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TREATMENT OF INTEREST ON INDEX-LINKED DEBT INSTRUMENTS[1]

Manik Shrestha
Statistics Department
International Monetary Fund

The views expressed in this paper are those of the author and should not be attributed to the International Monetary Fund, its Executive Board, or its management.

Executive Summary

The main issue is how interest accruals should be determined when payments on a bond are indexed. As the values of indicators used in indexation are not known in advance, interest flows can not be known at the time of issue. Sometimes, they cannot be determined until the instrument is redeemed.

Based on the attached papers and discussions held in BOPTEG and AEG meetings, the following four alternatives can be considered:

- ***Keeping the 1993 SNA unchanged for the concept of interest and not allowing revisions of interest accruals*** *(when the coupons are index-linked, the full amounts paid as coupons, after indexation, are accrued as interest; and when the value of the principal is index-linked the difference between the actual redemption value and the issue price is treated as interest accruing over the life of the instrument(paragraph 7.104)). For determining interest accruing in an accounting period, the movement in the relevant index during the period is used to determine interest accruing in that period, without revising them later.*

- ***Keeping the 1993 SNA unchanged for the concept of interest, and accepting revisions*** *of interest accruals that will be determined in each accounting period either*

[1] The original version of this paper was considered at the November-December 2004 meeting of the Balance of Payments Technical Expert Group (BOPTEG), which was set up to consider issues and advise the IMF Committee on Balance of Payments Statistics (the Committee). BOPTEG's recommendations to the Committee are available from the IMF website. This paper was also discussed at the second meeting of the AEG as an information item. The paper will be considered by the Committee at its meeting of June 27-July 1, 2005. The conclusions of the Committee will be supplied to the AEG in time for the July 18-22, 2005 meeting.

*(a) by **using the movement in the relevant index in each accounting period** and revising interest when actual redemption value is known, or*
*(b) by **using the most recent observation of the relevant index** and revising interest continuously.*

- ***Clarifying or changing the 1993 SNA for defining interest on index-linked instruments by fixing the rate of accrual at the time of issue**, and treating any deviation of the index from the expected path as holding gains/losses.*

- ***Clarifying or changing the 1993 SNA for defining interest by regarding indexed-linked instruments as effectively including derivative contracts.** This is similar to previous approach. However, interest is imputed based on a similar instrument that is not indexed and the value of the embedded derivative reflects the deviation (of the imputed interest) from actual movements in the relevant index.*

I. Introduction

1. The main issue is how interest accruals should be determined for each accounting period when principal is indexed. An internal working group of the IMF Statistics Department has reviewed the treatment of interest for index-linked debt instruments denominated in domestic currency and offered a clarification on the calculation of interest for these instruments within the existing *1993 SNA* concept of interest (the STA position paper is attached). A summary is presented below.

2. The SNA update paper on issue # 43a presents the IMF Statistics Department's proposal that debt instruments with both principal and coupons linked to a foreign currency be classified and treated as though they are denominated in that foreign currency. Following that proposal, all other types of index-linked instruments, except those denominated in a foreign currency but including those that are partially linked to exchange rates (for example, those for which only principal or only coupons are linked to an exchange rate), would be treated as being denominated in domestic currency for the recording of interest and other economic flows.

II. Current international standards for the statistical treatment of the issue

3. The *1993 SNA* follows the so-called "debtor approach" for defining interest, i.e., when principal is indexed, the difference between the eventual redemption price and the issue price is treated as interest accruing over the life of the asset. For determining interest accruals in any given period, para. 7.104 suggests that *In practice, the change in the value of the principal outstanding between the beginning and end of a particular accounting period due to the movement in the relevant index may be treated as interest accruing in that period, in addition to any interest due for payment in that period.*

4. It seems that the ESA95 chose not to follow this recommendation for instruments linked to indicators other than price indices, as para. 4.46c, which suggests this treatment, mentions only instruments linked to a price index.

5. The External Debt Statistics: Guide for Compilers and Users, drawing on the ESA95 Manual on Government Deficit and Debt, states that in the absence of firm information, the accrual of interest costs should be estimated ... using the most recent relevant observation(s) of the reference index. Revisions to back data should be undertaken when the amount of interest costs that have been accrued is known with certainty (para. 2.82).

