

Extending RSS to Meet Central Bank Needs

Paul Asman
Federal Reserve Bank of
New York, USA
paul.asman@ny.frb.org

San Cannon
Federal Reserve Board,
USA
sandra.a.cannon@frb.gov

Christine Sommo
Federal Reserve Bank of
New York, USA
christine.sommo@ny.frb.org

Abstract

The Federal Reserve wanted to use RSS to represent not only news, such as press releases, but also data, such as exchange rates. The Fed hoped to use one set of feeds to accommodate two different audiences for RSS, human readers (at one remove) and self-contained automated processes. While the different RSS specifications provide elements for traditional news items, they require extensions to handle data. Since central banks all tend to report the same sorts of information, the Fed joined with other central banks to create an extended specification that met their needs. This specification extends RSS 1.0, which is the more readily extended RSS specification. The extension uses elements from established metadata standards wherever it can, such as for language and audience, and adds elements when subjects are not found in those standards or are more particular to central banks, such as (monetary) currency. Although the central banks intend these new elements to be used primarily by machine processes, the element names have sufficient semantic transparency so that they can be understood by human readers.

Keywords: rss; semantic transparency; central bank; extension; aggregation; linked data

1. Introduction: Using RSS

RSS feeds have long become industry best practice. As early as 2004, Kedrosky (2004) predicted that “within two years, not having a feed on your corporate news will be analogous to not having a Web site. It will mark you as unresponsive and retrograde.” Kedrosky recommended creating feeds for whatever data are sought. By 2007, a Gartner report (Bell & Heiser, 2007), addressed to enterprises, recommended, “Establish RSS feeds and begin the process of feeding the Internet with information you want users to find.” The subject of the report was managing one’s internet reputation.

It was therefore an easy decision for both the Federal Reserve Bank of New York and the Federal Reserve Board of Governors to offer RSS feeds. Customer response has validated this decision. The New York Fed began offering feeds in July 2005, and its RSS feeds were viewed approximately 147,000 times that year. In 2009, there was an average of 679,000 views per month. The Board began publishing RSS feeds in December 2006. In 2009, there was an average of 1,716,000 views per month.

The New York Fed first offered RSS feeds as links to the news it publishes (of, for example, events, speeches, and publications). Standard RSS specifications were sufficient for this. The New York Fed was aware that aggregators would compile titles and descriptions, and link to content. That ‘title’ and ‘description’ are semantically opaque with respect to the underlying subjects – that they carry no more information about the content than row and column carry about data in relational databases – posed no problem.

The Board began publishing RSS feeds, for announcements only, as a means of alerting users of its Data Download Program to changes in the data. Although these announcements were (and remain) available as static HTML pages, the Board was concerned that users with automated data download processes were unlikely to see them. Such users are more likely to automate information retrieval through a feed than to look at a webpage.

For many consumers of Fed information, data are more important than prose. Both the New York Fed and the Board use the SDMX (2005) specification for much of their data. Consumers of

the Fed's SDMX data can download them into their processes by various means, including web services. But the Fed could not reasonably ask a human reader to parse SDMX to see, for example, the current value of an interest rate.

Furthermore, not all consumers of Fed data process SDMX. Nor have all central banks adopted its use in publishing their data. While SDMX is an excellent mechanism for larger scale data exchanges, RSS offers another approach to automated consumers of data, especially those consumers who are interested in only the latest value or values instead of a lengthy series of observations. Central banks want their public information to be broadly available, and a multiplicity of channels helps meet this goal. A common central bank representation also offers aggregators the opportunity to take information from a number of different central banks and easily combine it.

RSS might not seem to be an appropriate alternative, as it is not immediately clear how the elements RSS uses to represent news can represent data. It is relatively straightforward to determine what the title of an event should be. It is not at all straightforward what title a datum should have, or whether it even makes sense to title a datum. An exchange rate, for example, has many components, including base currency, target currency, time of the observation, and the value itself. What might the title be?

