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The J-Curve: Evidence from Industry Trade Data between US and UK

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ABSTRACT

Previous research seeking to assess the short-run and long-run effects of currency depreciation on the UK trade balance has employed either aggregate trade data between U.K. and the rest of the world or bilateral trade data between U.K. and one of its major trading partners, the US. Neither group of studies was able to discover any significant relation beween the two variables. In this paper we disaggregate the trade data between the US and UK at the commodity level and try to assess the impact of changes in the real dollar-pound bilateral rate on the trade balance of each industry. Using the bounds-testing approach to cointegration and error-correction modeling we show that 107 of 177 industries' trade balance respond to a real depreciation in the British pound in the short-run. The short-run effects last into the long-run only in 66 industries, supporting a new definition of the J-Curve.

1. INTRODUCTION

THERE IS NOW A GENERAL BELIEF that the short-run effects of currency depreciation on the trade balance could be different from its long-run effects. Indeed, in the short-run, because of lags in the adjustment mechanism, depreciation could worsen the trade balance. Once new contracts at the new exchange rate and new prices are realised the trade balance could improve, resulting in a pattern of movement over time that resemble the letter J, hence, the J-Curve phenomenon.[2]

Since its introduction by Magee (1973), researchers have tested the J-Curve phenomenon by using aggregate trade data between one country and rest of the world. Some have tested the phenomenon for an individual country and some for several countries. Concentrating on the experience of the United Kingdom, a few studies have included UK in their sample. Miles (1979)

introduced a trade balance model and a balance of payments model in which he included government spending as a measure of fiscal policy, money supply as a measure of monetary policy, output growth as scale variable, and the real exchange rate. The models were estimated for 14 developed and developing countries, including the UK, to asses the long-run effects of devaluation. Although the exchange rate coefficient in both models for the U.K. were found to be significant, they had the wrong sign, implying that a real depreciation of the British pound will worsen the UK trade balance and the balance of payments in the long run. However, when Himarios (1989) revisited the issue using similar specifications, he contradicted Miles's finding for the UK. Given the evidence of unit roots in most time-series variables, Himarios's results that were based on using the level of variables should be viewed with caution as compared to Miles's results who used first differenced variables that are mostly stationary.[3]

Since the introduction of cointegration and error-correction modeling, researchers have emphasised the integrating properties of the variables in a given model and cointegrating properties of all variables together. To establish the long-run relationship between the trade balance and the exchange rate in addition to income variables, Rose (1991) employed Engle-Granger (1987) cointegration analysis to estimate a trade balance model for Canada, Germany, Japan, UK and the US. In none of the cases was there evidence of cointegration among the variables of the trade balance, implying that real depreciation is ineffective in improving the trade balance in the long run. Exactly the same result was found for the UK by Bahmani-Oskooee and Alse (1994), who examined the cointegration between the trade balance and the real exchange rate only. However, when Boyd *et al.* (2001) allowed for feedback effects among the variables of the trade balance by applying Johansen's cointegration analysis to nine developed countries, including UK, they were able to find one cointegrating vector for each country. The estimate of the cointegrating vector for the UK, however, revealed that the real exchange rate was insignificant, supporting Rose (1991) and Bahmani-Oskooee and Alse (1994).[4] The failure to find a significant relation between the trade balance and the exchange rate led Rose and Yellen (1989) to criticise the approach of using aggregate trade data between one country and the rest of the world. In an effort to discover whether earlier studies did suffer from aggregation bias, these authors estimated a trade balance model using cointegration and error-correction modeling on a bilateral basis, between the US and each of its six major trading partners including the UK. Not only were no short-run patterns resembling the J-Curve found, but no long-run effects of depreciation were validated either. This was true for all trading partners. After criticising Rose and Yellen (1989), Bahmani-Oskooee and Brooks (1999) employed bounds testing to cointegration and error-correction modeling and contradicted Rose and Yellen in all cases except the UK. Only in the model between the US and UK was the real bilateral exchange rate found to be insignificant.[5] It should

be noted that Cushman (1987) had already investigated US bilateral export and import values (but not the trade balance) with its seven large trading partners for real exchange rate effects and had found that dollar devaluation could be harmful to trade between the US and U.K.[6]

The above review shows clearly that neither in the trade between UK and the rest of the world, nor between the UK and a major trading partner such as the US, did a real depreciation of the British pound play a significant role. We suspect that studies that estimated a bilateral trade balance model between the US and UK still suffer from an aggregation bias problem. The two countries trade many different commodities with each other, some of which could be sensitive to the real dollar-pound rate and some perhaps not. We can identify these commodities only if we disaggregate the trade data between the two countries at the commodity level. Thus, it is the main purpose of this article to assess the short-run and the long-run effects of changes in the real dollar-pound rate on the trade balance of 177 industries for which continuous data over 1962-2003 are available. The model and the estimation method, based on Pesaran *et al.*'s (2001) bounds testing approach, are detailed in Section II. The empirical results that support a new definition of the J-Curve in 66 industries are reported in Section III, with a conclusion in Section IV. Finally, data definitions and sources are cited in an Appendix.

2. The model and method

Most recent studies, such as Rose and Yellen (1989) and Bahmani-Oskooee and Brooks (1999), have identified the level of income at home and in a trading partner, as well as the real exchange rate, to be the main determinants of the trade balance between two countries. Thus, we follow the aforementioned studies and specify a long-run trade balance model for industry i by the following equation:

$$LnTB_{i,t} = a + bLnY_{UK,t} + cLnY_{US,t} + dLnRE_t + \varepsilon_{i,t} \qquad (1)$$

In (1), TB_i is a measure of the trade balance for industry i, defined as the ratio of UK imports from the US by industry i over U.K. exports to the US for the same industry. Previous authors who used such a ratio justified it on the grounds that not only does it enable us to specify the model in log linear form, but also the ratio is a unit-free measure of the trade balance. Y_{UK} (Y_{US}) is a measure of economic activity in UK (US) and RE is the real dollar-pound exchange rate.

Following the literature, since an increase in UK income is expected to increase imports for industry i, an estimate of b is expected to be positive. However, if the increase in UK income is due to an increase in production of import-substituting goods, the UK could actually import less, implying a neg-

ative expected sign for an estimate of *b*. On the other hand, since an increase in US income is expected to increase UK exports from industry *i*, an estimate of *c* is expected to be negative. Once more an estimate of *c* could be positive if the increase in US income is due to an increase in the production of import-substituting goods. Finally, as the Appendix shows, a decrease in RE reflects a real depreciation of the pound. If a real depreciation of the pound lowers UK imports from industry *i* and stimulates exports from industry *i*, an estimate of *d* is expected to be positive, implying an improvement in industry *i*'s trade balance in the long run.

Since our intention is to assess the short-run effects of a real depreciation on each industry's trade balance, or the J-Curve effect, we need to incorporate the short-run dynamics into the long-run model outlined by (1). To this end we follow Pesaran *et al.*'s (2001) bounds testing approach to cointegration and error-correction modeling and specify (1) as an Autoregressive Distributed Lag (ARDL) form as in equation (2):

$$\Delta LnTB_{i,t} = a + \sum_{k=1}^{n} b_k \Delta LnTB_{i,t-k} + \sum_{k=0}^{n} c_k \Delta LnY_{US,t-k} + \sum_{k=0}^{n} d_k \Delta LnY_{UK,t-k} + \sum_{k=0}^{n} e_k \Delta LnRE_{t-k}$$
$$+ \delta_1 LnTB_{i,t-1} + \delta_2 LnY_{US,t-1} + \delta_3 LnY_{UK,t-1} + \delta_4 LnRE_{t-1} + \mu_t \qquad (2)$$

Equation (2) is somewhat different from the Engle and Granger (1987) specification in that a linear combination of the lagged level of variables is entered into the error-correction model directly. Pesaran *et al.* (2001) then demonstrate that if the lagged level variables are jointly significant, they are cointegrated. This is done by applying the familiar *F*-test. Note that although the *F*-test is used to carry the test for cointegration, one cannot use the standard *F*-table for critical values because variables in (2) could be stationary, non-stationary or even fractionally integrated. Pesaran *et al.* (2001) tabulate two sets of appropriate critical values. One set assumes all variables are I(1) and another assumes that they are all I(0). This provides a band covering all possible classifications of the variables into I(1) and I(0) or even fractionally integrated. If the calculated *F*-statistic lies above the upper level of the band, δ_1-δ_4 are said to be jointly significant or cointegrated.