III. Concerns/shortcomings of the current treatment

6. As the values of indicators used in indexation are not known in advance, interest flows can not be known at the time of issue. Sometimes, they cannot be determined until the instrument is redeemed. This may be the reason why the *1993 SNA* allows flexibility in computing interest flows for each accounting period when principal is indexed. However, this practical approach may lead to counter-intuitive results, including highly fluctuating as well as negative interest flows (such as when the value of the indicator declines during an accounting period). This method includes all changes and fluctuations in the value of principal in each accounting period due to the movement in the relevant index as interest.

7. The *Annotated Outline* (para. 10.21) noted inadequate guidance for calculating interest for index-linked instruments.

IV. Possible alternative treatments

8. Within the existing *1993 SNA* concept of interest, the IMF Statistics Department proposed that the accrual of interest on index-linked debt instruments denominated in domestic currency be estimated using the most recent relevant observation(s) of the relevant index(es). This method will involve revisions of interest as new information becomes available.

9. The BOPTEG and AEG discussed this issue at their meetings in December 2004. BOPTEG members expressed reservations on limiting the discussion (as presented in the preceding paragraph). This paper was also presented at the December 2004 AEG meeting as an information item. The AEG expressed the view that the debtor approach did not limit discussion to Alternative 1 from the attachment (IMF Statistics Department’s paper), and Alternatives 2 and 4 in the attachment received some support.

10. As a result, the BOPTEG had further electronic discussions and as a consequence the four alternatives described in the Executive summary were put before the IMF Committee on Balance of Payments Statistics.

V. Points for discussion

Which alternative, among the four presented in the Executive Summary, do the members prefer?

References

Annotated Outline for the Revision of BPM5, IMF, April 2004 (Chapter 10).

1993 SNA (para. 7.104).

European System of Accounts 1995 (para. 4.46c).

External Debt Statistics: Guide for Compilers and Users (para. 2.82).

STA POSITION PAPER ON THE TREATMENT OF INTEREST ON INDEX-LINKED DEBT INSTRUMENTS

April 2005

Prepared by the Working Group on Indexed and Foreign Currency Debt

I. BACKGROUND

1. In May 2003, the Statistics Department (STA) of the International Monetary Fund created an internal Working Group on Indexed and Foreign Currency Debt (WGIFCD). The main objective of the WGIFCD was to examine the methodological treatment in the current international statistical standards of indexed domestic-currency debt instruments and foreign-currency debt instruments. The question arose when a member country asked the Fund whether foreign-currency bonds are to be treated differently from bonds indexed to a foreign currency. It was soon realized that it would be useful to broaden the question and review whether the treatment of indexed debt is clear and consistent with the fundamentals of macroeconomic statistics.

2. As a first step, the WGIFCD prepared a paper synthesizing its findings on whether a debt denominated in foreign currency and a debt with both principal and coupons linked to a foreign currency should be treated similarly or differently. In July 2004, STA accepted the WGIFCD's recommendation that <u>debt instruments with both principal and coupons indexed to a foreign currency should be classified and treated in the national accounts as though they are denominated in that foreign currency.</u> This recommendation has specific consequences for the recording of interest and other economic flows. [2] In determining any currency composition of positions, foreign-currency-linked debt should be classified with foreign-currency-denominated debt. (see STA Position Paper on Debt Instruments Indexed to a Foreign Currency, July 2004.)

3. This paper examines the treatment of interest for index-linked debt instruments denominated in domestic currency and offers a clarification on the calculation of interest for these instruments. The STA position has been to support the debtor approach (over the

[2] In contrast, under the current statistical guidelines, in the case of debt instruments denominated in a foreign currency, the manuals recommend to classify changes in the value of the principal in domestic currency terms that arise from exchange rate variations as holding gains (non-transactions). In the case of debt instruments indexed to a foreign currency, the manuals treated such changes as interest (transactions). This is in line with how the existing statistical standards treat all index-linked instruments.

creditor approach) for defining interest. Therefore, STA recommendations have been developed within this context, without opening this issue.

II. A BREAKDOWN OF INTEREST-BEARING INSTRUMENTS

4. For the purpose of defining and measuring interest, it is useful to distinguish between the following three categories of arrangements:

- **Domestic-currency-denominated fixed-rate instruments**. At inception, the contracting parties determine all future cash flows that the debtor must make in domestic currency. Following the approach for defining interest as recommended in the *System of National Accounts 1993* (*1993 SNA*), interest for these instruments is the difference between the sum of all debtor's payments and the principal the creditor makes available to the debtor. The information needed to calculate all interest accrual is known at inception.

