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"ERRORS & OMISSIONS" IN THE REPORTING OF AUSTRALIA'S CROSS-BORDER TRANSACTIONS

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ABSTRACT

Large and variable errors & omissions imply that reported data constitute erroneous and potentially unreliable information for policy formation. To the extent that successive data revisions involve substantial alterations in the reported statistics, the study of policy conduct and of policy effectiveness is susceptible to distortion. These considerations draw attention to the nature and extent to which economic processes are misreported. Accordingly, the present study explores two specific issues in the statistical reporting of Australia's cross-border transactions: convergence of reported transactions over successive revisions, and the potential source or prominent driver/-s of the balancing item. The major positive findings are that there is only limited evidence of convergence of measured to true magnitudes of cross-border transactions; that there is robust evidence of structural instability of the balancing item; and that financial sector transactions appear increasingly to constitute the major source of misreporting of balance of payments outcomes.

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Quantitative information about cross-border transactions is collected from a variety of sources and is typically incomplete at the time of initial release. Reconciliation of the divergent reporting conventions, coverage, and time frames requires careful judgments by the statistical reporting agency. Such judgments inevitably afford room for mistakes while the available quantitative reports are invariably incomplete. Since compilation of the balance of payments accounts is governed by the principles of double entry book-keeping, any residual disparities between the reported aggregate flows of credit and debit transactions are recorded as "errors and omissions" (E&O). By construction, this "balancing item" reflects not only inconsistencies in the reporting of the two sides of transactions but also missing information.
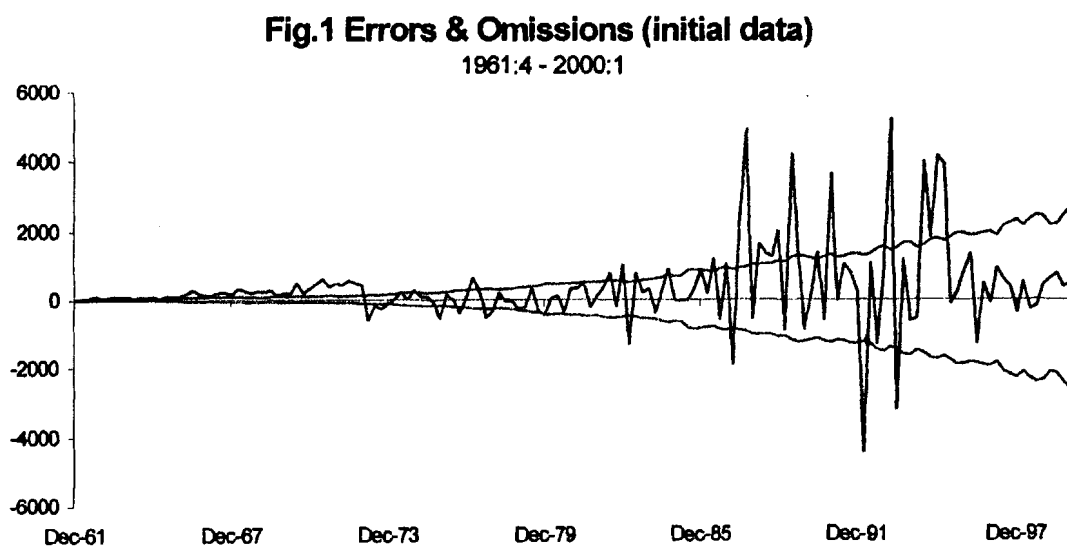
E&O are an intrinsic element of the statistical reporting of market transactions in a limited information environment. Provided that the magnitude of the discrepancies is contained within "reasonable" bounds, and that it diminishes with subsequent revisions of the data, there is a presumption of gradual convergence between the

reported and true values of the transaction flows. However, such a presumption may be unjustified if both credit and debit transactions are systematically over or underreported, respectively, with the result that the positive and negative E&O tend to cancel out. More importantly, statistical reports of economic performance constitute an important input into policy formation. If economic data do not provide an accurate picture of the performance of the economy, the ensuing policy measures will be suboptimal and may well be destabilizing. This problem is particularly acute in the context of cross-border transactions because of the prominent role that "key" performance indicators of the balance of payments, such as the current account deficits or changes in the foreign debt, play in media commentary and public debate. Furthermore, understanding of polcy effectiveness may be distorted if the data sets utilized in research differ from the actual policy input data by any number of revisions.

The present paper explores these issues in some detail by examining, in section 1, relevant quantifiable properties of the balancing item in the Australian balance of payments statistics and its evolution through successive revisions; its convergence properties and structural stability in section 2; and alternative analytical perspectives on the potential drivers of E&O in section 3. Current period data are employed throughout the investigation in order to preserve the temporal availability of the information as it evolves over time.

1. DESCRIPTIVE CHARACTERISTICS

A summary view of nearly four decades of E&O is provided in Figure 1. The graph shows the values of E&O recorded at the time of initial release of quarterly balance of payments data over the period 1961:4 to 2000:1. Distinguishing features of the time series include the predominance of positive entries for E&O, and the significant variations in their size and variability during the reporting period. The graph also shows the internationally recognized 'tolerance margin' for E&O of ± 5 percent of the absolute sum of gross merchandise imports and exports[1]

Fig.1 Errors & Omissions (initial data)
1961:4 - 2000:1

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[1] This "rule of thumb" is identified in the IMF *Balance of Payments Manual* (1977) and endorsed by the ABS (1988, 29). The endorsement was withdrawn subsequently (ABS, 1996) as "no longer appropriate [beyond] the mid-1970s when capital flows [had been] generally more constrained and services and income flows [had been] of less significance..." (15).
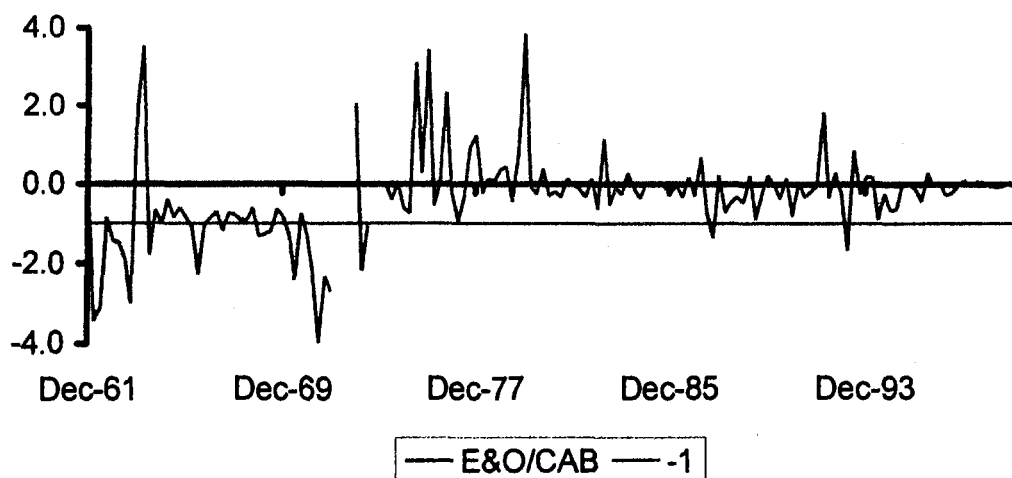
1.1 Properties of initial release data

Prominent features of the time series include the predominance of positive entries and their large size. Some seventy per cent of reported E&O are positive suggesting a systematic overreporting of debit transactions, or underreporting of credit transactions. Initial Australian balance of payments records consistently overstate transactions that give rise to payments to foreigners– loosely, imports and purchases of foreign assets – and understate those that give rise to receipts from foreign residents – loosely, exports and capital inflows. Such misreporting exaggerates current account deficits or understates net capital inflows. More than fifty per cent of the observations exceed the tolerance bounds. The incidence of such "excessive" balancing items shows a steady secular decline, and was least frequent during the last decade. At the same time, this latter period witnessed also the most severe overshooting (in 1992:1 and 1993:1). Another remarkable feature is the dramatic increase in magnitude and variance of first release entries for E&O during the decade following the mid-1980s.

