A change in business confidence such as might be triggered by a crash in the stockmarket may lead to a depression. Using a micro–macroeconomic analysis (for both the short- and long-run models), it is shown that an expected fall in real aggregate demand may be self-fulfilling. Moreover, under such conditions the maintenance of aggregate demand by monetary and fiscal policies is insufficient to prevent a depression. In addition, it may be necessary to reduce real wage-rates as unemployment increases and to prevent real wage-rates from increasing as prices fall. If the number of firms decreases, the (transitional) reduction in wage-rates has to be substantial enough to more than offset this exit effect.

**Key words:** Business cycles; depression; business confidence; aggregate demand; imperfect competition.

1. **Introduction**

The sharp fall in share prices across the world in October 1987 raises serious questions as to whether a deep depression may be triggered by a similar event in the future and if so how it may be prevented. Without attempting to address these important issues in all relevant aspects, this paper provides some insights, using a micro–macroeconomic analysis.

A sharemarket crash may trigger a depression mainly by reducing aggregate demand (through wealth effects and possibly money contraction effects as bankers become more cautious in lending money) and/or by causing a collapse in business confidence. In a simple model of perfect competition with the resulting Classical Dichotomy between the real sector and the financial sector, a reduction in (nominal)
aggregate demand should only reduce the price level without affecting real variables. Retaining all simple features (comparative-static analysis, no time lags, misinformation or any other rigidities), just the relaxation of perfect competition is sufficient to break the Classical Dichotomy (Section 2).

Elsewhere, Ng (1977, 1980, 1982a, 1986) has developed a micro–macroeconomic analysis of a not necessarily perfectly competitive representative firm to analyse the effects of economy-wide changes on aggregate output and the price level (dubbed 'mesoeconomics' for brevity). It takes account of the profit-maximization calculation at the firm level as well as inter-firm interactions and repercussions through aggregate variables, including the effects of aggregate demand, aggregate output, and the price level on the demand and cost curves of the firm. Although hailed by Marris (1991) as the modern pioneer of imperfect competition microfoundations of macroeconomics, the analysis has not received widespread attention. In this paper I use this method to analyse the effects of a change in business confidence in the form of a fall (or increase) in expected real aggregate demand. To make the paper readily accessible to general readers, mathematical derivations of results are confined to Section 3, which can be skipped without loss of continuity by general readers not interested in the rigorous derivation of results. Section 4 consists of verbal discussion and illustrations of some results in the familiar two-dimensional figures of the firm. Nevertheless, interaction of the representative firm with the rest of the economy and with macroeconomic variables are taken into account by appropriately shifting the demand and cost curves. This is an adequate analysis since price and output decisions are made by firms and since other variables can affect these decisions only by affecting demand and/or the cost curves, assuming a profit-maximization equilibrium.

As in virtually all aggregative analysis, our method abstracts away effects of changes in relative prices and distributive effects. However, the price of the representative firm relative to the average price of all other firms (which equals the price level) is of importance in determining the internal profit-maximization calculation of the firm, though in any actual equilibrium outcome its price always equals the price level. Readers not familiar with this duality in the role of the price (and other variables such as output) of the representative firm are referred to the discussion of the methodology in Ng (1982a; 1986, pp. 4–8, Ch. 2, pp. 24–25, Appendix 31).

As shown below, a fall in expected real aggregate demand will lead to a fall in aggregate output (and hence employment) by the full extent (hence making the fall in expected aggregate demand self-fulfilling) whether nominal aggregate demand falls with real aggregate demand or is maintained or even increased by monetary and fiscal policies (or by other means; all these are regarded as exogenous to this model), if costs (mainly wages) do not fall (as output falls) by a sufficient amount to more than offset any decrease in demand elasticity as may occur when the number of firms decreases. While the maintenance of nominal aggregate demand may also be important if complications such as time lags are introduced, the adjustment of costs is of paramount importance in our comparative-static model.
2. Breaking the Classical Dichotomy

The Classical Dichotomy and how it is broken with the introduction of non-perfect competition may be briefly shown. A most simple model of a perfectly competitive economy consists of the following four equations: \( Y = F(L) \), \( F_L = W/P \), \( W/P = \psi(L) \), and \( kY = M/P \), respectively specifying that real output \( Y \) is a function of the only variable input \( L \) whose marginal product \( F_L \) must equal its real wage rate \( W/P \) which must lie on its (inverse) supply function \( \psi \), and the simple classical demand for money equals supply. The first three equations completely determine the three real variables of the whole model: \( Y, L, W/P \), leaving the last equation to determine only the nominal variable \( P \), the price level. This Classical Dichotomy is broken simply by the introduction of non-perfect competition which necessitates replacing the second equation \( PF_L = W \) by \( \mu F_L = W \), where \( \mu \) = marginal revenue. As shown in Ng (1980, 1982b), a change in (nominal) aggregate demand may change \( \mu \) at a given real output level by changing the elasticity of demand for the product of the representative firm at a given output level. A change in money supply may change the output level to a new equilibrium level.1

As illustrated in Fig. 1(a), profit maximization requires producing at \( MC - MR \) (\( = P \) under perfect competition). Given the production (or cost) function, equilibrium output can change only if \( P \) changes. However, if we have full response

![Fig. 1. (a) Perfect competition: no change in output. (b) Imperfect competition: possibility of a change in output.](image)

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1 For other mechanisms where money may affect real output, see Blanchard (1990) for a survey. In particular, the significance of imperfect competition has received close attention: see, for example, Negishi (1979), Hart (1982), Snower (1983), Solow (1986), Blanchard and Kiyotaki (1987), Dixon (1987), McDonald (1987).
of costs to prices (no money illusion, no time lags, etc.) a change in $P$ to $P'$ shifts $MC$ to $MC'$ by a corresponding amount, leaving output unchanged.

