Introduction to the London Term Sheet for a GDP-linked Bond
4 October 2016

The London Term Sheet for a GDP-linked bond (the London Term Sheet) has been drafted for a fictitious sovereign, Arcadia, which has many characteristics of an emerging market economy. However, the London Term Sheet provides a set of standard terms for a GDP-linked bond (the GDP Bond) suitable for both advanced and emerging market economies, with the understanding that certain provisions will be more or less relevant depending on the issuing sovereign.

The design of the GDP Bond described in the London Term Sheet has been guided by the principle of aligning Arcadia's payment obligations (both coupon and principal) with its ability to pay, in order to reduce or avoid the need for costly sovereign defaults and debt restructurings. A sovereign's ability to service its debt depends to a large extent on the evolution of nominal tax receipts in domestic currency. In turn, changes in nominal tax receipts in domestic currency are strongly correlated with changes in the country's nominal gross domestic product (GDP). With this in mind, the London Term Sheet defines an instrument:

- denominated in **domestic currency**;

- with **coupon and principal repayments indexed to the level of domestic GDP at current prices**, measured in domestic currency, over a specified period of time;

- with **long maturities** allowing investors to take a long term view on the economic performance of the sovereign issuer.

In contrast to the many forms of highly bespoke GDP warrants – issued in the past as "sweeteners" in the context of sovereign debt restructurings – and with no downside protection for the issuer, the GDP Bond:

- has a fully **symmetrical payout profile** with no caps and floors, which allows for risk sharing between the investors and the sovereign issuer;

- provides the issuer with **debt and cash flow relief** in the event of an economic downturn;

- allows the investor to **participate in the fruits of an economic upturn** by receiving higher coupon and principal payments in times of strong GDP growth.

These characteristics have been achieved while preserving the character of the GDP Bond as a plain vanilla instrument that allows for a store of value over time. Specifically:

- the payment formula is very simple and **modeled on inflation-linked bonds**, which most public debt management agencies and institutional investors are familiar with, since they are regularly being issued by the majority of G-20 members as well as by a number of other sovereigns;

- being a bond, the GDP Bond pays a semi-annual coupon, and has a **bullet repayment** at a specified maturity date, in contrast to GDP warrants (which are streams of annuity payments);

- the GDP bond can be issued with a **factor on the principal amount** of less than 1, which avoids the potential problem of negative coupon payments in an environment of very low risk free rates; allows the issuer to front-load cash flows and potential debt relief; and, moves the issue price towards par in spite of the step-up structure of coupon and redemption payments, resulting from their indexation to nominal GDP.

The contractual terms of the GDP Bond provide the issuer with automatic and pre-defined debt relief in the event of an economic crisis, thus reducing the need for a payment default on those instruments. By providing automatic cash flow and principal relief, the sovereign's debt sustainability position is enhanced. This further helps avoid a legal default, which often has costly

economic effects for its wider economy (as well as uncertain outcomes for the bondholders). Long-term investors have an economic incentive to refinance maturing bonds even during a severe downturn as they gain to benefit from a swifter economic recovery. This alignment of interests during an economic downturn provides both the sovereign and investors with incentives to keep the GDP Bond fully performing, even in the event of default on the sovereign's fixed rate bonds. The London Term Sheet achieves this by legally ring-fencing the GDP Bond, which:

- is governed by the laws under which Arcadia issues its debt to international investors in the normal course, either domestic or foreign (*e.g.* for Arcadia, they are **governed by the laws of England and Wales,** although they could equally be governed by other appropriate external laws);

- contains the **state-of-the-art ICMA collective action clauses**, including a single-limb provision for the cross-series modification of payment terms with elevated voting thresholds and the disenfranchisement of sovereign holdings in bondholder votes, but aggregate only over the universe of the sovereign's GDP-linked securities and not with its other bonds or warrants, which allows a sovereign to keep the GDP Bond and its other GDP-linked securities outside of a restructuring of fixed rate government bonds, loans or other borrowed money;

- **cross-defaults only with the sovereign's other GDP-linked securities**, which allows the issuer to cease payments on fixed rate government bonds, loans or other borrowed money without risking an involuntary acceleration of the GDP Bond;

- **ranks equally** with all the sovereign issuer's borrowed money obligations, thus ensuring investors no worse legal treatment than other borrowed money claims.

