Structural Change and Economic Behaviour: The Case of UK Exports

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Abstract
In this paper, we make use of the sequential testing procedure which dates unknown break points proposed in Banerjee and Urga (1995a,b) to analyze UK export behaviour. We show that the evidence points to a structural shift in 1979. Although there is some support for a supply-side interpretation in that there have been changes in the behaviour of prices, this does not appear to be closely associated with the changes in export behaviour and there appears to have also been a shift in the underlying demand for UK exports. We also find that variables which proxy changes in the quality of UK exports, or other supply-side influences, do not properly account for the observed structural break in UK export performance.

1. Introduction

A thorough understanding of export behaviour is central to managing the macroeconomy as the balance of trade is an important indicator of the relevance of supply constraints within the economy at any point in time. Judgments about the control of inflation and the desirability of fiscal expansion or contraction hinge crucially on our assessment of the ability of the economy to expand in a non-inflationary way and this follows from our assessment of the ability of the supply side of the economy to respond positively to economic events. The traditional view of export determination has been widely attacked over the last decade however. Traditional models have related exports to world trade and some measure of relative competitiveness. Measures of the UK export share of world trade reveal a declining trend for much of the post-war period. However more recent data has suggested a stabilisation of this trend. Empirical estimation of export equations over the period of declining share tended to produce a freely estimated coefficient of less than unity with respect of exports to world trade. Alternatively the phenomenon of declining share could be represented as a secular effect through the inclusion of a deterministic time trend. The stabilisation of the UK export share in the 1980s has been interpreted as a structural shift in export behaviour. In a recent paper Banerjee and Urga (1995b) applied a new sequential test procedure for detecting structural breaks and demonstrated that there was indeed a highly significant structural break in 1980.

There are however a number of explanations for this break which have been put forward in recent years. Some investigators have allowed for shifts in behaviour through rolling regressions, recursive techniques and stochastic time trends (e.g. Landesman and Snell, 1989; Anderton, 1992). This is not really an explanation but simply a recognition that a break exists which we can not explain. Others (e.g. Blake and Pain, 1994) have argued that export relationships have been mis-specified and have suggested additional variables such as research and development expenditure, or cumulated investment as a measure of non-price competitiveness. Research in a similar spirit has been carried out by Owen and Wren-Lewis (1992) and Allen and Whitley (1994). Blake and Pain (1994) argue, in particular, that there has been a structural break in the export demand relationship during 1981 which can be explained by these missing regressors. Yet another view advanced by Holly and Wade (1991) points to a shift in supply-side factors as the cause of a structural shift.

In this paper we use the methodology developed by Banerjee and Urga (1995a,b) to date unknown breaks to investigate these possible explanations of the change in export performance. We argue that the evidence points to a structural shift in 1979 and although there is some support for the supply-side interpretation of Holly and Wade (1991) this can not fully account for the structural shift which has been observed. Furthermore we find that the inclusion of missing variables such as cumulated investment as suggested by Blake and Pain does not eliminate the case for a structural break in UK export performance.

The paper is set out as follows. In section 2 we outline the procedure for investigating structural change through the endogenous sequential testing procedure proposed by Banerjee and Urga (1995b). Section 3 of the paper applies this methodology to UK export performance. We perform structural change investigations on the underlying demand schedule, the price setting schedule and the reduced form of the system to show how some structural breaks are associated with the behaviour of relative prices and, by association, with the supply side, but that changes in relative price behaviour leaves unexplained a residual shift in UK export behaviour. We go on to show how the introduction of non-price competitiveness measures reduces the degree of misspecification but does not eliminate the finding of structural breaks. We also find that there is some evidence of pricing to market in respect of exchange rate changes which reduces the role of investment measures but which also do not eliminate the case for a more general structural break around 1979. Although this period also coincided with a dock strike this timing effect on exports should not have affected the mean of the export series. The final section of the paper draws conclusions.

