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DUTCH DISEASE — HOW MUCH SICKNESS, HOW MUCH BOON?

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This paper sets out a very simple neo-classical, small-country, open-economy model with non-tradeable goods, tradeables other than oil, and oil. Using the comparative static version of the model it is shown that a rise in the world price of oil must, ceteris paribus, cause the price level of non-tradeables to rise if a fixed exchange rate is maintained. Using the dynamic version of the model it is shown that the path of the non-tradeables price level in response to an oil shock may carry it through substantial overshooting before the final equilibrium is reached. However, it is also shown that the degree of overshooting can be reduced dramatically by the simple expedient of seeing to it that the increase in spending generated by the added revenues takes place gradually through time, rather than precipitously. In this way the rise in the domestic price level caused by the oil shock can be limited (for practical purposes) to approximately the amount dictated by the degree of appreciation of the real exchange rate necessary to restore equilibrium.

1. Introduction

The term 'Dutch disease' was coined to describe the reaction that an economy can have to the emergence of a new major export industry, or, alternatively, to a significant rise in the international price of one or more existing exports.

In the present paper we develop a simple model to analyze the 'export boom' phenomenon. The model, probably the simplest that can be devised to handle the problem, covers all its essential components. Its equations distinguish between 'oil' (the export boom product), the production of tradeables other than oil, the demand for tradeables other than oil, and the supply and demand for home goods (non-tradeables).

*Author's note: This paper was written during August and September, 1981, while I was serving as a consultant to the Ministry of Finance of Indonesia under the auspices of the Harvard Institute of International Development (to both of which institutions I am grateful for permission to publish). The study was done under circumstances and time constraints which precluded any careful examination of the literature. When, later, I attempted to remedy this deficiency, I found the task of distilling and summarizing the existing work on the general topic of Dutch disease, and of relating it to my own contribution, to be more formidable by far than the work that culminated in the present paper. Certainly such a task would merit, at this stage of development of the literature, an independent review article. Under the circumstances, I have decided to include a bibliography of work on Dutch disease and related subjects, containing the contributions that have come to my attention. The large number of papers there listed itself suggests that I have not uncovered all that has been done. I have therefore called it a partial bibliography on Dutch disease and related topics.

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In section 2 the simplest version of this model is considered, in which only comparative static solutions emerge. This model is evolved in the context of a fixed exchange rate economy, but this really plays no role in the final solutions for relative prices and real quantities. The use of the assumption of a fixed exchange rate is nothing more than the choice of foreign currency as the 'numeraire' of the system. Other choices of numeraire (e.g., the wage rate or the money supply) would yield the identical results (for real quantities and relative prices).

In section 3 of the paper certain monetary dynamics are explored. Here the assumption of fixed exchange rates is again made, but now it has more substantive content, as there is no reason why the dynamic process under a fixed exchange rate system should match the one that would exist under, say, a flexible rate system. The final equilibria should be the same, but the time paths by which those equilibria are approached can easily differ. Indeed, even when the exchange rate is specified to be fixed, many alternative dynamic processes could be compatible with it. In our exercises, we will use processes that we believe to be plausible.

2. The 'real' model

We posit an economy described by the following equations for

Home Goods Demand:

$$H^d = a_0 - a_1(P_h - P_t) + a_2 Y, \tag{1}$$

which depends on the price of home goods (P_h) relative to that of tradeables (P_t) and on the level of real output (Y) (*initial prices are calibrated to 1.0*, hence $P_h - P_t$ approximates the corresponding price ratio; note, too, that a_1 is defined to be positive).

Home Goods Supply:

$$H^s = b_0 + b_1(P_h - w), \tag{2}$$

which depends on the price of home goods (P_h) relative to the level of factor costs or wages (w).

Tradeable Goods Supply:

$$T^s = c_0 + c_1(P_t - w), \tag{3}$$

which depends on the price level of tradeable goods (P_t) relative to the level of factor costs or wages (w).

National Real Product Generated by 'Oil' (O):

$$Z = P_0 O, \tag{4}$$

where the oil economy of the country is assumed to have a life of its own. Output is exogenous in the sense that it is the product of past discoveries, and the world price is also taken to be exogenous. The disturbance to be analyzed is a change (dZ) assumed to come from a rise in oil prices.

Real Output:

$$y = H^s + T^s + Z, \tag{5}$$

note that we assume the world price of non-oil tradeables to be exogenous and constant over the exercise.

Factor Costs or Wages:

$$w = f_1 P_h + (1 - f_1) P_t, \quad f_1 = b_1/(b_1 + c_1), \tag{6}$$

which is an index of the variable costs that are relevant in the production of H^s and T^s. As the oil sector is assumed to be able to command the resources it desires, we build in the assumption that sectors H and T compete for the remaining resources. Thus $\mathrm{d}H^s = b_1(\mathrm{d}P_h - \mathrm{d}w) = -\mathrm{d}T^s = -c_1(\mathrm{d}P_t - \mathrm{d}w)$. With $\mathrm{d}P_t = 0$, this means $b_1 \mathrm{d}P_h - b_1 \mathrm{d}w = +c_1 \mathrm{d}w$, or $\mathrm{d}w = b_1 \mathrm{d}P_h/(b_1 + c_1)$.

Demand for Tradeables:

$$T^d = a_0 + a_1(P_h - P_t) + (1 - a_2) Y, \tag{7}$$

where it is assumed that all income is spent — either consumed or invested — on either tradeables or home goods. Hence the coefficient of Y in the tradeables demand equation is 1 minus its coefficient in the home-goods demand equation. The standard 'Slutsky condition' on compensated price effects requires that $\partial T^d/\partial P_h = \partial H^d/\partial P_t$. Using a_1 as the coefficient of $(P_h - P_t)$ ensures this.

Balance of Trade:

$$B = T^s + Z - T^d, \tag{8}$$

which is usually defined as exports minus imports. This is equal to non-oil exports + oil exports minus imports. Add to non-oil exports the home consumption of home-produced exportables and the home consumption of home-produced importables; this is the supply of tradeables. Add the same two items to imports to get the demand for tradeables. Thus the trade balance can be expressed as shown.

World Price of Tradeables:

$$P_t = \bar{P}_t, \tag{9}$$

which is taken as exogenous, and (implicitly) the exchange rate is taken as given. This equation thus defines the numeraire of the system. Alternatively, a different numeraire could be chosen; P_t would then be defined as $P_t = E\bar{P}_t$ where $\bar{P}_t$ is the price of tradeables in world prices and E is the exchange rate.

Demand for Money:

$$M^d = kyw, \tag{10}$$

which is a version of the 'Cambridge equation' where the price level relevant for money demand is defined to be the level of wages (or unit factor costs).