One useful reference measure to gauge the relative significance of the reported statistical discrepancy is the ratio of E&O to the current account balance (CAB) (Fig. 2). On forty-one occasions (thirty-two percent of the observations) the E&O are absolutely larger than the CAB, and on twenty-nine of these occasions (nineteen percent of observations) the two series are of opposite sign. Such

outcomes place in stark relief the potential (mis-)information cost of sizable E&O.

On these twenty-nine occasions, the reported current account deficits potentially

masked actual current account surpluses. This would be the case if the recorded

E&O are dominated by incorrect reporting of current account transactions.

It is interesting to note that these relatively large negative E&O (in terms of the

current account balance) are concentrated in the 1960s and early 1970s, and that

they are followed by some comparably large positive values during the second half

Fig.2 E&O deflated by the Current Account Balance*
1961:4 - 2000:1

* The following outlier values have been removed from the graph: 1971:4 -11.00;
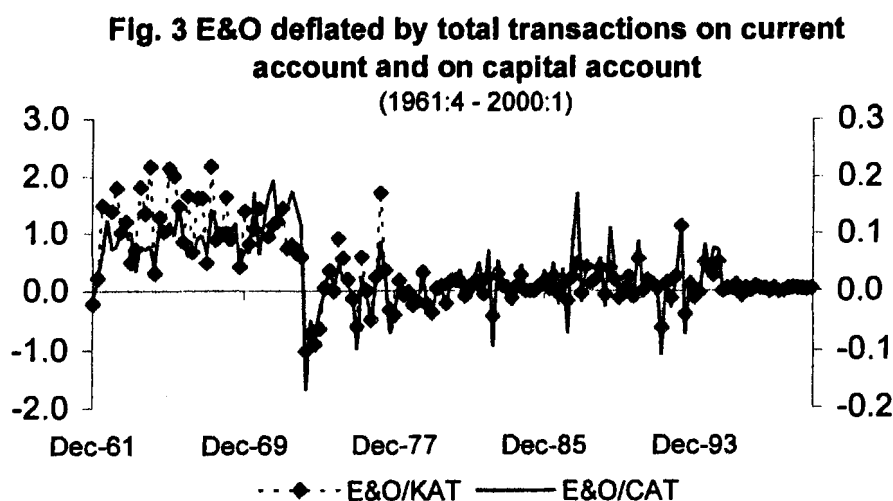1972:2 +8.38; 1972:3 +5.34; 1973:3 –7.07; 1973:4 – 12.75

of the 1970s. This volatility may reflect incomplete reporting of capital account

transactions throughout the 1960s and 1970s. Information about private capital

flows was not collected quarterly but derived from the annual Survey of Overseas

Investment. Accordingly, the ABS did not draw a sharp or consistent distinction

between the balancing item and private capital flows, frequently using the terms interchangeably.[2] This equivocation ceased formally in 1985:4 with the unequivocal declaration that the "balancing item is no longer regarded as part of the capital account". Informally, the improvements from the quarterly survey of "Australian portfolio and other investment abroad" had been implemented in the reporting of capital account transactions since 1982:3.

Casual inspection of Figure 1 indirectly corroborates the close yet vague association between the reported E&O and capital account transactions. The mapping suggests structural breaks in the series that seem to coincide loosely with innovations in financial markets. The marked increase in variability of the E&O series during the early 1970s overlaps with the breakdown of Bretton Woods and extensive exchange rate realignments. A second break is indicated in the mid-1980s after the floating of the Australian dollar and financial deregulation in Australia, and the improvement in the reporting of capital account transactions by the ABS. A third break seems to occur in the mid-1990s that could be attributed to further improvements in survey and measurement methods by the ABS (1996, pp 67).

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[2] Various contemporary releases of *Balance of Payments and International Investment Position* (Cat. No.5203.0). From time to time they identify major one-off transaction flows such as short-term debt repayments to China (1960-61), "reductions in outflows associated with transactions by marketing authorities" (1961-62), direct investment flows (1965 and 66). The turbulence in capital markets associated with the floating of Sterling in June 1972 and the subsequent (10 per cent) devaluation of the US dollar in February 1973 was duly reflected in extreme values of the Australian E&O entries.

Some tentative indications of the dominant driver may be obtained by relating

E&O to pertinent transaction activities. Systematic misreporting of either current

or capital account transactions should affect the relative shapes of the respective

series. For instance, if systematic misrepresentation of current account transactions

were to dominate E&O, then the E&O/CATT series should be relatively smooth in

comparison with E&O deflated by KATT. Fig. 3 maps the real magnitude of E&O

deflated by current account total transactions (right-hand scale) and by capital

account total transactions (left-hand scale).[3]

Fig. 3 E&O deflated by total transactions on current account and on capital account
(1961:4 - 2000:1)

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[3] Three outliers associated with unusually low transactions volumes on capital account in 1962:3, 1969:2, and 1970:4 have been removed from the graph. The values for the outliers are 6.4, 3.7, and 3.8, respectively.

The volatility of both series does not unequivocally identify one consistently dominant transaction category. Rather it indicates a pattern shift that coincides loosely with the disintegration of the Bretton Woods regime. The current account transactions deflator generates a series that is relatively smooth during the 1960s but becomes relatively volatile in the post-Bretton Woods era. The capital account transactions deflator generates the obverse pattern. By this weak criterion the main driving force of E&O switched in the early 1970s from current to capital account transactions. The blowout of E&O during the decade following the mid-1980s seems to be predominantly associated with capital account transactions as reflected in the pronounced increase in volatility of the current transactions compared to the financial transactions series.

