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by

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THE IRISH PAPER POUND OF 1797-1820: SOME CLIOMETRICS OF THE BULLIONIST DEBATE[1]

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Isaac Newton's under-valuation of silver at the mint in 1717 and the subsequent rise in its market price meant that Great Britain was on a **de facto** gold standard for most of the eighteenth century. So was Ireland, with the Irish pound exchanging at a ratio never straying far from 13 Irish for 12 sterling (McCusker, 1978: 39-41). However, wartime speculation forced the British pound off gold on 26th February 1797 and the Irish currency followed a few days later. There ensued the Restriction Period (1797-1820), so-called because the government 'restricted' both the Bank of England and the Bank of Ireland from paying specie on demand for their notes. These chartered banks dominated note issue in their respective jurisdictions. Severed from gold, the Irish and English pounds were free to float against each other and against other currencies. The controversies provoked by the resulting fluctuations include some of the classic works of monetary theory. The new status of the English paper pound gave rise to Henry Thornton's **Paper Credit of Great Britain** (1802) and Lord Peter King's **Thoughts on the Restriction of Payments in Specie at the Banks of England and Ireland** (1803). King's pamphlet had been prompted by a fall in the value of the English currency relative to hard currencies and the even greater depreciation of the Irish paper pound, for which King put the blame squarely on the chartered banks. Thornton's celebrated analysis was more tempered: in the long-run, he agreed, depreciation was a purely monetary phenomenon, but in the short run real factors might play a role. In an important passage he argued (1802: 143):

> But though the value of the commercial exports and imports of a country will have this general tendency to proportion themselves to each other, there will not fail occasionally to arise a very great inequality between them. A good or bad harvest, in particular, will have a considerable influence in producing this temporary difference. The extra quantity of corn and other articles imported into Great Britain in this and the last year, with a view to supply the deficiency of our crops, must have amounted in value to so many millions .. If the harvest fails, and imports are necessary, in order to supply the deficiency, payment for those imports is almost

> immediately required: but the means of payment are to be supplied more gradually through the limitation of private expenditure, or the encrease of individual industry. Hence a temporary pressure, and how to encounter it, is a great part of the wisdom of a commercial state.

This passage bears on an issue separating Thornton and Ricardo. Both shared the bullionist belief in a monetary interpretation of exchange rate and balance of payments determination. ~~Unlike~~ Thornton, however, Ricardo denied that real factors such as a poor harvest or speculative panic could cause a balance of payments deficit or, given inconvertibility, a currency depreciation even in the short run; such a deficit or depreciation could only be due to monetary policy (Ricardo, 1951; compare Perlman, 1986).

The premium on sterling against the Irish pound fell in the wake of suspension, and did not veer far above its par value of 8.33 percent during 1798 and early 1799. Perhaps this reflected the expectation in Dublin (and in London) that gold payments would soon be resumed. However, the premium rose thereafter and (measured in terms of 21-day bills on Dublin) exceeded fourteen percent in December 1799, only to drift back down to ten percent, not far from par, during 1800. It then rose erratically, and by summer 1803 had reached almost eighteen percent, meaning an effective depreciation of about ten percent. The depreciation gave rise to a pamphlet war, controversy in parliament, and a select committee. Leading actors in the controversy included Henry Parnell (1776-1842), a future paymaster general and advocate of free banking, and John Foster (1740-1828), last speaker of the Irish House of Commons. Parnell wrote a useful pamphlet (Parnell, 1804) at the height of the controversy, while Foster was the chairman of the select committee that produced the Report of the Committee on the Circulating Paper, the Specie and Current Coin of Ireland (Fetter, 1955). That report, published in June 1804, contains a clear articulation of the monetary theory of exchange rate determination. Probably because the depreciation crisis had abated somewhat by the time the Report - henceforth described as the Irish Currency Report - was published, it attracted little attention at the time, and was never debated in parliament. Indeed, the controversy that led to the Report may well have dampened expectations of future over-issues and reduced the pressure on the Irish pound (O'Brien,

1927). The premium on the Irish currency averaged less than eleven percent in 1805-8.