2. The endogenous sequential test procedure

The traditional approaches to testing for structural breaks require the *a priori* knowledge of the timing of the potential breakpoint and they are based around a single equation framework (eg. Holly and Wade (1991)) and do not allow for the possibility of distinct structural breaks affecting different parts of a system of equations at different points of time. More recent work such as, Landesmann and Snell (1989), Anderton (1992) and Blake and Pain(1994) use, respectively, rolling regression, stochastic trend, and Hansen (1992) and Gregory/Hansen (1992) stability tests for integrated regressors to overcome some of these disadvantages. The procedures developed by Banerjee and Urga (1995) are related to these techniques but are specifically designed to deal with a more general class of possible behaviour. In this general case they allow for the breaks in the marginal and conditional processes to be distinct. By prior estimation of the break in the marginal process they are able to incorporate this information in determining the timing of any break in the conditional process. The more formal representation of the problem is given by a data generating process (DGP) which, under the null hypothesis, is in the form of a bivariate cointegrated system with I(1) variables with an alternative where the system is allowed to be structurally broken.

Thus let us consider the following DGP:

$$y_t = \beta x_t + \gamma D_t^1 + u_{2t}$$

$$x_t = \rho_1 x_{t-1} + \rho_2 \Delta y_t + \gamma_2 D_t^2 + u_t$$

where $y_0 = x_0 = 0$ and D^i_t are dummy variables such that

$D^1_t = 1$ if $t>k_1$, else $D^1_t = 0$
$D^2_t = 1$ if $t>k_2$, else $D^2_t = 0$, $k_1 \neq k_2$.

The idea behind this specification is that y_t is the variable of interest and x is the set of variables which we are using to explain y_t. x_t are generated by a set of marginal processes and then y_t is conditioned on x_t. This model allows for the possibility that x_t is either weakly or strongly exogenous with respect to y_t. x_t is strongly exogenous for the parameter of interest in the conditional model if $\rho_2 = 0$, otherwise x_t is only weakly exogenous. Standard t tests on ρ_2 therefore represents tests of weak or strong exogeneity. The parameter ρ_1 is important in determining the stationarity or non-stationarity of the system as the only source of unit roots in this system is from the marginal processes. Under the null hypothesis $\gamma_1 = \gamma_2 = 0$, there are no structural breaks. The idea is to estimate the model under all possible assumptions about the timing of the possible break points. We may then select the most significant combination of breaks as the likely true break point. Of course a complication arises that with so many tests being performed conventional critical values would not be appropriate and so relevant critical values are calculated using Monte Carlo methods. In Banerjee and Urga (1995a) it is shown that searching for all possible pairs of break-points unconditionally, computing the F test $\gamma_1=\gamma_2 = 0$, and identifying break points where the F-statistic is a maximum, is extremely intensive in terms of computer time. Instead a two-stage procedure is proposed. In the first stage sequential procedures are used in the marginal models to date the marginal breaks. The results of this test are then incorporated in the reduced form of the conditional model where a linear combination of breaks is considered. This two stage analysis is applied to the behaviour of UK exports.

This test is appropriate for examining breaks in the mean of an I(1) series but not for breaks in trend (although it can easily be extended to this case by considering the procedure in first differences). The method identifies the most important break only. The power of the test is weaker towards the end of the sample. Hence it is important to test the sensitivity of the results to truncated sample periods. In our empirical example below, truncating the sample may then reveal a different break in mean; this can be interpreted as the next most important period of break.

3. The case of UK exports

Banerjee and Urga (1995b) examine the question of stability in the conventional export equation. They show that while the traditional model relates exports to world trade with an elasticity which is clearly less than unity a much better specification relates exports to world (or G6) GNP and in this case a unit elasticity in the long run is clearly acceptable over the whole sample (see figure

