typically is assumed to be a vertical curve that is independent of the interest rate, and dependent on Y. Then as Y exogenously increases, S shifts out, I does not shift, and a downward sloping IS curve is traced out in the plane of Y and R. For fiscal policy as in equation (4), an increase in A can be graphed in the capital market as a parallel shift out of the downward-sloping investment schedule I', with the horizontal-axis intercept rising by A. This causes a shift up in the IS curve and, with a standard LM curve, causes an increase in Y

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16. Keynes (1936) and Hicks (1937) use the demand for investment and the supply of savings to construct the (first) IS diagrams with investment and savings on one axis and the interest rate on the other axis. See also

(see Figure 2).

Mathematically, computation of the multipliers for *C* and for *I* also shows that an increase in $A \equiv G$ causes an increase in output. But an examination of the multiplier suggests the interpretation of how costs are kept constant when *G* increases. With *I=d+eR*, an increase in *G* from 0 to $\bar{G}$ means that savings (*S=I+G*) rises in tandem by $\bar{G}$, that output (*Y=C+I+G*) initially rises in tandem by $\bar{G}$, and then that output rises again because *C* rises. Consider that solving for *C* from *Y=C+I+G* implies that *C=[cI+cG+a+bR]/[1-c]*. With the increase in *G* from 0 to $\bar{G}$, the consumption solution gives an extra $c\bar{G}/(1-c)$ increase in *C*. The total increase in *Y* is then $\bar{G}+c\bar{G}/(1-c)= \bar{G}/(1-c)$, the standard IS multiplier. However the decomposition into the above two components can be interpreted as a result of two perfectly-elastic supplies, of savings and output. If the downward-sloping demand for capital shifts out by $\bar{G}$ when government spending rises by $\bar{G}$, and the equilibrium investment rises by $\bar{G}$, then the savings curve appears to be a horizontal line. And if the demand for output shifts out by $\bar{G}/(1-c)$ because the investment shifts by an increase of $\bar{G}$ and consumption by the increase $c\bar{G}/(1$-c*)*, then apparently the output supply curve is a horizontal line. This implies that the multiplier increase in *Y* results from turning *G* amount of the unlimited savings at the given interest rate into more *Y* directly, and from the consumption out of income, along a flat marginal-cost-of-income line, that has initially increased by *G*. A horizontal *S* curve implies the notion of excess, unused, savings that is found in the literature. And the flat marginal cost of output schedule is as in the cross reconstruction. This bolsters the interpretation that the multiplier results because of the lack of scarcity in savings and

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footnote 27.

income, in the sense of horizontal savings and output supply curves.[17] And a horizontal

output schedule is a marginal/average cost schedule that remains fixed only if the cost

schedules do not shift up when spending increases.

Now consider when there are additional costs in terms of higher taxes. Let the agent's

income constraint find an increase in government spending but also an equal decrease in

wages from higher taxes, as in standard general equilibrium neoclassical models. Starting

from $Y=C+I$, $C=a+bR+cY$ and $I=d+eR+fY$, suppose that now that $Y'=C'+I+G-tY$,

$C'=a+bR+c(Y-tY+G)$, $I'=d+eR+fY'$, and $G=tY$, where t is an income tax rate. Government

spending is a wash; and $Y'=Y=C+I$. While such a "wash" has been emphasized by

"Ricardians", and found by Bishop (1948), here the point is to view this as a cost increase in

the IS-LM analysis that is comparable to a cost increase in the cross construction of Section 2,

both with the result that fiscal policy does not effect output. With distortionary taxes, output

in general would fall.

In sum, adding equation (4) to the total revenue and total cost equations, as

constructed from the *Treatise*'s price theory, replaces the profit notion implicit in equation (1)

with autonomous investment. Further keeping total costs constant as autonomous investment

rises allows conversion of the cross diagram of total revenue and total cost into a textbook –

type cross in terms of fiscal policy results. And with equation (4) and no allowable cost

schedule shifts, the IS model can give the same fiscal policy results when combined with a

flat or upward-sloping LM schedule. To both the cross and IS-LM constructions, the

qualification of no shift in the total cost schedule appears to be necessary for the standard

increase in output from an increase in government spending. And both the price theory and

the business cycle theory of the *Treatise* are lost in this revision of the total-cost/total-revenue

17. Colander (1995) also explores the lack of scarcity in the Keynesian framework.

framework.