Supply of Money:

$$M^s = M^d, \tag{11}$$

with a fixed exchange rate, the money supply (in equilibrium) is beyond the control of the monetary authorities, as long as they do not modify the pattern of trade distortions. The dynamic version of the model (see section 3), however, permits transitory divergences of M^s from M^d.

The solution of this model, starting from an initial situation in which $P_h = P_t = P_0 = w = 1$, is extraordinarily simple. Given the fact that $dH^s = -dT^s$ [see under eq. (6)], it follows that $dy = dZ$. The fact that dP_t is zero allows us, from eq. (6), to set $dw = f_1 dp_h$. With these two results, we equate dH^d and dH^s, from eqs. (1) and (2), as follows:

$$dH^d = -a_1\, dP_h + a_2\, dZ = b_1\, dP_h(1-f_1) = dH^s, \tag{12}$$

$$dp_h = \frac{a_2\, dZ}{a_1 + b_1(1-f_1)}. \tag{13}$$

This can be converted into more familiar elasticities using the following

subscripts formulas:

σ_h = income elasticity of demand for home goods $= a_2 y/H^d$,

η_h = price elasticity of demand for home goods $= a_1/H^d$,

ε_h = price elasticity of supply of home goods $= b_1/H^s$.

Eq. (13) then becomes

$$dp_h = \frac{\sigma_h(dZ/y)}{\eta_h + \varepsilon_h(1-f_1)}. \tag{14}$$

Table 1 shows, for illustrative but plausible values of σ, η, and ε, the equilibrium change in the price of home goods relative to that of non-oil tradeables. The conclusions are quite clear. In general a rise in world oil price sufficient by itself to increase real national income by 10 percent will necessarily raise home goods prices relative to those of tradeables. But given the magnitude of the shock, the size of the effect on home goods prices is surprisingly modest. Only in two cases out of the fourteen examined is this effect larger than 10 percent.

Table 1
Changes in the equilibrium price level of home goods *relative to the price level of non-oil tradeables*, for an oil shock equal to 10 percent of national income.

Assumed parameters				
Elasticities of demand for home goods		Elasticity of supply price	Weight of home-goods prices in wage index (f_1)	New equilibrium price level after oil shock ($P_h^0 = 1.00$)
Income	Price			
1	1	1	0.75	1.08
1	1	2	0.75	1.067
1	2	2	0.75	1.04
1	2	1	0.75	1.044
1	1	½	0.75	1.088
1	½	1	0.75	1.13
1	½	½	0.75	1.16
0.6	1	1	0.75	1.048
0.6	1	2	0.75	1.040
0.6	2	2	0.75	1.024
0.6	2	1	0.75	1.026
0.6	1	½	0.75	1.053
0.6	½	1	0.75	1.078
0.6	½	½	0.75	1.096

Table 2 explores another effect of interest of students of 'Dutch disease'. Obviously, a rise in home goods prices, relative to those of tradeables, creates an incentive to shift resources out of the production of tradeables and into that of home goods. It was, indeed, the decline in industrial output in the Netherlands that led to the baptism of 'Dutch disease'. The final column of table 2 depicts, for the combinations of parameters given, the amount of those shifts, expressed in percentage points of total initial national product. Here again the results are reassuring, with the resource shift in all cases being the equivalent of 2 percent of national output or less.

Also worthy of note is the fact that the results of table 2 depend only on the relative values of the price elasticities. That is to say, a doubling or halving of all price elasticities leaves the amount of the resource shift unchanged. This is evident once the expression for $\mathrm{d}p_h$ is inserted into eq. (2) [using eq. (6)], leading to

$$\mathrm{d}H^s = H^s E_1\,\mathrm{d}P_h(1-f_1) = \frac{H^s\varepsilon_h\sigma_h(1-f_1)}{\eta_h+\varepsilon_h(1-f_1)}\cdot\left(\frac{\mathrm{d}Z}{y}\right),$$

$$\frac{\mathrm{d}H^s}{y} = \left(\frac{H^s}{y}\right)\frac{\varepsilon_h\sigma_h(1-f_1)}{\eta_h+\varepsilon_h(1-f_1)}\left(\frac{\mathrm{d}Z}{y}\right). \tag{15}$$

Table 2

Amount of resources shifted out of this production of non-oil tradeables and into the production of home goods as a consequence of an oil shock equal to 10 percent of national income.

Assumed parameters: Elasticities of demand for home goods – Income	Price	Elasticity of supply price	Weight of home-goods prices in wage index (f_1)	Amount of resources shifted as percent of initial national product ($H_0^s=60$; $T_0^s=20$; $y_0=100$)
1	1	1	0.75	1.2
1	1	2	0.75	2.0
1	2	2	0.75	1.2
1	2	1	0.75	0.66
1	1	½	0.75	0.66
1	½	1	0.75	2.0
1	½	½	0.75	1.2
0.6	1	1	0.75	0.72
0.6	1	2	0.75	1.2
0.6	2	2	0.75	0.72
0.6	2	1	0.75	0.40
0.6	1	½	0.75	0.40
0.6	½	1	0.75	1.2
0.6	½	½	0.75	0.72

3. Adding monetary dynamics to the 'real' model

It takes little adaptation in order to introduce a plausible dynamics into the model of section 2. The principal changes are:

(a) To eliminate the requirement of continuous equality between money demand (M^d) and money supply (M^s). Instead we add terms to the demand equations for home goods and for tradeables; these terms state the increment to the demand for each of the two classes of goods that will take place as a consequence of the existence of a supply of money greater than what people want to hold (and vice versa for a shortfall in the money supply).

(b) To introduce a dynamic equation for the money supply, in which changes in international reserves cause the money supply to change in the same direction. In the simulations presented here, we work with the equation $M_j = M_{j-1} + B_j$, where M_j is the money supply at the end of period j and B_j is the balance of trade during period j. But with equal ease one can incorporate explicitly a distinction between money on the one hand and the monetary base on the other, with a 'money multiplier' as the link between the two.

(c) To introduce plausible lag patterns in the equations of the basic model. The establishment of specifically 'timed' relationships is, of course, essential once a dynamic focus is adopted. The key lagged relationships are:

(i) demand for home goods (H_j^d) and demand for tradeables (T_j^d) depend on last period's income (y_{j-1}) and on this period's relative prices ($P_{hj} - P_{tj}$).

(ii) transitory components in the demand for home goods (H_j^d) and for tradeables (T_j^d) appear whenever ($M_{j-1}^s - M_{j-1}^d$) is different from zero. These transitory components of demand are proportional to ($M_{j-1}^s - M_{j-1}^d$).

(iii) the wage of one period is based on the previous period's price levels of home goods and of tradeables.

The dynamic model is presented explicitly below, with j as the index for the time period.