The net practical effect of these economic characteristics and legal features is to create an instrument which is more likely to continue to perform and remain in the markets in times when the sovereign finds itself in a challenging economic situation, giving the GDP Bond **a practical seniority over other sovereign borrowings**, which should facilitate growth in the market for the instruments.

Institutional investors regularly purchase sovereign bonds with highly uncertain payout profiles, such as floating-rate bonds that are indexed to the future level of Libor or inflation-linked bonds that are indexed to changes in the Consumer Price Index (CPI) of a country or an economic region. Those state-contingent bonds are often held as assets in order to match equally uncertain, but correlated streams of liabilities (such as short-term customer deposits or defined benefit pension claims that evolve with wages), and they can readily be valued by market participants and traded in the secondary market. History has shown that financial and economic indices such as Libor or CPI are not only variable, but can also be subject to manipulation, which could apply to GDP. The GDP Bond provides investors with an extra layer of **protection against the manipulation of GDP statistics**:

- **put options** allow the investor to demand early repayment of the obligation if the issuer: (i) fails to publish an Article IV report in agreement with the IMF; (ii) violates data dissemination standards; (iii) receives an IMF censure; or, (iv) ceases to be a member of the IMF;

- a **fallback calculation mechanism** for GDP statistics is provided;

- a **penalty early redemption amount** if reliable GDP statistics are unavailable in a timely manner is suggested.

Official **data revisions** are potentially a source of uncertainty around the performance of the GDP Bond. A preliminary estimate for a quarter's GDP is typically produced around one or two months after the end of the quarter, a second estimate one month later and a first full set of quarterly accounts published after a further month. The data can often be revised further as GDP statistics for subsequent quarters are produced. To ensure that the third estimate, as published in the first full set of quarterly accounts, is available to be referenced in the GDP Bond, the London Term Sheet

indexes the principal and coupon on the bond to GDP data with a six-month lag. This compares to a three-month lag for inflation-linked debt, where the reference index is measured at a higher frequency and generally not revised.

In addition to the scheduled releases of a first, second and third estimate of quarterly GDP, there are often regular revisions to past estimates of growth, which can result in a material change to the level of GDP. There are two options in dealing with revisions to the history of recorded GDP growth when calculating payments on GDP-linked bonds. Payments can be indexed to (i) the latest vintage of data for cumulative GDP growth since issuance, taking into account periodic revisions of the latest available estimate of the base quarter, or to (ii) a chain-linked nominal GDP index that freezes the base quarter and subsequent quarterly growth rates at the third estimate of the latest available vintage of data. Preliminary consultations with the private sector, which were conducted with support of the International Capital Market Association (ICMA), indicate a preference for the latter option, where advantages are seen as providing a more stable and predictable pricing framework and a bond structure that promotes timely and consistent reporting of GDP data. While the structure of the term sheet is compatible with either choice for the index to nominal GDP, the Ad Hoc Working Group on GDP-linked Bonds notes a preference for linking to a chain-linked series of the third estimates.

Once a particular coupon or principle payment has been made, based on the specified vintage of the GDP-data available at the calculation date for determining the payment on the GDP Bond, that payment is final. There is no later compensation for future revisions to GDP-data.

All of these design elements and features of the London Term Sheet have been chosen in order to create a simple and solid instrument with practical seniority over other government obligations that can easily be valued and traded, at a low GDP risk premium over fixed rate government bonds of the same issuer.

This box has been prepared by the London-based Ad Hoc Working Group on GDP-linked Bonds.

INDICATIVE TERM SHEET — GDP BONDS

REPUBLIC OF ARCADIA

This Term Sheet sets out the indicative terms for a GDP-linked bond (GDP Bond) of a fictitious sovereign, the Republic of Arcadia. It is intended to generate discussion and debate on the usefulness of such instruments. It has not been prepared in contemplation of any transaction for any sovereign entity.

It is intended that this Term Sheet will go, in the context of this discussion and debate, through several iterations and that further work will be done on it as the discussion and debate on sovereign GDP-linked bonds continue.