The Fed joined with other central banks and central banking organizations to investigate the plausibility of using RSS to represent data. Initially, these institutions were the Bank of Canada, the Banco de México, and the Bank for International Settlements. The European Central Bank (ECB) and Swiss National Bank then joined the project. Later, more central banks participated.

The group created recommended formats for RSS representations of central bank data. To continue with exchange rate as an example, the group recommended that the title comprise, in order, a code for the country producing the rate, units of a target currency, a target currency code, units of a base currency, a base currency code, a date, an institutional identifier, and a rate name. Such a title – an instance of which is *US: 10.7660 MXN = 1 USD 2008-02-15 NYFed noon buying* – could enable a human reader to take in an exchange rate at a glance, no matter what central bank was the source. This instance is from the New York Fed (which no longer reports exchange rates). Here is a Banco de México version of the same rate (on a different day): *MX: 10.7350 MXN = 1 USD 2008-02-18 BM FIX*.

These RSS data feeds target a limited audience, but they have proved popular. In 2009, 11.4% of the views of Board RSS feeds were for data representations, with an average of 196,000 monthly views. For the New York Fed, 22.4% of the views of RSS feeds in 2009 were for data, with an average of 152,000 monthly views.

In addition to compact but meaningful titles, the group also created semantically transparent atomic elements for their components, to be used in common by the group's members as an extension of RSS. For exchange rate, the atomic elements are value, baseCurrency, targetCurrency, rateType, and observationPeriod. These atomic elements add some assurance that the information will not be misunderstood or misrepresented when repurposed by aggregators or other users. The group also created atomic elements for four other types of central bank information: events, news, papers and speeches.

2. Choosing RSS 1.0

RSS takes many forms. The most common are RSS 1.0 (RDF Site Summary) and RSS 2.0 (Really Simple Syndication), which are competing rather than successive specifications. Both are extensible through namespaces, as specified in RSS 1.0 (2001) and RSS 2.0 (2003). As such, either should meet the purposes of the central bank group in extending RSS.

In RSS 1.0, however, extension is semantically richer. Ayers (2003) summarizes this nicely:

“RSS 1.0's strong point is its use of the RDF model, which enables information to be represented in a consistent fashion. This model is backed by a formal specification,

which provides well-defined semantics. From this point of view, RSS 1.0 becomes just another vocabulary that uses the framework. In contrast, outside of the relationships between the handfull of syndication-specific terms defined in its specification, RSS 2.0 simply doesn't have a model. There's no consistent means of interpreting material from other namespaces that may appear in an RSS 2.0 document. It's a semantic void."

Hammond (2003) echoes this. He asks, "Which version of RSS best supports the delivery of metadata to users?" He answers that it is RSS 1.0: "Thus, for those wishing to create new applications with RSS, it is the extensible RSS 1.0 version with its explicit support for new modules build on a common data model that attracts the real interest."

While RSS 2.0 can be extended, its virtue is its simplicity, and extensions are not simple. RSS 1.0, on the other hand, is designed for extensions; they are at the core of its model. Since the group of central banks intended from the start to extend RSS with central bank-specific elements, RSS 1.0 was the clear choice.

3. Extending RSS with Semantic Transparency

As noted earlier, the basic RSS elements are semantically opaque with respect to subject matter. 'Title' and 'description' convey information about form and function, not about what is entitled and described. The central bank group, though, wanted to take advantage of the capacity XML has to make a "document more *meaningful* with respect to the information objects represented by text" (Cover, 1998). As Cover argues in this seminal article, "The markup itself is a form of 'metadata', explaining to us what the constituent elements *are* (by name), and how these information objects are structured into larger coherent units." Even though XML does not support semantic constraints, then, and even though all tags are equally meaningless to machines, the group wanted human creators, reviewers, and consumers of its RSS to see what it represented.