4. Modification with a neoclassical definition of profit

The *Treatise*'s price theory is innovative with its use of ("windfall") profit to construct a cohesive theory of business fluctuations, and notable for its ability to form a basis for the modern cross model. However by equating ("windfall") profit with the difference between investment and saving, it departs from generally accepted neoclassical macroeconomic theory. Neoclassical theory lets investment exceed saving when a country borrows capital from abroad (Obstfeld and Rogoff, 1996), which Keynes in the *Treatise* actually discusses,[18] but this borrowed capital is not equated with aggregate profit (although it may lead to an increase in the nation's permanent income stream).

Neoclassical, Marshallian, profit can be expressed in a form relative to equation (1). Looking at the marginal and average cost curves of a competitive firm, per unit profit at the equilibrium output is given by the marginal cost minus the average cost. And the competitive price as applied to an aggregate consumption basket, instead of equation (1), is

(5) $P=AC+(MC\text{-}AC),$

or just $P=MC$. Consider a reconstruction of a cross diagram from equation (5). Multiplying equation (5) through by y, and again setting $TR=C+I$, implies that $C+I=Py=(MC)y$, which is correct if $TR=C+I$. But unlike when the same operations were conducted with equation (1), this gives no information on total costs in general. And consider the classical long run. If $AC=MC$ and $P=AC$, then $TR\equiv C+I=(AC)y\equiv TC$. There is no implication that $TC=C+S$, although total cost can still be graphed as a 45 degree line by assuming constant returns to scale, unlimited factor supplies, and $P=1$. And the business cycle explanation based on differences between I and S is no longer implied. However the Hicks- type equation of

$S=I'+A=I$ still can be inserted so that $Y=C+I'+A$ and A has a role.

If the government or private sector increases long-run investment, then the purchases show up as increases in total revenue, or current dollar GDP. However without any equivalence of total costs with $C+S$, or any special role of savings in total cost, then total costs presumably shift up as well when A goes up. There is no description of S; it need not be horizontal or vertical. Any increase in Y by government action in general would require some conversion of scarce debt or tax revenue, either explicit current taxes, or increases in future taxes, or seignoirage, into something greater than it would otherwise yield. This could happen in general for example if the government taxing and spending activity more efficiently lowers transaction costs in markets than can the private sector.

5.   *Total Revenue, Total Cost, and AS-AD Analysis*

Substituting in the neoclassical definition of profit, the *Treatise*'s theory of aggregate price becomes in a sense only a shell for modern macroeconomic analysis as based on a representative consumer/firm. But with this shell, it is possible to derive aggregate supply and to add onto this the derivation of aggregate demand, yielding an AS-AD analysis that is derived from a general equilibrium economy.[19] Consider the following simple example, in which there is no investment, but rather only the aggregate good y and leisure $100-l$, where l is the time spent working. With s and d superscripts denoting supply and demand, utility is defined as $u = \ln y^d + \alpha \ln(100 - l^s)$. The production technology is $y^s = A(l^d)^\gamma$, where $\gamma \in (0,1)$, and A is a technological shift parameter. The optimization problem can be divided into consumer and firm parts. With Π denoting nominal firm profit, W denoting the nominal wage and P denoting the nominal price of the aggregate good, the consumer maximizes u

subject to $Py^d = \Pi + Wl^s$, with respect to the demand for output and the supply of labor.

And the firm maximizes $\Pi = Py^s - Wl^d$ subject to the production technology, with respect to

the supply of output and the demand for labor. The supply and demand for goods and labor

can be solved as can the profit and the equilibrium wage.

On the firm side, and as in the *Treatise*, nominal profit can be expressed as total

revenue minus total cost. The example implies that these are given as $TR \equiv Py^s$ and

$TC \equiv Wl^d$. In equilibrium, it can be found that the aggregate supply curve (AS) is

$y^s = (A^{1/\gamma}\gamma P / W)^{\gamma/(1-\gamma)}$. Solving for P this can be written as $P = W(y^s)^{(1-\gamma)/\gamma} / (\gamma A^{1/\gamma})$.