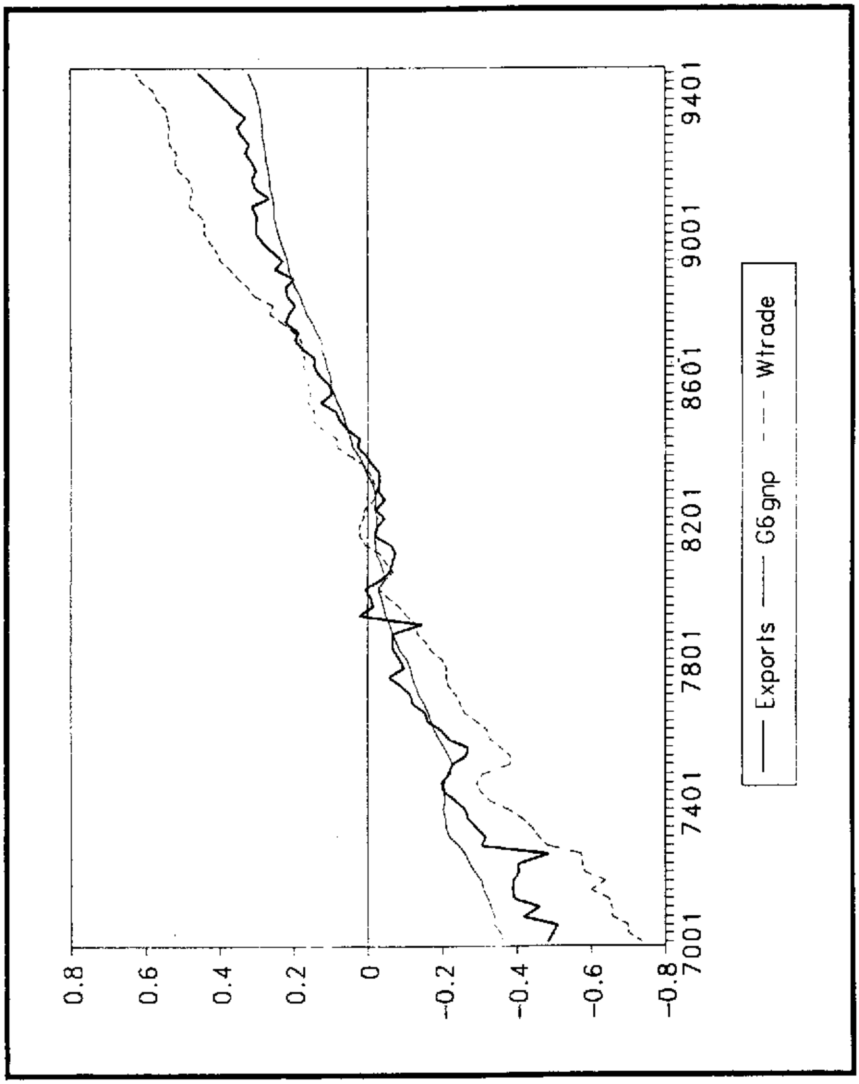

Figure 1: Comparing Exports G6 GNP and World Trade

1 for a graphical illustration of this point). This result alone is of some considerable interest although it is not un-intuitive. World trade has traditionally grown much faster than world GNP but much of this growth is located in new and emerging markets such as the far east and the Pacific rim. As an old and well established trading nation it may not be reasonable to expect the UKs trade to grow in line with these new markets. Retaining our markets may only imply growing in line with GNP generally and not keeping pace with world trade. It is also instructive to think of the specification of the rest of the world's imports from the UK equations (which are after all just the reverse of our export equations) and these would clearly normally be related to the foreign countries demand rather than their levels of trade. So again GNP seems a more reasonable scale variable on *a priori* grounds. The long-run export equation can therefore be written as:

X-Y= f(PD-PF), where[2]

X = log of exports of goods and services
Y = log (GNP for the G6 economies)
PD = log(Domestic prices)
PF = log(World prices)

This relationship is commonly interpreted as a demand relationship. Banerjee and Urga (1995b) investigate the structural stability of this basic model, the results support the view that (PD-PF) is strongly exogenous and that it is an integrated series with a break in the marginal model for the relative price term dated at 1984:4. They then test the conditional model subject to the existence of this break in pricing behaviour and find that there is a break in 1979:1 (Equation (2) in Banerjee and Urga, 1995b) .

These results leave open the question of whether there is a structural break in the underlying demand relationship, in the determination of supply or if something is simply omitted from the model. The issue that we are concerned with in this paper is whether structural shifts in this relationship can be seen as arising from demand influences, supply influences or if there is a true structural shift. Plots of the relevant series show that they are likely to be integrated of order 1 with breaks in mean and (or) trend. We will not report formal stationarity tests although these do confirm that all the series we will be examining are non-stationary when no allowance is made for structural breaks. This conclusion can only be changed with an implausibly large number of structural break dummies.