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Issuer:	The Republic of Arcadia (the **Republic** or the **Issuer**).
GDP Bonds:	The bonds issued by the Republic under this issue.
Form:	The GDP Bonds will be bearer or registered in global form held on behalf of Euroclear and Clearstream, Luxembourg.
GDP-linked Securities:	The Republic's GDP-linked securities similar to the GDP Bonds (excluding any GDP warrants) including, where the context permits, the GDP Bonds.
Currency:	Arkadins (**K$**). [*only domestic currency issues*]
Status:	The GDP Bonds constitute direct, unconditional, unsubordinated and unsecured obligations of the Republic. The GDP Bonds rank, and will rank, equally among themselves and with all other unsubordinated and unsecured borrowed money of the Republic; provided, however, that, consistent with similar provisions in the Republic's other indebtedness, this provision shall not be construed so as to require the Republic to pay all items of its indebtedness rateably as they fall due. The due and punctual payment of the GDP Bonds and the performance of the obligations of the Republic with respect thereto are backed by the full faith and credit of the Republic. [*Status and ranking to be drafted to meet the requirements of individual issuers*.]
GDP:	In respect of a Reference Quarter, the Republic's seasonally-adjusted nominal gross domestic product (**GDP**) in K$ for that Reference Quarter as published by the relevant Publishing Entity.
Denomination:	K$[●] and integral multiples of K$[●] in excess thereof up to and including K$[●]. No Notes in definitive form will be issued with a denomination above K$[●]. [*Denomination to be set for 'wholesale' investors only*]
Principal Amount:	K$[●]. [*Principal Amount will be calculated by reference to the Base Date. Size should be large to enhance liquidity.*]
Principal Factor:	[●]. [*A number, greater than zero but less than one, (rounded if necessary to the fifth decimal place, with 0.000005 being rounded upwards) as specified at the Issue Date*.]
Issue Price:	[●]% of the Principal Amount (rounded if necessary to the fifth decimal place, with 0.000005 being rounded upwards) as specified at the Issue Date.
Issue Date:	[*Issue date*]
Base Date:	[DATE]. [*The Base Date will be at least a few business days prior to the Issue Date but may be a longer period depending on the overall issuance programme of the Republic. The Republic may, for example, choose to have the same base date for a number of issues, so as to have a common pricing base for all of its GDP-linked issues.*]
Base Interest Rate:	[●]% [*A positive number expressed as a percentage specified at the Issue Date.*]

Interest:	The interest payable on each Interest Payment Date per K\$[●] shall be an amount equal to:
	$$K\$ [\bullet] \; x \; \frac{BaseInterestRate}{2} \; x \; Nominal\ GDP\ Index\ Ratio_{Payment\ Date}$$
	Each amount of interest so calculated shall be rounded if necessary to the fifth decimal place, with 0.000005 being rounded upwards.
Interest Payment Dates:	Interest is payable semi-annually on [●] and [●] in each year (each an **Interest Payment Date**). [*Interest Payment Dates will be dates falling on integral multiples of six month intervals from the Base Date*] [*Annual coupons are also possible depending on an Issuer's and its investors' preferences.*]
Maturity Date:	[*Maturity date*] [*Term should be sufficiently long to provide for a smoothing of payments over a number of economic cycles, for example 10 or more years*]
Redemption Date:	(a) The Maturity Date; or
	(b) an early redemption date following:
	(i) the exercise of a Put Option; or
	(ii) an acceleration on an Event of Default.
Payment Date:	An Interest Payment Date or a Redemption Date.
Calculation Date:	The date falling two business days prior to a Payment Date.
Redemption Amount:	In respect of a Redemption Date, an amount payable in K\$ by the Republic on such Redemption Date per K\$[●] determined as follows:
	Redemption Principal Amount x Principal Factor
Redemption Principal Amount:	In respect of a Redemption Date, an amount in K\$ (rounded if necessary to the fifth decimal place, with 0.000005 being rounded upwards) equal to:
	K\$[●] x Nominal GDP Index Ratio$_{Redemption\ Date}$ x (Issue Price + Accrued Interest)
Nominal GDP Index Ratio$_{Payment\ Date}$:	In respect of a Payment Date, the ratio of Reference GDP applicable to such Payment Date (**Ref GDP$_{Payment\ Date}$**) *divided* by the Reference GDP with respect to the Base Date (**Ref GDP$_{Base\ Date}$**), (rounded if necessary to the fifth decimal place, with 0.000005 being rounded upwards), as expressed by this formula:
	$$Nominal\ GDP\ Index\ Ratio_{Payment\ Date} = \frac{Ref\ GDP_{Payment\ Date}}{Ref\ GDP_{Base\ Date}}$$
Accrued Interest:	Where interest is to be calculated in respect of a period which is less than a full six months, interest shall be calculated by applying the Base Interest Rate to each K\$[●] on the basis of (a) the actual number of days in the