Deriving the same AS schedule is possible also by deriving the labor demand, total cost, and

then the marginal cost. It can be found that $l^d = (y^s / A)^{1/\gamma}$, and so $TC \equiv Wl^d = W(y^s / A)^{1/\gamma}$.

Then marginal cost is given by $MC \equiv \partial(TC) / \partial y^s = W(y^s)^{(1-\gamma)/\gamma} / (\gamma A^{1/\gamma})$, and this is the

same AS function. Thus *P=MC* is the AS function and the AS can be derived from the

equilibrium total cost function as an application of Sheppard's lemma. Using the *P=MC*

equation, equilibrium *TR* can be expressed in terms of output: $TR \equiv Py^s = W(y^s)^{1/\gamma} / (\gamma A^{1/\gamma})$.

Therefore along with the AS graph, the *TC* and *TR* can be graphed as functions of y^s, with

each rising monotonically with y^s and the real profit per unit of goods constant at $(1-\gamma)$ [20].

Expressing each the AS, *TC*, and *TR* functions in real terms by dividing through by the

nominal wage *W*, they are graphed in Figure 3, with the parameters are set at $\gamma = 0.5$ and

A=1. The relative price of real output in the AS function is $P/W \equiv 1/w$, the inverse of the

real wage.

The equilibrium quantity of goods that are supplied and the equilibrium price can be

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framework.
20. The constancy of the real profit follows from the nature of the example Cobb-Douglas –type production

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determined with the addition of aggregate demand. While perhaps tempted to derive this from the total revenue function, just as aggregate supply was derived from the total cost function, this would be fallacious. Total revenue, a part of the profit function, is a simple function of aggregate supply; $TR \equiv Py^s$. Instead aggregate demand, the marginal benefit function, can be derived from the equilibrium total benefit (TB) function by using the envelope theorem. The total benefit is the indirect utility normalized by the marginal utility of income. Indirect utility is given in the economy as $u^* = \ln[y^d]^* + \alpha \ln[100 - (l^s)^*]$, where * denotes equilibrium. Divide this by the equilibrium marginal utility of income, which is the value of the Lagrangian multiplier, here denoted by λ, of the above consumer maximization of u subject to the income constraint. Then the total benefit can be expressed as $TB \equiv u^*/\lambda$. By the envelope theorem the derivative of TB with respect to the quantity of goods demanded is equal to the marginal utility divided by λ, which in turn can be defined as the marginal benefit (MB) function; or $\partial(TB)/\partial y^d = (\partial u^*/\partial y^d)/\lambda \equiv MB$. From the first-order conditions of the consumer problem, the marginal benefit equals the price of the consumption good ($[\partial u^*/\partial y^d]/\lambda = P$) and this equation of $MB=P$ is the aggregate demand (AD) function. It can be shown in equilibrium that $y^d = (\Pi + 100W)/[P(1+\alpha)]$. Solving for P, the AD function can be expressed as $MB = P = (\Pi + 100W)/[y^d(1+\alpha)]$. In real terms the AD function is $P/W = 1/w = [(\Pi/P) + 100w]/[y^d(1+\alpha)]$; with $\gamma = \alpha = 0.5$ and substituting in the equilibrium value of Π/P, which can be found to be $\Pi/P = A^2/(4w)$, the AD function can be written as $y^d = (2/3)[100w + A^2/(4w)]$. This is also graphed in Figure 3. The intersection of the AS and AD occurs at the equilibrium quantity of goods where the slopes of the TC and TB curves are equal. This is also where $MB=MC$ and where by welfare

function, in which both the labor share and the profit share are fixed.

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theorems (not proved here) the distance between the *TB* and *TC* curves is at a maximum (not where *TR* and *TC* intersect as in Figure 1).