The contrasting case of non-perfect competition is illustrated in Fig. 1(b). If a decrease (the converse applies for an increase) in nominal aggregate demand (such as one due to a change in money supply) is expected to decrease real aggregate demand, this shifts the (perceived) demand curve for the product of the firm from $d$ to $d'$ and its marginal revenue curve ($MRC$) from $MR$ to $MR'$. Figure 1(b) illustrates the case where the elasticity of demand remains unchanged at any given price (in the presence of such a change, the condition about the marginal cost has to be correspondingly changed to obtain the same result). If the marginal cost curve ($MCC$) is horizontal and does not shift in response to changes in aggregate output (as illustrated) or if the shift in $MCC$ offsets the slope of $MCC$ (not illustrated), the new profit-maximization point involves a lower output (by the same extent as the expected fall in real aggregate demand) with no change in price. Since real aggregate demand equals real aggregate output in equilibrium, the original expectation of a decrease in real aggregate demand and an unchanged price level is confirmed, making the lower output level a sustainable equilibrium point.

It may be thought that it is unlikely that costs do not fall with output/employment. However, it has been shown (e.g. McDonald and Solow 1981; Ng 1986, Ch. 12) that unchanged wage-rates as unemployment changes may be quite consistent with unions' utility maximization. Also, horizontal $MCC$ over a substantial range has received strong empirical support.

If costs do not fall as aggregate output falls from $q$ (or rather $Y = q\bar{N}$, where $\bar{N} =$ a given number of firms) to $q'(Y' = q'\bar{N})$, they should also remain unchanged as output increases from $q'$ to $q$, assuming symmetry. Then why do firms not expand output back to $q'$? If all firms do so simultaneously, this would in fact be feasible and profitable. However, each individual firm sees its $MRC$ as lying below $MCC$ after the point $q'$ and hence unprofitable to do so. This is a kind of isolation paradox involving what may be called an interfirm macroeconomic externality, as analysed in Ng (1986, Section 3.5). (Cf. Cooper and John, 1988.)

It might be thought that our result that a change in the money supply (or in business confidence as analysed below) may change real output under certain conditions is inconsistent with some recent results (e.g. Benassy, 1987; Blanchard and Kiyotaki, 1987; Dixon, 1987) on the neutrality of money in an imperfectly competitive economy. There is really no inconsistency if the conventional results are correctly interpreted. What these results show is that, for any given real equilibrium $E^1$ with a given money supply $M^1$, it (i.e. $E^1$) is still a possible equilibrium at another money supply $M^2$. This does not imply that a change in money supply will leave the real equilibrium unchanged. This common interpretation is only correct under the assumption of a unique equilibrium. However, under the certain conditions that give us our unconventional result, we do not have uniqueness but rather a continuum of real equilibria. Even in this case, the original equilibrium $E^1$ is still an equilibrium and could still be the prevailing equilibrium after a change in money
supply. Hence, there is really no contradiction. However, a change in money supply or business confidence may trigger a shift in the real variables from one equilibrium to another. In this sense, money may not be neutral. Moreover, our analysis shows that a continuum of real equilibria is more likely to apply with non-perfect competition. It may also be noted that while a continuum of equilibria is more susceptible to self-fulfilling collapses, the existence of just multiple equilibria may be sufficient for such collapses (see Cooper and John, 1988).

3. The method of analysis

Pricing and output decisions are made by firms subject to demand and cost conditions. Concentrating on the decisions of the firm is an adequate analysis provided factors affecting its demand and cost functions are appropriately taken into account. The concentration on a single representative firm makes the analysis inappropriate for analysing inter-firm changes. However, for economy-wide changes (or for industry-wide change; the method can be used for either one, but only one at the same time), it has been shown in a fully general-equilibrium analysis that (i) a representative firm exists that exactly represents the response of the economy in average price (i.e. the price level) and aggregate output to any given economy-wide change in demand or cost, and (ii) a representative firm defined by a simple method (weighted average) can be used as a good approximation for all changes not involving big changes in relative prices (Ng, 1986, Appendix 31).

In Ng (1982a) a micro-macroeconomic model of a representative firm is developed where the quantity demanded for its product is a function of its price \( p \) relative to the average price of all firms (or the price level \( P \)) and real aggregate demand \( A \) (equals \( a/P \), where \( a \) is nominal aggregate demand). That paper ignores the possible effects of \( A \) on the elasticity of demand and concentrates only on the short run where the number of firms \( N \) is fixed. Both simplifications are relaxed here. In addition, we use the model to analyse the effects of a change in business confidence (in the form of an expected change in real aggregate demand).

It has been suggested that an analysis with more content should be used, starting from consumer utility maximization and a labour supply function rather than from the firm’s demand and cost functions. However, since firms are the decision-makers deciding on price and output levels, any change must work through the demand and cost functions of firms. Our general functional forms for these demand and cost functions are consistent with virtually all reasonable specifications of a general-equilibrium model, except that we ignore inter-firm changes and distributional changes. For example, letting a representative consumer maximize

\[ \text{2 Since our purpose is to examine changes in the price level and aggregate output, it is natural to concentrate on the output market. However, other relevant factors are not ignored, e.g. the money supply is captured by } \epsilon^0 \text{ in equation (11). The role of the labour market is allowed through the values of } n^{cy}, \text{ etc. For a more explicit treatment, see Ng (1986).} \]
subject to
\[ \sum p_i q_i = \alpha, \tag{2} \]
where \( q_i \) = the amount consumed of good \( i \), \( p_i \) = the nominal price of good \( i \), \( N \) = the number of goods/firms, and \( \alpha \) = nominal aggregate demand, would yield demand functions
\[ q_i = f^i(p_1, \ldots, p_N, \alpha) \quad (i = 1, \ldots, N). \tag{3} \]

Concentrating on the representative firm 1, and using the average price \( P \) in place of the prices of all other firms (this step is justified by our concentration on aggregate variables; see Ng, 1982a, and 1986, Appendix 3I, for a detailed justification), we have
\[ q^1 = f^1(p^1, P, \alpha). \tag{4} \]

Since this demand function is homogeneous of degree zero, we may divide all arguments by \( P \) and obtain, dropping superscripts and the constant \( P/P \):
\[ q = f^1 \left( \frac{p}{P}, \frac{\alpha}{P} \right), \tag{5} \]
which is the demand function for the product of the representative firm used in Ng (1982a, 1986) and is to be used here.

Similarly, the effects of the labour supply function on our model are reflected in the way a change in aggregate output (and hence employment) affects the costs of firms. Our cost-function approach allows for greater generality consistent with multi-variable inputs. Nevertheless, to show that our results are consistent with the familiar case of a single variable input (labour), Appendix A provides an analysis with an explicit labour supply function. As can be readily seen, the results there are perfectly similar to the following, with, for example, a downward-sloping marginal-product-of-labour curve corresponding to an upward-sloping marginal cost curve here.