Creators, reviewers, and consumers are not secondary to the promotion and adoption of the feeds. The central bank group wished to create a specification that other central banks would accept and use. The group held that semantic transparency would facilitate this goal. All central bankers understand lending rates. The central bank specification includes tags for lending rates, so that anyone considering use of the specification could immediately see that (and how) they are handled. Ogbuji (2001) says, "The ultimate test of semantic transparency is whether a human, using *only* the mechanisms available to the XML processing software, can correctly understand the meaning of the XML data." The group believed that achieving such semantic transparency would further the adoption of the specification.

3.1. Dublin Core

Dublin Core terms (RSS/DC, 2000), which are easy for a person to understand, come "out of the box" with the RSS 1.0 specification (RSS 1.0, 2001). As such, any of them can be used in the central bank specification. The specification requires that each item use the Dublin Core date. It recommends the use of license (in the extended Dublin Core set) and language as best practices. It also recommends using another Dublin Core term, audience, for events and speeches. All other Dublin Core terms are optional. (Section 5.1 discusses these usage levels.)

Because these Dublin Core term names – date, license, language, and audience – provide semantic transparency, they meet the central bank group's needs. One of them, date, is ambiguous for the group's purposes; section 4.1 discusses the resolution of that ambiguity.

3.2. Other Metadata Standards

The central bank group considered employing other standards, such as PRISM (2004), an XML metadata standard for publishing. Most central banks engage in publishing, as well as other activities for which metadata standards have been promulgated, and the group wished to use existing and widely accepted metadata standards when it could. Ultimately, it decided against specifying most additional external standards.

While different standards cover parts of different central bank businesses, their adoption increases the complexity of the specification. The group attempted to balance complexity and reward. Furthermore, in many domains (including publishing), central banks have established the information sets they wish to report, and these information sets do not necessarily conform to external standards. It is difficult to ask central banks to change their reporting practices, especially when the rewards of doing so are not immediately evident.

To date, the group has endorsed only one additional standard as having sufficient reward to justify its inclusion, GeoRss (2007), Geographically Encoded Objects for RSS Feeds. Geographical encoding requires technical expertise that lies outside normal central banking competence, and central banks do not have the commitments to existing ways of reporting geographical metadata that they do for other metadata. More standards may be endorsed later; there is nothing in the specification that cannot be amended (as described in section 6.2).

3.3. Central Bank Standard

The central bank specification, called RSS-CB, extends RSS 1.0 in part by changing the status of one element each from RSS ('description') and Dublin Core ('date') from optional to required. Most of the extension, though, comprises elements specified to meet central bank needs. The group created higher-level elements for different types of central bank information, and then specified semantically transparent atomic elements for the components of that information.

The types of information for which the group specified higher-level elements are event, news, research paper, speech, and statistics. Statistics itself has secondary higher-level elements for exchange rate, interest rate, transaction, and statistics not otherwise classified. All element names are intended to be semantically transparent. The element name for speeches, for example, is 'speech', and for exchange rates, 'exchangeRate'. Within the speech element are elements including 'occurrenceDate' and 'institutionAbbrev'; within the exchange rate element are elements including 'baseCurrency' and 'targetCurrency'.

3.4. Custom Extensions

While central banks tend to produce the same sorts of information, there are differences in what individual central banks report. The RSS-CB specification therefore permits custom extensions to meet the needs of individual institutions. Neither the New York Fed nor the Board of Governors has yet found a need to create custom extensions.

4. Identification of Elements for the Central Bank Namespace

Specifying atomic elements required many discussions and debates, some of which continue. For many domains, these discussions began with consideration of the suitability of Dublin Core terms. The group was especially attentive to time, provenance, and geography. A discussion of these three domains shows how the group proceeded.

4.1. Time

The Dublin Core representation of date contains all the elements central banks need to represent dates. But central banks use dates for many purposes, and no one of them is the obvious use of 'dc:date'. Most of the group's element sets therefore include an atomic element 'occurrenceDate', to capture the date the information provider associates with the information. A meeting, for example, will have an occurrence date different from the date on which the meeting is announced. 'occurrenceDate' represents the meeting date, while 'dc:date' represents the date of the announcement. An aggregator could use either or both, depending on its purpose – 'dc:date' for a news item, and 'occurrenceDate' for a calendar of meetings.