Derivation of the AS and AD functions allows for comparative statics that represent the essence of the propagation mechanism of real business cycle: exogenous shocks to productivity. This can be illustrated by a change in the production shift parameter *A* in the example economy. Figure 4 shows, for $\gamma = \alpha = 0.5$, that when the parameter *A* doubles in value from 1 to 2, the AS and AD curves both shift out. Supply pivots out because of higher productivity and demand pivots out because of higher income from a higher profit. Also the demand for labor shifts out because of higher productivity and the supply of labor pivots up because of the income effect of the higher profit. The equilibrium real wage rises, so that the relative price 1/*w* falls, as supply shifts out by more than demand. The fall in *1/w* is consistent with a cyclic upturn and with a secular growth trend, described here by a supply that shifts out faster than demand (see Harberger, 1998, for a focus on secularly falling cost).[21]

The simple economy can conceivably be expanded into a fuller model with physical capital and constant returns to scale, and even two-sectors with a market and non-market good. Then the "price" against which the AS-AD curves is graphed can be the ratio of the real interest rate to the real wage, which is generally thought to be pro-cyclic, rather than only the inverse of the real wage as above. Exploring how the ratio of the real interest rate to the real wage moves over the business cycle in response to shocks that shift AS and AD would

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21. Note that in this example, behind the AS-AD shifts, *TB/W* pivots up because the marginal utility of income $W\lambda$, which in equilibrium is given by $W\lambda = 1.5 / \{[A^2 / (4w)] + 100\}$, falls as the increase in *A* causes an increase in profit. This makes the slope of *TB/W* higher for each *y* and this corresponds to a higher price *1/w* for each y^d along the new AD curve. The *TC/W* curve pivots down, making the slope lower for each *y* and this corresponds to a lower price *1/w* for each y^s along the AS curve. The curve *TR/W* also pivots down whereby

not only further the development of AS-AD analysis but may also enrich the real business cycle literature by bringing out the AS-AD analysis that is implicit in it.

6. Discussion and Comparison of the Analysis

The preceding sections argue that the *Treatise* is important historically for laying a foundation for modern cross and even IS-LM analysis. But further, the *Treatise's* theory of price and business cycles, based on exogenous profit shocks that change productivity, can be seen as a basis for modern AS-AD analysis. In particular, the AS-AD analysis and modified total-cost/total-revenue analysis presented here clearly lie at the basis of both the neoclassical growth and business cycle models, although they are rarely drawn out. And therefore the *Treatise's* message, that profit is a shock driving the business cycle, may be equally valid and worth investigating.

Such a constructive view of the *Treatise* stands a bit at odds with, for example, Patinkin (1976) and Dimand (1988). Patinkin (p. 25) writes that the *Treatise* is only of historical interest and does not much underlie the *GT*.[22] Dimand perhaps gives the *Treatise* more stature as being a force that is extended into the *GT*.[23] Both argue that a difference between the two works is that the marginal propensity to consume is implicitly assumed to be one in the *Treatise* and less than one in the *GT*. But putting aside how much the *Treatise* underlies the *GT*, the main difference of the perspective of these well-known writers from the

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the real profit per unit of output, $\Pi / (Py)$, remains the same at 0.5.

22. Patinkin (1976, p.25): "From the substantive viewpoint, all of these volumes are now in the domain of the history of monetary doctrine: their basic scientific contributions have long since been incorporated in the current macroeconomic literature…of importance only to students of this history." "…the recent revival in the *Treatise* notwithstanding, I can (from the viewpoint of macroeconomic theory) see little profit (and certainly no pleasure) in reading it today….it contributes little toward an understanding of the substance of the [*GT*] theory itself, which differs so fundamentally from that of the *Treatise*".

23. Dimand (1988, p22) writes "Keynes' reliance on disequilibrium analysis in the *Treatise* and his insistence on the continual evolution of his thought indicate that these disequilibrium interpretations of the *General Theory* are not simply pulled out of thin air. A close reading of the *Treatise*, in fact, shows that they were part and parcel of Keynes' thought for at least a decade….The disequilibrium interpretation of the *General Theory* suggestst that

point of view of this paper is the investigation of the "fundamental equations" on price, and the implication arising from this. Patinkin and Dimand both consider Keynes's definition of profit a tautology[24], while this paper points out the definition's inconsistency with neoclassical theory. And while it might be possible somehow to interpret Keynes's definition of I and S so that I-S is equivalent to MC-AC, that is an exercise not attempted here. And so this paper stands in contrast because it says that the price theory requires correction. With this correction, and with cost increases allowed when there is government spending, the standard fiscal policy results of the cross and IS-LM do not apply. But with the correction, the *Treatise's* theory points to a seemingly unjustly ignored aspect that may be crucial in advancing the neoclassical growth and business cycle theory: the potential role of profits as the exogenous shock that may underlie the productivity shock of neoclassical theory.