period from and including the date from which interest begins to accrue (the **Accrual Date**) to but excluding the date on which it falls due divided by (b) the actual number of days from and including the Accrual Date to but excluding the next following Interest Payment Date multiplied by 2. The resultant figure shall be rounded if necessary to the nearest cent, with half a cent being rounded upwards.

Reference Quarter: Each calendar quarter for which the Republic is scheduled to publish GDP statistics.

Reference GDP for the Base Date: The result of a straight-line-basis calculation between (i) the GDP for the Reference Quarter ended six months prior to the Reference Quarter in which the Base Date falls, and (ii) the GDP for the Reference Quarter ended three months prior to the Reference Quarter in which the Base Date falls, each as published by the Statistical Institute as at the Base Date, using the following formula:

$$Nominal\ GDP\ for\ the\ calendar\ quarter\ ended\ six\ months\ prior\ to\ the\ Base\ Date\ +$$

$$\frac{Actual\ number\ of\ days\ between\ the\ end\ of\ the\ previous\ calendar\ quarter\ and\ the\ Base\ Date - 1}{Actual\ number\ of\ days\ in\ the\ calendar\ quarter\ in\ which\ the\ Base\ Date\ falls}$$

$$\times \left(\begin{array}{l} Nominal\ GDP\ for\ the\ calendar\ quarter\ ended\ three\ months\ prior\ to\ the\ Base\ Date \\ - Nominal\ GDP\ for\ the\ calendar\ quarter\ ended\ six\ months\ prior\ to\ the\ Base\ Date \end{array} \right)$$

Reference GDP for the Payment Date: The result of a straight-line-basis calculation between (i) the GDP for the Reference Quarter ended six months prior to the Reference Quarter in which the Payment Date falls, and (ii) the GDP for the Reference Quarter ended three months prior to the Reference Quarter in which the Payment Date falls, each as published by the Statistical Institute as at the relevant Calculation Date, using the following formula:

$$=$$
$$Nominal\ GDP\ for\ the\ calendar\ quarter\ ended\ six\ months\ prior\ to\ the\ Payment\ Date\ +$$

$$\frac{Actual\ number\ of\ days\ between\ the\ end\ of\ the\ previous\ calendar\ quarter\ and\ the\ Payment\ Date - 1}{Actual\ number\ of\ days\ in\ the\ calendar\ quarter\ in\ which\ the\ Payment\ Date\ falls}$$

$$\times \left(\begin{array}{l} Nominal\ GDP\ for\ the\ calendar\ quarter\ ended\ three\ months\ prior\ to\ the\ Payment\ Date \\ - Nominal\ GDP\ for\ the\ calendar\ quarter\ ended\ six\ months\ prior\ to\ the\ Payment\ Date \end{array} \right)$$

If the Publishing Entity has not published such statistics for all relevant Reference Quarters by the Calculation Date, the Reference GDP for all such Reference Quarters shall be the nominal GDP for the immediately preceding Reference Quarter for which the Publishing Entity has published such statistics for all such Reference Quarters, *multiplied* by 1.1.

[*Investors' requirements with respect to the sources of GDP, revisions of GDP and relevant fall-backs for late or non-publication of GDP may vary depending on the particular sovereign and investors' concerns as to the reliability of the GDP data available for that sovereign. In this*

regard, an earlier warning trigger for non-availability of GDP may have to be considered].