One way of disentangling the question of supply or demand side breaks is to consider the stability of the full reduced form of the export relationship in comparison with the stability of the conditional and marginal models. A break in the marginal process for relative prices is consistent with a shift in export pricing behaviour and hence is essentially a supply shift. While a break in the conditional model for exports conditioned on prices suggests a demand shift.

Let the underlying structural demand equation be of the log-linear form:

$$x_t^d = \alpha_0 + \alpha_1(p_t^x - p_t^f) + \alpha_2 z_t$$

where x^d_t is the demand for exports, p^x_t is the export price, p^f_t is the foreign price and z_t is world demand. We expect $\alpha_1 \leq 0$ and $\alpha_2 \geq 0$.

The implicit assumption required to generate behaviour of actual exports consistent with this equation is that export supply is perfectly elastic at the going price, and this in turn requires export prices to be determined by domestic prices and not world prices. Otherwise actual exports are influenced by supply behaviour; hence we need to specify an export supply relationship. Holly and Wade (1990) show that this can be derived from a restricted profit function and can be represented as:

$$x_t^s = \beta_0 + \beta_1(p_t^x - p_t^d) + \beta_2(y_t/k_t) + \beta_3(p_t^x - c_t)$$

where p^d_t is the domestic price, (y/k_t) the ratio of output to capital representing the pressure of demand and c_t the level of domestic costs. We expect β_1, $\beta_2 \geq 0$ and $\beta_3 \leq 0$.

The reduced form of this system for the volume of exports can be written as:

$$x_t = \gamma_0 - \frac{\beta_1}{(1-\pi)}p_t^d + \frac{\beta_2}{(1-\pi)}(y_t/k_t) - \frac{\beta_3}{(1-\pi)}c_t - \frac{(\beta_1+\beta_2)}{(1-\pi)}p^f - \frac{\alpha_2}{\alpha(1-\pi)}z_t$$

$$\text{where} \quad \pi = \frac{\beta_1 + \beta_2}{\alpha_{11}}$$

More generally:

$$x_t = \gamma_0 + \gamma_1 p_t^d + \gamma_2(y_t/k_t) + \gamma_3 c_t + \gamma_4 p^f + \gamma_5 z_t$$

The structural parameters of demand and supply are identifiable from this reduced form although it is not possible to sign the reduced form parameters on domestic prices or costs. This represents the traditional problem of identifying reduced form quantity responses when the relative magnitudes of demand and supply price elasticities are unknown. Since β_1 and β_2 are positive and α_1 is negative π is also negative but the sign of the reduced form γ coefficients depends on whether π exceeds unity; i.e. whether the sum of the supply elasticities exceeds the absolute value of the price elasticity of demand.

We begin by testing this basic model of exports to see if the structural break which was observed by Banerjee and Urga(1995b) in the demand model can be associated either with pure demand effects or if it is coming from a possible omitted supply side effect. The results of the testing procedures are reported in Table 1a. In the top half of this table we summarize the models for the marginal variables which explain exports. This shows that foreign income and prices are strongly exogenous, but as we would expect, domestic prices and costs are not. The marginal processes show a break in foreign and domestic prices occurring in 1978:3 and 1978:4 respectively with a break in domestic costs in 1977:2 and much later in the foreign and domestic income variables . The next stage is to substitute these breaks into the conditional model and repeat the sequential testing procedure to see if there is a break in the conditional model even once these marginal breaks are allowed for. This process finds a structural break at 1979:1 in the reduced form export model.