1.2 Convergence of Data Revisions

The secular increase in the quality and extent of available information should generate progressive improvements in the accuracy of transaction reports over successive data revisions. Comparison of initial data releases with the final statistics reported in 2000:1 after the completion of a substantial number of revisions[4] provides some general support for this conjecture (Fig. 4). Evidence of significant reductions in E&O over successive revisions is concentrated in the

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[4] The exact number of revisions cannot be determined since updating of information by the ABS is an ongoing process. Since our tracing of ten revisions did not yield the data set reported in 2000:1, further rounds of revisions must have occurred.
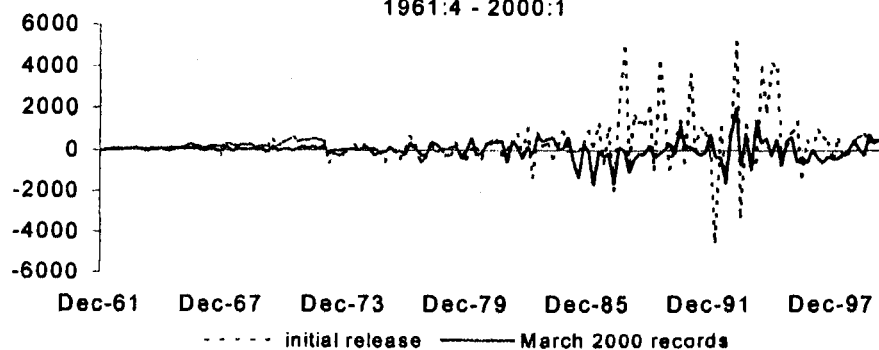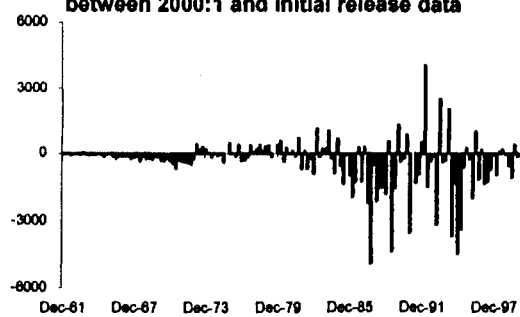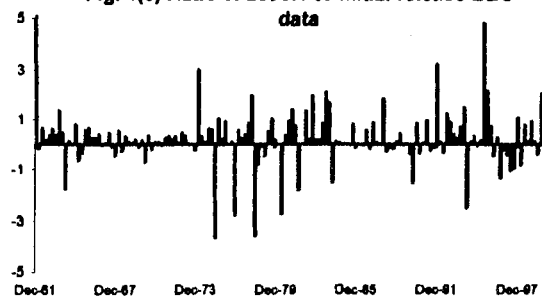
decade from the mid-80s that witnessed the large increase in the variance of E&O. However, the extent of the persistent or "permanent" statistical discrepancy during that period of substantial revisions is remarkable. For one out of every four quarters (or 26 per cent of the observations), the successive revisions create a final entry (in 2000:1) for E&O that exceeds the initially reported E&O for that quarter. For seven quarters during the period 1976:2-1986:3 the

absolute value of E&O reported in 2000:1 is more than seven times larger than the initial figure.[5] Approximately 33 per cent of the observations involve sign reversals between the initial and the 2000:1 figure, with 13 of these observations exceeding (negative) unity, by a substantial margin in several cases. This strong tendency towards divergence is not confined to a brief subsample of pronounced volatility but occurs throughout the observation period.

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[5] Figure 4, panels (b) and (c)), illustrate these observations. The seven outliers have been removed from panel (c) of Fig 4. Their values are:

1976:2	1980:1	1981:4	1984:4	1985:1	1985:2	1986:1
29.00	17.06	-7.21	-13.52	9.61	36.7	-9.82

Fig.4(a) "Permanent" E&O
1961:4 - 2000:1

- - - - - initial release ———— March 2000 records

Fig.4(b) Absolute difference in reported E&O between 2000:1 and initial release data

Fig. 4(c) Ratio of 2000:1 to initial release E&O data

Some insight into the convergence properties can be gleaned from the comparison of successive revised data. The first five revisions provide consistent evidence of sign instability among successive pairs of data revisions (Table 1, panel a). Given the apparent changes in the trend of the E&O series, we have conducted these

Table 1: E&O sign switches over successive revisions (percent)

(a)	Or-Rev 1	Rev 1 – 2	Rev2 – 3	Rev3 – 4	Rev4 – 5
1961:4 1969:4	–	3	0	0	0	9
1970:1 1979:4	–	15	15	0	3	5
1980:1 1989:4	–	28	10	10	8	8
1990:1 1998:4	–	14	21	11	14	14
Total		**60**	**46**	**21**	**25**	**36**
Average*		**15**	**12**	**5**	**6**	**9**
(b)	Or-Rev1	Or-Rev2	Or-Rev3	Or-Rev4	Or-Rev5
1961:4 1969:4	–	3	3	3	3	6
1970:4 1979:4	–	15	15	15	17	23
1980:4 1989:4	–	28	28	28	30	33
1990:4 1998:4	–	14	22	22	25	28
Total		**60**	**68**	**68**	**75**	**96**
Average*		**15**	**17**	**17**	**19**	**25**

(a) Proportion of sign switches between pairs of successive recordings of E& over five revisions.
(b) Proportion of sign switches between initial recording of E&O and successive revisions.
* Number of observations = 149

comparisons also for subperiods, chosen arbitrarily to coincide with calendar decades. The proportion of sign switches reaches a minimum for the change from the second to the third revision and then increases again. Comparison between the initial data and successive revisions (Table 1, panel b) reveals fairly persistent sign instability that reinforces the lack of a discernable convergence pattern. The sign instability is significantly more pronounced during the latter half of the observation period. For the period as a whole, the proportion of E&O that switch sign consistently increases with successive revisions in the aggregate and for the arbitrarily chosen decade subperiods. On the fifth revision an average of twenty five per cent of the initial E&O entries change sign. That is hardly indicative of an asymptotic convergence pattern.

The predominance of positive entries for E&O characterises each successive revision in the aggregate as well as the decade-long subperiods (Table 2). Once again, no readily discernable trend is apparent over successive revisions. The incidence of positive E&Os is highest during the 60s and lowest during the 70s. For the period as a whole the average proportion falls slightly after the initial data release, by approximately five percent, and stabilises at that level for the five successive revisions. The fact that positive entries dominate by a significant and remarkably stable margin in each of the successive reporting rounds provides

compelling evidence of systematic reporting bias in favour of crossborder debit transactions.

Table 2: Proportion of positive E&O

	Original	Rev 1	Rev 2	Rev 3	Rev 4	Rev 5
1961:4 – 1969:4	97	94	94	94	94	94
1970:1 – 1979:4	58	43	48	48	45	50
1980:1 – 1989:4	68	70	65	70	73	70
1990:1 – 1998:4	64	61	64	53	50	47
Average*	**71**	**66**	**66**	**65**	**64**	**64**