The *Treatise's* discussion of profit therefore in itself is of some interest, in particular because it shows a genesis of how Keynes distinguished between analyzing the business cycle and determining how to induce changes in the business cycle. Keynes describes investment and profit as increasing for example when banks increase lending to firms with savings unchanged, causing the real interest rate to fall.[25] Keynes's business cycle theory is that when

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the methodological break between that book and the *Treatise* was not as sharp as has usually been supposed."
24. Patinkin (1976, p.35): "Thus all that fundamental equation (i) consists of is the quite obvious statement that the change (with respect to the base period) in the price of consumption goods equals the change in per-unit costs of production of these goods plus the change in per-unit profits(assumed zero in the base period); and equation(ii) makes a correspondingly obvious statement for output as a whole….(p.36) Keynes was fully aware of the triviality of these conclusions per se….(p.51) in reading the *Treatise* I have had the uncomfortable feeling that Keynes was so enthusiastic about what he felt were the new truths revealed by his fundamental equations that he all too frequently shifted unawares across the slippery line that lies between 'tracing cause and effect' and simply repeating the tautologies inherent in these equations….and even when this is done in a way which succeeds in escaping the tautologies of the fundamental equations, Keynes' argument at these points reduces to an extremely mechanical application of these equations." Dimand (1988, pp.23-24) reverberates that "Keynes' two Fundamental Equations for the price level of consumption goods and for the price level of output as a whole are tautologies, but are converted into equilibrium conditions by the imposition of behavioral constraints on the variables in the equations."
25. See Patinkin (pp.36-37). Note that while the argument here is that investment increases when banks lend out more, an increase in lending out of reserves can be consistent with only a change in the composition of investment, as funds are shifted from low interest government-type securities to higher yield corporate lending.

profit rises so does the aggregate price, and so does investment. This is arguably consistent

with modern facts (see den Haan, 2000, for evidence of a pro-cyclic aggregate price). The

difficulty occurs when Keynes talks of an injection of money into the banking system that

lowers the real interest rate, raises investment, increases "windfall" profits, and increases

output. As Patinkin (p. 47) points out, this type of analysis is found as early as Marshall's

evidence before the Gold and Silver Commission of 1887. It is closely related to a Phillips-

curve type increase in output, rather than a normal, or "spontaneous" in Keynes's words,

exogenous profit-shock induced type of business cycle. What alerts the reader to the

incompatibility of this phenomenon with "long-term" business cycle "facts", is that here the

real interest rate moves conter-cyclically rather than pro-cyclically as in the facts. Thus

Keynes's discussion of profits in the *Treatise* gives the readers a fine line that is easily

crossed,[26] that of considering how to induce continually an increase in profits with a money

supply or government spending increase, versus an understanding that profits can act as the

exogenous shock that drive real business cycles. And here, it almost seems, is found the key

to a mystery that Lucas (1976, p.104) lamented: "The inference that permanent inflation will

therefore induce a permanent economic high is no doubt equally ancient, yet it is only

recently that this notion has undergone the mysterious transformation from obvious fallacy to

cornerstone of the theory of economic policy."

Keynes's discussion of price, profit, and how the cycle might be propagated also

relates to the price stability goals of modern central bankers (and of Keynes in the *Tract*).

Patinkin argues that the *Treatise* implies that price stability results by letting the interest rate

follow its natural path.[27] And indeed this is the same intuition behind today's widespread

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26. Patinkin seems to allude to this conundrum; see footnote 24.
27. Patinkin (1976, p.37): "It follows that if there are no 'spontaneous' changes in these rates of earnings- and

confirmation of the applicability of the Taylor (1993) rule, and the increasingly global use of inflation-rate targeting. While outside the scope of this paper, it can be shown that the central bank model of the Taylor rule can be interpreted so as to imply that price stability results if the central bank allows the real interest rate to rise and fall as does the output growth rate. This appears consistent with Patinkin's conclusion from the *Treatise*, and it suggests that Keynes's price and business cycle analysis has some consistency not only with the neoclassical real business cycle theory but also with the recent neoclassical policy prescriptions for the supply of money.