The total cost of production \( C \) is taken as a function of the firm’s own output \( q \), aggregate output of the economy \( Y \), the price level \( P \), and some exogenous (set of) factor(s) \( \varepsilon^c \):
\[ C = C(q, Y, P, \varepsilon^c). \tag{6} \]
That \( Y \) may affect \( C \) is due to possible effects on input prices (wage-rates) as aggregate output (and input employment) increases or due to external economies/diseconomies. Letting the representative firm maximize \( pq - C \), where \( q \) and \( C \) are as given in (5) and (6), we have the following first-order conditions:
\[ P \left( 1 + \frac{1}{\eta(p/P, \alpha/P)} \right) = c(q, Y, P, \varepsilon^c), \tag{7} \]
where \( c = \partial C / \partial q \) is the marginal cost and \( \eta = (\partial q / \partial p) p / q \) is the (own-price) elasticity of demand.

Since the firm is, by construction, representative of the whole economy, its price equals the average price level at equilibrium,

\[
p = P, \tag{8}
\]

and its output equals \( 1 / \bar{N} \) (where \( \bar{N} \) is the given number of firms; to be made a variable in the long-run analysis below) that of aggregate output,

\[
q \bar{N} = Y. \tag{9}
\]

Although (8) must hold in an equilibrium, we must distinguish the different roles of \( p \) and \( P \). If a representative firm charges a price according to its profit-maximizing calculation, it will turn out to equal the average price. Nevertheless, it cannot then assume that, whatever price it charges, the average price will be equal to it. This would be the case only if there were complete collusion. In the absence of collusion, we take \( \partial P / \partial p = 0 \) in deriving the first-order condition (7) but take \( dP = dp \) in doing the comparative statics.

Also, at equilibrium, aggregate demand equals aggregate supply:

\[
\alpha = P Y. \tag{10}
\]

Nominal aggregate demand is a function of \( P, Y, \) and an exogenous factor \( \epsilon \) (including money supply as a likely component; anything other than price and output is regarded as exogenous in this model),

\[
\alpha = \alpha(P, Y, \epsilon); \quad \eta^{op}, \eta^{op}, \eta^{oY} < 1, \tag{11}
\]

where \( \eta^{op} = (\partial \alpha / \partial P) P / \alpha \), etc. The restrictions \( \eta^{op}, \eta^{oY} < 1 \) are similar to the requirement that the aggregate expenditure curve in the simple Keynesian-cross diagram be less steep than the 45° line; otherwise the system is explosive. Both Keynesian and monetarist (and in fact other) aggregate demand functions can be shown to be special cases of (11).

This completes the specification of the equilibrium conditions of our short-run model. To derive the comparative statics, totally differentiate (7), divide through by the LHS or RHS of (7) as appropriate, substitute in \( dp / p = dP / P \), \( dY / Y = dq / q \), and \( d\alpha / \alpha = dP / P + dY / Y \) from the total differentiation of (8), (9), and (10), yielding

\[
(1 - \eta^{oP}) dp / p - (\eta^{aq} + \eta^{oY} - D) dq / q = d\epsilon / c, \tag{12}
\]

where \( \eta^{xy} = (\partial x / \partial y)(y / x) \), \( d\epsilon = (\partial c / \partial \epsilon) d\epsilon \), \( D = (\partial \mu / \partial A) A / \mu = -(p / c \eta) \eta^{oA} \) (where \( \mu = MR \) at given \( p, P \), and \( N \). (\( D \) is the effect of an increase in real aggregate demand in increasing marginal revenue at given prices.) While \( \eta^{aq} \) refers to the slope of the MCC (in proportionate or elasticity form), \( \eta^{oP} \) and \( \eta^{oY} \) refer to the endogenous shift in MCC as the price level and aggregate output change, and \( d\epsilon / c \) refers to an exogenous shift in MCC.

Totally differentiate (10) and (11), divide through appropriately to express in pro-
portionate form and eliminate $d\alpha/\alpha$ between the two resulting equations, to obtain:

$$(1 - \eta^{aP}) \frac{dP}{P} + (1 - \eta^{aY}) \frac{dq}{q} = d\alpha/\alpha,$$

(13)

where $d\alpha = (\partial\alpha/\partial\epsilon^a) \Delta \epsilon^a$ is the exogenous change in nominal aggregate demand.3

3.1. Changes in nominal aggregate demand

Considering only the effect of an exogenous change in nominal aggregate demand (thus taking $d\epsilon = 0$; this is not a partial analysis since endogenous cost and demand changes are considered), eliminate $dq/q$ and $dp/p$ in turn between (12) and (13), to give

$$\sigma^{Pa} = \sigma^{aP} = (\eta^{ca} + \eta^{cY} - D)/Z \quad (14)$$

and

$$\sigma^{Ya} = \sigma^{aY} = (1 - \eta^{cP})/Z,$$

(15)

where $\sigma^{xy} = (dx/dy)x/y, \quad Z = (1 - \eta^{cP})(1 - \eta^{aY}) + (\eta^{ca} + \eta^{cY} - D)(1 - \eta^{aP})$ may be taken as non-negative for the purpose of evaluating the comparative-static effects.

From (14) and (15) it can be seen that if $\eta^{ca} + \eta^{cY} - D = 0$ and $1 - \eta^{cP} > 0$, we have the Keynesian case where a change in nominal aggregate demand changes only real output without affecting the price level. (In Ng 1980, 1982b, it is assumed that a change in real aggregate demand does not affect demand elasticity, making $D = 0$.)