Home Goods Demand:

$$H_j^d = a_0 - a_1(P_{hj} - P_{tj}) + a_2 y_{j-1} + a_3(M_{j-1}^s - M_{j-1}^d), \tag{1'}$$

Home Goods Supply:

$$H_j^s = h_0 + h_1(P_{hj} - w_j), \qquad H_j^s = H_j^d, \tag{2}$$

Tradeable Goods Supply:

$$T_j^s = c_0 + c_1(P_{tj} - w_j), \tag{3}$$

National Product Generated by 'Oil' (O)

$$Z_j = P_{0j} O_j, \tag{4}$$

Real Output:

$$y_j = H_j^s + T_j^s + Z_j, \tag{5}$$

Factor Costs or Wages:

$$w_j = f_1 P_{h,j-1} + (1 - f_1) P_{t,j-1}, \tag{6'}$$

Demand for Tradeables:

$$T_j^d = e_0 + a_1(P_{hj} - P_{tj}) + (1 - a_2) y_{j-1} + e_3(M_{j-1}^s - M_{j-1}^d), \tag{7'}$$

Balance of Trade:

$$B_j = T_j^s + Z_j - T_j^d, \tag{8}$$

World Price of Tradeables:

$$P_{tj} = \bar{P}_t, \tag{9}$$

Demand for Money:

$$M_j^d = k y_j [f_1 P_{h,j} + (1 - f_1) P_{t,j}], \tag{10}$$

Supply of Money:

$$M_j^s = M_{j-1}^s + B_j. \tag{11'}$$

There follow a series of simulations in which the dynamics implicit in the above model are worked out under a number of alternative assumptions. Simulations 1, 2, and 3 are all based on the assumption that the elasticities of demand and supply of home goods are equal to one, and that the income elasticities of both goods as well as the supply elasticity of tradeables are also equal to unity. (The demand elasticity for tradeables is 1.5 in these simulations, as determined by the Slutsky condition.)

In Simulation 1, it is posited that when the money supply is greater (less) than what people want to hold, they eliminate the excess (shortfall) in just one period. In Simulation 2, it is assumed that they only eliminate half of the excess or shortfall in the first period; then they eliminate half of any excess or shortfall that remains in the second period, etc.

In the three simulations, 1, 2, and 3, the equilibrium values of all the variables are the same. The dynamic paths of the variables, however, differ as among these simulations, because the speed with which excess money is spent is slower in Simulations 2 and 3 than in Simulation 1, and because the pattern in which excess money is spent differs as between Simulations 2 and 3. In Simulation 1, for example, the price level of home goods (P_h) rises to a maximum of 1.125 times the price level of tradeables, before adjusting (in a damped oscillatory process) to its final equilibrium level of 1.08 times P_t. In Simulation 2, P_h rises only to a maximum of 1.113 times P_t. This is exclusively due to the slower process of working off excess money balances.

Simulation 3 begins a series of experiments in which we make a conscious effort to increase both the response of P_h to the oil shock in the final equilibrium *and* the degree to which P_h overshoots its final equilibrium level in the process of adjustment. The first experiment (Simulation 3) involves increasing the share of excess money balances which is spent on home goods, and reducing correspondingly the share spent on tradeables. This should have the effect of 'bottling up' excess balances within the economy, and causing a somewhat greater overshoot. This is indeed the case, with P_h reaching 1.123 in Simulation 3 as against 1.114 in Simulation 2, but the magnitude of the effect is obviously not very great.

In Simulation 4 we extend the same sort of adjustment to the marginal proportions in which income is spent (for consumption and investment). These are changed (as against Simulation 3) from 0.6 and 0.4 for home goods and tradeables, respectively, to 0.8 and 0.2, implying an income elasticity of demand for home goods (in the neighborhood of the initial equilibrium) of 1.33, and an income elasticity of 0.5 for tradeables. This sort of pattern of income elasticities is quite implausible, as in general luxury goods tend to be concentrated among the tradeables. Yet the assumption is made in order to test the sensitivity of the results. In the particular case examined in Simulation 4, the equilibrium level of P_h moves from 1.08 to 1.107, while the maximum point on its time path shifts upward somewhat more sharply, from 1.123 to 1.184.

Simulations 5 and 6 experiment with changing price elasticities. Both are to be compared with Simulation 4. Starting from this base, Simulation 5 cuts in half all four price elasticities (those of supply and demand for both home goods and tradeables), while Simulation 6 reduces by one half only the two demand elasticities.

The effect of cutting price elasticities is much more marked than those of our earlier experiments. In Simulation 5 the equilibrium value of P_h moves up from 1.107 in Simulation 4 to 1.213, while its maximum value moves from 1.162 to 1.340.

Simulation 6 produces an equilibrium value of P_h equal to 1.178, as compared with 1.107 for Simulation 4. The increase in the maximum value is even sharper — from 1.162 to 1.297. It appears, then, that reducing demand elasticities has stronger effects in generating 'overshooting' than does a corresponding reduction of supply elasticities. [That changes in demand elasticities have a stronger effect on equilibrium values than corresponding changes in supply elasticities is evident from eq. (14). It is not self-evident that this should be true for the degree of overshooting as well, but that is the conclusion suggested by the comparison of Simulations 5 and 6.]

4. Introducing lags in supply response, plus greater long-run elasticity

In this section we try to zero in somewhat more carefully on parameter patterns that are likely to reflect reality. These diverge somewhat from the patterns used in earlier sections, which were intended mainly for the purpose of assessing the sensitivity of our results to changes in the values of particular parameters.

4.1. *Income elasticity of demand: 1.25 for tradeables, 0.83 for home goods*

These assumptions imply that marginal income is spent half on tradeables and half on home goods. Since the initial average propensities to spend (i.e., consume *and* invest) on the two classes of goods are 0.4 and 0.6, the stated elasticities emerge from the definition of income elasticity (=marginal propensity divided by average propensity). These figures were chosen because of our conviction that in general (for less developed countries) tradeable goods are somewhat more likely to fall in the luxury ($\sigma > 1$) category than non-tradeables, while at the same time the income elasticities of expenditure on all goods and services have to average to one.

4.2. *Price elasticity of demand: 0.6 for tradeables, 0.4 for home goods*

These assumptions imply a unitary elasticity of substitution between tradeables and non-tradeables. It is unlikely that the true elasticity is significantly greater than this, if only for the reason that any good that is a close substitute for an import or export commodity would normally be

classified with the tradeables. (The relative sizes of the two elasticities are determined by the Slutsky condition; they must be inversely proportional to the budget shares of the two groups of goods, and their sum must be equal to the elasticity of substitution.)