We can shed further light on possible reasons for this shift by estimating an export price equation (see Table 2) where export prices are related to domestic prices and costs, foreign prices and domestic capacity pressure. If exporters have changed their pricing behaviour we would expect to find a structural shift in export pricing. However estimation of the marginal and conditional models for export prices confirms that although there are marginal breaks around 1978-9 the conditional break is dated as late as 1992 and less confidence can be placed in

Table 1a: The Reduced Form Export Equation
Marginal Models

variable	*PF*	*YF*	*PD*	*Y*	*PDC*
date of break	D^2	D^3	D^4	D^5	D^6
	1978:3	1982:4	1978:4	1984:2	1977:2
	(6.7)	(4.6)	(4.7)	(2.8)	(3.1)
strongly exogenous	YES	YES	NO	YES	NO

The Conditional Model for Exports, Conditional Break=1979:1 (D^1)

$$X = \underset{(2.2)}{2.27} + \underset{(4.4)}{0.11D^1_t} + \underset{(4.6)}{0.5X_{t-1}} - \underset{(1.44)}{0.15PF_{t-1}} + \underset{(2.36)}{0.87YF_{t-1}} + \underset{(0.83)}{0.09PD_{t-1}} - \underset{(1.7)}{0.31Y_{t-1}} + \underset{(2.03)}{0.23PDC_{t-1}}$$

$$- \underset{(3.84)}{0.08D^2_t} + \underset{(0.8)}{0.01D^3_t} + \underset{(6.7)}{0.19D^4_t} + \underset{(0.3)}{0.004D^5_t} + - \underset{(3.4)}{0.06D^6_t}$$

Notes: 1 t-statistics (absolute values) in parenthesis
2 Variables are defined as above, all variables are in logs.

Table 1b: The Reduced Form Export Equation with the Real Exchange Rate added Marginal Models

variable	*PF*	*YF*	*PD*	*Y*	*PDC*	*UKRX*
date of break	D^2	D^3	D^4	D^5	D^6	D^7
	1978:3	1982:4	1978:4	1984:2	1977:2	1980:4
	(6.7)	(4.6)	(4.7)	(2.8)	(3.1)	(3.7)
strongly exogenous	YES	YES	NO	YES	NO	NO

The Conditional Model for Exports, Full Sample Conditional Break=1989:2 (D^1)
Last 22 Observations Dropped Break=1979:2(D^1)

$$X = \underset{(1.6)}{1.92} + \underset{(3.1)}{0.05D^1_t} - \underset{(1.7)}{0.17X_{t-1}} - \underset{(8.66)}{0.98PF_{t-1}} + \underset{(3.5)}{0.87YF_{t-1}} + \underset{(4.0)}{0.33PD_{t-1}} - \underset{(2.2)}{0.38Y_{t-1}} + \underset{(1.5)}{0.18PDC_{t-1}}$$

$$+ \underset{(7.8)}{0.26UKRX_{t-1}} - \underset{(5.8)}{0.08D^2_t} - \underset{(2.5)}{0.03D^{3t}} + \underset{(10.5)}{0.17D^{5t}} + \underset{(2.8)}{0.03D^5_t} - \underset{(3.8)}{0.04D^6_t} + \underset{(2.1)}{0.02D^7_t}$$

Notes: 1 t-statistics (absolute values) in parenthesis
2 Variables are defined as above, all variables are in logs.

Table 2: The Export Price Equation
Marginal Models (1975:1 - 1994:3)

Variable	*PFPX*	*CPXA*	*PDC*	*Y*	*UKRX*
date of break	D^2 1978:3 (4.9)	D^3 1980:4 (4.0)	D^4 1977:2 (3.6)	D^5 1979:1 (4.9)	D^6 1980:4 (3.7)
strongly exogenous	NO	NO	NO	NO	NO

Conditional model without the real exchange rate
Conditional break=1992:1 (D^1)

$$PX = \underset{(1.0)}{-\,0.6} + \underset{(3.4)}{0.03D^1_t} + \underset{(14.7)}{1.03PX_{t-1}} - \underset{(1.6)}{0.15PFPX_{t-1}} + \underset{(0.01)}{0.003CPXA_{t-1}} + \underset{(0.09)}{0.09PDC_{t-1}}$$

$$+ \underset{(0.04)}{0.04Y_{t-1}} - \underset{(0.1)}{0.001D^2_t} - \underset{(0.5)}{0.005D^3_t} - \underset{(0.6)}{0.008D^4_t} + \underset{(0.01)}{0.0002D^5_t}$$