3.2. Changes in business confidence

Changes in business confidence may be modelled by changes in the expected value of real aggregate demand $\hat{A}$ (the '}' indicates expected value). Since $A = Y = \alpha/P$ in equilibrium, we may replace $\alpha/P$ and $Y$ in (7) by $\hat{A}$ and examine the effects of a change in $\hat{A}$ by total differentiation (but holding $\epsilon^c$ constant since no exogenous cost changes are involved), to obtain:

$$(1 - \eta^{cP}) \frac{dP}{P} - (\eta^{cY} - D) \frac{d\hat{A}}{\hat{A}} = \eta^{ca} \frac{dq}{q}.$$  

(16)

Substituting in $dq/q = dY/Y$ and $dP/P = dp/p$ from (13) we have, after minor rearrangement,

$$\sigma^{YA} = 1 - \frac{\eta^{ca} + \eta^{cY} - D - \{(1 - \eta^{cP})/(1 - \eta^{aP})\} \sigma^{\alpha A} + (1 - \eta^{cP})(1 - \eta^{aY})/(1 - \eta^{aP})}{\eta^{ca} + (1 - \eta^{cP})(1 - \eta^{aY})/(1 - \eta^{aP})}.$$  

(17)

For the change in business confidence to be self-fulfilling, we need to have $\sigma^{YA}(\equiv dY/d\hat{A})A/Y = 1$, since $A = Y$ in equilibrium. For the new position to be in equilibrium, it is important to have $\sigma^{YA} = 1$ instead of just a positive value. If

3 An exogenous change in nominal aggregate demand is a change in $\alpha$ due to a change in $\epsilon^a$ (i.e. any factor other than $P$ and $Y$ affecting $\alpha$). Whether this change in $\alpha$ will change real aggregate demand ($= \alpha/P$) in the same direction depends on what happens to $P$. 

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0 < \sigma^{YA} < 1$, while real output may initially be decreased by a collapse in business confidence, the extent of the reduction is less than expected. In the absence of further collapses, firms will find themselves to be in disequilibrium and will adjust back towards the original position. If $\sigma^{YA} > 1$, the expected change in $A$ is overfulfilled and may lead to cumulative collapses.

From (17), for $\sigma^{YA} = 1$, we require the numerator of the complicated ratio to equal zero. It can be seen that, if $\eta^{aq} + \eta^{cy} - D + (1 - \eta^{ap})(1 - \eta^{ay})/(1 - \eta^{Ap}) > 0$, a positive $\gamma^{a}$ will help to make the numerator zero if $\eta^{aq} < 1$ (i.e. if costs respond less than fully to prices). This means that if a collapse in business confidence is associated with a reduction in aggregate demand through $e^{a}(\sigma^{A} > 0)$, the collapse is more likely to lead to a reduction in real output by an extent justifying the initial expected reduction in $A$. However, even if monetary and fiscal policies succeed in maintaining $e^{a}$ in the face of a reduction in $A$, i.e. even if $\sigma^{A} = 0$, a change in business confidence may still be self-fulfilling if $\eta^{aq} + \eta^{cy} - D + (1 - \eta^{ap})(1 - \eta^{ay})/(1 - \eta^{Ap}) = 0$. The specific case of $D = \eta^{aq} + \eta^{cy} = 1 - \eta^{ap} = 0$ is illustrated in Fig. 3 in the next section.

3.3. Long-run analysis

We now allow the number of firms $N$ to be variable and let it enter the demand function for the product of the representative firm. An increase in $N$ is reasonably assumed to increase the absolute value of demand elasticity by increasing the degree of competition. For simplicity and consistency with most other analyscs, only aggregate output $Y$, not $N$ itself, enters the cost function. To get the equilibrium value of $N$, we impose the normal zero profit condition, $pq = C$. With these changes but keeping other features of the above model unchanged, we may derive, similar to the derivation of (14) and (15),

$$\sigma^{pa} = \{M\eta^{cy} + (E + \eta^{aq})\eta^{cy} - M(D + E)\}/Z'$$

(18)

and

$$\sigma^{Ya} = \{M(1 - \eta^{ap}) + (E + \eta^{aq})(1 - \eta^{CP})\}/Z'$$

(19)

where $M = (p - c)/p$ is the mark-up of price over marginal cost (= 0 under perfect competition), $E = (\partial \mu / \partial N)N/\mu_{[p, \mu]}$ is positive from the competition effect (increased competition increases absolute demand elasticity and hence marginal revenue $\mu$ at given prices), and $Z' = (1 - \eta^{ap})\{M\eta^{cy} + (E + \eta^{aq})\eta^{cy} - M(D + E) + (1 - \eta^{cy})\{M(1 - \eta^{cp}) + (E + \eta^{aq})(1 - \eta^{CP})\}$ is non-negative for comparative-static evaluation.

To analyse the effects of a change in business confidence, we proceed as above in the derivation of equation (17) (i.e. appropriately replacing $Y$ and $a/p$ by $A$) and obtain (see Appendix B for details):

$$\sigma^{YA} = 1 - \frac{M\eta^{cy} + (E + \eta^{aq})\eta^{cy} - M(D + E) - \{J/(1 - \eta^{ap})\} \sigma^{aA} + B}{B + \eta^{cq} + Ec/p},$$

(20)
where \( J = \{ M(1 - \eta^cP) + (E + \eta^q)(1 - \eta^CP) \} \) and \( B = J(1 - \eta^oY)/(1 - \eta^oP) \).

Comparing (18), (19), and (20) with (14), (15), and (17), respectively, it can be seen that all the short-run results are still present in the long run except that the respective conditions are changed, with \( M\eta^cY + (E + \eta^q)\eta^cY - M(D + E) \) (termed 'combined output on costs and elasticity effects') replacing \( \eta^q + q^cY - D \), and \( M(1 - \eta^cP) + (E + \eta^q)(1 - \eta^CP) \) replacing \( (1 - \eta^cP) \). (This is so because the long-run consideration makes the total cost and the entry effect important.) In particular, referring to (20), even if \( \sigma^c\Delta = 0 \) (\( \epsilon^c \) maintained unchanged in the face of say a collapse in confidence), if \( M\eta^cY + (E + \eta^q)\eta^cY - M(D + E) + B = 0 \), the change in business confidence may still be self-fulfilling. The specific case where \( M\eta^cY + (E + \eta^q)\eta^cY - M(D + E) = 1 - \eta^cP = 1 - \eta^CP = 0 \) is illustrated in Figs. 5 and 6 in the next section.

It may be true that, in the long run, it is less likely for the output-on-costs effects \( (\eta^cY, \eta^cP) \) to be small or even zero and also less likely for costs to respond less than fully to prices \( (\eta^cP, \eta^CP < 1) \). However, on the other hand, the entry/exit effect \( E \) is definitely positive.