4.3. *Price elasticities of supply: Between 2.0 and 5.0 in the long run*

We know both from individual industry studies and from simulations that the elasticities of supply of individual industries as well as of large sectors of the economy tend to be significantly greater than unity. (In general, low elasticities appear only when activities are characterized by severe natural resource constraints.) At the same time, we know that there are severe limits to the amount by which the bulk of activities can be expanded within a short time (say, a year or so). Both of these appreciations of reality can be incorporated into our simulations by introducing lagged price terms in the supply function. In what follows we shall use the following lag distributions:

4L	0.25,	0.25,	0.25,	0.25		
4D	0.40,	0.30,	0.20,	0.10		
6L	0.167,	0.167,	0.167,	0.167,	0.167,	0.165
6D	0.35,	0.25,	0.16,	0.12,	0.08,	0.04.

This means that, for 4L, one-fourth of the total long-run effect of the change in price takes place in the first period (which in setting up the dynamics I have thought of as being something like a year); one-half takes place by the end of the second period, three-fourths by the end of the third, and the full effect by the end of the fourth period. For lag pattern 6L, the initial response is one-sixth of the long-run response, and an additional one-sixth is added each period. For the lag pattern 4D, we have 40 percent of the total response in the first period, 70 percent by the end of the second, 90 percent by the end of the third and 100 percent by the end of the fourth. In pattern 6D these cumulative percentages of the total effect are, for successive periods, 35, 60, 76, 88, 96, and 100 percent. We believe that these four response patterns are sufficiently different from each other to give us a good sense of how our results respond to plausible differences in response patterns, while at the same time reflecting our belief that long run supply elasticities are significantly greater than we would infer from the first period response.

4.4. *Coefficients of* $(M^s - M^d) = 0.25, 0.25$*, or, alternatively,* $0.5, 0.5$

These coefficients dictate the fraction of 'excess money supply' that will be reflected in spending on each of the two categories of goods within one period. Thus in the first case it is assumed that one quarter of the excess is spent on home goods, one quarter on tradeables, within one period. If this is the pattern, three-fourths of a given excess supply would be worked off after two periods, seven-eighths after three periods, etc., assuming no intervening or additional disturbances.

The alternative assumption, that all the excess is spent within one period, requires no elaboration.

4.5. *The money multiplier (money/international reserves)*

The monetary mechanism that is built into our simulations is that of a fixed exchange rate system. The ultimate reserves of such a system are gold and foreign currency, and they are acquired through surpluses in the balance of payments (balance of trade in the case of our model, since we abstract from voluntary capital movements). A money multiplier of unity is implicit in the equation $M_j^s = M_{j-1}^s + B_j$. To introduce a different multiplier, μ, this is altered to $M_j^s = M_{j-1}^s + \mu B_j$. In table 4 we explore the consequences of changing μ from 1.0 to 1.5.

4.6. *The oil shock*

In each of tables 3 and 4, allowance is made for the possibility of 'spreading' over time the response of the economy to the oil shock. This is accomplished by spending in the first period only a relatively small part of the shock, followed by steadily increasing fractions in subsequent periods, until finally the full effect of the assumed increment of oil prices is reflected. Three alternative patterns are explored:

(a) *Full Immediate Impact* (20, 30, 30, ...). Here the contribution of oil proceeds, which starts at 20 percent of the national product, goes immediately to 30 percent, and stays there.

(b) *Declining Increments* (20, 24, 27, 29, 30, ...). Here the path from a 20 percent to a 30 percent contribution of oil is spread out over four years, with successively smaller increments being reflected each year.

(c) *Equal Increments* (20, 22, 24, 26, 28, 30, ...). Here the shock is spread over a five-year period with equal increments in each.

Obviously, patterns (b) and (c) would entail accumulation of foreign reserves, if the actual oil-price rise was such as to permit pattern (a). The cumulative reserve accumulation under pattern (b) would be equal to 10 percent of GDP; that is, equal in size to one year's contribution of the oil shock itself. In the case of pattern (c) this accumulation of reserves would amount to 20 percent of GDP, or twice the annual contribution of the oil

Table 3

Maximum level reached by P_h during adjustment process; money multiplier = 1.

	Supply elasticity = 2 Lag pattern			
Oil shock	4L	4D	6L	6D
Coefficients of $(M^s - M^d) = 0.25, 0.25$				
20, 30, 30, ...	1.133	1.123	1.153	1.134
20, 24, 27, 29, 30, ...	1.108	1.110	1.127	1.117
20, 22, 24, 26, 28, 30, ...	1.114	1.107	1.122	1.112
Coefficients of $(M^s - M^d) = 0.5, 0.5$				
20, 30, 30, ...	1.167	1.129	1.204	1.139
20, 24, 27, 29, 30, ...	1.105	1.104	1.124	1.112
20, 22, 24, 26, 28, 30, ...	1.115	1.105	1.121	1.109
	Steady state = 1.093			
Maximum price rise/equilibrium price rise				
Coefficients of $(M^s - M^d) = 0.25, 0.25$				
20, 30, 30, ...	1.46	1.32	1.65	1.44
20, 24, 27, 29, 30, ...	1.16	1.18	1.37	1.26
20, 22, 24, 26, 28, 30, ...	1.23	1.15	1.31	1.20
Coefficients of $(M^s - M^d) = 0.5, 0.5$				
20, 30, 30, ...	1.79	1.39	2.19	1.49
20, 24, 27, 29, 30, ...	1.13	1.18	1.33	1.20
20, 22, 24, 26, 28, 30, ...	1.18	1.08	1.30	1.17

	Supply elasticity = 5 Lag pattern			
Oil shock	4L	4D	6L	6D
Coefficients of $(M^s - M^d) = 0.25, 0.25$				
20, 30, 30, ...	1.082	1.069	1.104	1.077
20, 24, 27, 29, 30, ...	1.064	1.063	1.082	1.069
20, 22, 24, 26, 28, 30, ...	1.064	1.060	1.072	1.065
Coefficients of $(M^s - M^d) = 0.5, 0.5$				
20, 30, 30, ...	1.091	1.078	1.121	1.087
20, 24, 27, 29, 30, ...	1.064	1.061	1.081	1.069
20, 22, 24, 26, 28, 30, ...	1.063	1.059	1.068	1.062
	Steady state = 1.051			
Maximum price rise/equilibrium rise				
Coefficients of $(M^s - M^d) = 0.25, 0.25$				
20, 30, 30, ...	1.61	1.35	2.04	1.51
20, 24, 27, 29, 30, ...	1.25	1.24	1.61	1.35
20, 22, 24, 26, 28, 30, ...	1.25	1.18	1.41	1.27
Coefficients of $(M^s - M^d) = 0.5, 0.5$				
20, 30, 30, ...	1.78	1.53	2.37	1.71
20, 24, 27, 29, 30, ...	1.25	1.20	1.59	1.35
20, 22, 24, 26, 28, 30, ...	1.24	1.16	1.33	1.22

Table 4
Maximum level reached by P_h during adjustment process; money multiplier = 1.5.