Further controversy was caused by the renewed depreciation of Bank of England notes against gold in 1808-9. That depreciation gave rise to another pamphlet war, another select committee, and the famous Bullion Report of 1810 (Cannan, 1925). Both 1804 and 1810 select committee reports reached broadly similar diagnoses and policy prescriptions. Both blamed an over-issue of banknotes for depreciation. Both rejected apologetics from the chartered banks based on the Real Bills Doctrine (Fetter, 1955: 32-3, 39-41; Fetter, 1965: 42-3; Cannan, 1925: 49-51). Both invoked specially constructed trade data to undermine interpretations based on an adverse balance of payments (Fetter, 1955: 67-8; Cannan, 1925: 26-7). The Irish Report's solution was "the Bank of Ireland Notes being made convertible into Bank of England Notes, almost in the same manner as if the Restriction ceased, and they were convertible into Gold" (Fetter, 1955: 82). The Bullion Report advocated "the Repeal of the Law which suspends the Cash Payments of the Bank of England" (Cannan, 1925: 69).

The economic analysis of exchange rate determination with fiat currencies begins with Henry Thornton (1802). As noted, Thornton allowed real factors (such as wars and poor harvests) a role in the short run, but in the long run, the determination of the exchange rate was a purely monetary phenomenon. Curiously, though Thornton was a member of the select committee that produced the Irish Currency Report, that report was more dogmatic both in its rhetoric and analysis than his **Paper Credit**. Much closer to the spirit of the Irish Report were Ricardo's earliest publications. In 1809-10 Ricardo vigorously criticized those, like Thornton, who had allowed real factors a role, even for a short time (Ricardo, 1951: 81-4). The Bullion Report was more equivocal, admitting that real factors might play a part in the short run: "Your Commitee are disposed to think .. that the circumstances of the trade of the country, in the course of the last year, were such as to occasion a real fall of our Exchanges with the Continent to a certain extent". Balance of payments problems could have forced the exchange rate down to "the limit fixed by the cost at that time of transporting specie". However, the depreciation

substantially exceeded that limit, and in the end the Report pointed the finger at "the want of a sufficient check and control in the issues of paper from the Bank of England" (Cannan, 1925: 26, 30, 66).

The Bullion Report lauded the findings of the 1804 Irish select committee (Cannan, 1925: 39-42), the main focus of this paper. The conclusions of the Irish Report stemmed from a largely implicit model of the economy, which assumed both a stable demand for money and purchasing power parity. Fending off all explanations resting on real factors, the Irish Report found that the depreciation of the Irish pound "arises almost entirely, if not exclusively, from an excess of Paper". For this, it pointed the finger at the Bank of Ireland as determinant of the country's money supply. Prior to the Restriction, the Report reasoned, the threat of demands for cash ensured that the Bank reduced its issues as soon as the premium on sterling rose, but the Restriction Act "freed the Directors of the Bank of Ireland from that necessity". The select committee left open why the Bank over-expanded its note issue, not meaning "to decide whether the Directors of [the Bank] might not have had strong reasons for their conduct" (Fetter, 1955: 72).[2] Others were less indulgent towards the Bank, accusing it of lining its own pockets by issuing more and more paper (King, 1803: 52-3; Parnell, 1804: 175-6). Either way, if stability was the object, the policy implication was almost inescapable: the Bank of Ireland must be disciplined by making it pay on demand, if not gold, then Bank of England notes against its own at the previous par of exchange (Fetter, 1955: 71, 72, 82). Several witnesses before the select committee had claimed that an adverse balance of payments was responsible for the depreciation, but the committee replied that this claim was based on defective trade data. Their own specially-constructed balance of trade statistics tellingly reversed the sign implied by data at 'official', rather than current market, values (Fetter, 1955: 67-8). The Irish Report, succinct and cogent, earned a considerable reputation in its day, and was officially republished twice, in 1810 as an appendix to the more famous Bullion Report, and again in 1826. It was 'rediscovered' by Frank Whitson Fetter, who produced a new edition with an excellent introduction and selections from the minutes of evidence (Fetter, 1955).