4. The results illustrated

Figure 1(b) illustrates how a decrease in nominal aggregate demand may lead to a decrease in real output. (Discussion in Section 2.) While a decrease in nominal aggregate demand is part of, if not the main problem in the Great Depression, we are of course facing a different situation from 1929. It is now very unlikely that the government will let aggregate demand collapse without using monetary and fiscal policies to counter the collapse. Suppose that the government is successful in maintaining aggregate demand intact, is this sufficient to ensure that a great depression will not occur? Unfortunately, the answer is 'not necessarily'.

4.1. Self-fulfilling collapse in confidence

Consider Fig. 2. As in the case illustrated in Fig. 1(b), a decrease in real aggregate demand (as will result if nominal demand decreases with the price level unchanged) shifts the demand curve for the product of a representative firm from \( d \) to \( d' \) in the absence of an elasticity change (which may go either way). From the position of \( d' \), consider an increase in the price level with real aggregate demand unchanged (as will result if nominal aggregate demand and the price level increase by the same proportion). This should shift the demand curve vertically upward since if this firm also increases its price by the same proportion, quantity demanded should remain unchanged as only nominal variables have changed (homogeneity of degree zero). Combining the above two changes, we should have the demand curve twisted from \( d \) to \( d'' \) if only the price level increases with nominal aggregate demand unchanged (real aggregate demand decreases).
If a collapse in business confidence leads to an expected decrease in real aggregate demand while the nominal aggregate demand is unchanged, we have the demand curve of the representative firm expected to twist from $d$ to $d''$. As shown in Fig. 3, this also twists its marginal revenue curve to $MR''$. If $MC$ is not responsive to output but proportionately responsive to the price level, the new profit-maximizing point involves exactly a higher price and a lower output by the same proportion as the (originally expected) changes in the price level and real aggregate demand, making the collapse in business confidence self-fulfilling.

The result illustrated in Fig. 3 shows that, under certain conditions (e.g. $MC$ not responsive to output but proportionately responsive to the price level; for more general conditions, see equation (17) in the previous section\(^4\)), if real aggregate demand is expected to decrease, the maintenance of nominal aggregate demand (within a free market economy, macroeconomic policies cannot directly affect real aggregate demand) may not be sufficient to avoid a decrease in real aggregate demand and output. If real aggregate demand is firmly expected to decrease, the maintenance of nominal aggregate demand may just lead to an expected (and eventually an actual) increase in the price level. Then, on top of a decrease in real output, we have an increase in the price level, as illustrated in Fig. 3. In fact, the new

\(^4\) In terms of equations (14), (15) and (17), Figs. 1(b) and 3 illustrate the case $\eta^q + \eta^Y = 1 - \eta^D = D = 0$; the general case requires the numerator in the complicated ratio in equation (17) to equal zero. Equation (17) (after putting $\sigma^{\delta A} = 0$) refers to the case where exogenous factors affecting aggregate demand (i.e. anything other than prices and output, including the money supply) are held unchanged, but aggregate demand is allowed to vary endogenously with respect to the price level and aggregate output. In the figures in the text, for simplicity we ignore these endogenous changes in aggregate demand. This slight difference does not affect the qualitative results since the endogenous aggregate demand effects only affect the quantitative results; see Ng (1982a, pp. 131–132).
equilibrium situation in Fig. 3 \((d'', MR'', MC'', p'', q'')\) differs from that in Fig. 1(b) \((d', MR', MC, p, q')\) only in that the former involves homogeneous price and cost increases, leaving real output unchanged (where \(q'' = q'\)). This comparison helps us to see, without consulting equation (17), why \(MC''\) intersects \(MR''\) at the required point where \(q'' = q'\).

In the depression after 1929, of course prices fell instead of increased. This was so because nominal aggregate demand also decreased. This may be illustrated in Fig. 4. If both real aggregate demand and the price level fall, nominal aggregate demand falls even more, shifting the demand curve for the representative firm from \(d\) to \(d'\), causing falls in both price and output.
Figure 4 illustrates a case where $MC$ is not responsive to output but proportionately responsive to the price level. What actually happened in the post-1929 depression may differ from this case in two important aspects. First, the post-1929 depression involves the exit of many firms not captured by the short-run result illustrated here. This long-run effect is illustrated in Fig. 5 below. Secondly, the post-1929 depression probably involved some negative responses of marginal costs (mainly through wages) to a reduction in aggregate output. This in itself should work in favour of restoring full employment. However, wages did not respond fully to the fall in the price level, leading in fact to increases in real wages for those employed. As shown in the previous section (second paragraph after equation (17)), these two effects may offset each other, leading to a prolonged underemployment equilibrium.

From the analysis above it seems that, to ensure the avoidance of a depression following a collapse in business confidence, it is important, apart from the maintenance of (nominal) aggregate demand, to lower wage-rates if unemployment increases and to lower wage-rates fully and quickly if the price level falls.

4.2. Considering the entry/exit of firms

A depression is not just characterized by output and employment curtailment by firms but also by the closing down of some firms. This free entry/exit of firms is modelled by imposing the customary zero-profit condition. Equilibrium then requires the representative firm to operate at a point involving not only $hR = MC$ but also total revenue $= \text{total cost}$. It may be thought that the zero-profit condition should only apply to the marginal firms and not to the representative firm which should earn some positive profits. However, the ability of inframarginal firms to
earn positive profits must be due to the possession of some superior factors (resources, position, good management, etc.). Assuming competition for these factors, the supernormal profits should be transformed into higher prices for these superior inputs. Thus, the zero-profit requirement is reasonable for modelling the effects of free entry/exit, not to mention the issue of contestability.

In the long run, it is more likely that a reduction in aggregate output will lower the cost curves (through reduced input prices). In this respect, a depressed equilibrium is less likely than in the short run. However, as shown in the previous section, the exit effect may work to offset this. As a depression sets in, some firms exit, decreasing the number of firms and hence lowering the degree of competition, leading to a less elastic demand curve. A collapse in business confidence (real aggregate demand expected to decrease) may still be self-fulfilling. Figure 5 shows a case where the collapse is associated with a decrease in nominal aggregate demand, and Fig. 6 shows a case where the nominal aggregate demand is maintained unchanged. In both figures we allow for the full response of costs to prices (not significant for Fig. 5 where prices remain unchanged).