Oil shock	Supply elasticity = 2 Lag pattern 4L	4D	6L	6D
Coefficients of $(M^s - M^d) = 0.25, 0.25$				
20, 30, 30, ...	1.153	1.137	1.187	1.148
20, 24, 27, 29, 30, ...	1.113	1.110	1.133	1.119
20, 22, 24, 26, 28, 30, ...	1.117	1.109	1.124	1.113
Coefficients of $(M^s - M^d) = 0.5, 0.5$				
20, 30, 30, ...	1.153	1.160	1.261	1.174
20, 24, 27, 29, 30, ...	1.113	1.100	1.121	1.109
20, 22, 24, 26, 28, 30, ...	1.120	1.107	1.122	1.110
	Steady state = 1.093			

Oil shock	Supply elasticity = 5 Lag pattern 4L	4D	6L	6D
Coefficients of $(M^s - M^d) = 0.25, 0.25$				
20, 30, 30, ...	1.091	1.078	1.115	1.088
20, 24, 27, 29, 30, ...	1.068	1.064	1.087	1.071
20, 22, 24, 26, 28, 30, ...	1.065	1.061	1.072	1.065
Coefficients of $(M^s - M^d) = 0.5, 0.5$				
20, 30, 30, ...	1.091	1.078	1.155	1.087
20, 24, 27, 29, 30, ...	1.064	1.061	1.081	1.067
20, 22, 24, 26, 28, 30, ...	1.065	1.051	0.071	1.060
	Steady state = 1.051			

shock. Thus, although the time periods of spreading differ relatively little as between patterns (b) and (c) the effective amount of spreading is substantially greater in the latter case.

4.7. *Interpretation of tables 3 and 4*

Tables 3 and 4 summarize the results of 96 different simulations. We have focused on the maximum level reached by the price level of home goods during the initial overshoot (which invariably occurs in the cases investigated). The overshoot is, however, substantially more moderate than in the extreme examples of simulations 5 and 6. Moreover, adopting a gradual response to the oil shock succeeds in limiting the overshoot even further.

When a supply elasticity of 2 is used, and 25 percent of excess money holdings is spent on each good in each period, we are placed in the upper panels of tables 3 and 4. With full immediate impact of the oil shock, the biggest overshoot carries p_h to a maximum of 1.153 in table 3 (lag pattern 6L). This is reduced to 1.127 and 1.122 under gradual response with declining or with equal increments. The overshoots in these cases are very modest indeed, because the steady state level of p_h is 1.093.

A similar exercise for table 4 yields an overshoot to 1.187 in the full immediate impact case, reduced to 1.133 and 1.124 when a gradual adaptation to the oil shock is imposed.

The story is similar for the other cases examined in tables 3 and 4. Under the 20, 24, 27, 29, 30, ... pattern of gradual response to an oil shock, the maximum level of p_h never reaches a level as high as 1.127 in the remaining panels of table 1 nor a level as high as 1.133 in the remaining panels of table 2.

When a long-run elasticity of supply of 5.0 is assumed (which I believe to be more plausible than 2.0 in any event), the maximum points on the time path of p_h are as follows:

Nature of response to oil shocks	From table 3	From table 4
Full immediate impact (20, 30, 30, ...)	1.121	1.155
Gradual, declining increments (20, 24, 27, 29, 30, 30, ...)	1.082	1.087
Gradual, equal increments (20, 22, 24, 26, 28, 30, 32, ...)	1.072	1.072
Steady state (for reference)	1.051	1.051

The clear conclusion to be drawn from this exercise is that by adopting a gradual pattern of response to an oil shock the extent of overshooting can very likely be kept within modest and easily manageable limits.

5. Some concluding observations

The exercises that we have reported on here cover quite a wide range of possibilities, but obviously not the whole set of potentially interesting cases. In conversations with colleagues, I have found that the greatest interest in alternatives has to do with cases in which the government spends the 'oil money', Z, in a fashion somewhat different from that which our exercises have assumed.

The assumption implicit in our exercises is that the government spends the oil money in substantially the same pattern (as between tradeables and home goods) as consumers would have chosen. This assumption would obviously also hold in the case where the government simply gives the money to consumers to spend, either via direct transfer payments or via reductions in taxes.

The results of such an exercise can easily be predicted, without actually going through the exercise of a simulation. The key feature is that money that is spent abroad simply has (in the context of the model) no feedback to the local economy. Suppose, for example, that all of the oil proceeds were spent for military equipment in the international market-place. It would be 'as if' y had stayed constant at 100, as far as economic agents other than the government and the military were concerned. Old exports and old imports would continue as before, in balance as before. New oil exports would balance new imports of military hardware. There would be no added income received at home that would bid up the prices of home goods or change the allocation of resources as between H^s and T^s. The oil windfall would simply have been translated into a military equipment windfall.

Now if the expenditure were not on military hardware, but, say on productive capital goods (a steel plant??), the results, as far as the model is concerned would be the same. Obviously the long-term growth of the economy would be different with a steel plant than with military hardware, but in the period while the steel plant was being built and even in its first years of operation when profits would probably not yet be generated, there would be no serious difference between the two cases, so far as their impact on p_h and the other variables in the model are concerned.

Now if instead of spending the incremental revenues fully on foreign goods (or, what is the same thing, on tradeables, regardless of where they are produced) they had been spent fully on home goods, the effects on p_h would be just double those recorded in tables 3 and 4. The reason is that if all the money is spent on home goods, that particular source of disturbance is precisely twice as great as the corresponding one analyzed in tables 3 and 4 (where half of the 'autonomous' expenditure of oil proceeds goes to buy tradeables). At the same time the size of the increment to foreign exchange availability (dZ) that is 'available' to help adjust the balance of payments is now, in a sense, also twice what it was before. In the cases analyzed in tables 3 and 4, half of the proceeds of the oil shock simply disappeared overseas in the first round, as it were. But if the full proceeds are spent on home goods, the full counterpart of that expenditure is available in the form of foreign currency, to bring about the consequent balance-of-payments adjustment.

SIMULATION 1 — $\varepsilon_h=1$, $\varepsilon_t=1$, $\eta_h=1$, $\eta_t=1$, $\sigma_h=1$, $\sigma_t=1$, $a_3=0.6$, $e_3=0.4$.