*   Number of observations = 149

Further qualitative indications of the convergence properties are provided by a comparison of the absolute size of E&Os and the marginal changes of the balancing item through successive revisions. There is no apparent trend in the magnitude of marginal changes from one revision to the next (Fig.2)[6] Strong evidence of a consistent reduction in the magnitude of E&O is observed only for the decade of the 1970s (Table 3). Throughout the 1980s and 1990s the size of E&O consistently increases for a clear majority of observations up to the fifth revision.
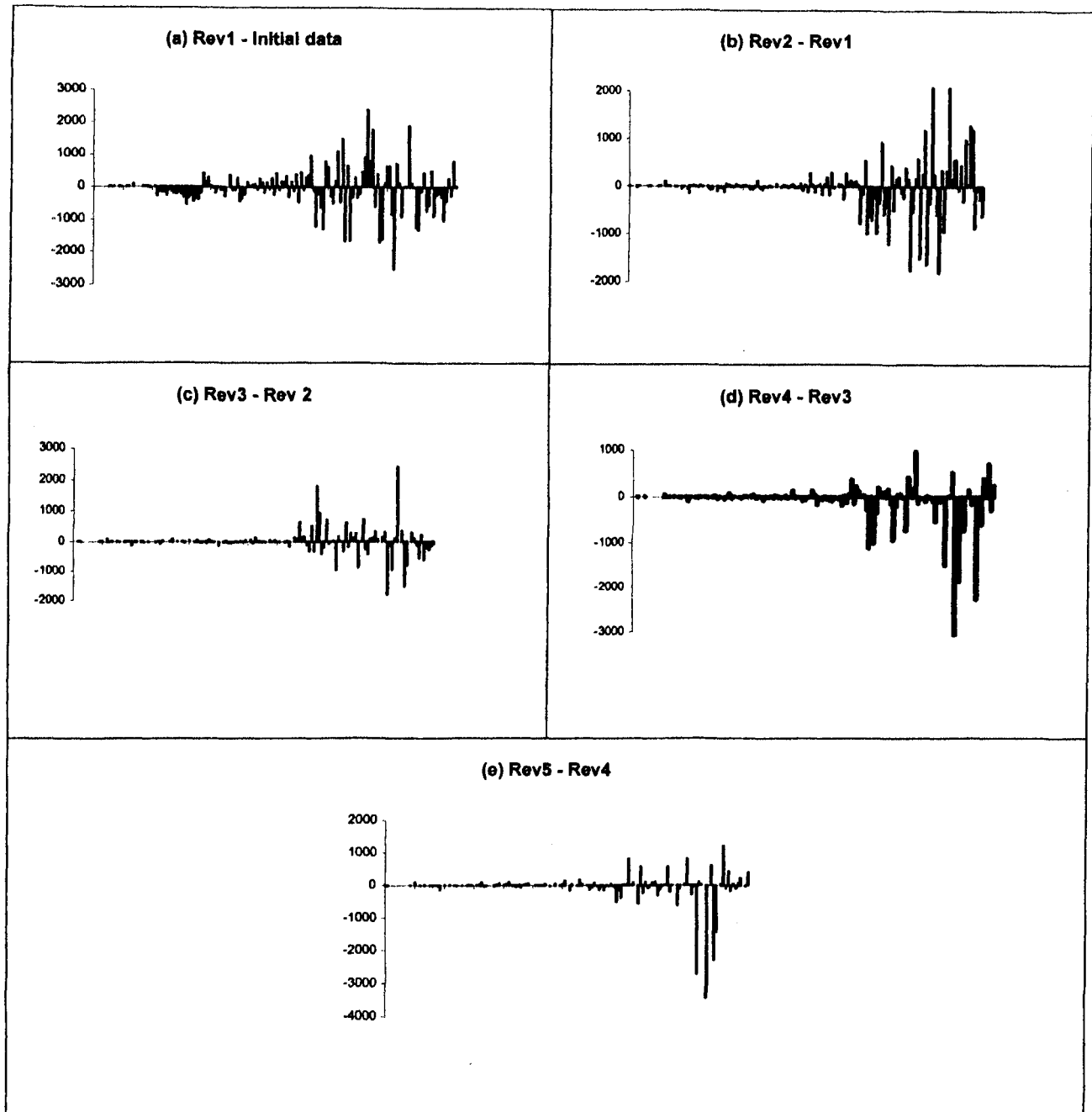
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[6] Fig.5 maps the size of the marginal changes of E&Os over successive pairs of revisions while Table 3 compares the size of successively revised E&Os with the initially reported size.

Table 3: **Proportion of revised E&O values that are absolutely smaller than the initially released values**

	Rev 1	Rev 2	Rev 3	Rev 4	Rev 5
1961:4 – 1969:4	52	64	58	58	58
1970:4 – 1979:4	80	73	75	73	73
1980:4 – 1989:4	45	40	38	43	55
1990:4 – 1998:4	36	39	42	47	53
Period average*	**54**	**55**	**53**	**55**	**59**

* Number of observations = 149

Significant "permanent" E&O remain after the revision process has been substantially completed. Figure 4 illustrates that the revision process generally eliminates the unusually large variations. However, during that processboth the size and sign of E&O change frequently, and dramatically in some instances, while large corrections are made even in the late revisions. The dominant impact of revisions appears to be concentrated on outliers. In general, increases and decreases in the absolute size of the corrections to E&O over successive revisions almost balance, with only a slight bias in favor of decreases.

Fig.5 Changes in E&Os between successive revisions

(a) Rev1 - Initial data

(b) Rev2 - Rev1

(c) Rev3 - Rev 2

(d) Rev4 - Rev3

(e) Rev5 - Rev4

In general terms, there is no compelling evidence of steady reduction over time in the average size of reported E&O. Rather, empirical evidence suggests these observations suggest the presence of persistent obstacles to the convergence of measured cross-border transactions to their true value from the initial data release to the final revision. The persistence of significant and predominantly positive "permanent" E&O indicates systematic underreporting of credit transactions (exports and capital inflows), or overreporting of debit transactions (imports and capital outflows), in the Australian balance of payments accounts.

2. STRUCTURAL STABILITY

Casual inspection of the statistical evidence suggests changes in the behavior pattern of E&O over the observation period. This impression conforms to expectations. Incisive changes in the principles and methods of data collection, and in the institutional and regulatory setting within which crossborder transactions are conducted, should be reflected in systematic differences in the quality of the statistical record and, hence, in the magnitude and behavior of the residual balancing item. We have employed two strategies to investigate the existence and timing of possible breaks in the E&O series. An OLS-based approach integrates descriptive properties of the data with prior information about the environment, while the Bayesian approach determines the breakpoints endogenously.

2.1 Properties of E&O time series

E&O entries are almost entirely positive throughout the 1960s and split almost evenly in the following decade (Table 2). The persistent run of positive entries ended in 1972:4 with an abrupt reversal from a large positive to an (absolutely) large negative entry in 1973:1. This change coincided with the disintegration of the Bretton Woods system and major exchange rate realignments following the floating of sterling in June 1972 and the devaluation of the US dollar in February 1973. The appreciation of the Australian dollar relative to both currencies would be expected to alter cross-border transaction patterns as well as providing incentives for short-term financial flows that are not easily tracked by the authorities.

A dramatic increase in the variance of E&O characterises the decade from the mid-1980s (Fig.1). At the same time, the proportion of sign switches over successive revisions of the balance of payments data (Table 1) went up substantially, while the proportion of E&O that became absolutely smaller over successive revisions decreased noticeably (Table 3). This shift in the E&O pattern coincides loosely with the implementation of financial deregulation in Australia. It also followed closely on extensive changes in the compilation of balance of payments statistics that were implemented by the ABS in 1985:4, most notably a significant improvement in the measurement of Australian investment abroad. Inspection of the data indicates a potential breakpoint in 1986:4. Once again, there is a reversal

from a large positive to a large negative entry that initiates a sustained increase in the magnitude of quarterly E&O. This run stops in 1995:1, followed by a sustained reduction in the variance of the E&O entries.

Accordingly, behavior of the data and prior information about the environment suggest that the forty-year observation period contains three distinct structural breaks. The four subperiods are 1961:1 – 1972:4, 1973:1 – 1986:4, 1987:1 – 1995:1, and 1995:2 – 2000:1. We used simple variance, mean, and trend tests on the initially released data to examine the statistical significance of the hypothesized structural breaks, and report the findings in Table 4.