No post-Calculation Date adjustments:	No adjustments will be made to any future payments as a result of any rebasing or revisions of Reference GDP following the Calculation Date.
Statistical Institute:	The Republic's nationally recognised statistical institute being [●].
Central Bank:	The Republic's central bank being [●].
Publishing Entity:	The Statistical Institute or, if the Statistical Institute fails to publish the relevant statistics, the Central Bank. [*For issues with annual coupons and depending on the issuer, the IMF and its relevant statistics in the most recent issue of the World Economic Outlook could be a further fall-back*].
Trustee:	[●]. [*Trust or Fiscal Agency structure will have to be discussed on a case by case basis as a matter of preference and policy for each issuer.*]
Calculation Agent:	[The Republic] [*Entity entrusted with this role*].
Calculation of Payments:	All calculations relating to the GDP Bonds will be calculated by the Calculation Agent and any announcements will be made as set out under '**Notices**' below.
Call Option:	None.
Put Option:	The holder of any GDP Bond may, on the occurrence of a Put Event, exercise an option to require the Republic to redeem such GDP Bond on a specified Put Date (as defined in the relevant put notice delivered to the Republic by such holder) at the Redemption Amount.

Put Event: Will be deemed to occur if any of the following occurs:

(a) the Republic and/or the Central Bank fails to publish GDP data by the agreed date and in the manner agreed (subject to an agreed grace period);

(b) the IMF fails to publish an Article IV report for the Republic for two consecutive calendar years prior to any Calculation Date;

(c) the Republic ceases to subscribe to the IMF's Special Data Dissemination Standard applicable to it;

(d) the IMF's Executive Board issues a declaration of censure of the Republic; and

(e) the Republic ceases to be member of the IMF.

[Requirement for a Put Option, the nature of the specified Put Events and interplay with Events of Default will be determined by the relevant parties on an issuer by issuer basis.]

Negative Pledge: So long as any GDP Bond remains outstanding, the Republic shall not create or permit to subsist any mortgage, pledge, lien or charge upon any

of its present or future revenues, properties or assets to secure any Relevant Indebtedness, unless the GDP Bonds shall also be secured by such mortgage, pledge, lien or charge equally and rateably with such Relevant Indebtedness or by such other security (A) as the Trustee shall in its absolute discretion deem to be not materially less beneficial to the interests of the holders or (B) as may be approved by a resolution of the requisite majority of holders or written resolution of the holders.

[Inclusion of and/or scope of Negative Pledge to be determined by individual issuers.]

"**Relevant Indebtedness**" means, for the purpose of the Negative Pledge, any borrowed money in the form of bonds or similar debt instruments (and whether linked to any index or not) issued or guaranteed by the Republic which are, or are capable of being and intended to be, quoted, listed or ordinarily purchased and sold on any stock exchange, automated trading system or over the counter or other securities market.

Events of Default:
Each of the following events is an Event of Default:

(a)   the Republic fails to pay principal or interest on any GDP Bond (subject to appropriate grace periods);

(b)   the Republic is in default in the performance of any covenant, condition or provision and continues to be in default for [*appropriate grace period*] after written notice has been given to the Republic by [any holder] [the Trustee];

(c)   (i) any payment of principal in relation to any GDP-linked Indebtedness is not paid when due after giving effect to any applicable grace period or (ii) any GDP-linked Indebtedness has become due and payable prior to its stated maturity by reason of an event of default (however described), [provided that the amount of GDP-linked Indebtedness referred to in sub-paragraph (i) and/or sub-paragraph (ii) above individually or in the aggregate exceeds K$[●] (or its equivalent in any other currency or currencies)];

(d)   the Republic declares a moratorium with respect to the GDP Bonds, including where such moratorium forms part of a general moratorium over all or part of the Republic's indebtedness;

(e)   the Republic rescinds, repudiates or expropriates, (or purports to do so) any of the GDP Bonds or its obligations arising under the GDP Bonds or otherwise declares invalid its obligations under the GDP Bonds; and

(f)   any applicable order, decree, enactment, treaty or regulation prevents the Republic from performing its obligations under or in respect of the GDP Bonds.