- **Foreign-currency-denominated fixed-rate instruments**. At inception, future cash flows are determined in the relevant foreign currency. The recording of interest on foreign currency fixed-rate instruments is also straightforward, following the *1993 SNA*. Interest is defined according to the formula described above, with the only difference being that, in the first instance, a foreign currency is used as the unit of account. Interest expressed in foreign currency is to be converted into the domestic currency units at the mid-point market exchange rate for the periods in which the interest accrues. The information needed to calculate all interest accrual in the currency of denomination is known at inception.

- **Indexed-linked instruments**. The indexation mechanism links the coupon and/or principal payments to indicators agreed by the parties, and the values of the indicators are not known in advance. As a result, the amount of interest cannot be known at the time of issue. For some instruments, it can only be determined at the time of redemption. Indexed instruments include those indexed to an interest rate, the consumer price index, a stock exchange index, a commodity price, an exchange rate, etc.

5. As stated in paragraph (2) above, STA recommended that debt instruments with both principal and coupons linked to a foreign currency be classified and treated as though they are denominated in that foreign currency. All other types of index-linked instruments, except those denominated in a foreign currency but including those that are partially linked to exchange rates (for example, those for which only principal or only coupons are linked to an exchange rate), would be treated as being denominated in domestic currency for the recording of interest and other economic flows.

III. CURRENT TREATMENT OF INTEREST FOR INDEX-LINKED DEBT INSTRUMENTS

6. The indexation mechanism links the amount of coupons and/or principal to changes in indicators agreed by the parties involved. The current treatment is the same in the various statistical manuals and is described in the following extract from the *1993 SNA*:

> *When the coupon payments are index linked, the full amounts of such payments are treated as interest receivable and payable, in the same way as the interest receivable and payable on any other security paying a contractually agreed variable income. When the value of the principal is index linked, the difference between the eventual redemption price and the issue price is treated as interest accruing over the life of the asset in the same way as for a security whose redemption price is fixed in advance. In practice, the change in the value of the principal outstanding between the beginning and end of a particular accounting period due to the movement in the relevant index may be treated as interest accruing in that period, in addition to any interest due for payment in that period. The interest accruing as a result of the indexation is effectively reinvested in the security and this additional investment must be recorded in the financial accounts of the holder and issuer. (paragraph 7.104)*

7. The following conclusions regarding index-linked debt instruments can be derived from the above text:

- Interest is defined as the difference between the future cash flows debtor makes to the creditor and the principal the creditor makes available to the debtor: all the coupons plus (or minus) the difference between the redemption value of the debt instrument and its issue value. First, when *the coupon payments are index linked, the full amounts of such payments are treated as interest*. And, second, when *the value of the principal is index linked, the difference between the eventual redemption price and the issue price is treated as interest accruing over the life of the asset in the same way as for a security whose redemption price is fixed in advance.*

  This treatment appears to be consistent with the so-called debtor approach for defining interest accrual.

- *In practice, the change in the value of the principal outstanding between the beginning and end of a particular accounting period due to the movement in the relevant index may be treated as interest accruing in that period, in addition to any interest due for payment in that period.*[3]

[3] This treatment is also suggested in *ESA95* para. 4.46c, which mentions only instruments linked to a price index. Paragraph 5.138e mentions also instruments linked to a commodity or exchange rate index with reference to “interest that is accrued over the life of the security.” However, it seems that the ESA95 chose not to follow this recommendation for instruments linked to indicators other than price indices.

8. As the values of indicators used in indexation are not known in advance, interest flows can not be known at the time of issue. Sometimes, they cannot be determined until the instrument is redeemed. This may be the reason why the *1993 SNA* allows flexibility in computing interest flows for each accounting period when principal is indexed. However, this practical approach may lead to counter-intuitive results, including negative interest flows (such as when the value of the indicator declines during an accounting period).[4]

IV. Possible Alternatives

9. Four alternative approaches for dealing with indexation of debt instruments are discussed below.[5] They are (1) the method described in the *1993 SNA* paragraph 7.104, with variations in the practical implementation, (2) an interpretation of the debtor approach, (3) application of the creditor approach, and (4) an embedded derivative approach.

Alternative (1)

10. Alternative (1) uses the *1993 SNA* (and *BPM5* (paragraph 397)) definition of interest and clarifies the determination of interest accruals in each accounting period. Accordingly, when the coupons are index-linked, the full amounts paid as coupons, after indexation, are accrued as interest; and when the value of the principal is index-linked the difference between the eventual redemption price and the issue price is treated as interest accruing over the life of the instrument.