Table 4: OLS tests of structural breaks in the E&O series

(a) Var test	F calc	F crit 5%	F crit 1%	Reject 5%	Reject 1%
S2/S1	1.071	1.67	2.06	No	No
S3/S2	2.590	1.99	2.69	Yes	No
S4/S3	4.039	1.72	2.15	Yes	Yes
(b) Mean test	T calc	T crit 5%	T crit 1%	Reject 5%	Reject 1%
S2 – S1	-2.157	1.671	2.39	Yes	No
S3 – S2	2.559	1.697	2.46	Yes	Yes
S4 – S3	-5.518	1.771	2.65	Yes	Yes
(c) Trend test	T calc	Tcrit 5%	T crit 1%	Reject 5%	Reject 1%
S2 – S1	-4.236	1.671	2.39	Yes	Yes
S3 – S2	-1.199	1.697	2.46	No	No
S4 – S3	1.253	1.771	2.65	No	No

There is some patchy support for our hypothetical decomposition of the sample period. The variance test corroborates our conjecture that the variance of subperiod 3 differs significantly (at 5 percent) from the variance of both adjoining periods. The mean test confirms that the means in each of the four subperiods are significantly different. At the 1 percent level the conjecture is rejected only for the transition from period one to two. The trend test confirms that the trends in the subperiods 1 and 2 differ significantly but it does not support such trend changes for any of the other breakpoints. This pattern is entirely consistent with expectations based on our earlier observations about ABS reporting practices. Since the ABS did not draw initially a sharp distinction between the balancing item and private capital flows, the incidence of misreported capital transactions would be expected to increase with the expansion and liberalization of financial markets. Accordingly, E&O should be increasing over time, and we would expect to reject the null that there was no trend change between the first two subperiods. By the same token, improvements in financial transactions reporting from the early 1980s are consistent with the finding of significant shifts in the mean of E&O between subperiods two, three and four, respectively. Thus, each of the hypothesized breaks receives some support, but none is supported by all three criteria.

2.2 Testing for structural breaks using Bayesian methods

One advantage of Bayesian inference procedures is that they combine sample information with prior information in generating posterior probability distributions for unknown parameters. This makes it possible to determine endogenously the occurrence of breaks in the mean, trend and variance of the time series. We follow the procedures outlined by Wang and Zivot (2000) in using the following time series model

$$y_t = \alpha_t + tb_t + \phi_1 y_{t-1} + \ldots\ldots + \phi_{t-r} y_{t-r} + s_t \mu_t$$

The dependent variable is the nominal value of E&O deflated by the CPI (weighted average of 8 major cities), and $t = 1,2, \ldots,154$. The unknown parameters (θ_t) to be estimated are $\alpha_t, b_t, \phi_t, s_t$ and k_t. The parameters α_t, b_t and s_t (intercept, trend and variance) are subject to m<T structural changes. Alternative numbers of structural changes (m) are set exogenously, the timing of the breaks (k_t) is determined endogenously, and the optimal number of breaks is determined as a model selection exercise based on the Schwartz criterion of minimising BIC(m).

The procedure involves combining prior information on θ with sample information captured in the likelihood function. We need to obtain the individual

elements of θ_i from the joint posterior distribution. To this end we generate random samples from the full conditional posterior distributions. With a sufficiently large number of iterations these converge to the joint posterior distribution. At the same time, the individual draws of θ_i converge to the marginal posterior distribution of that element. Thus we are able to take the mean of that distribution as our estimate of the unknown parameter. We use the GibbsSampler Algorithm to derive the estimated values of θ_i from running 2000 iterations. The resulting estimates for a particular parameter yield plots of the probability density mass.

Table 5   **Test results of Bayesian model of structural breaks**

Test	Number of structural breaks				
	1	*2*	*3*	*4*	*5*
BIC	871.47	823.85	835.65	**798.09**	821.07
Marginal likelihood	-582.50	-573.28	-564.60	**-547.02**	-547.42

Setting the number of structural breaks (m) exogenously at four, and excluding any lagged regressors yields our optimal model for the time series of real E&O (Table 5). The endogenously determined dates (k_t) of the structural breaks are 1973:1, 1973:2, 1987:1, and 1996:3, and the probability density mass for parameter k_t is plotted in Fig.5. An immediately apparent oddity of this finding is that the first two structural breaks occur in adjacent quarters. Experiments with the alternative specification of m=3 failed to yield satisfactory results. Most notably, this model

failed to acknowledge the manifest drop in the variance of the series in the mid-90s. On reflection, the "oddity" of immediately adjacent breaks appears increasingly less odd considering that 1973:1 witnessed a dramaticreversal from a persistent run of large positive entries to an "extraordinarily" large negative E&O (of -$632m). The very "extraordinaryness" of that outlier warrants another break in the following quarter before the next stable pattern gets established.

Fig.6 Probability Density Mass of Changepoints (E&O/CPI)

The parameter estimates of the optimal model (Table 6) have the following properties:

- The intercept is not significantly different from zero in each of the subperiods indicating a mean value of zero for E&O throughout the sample period.

- The trend is significantly different from zero in subperiods 1 and 3, positive and declining over time. It is strongly positive (0.461) during the first subperiod

(1961:4 – 1973:1), decreases to (0.171) during the third subperiod (1973:3 – 1987:1), and approximates zero in the last subperiod.

- The variance is significantly different from zero in all subperiods, increasing steadily during the initial thirty-five years of observation (from 3.29 in the first subperiod, to 8.98 for the 1973-87 interval, to 20.57 after 1987:1), and dropping significantly (to 3.65) during the last four years of the sample period. Despite this substantial shift, the variance is still larger than during the initial decade of the sample period which was characterized by restrictive cross-border transaction regimes and relatively poor reporting.

This analysis lends formal support to our earlier less rigorous conjectures. While not all structural breaks coincide exactly there is considerable conformity in the identification of the subperiods. Both approaches date the end of the first subperiod at 1972/3 (1972:4 and 1973:1, respectively). Abstracting from the onequarter long second subperiod identified by the Bayesian approach, both approaches place the next breakpoint in 1987:1. The most pronounced difference (of six quarters) is in the timing of the last breakpoint in the mid-90s.

Table 6 **Test results of the optimum Bayesian model of structural breaks (m=4), 1961:4 – 2000:1**

Endogenous variables	Mean value	Standard deviation	Lower confidence bound	Upper confidence bound	Reject null hypothesis of equal to zero
Level 1	0.54	3.81	-2.74	3.53	No
Level 2	-2.27	26.17	-59.71	53.42	No
Level 3	-12.17	8.49	-24.92	0.14	No
Level 4	9.23	24.93	-37.75	55.15	No
Level 5	-6.54	21.88	-50.36	36.62	No
Trend 1	0.46	0.66	0.09	0.76	Yes
Trend 2	-0.09	1.96	-1.83	1.04	No
Trend 3	0.17	0.11	0.01	0.34	Yes
Trend 4	0.00	0.21	-0.38	0.39	No
Trend 5	0.06	0.15	-0.23	0.36	No
Variance 1	3.29	4.02	1.01	5.32	Yes
Variance 2	2.43	8.42	0.01	7.07	Yes
Variance 3	8.98	1.34	7.64	10.84	Yes
Variance 4	20.57	2.74	16.29	26.66	Yes
Variance 5	3.65	1.60	2.30	5.80	Yes

3 ANALYSIS

In this section we address the question of the data generating process for E&O. In principle, the statistical discrepancy in the balance of payments accounts can be a random phenomenon. On this interpretation E&O are determined by the vagaries of reporting, processing and recording of transactions. Explanations would emphasise such irregularities as absenteeism in administrative offices, work practices and congestion on the docks, breakdown of communications equipment, timing of customs inspections, or the susceptibility of payment practices to volatile

conditions in financial markets. Such an interpretation is difficult to sustain against the robust indications of discernible patterns and distinct structural shifts in the time series of E&O.