Pesaran *et al.*'s (2001) approach has two distinct advantages. First, there is no need for pre-unit-root testing as variables could be I(1) or I(0). Second, the approach allows us to distinguish the short-run effects from the long-run effects.The short-run effects of currency depreciation are inferred by the estimates of e_k's. The traditional J-Curve is supported if the estimate of *e* is negative at lower lags and positive at higher lags. The long-run effects are judged by the estimate of δ_4 that is normalised on δ_1.[7]

3. EMPIRICAL RESULTS

The error-correction model outlined by equation (2) is subject to empirical testing in this section. We employ annual data from 177 industries (SITC classifications) that traded between U.S. and U.K. over the period 1962-2003.[8] In applying the *F*-test, it has been demonstrated by Bahmani-Oskooee and Brooks (1999) that the results could be sensitive to the number of lags imposed on the first differenced variables. Following Bahmani-Oskooee and Gelan (2006), we impose four lags on each first-differenced variable and use Akaike's Information Criterion (AIC) to select the optimum number of lags. We then carry the F test for cointegration at the optimum lags. The results from the optimum model for each industry are reported in Tables 1 and 2 (Table 1 reports the short-run and the long-run coefficient estimates, Table 2 reports diagnostic statistics).

First, consider Table 1. As far as the short-run coefficient estimates are concerned, for brevity we report only the coefficient estimates for the real exchange rate, so that we can judge the J-Curve pattern. From the short-run results we gather that there are 107 industries in which there is at least one lagged coefficient that is significant at the 10 per cent level, implying that in almost 60 per cent of the cases currency depreciation has short-run effects. Furthermore, negative coefficients followed by positive ones that resemble the J-Curve pattern are only observed in 13 cases, offering rather weak support for the J-Curve. In a majority of industries, there is no specific short-run pattern. However, if we rely upon Rose and Yellen (1989, p. 67) and subscribe to a new definition of the J-Curve, i.e., negative short-run effects combined with positive long-run effects, then support for the J-Curve increases substantially. From the long-run coefficient estimates we find that there are 66 industries in which the long-run coefficient obtained for the real exchange rate is positive and significant at the 10 per cent or 5 per cent level. This new definition of the J-Curve seems to be closer to theory than the old one. Magee (1973), who originally introduced the concept, conjectured that the trade balance can follow any pattern in the short run. Thus, short-run fluctuations in the trade balance combined with long-run improvements could constitute an even better definition of the J-Curve. Our findings at the commodity level contradict the findings by Rose and Yellen (1989) who used aggregate bilateral trade data between U.S. and U.K. and showed that there were neither short-run nor long-run effects of a currency depreciation on the bilateral trade balance between the two countries.[9]

The above long-run analysis would only be valid if the variables are cointegrated. To this end, we shift to Table 2 and review the diagnostics. First consider the *F*-test results at optimum lags. The calculated *F*-statistic is greater than its critical value of 3.52 at the 10 per cent level of significance in 103 cases, supporting cointegration of variables in these cases. Additional support for cointegration is provided by the lagged error-correction term, ECM_{t-1}. Using the long-run coefficient estimates from Table 1 we form an error-correction

Table 1: Short-run and long-run coefficient estimates (absolute value of the *t*-ratio).

Industry	Short-run coefficient estimates				Long-run coefficient estimates			
	Δ Ln RE_t	Δ LnRE_{t-1}	Δ Ln RE_{t-2}	Δ Ln RE_{t-3}	*Constant*	Ln Y_{US}	Ln Y_{UK}	Ln *RE*
Live animals	1.70 (1.37)	5.09 (3.52)	1.12 (0.81)	5.45 (4.12)	42.07 (3.41)	29.76 (3.65)	-37.96(3.61)	-4.65 (1.30)
Meat and meat preparations	5.58(2.86)	-	-	-	39.88(1.85)	13.29(1.03)	-21.55(1.23)	1.62(0.40)
Meat, fresh, chilled or frozen	3.14(1.08)	7.14(2.35)	1.86(0.63)	5.79(1.87)	70.30(1.57)	46.40(1.36)	-58.22(1.39)	-25.53(1.20)
Dairy products and eggs	0.20(0.11)	-	-	-	-32.45(2.42)	-25.84(3.22)	32.39(2.99)	0.22(0.11)
Cheese and curd	-1.07(0.69)	-	-	-	-13.54(0.73)	7.10(0.60)	-4.81(0.31)	-2.09(0.72)
Fish and fish preparations	2.72(3.95)	-	-	-	20.17(2.06)	8.71(1.51)	-13.62(1.74)	6.67(2.41)
Fish,fresh & simply preserved	0.19(0.16)	-	-	-	18.70(2.54)	7.30(1.63)	-11.86(1.97)	3.82(2.95)
Fish,in airtight containers,nes	4.09(1.81)	-	-	-	5.47(0.50)	15.28(0.21)	-15.45(0.16)	-12.34(0.61)
Cereals and cereal preparations	0.10(0.15)	-	-	-	-62.61(1.13)	-54.22(1.55)	66.87(1.44)	9.21(1.46)
Fruit and vegetables	0.55(1.23)	-	-	-	-22.00(1.92)	-14.29(2.15)	19.72(2.16)	1.47(1.05)
Fruit, fresh, and nuts - excl. oil	-1.86(0.70)	6.40(2.29)	-	-	-133.4(1.45)	-51.81(1.23)	87.38(1.36)	-27.00(1.18)
Fruit,preserved and fruit preparation	1.49(1.94)	-1.52(1.85)	-1.16(1.45)	-2.49(2.96)	-11.13(1.57)	-13.66(2.58)	15.48(2.35)	8.61(3.21)
Vegetables, roots & tubers, fresh	1.29(0.95)	-5.09(3.21)	-3.09(2.05)	-1.67(1.18)	-5.66(0.72)	-10.71(2.17)	12.09(1.88)	3.30(1.51)
Vegetables, roots & tubers pres or	-0.35(0.32)	-	-	-	-8.90(0.75)	-14.84(2.03)	16.95(1.75)	2.50(1.31)
Sugar, sugar preparations and honey	1.97(2.20)	-	-	-	10.10(1.11)	4.87(0.87)	-7.65(1.03)	3.37(2.32)
Sugar and honey	3.02(2.04)	-	-	-	-26.87(1.34)	-14.95(1.21)	21.24(1.27)	5.40(2.00)
Sugar confy, sugar preps. ex chocol	3.91(2.26)	2.94(2.26)	-	-	-3.70(0.43)	-0.53(0.09)	0.85(0.11)	3.46(2.11)
Coffee, tea, cocoa, spices & manufa	4.61(2.64)	-4.52(2.26)	-4.28(2,37)	-2.87(1.64)	-29.26(2.44)	-18.49(2.31)	22.70(2.21)	11.92(3.37)
Coffee	8.75(2.12)	-4.62(1.18)	-8.56(2.05)	-	5.35(0.14)	-10.09(0.38)	5.06(0.15)	31.40(2.62)
Chocolate & other food preptns cont	2.09(1.68)	-	-	-	-12.89(1.56)	3.26(0.66)	-1.28(0.19)	2.19(1.66)
Spices	-1.60(2.28)	--	-	-	0.78(0.18)	-1.02(0.38)	1.00(0.28)	-1.60(2.28)
Feed.-stuff for animals excl. unmil	3.20(2.98)	-	-	-	7.08(0.41)	-4.69(0.44)	2.97(0.21)	7.29(2.48)
Miscellaneous food preparations	-0.60(0.58)	-3.19(2.77)	-	-	-16.78(0.92)	-18.91(1.92)	22.05(1.59)	4.43(0.93)
Food preparations,nes	0.73(0.85)	-2.32(2.71)	-	-	-17.10(2.00)	-12.26(2.08)	15.76(2.06)	4.63(3.35)
Beverages	0.62(1.46)	1.07(2.17)	-	-	-23.09(2.18)	1.32(0.22)	3.35(0.41)	3.32(1.51)
Alcoholic beverages	0.54(1.29)	1.04(2.14)	-	-	-24.58(2.58)	0.74(0.13)	4.27(0.58)	3.01(1.56)
Tobacco and tobacco manufactures	0.18(0.32)	-	-	-	13.17(1.98)	-7.38(1.85)	4.44(0.83)	0.33(0.32)
Tobacco manufactures	-0.64(0.86)	-	-	-	10.35(1.31)	-3.01(0.64)	0.37(0.06)	-1.00(0.87)
Hides, skins and fur skins, undress	-0.48(0.52)	-	-	-	-35.27(1.01)	-25.17(1.24)	33.31(1.20)	-2.42(0.52)
Hides & skins,-exc.fur skins- undre	-2.28(1.16)	-3.98(1.81)	2.38(1.09)	-5.22(2.23)	-59.34(1.46)	-43.63(1.55)	56.36(1.56)	3.41(0.33)
Fur skins, undressed	-1.17(0.65)	-	-	-	-17.29(1.09)	-16.42(1.69)	20.27(1.56)	2.52(1.02)