This paper is concerned with the evidential statistical basis for the model and policy prescriptions of the Irish Currency Report. It is curious that in linking note issue and the exchange rate, the 1804 Report inferred a trend from three observations. It noted that in March 1797, when Bank of Ireland note-issues totalled between £600,000 and £700,000, the premium on sterling ranged between 5.5 and 6.75 percent; by April 1801, the note-issue was £2.27 million and the premium 11.75 to 13 percent; at the beginning of 1804, the numbers were £2.99 million and 17 to 18 percent (Fetter, 1955: 72). Now this will hardly pass muster as conclusive evidence: indeed, as made clear elsewhere in the Report, it was the **ratio** of note issues in Dublin and London that counted. The implicit message of the Report's model is that by expanding note issue faster than its English counterpart, the Bank of Ireland forced up the note exchange and depreciated the Irish currency. This suggests a relationship such as

$$(1) \qquad EX_t = a_t + b_t RN_t$$

where EX is the natural logarithm of the nominal exchange rate and RN the natural logarithm of the ratio of Bank of Ireland to Bank of England note issues, so that (1) implies that a one percent rise in RN depreciates the equilibrium value of the exchange rate by b percent. Interpreting (1) as a long-run equilibrium relationship we may model the observed relationship between EX and RN in any period by the error process:

$$(2) \qquad u_t = EX_t - a_t - bRN_t$$

where u_t is the extent to which the system is out of equilibrium, or the equilibrium error. If (1) is a valid equilibrium relation, then (2) must have several special properties. Specifically the generating mechanism for u_t must be a *stationary process* with a time invariant mean and variance, i.e. the mean or expected value and variance of u_t must be constant with respect to time so that the expectation of u at some time t+k is independent of shocks at time t for 'large' k.

As a simple example consider (a, b) = (0, 1) so that a one percent

relative rise in the Irish note issue **eventually** leads to a one percent depreciation in the equilibrium value of the nominal exchange rate. If the adjustment process is spread over time u_t defines the extent of disequilibrium in any period t and will eventually tend to zero, its expected value, as the adjustment proceeds. If, on the other hand, u does not revert but increases over time then the assumed equilibrium between EX and RN will not be attained, and a relationship such as (1) will be statistically invalid.

Drawing on the work of Engle and Granger (1987), (1) can be interpreted as a valid equilibrium relationship if (a) EX and RN are integrated of the same order, and (b) u_t is a stationary series. If these conditions hold then EX and RN are said to be co-integrated variables. A variable is integrated of order zero, or I(0), if it is stationary in its levels and is integrated of order one, or I(1), if it is non-stationary in levels but stationary after first-differencing. If EX and RN are both I(0) then u_t will also be I(0), and (1) can be said to describe a statistically valid relationship. If, however, EX and RN are each integrated of order one, then (1) is only statistically valid if there exists a co-integrating vector (a*, b*) such that the error process

$$(3) \qquad e_t = EX_t - a^* - b^*RN_t$$

is I(0). Given, as is demonstrated below, that we cannot reject the hypothesis that both EX and RN are I(1), then the validity of the accusation against the Bank of Ireland requires that the variables are co-integrated. That is, there exists a linear combination of EX and RN which produces an I(0) error process. [A finding of non-cointegration must not be interpreted as meaning that no relationship between EX and RN exists, for two reasons. First, the test for cointegration used below has generally quite low power. Second, if the relationship between EX and RN is not truly bivariate, then EX and RN might appear not to be cointegrated, though using EX, RN, and one or more omitted variables (such as the rates of real income growth in Ireland and England or some proxy reflecting contrasts in the evolution of banking in both countries) might well lead to

a different conclusion]. Engle and Granger (1987) propose the following procedure to test for co-integration between a pair of time series:

(i) Test that each series is I(1) as against I(0);

(ii) If (i) cannot be rejected, estimate the co-integrating vector by ordinary least squares (OLS). Engle and Granger show that if the series are co-integrated then the co-integrating vector will be unique and will be found by an OLS regression of EX on RN or RN on EX.

(iii) Test that the residuals from (ii) are an I(1) process as against I(0).