Conversely, E&O could be determined by systematic distortions in the information-gathering process. Without casting aspersions on the motivations of transactors, it is entirely plausible that, for instance, differences in the reporting and data collection periods of goods shipments and their payments introduce a systematic lag into the receipt of information about the two sides of a transaction. Or particular types of transactions may be particularly difficult to monitor, for instance non-market transactions like the accrual and use of foreign investment income or unrequited transactions such as migrant remittances. Market signals, including conditions in money, credit and foreign exchange markets may provide powerful incentives to rearrange payment dates relative to order and shipment dates, giving rise to the well-known "leads and lags" in international payments. In short, there are potentially powerful forces at work that make for systematic discrepancies within a given time interval between the two sides of transaction records. These stable, or systematic, discrepancies may be stationary or variable.

3.1 Systematic and unsystematic errors

By definition, the E&O entry represents deviations of measured cross-border transactions from their true value. The balance of payments constraint dictates that

(1) $\qquad CA + KA + FA \equiv 0$

where CA, KA, and FA denote the true balances of transaction flows on current, capital and financial accounts.[7] On the other hand, the balance of payments accounts report

(2) $\qquad \hat{CA} + \hat{KA} + \hat{FA} + EO \equiv 0$

where the "^" denotes measured quantities, and EO represents the residual balancing item (E&O). Solving equations (1) and (2) simultaneously for EO yields

(3) $\qquad EO \equiv \left(CA - \hat{CA}\right) + \left(KA - \hat{KA}\right) + \left(FA - \hat{FA}\right).$

Errors and omissions are composed of the sum of discrepancies between true and measured transactions balances on current, capital, and financial accounts. As indicated above, the discrepancies may consist of systematic errors (ε_i) and of unsystematic errors (υ_i) where i=CA, KA, FA. Assuming that unsystematic errors are iid with zero mean and constant variance, we can express E&O in terms of the systematic errors in the component balances of the balance of payments accounts. With independent information about the true values of the component balances, say from a CGE model, the major drivers of the E&O series could in principle be

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[7] This formulation acknowledges the structural composition of the balance of payments accounts adopted by the ABS in December 1997.

identified. However, such an undertaking is not only exceedingly ambitious but, given the structural restrictions that are of necessity imposed on CGE models, it is also of doubtful benefit in providing reliable information about the data generating process.

3.2 Sectoral balance constraint

An alternative means for introducing some macroeconomic structure into the analysis is provided by the goods market balance constraint

$$(5) \quad S^n - I = CA \equiv C\hat{A} + EO$$

where S^n represents national (private plus public sector) saving. The goods market balance identifies a potential set of drivers of E&O if we interpret the balance between national saving and investment as a proxy for the true current account balance (CA). Conversely, we can follow Feldstein and Horioka (F&H, 1982) and interpret the national saving investment balance as the true measure of cross-border capital movements (KA).[8] Given the measured balance on current or capital account, E&O should vary with the national saving investment balance. Such systematic variation implies that E&O are dominated by current account or capital account transactions, respectively. The sectoral balance constraints of the open

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[8] F&H emphasized the medium-term horizon in their capital flow interpretation, and to that extent the present implementation stretches their argument. However, in the absence of a priori arguments that short-term variations of net capital flows relative to the national saving/investment balance are dominated by random disturbances we may interpret systematic covariation as evidence of unrecorded capital movements.

economy do not discriminate between the alternative interpretations. But some supplementary evidence could be obtained from examining the relation between the two component balances and E&O directly. An alternative, and potentially more useful test of this association relates E&O not to the net transactions balances but to total transactions activity recorded in the alternative component accounts (CATT and KATT, respectively, the absolute sum of total credit and debit entries recorded on the component accounts). Diagnostics of simple regressions based on the different interpretations are reported in Table 7.

Table 7   Diagnostics of testing E&O against sectoral balance

Test time	DW				BG				White				JB			
	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4
S^n-I	s+	ns+/-	ns+/-	ns+/-	s	ns	ns	ns	nsM	nsH	nsH	nsH	ns	ns	ns	ns
CA	s+	ns+/s-	ns+/s-	ns+	s	ns	ns	ns	nsM	nsH	nsH	nsH	s	ns	ns	ns
CATT	i+	ns+/-	ns+/-	ns+	ns	ns	ns	ns	sH	nsH	nsH	nsH	ns	ns	ns	ns
KA	s+	i+	s+	ns+	s	ns	s	ns	nsM	nsH	nsM	nsH	ns	ns	ns	ns
KATT	ns+	ns+/-	ns+/-	ns+/-	s	ns	ns	ns	nsM	nsH	nsH	nsH	ns	s	ns	ns

Si – subperiods (S1 – 1961:4-1972:4; S2 – 1973:1-1986:4; S3 – 1987:1-1996:1; S4 – 1996:2-200:1)

DW – Durban Watson test for positive first-order autocorrelation; s+ means evidence of positive autocorrelation; ns+/- means no basis for rejecting H_0 of no positive/negative autocorrelation; i– inconclusive;

BG – Breush-Godfrey test for fourth-order serial correlation; s – significant; ns – not significant;

White's test: H – test of heteroscedasticity; M – test of misspecification, given evidence of serial correlation;

JB – Jarque-Bera test for normal distribution of residuals

The diagnostics of regressing the CPI-deflated E&O on the real saving-investment balance are satisfactory for all subperiods other than the initial period. The alternative interpretations of the S/I balance yield essentially equivalent results. Only the first subperiod returns consistent evidence of misspecification. The current account interpretation of the goods market balance performs marginally better than the capital account interpretation. Replacing the component balances by total transaction records has no significant influence on the statistical quality of the results. Ignoring the first subperiod, the diagnostics are virtually identical except for the JB test for the second subperiod. That, however, is not a sufficiently robust foundation for discriminating between the alternative interpretations.

An alternative set of criteria is provided by the explanatory power of the parameter estimates generated by the different regression models (reported in Table 8). Oddly, the first subperiod produced the highest incidence of significant parameter estimates. Given the poor diagnostics of the estimating equations for that subperiod these results must be discounted. Some models generate significant estimates for some of the remaining subperiods. Once again, we observe a general secular deterioration in the explanatory power of the alternative regressors.

Table 8: Parameters estimated in alternative E&O regressions

time	S1		S2		S3		S4	
model	cons t	paramet er	cons t	paramet er	cons t	paramet er	cons t	paramet er
S^n-I	s	ns	ns	s	ns	ns	ns	ns
CA	s	s	s	s	ns	ns	ns	ns
CATT	s	s	s	s	ns	ns	ns	ns
KA	s	s	ns	n	s	s	s	ns
KATT	s	s	ns	s	ns	ns	ns	s

s/ns – significant/not significant, based on t-statistics evaluated at the 95% confidence interval.

One interesting finding is the slightly superior performance throughout the sample period of regressors based on the capital account. Total transactions on capital account (KATT) are significant in all but the third subperiod. That was the period of extreme turbulence in the E&O series. Strangely, that was the one period during which the balance on capital account proved significant (ignoring the discounted first subperiod). In contrast, neither of the regressors based on the current account performed well during the last two subperiods although both performed consistently well during the first two subperiods.