'occurrenceDate' has the same format as 'dc:date', which permits any level of granularity. There are circumstances, however, where a W3C date element is not appropriate. A quarterly journal, for example, even if it is published on the first day of the second month of a quarter, may

be given a publication date such as "First Quarter 2009" or "Winter 2009." The group therefore specified a free-text 'publicationDate' to capture the date given on the publication itself, whenever the actual publication may have occurred.

Date ranges presented another challenge. Central banks normally calculate and publish exchange rates and interest rates daily. But central bank data do not always refer to single dates. The Federal Reserve Board, for example, publishes industrial production indexes monthly and Flow of Funds data quarterly. No single date captures these. The Board publishes other data with a time lag, which may be considerable. To ensure that the meanings of dates associated with data were clear, the group created an element 'observationPeriod' for all statistical data.

When the group created 'observationPeriod', it was unaware of the class 'PeriodOfTime' (earlier, 'Period') specified in *Domains and Ranges for DCMI Properties* (Domains, 2008). After the group has become aware of this, a discussion was held to determine whether to use that class. The group decided to retain observationPeriod as is.

4.2. Provenance

The Dublin Core metadata standards provide several terms for representing provenance. The group thought to use 'dc:creator' for two different purposes, but found that the term did not fully reflect its intentions. The first purpose was identifying the authors of research papers. 'dc:creator' is one of the four core elements related to intellectual property, and multiple instances of the element can accommodate multiple authors. The guidance given for the term speaks to the group's needs: "Creators should be listed separately, preferably in the same order that they appear in the publication. Personal names should be listed surname or family name first, followed by forename or given name. When in doubt, give the name as it appears, and do not invert." (Usage, 2005)

The group encountered two difficulties in using 'dc:creator' for this purpose. Neither is directly related to the proper representation of metadata, though, and these difficulties are not a negative assessment of the term for its stated purposes. First, aggregators found it problematic to repurpose multiple instances of 'dc:creator' correctly; the individual instances of 'dc:creator' did not concatenate into a recognized bibliographic style. Second, 'dc:creator' did not straightforwardly offer central banks a way of providing the creators' names as they wished them to be represented. The group therefore augmented 'dc:creator' with a new term, 'byline'. As the group's user guide (discussed in section 5.2) states, "it is worthwhile to have a dedicated element for the complete byline, with all the author names in proper order and with all the necessary punctuation and diacriticals. This approach makes it unnecessary for a client application to reconstruct the bylines for display to the users' screens." (RSS-CB User Guide, 2008)

The group also found that a more general term 'person' was better suited to its multiple needs than 'dc:creator'. The group specified 'person' not only for the authors of papers, but also for the deliverers of speeches, who may not have created the content they deliver. The specification of 'person' includes additional metadata such as titles, roles, and affiliations. Since the central bank specification permits the use of all Dublin Core terms, 'dc:creator' can be used by adherents to the standard who wish to represent metadata in overlapping ways.

The group also specified a new element for succinct representation of institutional creators. While 'dc:creator' is entirely adequate for representing an institution, the Usage (2005) guide creates an expectation that such an item will contain detailed information about the institution and its subdivisions: "In the case of organizations where there is clearly a hierarchy present, list the parts of the hierarchy from largest to smallest, separated by full stops and a space." The group needed a way to represent an institution that would be viewable within a title for a statistical datum, as indicated in the example of foreign exchange in section 1. Since using only a few characters to instantiate 'dc:creator' would not meet expectations for that term, the group created an additional element, 'institutionAbbrev'. Once again, nothing stops an adherent to the central bank standard from using 'dc:creator' as well to represent institutions.