OBS	PERIOD	OIL	HOMPRICE	INCOME	DHOMGOOD	SHOMGOOD	DTRDGOOD	STRDGOOD	TRD_BOP	DMONEY	SMONEY	MONEYDIF
1	0	20	1.00000	100.000	60.0000	60.0000	40.0000	20.0000	0.0000	20.0000	20.0000	0.0000
2	1	30	1.00000	110.000	60.0000	60.0000	40.0000	20.0000	10.0000	22.0000	30.0000	8.0000
3	2	30	1.09000	115.400	65.4000	65.4000	52.6000	20.0000	-2.6000	24.6379	27.4000	2.7621
4	3	30	1.12456	112.074	63.4236	63.4236	54.7385	18.6500	-6.0885	24.5087	21.3115	-3.1972
5	4	30	1.09109	107.992	59.8603	59.8603	49.0161	18.1316	-0.8845	23.0740	20.4270	-2.6470
6	5	30	1.06088	108.188	59.5539	59.5539	45.7910	18.6336	2.8426	22.6255	23.2696	0.6440
7	6	30	1.06699	110.366	61.2796	61.2796	47.5520	19.0867	1.5348	23.1823	24.8043	1.6221
8	7	30	1.08506	111.084	62.0892	62.0892	49.8991	18.9952	-0.9040	23.6343	23.9004	0.2661
9	8	30	1.08865	110.215	61.4912	61.4912	49.8593	18.7241	-1.1352	23.5087	22.7651	-0.7435
10	9	30	1.08060	109.517	60.8469	60.8469	48.6249	18.6702	0.0453	23.2275	22.8105	-0.4171
11	10	30	1.07573	109.707	60.9164	60.9164	48.1836	18.7910	0.6073	23.1876	23.4178	0.2302
12	11	30	1.07809	110.142	61.2774	61.2774	48.6602	18.8641	0.2040	23.3184	23.6218	0.3034
13	12	30	1.08151	110.205	61.3766	61.3766	49.0684	18.8287	-0.2397	23.3884	23.3821	-0.0063
14	13	30	1.08156	110.003	61.2258	61.2258	48.9732	18.7774	-0.1958	23.3464	23.1863	-0.1601
15	14	30	1.07980	109.894	61.1178	61.1178	48.7253	18.7766	0.0513	23.2943	23.2377	-0.0567
16	15	30	1.07911	109.959	61.1558	61.1558	48.6820	18.8030	0.1210	23.2967	23.3587	0.0620
17	16	30	1.07977	110.039	61.2262	61.2262	48.7947	18.8133	0.0186	23.3246	23.3773	0.0527
18	17	30	1.08038	110.036	61.2328	61.2328	48.8594	18.8034	-0.0560	23.3339	23.3213	-0.0125
19	18	30	1.08026	109.993	61.1987	61.1987	48.8250	18.7944	-0.0306	23.3228	23.2907	-0.0321
20	19	30	1.07990	109.979	61.1824	61.1824	48.7785	18.7961	0.0176	23.3138	23.3083	-0.0055
21	99	30	1.08000	110.000	61.2000	61.2000	48.8000	18.8000	-0.0000	23.3200	23.3200	-0.0000

SIMULATION 2 — $\varepsilon_h=1$, $\varepsilon_t=1$, $\eta_h=1$, $\eta_t=1.5$, $\sigma_h=1$, $\sigma_t=1$, $a_3=0.6$, $e_3=0.2$.

OBS	PERIOD	OIL	HOMPRICE	INCOME	DHOMGOOD	SHOMGOOD	DTRDGOOD	STRDGOOD	TRD_BOP	DMONEY	SMONEY	MONEYDIF
1	0	20	1.00000	100.000	60.0000	60.0000	40.0000	20.0000	0.0000	20.0000	20.0000	0.0000
2	1	30	1.00000	110.000	60.0000	60.0000	40.0000	20.0000	10.0000	22.0000	30.0000	8.0000
3	2	30	1.07000	114.200	64.2000	64.2000	48.8000	20.0000	0.2000	24.0381	30.2000	6.1609
4	3	30	1.11265	112.558	63.6091	63.6091	53.6713	18.9500	-4.7213	24.4138	25.4787	1.0649
5	4	30	1.10770	109.703	61.3928	61.3928	51.6988	18.3102	-3.3886	23.7129	22.0901	-1.6228
6	5	30	1.08485	108.629	60.2442	60.2442	48.6474	18.3845	-0.2630	23.1082	21.8272	-1.2811
7	6	30	1.07176	109.215	60.4874	60.4874	47.5007	18.7273	1.2266	23.0185	23.0537	0.0352
8	7	30	1.07307	110.079	61.1551	61.1551	48.0772	18.9236	0.8465	23.2223	23.9002	0.6779
9	8	30	1.07949	110.385	61.4812	61.4812	48.8365	18.9039	-0.0326	23.3932	23.8676	0.4744
10	9	30	1.08292	110.206	61.3982	61.3982	49.2242	18.8076	-0.4165	23.4119	23.4511	0.0392
11	10	30	1.08222	109.958	61.2019	61.2019	49.0235	18.7562	-0.2673	23.3478	23.1838	-0.1640
12	11	30	1.08021	109.879	61.1128	61.1128	48.7633	18.7667	0.0034	23.2980	23.1872	-0.1108
13	12	30	1.07920	109.939	61.1424	61.1424	48.6817	18.7968	0.1151	23.2939	23.3023	0.0084
14	13	30	1.07942	110.013	61.2010	61.2010	48.7424	18.8120	0.0696	23.3131	23.3719	0.0588
15	14	30	1.07999	110.035	61.2258	61.2258	48.8165	18.8087	-0.0078	23.3272	23.3641	0.0369
16	15	30	1.08026	110.016	61.2161	61.2161	48.8370	18.8001	-0.0369	23.3278	23.3272	-0.0005
17	16	30	1.08018	109.995	61.1989	61.1989	48.8170	18.7961	-0.0210	23.3219	23.3063	-0.0156
18	17	30	1.08000	109.989	61.1921	61.1921	48.7950	18.7973	0.0023	23.3178	23.3086	-0.0092
19	18	30	1.07993	109.995	61.1954	61.1954	48.7895	18.8000	0.0105	23.3178	23.3191	0.0013
20	19	30	1.07995	110.002	61.2005	61.2005	48.7955	18.8011	0.0056	23.3196	23.3247	0.0051
21	98	30	1.08000	110.000	61.2000	61.2000	48.8000	18.8000	0.0000	23.3200	23.3200	0.0000

SIMULATION 3 — $\varepsilon_h = 1$, $\varepsilon_t = 1$, $\eta_h = 1$, $\eta_t = 1.5$, $\sigma_h = 1$, $\sigma_t = 1$, $a_3 = 0.4$, $e_3 = 0.1$.