Oil-seeds, oil nuts and oil kernels	5.40(2.31)-	-	-	-	30.25(1.28)	9.84(0.69)	-15.61(0.81)	8.47(2.37)
Crude rubber including synthetic an	-0.86(0.64)	-	-	-	9.75(1.15)	-3.55(0.68)	1.40(0.20)	-0.86(0.64)
Wood, lumber and cork	2.29(2.10)	-	-	-	78.65(1.78)	34.47(1.60)	-51.76(1.64)	6.39(1.35)
Wood in the rough or roughly square	4.18(1.57)	-5.39(2.00)	-	-	15.79(0.84)	13.08(1.11)	-16.01(1.03)	4.20(1.07)
Wood,shaped or simply worked	2.94(2.02)	-	-	-	97.78(1.66)	40.96(1.43)	-62.60(1.49)	7.13(1.43)
Pulp and paper	-3.31(1.20)	-	-	-	42.84(0.93)	22.61(0.82)	-29.97(0.81)	-7.93(1.06)
Textile fibres, not manufactured,	1.98(2.16)	-1.04(0.97)	-1.12(1.13)	-3.49(3.53)	-12.46(0.67)	-18.60(1.25)	20.58(1.12)	9.19(1.67)
Wool and other animal hair	1.56(1.60)	-1.58(1.70)	-	-	49.07(2.05)	14.73(1.36)	-26.26(1.72)	2.78(0.72)
Synthetic and regenerated-artificia	2.07(1.32)	-0.73(0.45)	-2.63(1.65)	-4.65(2.82)	-44.79(1.74)	-38.11(2.07)	46.62(1.99)	11.86(1.83)
Waste materials from textile fabric	-2.74(1.91)	0.97(0.82)	-3.00(2.26)	-8.05(1.29)	-29.21(1.52)	-19.01(1.35)	24.72(1.40)	9.24(1.52)
Crude fertilizers and crude mineral	1.23(1.41)	-4.32(4.04)	-3.10(2.95)	-	-62.59(1.78)	-45.28(1.83)	57.47(1.82)	14.48(1.84)
Stone, sand and gravel	3.13(1.85)	-10.10(4.18)	-3.27(1.47)	-	5.09(0.23)	-39.95(0.67)	32.71(0.54)	51.54(0.91)
Natural abrasives-incl.industrial	1.05(0.84)	-8.31(5.10)	-7.28(4.78)	-3.95(2.76)	-226.2(0.92)	-173.5(0.93)	215.95(0.92)	61.22(0.93)
Other crude minerals	-0.17(0.39)	-	-	-	-8.58(2.82)	-4.06(2.24)	6.43(2.60)	-0.17(0.38)
Metalliferous ores and metal scrap	0.58(0.53)	-	-	-	6.70(0.56)	-3.41(0.47)	1.98(0.20)	0.95(0.53)
Iron and steel scrap	-4.13(1.73)	-	-	-	20.84(0.54)	-0.13(0.01)	-3.23(0.10)	-10.41(1.53)
Ores & concentrates of non-ferrous	6.27(2.22)	-7.62(2.66)	-11.25(2.79)	-	-3.06(0.12)	-13.87(0.76)	12.21(0.55)	21.38(1.41)
Non-ferrous metal scrap	3.51(2.03)	2.82(2.18)	-	-	36.05(4.53)	9.76(1.97)	-17.99(2.74)	-0.06(0.04)
Crude animal and vegetable material	1.33(2.39)	-1.32(2.12)	-	-	3.41(0.53)	1.53(0.37)	-2.25(0.41)	0.06(0.05)
Crude animal materials,nes	0.86(1.10)	-	-	-	34.94(1.56)	24.80(1.80)	-31.68(1.72)	-2.25(0.66)
Crude vegetable materials,nes	-0.52(1.70)	-	-	-	-17.20(6.15)	-11.55(7.34)	15.40(7.10)	-0.65(1.6)
Petroleum and petroleum products	4.34(2.64)	-6.79(3.82)	-5.20(3.10)	-2.01(1.34)	-409.3(0.55)	-185.0(0.64)	286.02(0.60)	-104.7(0.47)
Petroleum products	2.99(2.44)	-3.93(2.54)	-5.51(3.90)	-	16.29(1.75)	-9.56(1.51)	4.13(0.52)	9.15(1.98)
Gas, natural and manufactured	-5.42(1.44)	-	-	-	-5.04(0.06)	-17.32(0.32)	16.97(0.23)	9.70(0.69)
Animal oils and fats	-0.21(0.08)	0.17(0.05)	-6.56(2.09)	-5.05(1.59)	-5.37(0.11)	-50.61(1.34)	48.33(1.05)	31.09(1.82)
Fixed vegetable oils and fats	-1.28(0.29)	-7.16(1.83)	-	-	-385.9(0.33)	-228.5(0.36)	322.50(0.35)	-78.10(0.35)
Other fixed vegetable oils	-0.12(0.04)	-	-	-	-3.22(0.08)	-13.21(0.49)	13.82(0.38)	-0.27(0.04)
Animal and vegetable oils and fats,	-0.85(0.81)	-	-	-	-31.56(2.05)	-15.20(1.71)	22.71(1.87)	-1.71(0.78)
Chemical elements and compounds	0.07(0.20)	-	-	-	3.15(0.27)	-0.43(0.05)	-0.76(0.07)	0.35(0.19)
Organic chemicals	0.13(0.32)	-	-	-	-13.36(2.58)	-13.33(4.46)	16.00(3.98)	-1.06(1.25)
Inorg.chemicals-elems.,oxides,halog	-1.64(2.99)	0.31(0.47)	1.70(2.69)	-	20.14(0.32)	-11.98(0.55)	8.41(0.29)	-1.48(0.16)
Other inorganic chemicals	-0.20(0.53)	-	-	-	-10.34(2.54)	-4.86(2.09)	7.35(2.30)	-0.27(0.53)
Radioactive and associated material	0.16(0.07)	-	-	-	105.33(1.57)	52.80(1.46)	-77.10(1.51)	9.60(1.32)
Crude chemicals from coal, petroleu	0.48(0.25)	-	-	-	72.15(3.69)	43.89(3.78)	-59.83(3.81)	0.73(0.25)
Dyeing, tanning and colouring mater	-0.06(0.14)	-0.92(1.87)	-	-	-22.69(3.71)	-15.33(3.84)	19.67(3.79)	4.32(3.41)
Synth.organic dyestuffs,natural ind	-0.23(0.46)	-	-	-	-10.10(1.72)	-8.73(2.24)	10.32(2.05)	3.77(3.31)
Dyeing & tanning extracts,synth.tan	1.87(1.34)	-	-	-	-11.70(0.61)	-2.28(0.20)	5.51(0.36)	-3.97(1.08)