7. Conclusions and Qualifications

The paper contributes a *Treatise* -motivated construction of a cross analysis that frames the *Treatise*'s equilibrium theory of business cycles. The fiscal policy of this construction shows that income rises when government spending increases as in the standard cross analysis only if it is assumed that the total cost schedule does not pivot up. This qualification is argued also to be applicable to the *IS-LM* fiscal policy results. Then the paper replaces the *Treatise*'s specification of profit with a Marshallian definition. While lacking any of the standard cross-type fiscal policy results, this allows derivation of AS-AD from an extended total-revenue/total-cost framework, and of comparative statics of a change in productivity as in a business cycle. The total cost/total revenue approach also suggests investigating whether profit constitutes the exogenous technology shock in cycle theory.

The paper stands in contrast to the discussion of Keynes's concepts in Patinkin (1976, p.8), who wants to "try to avoid the temptation to translate them into modern concepts". And

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for the most part Keynes was not concerned with such changes- then a necessary and sufficient condition for price stability is that the market rate of interest equal the natural rate….(p.47) the natural rate was in his view not a separate analytical entity, but a certain value of the market rate; namely, that value at which savings and investment are equal."

while Patinkin at the same time argues that Keynes focuses ineffectively on the fundamental

equations in the *Treatise*,[28] here an attempt to develop relevance for modern concepts is

derived from a focus on Keynes's equation for the theory of aggregate price. Such a focus on

the mathematical structure of a theory can be particularly worthwhile because it forces

clarification of the issues to such a point that they can more easily be advanced. And here the

advancement is that the *Treatise's* theory when corrected seems to contain an insufficiently

explored element of neoclassical analysis. In the neoclassical real business cycle theory there

generally is no profit per se because of the constant-returns-to-scale assumption for

production. There is only an increase and decrease in the marginal products of factors,

leading Mankiw (1989) to suggest that such negative shocks other than oil shocks have never

been seen.[29] But clearly negative profits have always been seen and continue to be identified.

And a profit increase is the manifestation of how capital has a higher yield, while

"restructuring" that writes off capital losses is the manifestation of how capital has a lower

yield. Therefore it remains a potentially worthwhile endeavor to sort out the profit

contribution to the marginal product change. In a way that seems suggested by the *Treatise,* it

may entail endogenizing the exogenous productivity change so that instead there is the

exogenous profit shock that induces the productivity change.

　　　The shift of cash into loans, as in the *Treatise* and as Patinkin (1976, p. 45, for

example) discusses, may certainly be a part of the process of a profit increase. However other

than being induced by government injections of money, this might occur competitively within

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28. Patinkin (1976, pp.23-24) "…the mathematical analysis that appears in these [GT] chapters is not only not essential to the argument but is also problematic. And this fact –together with the effectualness of the "fundamental equations" of the *Treatise*- makes it clear that whatever may have been Keynes's attitude toward the proper role of mathematical methods in economic analysis, his strength did not lie in the use of such methods."

29. We argue in Gillman and Nakov (2001) that oil "shocks" were merely a reflection of the acceleration of the US inflation rate, and so were monetary phenomenon rather than supply side shocks.

banking as investment is shifted from low risk, low yield, sectors into higher risk, higher yield, sectors. And it may be that realistic changes in expectations of the future flow of profit constitute a shock that pushes the cycle up or down. Further, it may not be a far-fetched speculation that the underlying element of such shifts in expectations of profit may simply be changes in the implicit and explicit taxes of operating in markets. For example the information technology sector recently began its collapse after the change in the regulatory environment as signaled by the Microsoft antitrust case. Or take the expansion of markets as induced by less restrictive democratic governments coming to power in Eastern Europe, Russia, and China. Or consider Ireland's dramatic reduction in the corporate income tax and its subsequent growth-induced upturn; the mid 1980s US reduction in corporate and personal taxes and its subsequent growth; or the recent Russian dramatic reduction in personal income taxes to 13%, and the recent Russian-proposed reduction in corporate taxes to 24%. This view, about the effects of changes in policy, suggests that changes that affect the aggregate cost of production may lead to large changes in profits and output. This would bring the analysis full circle, from the implicit assumption in the paper's cross construction that costs are held fixed to the view that policy-induced changes in aggregate cost may shock business cycles. And such policy-induced changes are identifiable at the aggregate level.