11. This approach has the advantage of simplicity, because the amount of interest recorded is equal to the actual amounts the debtors will have to pay to their creditors over and above the repayment of the initial principal. A disadvantage, however, is that the interest can only be determined ex-post.[6] In practice, this means that the amounts of interest accruing

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[4] Assume that the principal advanced is 1000, the value of index at the beginning of the period is 100 and at the redemption date is 110, there are two accounting periods during the life of the instrument, and the value of the index at the end of the first accounting period is 120. Then, the interest for the life of the instrument according to the *1993 SNA* is 100 ([1000*1.10] - 1000), which is the actual amount the debtor pays to the creditor. The proxy method suggested by the *1993 SNA* for calculating interest flows for each accounting period results interest flows of 200 ([1000*1.20] - 1000) in the first accounting period and -100 ([1000*1.10] - 1200) in the second accounting period.

[5] These alternatives approaches would apply to indexed debt, except for debt with both principal and coupons indexed to a foreign currency, which are treated as though denominated in foreign currency, as noted in paragraph 2.

[6] If a resetting mechanism is used, all actual cash flows for the instrument are known before maturity, at the time of the last resetting to the indexation formula (i.e., one reset period prior
(continued)

in each period are estimates in the first instance, to be revised when all actual payable amounts will be known.

12. Under alternative (1), there are two possibilities for making the initial estimates of interest accruing in an accounting period:

i. Using the movement in the relevant index during that period (as suggested in the *1993 SNA*)[7], which may result in negative interest. This method will include all changes and fluctuations in the value of principal in each accounting period due to the movement in the relevant index as interest. Estimates of interest are revised when actual amounts are known.

ii. Using the most recent relevant observation(s) of the relevant index(es). The *External Debt Statistics: Guide for Compilers and Users* (*External Debt Guide*) recommends this approach. It states that *in the absence of firm information, the accrual of interest costs should be estimated ... using the most recent relevant observation(s) of the reference index. Revisions to back data should be undertaken when the amount of interest costs that have been accrued is known with certainty* (para. 2.82).[8] Estimates of interest are revised as new information becomes available.

13. Over the entire life of the instrument, holding gains and losses due to changes in market value of the instruments (as a result of changes in interest rates or credit ratings) will cancel out.

Alternative (2)

14. Alternative (2) assumes that interest for indexed instruments under the debtor approach can be measured using the market interest rate expectation at the time of issue. Accordingly, interest is the difference between the issue price and the market expectation, at inception, of all payments that the debtor will have to make; it is recorded as accruing over the life of the instrument. This definition records as income the yield-to-maturity at issuance, which incorporates the results of the indexation that are foreseen at the moment the instrument was created. Any deviation of the underlying index from the originally expected path leads to holding gains or losses that will not normally cancel out over the life of the instrument. As the interest accruals are determined ex-ante, they are not subject to revisions later on. The disadvantage of this approach is that interest is not recorded in conformity with

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to the maturity). The resetting mechanism involves updating the indexation at periodic intervals and the calculation of cash flows using the updated index until the next reset date.

[7] *BPM5* provides no “practical” suggestion for calculating interest.

[8] The *External Debt Guide* approach draws on the *ESA95 Manual on Government Deficit and Debt.*

the *1993 SNA* as the difference between future cash flows and the initial cash flow unless ex-ante market expectations are exactly met.

15. Another disadvantage is that the logical conclusion of this approach is that all debt instruments are fixed-rate, given that all variable rate instruments are by definition linked to an index of some sort.[9]

Alternative (3)

16. Alternative (3) uses the so called creditor approach definition of interest. Accordingly, interest is the income that follows from applying, at any point in time, the accrual principle to the difference between the instrument's current market price and the market expectation of all remaining payments the debtor will have to make. The accrual of interest under the creditor approach reflects current market conditions and expectations. Like alternative (2), holding gains and losses may not cancel out because recorded interest would reflect market rates each period, and these may be influenced by factors additional to the specified index. No revisions of the accounts of previous periods are needed.

Alternative (4)

17. Alternative (4) follows an embedded derivative approach. If index-linked contracts are regarded as effectively including embedded derivative contracts, an argument can be made for imputing interest based on a similar instrument that is not indexed. Any remaining difference between the issue and redemption price would then be attributed as a flow on the interest rate derivative contract. This is similar to approach (2) except that holding gains and losses that do not cancel out over the life of the instrument would be classified under financial derivatives not debt instruments. All other holding gains and losses from period to period would be classified under the debt instruments.