Pigments, paints, varnishes & relat	0.47(1.17)	-	-	-	-13.29(1.69)	-9.20(1.91)	11.88(1.85)	1.46(0.96)
Medicinal and pharmaceutical prod.	-0.32(0.71)	-0.85(1.84)	-	-	-16.74(1.57)	-13.89(2.11)	17.29(1.95)	1.23(0.93)
Perfume materials, toilet & cleansi	-0.88(2.74)	0.72(1.85)	-	-	-13.91(3.03)	-13.67(4.91)	16.53(4.43)	1.50(2.01)
Essential oils, perfume and flavour	-1.06(1.70)	-0.65(0.91)	0.83(1.22)	-1.35(1.87)	-24.40(3.39)	-22.05(4.62)	27.31(4.41)	2.05(1.05)
Perfumery, cosmetics, dentifrices,	0.47(1.02)	-	-	-	-2.50(0.39)	-6.05(1.43)	6.14(1.11)	4.45(3.36)
Soaps,cleansing & polishing prepara	-1.06(1.50)	2.35(3.11)	-	-	-2.71(0.10)	-2.43(1.14)	3.18(1.14)	-2.08(0.38)
Explosives and pyrotechnic products	-1.14(1.21)	1.36(1.12)	2.38(2.16)	1.95(1.92)	18.87(0.73)	19.55(1.03)	-21.06(0.94)	-11.57(0.78)
Plastic materials, etc.	-0.46(1.51)	-0.86(2.13)	-1.03(3.02)	-0.49(1.40)	-1.79(0.95)	-4.22(3.17)	4.45(2.64)	1.59(2.74)
Chemical materials and products, ne	-0.88(1.93)	-	-	-	2.30(0.42)	-2.01(0.60)	1.45(0.32)	0.56(0.61)
Leather, lthr. manufs., nes & dress	1.74(2.45)	-0.80(1.10)	1.68(2.13)	-	-9.74(0.71)	-6.06(0.69)	7.68(0.66)	1.94(0.58)
Leather	2.86(2.82)	-2.16(1.95)	-	-	-0.83(0.10)	-1.89(0.33)	1.27(0.17)	3.45(1.83)
Manuf.of leather or of artif.or rec	0.09(0.11)	-3.08(3.46)	-2.03(2.28)	-2.01(2.16)	-12.00(3.16)	-4.20(1.58)	5.99(1.78)	5.51(4.89)
Fur skins, tanned or dressed, inclu	0.47(0.35)	-	-	-	-11.45(0.81)	-0.18(0.02)	2.96(0.26)	0.73(0.35)
Rubber manufactures, nes	1.53(2.11)	-1.86(2.58)	-	-	13.01(1.86)	8.66(2.07)	-12.02(2.13)	3.93(2.52)
Articles of rubber,nes	1.57(2.08)	-1.83(2.43)	-	-	16.57(2.30)	12.30(2.76)	-16.37(2.74)	3.06(2.07)
Wood and cork manufactures	1.41(3.01)	-	-	-	-0.59(0.09)	-4.20(1.08)	4.37(0.84)	2.83(2.86)
Veneers, plywood boards	1.66(2.43)	-	-	-	0.18(0.02)	-0.21(0.03)	0.39(0.04)	4.17(2.12)
Wood manufactures,nes	1.17(1.98)	-	-	-	-11.29(0.85)	-12.30(2.76)	-16.37(2.74)	3.06(2.07)
Cork manufactures	2.66(1.77)	-	-	-	-3.78(0.15)	8.17(0.54)	-7.71(0.38)	6.22(1.41)
Paper, paperboard and manufactures	-0.23(0.65)	-	-	-	-2.49(0.22)	-10.65(1.63)	10.49(1.18)	3.45(1.04)
Paper and paperboard	0.15(0.50)	-	-	-	3.39(0.30)	-7.51(1.11)	6.28(0.70)	0.85(0.42)
Articles of paper, pulp, paperboard	-0.38(1.09)	-	-	-	-16.15(3.36)	-11.30(3.50)	14.66(3.48)	2.97(4.07)
Textile yarn, fabrics, made-up arti	1.16(3.84)	-	-	-	-8.92(0.83)	-10.33(1.350	11.52(1.18)	5.77(2.49)
Textile yarn and thread	2.24(2.80)	-2.14(2.36)	-	-	1.00(0.08)	-1.55(0.19)	0.69(0.06)	4.56(1.76)
Cotton fabrics,woven ex.narrow or s	-0.23(033)	1.95(2.77)	-	-	-17.31(1.01)	-15.88(1.48)	20.10(1.41)	-3.83(0.68)
Text fabrics woven ex narrow, spec,	1.72(3.38)	-	-	-	-8.75(0.77)	-11.31(1.48)	12.49(1.26)	5.69(2.76)
Tulle, lace, embroidery, ribbons, t	0.56(0.89)	1.57(2.18)	-	-	-16.35(2.70)	-9.35(2.55)	12.83(2.58)	1.75(1.44)
Special textile fabrics and related	1.34(3.22)	-	-	-	13.08(1.22)	3.65(0.54)	-7.12(0.80)	5.60(2.04)
Made-up articles,wholly or chiefly	0.72(1.05)	-	-	-	-162.4(1.80)	-117.6(1.87)	149.99(1.85)	27.10(2.04)
Floor coverings, tapestries, etc.	2.32(3.11)	-	-	-	1.53(0.33)	2.38(0.86)	-3.20(0.86)	3.66(4.41)
Non-metallic mineral manufactures,	-0.93(1.96)	-	-	-	-817.3(0.08)	-541.1(0.08)	716.32(0.08)	73.89(0.08)
Lime,cement & fabr.bldg.mat.	1.01(0.72)	-4.97(2.66)	-3.66(2.28)	-	14.09(2.16)	11.30(2.81)	-15.33(2.89)	4.70(2.05)
Clay and refractory construction ma	0.37(0.55)	-	-	-	-33.34(2.21)	-20.34(2.16)	27.39(2.17)	2.15(1.84)
Mineral manufactures, nes	-0.81(2.02)	-	-	-	-7.87(2.32)	-6.34(3.15)	7.98(2.93)	0.14(0.30)
Glass	0.03(0.05)	-1.29(1.98)	-	-	-8.70(1.65)	-6.87(1.81)	8.66(1.79)	3.05(2.75)
Glassware	-0.62(0.81)	0.10(0.11)	1.80(2.03)	-	-28.90(2.73)	-17.95(2.93)	24.33(2.89)	-0.03(0.01)
Pottery	0.80(1.06)	-	-	-	13.98(2.09)	17.94(4.72)	-21.63(4.13)	0.89(1.00)

Pearls and precious and semi-precio	1.75(1.62)	-	-	-	-9/31(0.53)	-3.20(0.29)	4.25(0.29)	4.04(1.46)
Iron and steel	0.22(0.33)	-	-	-	-11.19(2.83)	-5.97(2.57)	8.18(2.59)	0.22(0.33)
Pig iron, spiegeleisen, sponge iron	-1.94(1.56)	-	-	-	-19.86(1.95)	-15.37(2.43)	19.57(2.33)	-2.67(1.38)
Ingots & other primary forms of iro	-0.32(0.11)	-3.18(1.26)	-	-	-46.81(1.37)	-34.15(1.57)	42.29(1.48)	10.29(0.98)
Iron and steel bars,rods,angles,sha	-0.24(0.39)	-	-	-	-11.24(2.66)	-0.59(0.25)	2.74(0.84)	-0.19(0.39)
Universals,plates and sheets of iro	3.98(2.80)	-	-	-	-7.64(0.88)	-2.73(0.53)	3.85(0.55)	3.98(2.80)
Iron and steel wire, excluding wire	0.70(1.15)	-	-	-	-25.46(2.89)	-7.65(1.42)	12.88(1.78)	1.48(1.10)
Tubes,pipes and fittings of iron or	2.11(2.17)	-2.29(2.22)	-2.92(2.75)	-1.92(1.77)	-13.27(2.19)	-11.33(2.53)	13.47(2.42)	6.56(2.95)
Iron steel castings forgings unwork	4.22(4.46)	-	-	-	17.44(2.86)	5.69(1.57)	-10.05(2.05)	4.22(4.46)
Non-ferrous metals	1.78(1.83)	-	-	-	-19.66(1.11)	-9.22(0.95)	13.69(1.01)	-1.45(0.55)
Silver and platinum group metals	2.54(1.00)	-	-	-	-22.76(0.90)	-4.66(0.32)	9.74(0.49)	-2.53(0.61)
Copper	0.78(1.50)	-	-	-	-2.75(0.94)	-6.76(3.87)	7.15(3.03)	0.69(1.57)
Nickel	-0.07(0.07)	-	-	-	-10.90(0.91)	-3.27(0.48)	5.99(0.63)	-0.14(0.07)
Aluminium	-0.25(0.32)	-	-	-	-26.35(2.74)	-21.54(3.98)	27.58(3.66)	-0.31(0.32)
Lead	-2.59(1.05)	-	-	-	-35.71(2.92)	-11.64(1.58)	19.75(1.99)	1.13(0.57)
Zinc	-0.57(0.27)	-	-	-	-42.61(1.13)	-19.90(0.87)	29.32(0.96)	-1.48(0.27)
Tin	-2.27(1.03)	-3.89(1.66)	-3.51(1.46)	-	-8.18(0.82)	2.01(0.29)	-1.05(0.12)	-0.80(0.86)
Miscell.non-ferrous base metals	-0.36(0.88)	-	-	-	-7.66(1.25)	-3.52(0.97)	5.49(1.12)	-0.80(0.86)
Manufactures of metal, nes	-0.16(0.67)	-0.36(1.24)	-	-	-19.57(1.14)	-14.60(1.05)	18.40(1.07)	4.08(1.04)
Finished structural parts and struc	1.35(1.03)	-2.31(1.42)	-	-	34.66(2.18)	7.11(1.05)	-15.55(1.52)	6.96(1.66)
Metal containers for storage and tr	-0.59(1.01)	-	-	-	-18.88(3.50)	-10.47(3.51)	14.71(3.54)	-0.66(0.96)
Wire products - ex electric - & fen	1.09(1.70)	-	-	-	2.76(0.54)	7.25(2.56)	-7.89(2.01)	1.09(1.70)
Nails,screws,nuts,bolts,rivets and	0.40(1.46)	-	-	-	-1.60(0.92)	1.26(1.21)	-0.80(0.57)	0.40(1.46)
Tools for use in the hand or in mac	-0.18(0.67)	-1.13(3.13)	-1.13(3.22)	-0.68(2.49)	-20.07(2.19)	-19.44(2.63)	23.18(2.55)	5.54(2.10)
Cutlery	0.48(0.69)	-	-	-	-31.22(1.92)	-6.04(0.63)	13.08(1.00)	1.57(0.64)
Household equipment of base metals	-1.84(2.96)	0.59(0.82)	1.79(2.36)	-	-13.47(1.67)	-4.40(0.87)	7.38(1.10)	-0.10(0.06)
Manufactures of metal, nes	0.15(0.54)	0.71(1.87)	0.69(1.99)	-	0.50(0.15)	0.28(0.13)	-0.39(0.14)	0.48(0.63)
Machinery, other than electric	-0.37(1.54)	-	-	-	-2.72(0.38)	-3.69(0.71)	4.17(0.63)	1.40(0.87)
Power generating machinery, other t	-0.16(0.63)	-	-	-	-5.92(1.67)	-0.59(0.28)	1.85(0.65)	-0.32(0.62)
Agricultural machinery & implemen	-1.59(2.78)	-	-	-	-27.03(2.53)	-15.56(2.40)	21.23(2.43)	1.74(1.20)
Office machines	-0.26(0.64)	-	-	-	-8.18(0.39)	-14.27(0.93)	18.67(0.81)	4.81(1.26)
Metalworking machinery	0.34(0.55)	-1.30(1.67)	-1.61(2.33)	-1.15(1.82)	-12.57(3.87)	-10.75(5.21)	13.11(4.86)	2.21(2.21)
Textile and leather machinery	0.07(0.17)	-	-	-	-3.62(0.51)	1.24(0.29)	-0.44(0.08)	0.18(0.17)
Machines for special industries	-1.04(2.47)	-	-	-	-6.88(1.41)	-9.67(3.13)	10.99(2.68)	1.53(2.36)
Machinery and appliances-non electr	-0.45(2.30)	-0.35(1.75)	-	-	-13.42(3.11)	-11.02(4.13)	13.74(3.88)	1.35(1.88)
Electrical machinery, apparatus and	0.27(1.11)	-0.95(3.14)	-0.71(2.67)	-	-11.30(1.21)	-16.52(1.91)	18.00(1.77)	7.94(2.02)
Electric power machinery and switchg	0.70(2.30)	-	-	-	-4.22(0.56)	-6.97(1.43)	7.75(1.20)	2.34(1.93)