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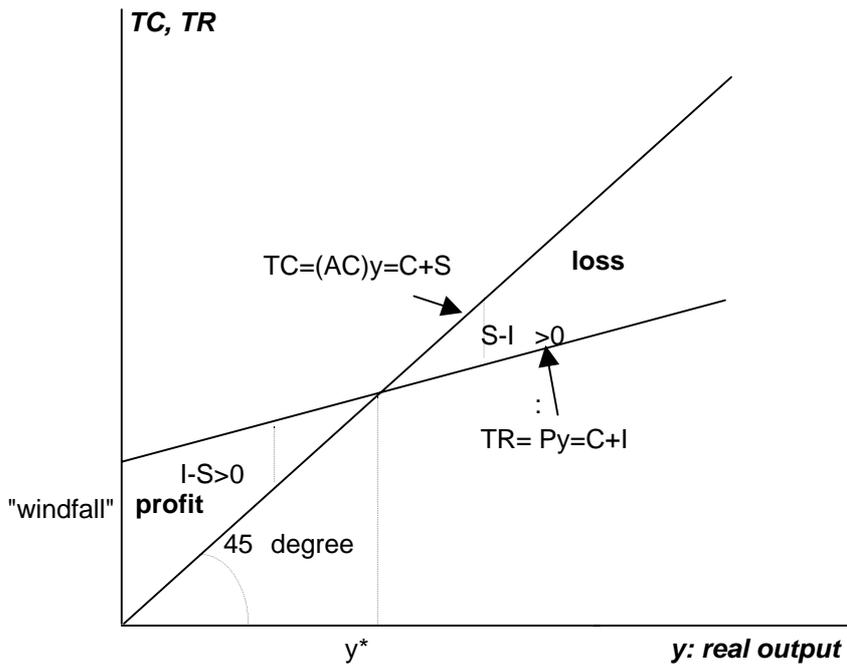
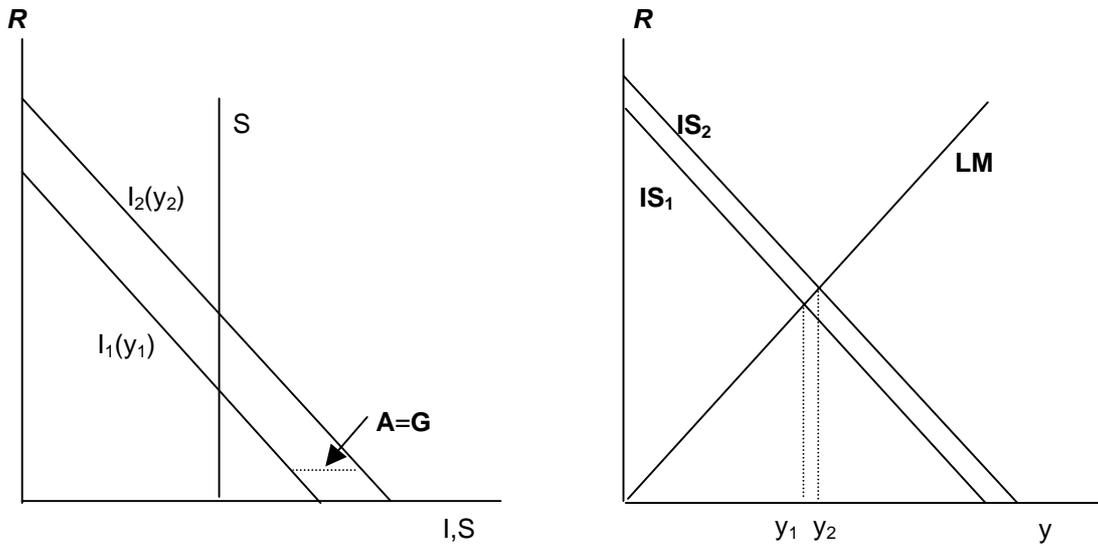**Figure 1: Total Cost and Total Revenue Construction**
of a Keynesian Cross
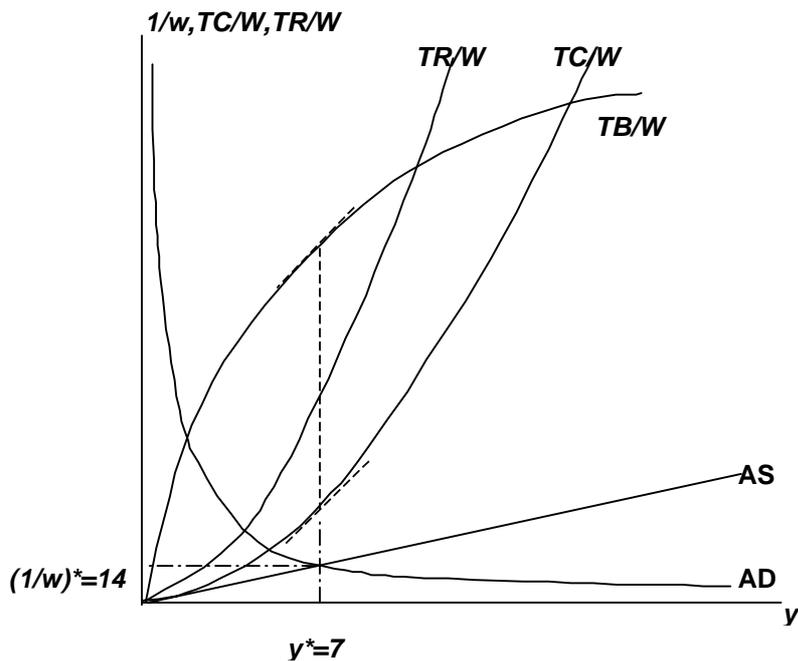