Conditional model with the real exchange rate
Conditional break = 1992:1 (D^1)

$$PX = \underset{(4.3)}{-3.3} + \underset{(4.5)}{0.04D^1_t} + \underset{(11.9)}{0.87PX_{t-1}} + \underset{(0.1)}{0.01PFPX_{t-1}} + \underset{(4.9)}{0.41CPXA_{t-1}} + \underset{(4.6)}{0.61PDC_{t-1}}$$

$$+ \underset{(1.18)}{0.06Y_{t-1}} + \underset{(5.0)}{0.5UKRX_{t-1}} - \underset{(1.4)}{0.01D^2_t} - \underset{(0.27)}{0.003D^3_t} + \underset{(0.85)}{0.009D^4_t} + \underset{(1.4)}{0.01D^5_t} + \underset{(1.0)}{0.01D^6_t}$$

Notes: 1 t-statistics (absolute values) in parentheses
2 Variables are defined as above, all variables in logs

estimates of breaks near the end of the sample. Moreover the marginal break points are not statistically significant in the conditional model which suggests that there has been no shift in the relationship of export prices to domestic costs, foreign prices or domestic demand, although the means of the component series of relative prices and costs all shifted in the late 1980s. So we may conclude that the structural breaks in export behaviour do not seem to be associated with breaks in pricing and supply behaviour.

So we may conclude that the basic export equation exhibits a break which seems to be associated with a structural change in demand behaviour during 1979-80. However the possibility still exists that some other variable may have been the cause of this break and that the main problem is simply an omitted variable and not a structural shift. We now turn to this possibility.

Blake and Pain (1994) argue that the

structural break in export behaviour is related to the exclusion of measures of price competitiveness such as cumulative investment, R and D or foreign direct investment. We test this explanation by re-estimating the reduced form model with the addition of a variable measured as the five year cumulative level of gross investment (this is the variable which has been traditionally used to capture this effect). Note that this variable can be given either a demand or a supply side interpretation. The demand side association (see Owen and Wren-Lewis (1993)) is usually in terms of a measure of non-price competitiveness but an increase in the stock of capital can also be interpreted as an increase in output supply enabling more exports to be supplied at any given price. The results of testing the model which includes cumulated investment are reported in Table 3. The marginal process for cumulated investment shows a break at 1979:3 and it proves to be strongly exogenous. The new variable is statistically significant when included in the conditional model and the conditional shift dummy is dated 1989:1. So this variable has removed the 1980 period as the most important structural break in the sample. Clearly this variable does have some power in explaining the break. However as this procedure only detects the most important break in a sample this does not mean there is no significant break in 1980. One way of testing this possibility is to exclude the detected break from the sample. This can be done by truncating the sample by dropping the last 22 observations (as reported in the lower part of Table 3). This then produces an estimate of a conditional break in 1979:4, the original break point. We therefore conclude that cumulated investment does provide a partial

Table 3: The Reduced Form Export Equation with Cumulated Investment
Marginal Model for Cumulated Investment

variable	*RINV*
date of break	D^8
	1979:3
	(6.67)
strongly exogenous	YES

The Conditional Model for Exports with Cumulated Investment
Full Sample Conditional Break = 1989:1 (D^1)
Last 22 Observations Dropped Break = 1979:4 (D^1)

Export Equations (last 22 observations dropped)

$$X = \underset{(5.4)}{9.05} - \underset{(3.4)}{0.08D^1_t} + \underset{(0.9)}{0.11X_{t-1}} - \underset{(3.9)}{0.60PF_{t-1}} + \underset{(2.5)}{0.91YF_{t-1}} + \underset{(3.2)}{0.40PD_{t-1}} - \underset{(2.1)}{0.49Y_{t-1}}$$

$$+ \underset{(1.9)}{0.36PDC_{t-1}} - \underset{(2.1)}{0.4RINV_{t-1}} - \underset{(4.7)}{0.09D^2_t} + \underset{(0.3)}{0.005D^3_t} + \underset{(6.6)}{0.14D^4_t} + \underset{(2.0)}{0.03D^5_t} - \underset{(4.4)}{0.07D^6_t} - \underset{(0.3)}{0.007D^8_t}$$

Notes: 1 t-statistics (absolute value) in parenthesis;
2 Variables are defined as above, all variables in logs