Equipment for distributing electric	1.06(1.73)	0.40(0.61)	1.18(1.80)	1.76(2.58)	23.28(2.81)	16.85(2.91)	-21.09(2.88)	-4.93(1.93)
Telecommunications apparatus	-0.34(0.90)	-	-	-	8.74(1.75)	-2.12(0.73)	0.07(0.02)	2.47(2.49)
Domestic electrical equipment	-0.23(0.35)	-	-	-	-191.9(0.42)	-145.4(0.42)	182.08(0.42)	44.99(0.43)
Elec.apparatus for medic.purp.,radi	1.80(2.18)	-	-	-	19.55(1.06)	9.38(0.90)	-14.35(0.99)	6.21(1.45)
Other electrical machinery and appa	0.07(0.35)	-1.14(4.43)	-0.90(3.82)	-	-28.39(1.98)	-26.83(2.45)	32.04(2.35)	7.96(2.34)
Transport equipment	1.65(3.57)	-	-	-	1.16(0.31)	1.76(0.80)	-2.08(0.70)	1.92(3.06)
Railway vehicles	1.23(0.66)	-	-	-	-13.53(1.43)	1.68(0.29)	1.57(0.20)	-1.70(1.20)
Road motor vehicles	0.44(0.95)	-	-	-	-7.59(2.47)	-3.95(2.29)	5.29(2.22)	1.66(4.24)
Road vehicles other than motor vehi	2.47(2.69)	-1.15(1.04)	-1.01(0.95)	1.50(1.44)	36.89(2.77)	30.73(4.13)	-38.97(3.92)	6.16(1.40)
Aircraft	1.27(2.27)	-	-	-	-6.61(1.73)	-2.86(1.25)	4.42(1.44)	1.27(2.27)
Ships and boats	5.09(2.37)	-	-	-	16.57(0.92)	7.96(0.72)	-11.93(0.81)	3.16(1.12)
Sanitary,plumbing,heating & lightin	-1.06(2.08)	0.64(1.09)	-0.93(1.72)	-	-2.07(0.56)	-4.04(1.62)	4.44(1.39)	1.51(1.51)
Furniture	-0.14(0.35)	1.70(3.54)	1.17(2.77)	-	8.04(0.99)	10.66(1.96)	-12.21(1.76)	-1.00(0.46)
Travel goods, handbags and similar	0.90(1.07)	-	-	-	-21.24(2.79)	-6.08(1.28)	10.45(1.65)	4.99(4.28)
Clothing	2.64(4.70)	-	-	-	-45.25(1.75)	-30.43(1.71)	39.08(1.70)	11.01(2.67)
Clothing except fur clothing	2.70(4.68)	-	-	-	-45.14(1.72)	-30.17(1.67)	38.78(1.65)	11.11(2.62)
Fur clothing and articles of artifi	1.75(1.12)	5.01(3.06)	-	-	-11.20(0.32)	-14.70(0.64)	17.23(0.56)	1.42(0.21)
Footwear	-0.12(0.12)	5.66(5.09)	-	-	4.87(0.21)	17.07(1.30)	-17.11(0.93)	-7.31(1.40)
Scientif & control instrum, photogr	-0.17(0.87)	-	-	-	-106.0(0.32)	-75.37(0.35)	97.24(0.34)	10.97(0.36)
Scientific,medical,optical,meas./co	-0.45(2.15)	-	-	-	-14.65(1.94)	-15.72(3.38)	18.87(3.02)	0.61(0.78)
Photographic and cinematographic	0.35(0.73)	-	-	-	-30.48(0.50)	-19.28(0.52)	25.80(0.52)	3.46(0.62)
Developed cinematographic film	1.36(1.23)	-0.67(0.60)	-3.09(2.64)	-	2.92(0.26)	-2.78(0.36)	1.55(0.16)	6.30(1.94)
Watches and clocks	-0.74(0.44)	2.96(1.48)	-1.07(0.57)	5.19(2.60)	26.99(1.85)	21.21(2.22)	-26.92(2.17)	-2.08(0.53)
Miscellaneous manufactured articles	0.35(2.25)	0.06(0.26)	0.43(2.37)	-	-5.84(2.89)	-2.52(1.93)	3.51(2.08)	2.42(4.01)
Musical instruments,sound recorders	1.20(4.31)	-	-	-	24.46(2.27)	13.73(2.47)	-19.54(2.52)	6.05(2.08)
Printed matter	0.01(0.34)	-	-	-	-0.18(0.03)	-0.37(0.11)	-0.12(0.02)	4.74(1.83)
Articles of artificial plastic mate	-0.76(1.41)	1.16(2.04)	0.91(1.52)	-	-8.46(0.80)	-0.85(0.11)	3.02(0.31)	-2.54(0.74)
Perambulators,toys,games and sporti	0.91(1.91)	-0.89(1.73)	-	-	6.63(2.99)	9.17(6.01)	-10.51(5.39)	1.16(1.75)
Office and stationery supplies, nes	0.89(1.91)	-	-	-	-17.55(2.60)	-14.46(3.65)	18.30(3.38)	1.54(1.82)
Works of art,collectors pieces and	0.43(1.04)	-	-	-	-14.40(6.47)	-8.25(6.38)	11.01(6.26)	1.22(3.42)
Jewellery and gold/silver-smiths wa	-1.38(1.82)	3.05(3.08)	2.06(2.48)	0.84(1.20)	-20.40(0.61)	2.52(0.22)	3.41(0.18)	-12.94(0.81)
Manufactured articles, nes	-0.40(0.56)	2.38(3.35)	-	-	17.52(2.32)	13.29(2.81)	-16.67(2.66)	-2.38(1.79)

term and substitute the lagged level of variables in (2) by the lagged error-correction term, ECM_{t-1}. We then re-estimate the model after imposing optimum lags selected for each variable earlier. Bahmani-Oskooee and Brooks (1999) have shown that a significantly negative coefficient obtained for ECMt-1 is an alternative and stronger way of validating cointegration. As can be seen from Table 2, indeed, the ECM_{t-1} carries a negative and significant coefficient in the majority of cases, supporting cointegration.