OBS	PERIOD	OIL	HOMPRICE	INCOME	DHOMGOOD	SHOMGOOD	DTRDGOOD	STRDGOOD	TRD_BOP	DMONEY	SMONEY	MONEYDIF
1	0	20	1.00000	100.000	60.0000	60.0000	40.0000	20.0000	0.0000	20.0000	20.0000	0.0000
2	1	30	1.00000	110.000	60.0000	60.0000	40.0000	20.0000	10.0000	22.0000	30.0000	8.0000
3	2	30	1.07667	114.600	64.6000	64.6000	49.4000	20.0000	0.6000	24.2379	30.6000	6.3621
4	3	30	1.12296	112.777	63.9274	63.9274	53.8536	18.8500	-5.0036	24.6355	25.5964	0.9609
5	4	30	1.11320	109.415	61.2589	61.2589	51.9990	18.1556	-3.8433	23.7407	21.7530	-1.9877
6	5	30	1.08290	108.182	59.8798	59.8798	48.5408	18.3020	-0.2388	22.9816	21.5142	-1.4673
7	6	30	1.06710	109.052	60.2959	60.2959	47.1523	18.7566	1.6043	22.9082	23.1185	0.2103
8	7	30	1.07113	110.241	61.2480	61.2480	47.9097	18.9934	1.0838	23.2245	24.2023	0.9778
9	8	30	1.08114	110.601	61.6676	61.6676	49.0627	18.9331	-0.1296	23.4662	24.0727	0.6064
10	9	30	1.08545	110.259	61.4759	61.4759	49.4280	18.7829	-0.6451	23.4650	23.4275	-0.0375
11	10	30	1.08321	109.866	61.1475	61.1475	49.0926	18.7182	-0.3743	23.3445	23.0532	-0.2913
12	11	30	1.07956	109.781	61.0291	61.0291	48.6909	18.7518	0.0609	23.2664	23.1141	-0.1523
13	12	30	1.07823	109.920	61.1137	61.1137	48.5911	18.8066	0.2154	23.2740	23.3295	0.0556
14	13	30	1.07912	110.053	61.2269	61.2269	48.7211	18.8265	0.1054	23.3169	23.4349	0.1181
15	14	30	1.08033	110.073	61.2594	61.2594	48.8531	18.8131	-0.0400	23.3409	23.3950	0.0541
16	15	30	1.08067	110.020	61.2251	61.2251	48.8745	18.7950	-0.0794	23.3353	23.3155	-0.0198
17	16	30	1.08029	109.977	61.1871	61.1871	48.8232	18.7900	-0.0332	23.3198	23.2823	-0.0375
18	17	30	1.07987	109.975	61.1792	61.1792	48.7791	18.7957	0.0166	23.3125	23.2990	-0.0135
19	18	30	1.07978	109.995	61.1928	61.1928	48.7754	18.8020	0.0266	23.3153	23.3256	0.0103
20	19	30	1.07993	110.009	61.2054	61.2054	48.7945	18.8033	0.0088	23.3206	23.3344	0.0138
21	99	30	1.08000	110.000	61.2000	61.2000	48.8000	18.8000	0.0000	23.3200	23.3200	0.0000

SIMULATION 4 — $\varepsilon_h = 1$, $\varepsilon_t = 1$, $\eta_h = 1$, $\eta_t = 1.5$, $\sigma_h = 1.33$, $\sigma_t = 0.5$, $a_3 = 0.8$, $e_3 = 0.2$.

OBS	PERIOD	OIL	HOMPRICE	INCOME	DHOMGOOD	SHOMGOOD	DTRDGOOD	STRDGOOD	TRD_BOP	DMONEY	SMONEY	MONEYDIF
1	0	20	1.00000	100.000	60.0000	60.0000	40.0000	20.0000	0.0000	20.0000	20.0000	0.0000
2	1	30	1.00000	110.000	60.0000	60.0000	40.0000	20.0000	10.0000	22.0000	30.0000	8.0000
3	2	30	1.12000	117.200	67.2000	67.2000	50.8000	20.0000	-0.8000	25.5496	29.2000	3.6504
4	3	30	1.18400	113.840	65.6402	65.6402	55.2102	18.2000	-7.0102	25.9101	22.1898	-3.7203
5	4	30	1.13647	107.148	59.9079	59.9079	50.2120	17.2400	-2.9720	23.6229	19.2177	-4.4051
6	5	30	1.06946	105.980	58.0266	58.0266	44.7161	17.9530	3.2369	22.3001	22.4546	0.1545
7	6	30	1.06694	109.849	60.8908	60.8908	45.2433	18.9581	3.7148	23.0728	26.1694	3.0966
8	7	30	1.11141	112.668	63.6720	63.6720	49.2735	18.9959	-0.2776	24.4164	25.8918	1.4754
9	8	30	1.13607	111.480	63.1507	63.1507	50.9927	18.3289	-2.6638	24.5712	23.2281	-1.3432
10	9	30	1.11860	108.952	60.9931	60.9931	49.1434	17.9590	-1.1844	23.7287	22.0437	-1.6850
11	10	30	1.09292	108.459	60.2383	60.2383	47.0288	18.2210	1.1922	23.2036	23.2359	0.0323
12	11	30	1.09146	109.912	61.3059	61.3059	47.1857	18.6062	1.4204	23.4902	24.6563	1.1661
13	12	30	1.10815	111.002	62.3735	62.3735	48.7047	18.6282	-0.0765	24.0011	24.5798	0.5788
14	13	30	1.11776	110.577	62.1988	62.1988	49.3816	18.3777	-1.0039	24.0685	23.5759	-0.4926
15	14	30	1.11139	109.618	61.3840	61.3840	48.7000	18.2336	-0.4663	23.7550	23.1096	-0.6454
16	15	30	1.10158	109.412	61.0827	61.0827	47.8895	18.3292	0.4397	23.5496	23.5493	-0.0003
17	16	30	1.10084	109.955	61.4790	61.4790	47.9326	18.4762	0.5436	23.6542	24.0929	0.4387
18	17	30	1.10711	110.376	61.8887	61.8887	48.5062	18.4874	-0.0178	23.8485	24.0751	0.2266
19	18	30	1.11085	110.225	61.8312	61.8312	48.7715	18.3934	-0.3781	23.8777	23.6970	-0.1807
20	19	30	1.10853	109.861	61.5234	61.5234	48.6204	18.3373	-0.1832	23.7606	23.5138	-0.2468
21	99	30	1.10667	110.000	61.6000	61.6000	48.4000	18.4000	-0.0000	23.7600	23.7600	-0.0000

SIMULATION 5 — $\varepsilon_h = 0.5$, $\varepsilon_t = 0.5$, $\eta_h = 0.5$, $\eta_t = 0.75$, $\sigma_h = 1.33$, $\sigma_t = 0.5$, $a_3 = 0.8$, $e_3 = 0.2$.