Table 4: The Reduced Form Export Equation with Cumulated Investment and the Real Exchange Rate

Full Sample Conditional Break = 1989:2 (D^1)

$$X = \underset{(1.4)}{1.43} + \underset{(2.8)}{0.04D^1_t} - \underset{(1.1)}{0.1X_{t-1}} - \underset{(6.8)}{0.73PF_{t-1}} + \underset{(4.0)}{1.14YF_{t-1}} + \underset{(2.3)}{0.23PD_{t-1}} + \underset{(1.1)}{0.18Y_{t-1}} + \underset{(1.6)}{0.23PDC_{t-1}}$$

$$\underset{(0.86)}{-0.10RINV_{t-1}} + \underset{(6.6)}{0.20UKRX} - \underset{(5.5)}{0.09D^2_t} - \underset{(2.3)}{0.03D^3_t} + \underset{(9.1)}{0.16D^4_t} + \underset{(1.4)}{0.02D^5_t} - \underset{(3.6)}{0.05D^6_t} - \underset{(0.6)}{0.01D^7_t} + \underset{(0.4)}{0.01D^8_t}$$

Last 22 Observations Dropped, Break = 1979:2 (D^1)

$$X = \underset{(2.3)}{3.2} + \underset{(3.2)}{0.06D^1_t} - \underset{(1.6)}{0.16X_{t-1}} - \underset{(8.5)}{1.1PF_{t-1}} + \underset{(4.1)}{1.09YF_{t-1}} + \underset{(3.5)}{0.29PD_{t-1}} + \underset{(1.1)}{0.21Y_{t-1}} + \underset{(2.2)}{0.31PDC_{t-1}}$$

$$\underset{(2.0)}{-0.34RINV_{t-1}} + \underset{(7.8)}{0.27UKRX} - \underset{(5.8)}{0.08D^2_t} - \underset{(3.2)}{0.04D^3_t} + \underset{(10.9)}{0.17D^4_t} + \underset{(1.2)}{0.02D^5_t} - \underset{(3.3)}{0.04D^6_t} - \underset{(0.5)}{0.01D^7_t} + \underset{(0.6)}{0.01D^8_t}$$

Notes: 1 t-statistics (absolute values) in parentheses
2 Variables are defined as above, all variables in logs

1980 but that this explanation is by no means complete and that even once an allowance for this variable is made in the model there is still evidence of a change in behaviour in 1980.

Finally we consider the possibility of pricing to markets and the notion that exporters may not fully adjusted export prices in the light of exchange rate changes by including the exchange rate in the model. The marginal process for the exchange rate shows a structural break in 1984:4 (Table 1b) but the conditional break remains unaffected at 1979. So within the context of the simple exchange rate model exchange rate behaviour can not explain the 1980 break. We can then go on to combine this explanation with the cumulated investment effect. This is done in table 4 where over the whole sample period the inclusion of the exchange rate in the conditional model makes the cumulative investment term statistically insignificant but the conditional break is still estimated to have occurred in 1989 (1989:2). Trimming the sample to exclude the final 22 observations (see the lower part of table 4) makes cumulative investment marginally significant and once more delivers a conditional break estimate in 1979 (1979:2). The marginal breaks in foreign prices, domestic costs and prices, and foreign income are all statistically significant in the conditional model. So even a combination of the supply effects in the form of cumulated investment and pricing-to-market effects can not provide an acceptable explanation of the structural break in export determination in 1980.

4. Conclusions

What conclusions can we draw from these results? If we can genuinely interpret the relationship of exports to relative prices and foreign demand as a demand relationship then there is evidence of a structural shift in 1979, after allowing for changes in the mean of the components of relative prices. The underlying price setting schedule appears to be unaffected by structural change, and hence the common shift in both demand and reduced form relationships provides further support for a shift in the demand schedule around 1979, since it is unlikely that both supply and demand shifted at around the same time. The fact that a dock strike occurred at the same time raises some uncertainty about this conclusion of a shift but we can gain some comfort in that estimates of the break point do not always coincide with the dock strike period. Theories which provide a role for cumulated investment do have some empirical support but do not eliminate the case for a structural break and the role for this variable is weakened if we allow for some pricing to markets in the 1980s. But even a combination of these two can not provide a full explanation and so we are led to conclude that there has, on present evidence been an unexplainable structural shift in export behaviour in 1980.