The Lagrange Multiplier (LM) statistic is also reported in Table 2, which tests for serial correlation in the presence of a lagged dependent variable; and Ramsey's RESET statistic which tests for functional misspecification. Both are distributed as χ^2 with one degree of freedom. Given its critical value of 3.84 at the usual 5 per cent level of significance, we gather that both statistics are less than the critical value in almost all cases, implying that in each case the residuals are autocorrelation-free and the model is correctly specified. Two other tests results are reported in Table 2. Following Bahmani-Oskooee et al. (2005) we test for stability of the short-run as well as the long-run coefficients, within the bounds testing approach, by applying the CUSUM and CUSUMSQ tests to the residuals of the optimum models. Stable coefficients are denoted by 's' and unstable ones by 'u'. As can be seen, stability is supported by both tests in a majority of the cases.[10] Finally, reported in Table 2 is the size of the adjusted R^2. In many cases its size is reasonable, indicating a good fit.

4. Conclusion and summary

Previous studies that investigated the short-run and the long-run effects of real depreciation of British pound on the U.K. trade balance either used trade data between the U.K. and the rest of the world, or between the U.K. and a major trading partner, such as the U.S. No significant impact was discovered by either group. We suspect that both groups of studies suffer from aggregation bias. Disaggregating trade data at the industry level may reveal a significant relation between the real exchange rate and the trade balance for at least some industries.

In this paper we employ annual data from 177 industries that traded between the U.S. and U.K. during 1962-2003 in order to assess the short-run and long-run effects of changes in the real dollar-pound rate on the trade balance of each industry. A method that does not require pre-unit-root testing but incorporates the integrating properties of the variables into the estimation procedure, i.e., the bounds testing approach to cointegration and error-correction modeling, was employed for the empirical analysis. Unlike previous research, we found that the trade balance of 60% of the industries respond to currency depreciation in the short-run with no specific patterns. The new definition of the J-Curve, i.e., short-run deterioration combined with long-run improvement receives support in 66 industries. Furthermore, included among the 66 industries that responded favourably to a real depreciation in the long run are durable as well as non-durable commodities. This later finding at

Table 2: Diagnostic statistics

Industry	Diagnostics						
	F	ECM_{t-1}	*LM*	*RESET*	*CUSUM*	*CUSUMSQ*	*Adj. R2*
Live animals	8.29	-0.58 (4.81)	0.29	0.29	*S*	*S*	0.61
Meat and meat preparations	2.52	-0.44(3.08)	1.26	0.51	*S*	*U*	0.34
Meat, fresh, chilled or frozen	3.42	-0.31(3.92)	0.19	0.50	*S*	*S*	0.39
Dairy products and eggs	4.38	-0.90(4.44)	0.13	0.09	*S*	*S*	0.31
Cheese and curd	4.63	-0.51(3.85)	0.003	0.19	*S*	*S*	0.55
Fish and fish preparations	2.87	-0.41(3.22)	0.17	0.34	*S*	*S*	0.39
Fish,fresh & simply preserved	6.45	-0.74(4.72)	0.88	0.27	*S*	*S*	0.43
Fish,in airtight containers,nes & f	1.47	0.19(1.03)	0.01	4.99	*S*	*S*	0.50
Cereals and cereal preparations	4.86	-0.13(1.80)	0.75	0.96	*S*	*S*	0.39
Fruit and vegetables	3.37	-0.37(2.62)	0.35	0.30	*S*	*S*	0.39
Fruit, fresh, and nuts - excl. oil	3.89	-0.23(1.58)	0.30	2.76	*S*	*S*	0.30
Fruit,preserved and fruit preparati	5.11	-0.50(3.69)	0.03	0.28	*S*	*S*	0.40
Vegetables, roots & tubers, fresh o	11.79	-0.98(5.68)	3.60	2.30	*S*	*S*	0.64
Vegetables, roots & tubers pres or	2.29	-0.46(3.16)	0.06	0.63	*S*	*S*	0.41
Sugar, sugar preparations and honey	3.00	-0.58(3.42)	1.09	7.53	*S*	*S*	0.37
Sugar and honey	4.28	-0.56(3.67)	0.76	0.21	*S*	*S*	0.25
Sugar confy, sugar preps. ex chocol	5.41	-0.93(4.28)	2.30	1.98	*S*	*S*	0.68
Coffee, tea, cocoa, spices & manufa	5.65	-0.73(4.12)	0.01	0.27	*S*	*S*	0.55
Coffee	5.39	-0.45(3.88)	0.68	1.72	*S*	*S*	0.32
Chocolate & other food preptns cont	5.76	-0.95(5.22)	0.03	0.10	*S*	*U*	0.45
Spices	7.08	-0.89(5.44)	0.05	2.09	*S*	*S*	0.47
Feed.-stuff for animals excl. unmil	2.48	-0.44(3.48)	0.19	0.003	*S*	*S*	0.29
Miscellaneous food preparations	1.63	-0.31(2.10)	1.28	1.45	*S*	*S*	0.49
Food preparations,nes	8.10	-0.58(4.35)	1.98	0.82	*S*	*S*	0.54
Beverages	1.17	-0.23(1.64)	2.36	1.83	*S*	*S*	0.49
Alcoholic beverages	1.21	-0.24(1.78)	2.45	1.57	*S*	*S*	0.49
Tobacco and tobacco manufactures	3.48	-0.55(3.81)	0.84	0.69	*S*	*S*	0.25
Tobacco manufactures	3.15	-0.63(3.66)	0.38	5.41	*S*	*S*	0.21
Hides, skins and fur skins, undress	1.13	-0.20(1.92)	1.20	0.06	*S*	*S*	0.02
Hides & skins,-exc.fur skins- undre	1.59	-0.28(2.28)	0.19	0.17	*S*	*S*	0.28
Fur skins, undressed	4.00	-0.57(3.59)	0.25	7.90	*S*	*S*	0.22

Oil-seeds, oil nuts and oil kernels	3.59	-0.64(3.96)	0.01	0.09	S	S	0.27
Crude rubber including synthetic an	3.99	-0.85(4.17)	3.21	1.79	S	S	0.34
Wood, lumber and cork	2.91	-0.36(1.62)	0.004	5.03	S	S	0.58
Wood in the rough or roughly square	4.30	-0.61(3.71)	0.02	0.002	S	S	0.33
Wood,shaped or simply worked	3.43	-0.41(1.66)	1.70	1.05	S	S	0.64
Pulp and paper	2.61	-0.42(2.83)	0.01	5.96	S	S	0.17
Textile fibres, not manufactured, a	3.53	-0.32(2.35)	0.62	0.60	S	U	0.43
Wool and other animal hair	6.31	-0.22(2.13)	1.82	0.31	S	U	0.50
Synthetic and regenerated-artificia	2.85	-0.37(2.71)	0.33	0.09	S	S	0.45
Waste materials from textile fabric	0.95	-0.28(2.09)	3.13	0.56	S	S	0.28
Crude fertilizers and crude mineral	6.95	-0.31(2.19)	2.63	0.02	S	S	0.52
Stone, sand and gravel	4.89	-0.19(1.06)	2.13	0.65	S	S	0.62
Natural abrasives-incl.industrial d	9.05	-0.16(0.99)	4.01	4.40	S	S	0.63
Other crude minerals	5.38	-0.91(4.86)	0.01	1.88	S	S	0.58
Metalliferous ores and metal scrap	3.49	-0.61(3.72)	0.19	0.02	S	S	0.38
Iron and steel scrap	2.48	-0.40(3.45)	0.08	0.96	S	S	0.28
Ores & concentrates of non-ferrous	5.15	-0.52(1.83)	0.55	0.12	S	S	0.61
Non-ferrous metal scrap	9.26	-0.84(6.39)	0.49	0.63	u	S	0.50
Crude animal and vegetable material	1.79	-0.42(2.01)	0.32	0.60	S	S	0.50
Crude animal materials,nes	1.90	-0.23(2.09)	0.13	0.48	S	S	0.22
Crude vegetable materials,nes	7.06	-0.79(5.20)	0.01	0.47	S	S	0.59
Coal, coke and briquettes	7.12	0.08(0.46)	0.42	1.87	S	S	0.58
Petroleum products	5.12	-0.55(3.13)	0.15	4.84	S	S	0.54
Gas, natural and manufactured	1.96	-0.25(2.38)	0.51	0.35	S	S	0.34
Animal oils and fats	3.98	-0.32(2.84)	0.77	3.66	S	S	0.30
Fixed vegetable oils and fats	2.04	0.09(0.31)	5.93	0.09	S	S	0.38
Other fixed vegetable oils	1.25	-0.43(1.57)	0.07	0.03	S	S	0.36
Animal and vegetable oils and fats,	2.23	0.50(2.96)	0.08	0.92	S	S	0.17
Chemical elements and compounds	1.92	-0.19(1.57)	2.21	0.50	S	S	0.25
Organic chemicals	2.57	-0.43(2.72)	1.47	5.69	S	S	0.40
Inorg.chemicals-elems.,oxides,halog	3.83	0.07(0.62)	3.32	0.61	S	U	0.55
Other inorganic chemicals	5.55	-0.73(4.43)	0.03	0.18	S	S	0.61
Radioactive and associated material	7.39	-0.40(2.17)	0.82	1.43	S	S	0.57
Crude chemicals from coal, petroleu	4.05	-0.65(4.75)	1.43	0.12	S	S	0.41
Dyeing, tanning and colouring mater	9.01	-0.49(3.81)	0.07	2.85	S	S	0.61
Synth.organic dyestuffs,natural ind	7.39	-0.48(3.77)	0.30	0.88	S	S	0.56
Dyeing & tanning extracts,synth.tan	2.38	-0.37(2.85)	0.01	0.52	S	S	0.18