18. In addition to having the same drawbacks as described under (2) above, this approach assumes that the embedded derivative can be separately identified and valued, runs counter to existing *1993 SNA* methodology for the treatment of embedded derivatives, and to International Accounting Standard 39 (IAS39) for debt instruments valued at fair value. It assumes that data are available on comparable instruments, because without such information interest cannot be measured, and that any differences in interest so observed is solely due to the indexation and takes no account of the underlying liquidity of the markets or other characteristics of the instruments and the markets in which the instruments trade.

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[9] The *External Debt Guide* (para. 6.15) defines variable-rate debt instruments as "those on which interest costs are linked to a reference index—for example, LIBOR, or the price of a specific commodity, or the prices of a specific financial instrument that normally changes over time in a continuous manner in response to market pressures." Indeed, both the debtor and creditor may have a variety of economic reasons for structuring a contract with a particular type of market-related index.

19. It is worth noting that the IAS39 recommends that embedded derivatives should be accounted separately if economic characteristics and risks of the embedded derivative are not closely related to those of the host contract and the combined instrument is not measured at fair value with changes in fair value reported in profit or loss (IAS39 para. 11). This approach was adopted to close a loophole whereby companies could avoid recording gains and losses on derivative instruments in income (and hence in capital and reserves) by "attaching" them to unrelated instruments valued at nominal value. It mentions equity-indexed and commodity-indexed interest or principal payments as embedded derivatives that have economic characteristics and risks not closely related to host contracts (IAS39 para. AG30). However, whether valued separately or not, the outcome of embedded derivatives are reflected in profit or loss.

Recommendation

20. The Intersecretariat Working Group on National Accounts (ISWGNA) is of the opinion that the *1993 SNA* follows the debtor approach. Given this position, STA proposes that the accrual of interest on index-linked debt instruments be estimated using the most recent relevant observation(s) of the relevant index(es), which is alternative 1.b above, as suggested in the *External Debt Guide*. This method will involve revisions of interest as new information becomes available, but these are likely to be relatively small.

21. STA further suggests that the various alternatives described above be considered in any further debate on the definition and recording of interest.

AN ILLUSTRATIVE EXAMPLE ON INDEXATION OF DEBT INSTRUMENTS[10]

1. This paper explores the characteristics of the four alternative methodologies for the accrual of interest on indexed debt instruments. The analysis within the paper is based upon a set of arithmetic examples. The examples are constructed on assumptions which are essentially arbitrary, but which are nevertheless considered capable of delivering robust conclusions.

The Basic Model

2. A five year zero coupon bond is issued for $1000 with its redemption value indexed to a commodity price index. The expected yield to maturity (YTM) at issue is 8% which represents a risk premium of 2pp over the opportunity cost of funds invested in a conventional zero coupon bond. The bond is traded in the secondary market where its quoted value reflects both the expected level of the indicator index at maturity and the current opportunity cost of funds. Other things being equal, an increase in the expected maturity value of the commodity index will be associated with an increase in the current market value of the debt instrument, while an increase in the opportunity cost of funds would be associated with a fall in the current market value of the debt instrument. It is further assumed that the market interest rate is effectively independent of the commodity index, i.e., the return on holding the commodity is determined by fundamentals in the supply and demand for the commodities included in the index and by expectations about those fundamentals.

3. Consider first the case where the opportunity cost of funds – the market interest rate – is unchanged at 6% over the life of the bond. What data are then needed to construct accrued interest flows and associated stock reconciliations under the various alternatives?

Alternative 1: Interest based on the actual path of the commodity index

4. In its pure form, in which data are prepared after redemption, this approach only requires the value of the indicator series at the time of redemption and the actual market values of the debt instrument at each reference date. In practice the market value series is sufficient because the value of the indicator series will be embodied within the value of the debt instrument at redemption. Before the redemption date, some estimation methods will have to be used that may require the actual path of the indicator series.

[10] The numerical examples and their explanations were prepared by Chris Wright (Bank of England) in May 2005.

Alternative 2: Interest based on expected YTM at the time of issue

5. This approach again requires the market value of the debt instrument plus the expected redemption value of the instrument at the time of issue.

Alternative 3: Interest based on expected current YTM in each period

6. This approach requires the actual and expected path for the value of the debt instrument. Notwithstanding the assumption of no change in the opportunity cost of funds, these values can diverge because actual values are affected by unforeseen changes in the indicator series.