Figure 2: Investment, Savings, Government Spending, and IS-LM

1/w,TC/W,TR/W

TR/W   TC/W

TB/W

AS

AD

$(1/w)^*=14$

y

$y^*=7$

Figure 3: Derivation of AS-AD from TC and TB
with $\gamma=\alpha=0.5$, $A=1$

1/w

AD_1: $(2/3)[(1/w)+100w]=y^d$

AD_2: $(2/3)[(1/[4w])+100w]=y^d$

AS_1: $(1/w)=2y^s$

AS_2: $(1/w)=0.5y^s$

$(1/w)_1=14$
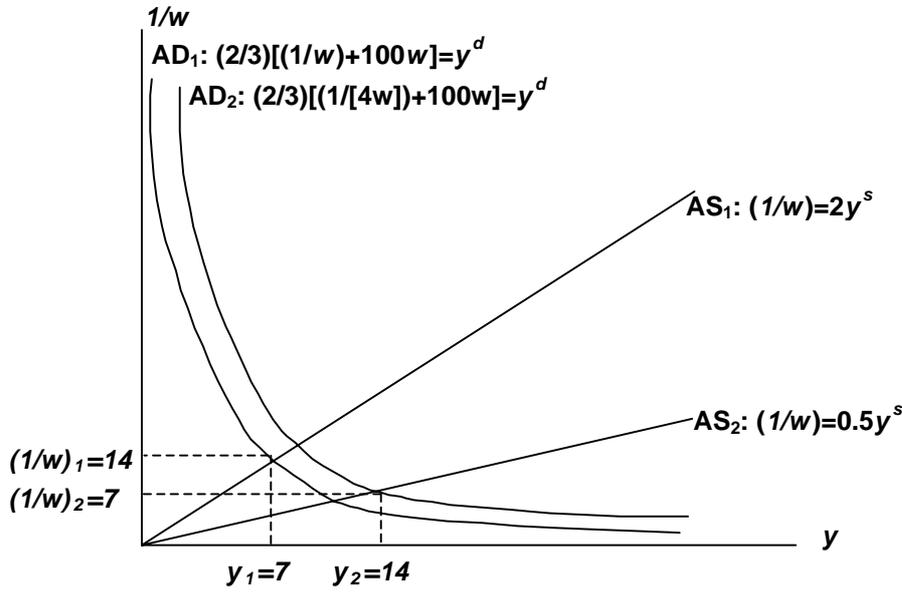$(1/w)_2=7$

y

$y_1=7$ $y_2=14$

Figure 4: Comparative Statics of an Increase in
Productivity from $A=1$ to $A=2$