An expected decrease in real aggregate demand shifts the demand curve from $d$ to $d'$. The absolute demand elasticity decreases at given $p$ owing to the decreased competition effect. Cost curves shifts downward in Fig. 5 owing to the depressing effects of a reduction in aggregate output on input prices. Despite this, the new equilibrium point involves a lower output at unchanged price level, making the original decrease in expected real aggregate demand self-fulfilling.

Since costs actually fall as aggregate output falls, firms exit and the representative firm moves from $A$ to $B$. Why do firms not re-enter to take advantage of the lower costs? The answer is that firms are not making positive profits; an individual firm considering entry would see itself making losses as it forces the demand curve for

![Fig. 6. Long-run self-fulfilling collapse in confidence: nominal aggregate demand maintained unchanged.](image)
each firm in that industry to move leftward with entry into that (any) industry. While if firms in all industries re-enter and expand, the economy can move back to the original equilibrium $A$, each firm sees it as unprofitable to do so.

In Fig. 6, the price level is expected to increase as real aggregate demand is expected to fall and nominal aggregate demand to remain unchanged. This shifts the demand curve $d'$ vertically upward in comparison with the $d'$ in Fig. 5. Cost curves move upward but proportionately less than the upward increase in price since a depressing effect through the aggregate output is allowed. In both figures the depressed position remains an equilibrium point which confirms the original collapse in business confidence.

The above analysis shows that, when the exit effect is taken into account, the maintenance of nominal aggregate demand plus the lowering of wages as aggregate output falls and the full response of wage-rates to a lower price level (which in combination is sufficient to prevent a depression in the short-run model where the number of firms is given) may not be sufficient to prevent a depression in the face of a collapse in business expectation in the presence of the exit effect. We may have to lower wage-rates (as unemployment increases) by a sufficient margin in order to more than offset the exit effect.

It may be thought that the exit effect is unlikely to occur since firms are unlikely to go bankrupt just on the weight of a collapse in business confidence before real aggregate demand actually (instead of just expected to) decreases substantially. However, in a growing and changing economy, entry and exit take place as a matter of routine. A collapse in confidence will almost certainly hasten exits and delay or stifle planned entries. Thus, the number of firms may be substantially cut as soon as confidence collapses. The entry/exit effect, although classified as a long-run effect for analytical purposes, may take place very quickly, especially if the expected decrease in real aggregate demand is believed to be prolonged.

4.3. The desirability of decreases in wage-rates

The desirability of a decrease in wage-rates may be questioned on the ground that it leads to a decrease in aggregate demand since wage earners have higher marginal propensities to consume. The validity of this argument is questionable. However, even assuming that a decrease in wage-rates does in fact decrease aggregate demand, its desirability in preventing a depression can still be shown.

Consider Fig. 7 which is similar to Fig. 1, ignoring $MC'$. As depicted, a decrease in (real and nominal) aggregate demand will lead the economy to a depressed equilibrium point $q'$. A decrease in wage-rates lowers the cost curve from $MC$ to $MC'$. It may be thought that this only involves a small expansionary effect from $q'$ to $q''$ which will be offset by a further decrease in aggregate demand induced by the decrease in wage-rates. This is an incomplete and misleading analysis.

The demand curve $d'$ is drawn assuming that the price level is at $p$. With the cost curve decreased to $MC'$, the new profit-maximizing price, even with the demand
Fig. 7. A small wage reduction may be sufficient to restore full employment.

curve still at $d'$, is lowered to $p''$. Since this is the position for a representative firm, it means that the price level is also lowered to $p''$. This will twist the demand curve, making it more elastic and hence lift $MR$ at a given price. (This is the shift from $d''$ to $d$ in Fig. 3, since only the price level falls.) Moreover, the lower price level will also further shift the $MCC$ downward. Both these shifts in $MRC$ and $MCC$ result in higher output and lower price, leading the firm and the economy eventually back to the original equilibrium $q$.

For the short-run case ignoring any significant effect of real aggregate demand on elasticity ($D = 0$) illustrated in Fig. 7, a small decrease in marginal cost as aggregate output decreases ($\eta^{cd} + \eta^{CY} > 0$) is sufficient to ensure that the economy remains at (or moves back to) the high equilibrium output level. For the long-run case (illustrated in Fig. 5), a small decrease in marginal cost as aggregate output decreases may not be enough. The decrease has to be substantial enough to offset the elasticity effect.\(^5\)

It should be emphasized that, both for the short-run and the long-run cases, the required reduction in costs (mainly through wage-rates) is only transitional. If the required reduction has been achieved, the economy should move back to the high equilibrium output $q$ in Figs. 5 and 7. At this point, costs (and wage-rates) are back to the original levels (corresponding to $J$ in Fig. 5). In contrast, if unions refuse to have the wage-rates lowered by the required amount, the economy may be stuck at the low equilibrium $q'$ with lower real wage-rates (corresponding to $J'$ instead of $J$) for a long time until the prolonged depression changes union militancy.

If we superimpose in our comparative-static analysis the growth in productivities

\(^5\) From equation (20), assuming full response of costs to prices (i.e. $\eta^{CP} = \eta^{CD} = 1$), we need $M\eta^{CY} + (E + \eta^{cd})\eta^{CY} > M(D + E)$.\)
over time, wage-rates could have risen over the interval (when the economy falls below $q$ and then back to $q$). Then, the original required reduction also may be correspondingly smaller. If the growth in productivity is large enough, preventing increases in wage-rates may be all that is required.