Alternative 4: Separating the embedded derivative

7. For the debtor approach, interest flows are equivalent to those delivered by applying the unchanged market interest rate (using the information for similar instruments that are not indexed). Under this approach, the market value of the debt instrument will need to be decomposed into an element representing the value of the implied 8% bond (6% + 2pp risk premium), and the residual representing the value of the imputed derivative.

The Data

8. The starting point for the example is the actual path of the indicator series which is assumed exogenous, and the expected path of this series at the time of issue.

Table 1:

	0	1	2	3	4	5	Yield to redemption
Actual indicator	1000	1070	1130	1290	1480	1403	7.0%
Expected values at time of issue	1000	1080	1166	1260	1360	1469	8.0%
Period Changes in expected values at issue		80	86	94	100	109	
Amortized values based on actual redemption value	1000	1070	1145	1225	1311	1403	
Period Changes in amortized value		70	75	80	86	92	

9. At the end of period 1, it can be seen that the commodity index has underperformed its expected path at the time of issue. It is assumed that this will cause the expected

redemption value to be revised and thereby lead to the current market value of the debt instrument also falling below its expected value at the time of issue. For the purpose of this illustration, the expected YTM of the commodity index at the end of period t is taken to be the weighted average of the previous expected YTM and the current growth in the index, with weights of 0.7 and 0.3 respectively. Thus in period 1 the expected YTM of the index is 7.7% giving an expected redemption value of 1440. With market interest rates and the required risk premium constant this gives a market value for the debt instrument of 1058 to deliver a YTM to new investors of 8%. Following this assumed relationship through to later periods delivers the following:

Table 2:

	0	1	2	3	4	5
Expected redemption values	1469	1440	1387	1538	1641	1403
Expected remaining YTM	8.00%	7.70%	7.07%	9.20%	10.86%	
Market value of debt instrument	1000	1058	1101	1319	1519	1403

10. In this example, the market value of the debt instrument underperforms initial expectations in years 1 and 2 but then substantially over-performs in years 3 and 4 before collapsing in year 5 in response to an unanticipated downturn in the commodity index. The calculations above are shown only for illustrative purposes, in practice market values of securities at a point in time are available from markets and should be used.

11. Returning to the *1993 SNA* and the four alternatives discussed in the IMF paper for computing interest we see the following:

***1993 SNA*:**

12. Interest accruing in each accounting period is determined using the movement in the index during that period. Estimates of interest are not revised. It can be seen that total interest payments equal the difference between the issue and redemption price of the bond and that revaluations net to zero.

Table 3:

Year	Opening Balance	Interest	Revaluation	Closing Balance
1	1000	70	-12	1058
2	1058	60	-17	1101
3	1101	160	58	1319
4	1319	190	10	1519
5	1519	-77	-39	1403
Total		403	0	

Alternative 1 method (a):

13. Interest accruing in each accounting period is determined using the movement in the index during that period and revised when the actual redemption value is known. Note that the only difference with the *1993 SNA* is that the estimates of interest based on the movements in the relevant index are revised once when actual redemption value is known.

Table 4:

Year	Opening Balance	Interest		Revaluation		Closing Balance
		Initial	Final at end of year 5	Initial	Final at end of year 5	
1	1000	70	70	-12	-12	1058
2	1058	60	75	-17	-32	1101
3	1101	160	80	58	138	1319
4	1319	190	86	10	114	1519
5	1519	-77	92	-39	-208	1403
Total		403	403	0	0	

Alternative 1 method (b):

14. Interest accruals are determined using the most recent observation of the index and revised continuously.

Table 5:

Year	Opening Balance	Interest (estimates made in the year)				
		Year 1	Year 2	Year 3	Year 4	Year 5
1	1000	70	63	89	103	70
2	1058		67	96	114	75
3	1101			105	125	80
4	1319				138	86
5	1519					92
Total						403

15. In this example, the interest accruals for the entire period, from the beginning through the current period, are derived using the most recent observation of the index. This involves continuous revision of past data until the debt instrument is redeemed. The closing balances are given by the market values of the instrument at the end of the period (they will be the same as in Table 4). Each period, the difference between the closing balance and the opening balance plus interest accrued gives holding gains/losses.

Alternative 2

16. Interest is defined, for the life of the instrument, as the difference between expected redemption value at the time of issue and the issue price. Thus, interest accruals are calculated using the expected YTM at issue.