OBS	PERIOD	OIL	HOMPRICE	INCOME	DHOMGOOD	SHOMGOOD	DTRDGOOD	STRDGOOD	TRD_BOP	DMONEY	SMONEY	MONEYDIF
1	0	20	1.00000	100.000	60.0000	60.0000	40.0000	20.0000	0.0000	20.0000	20.0000	0.0000
2	1	30	1.00000	110.000	60.0000	60.0000	40.0000	20.0000	10.0000	22.0000	30.0000	8.0000
3	2	30	1.24000	117.200	67.2000	67.2000	50.8000	20.0000	-0.8000	27.6592	29.2000	1.5408
4	3	30	1.33988	112.996	64.7963	64.7963	53.9445	18.2000	-5.7445	28.3600	23.4555	-4.9045
5	4	30	1.23535	106.864	59.4131	59.4131	48.6787	17.4509	-1.2278	25.1453	22.2277	-2.9176
6	5	30	1.14087	107.166	58.9309	58.9309	45.0155	18.2349	3.2194	23.6977	25.4471	1.7494
7	6	30	1.17170	110.926	61.9813	61.9813	46.9340	18.9434	2.0095	25.0418	27.4566	2.4148
8	7	30	1.24225	112.116	63.4042	63.4042	49.9353	18.7123	-1.2230	26.4973	26.2335	-0.2638
9	8	30	1.24888	110.199	62.0158	62.0158	49.8369	18.1831	-1.6538	26.1537	24.5798	-1.5740
10	9	30	1.20833	108.784	60.6501	60.6501	47.9749	18.1334	0.1585	25.1561	24.7383	-0.4178
11	10	30	1.18967	109.440	61.0026	61.0026	47.3631	18.4375	1.0744	25.0016	25.8127	0.8111
12	11	30	1.20781	110.544	61.9667	61.9667	48.2845	18.5775	0.2930	25.5546	26.1057	0.5511
13	12	30	1.22587	110.542	62.1003	62.1003	48.9950	18.4414	-0.5536	25.8535	25.5521	-0.3014
14	13	30	1.22124	109.861	61.5552	61.5552	48.6852	18.3060	-0.3792	25.6181	25.1729	-0.4451
15	14	30	1.20851	109.618	61.2775	61.2775	48.1385	18.3407	0.2022	25.3521	25.3751	0.0229
16	15	30	1.20674	109.947	61.5107	61.5107	48.1304	18.4362	0.3057	25.3989	25.6808	0.2819
17	16	30	1.21391	110.215	61.7657	61.7657	48.4631	18.4494	-0.0136	25.5795	25.6672	0.0877
18	17	30	1.21759	110.110	61.7146	61.7146	48.5882	18.3957	-0.1925	25.6159	25.4747	-0.1412
19	18	30	1.21452	109.908	61.5398	61.5398	48.4293	18.3681	-0.0612	25.5181	25.4134	-0.1047
20	19	30	1.21115	109.899	61.5079	61.5079	48.2952	18.3911	0.0959	25.4606	25.5093	0.0487
21	99	30	1.21333	110.000	61.6000	61.6000	48.4000	18.4000	0.0000	25.5200	25.5200	0.0000

SIMULATION 6 — $\varepsilon_h = 1$, $\varepsilon_t = 1$, $\eta_h = 0.5$, $\eta_t = 0.75$, $\sigma_h = 1.33$, $\sigma_t = 0.5$, $a_3 = 0.8$, $e_3 = 0.2$.

OBS	PERIOD	OIL	HOMPRICE	INCOME	DHOMGOOD	SHOMGOOD	DTRDGOOD	STRDGOOD	TRD_BOP	DMONEY	SMONEY	MONEYDIF
1	0	20	1.00000	100.000	60.0000	60.0000	40.0000	20.0000	0.0000	20.0000	20.0000	0.0000
2	1	30	1.00000	110.000	60.0000	60.0000	40.0000	20.0000	10.0000	22.0000	30.0000	8.0000
3	2	30	1.16000	119.600	69.6000	69.6000	48.4000	20.0000	1.6000	26.7904	31.6000	4.8096
4	3	30	1.29697	118.218	70.6185	70.6185	53.7911	17.6000	-6.1911	28.9099	25.4089	-3.5010
5	4	30	1.27931	108.940	63.3947	63.3947	51.3228	15.5454	-5.7774	26.3522	19.6315	-6.7207
6	5	30	1.15938	102.804	56.9940	56.9940	45.2253	15.8104	0.5850	23.0187	20.2165	-2.8021
7	6	30	1.07971	105.220	57.6105	57.6105	42.3918	17.6093	5.2175	22.3020	25.4340	3.1320
8	7	30	1.11409	112.063	63.2586	63.2586	45.0931	18.8043	3.7112	24.3304	29.1452	4.8148
9	8	30	1.20707	115.579	67.2900	67.2900	49.5877	18.2886	-1.2991	26.7057	27.8461	1.1405
10	9	30	1.25215	112.705	65.8108	65.8108	50.9083	16.8939	-4.0144	26.8037	23.8318	-2.9719
11	10	30	1.21259	107.626	61.4086	61.4086	48.3242	16.2178	-2.1065	24.9573	21.7253	-3.2320
12	11	30	1.14536	105.966	59.1548	59.1548	45.2395	16.8112	1.5716	23.5036	23.2969	-0.2067
13	12	30	1.12387	108.711	60.8913	60.8913	44.8680	17.8197	2.9517	23.7621	26.2486	2.4865
14	13	30	1.16147	112.256	64.1139	64.1139	47.0836	18.1419	1.0584	25.1700	27.3070	2.1369
15	14	30	1.20867	112.832	65.2541	65.2541	49.1386	17.5780	-1.5607	26.0981	25.7463	-0.3518
16	15	30	1.21527	110.396	63.5261	63.5261	48.9542	16.8700	-2.0842	25.6440	23.6621	-1.9819
17	16	30	1.18243	108.029	61.2585	61.2585	47.1557	16.7709	-0.3847	24.5620	23.2774	-1.2847
18	17	30	1.15117	108.124	60.8608	60.8608	45.8840	17.2636	1.3796	24.0766	24.6570	0.5804
19	18	30	1.15296	110.106	62.3750	62.3750	46.3297	17.7325	1.4028	24.5478	26.0597	1.5119
20	19	30	1.17976	111.608	63.9027	63.9027	47.7168	17.7056	-0.0112	25.3311	26.0486	0.7174
21	199	30	1.17778	110.000	62.6667	62.6667	47.3333	17.3333	0.0000	24.9333	24.9333	0.0000
22	200	30	1.17778	110.000	62.6667	62.6667	47.3333	17.3333	-0.0000	24.9333	24.9333	-0.0000

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