What about the decrease in aggregate demand owing to a fall in wage-rates? Under the conditions where costs are reduced with a reduction in aggregate output (an increase in unemployment) and costs also respond fully to the price level, a change in aggregate demand affects the price level only, not real output, as shown more rigorously in the previous section. (In terms of equations (14) and (15), the numerator of equation (14) is made positive and that of equation (15) made zero. This also makes equation (17) not equal to 1, making a change in business confidence not self-fulfilling.) Thus, with the appropriate policy of reduction in wage-rates to ensure an adequate response of costs to aggregate output, we do not have to worry about a reduction in (nominal) aggregate demand. Moreover, if a reduction in aggregate demand is a problem, monetary and fiscal policies may be adjusted to maintain aggregate demand from being adversely affected by a decrease in wage-rates.\(^6\)

An alternative to wage reduction in preventing a depression is to encourage/discourage entry/exit of firms or, more generally, to encourage/discourage expansion/contraction. As illustrated in Fig. 5, if the economy is at the low equilibrium $q'$, a coordinated expansion and entry may move it to a high equilibrium $q$. Similarly, starting from $q$, a coordinated discouragement of contraction and exit may prevent the economy falling to the low equilibrium $q'$ in the face of a collapse in confidence. However, it is inappropriate to encourage/discourage entry/exit and expansion/contraction when the economy is already at the high equilibrium not challenged by imminent depression. Moreover, the appropriate way to achieve encouragement/discouragement may also raise difficult microeconomic problems. These problems and the relative merit of wage reduction versus discouraging contraction are beyond the scope of this paper.

5. Concluding remarks

As we have seen above, a collapse in business confidence may be self-fulfilling or even lead to cumulative decreases in real output and employment. As real aggregate demand is expected to fall, firms expect the demand for their products to fall. Entries of new firms are reduced and exits increase, reducing the degree of competition and hence the absolute elasticities of demand. This induces firms to charge higher prices and produce less (the latter effect being on top of that of expected de-

\(^6\) There may be other undesirable effects (such as on distributional grounds) not captured in our model. These are beyond the scope of this paper. Actual policy decisions to lower wage-rates have of course to take a fuller picture into account.
mand reduction). Thus, unless costs fall (through falling input prices as output and employment decrease) by a sufficient extent to offset the above effects, firms find the reduced output levels profit-maximizing, confirming the original expected fall in real aggregate demand. Under such conditions, the maintenance of nominal aggregate demand may just lead to a higher price level without preventing the fall in real output.

Our analysis showing the possibility of a self-fulfilling collapse in business confidence and the insufficiency of the maintenance of (nominal) aggregate demand in preventing a depression under such conditions does not mean that the real economy is actually characterized by these conditions. However, owing to the importance of preventing a great depression, we should have adequate understanding of the mechanisms involved even if these apply to rare specific cases only. The question as to whether a specific economy in a specific period does or does not satisfy the required conditions is beyond the scope of this paper. Nevertheless, the persistence of a high unemployment rate in the United Kingdom over many years may partly be due to similar conditions making a depressed situation possible as a long-run equilibrium.

Appendix A: The model with an explicit labour supply function

This appendix shows that the inclusion of an explicit labour supply function gives exactly similar results as the model in the text which is more general, being not confined to a single variable input.

For simplicity, the output \( q \) of the firm is taken to be a function of the only variable input \( l \) (labour):

\[
q = q(l).
\]  
(A1)

The firm maximizes profit \( (pq - wl) \) subject to (A1) and (5) in the text, taking the wage-rate \( w \), average price \( P \) and aggregate demand \( \alpha \) as given, which yields the following first-order condition:

\[
\frac{p\{1 + \frac{1}{\eta(p/P, \alpha/P)}\}}{\alpha}q_l = w,
\]  
(A2)

which specifies the equality of the marginal revenue product of labour with the wage-rate, where \( \eta = \frac{\partial q}{\partial p}p/q \) is the elasticity of demand for the product of the firm, and \( q_l = \frac{\partial q}{\partial l} \) is the marginal physical product of labour.

The inverse labour supply function for the whole economy may be written as

\[
w = w(L, P),
\]  
(A3)

where

\[
L = \bar{N}l,
\]  
(A4)

where \( \bar{N} \) = the given number of firms.

Together with equations (5), (8), (9), (10), and (11) in the text, this completes the
specification of the equilibrium conditions. To derive the comparative statics, totally differentiate (A2), divide through by the LHS or RHS of (A2) as appropriate, substitute in \( dp/p = dP/P \) from the total differentiation of (8), to yield
\[
\eta^{ql} \frac{dl}{l} + D \left( \frac{\alpha - dP}{P} \right) = \frac{dw}{w} - \frac{dP}{P}, \tag{A5}
\]
where \( \eta^{ql} = (\partial q_i/\partial l)(l/q_i) \) and \( D = -[1/(1+\eta)]\eta^{PA} \) is the effect of an increase in real aggregate demand \( A(=\alpha/P) \) on marginal revenue in proportionate terms at given \( p, P, N \). To see the equivalence of the \( D \) defined here with that defined in the text, note that \( p(1/(1+\eta)) = c \), hence \( p/c\eta = 1/(1+\eta) \).

Substitute in \( d\alpha/\alpha = dP/P + dY/Y \), \( dL/L = dl/l = (dq/q)/\eta^{ql} \), and \( dw/w = \eta^{WL} dL/L + \eta^{WP} dP/P \), \( dq/q = dY/Y \) (from the total differentiation of equations (10), (A4), (A1), (A3), and (9), respectively), to obtain:
\[
(1 - \eta^{WP}) \frac{dP}{P} + \left( D + \frac{\eta^{ql} - \eta^{WL}}{\eta^{ql}} \right) \frac{dY}{Y} = 0. \tag{A6}
\]

Noting that \( dp/p = dP/P \) and \( dq/q = dY/Y \), we have from (13) in the text,
\[
(1 - \eta^{AP}) \frac{dP}{P} + (1 - \eta^{AY}) \frac{dY}{Y} = d\alpha/\alpha. \tag{A7}
\]

Changes in nominal aggregate demand

The effects of an exogenous change in nominal aggregate demand on the price level \( P \) and on real aggregate output \( Y \) can be obtained by eliminating \( dY/Y \) and \( dP/P \) in turn between (A6) and (A7), obtaining, respectively,
\[
\left( \frac{dP}{d\alpha} \right) \alpha/P = \left( \frac{\eta^{WL} - \eta^{ql}}{\eta^{ql}} - D \right) \left/ Z' \right. \tag{A8}
\]
and
\[
\left( \frac{dY}{d\alpha} \right) \alpha/Y = \left( \frac{dq/q}{d\alpha/\alpha} \right) q = (1 - \eta^{WP})/Z', \tag{A9}
\]
where \( Z' = (1 - \eta^{AP})(1 - \eta^{WP}) - (1 - \eta^{AP})\{D - (\eta^{WL} - \eta^{ql})/\eta^{ql}\} \) may be taken as non-negative for the purpose of evaluating the comparative-static effects, since otherwise the system is explosive.