Pigments, paints, varnishes & relat	2.83	-0.32(2.53)	0.17	0.004	S	S	0.17
Medicinal and pharmaceutical produc	2.90	-0.31(2.24)	0.05	1.46	S	S	0.37
Perfume materials, toilet & cleansi	5.19	-0.37(3.75)	0.72	1.18	S	S	0.62
Essential oils, perfume and flavour	6.60	-0.49(4.23)	5.26	5.38	S	S	0.54
Perfumery, cosmetics, dentifrices,	7.78	-0.43(3.49)	0.38	0.13	S	S	0.42
Soaps,cleansing & polishing prepara	0.50	-0.12(1.15)	0.37	2.81	S	S	0.41
Explosives and pyrotechnic products	1.91	-0.20(1.15)	0.15	1.43	S	S	0.37
Plastic materials, etc.	8.78	-0.80(5.58)	0.09	0.03	S	S	0.54
Chemical materials and products, ne	3.48	-0.42(3.26)	0.08	0.08	S	S	0.28
Leather, lthr. manufs., nes & dress	1.32	-0.23(1.97)	0.08	5.07	S	S	0.36
Leather	3.66	-0.55(3.63)	0.05	1.62	S	S	0.45
Manuf.of leather or of artif.or rec	9.40	-0.98(6.48)	0.07	1.17	S	S	0.69
Fur skins, tanned or dressed, inclu	3.35	-0.64(3.82)	0.59	6.75	S	U	0.23
Rubber manufactures, nes	8.09	-0.52(4.59)	0.01	1.56	S	S	0.48
Articles of rubber,nes	7.33	-0.52(4.41)	0.08	1.88	S	S	0.49
Wood and cork manufactures excludin	3.87	-0.50(3.88)	0.32	4.35	S	S	0.31
Veneers,plywood boards & other wood	2.83	-0.40(2.89)	0.44	0.30	S	S	0.20
Wood manufactures,nes	1.83	-0.28(2.70)	0.43	1.09	S	S	0.35
Cork manufactures	1.30	-0.42(2.32)	0.002	2.31	S	S	0.32
Paper, paperboard and manufactures	2.17	-0.16(1.44)	0.67	1.53	S	S	0.45
Paper and paperboard	1.29	-0.17(1.57)	0.43	3.25	S	S	0.27
Articles of paper, pulp, paperboard	12.04	-0.48(5.02)	0.20	0.10	S	U	0.60
Textile yarn, fabrics, made-up arti	3.26	-0.20(2.73)	0.14	1.01	S	U	0.63
Textile yarn and thread	3.60	-0.49(2.03)	0.11	2.25	S	S	0.53
Cotton fabrics,woven ex.narrow or s	3.23	-0.17(2.03)	0.02	0.03	S	S	0.39
Text fabrics woven ex narrow, spec,	3.77	-0.30(3.15)	0.01	0.27	S	S	0.46
Tulle, lace, embroidery, ribbons, t	3.61	-0.51(3.69)	0.59	0.76	S	S	0.45
Special textile fabrics and related	2.21	-0.24(2.11)	0.81	5.39	S	U	0.26
Made-up articles,wholly or chiefly	16.61	-0.14(2.16)	0.01	1.03	S	S	0.64
Floor coverings, tapestries, etc.	7.13	-0.94(4.76)	0.41	0.90	S	U	0.62
Non-metallic mineral manufactures,	5.28	-0.01(0.08)	2.89	2.49	S	S	0.57
Lime,cement & fabr.bldg.mat.-ex gla	8.83	-1.05(4.66)	1.23	7.97	S	S	0.76
Clay and refractory construction ma	8.96	-0.56(2.89)	1.93	1.18	S	S	0.53
Mineral manufactures, nes	9.94	-0.72(5.39)	0.33	0.43	S	S	0.50
Glass	8.08	-0.64(4.20)	0.04	1.88	S	S	0.62
Glassware	7.29	-0.43(3.18)	1.67	2.06	S	S	0.67
Pottery	4.50	-0.89(3.92)	0.19	0.17	U	S	0.35

Pearls and precious and semi-precio	3.05	-0.43(3.07)	0.34	0.02	S	S	0.19
Iron and steel	8.63	-1.01(6.14)	0.21	7.57	S	U	0.52
Pig iron, spiegeleisen, sponge iron	4.12	-0.73(3.96)	0.41	0.10	S	S	0.36
Ingots & other primary forms of iro	1.81	-0.33(1.89)	0.002	6.16	S	U	0.22
Iron and steel bars,rods,angles,sha	12.39	-1.32(7.45)	0.19	5.43	S	S	0.78
Universals,plates and sheets of iro	5.10	-0.83(4.74)	0.01	0.84	S	U	0.40
Iron and steel wire, excluding wire	2.58	-0.47(3.78)	0.20	0.25	S	S	0.34
Tubes,pipes and fittings of iron or	4.96	-0.75(3.91)	0.01	2.29	S	S	0.37
Iron steel castings forgings unwork	9.78	-1.06(6.58))	0.13	0.09	S	S	0.58
Non-ferrous metals	2.26	-0.38(2.50)	0.03	2.08	S	S	0.60
Silver and platinum group metals	2.11	-0.62(2.33)	0.15	0.01	S	S	0.63
Copper	12.64	-1.13(7.66)	0.18	6.01	S	U	0.66
Nickel	3.19	-0.51(3.13)	0.44	0.19	S	S	0.27
Aluminium	5.47	-0.80(3.59)	0.94	2.70	S	U	0.62
Lead	10.47	-0.94(6.82)	0.07	0.25	S	S	0.58
Zinc	1.65	-0.39(2.61)	0.07	2.55	S	S	0.08
Tin	4.64	-0.92(3.44)	0.07	2.87	S	S	0.71
Miscell.non-ferrous base metals	2.41	-0.46(3.08)	0.16	0.39	S	S	0.18
Manufactures of metal, nes	4.51	-0.18(1.15)	0.05	1.60	S	S	0.57
Finished structural parts and struc	4.61	-0.70(1.81)	0.33	4.00	S	U	0.64
Metal containers for storage and tr	5.75	-0.89(4.74)	3.53	0.19	S	S	0.43
Wire products - ex electric - & fen	5.66	-0.83(4.90)	0.35	2.58	S	S	0.39
Nails,screws,nuts,bolts,rivets and	8.46	-1.09(6.10)	0.05	3.13	S	U	0.49
Tools for use in the hand or in mac	6.42	-0.27(2.37)	0.55	0.01	S	U	0.75
Cutlery	1.79	-0.31(2.44)	0.89	2.71	S	S	0.10
Household equipment of base metals	2.00	-0.42(2.13)	0.53	0.64	S	S	0.64
Manufactures of metal, nes	3.36	-0.50(2.48)	0.17	0.20	S	S	0.71
Machinery, other than electric	2.45	-0.24(1.45)	0.25	0.08	S	S	0.67
Power generating machinery, other t	1.97	-0.50(3.18)	0.28	0.92	S	S	0.16
Agricultural machinery and implemen	5.40	-0.44(2.56)	0.004	0.08	S	S	0.59
Office machines	2.54	-0.15(1.57)	0.11	0.31	S	S	0.21
Metalworking machinery	6.72	-0.90(5.54)	0.17	0.74	S	S	0.54
Textile and leather machinery	2.42	-0.40(2.51)	0.09	0.002	S	S	0.20
Machines for special industries	13.64	-0.65(4.58)	0.02	0.18	S	S	0.66
Machinery and appliances-non electr	6.34	-0.28(3.80)	1.12	4.57	S	S	0.51
Electrical machinery, apparatus and	10.73	-0.24(2.30)	1.57	0.28	S	S	0.62
Electric power machinery and switchg	2.97	-0.30(2.73)	0.16	1.67	S	U	0.26