The switch with the transition from S2 to S3 in the apparent efficacy of the alternative explanators of E&O is consistent with the conjecture that the dominant determinants of E&O changed as financial deregulation accelerated during the

mid-1980s. Superficially, this interpretation might seem to conflict with the previously noted explicit practice, before 1987, of assimilating into the balancing item some capital account transactions. However, those conventions implied that entire transaction categories were reported with the balancing item rather than merely the inadvertent and unavoidable errors and omissions of transactions formally reported on capital account. By definition, such transactions cannot be picked up by capital account based regressorss because they were not recorded on the capital account. One possible reading of this evidence is that two changes occurred at similar times during the mid-80s. There was an "exogenous" change in the recording practice by the ABS of capital account transactions, and an "endogenous" change in the market place associated with the dramatic growth in the volume and type of financial cross-border transactions. The financial innovations of the time proceeded at such a rapid pace as to make successful tracking by the authorities well nigh impossible.

3.3   Transaction categories

A more direct approach builds on the composite nature of the component balances. If the systematic mistakes are specific to particular types of transaction flows, then their influence should be revealed in appropriate regression analysis of E&O. Current ABS conventions distinguish the following main account balances and component transaction categories:

$$CA = EX - IM + FY + CT$$

$$KA = KT + NADNFA$$

$$FA = DI + PI + OI + \Delta IR.[9]$$

where all symbols represent measured magnitudes. Making the appropriate substitutions in equation (2) yields,

(4) $EO = -(EX - IM + FY + CT) - (KT + NADNFA) - (DI + PI + OI + \Delta IR)$.

Estimation of this equation, deflated by the CPI and augmented by an error term, should identify systematic mistakes associated with particular component transaction flows. Not unexpectedly, the exercise conducted over the entire forty-year sample period yielded remarkably poor diagnostics: evidence of autocorrelation, misspecification, and non-normality (Table A9). But it also reaffirmed our findings of structural instability of the E&O series: the Goldfeld-Quandt test showed significant evidence of change in variance during the sample period, while Chow tests corroborated the structural breaks identified by Bayesian methods (1973:1, 1987:1, and 1996:3)[10].

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[9] EX – exports of goods and services; IM – imports of goods and services; FY – net income receipts from abroad; CT – current transfers; KT – capital transfers; NADNFA – net acquisition/disposal of non-produced non-financial assets; DI – net direct investment flows; PI – net portfolio flows; OI – other investment flows; ΔIR – change in reserve asset holdings.

[10] Because of the close proximity of the second and third breaks reported in section 2.2 we ignored the second breakpoint in 1973:2 and conducted the following experiments on the basis of three breakpoints, and correspondingly four subperiods.

Reestimating the component flow equation for the four subperiods yielded better test diagnostics: while DW tests for first-order autocorrelation remained inconclusive there was no evidence of fourth-order serial correlation in any of the four subperiods. White's test for heteroscedasticity did not return any significant results for the subperiods, and there was no longer any evidence of non-normality in the distribution of the residuals (Jarque-Bera). However, while all parameters other than CT and KT are significant for the entire sample period, there is a notable secular deterioration in their significance (Table 9).[11]

Table 9: Significance* of transaction flow parameters

Parameters	1961:4-2000:1	S1	S2	S3	S4
constant	s	s	s	ns	ns
GDS	s	s	s	s	ns
SER	s	s	s	ns	ns
FY	s	s	ns	ns	ns
CT	ns	ns	ns	ns	ns
KT	ns	ns	ns	ns	ns
PI	s	ns	s	ns	ns
OI	s	s	ns	ns	ns
DI	s	ns	ns	ns	ns
ΔIR	s	s	s	s	ns

* t-tests at 95% significance

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[11] CT and KT are not significant in any of the subperiods nor is direct investment (DI). Portfolio investment (PI) is not significant except for the second subperiod. All other parameters are significant for the first subperiod. From the second subperiod onwards net income receipts from abroad (FY) and other investments (OI) cease to be significant. Services (SER) and the constant term follow suit from the third subperiod onwards. In the last subperiod none of the parameters is significant.

The steady deterioration in the explanatory power of the estimators suggests some underlying structural alteration independent of the breaks already identified. Apparently the E&O in the recording of cross-border transactions have become endemic or generic as distinct from being prominently associated with particular transaction categories. This could be the consequence of deregulation and liberalization removing specific distortions from cross-border transaction flows and/or their reporting. Conversely, the erosion in the fit of the regressors could simply reflect the declining scope for revisions of more recent observations. Balance of payments data revision is a continuing process at the ABS rather than an exercise restricted to a limited number of iterations. Hence, the more distant the observation point, the greater the opportunity for improvement of its recorded measurement. Our findings are therefore not inconsistent with the joint hypothesis that E&O are systematically related to component transactions flows and that the accuracy of the statistical record continues to improve with time.

3.4   The IMF diagnosis

Concern with the size, persistence and volatility of E&O is not specific to the Australian balance of payments recording. It is a universal phenomenon brought into stark relief by the observation that annual reports of national trade balances imply a non-trivial global current account deficit of US$88 billion in 1996.

Consistent with the Australian experience, this global imbalance suggests a persistent overstating in national economic data of debit transactions and underreporting of credit transactions. The findings of the IMF Working Party (1987) into the nature of this statistical discrepancy may be useful in illuminating the nature of Australia's large and volatile E&O.

The IMF report located the "overriding factor" in the secular growth of the statistical discrepancy in the global investment income account, emphasizing "the emergence of a large body of cross-border assets recognized by the debtor countries but not by the creditors, coupled with higher interest rates after 1979" (pp2). It also identified "persistent excess of debits in the shipping and transportation accounts" and in the reporting of official unrequited transfers. "[T]aken together, the income, transportation, and official transfer sectors are responsible for most of the overall C[urrent] A[ccount] discrepancy, and for its growth, since 1979" (pp9). At the same time, there are indications that assets and incomes of indebted countries are systematically underrecorded (pp12).

Our implementation of the IMF diagnosis involved testing the following model

$$(6) \quad \frac{BI}{CPI} = \alpha + \alpha \frac{KT}{CPI} \alpha \frac{DI}{CPI} \alpha \frac{PI}{CPI} \alpha \frac{OI}{CPI} + \varepsilon$$

Once again, the test diagnostics of the estimating equation are fairly sound (Table 10). However, the explanatory power for Australia's E&O of the variables emphasized by the IMF is extremely patchy, and disappears altogether in the last subperiod of our sample (Table 11). The one moderately resilient finding is that direct investment is significant for the first three subperiods. However, the conceptual and practical difficulties of tracking DI compromise the usefulness of this positive finding.