Table 6:

Year	Opening Balance	Interest	Revaluation	Closing Balance
1	1000	80	-22	1058
2	1058	86	-43	1101
3	1101	94	124	1319
4	1319	100	100	1519
5	1519	109	-225	1403
Total		469	-66	

17. Total interest flows are higher than under the *1993 SNA* approach and Alternative 1, but are offset by a net negative revaluation (holding loss) reflecting the difference between the actual and expected redemption value at the time of issue. Estimates of interest are not revised.

Alternative 3

18. Interest is defined, for the remaining life of the instrument, as the difference between the expected redemption value at the current time and the current market price.

Table 7:

Year	Opening Balance	Interest	Revaluation	Closing Balance
1	1000	80	-22	1058
2	1058	85	-42	1101
3	1101	88	130	1319
4	1319	106	94	1519
5	1519	122	-238	1403
Total		481	-78	

19. It should be remembered here that market interest rates are unchanged. The approach nevertheless delivers a different result from alternatives 1 and 2 because these latter compute interest based on an assumption of the instrument being held from issue to redemption. Alternative 3 uses an approach based on the expected return in the secondary market.

Alternative 4

20. Interest accruals and values of embedded derivative are separated. For the debtor approach, this means that interest is determined using the expected YTM at issue. The value

of the embedded derivative reflects any deviation of the interest accruals from actual movements in the relevant index.

Table 8:
Standardized Bond

Year	Opening Balance	Interest	Revaluation	Closing Balance
1	1000	80		1080
2	1080	86	0	1166
3	1166	94	0	1260
4	1260	100	0	1360
5	1360	109	0	1469
Total		469	0	

Derivative

Year	Opening Balance	Interest	Revaluation	Closing Balance
1	0	0	-22	-22
2	-22	0	-43	-65
3	-65	0	124	59
4	59	0	100	159
5	159	0	-225	-66
Total		0	-66	

21. The relationship between Alternative 4 and Alternative 2 can be seen easily from these tables. Summing the corresponding cells of the standard bond and derivative in table 8 restores the Alternative 2 presentation in table 6.

22. In this particular example in the paper, it is assumed that only the market expectation about future path of the index changes (general market interest rate and credit risk remain unchanged). Therefore, it is considered that the change in the market value of the combined instrument due to revaluations reflects the effect of the index, which passes through embedded derivative. If there were changes in interest rates as well, then one would assume that the change in market values due to the change in general interest rate would be attributed to the bond rather than the derivative. When expectation on the future path of the index as well as market interest rate and credit risk change, it could become difficult to disentangle the effect of the index on the value of the combined instrument from the effect of these other factors. An alternative approach would be to consider that all revaluations pass through the embedded derivative.

23. The same example could be used to illustrate the effect of a change in the Market interest rate. For example, if the market rate were to rise from 6% to 6.5% at the end of year 1 with no change to the risk premium, then, other things being equal, the market value of the

debt instrument would be 1039, i.e. giving an expected yield of 8.5% to an unchanged expected redemption value of 1440. The interest flows under alternative 1 and 2 would be unaffected by this change, although the subsequent revaluations would change. Under Alternative 3, a larger negative revaluation (holding loss) would be recorded in period 1 while in years 2 and following the recorded interest stream would change. Under Alternative 4, the impact of the change in the interest rate would be reflected in the market value of the standard bond with equivalent revaluation changes. The relationship between Alternative 4 and Alternative 2 would continue to hold.

Exploring the four alternatives

24. The recorded accrued interest measures for the four core alternatives described in the STA paper are not too dissimilar in this example because the actual redemption value of the commodity index is assumed to be fairly close to its expected value when the debt instrument was issued. But the story could be a very different one.

25. For example, the STA paper notes (and the above table confirms) that estimation approach A under Alternative 1 could give rise to negative interest in some periods. In fact, Alternative 1 is capable of delivering negative interest in every period – this would automatically occur if the commodity index turned out to be lower at the end of period 5 than when the debt instrument was issued at the end of period 0. This might be thought to be an extreme example but is nevertheless one which the favored method should accommodate.

26. Suppose that expectations at the time of issue were the same as in the earlier example, but that the actual value of the commodity index starts drifting down straight away and is down to 950 by year 5. Alternative 1 would then deliver negative interest flows of approximately 10 per year while Alternative 2 would deliver the same positive interest stream as in the original example as expectations at the point of issue would be fixed.