Equipment for distributing electric	6.43	-0.41(3.90)	0.07	0.55	S	S	0.43
Telecommunications apparatus	8.10	-0.44(3.01)	2.44	6.51	S	S	0.63
Domestic electrical equipment	5.04	-0.05(0.44)	0.33	0.74	S	S	0.30
Elec.apparatus for medic.purp.,radi	3.22	-0.29(2.35)	0.19	3.54	S	U	0.21
Other electrical machinery and appa	20.36	-0.23(2.60)	3.57	0.04	S	U	0.75
Transport equipment	8.22	-0.86(4.59)	0.49	1.73	S	S	0.53
Railway vehicles	7.08	-0.85(5.57)	0.37	1.72	S	S	0.43
Road motor vehicles	11.15	-0.98(7.10)	1.91	0.20	S	S	0.54
Road vehicles other than motor vehi	3.62	-0.43(2.67)	0.78	0.004	S	S	0.55
Aircraft	13.24	-0.92(7.52)	0.05	0.002	S	U	0.58
Ships and boats	3.22	-0.63(3.59)	0.14	3.74	S	S	0.34
Sanitary,plumbing,heating & lightin	3.67	-0.61(3.72)	0.06	0.23	S	S	0.50
Furniture	2.60	-0.27(2.29)	1.03	0.11	S	S	0.59
Travel goods, handbags and similar	7.23	-0.63(4.33)	0.04	7.00	S	S	0.41
Clothing	6.94	-0.24(3.00)	0.003	1.46	S	S	0.59
Clothing except fur clothing	6.94	-0.24(2.93)	0.001	2.28	S	S	0.58
Fur clothing and articles of artifi	1.69	-0.24(1.66)	5.86	11.46	S	S	0.53
Footwear	5.11	-0.28(.2.36)	2.20	0.04	S	S	0.62
Scientif & control instrum, photogr	4.20	0.03(0.36)	0.52	0.26	U	S	0.31
Scientific,medical,optical,meas./co	4.21	-0.22(3.13)	0.21	6.14	S	S	0.48
Photographic and cinematographic su	1.32	-0.10(0.97)	0.11	0.81	S	S	-0.01
Developed cinematographic film	2.89	-0.48(2.84)	0.23	2.62	S	U	0.26
Watches and clocks	1.63	-0.61(2.33)	0.21	0.67	S	U	0.42
Miscellaneous manufactured articles	2.43	-0.36(2.59)	1.98	0.85	S	S	0.83
Musical instruments,sound recorders	5.49	-0.20(2.44)	1.24	0.21	S	S	0.64
Printed matter	10.59	-0.24(2.25)	3.65	0.53	S	S	0.64
Articles of artificial plastic mate	1.32	-0.23(1.77)	0.33	0.75	S	S	0.40
Perambulators,toys,games and sporti	8.68	-1.19(3.91)	0.50	0.84	S	S	0.55
Office and stationery supplies, nes	4.49	-0.58(4.02)	0.04	0.14	S	S	0.50
Works of art,collectors pieces and	5.74	-1.05(4.09)	0.35	0.11	S	S	0.72
Jewellery and gold/silver-smiths wa	3.94	-0.22(1.06)	7.98	0.20	S	U	0.41
Manufactured articles, nes	4.02	-0.48(3.49)	3.24	3.73	S	S	0.38

Notes: Numbers in parentheses are the absolute values of t-ratios; LM = Lagrange multiplier test of residual serial correlation. It is distributed as (1); RESET = Ramsey's test for functional form. It is distributed as (1); CUSUM = Cumulative Sum of Recursive Residuals; CUSUMSQ = Cumulative Sum of Squares of recursive Residuals; the *F*-statistic is for testing the joint significance of lagged level variables (or cointegration) in each model. At the 10% level of significance, the upper bound critical value is 3.52. This comes from Pesaran *et al.* (2001, Table C1, Case III, p.300).

the industry level contradicts Burda and Gerlach (1992), who combined durables and non-durables and showed that durables are relatively more sensitive to the exchange rate than non-durables. They attributed the deterioration in the U.S. trade balance during the 1980s to the excessive importing of durable goods, defined as capital goods, automobiles, consumer durables, and durable industrial supplies. Our analysis shows that within each group, there are certain industries that are sensitive to the exchange rate. For example, the trade balance pertaining to the non-durable industry identified in Table 1 as 'fish and fish preparations' shows a favourable long-run effect of the exchange rate whereas, 'dairy products and eggs' does not. Similarly, the trade balance of 'iron and steel casting' as a durable industry reacts favourably to the exchange rate, whereas 'silver and platinum group metals' does not. Thus, our analysis reflects importance of disaggregation by commodity.

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APPENDIX

Data definition and sources

Annual data over 1962-2003 are used to carry out the empirical work. The data come from the following sources:

a. World Bank
b. International Financial Statistics of the IMF (CD-ROM).

Variables

TB_i = For each industry *TB* is defined as the ratio of UK imports from the US over her exports to the US. Import and export data are in millions of dollars and come from source a.

Y_{US} = A measure of US income. It is proxied by real GDP. The data come from source b.

Y_{UK} = UK real GDP, from source b.

RE = The real bilateral exchange rate between the dollar and pound, defined as $(P_{UK}.NE/P_{US})$ where P_{UK} (P_{US}) is the price level in UK (in US) and *NE* is the nominal bilateral exchange rate defined as number of dollars per pound. Thus, a decrease in *RE* reflects a real depreciation of the pound.

ENDNOTES

1. The Center for Research on International Economics (Bahmani-Oskooee) and The Department of Economics (Kovyryalova), The University of Wisconsin-Milwaukee, Milwaukee, WI 53201. Email: bahmani@uwm.edu

2. For a review article see Bahmani-Oskooee and Ratha (2004a).

3. Examples of some other studies that have tested the J-Curve for other countries are Bahmani-Oskooee (1985), Felmingham (1988), Karunaratne (1988), Noland (1989), Gerlach (1989), Himarios (1985), Brissimis and Leventakis (1989), Mahdavi and Sohrabian (1993), and Backus *et al* (1998).

4. An alternative method of assessing the long-run impact on the trade balance of currency depreciation is to estimate the Marshall-Lerner condition. According to this condition, if the sum of import and export demand elasticities adds up to more than one, a depreciation or devaluation will be effective in improving the trade balance. Bahmani-Oskooee and Niroomand (1998), who estimated the condition for almost 30 countries using cointegration analysis, found that for the U.K. it did not hold.

5. Note that like other studies including Rose and Yellen (1989), Bahmani-Oskooee and Brooks (1999) found no short-run pattern supporting the J-Curve.

6. To test for the J-curve, the bilateral trade balance between Canada and her trading partners is estimated by Marwah and Klein (1996); and between Japan and her trading partners by Bahmani-Oskooee and Goswami (2003).

7. For a detailed explanation and technical derivation of the long-run coefficients and other related methodological issues see Bahmani-Oskooee and Tanku (2007).

8. For the list of industries see Table 1.

9. The new definition of the J-Curve has been tested recently by Arora et al. (2003), Bahmani-Oskooee and Ratha (2004b) and Bahmani-Oskooee *et al.* (2005). Most earlier studies, however, have tested the traditional definition of the J-Curve with no success. These studies have already been reviewed in Bahmani-Oskooee and Ratha (2004a).

10. For a graphical presentation of the CUSUM and CUSUMSQ tests see Bahmani-Oskooee *et al.*(2005).

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