Note that the null hypothesis in (i) and (iii) is that the series in question is non-stationary or I(1), so that the standard statistical tests are inappropriate. The test procedure adopted for (i) is as follows. Regressions of the following form are run:

$$(4)\quad DX = a + bT + cX_{-1} + g_i DX_{-i} + e$$

where DX equals $X - X_{-1}$, and i is large enough to ensure that the residuals are white noise. A t-test is first used to test for c = 0 (using the tables given in Fuller (1976: Table 8.5.2, third block). If the null hypothesis is rejected, there is no need to proceed any further. If not, then we test for the significance of the trend (b = 0) under the now **accepted** null of a unit root. If the null hypothesis of b = 0 is rejected, that means that we cannot reject the hypothesis that the y_t process has a unit root with b not equal to zero. These steps involve testing for the unit root **separately** from testing for the significance of deterministic components and is generally a higher power procedure than testing for a = b = c = 0. If the null hypothesis of b = 0 is accepted, then we re-estimate (4), having dropped the time trend (Dolado, Jenkinson and Sosvilla-Rivero, 1990). The critical values for the t-test for a unit root are given in Fuller (1976: table 8.5.2, second block). If the null hypothesis c = 0 is

rejected, there is no need to proceed any further. However, if the null hypothesis is accepted, we should test for a = 0 in (4). If excluding the constant term while testing for c = 0 is warranted, the appropriate critical values now are those given in Fuller (1976: table 8.5.2, first block).

My test of the most important claim of the Irish Currency Report - that the over-issue of Bank of Ireland notes was responsible for the depreciation of the Irish pound - is whether relative note issue and the exchange rate were co-integrated. Note issue data are provided by Hall (1949: 391-3) for the Bank of Ireland and Morgan (1939: 206) for the Bank of England. Fetter (1955: 20) graphed, though he did not report, movements in the exchange rate. However, Fitzpatrick (1973: 380-1) reported month-by-month the exchange in London on 21-day sight bills drawn on Dublin; the rates in March, June, September and December are used here. The quarterly tests first covered the period 1793:1 to 1822:4. While a long data series is desirable, this arguably creates a problem in interpreting the Report. It could be that the relationship implied by the Report was right for part of the period, but broke down subsequently. I therefore also carried out analysis for two shorter periods, 1793:2 to 1805:3 and 1796:1 to 1808:2. The shorter periods correspond better to that discussed in the Report and its immediate aftermath.

The results are reported in Table 1. In no case could the hypotheses a = 0 or b = 0 be rejected. c(1) refers to the value of the test statistic on RN_{-1} and EX_{-1} when drift and trend terms are included, c(2) when the trend term is excluded, and c(3) when both constant and trend terms are excluded. Since the relevant critical values exceeded those obtained in all cases, the unit root hypothesis or non-stationarity cannot be rejected in for either EX or RN for any of the periods chosen.

Next, following a procedure developed by Engle and Granger (1987), I test for co-integration. The test is for the existence of a unit root in the residuals of (1). The appropriate the standard critical values of the test statistics - the Augmented Dickey-Fuller statistic - are given in Engle and Yoo (1987) The outcome is reported in Table 2. The null hypothesis of no co-integration cannot be rejected.

A possible drawback of the quarterly RN series used above is its exclusion of post-bills. The post-bill was a device to delay payment in the event of loss or theft in transit, operating rather like a post-dated check. Though "to some degree more analogous to bills of exchange than to notes" (Barrow, 1975: 30), post-bills sometimes circulated rather like ordinary bank-notes, and therefore arguably should be added to note-issue. In England post-bills were relatively unimportant, but in Ireland their ratio to note issue was significant but variable. A half-year series of Bank of Ireland note issues that includes post-bills is available for 1796:2 to 1822:2 (Great Britain, 1823; Fetter, 1955: 131). A new definition of relative note issue - the ratio of this series to Bank of England note issue - was accordingly created. The outcome of unit root tests for two periods is presented in Table 1.B. Following the procedure outlined above, the null hypotheses a = 0 and b = 0 could not be rejected in three out of four cases, so the appropriate test statistics are c(3). In the fourth case the hypothesis a = 0 is rejected, and so the appropriate statistic is c(2), evaluated against standardized normal tables. By this criterion the null hypothesis of a random walk with drift cannot be rejected. Again, the null hypothesis of no co-integration could not be rejected in any case. The outcome of the Sargan-Bhargava test (Sargan and Bhargava, 1983) using the Durbin-Watson statistics from the co-integrating regressions (as reported in Table 3) is also consistent with this finding.

In one sense the results are not so surprising. Despite the claims of the Irish Currency Report and several critics, much of the increase in note circulation in Ireland after 1797 simply replaced specie, which had played a relatively more important role in Ireland than in England prior to suspension. Moreover, the specification takes no account of the part played by issues of Irish and English private bank issues - even if those were of secondary importance, and in large part dependent on the increase in Bank of Ireland issues (O Grada, 1991).