Endnotes

1. Imperial College of Science, Technology and Medicine, London Business School and Bank of England respectively. Financial support from ESRC grant no. W116251003 is gratefully acknowledged.

2. Full definitions of data and sources are given in Appendix 1

Appendix I

Definition of Variables and Data Sources

X: Log of exports of goods and services, 1990 prices, CSO quarterly national accounts

PF: Log of G6 (G7 excluding the UK) consumers expenditure deflator, GNP weighted average of the G6 consumers expenditure deflators as published in datastream.

Y: Log of UK total final expenditure, 1990 prices, CSO quarterly national accounts

PD: log of domestic price: price index of total final expenditure, 1990=100, CSO quarterly national accounts.

YF: log of G6 (G7 excluding the UK) GNP, 1990 prices, constructed from the published GNP figures for the G6, source datastream.

PDC: Log of the index of unit labour cost in manufactures, 1990=1, Monthly Digest of Statistics, table 7.2

UKRX: Log of the real UK effective exchange rate index. UK effective exchange rate index (from Financial Statistics) deflated by PD and PF

RINV: Log of real cumulated investment, 1990 prices, investment from the quarterly national accounts.

References

Allen C and Witley J (1994), 'Modelling Bilateral Trade', in S. Hall (ed), *Applied Economic Forecasting Techniques*, Hemel Hempstead: Harvester Wheatsheaf.

Anderton R (1992), 'U.K. Exports of Manufactures: Testing for the Effects of Non-Price Competitiveness Using Stochastic Trends and Profitability Measures', *The Manchester School*, Vol. LX, 23-40.

Anderton R and Dunnett A (1987), 'Modelling The Behaviour of Export Volumes of Manufactures: An Evaluation of the Performance of Different Measures of International Competitiveness', *National Institute Economic Review*.

Banerjee A, Lumsdaine R L and Stock J H (1992), 'Recursive and Sequential Tests of the Unit-Root and Trend-Break Hypothesis: Theory and International Evidence', *Journal of Business and Economic Statistics*, vol. 10 (3), 271-250.

Banerjee A and Urga G (1995a), 'Looking for Structural Breaks in Co-Integrated Systems', *Discussion Paper* 18-95, Centre for Economic Forecasting, London Business School, June 1995.

Banerjee A and Urga G (1995b), 'Modelling UK Trade: An Exercise in Sequential Structural Breaks Procedures', *Discussion Paper* 24-95, Centre for Economic Forecasting, London Business School, July 1995.

Blake A P and Pain N (1994), 'Investigating Structural Changes in UK Export Performance: The Role of Innovation and Direct Investment', *National Institute Economic Review*, September

Gregory A W and Hansen B (1992), 'Residual-Based Tests for Cointegration in Models with Regime Shifts', *Institute for Economic Research*, Discussion Paper No. 862, Queen's University, Canada.

Hansen B (1992), 'Tests for Parameter Instability in Regressions with I(1) Processes', *Journal of Business and Economic Statistics*, vol. 10, 321-335.

H.M.T. Academic Panel (1995), 'Investment, R and D and Manufactured Trade', mimeo.

Holly S and Wade K (1991), 'U.K. Exports of Manufactures: The Role of Supply Side Factors', *Scottish Journal of Political Economy*, vol. 38, 1-18.

Landesmann M and Snell A (1992), 'The Consequences of Mrs. Thatcher for U.K. Manufacturing Exports', *Economic Journal*, 99, 1-27.

London Business School Quarterly Econometric Model of the U.K. Economy, Centre for Economic Forecasting, February 1995.

Owen C and Wren-Lewis S (1993), 'Variety, Quality and U.K. Manufacturing Exports', *ICMM Discussion Paper*, 14, University of Strathclyde, Glasgow.

Perron P (1989), 'The Great Crash, The Oil Price Shock, and The Unit Root Hypothesis', *Econometrica*, vol. 57, 1361-1401.