The Trustee at its discretion may, and if so requested in writing by the holders of at least one-fifth in principal amount of the GDP Bonds then outstanding shall, give notice to the Republic that each GDP Bond is, and

shall forthwith become, immediately due and payable at the Redemption Amount if any of Event of Default occurs.

"**GDP-linked Indebtedness**" for the purposes of cross-acceleration ((c) above) will be limited to the Republic's other GDP-linked Securities and not to any other borrowed money obligation in the form of bonds or similar debt instruments.

[These are sample Events of Default. Events of Default to be set by individual issuers and to be consistent across all of such issuer's GDP-linked Securities.]

Listing:	Yes
Rating:	Yes.
Security:	None
Holders' Voting Rights/CACs:	The GDP Bonds will contain provisions, commonly referred to as "collective action clauses", regarding approval of certain modifications and actions:

(a)   in respect of the GDP Bonds only, with the consent of the holders of at least [75%] (for Reserved Matters) and at least [66$_{2/3}$%] (for all other matters) of the aggregate principal amount of the outstanding GDP Bonds; and

(b)   in respect of the GDP Bonds and at least one other series of GDP-linked Securities (capable of aggregation for voting purposes with other series of GDP-linked Securities) issued by the Republic, with the consent of the holders of at least [75%] of the aggregate principal amount of the outstanding GDP-linked Securities of all affected GDP-linked Securities (taken in aggregate).

Aggregation will only be possible across series of GDP-linked Securities and not include any series of the Republic's other outstanding debt.

GDP-linked Securities held by the Republic or entities controlled by the Republic will not be considered to be outstanding and their holders will not be capable of voting.

Multiple series aggregation and modification may only take place provided the 'Uniformly Applicable' condition is satisfied. Such Uniformly Applicable conditions will be satisfied if, *inter alia*, (i) the holders of all affected series are invited to exchange or convert their GDP –linked Securities for the same new instruments or new instruments from an identical menu of instruments or (ii) the amendments proposed result in the amended GDP-linked Securities having identical provisions (except as necessarily required) including without limitation the methodology for the calculation of the GDP-linked interest and principal payment amounts.

The above conditions will only be satisfied if all exchanging, converting

or amending holders of each aggregated series are offered (i) proportionally the same amount of consideration in respect of principal and interest accrued but unpaid as offered to each other holder of an affected series or (ii) where a menu of instruments is offered to holders, proportionally the same amount of consideration in respect of principal and interest accrued but unpaid as offered to each other holder of an affected series electing the same option from such menu of instruments.

Recognising the potential economic differences between series of GDP-linked Securities, proposed modifications or actions pursuant to the abovementioned aggregation may be made in respect of some series only or different offers may be made to different groups of GDP-linked Securities.

Reserved Matters: These will include resolutions proposing changes to:

(a)   the date, amount, method of calculation, currency, place of any amounts payable;

(b)   the majorities required for the passing of certain resolutions;

(c)   certain definitions (including that of GDP-linked Securities, Uniformly Applicable and Reserved Matters) or certain other provisions, including majorities required, in the voting arrangements;

(d)   disenfranchisement provisions, ranking of GDP Bonds and calculation of outstanding GDP Bonds;

(e)   the Events of Default, the Put Events, the calculation of Reference GDP, the governing law and jurisdiction provisions; and

(f)   exchange of the GDP Bonds in a manner which results in inequitable treatment of the holders.

[Reserved Matters will seek to follow industry standards for aggregated CACs as published from time to time by ICMA.]

Taxation: All payments by the Republic on the GDP Bonds will be paid free and clear of any Arcadian withholding taxes or other applicable Arcadian taxes.

Selling Restrictions: [*Depending on type of offering*].

Documentation and structure: Trust structure. The GDP Bonds will be constituted by a Trust Deed which will be available for inspection at the offices of the Trustee.

[*Trust or Fiscal Agency structure will have to be discussed as a matter of preference and policy for sovereigns. For Arcadia a trust structure is proposed.*]

Notices: Notices will be given in accordance with the rules of the stock exchange where the GDP Bonds are listed and via Euroclear and Clearstream in

customary fashion. Notices will also be published on the website of the Ministry of Finance of Arcadia at [●]

Governing Law: English law [or such other law as customarily governs the Republic's international debt issuances].