At the same time, the results must not interpreted as meaning that a better specified model would not have produced an equilibrium relationship between RN and EX.[3] Indeed the finding that the coefficients of RN and EX

in Table 3 are not the inverses of each other suggests, recalling the discussion earlier, that there are omitted variables in the co-integrating regressors. In other words, the results outlined above fail to support **one precise form** of the 'over-issue' hypothesis, not any possible form. As co-integrating regressions attempting to capture the economic history at issue, the regressions would be invalid, since economic theory would suggest the inclusion of additional explanatory variables. However, the bivariate model **does** provide a test of the particularly simple bullionist model outlined in the Irish Currency Report.

Table 1: TESTING FOR UNIT ROOTS - STATISTICS ON c(1), c(2), AND c(3)

	EX			RN		
Period	c(1)	c(2)	c(3)	c(1)	c(2)	c(3)
A. Quarterly Data:						
1793:4-1822:4 (117)	-2.77	-2.70	0.02	-2.19	-2.14	1.87
1793:2-1805:3 (50)	-3.16	-1.87	0.41	-2.36	-1.16	1.21
1796:1-1808:2 (50)	-2.30	-2.38	0.27	-1.78	-2.27	1.35
B. Half-Yearly Data:						
1796:2-1822:4 (52)	-3.93	-3.73	-0.06	-2.13	-1.72	2.10
1796:2-1808:3 (25)	-2.38	-2.48	-0.03	-1.93	-2.52	1.59

The one and five percent critical values for c(1), c(2) and c(3) are (Fuller, 1976: 373):

	c(1)		c(2)		c(3)	
Sample size	0.01	0.05	0.01	0.05	0.01	0.05
100	-4.04	-3.45	-3.51	-2.89	-2.60	-1.95
50	-4.15	-3.50	-3.58	-2.93	-2.62	-1.95
25	-4.38	-3.60	-3.75	-3.00	-2.66	-1.95

Table 2: TESTING FOR CO-INTEGRATION

A. Quarterly data:		t	B. Half-yearly data:	t
1793:2-1822:4	(119)	-2.81	1796:4-1822:4	-1.24
1793:2-1805:3	(50)	-2.01		
1796:1-1808:2	(50)	-2.10		

The 5% critical values are -3.29 (n = 50) and -3.17 (n = 100).

Table 3: CO-INTEGRATING REGRESSIONS FOR THE SARGAN-BHARGAVA TEST

A. Quarterly data:

		DW
1793:2-1822:4 (119)		
	EX = 4.576 + 0.014**RN**	.329
	RN = -10.509 + 4.24**EX**	.083
1793:2-1805:3 (50)		
	EX = 4.379 + 0.361**RN**	.703
	RN = -61.234 + 14.95**EX**	.479
1796:1-1808:2 (50)		
	EX = 4.341 + 0.397**RN**	.660
	RN = -37.614 + 9.997**EX**	.390

B. Half-yearly data:

1796:4-1822:4 (53)		
	EX = .4704 + 0.000023**RN**	.875
	RN = 9.846 + 0.0031**EX**	.121

Note: the DWs are the Durbin-Watson statistics obtained from running ex on RN and vice versa. The critical values for n = 100 are 0.511 (1%) and 0.386 (5%). For n = 50 they are 1.00 (1%) and 0.78 (5%). The numbers of observation for each pair is given in brackets.

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FOOTNOTES

1. The comments of Anindya Banerjee, Gerry Boyle, Kevin Dowd, Michael Moore, Peter Sinclair, and Rodney Thom, are gratefully acknowledged.

2. Because the suspension of specie payments was closely followed by a big increase in government borrowing - at relatively low interest rates - The Bank of Ireland's attitude to its new-found control over the money supply was ambivalent. An examination of the Bank's records during this period shows that it was placed under considerable pressure by the Irish Treasury to increase its issues (O Grada, 1991).

3. The half-yearly or annual data required to estimate such a better-specified model are unavailable. Data on another potentially useful variable, interest rate differentials, might be easier to generate (e.g. from an analysis of bill discount rates), but have yet to be produced.