From (A8) and (A9), it can be seen that if \( \{\eta^{WL} - \eta^{ql}/\eta^{ql}\} - D \leq 0 \) and \( 1 - \eta^{WP} > 0 \), we have the Keynesian case where an increase in nominal aggregate demand increases the real output without increasing the price level. On the other hand, if \( 1 - \eta^{WP} = 0 \), \( \{\eta^{WL} - \eta^{ql}/\eta^{ql}\} - D > 0 \), we have the monetarist case where an increase in nominal aggregate demand increases only the price level. This gives the same results (equations (14) and (15)) in the text. Moreover, the conditions are completely analogous, with \( \eta^{WP} \) replacing the role of \( \eta^{cP} \) (since in this single variable input case, only the wage-rate affects marginal costs), \( -\eta^{ql}/\eta^{ql} \) replacing the role of \( \eta^{cq} \) and \( \eta^{WL}/\eta^{ql} \) replacing the role of \( \eta^{cY} \).

To analyse the effects of a change in business confidence, we replace \( \alpha/P \) in (A2)
by $\hat{A}$, and totally differentiate, and divide through to express in proportionate form, obtaining after substituting in $dp/p = dP/P$,

$$\eta_{ql} \frac{dl}{l} + D \frac{d\hat{A}}{A} = \frac{dw}{w} - \frac{dP}{P}. \quad (A10)$$

Substituting in $dl/l$ and $dw/w$ from the total differentiation of $(A4)$ and $(A3)$, and $dP/P$ from $(A7)$, we have, after minor rearrangement,

$$\frac{dY}{d\hat{A}} = 1 - \frac{\beta - \{(1 - \eta^{wP})(1 - \eta^{qP})\} \sigma_q \hat{A} + (1 - \eta^{wP})(1 - \eta^{qY})(1 - \eta^{aP})}{\{(1 - \eta^{wP})(1 - \eta^{qY})(1 - \eta^{aY})\} - \eta^{ql}/\eta^{qY}} - \frac{(1 - \eta^{wP})(1 - \eta^{qY})(1 - \eta^{aY})}{\eta^{qY} - \eta^{ql}}, \quad (A11)$$

where $\beta = \{(\eta^{wL} - \eta^{ql})/\eta^{qL}\} - D$. Again, (A11) is completely analogous to (17) in the text.

**Appendix B**

For the long-run case, quantity demanded and demand elasticity are also a function of $N$, the number of firms. To analyse the effect of an expected change in real aggregate demand $A = a/P$, replace $\alpha/P$ in (1) by $\hat{A}$. We thus have

$$p \left\{ 1 + \frac{1}{(p/P, \hat{A}, N)} \right\} = c(q, \hat{A}, P, \epsilon^c). \quad (B1)$$

Totally differentiate (B1), but hold $\epsilon^c$ constant (since no exogenous cost change is considered), evaluate at $dp/p = dP/P$, divide through by $c$, and express in elasticity form, yielding

$$(1 - \eta^{CP}) \frac{dP}{P} + (D - \eta^{CY}) \frac{d\hat{A}}{A} = \eta^{cq} \frac{dq}{q} - E \frac{dN}{N}, \quad (B2)$$

where $D = -(p/cq)\eta^{qA}$ and $E = -(p/cq)\eta^{NN}$ are respectively the effect on marginal revenue of a change in real aggregate demand and in the number of firms at given prices, through the change in the elasticity of demand.

The zero-profit condition gives

$$pq(p/P, \hat{A}, N) = C(q, \hat{A}, P, \epsilon^c), \quad (B3)$$

the total differentiation of which at unchanged $\epsilon^c$- and at $dp/p = dP/P$ gives

$$(1 - \eta^{CP}) \frac{dP}{P} - \frac{c}{p} \frac{dq}{q} + (1 - \eta^{CY}) \frac{d\hat{A}}{A} = \frac{dN}{N}, \quad (B4)$$

A detailed derivation of equation (20) in the text is provided here.
since \( \eta^{qA} = 1 \) and \( \eta^{qN} = -1 \) for the representative firm (i.e. a 1% increase in \( A \) increases \( q \) by 1% at unchanged \( N \) and \( p/P \); a 1% increase in \( N \) decreases \( q \) by 1% at unchanged \( A \) and \( p/P \)).

Since \( Y = qN \), we have from total differentiation:

\[
\frac{dq}{q} = \frac{dY}{Y} - \frac{dN}{N}. \tag{B5}
\]

Total differentiation of (10) and (11) in the text yields, after eliminating \( d\alpha/\alpha \) between the two resulting equations,

\[
(1 - \eta^aP) \frac{dP}{P} + (1 - \eta^{qY}) \frac{dY}{Y} = \frac{d\alpha}{\alpha}, \tag{B6}
\]

where \( d\alpha = (\partial \alpha/\partial e^a) \, de^a \) is the exogenous change in nominal aggregate demand.

Substituting (B5) into (B2) and (B4) to eliminate \( dq/q \), we obtain (B2') and (B4'), respectively (not shown). Then substitute (B4') into (B2') to eliminate \( dN/N \), which yields, after multiplying through by \( M = (p-c)/p \) and defining \( J = M(1 - \eta^aP) + (E + \eta^{cq})(1 - \eta^{CP}) \),

\[
J \frac{dP}{P} + \{M(D - \eta^{CY}) + (E + \eta^{cq})(1 - \eta^{CY})\} \frac{d\hat{\alpha}}{A} = \left(\eta^{cq} + E \frac{c}{p}\right) \frac{dY}{Y}. \tag{B7}
\]

Substituting \( dP/P \) from (B6) into (B7) yields

\[
(B + \eta^{cq} + Ec/p) \frac{dY}{Y} = \{MD + E + \eta^{cq} - Mn^{cq} - (E + \eta^{cq})\eta^{CY}\} \frac{d\hat{\alpha}}{A} + J \frac{d\alpha/\alpha}{1 - \eta^aP}, \tag{B8}
\]

where \( B = J(1 - \eta^{CY})/(1 - \eta^aP) \).

Divide through by \( d\hat{\alpha}/A \) and rearrange to obtain (20) in the text.

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