Jurisdiction: [The courts of England and arbitration (at the option of the holder). The Republic will appoint an independent process agent to receive service on its behalf in England.] [*Jurisdiction to be consistent with choice of governing law.*]

Clearing Systems: Euroclear Bank S.A./N.V. and Clearstream Banking SA

Payment structure on GDP-linked bonds
20 September 2016

For ease of reference, terms that refer to definitions in the London Term Sheet are underlined on their first mention in this box.

We consider the fictitious country Arcadia, for which the nationally recognized Statistical Institute has published the following time series for Arcadia's seasonally-adjusted quarterly GDP in current prices, i.e. its nominal GDP.

3Q2004	100.0000	2Q2006	111.6780
4Q2004	101.4356	3Q2006	112.6280
1Q2005	103.1801	4Q2006	113.6925
2Q2005	104.5673	1Q2007	115.0475
3Q2005	106.6166	2Q2007	116.8888
4Q2005	107.8620	3Q2007	118.0834
1Q2006	110.0616	4Q2007	119.0203

We assume that the government of Arcadia has issued a 10-year GDP Bond on 5 July 2005 with a Base Interest Rate of 1%, a Principal Amount of 100 Arkadins (K$) and a semi-annual coupon schedule. The Principal Amount of this bond is adjusted for changes in nominal GDP over the life of the bond and its semi-annual coupon payments are calculated off this adjusted principal. The Base Date for the indexation of interest and redemption amount payments has been set as 1 July 2005, i.e. two business days prior to the Issue Date.

We will now calculate the indexed principal on the second anniversary of the Base Date of this bond, i.e. on 1 July 2007. In order to achieve this, we first need to determine the Reference GDP Index for the Base Date. This is the GDP for the calendar quarter that ended six month prior to the Base Date, i.e. the fourth quarter of 2004 (4Q2004); its value is 101.4356. Then we need to determine the Reference GDP Index for the Payment Date. This is the GDP for the calendar quarter that ended six months prior to the Interest Payment Date, i.e. the fourth quarter of 2006 (4Q2006); its value is 113.6925.

Note that this indexation lag is necessary since a reliable estimate of GDP is typically released several months after the end of a given calendar quarter.

The indexed principal of the GDP-linked bond on 1 July 2007 becomes K$112.0834 (i.e. K$100 × 113.6925/101.4356). The semi-annual coupon paid at the end of that second year is calculated as 1%/2 × KS$112.0834 = KS$0.5604.

At the end of the third year of the bond, the indexed principal reaches K$117.3358 (i.e. K$100 × 119.0203/101.4356) and the semi-annual coupon amounts to K$0.5867.

In this example, we have considered a GDP Bond with a Base Date that falls on the first calendar day of the Reference Quarter. In practice, this Base Date may also fall on other calendar days. If the base date of a new issue falls before the initial settlement date, then the bond already has an accrued coupon at issuance and a Principal Amount that needs to be indexed to an interpolated level of GDP. The same applies to the pricing of GDP Bonds in secondary market trading, which will occur on a daily basis. In order to calculate the correct Issue Price and the invoice amount

for secondary market trades, we therefore need to compute daily reference values for the underlined Nominal GDP Index Ratio so that the Principal Amount can be adjusted for every trading day.

Following the Canadian model for inflation-linked bonds, we will calculate a Reference GDP Index (*Ref GDP*) for each settlement date, as a linear interpolation between the published quarterly nominal GDP values for two consecutive quarters in the past. We use the following formula:

$$Ref\ GDP_{Settlement\ Date} = GDP_{q-2} + \frac{(d_q - 1)}{D_q} \times (GDP_{q-1} - GDP_{q-2})$$

where:

GDP_{q-1} is the GDP for the calendar quarter ended three months prior to the Settlement Date;

GDP_{q-2} is the GDP for the calendar quarter ended six months prior to the Settlement Date;

d_q is the number of days elapsed in the Payment Quarter, i.e. the actual number of days between the end of the previous calendar quarter and the Settlement Date;

D_q is the total number of days in the Payment Quarter, using actual/actual as day-count convention.