4.3. Geography

The central bank group's attempt to provide geographical metadata progressed from simple to expansive. At first, the group proposed elements for 'city' and 'country', with a third element, 'venue', holding a host name and specific location. The group then refined this by limiting values of 'country' to those on the ISO 3166 alpha 2 codelist (ISO, 2008), with an extension for the European Union. Some members found this insufficiently precise, and the group changed the recommendations to permit the inclusion of street address and specific location within a 'location' element, while limiting 'venue' to an institution's name. Later, two elements were renamed to be more semantically transparent, 'locationCountry' and 'locationCity', and three were added, 'point', 'locationState', and 'locationAsWritten'.

The element 'point' comes from the GeoRSS (2007) standard; it holds longitude and latitude within one element. The elements 'locationState', 'locationCity', and 'locationAsWritten' are free text. The last holds a human-friendly description. With this most recent change, 'venue' was expanded back to its original form, holding both institution name and specific location.

With these elements, the specification of geography permits machine processing of two controlled elements, 'country' and 'point'. The latter is particularly suited for integration with mapping applications. The specification also provides a reasonable target to searches for cities and states. Finally, the specification provides aggregators with a representation suitable for passing on to humans, 'locationAsWritten'.

5. RSS-CB Artifacts

To promulgate RSS-CB, the group produced a formal specification (RSS-CB Specification, 2008), a user guide (RSS-CB User Guide, 2008), and a set of application guides specific to the different domains targeted (RSS-CB Application Guides, 2008).

5.1. Specification

The RSS-CB specification provides a normative description of the elements and attributes in the central bank extension to RSS 1.0. All elements have either sub-elements or text children; there are no elements with mixed content. Most text children are either free text, text without spaces, dates, numbers, integers, uris, urls, or drawn from controlled vocabularies. (Exceptions are the value for 'point', taken from the GeoRSS specification, where the text child is a latitude – longitude pair, and the value for a publication 'issue', which is an alpha-numeric ordinal.)

All elements are given one of four requirement statuses – required, recommended, optional, or prohibited. A feed is not compliant with RSS-CB if it omits a required element, and this is reflected in the schemas that the group has produced. Recommended elements are in effect indications of best practices; the schemas permit their omission. Recommended and optional elements are sometimes required for certain applications, and required by the schemas written for those applications. Prohibited elements exclude elements that RSS 1.0 itself allows. Elements also have a multiplicity limitation – one occurrence only, at most one occurrence, or at least one occurrence.

The following two subsections use the element 'title' (as a sub-element of 'item') to show the differences between the specification and the user and application guides.

5.2. User Guide

For 'title', the specification states, "The value of <title> is free text." This is followed by its requirement status, in this case required. The specification thus states what RSS-CB compliance demands, although it (elsewhere) hints at best practices through the status 'recommended'. The user guide is more expansive. It sets out the intended uses of RSS-CB, and explains what should be done to achieve those uses. The user guide is a non-normative document in which the promulgators of the specification ask that it be used in certain, unenforceable ways.

The user guide begins its discussion of 'title' (again, as a sub-element of 'item') by stating, "The content of the item title is at the discretion of the institution providing the RSS feed. This is the title that will be displayed by the reader for human consumption." The first sentence makes clear that the proposal is not normative, while the second offers an explanation justifying it.

The proposal then has a recommendation about length, and an account of why the recommendation is made: "The RSS 1.0 specification *suggests* 100 characters as a maximum. Because many RSS user agents will display no more than (and possibly not even) this number of characters, RSS-CB strongly recommends adherence to this maximum." Once again, this is not normative. The central bank group intends the user guide to do just what the title indicates, and no more: to guide the RSS-CB user.

5.3. Application Guides

RSS-CB has separate application guides for events, news, research papers, speeches, and statistical data, the five areas for which it has sets of atomic elements useful to aggregators and automated processes. For the most part, the application guides explain the intent behind the atomic elements in context. 'simpleTitle', for example, is described separately for a conference or other event, a news release, a speech, or a research paper.