27. But we would also expect some sizeable changes in the market value of the debt instrument. Using the same arbitrary expectations model as before, the expected YTM of the commodity index at the end of year 1 would be 5.3% (weighted average of 8% and -1%) giving an expected value at redemption of 1217. Secondary market investors in the debt instrument will still expect a yield of 8%, because the opportunity cost of funds and the risk premium have not change, so the market value of the debt instrument in year 1 will be 894.

28. Applying the same assumptions as before, a series for the expected value of the commodity index at the time of redemption of the debt instrument can be calculated for each period and the associated market value of the debt instrument worked out. This gives:

Table 9:

Year	0	1	2	3	4	5
Expected value of commodity index at time of redemption	1469	1217	1084	1011	971	950
Market value of Debt Instrument	1000	894	860	867	899	950

29. Based on these data, the computed interest flows under the four alternatives would be as follows:

Table 10:

Year	1993 SNA	Alt. 1 (after revision)	Alt. 2	Alt. 3	Alt. 4
1	Based on the actual movements	-10	80	80	80
2		-10	86	72	86
3		-10	94	69	94
4		-10	100	69	100
5		-10	109	72	109
Total		-50	469	362	469

30. The precise numbers here are not important - the data are illustrative and rely on an arbitrary assumption about how expectations of future performance are updated. But the broader story they tell about the characteristics of interest under the various alternatives appears robust and so the examples are useful.

31. The first question concerns the interpretation of an accruals methodology capable of delivering negative interest. While the fact that the investor has sustained a loss in this case is clear, the nature of the loss is presented differently under the four approaches. Alternatives 2 and 3 both impute positive interest flows offset by holding losses (downward revaluations) of the debt instrument. Alternative 4 similarly imputes a positive interest stream to a synthetic bond plus an accumulated liability position in derivatives. While Alternative 1 presents the whole of the loss as a reverse flow of interest with no net holding gain or loss.

32. Whilst this example has been deliberately chosen to represent an extreme situation, it should be clear that Alternative1 does not portray interest as equivalent to the service provided by the provision of capital. The investor knows when acquiring the debt instrument that it is capital uncertain so it makes no sense to presume that the whole of the change in value through its life represents the effect of reinvested interest (or involuntary disinvestments in this particular case). This argument is particularly forceful where measured interest is negative, but is a more general concern – had the commodity index risen from 1000 to 1050 over the life of the instrument, the recording of a 1% per annum interest stream in an environment where the risk free opportunity cost is 6% can make little sense. The reality must be that the investor has earned interest at the market rate but has sustained a holding loss. Such an interpretation is, however, at odds with the SNA text which regards the difference between the issue and redemption value of the instrument as interest.

33. The market rate of return is the key. While the redemption value of the debt instrument is linked to a commodity (or some other) index, the debt instrument is traded in a market where investors require a market return independent of the performance of commodity markets. So, in the last example, if the market expectation at the time of issue had been that the commodity index would fall to 950 by year 5, then the debt instrument would have needed to be issued at a lower price ($647) in order to deliver an expected return in line with the market rate and risk premium.

34. With this in mind, Alternative 2 may better characterize the standard debtor (historic cost) approach to interest measurement. It computes interest based on the expected rather than actual return on holding the instrument from issue to redemption. As such, interest is consistent with the market return at the time of issue.

35. Similarly, Alternative 4 can be characterized as presenting a standard zero coupon bond under the debtor approach with a separately valued embedded derivative. This approach may be considered consistent with IFRS guidance on the disclosure and valuation of instruments with embedded derivatives – namely to present the underlying and the derivative separately at market or fair value.

36. However, it should be noted that interest measurement under either Alternative 2 or 4 is invariant to actual movements in the commodity index. This results from the principle of determining interest flows at the point of issue and so is a feature of the debtor approach. The CYTM approach to interest measurement in Alternative 3 uses all available data from the commodity market to update expectations and so provides an interest measure reflecting both the opportunity cost of funds and developments in the commodity index.

Conclusion

37. Of the three Alternative s (1, 2 and 4) on which views are sought, I consider the choice to lie between Alternative 2 and Alternative 4. These two Alternatives are effectively equivalent so my preference between them is a weak one.

38. Adoption of either of these Alternatives over Alternative 1, will require a change to the current SNA guidance, that, when principal is indexed, the difference between the eventual redemption price and the issue price is treated as interest accruing over the life of the asset. In the light of these examples, interest under the debtor approach is measured as the difference between the issue price and the expected redemption value at the time of issue, with any difference between the actual and expected value recorded as a holding gain or loss.