This formula can be found in the section on Reference GDP of the London Term Sheet. It can be used to calculate the Reference GDP for the Base Date, for any Interest Payment Date or Redemption Date or for the Settlement Date of secondary market trades.

In order to determine the indexed principal of the bonds, we need two Reference GDP Index values: *Ref GDP*$_{Base\ Date}$ for the bond's Base Date, i.e. the accrual date for its first coupon payment, and *Ref GDP*$_{Settlement\ Date}$ for the settlement date. From these two index values, we can calculate a Nominal GDP Index Ratio (*IR*) to measure the principal adjustment. We use the following formula:

$$IR_{Settlement\ Date} = Ref\ GDP_{Settlement\ Date} / Ref\ GDP_{Base\ Date}$$

The full settlement price (*FP*) for a given settlement date is calculated as follows:

$$FP_{Settlement\ Date} = IR_{Settlement\ Date} \times (CP_{Trade\ Date} + AI_{Settlement\ Date})$$

where:

$CP_{Trade\ Date}$ is the clean price quoted by the broker-dealer, unadjusted for past growth;

$AI_{Settlement\ Date}$ is the accrued interest on the settlement date, unadjusted for past growth.

The accrued interest (*AI*) is calculated with the following formula:

$$AI_{Settlement\ Date} = \frac{d_s}{D_s} \times \frac{Base\ Interest\ Rate}{2} \times Principal\ Amount$$

where:

d_s is the number of days elapsed in the semi-annual coupon period, i.e. the actual number of days between previous coupon date and Settlement Date;

D_s is the total number of days in the coupon period, using actual/actual as day-count convention.

Note that this full settlement price including accrued interest will also be paid to holders of GDP-linked bonds in the case of an early redemption following the exercise of a <u>Put Option</u>.

We illustrate the calculation of the invoice amount for a trade in the secondary market using a GDP bond with the following characteristics:

Base Interest Rate: 1%
Base Date: 13 January 2005
First Coupon Date: 13 July 2005

We consider the purchase of K$1 million Principal Amount on 28 August 2007 at a Clean Price of 115.25 percent of Principal Amount. First, we calculate the Accrued Interest:

Settlement Date: 30 August 2007
Previous Coupon Date: 13 July 2007
Next Coupon Date: 14 January 2008 (using the "modified following" business day convention)
Number of actual days between previous coupon date and Settlement Date (d_s): 48
Number of actual days between previous and next coupon date (D_s): 185

$$AI_{30\ August\ 2007} = \frac{48}{185} \times \frac{1.00\%}{2} \times K\$\ 1,000,000 = \begin{array}{l} K\$\ 1,297.30 \\ \text{or } 0.12973 \text{ percent of Principal Amount} \end{array}$$

Then we calculate the Reference GDP Indices for the Base Date and for the Payment Date as well as the Nominal GDP Index Ratio:

Number of days elapsed in the Base Quarter (d_{bq}): 13
Total number of days in the Base Quarter (D_{bq}): 90

$$Ref\ GDP_{13\ January\ 2005} = 100.0000 + \frac{(13-1)}{90} \times (101.4356 - 100.0000) = 100.19141$$

Number of days elapsed in the Payment Quarter (d_{pq}): 61
Total number of days in the Payment Quarter (D_{pq}): 92

$$Ref\ GDP_{30\ August\ 2007} = 115.0475 + \frac{(61-1)}{92} \times (116.8888 - 115.0475) = 116.24835$$

$$IR_{30\ August\ 2007} = 116.24835/100.19141 = 1.16026 \text{ (rounded to the fifth decimal)}$$

With this, we calculate the total invoice amount:

$$FP_{30\ August\ 2007} = 1.16026 \times (115.25 + 0.12973) = 133.87049 \text{ percent of Principal Amount}$$

$$Invoice\ Amount = K\$\ 1,000,000 \times 133.87049\ \% = K\$\ 1,338,704.90$$

This box has been prepared by Christian Kopf