Table 10:   Diagnostics of applying the IMF diagnosis to Australia's reported E&O

Test time	DW				BG				White				JB			
	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4
IMF	i+	ns+	ns+/i-	ns+	s	ns	ns	ns	ns nsHnsHnsHM				ns	ns	ns	ns

s – subperiods (s1 – 1961:4-1972:4; s2 – 1973:1-1986:4; s3 – 1987:1-1996:1; s4 – 1996:2-200:1)

DW – Durban Watson for positive first-order autocorrelation; s+ means evidence of positive autocorrelation; ns+/- means no basis for rejecting H_0 of no positive/negative autocorrelation; i- inconclusive;

BG – Breush-Godfrey test for fourth-order serial correlation; s – significant; ns – not significant;

White's test: H – test of heteroscedasticity; M – test of misspecification, given evidence of serial correlation;

JB – Jarque-Bera test for normal distribution of residuals

Table 11:   Significance* of IMF parameter estimates

time	S1	S2	S3	S4
model	paramet er	paramet er	paramet er	paramet er
const	s	s	ns	ns
KT	ns	ns	ns	ns
DI	s	s	s	ns
PF	s	ns	ns	ns
OI	ns	s	ns	ns

s/ns – significant/not significant, based on t-statistics evaluated at the 95% confidence interval.

Notwithstanding the relatively poor track record of the estimators employed in the various models, the analysis of Australia's E&O has generated some positive results. Abstracting from the first subperiod, the test diagnostics are generally pretty good, and highly robust for the last subperiod. Specifically, for the period commencing in 1996:2, the diagnostics suggest that nothing of significance is left unexplained in the residuals. Yet for each of the models no estimating parameter returned a significant coefficient. Our findings give rise to the somewhat puzzling general observation of an inverse association between the quality of the test diagnostics and the quality of the parameter estimates.

4. CONCLUSION

The residual item Errors & Omissions is a quantitatively significant component of Australian quarterly balance of payments statistics. Its predominantly positive value suggests a systematic bias towards underrecording of cross-border transactions that give rise to receipts from foreign residents. Successive revisions of balance of payments data have helped to smooth the time series of "permanent" E&O by reducing their variance, especially during the particularly turbulent decade following the mid-1980s. However, a significant proportion of "permanent" quarterly E&O exceed the initially reported entry.

These general features have been remarkably robust over time, persisting in the face of wide-ranging changes in the institutional environment and regulatory framework that govern cross-border transactions. Our investigation loosely supports the perception that the temporal evolution of the balancing item is dominated by financial sector transactions. We have identified robust evidence of structural shifts in the behaviour of E&O that can be associated with changes in the institutional and policy environment. At the same time, our findings fail to yield solid support for the expectation of substantial convergence over successive revisions of balance of payments records to the true value of cross-border transactions.

Information about cross-border transactions constitutes an important input into the formulation of economic policies in open economies. In the real time setting of actual policy formation, policy makers rely on current or contemporaneous data as one important information input into their decision making process. To the extent that initial transaction reports are inaccurate, policy development is susceptible to commensurate distortion. By the same token, the empirical assessment of the effectiveness of economic policies is made difficult by the fact that transaction records are revised frequently and, on many occasions, substantially. These distortions are potentially exacerbated in open societies where policy makers are sensitive to public exhortation.

From time to time, the balance of payments occupies an exceedingly prominent place in public awareness and debate in very open small economies such as Australia. This prominence implies that balance of payments developments tend to receive significant media attention, and that public perceptions mediated by ostensibly expert commentary and discussion tend to exert a potentially powerful influence on the policy making process. The social benefit of such influence varies with the quality of the information on which public perceptions are based. From that perspective the magnitude and volatility of initial E&O, and the persistence of significant "permanent" E&O, gives some cause for concern.

Public debate is not always disinterested, nor does it always exploit all available information fully. Indeed, given the apparent error content in available contemporaneous economic statistics, it is rational for public fora such as radio talkback and media commentary to avoid preoccupation with quantitative minutiae and to focus instead on generic and presumably robust qualitative criteria such as the state of the current or capital account balance. Australia has witnessed numerous episodes when public debate was strongly preoccupied with the current account deficit and its presumed domestic resource allocation implications. Public preoccupation, voiced with sufficient urgency and intensity, may provoke political reactions that are designed to display demonstratively "corrective" policy activism. Such policy reactions can be particularly destabilizing if the reported current account deficit is grossly overstated or, worse, if it disguises an actual surplus. Accordingly, inaccurate reporting of cross-border transactions reflected in large E&O, amplified by vigorous public debate that tends to gain in intensity as elections approach, may seriously distort the policy formation process and potentially impose significant welfare losses on economies. Conversely, these potential welfare losses provide a powerful incentive for continuing improvements in the collection and compilation of economic data.

REFERENCES

Australian Bureau of Statistics (1965 to 2000) *Balance of payments and international investment position*, ABS Catalogue No. 5203.0.

_____ (1996), *Quality of Australian Balance of Payments Statistics*, Information Paper, ABS Catalogue No. 5342.0.

Ashley, R. (1984), "A simple test for regression parameter instability",*Economic Inquiry*, 22, 253-68.

Australian Bureau of Statistics, "Quality of Balance of Payments Statistics" in *Balance of Payments, Australia: Concepts, Sources and Methods*, ABS Catalogue No. 5331.0, page 144

Australian Bureau of Statistics, "Introduction of under coverage estimates of foreign investment in Australian real estate" in *Balance of Payments: Australia*, September Quarter 1989.

Australian Bureau of Statistics (1989), *Foreign Investment, Australia*, September Quarter, Catalogue No. 5306.0.

Bewley, R. and R. Milbourne (1992), "Analyzing statistical discrepancy", School of economics, UNSW, June, mimeo.

CSO (1992), "Improving Economic Statistics", *Economic trends*, February.

Eason, R. (1991), "Balance of Payments Statistics: A review of Collection and Compilation", CSO, mimeo.

Fausten, Dietrich K. and Robert Brooks (1996), "The balancing item in Australia's balance of payments accounts: an impressionistic view",*Applied Economics*, 28, 1303-1311.

Feldstein, M. and C. Horioka (1980), Domestic Saving and International Capital Flows," *Economic Journal*, 90 (June), 314-329.

IMF (1977), *Balance of Payments Manual*, 4th ed, Washington D.C.

_____(1987), *Final Report of the Working Party on the Statistical Discrepancy in World Current Account Balances*, September, Washington D.C.

Runkle, David E. (1998), "Revisionist History: How Data Revisions Distort Economic Policy Research," *Quarterly Review*, Federal Reserve Bank of Minneapolis, 3-12.

Wang, Jiahui and Eric Zivot (2000), "A Bayesian time series model of multiple structural changes in level, trend, and variance," *Journal of Business and Economic Statistics*, 18, July, 374-86.

Fig.1 Errors & Omissions (initial data)
1961:4 - 2000:1

Fig.2 E&O deflated by the Current Account Balance*
1961:4 - 2000:1

——E&O/CAB   – – – -1

Fig. 3 E&O deflated by total transactions on current account and on capital account
(1961:4 - 2000:1)

E&O/KAT — E&O/CAT

Fig.4(a) "Permanent" E&O
1961:4 - 2000:1

Dec-61   Dec-67   Dec-73   Dec-79   Dec-85   Dec-91   Dec-97

- - - - initial release   ———— March 2000 records

6000
4000
2000
0
-2000
-4000
-6000

Fig.4(b) Absolute difference in reported E&O between 2000:1 and initial release data

Fig. 4(c) Ratio of 2000:1 to initial release E&O data

Fig.5 Changes in E&Os between successive revisions

In general terms, there is no compelling evidence of steady reduction over time in the average size of reported E&O. Rather, empirical evidence suggests these observations suggest the presence of persistent obstacles to the convergence of measured cross-border transactions to their true value from the initial data release to the final revision.

Fig.6   Probability Density Mass of Changepoints (E&O/CPI)

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