Only the application guide for statistical data contains discussion of 'title' (as a sub-element of 'item'). There are separate discussions of 'title' for exchange rates, interest rates, transactions, and the generalized other types of statistical data. In each case, the title of a statistical datum represents an attempt to give a human reader a grasp of that datum at a glance. Some statistical information has many components, so grasping information at a glance requires some training. The group sees this as an argument for a common representation – a consumer familiar with one central bank's information will recognize that information on other banks' sites as well.

The application guides specify both components and their order in titles. The title of an exchange rate has already been given, in the introduction, and can be examined there. The title of transaction serves as an example here: *US: \$3.750B repo-1day 2008-02-20 NYFed temporary open market operations*. This will look strange to a casual reader, but not to one who is trained.

The components and their order are set in the application guide. The title begins with a country code for the country producing the observation; this permits aggregators to include titles from different sources without needing to differentiate them programmatically. Next is a value, in this case \$3.750 billion dollars. The unit (United States dollar, USD) and unit multiplier are not part of the title, but are included with the atomic elements. Their omission from the title signals a choice of concision over completeness for the title. The unit is reasonably inferred from the presence of the dollar sign and the originating country, and the unit multiplier from the 'B' suffix. In any case, they can be authoritatively taken from the atomic elements.

The title then holds a transaction name – repo, short for repurchase agreement – and a transaction term, 1 day. This title thus represents a report of a one day repurchase agreement, as a routine consumer of this information would recognize from the abbreviation. Then there is a date in ISO-8601 format, an institutional identifier, and a transaction type. Transaction type is a broader category than transaction name. The one day repurchase agreement is part of the temporary open market operations conducted by the New York Fed.

6. Creating RSS-CB

The artifacts described in the previous section – the specification, user guide, and application guides – are contained within a wiki. There is also a forum associated with this wiki. Most changes to the wiki occur only after consensus is reached through discussions on that forum.

6.1. Participation

The RSS-CB specification began with a meeting in June 2006, held at the Bank of Canada, and attended by its representatives as well as representatives of the Bank for International

Settlements, the Federal Reserve Board, the Federal Reserve Bank of New York, and the Banco de México. Those present agreed to develop standards for central bank representations of news, events, speeches, research papers, and statistics. Members of the group took ownership of applications in which they had professional expertise, and together created a draft specification that was refined by the group as a whole. In December 2006, the group, now joined by representatives of the European Central Bank and the Swiss National Bank, met at the Bank for International Settlements and established version 1.0 of the specification, user guide, and application guides.

The participants continued to refine these artifacts, sometimes after consultation with consumers of the content, including bloggers and application developers. In June 2007, RSS-CB 1.1 was introduced, containing a hierarchical structure. This new structure allowed better validation from schemas and an enforceable order of elements within an application.

Version 1.2 came about after the New York Fed attempted to create linked data from its RSS-CB feeds, as described in 7.3. When passing these feeds to the W3C RDF Validation Service, the Fed discovered that they were not in compliance with the RDF standard. There were two errors in the specification. The addition of `rdf:ParseType="Resource"` to all RSS-CB elements with child elements resolved one error.

The replacement of elements with both attributes and text children resolved the second error. The object of an RDF statement cannot be both a literal and a node, but a text child is a literal, and an attribute is a node. The solution creates new elements, `cb:observation` and `cb:observationPeriod`, and makes text children and attributes sub-elements of them. An observation, for example, instead of looking like `<cb:value cb:frequency="daily" cb:unit_mult="9" cb:units="USD" cb:decimal="3">1.937</cb:value>` now looks like this:

```
<cb:observation rdf:parseType="Resource">
  <cb:value>1.937</cb:value>
  <cb:unit>USD</cb:unit>
  <cb:unit_mult>9</cb:unit_mult>
  <cb:decimal>3</cb:decimal>
</cb:observation>
```

From a central bank point of view, version 1.2 represents a technical correction. The core purpose of RSS-CB is delivery of central bank information to its consumers in a guaranteed format that they can integrate into their processes, and the specification producing invalid RDF accomplished this.

The initial failure to create an RDF-compliant specification indicates the group's focus on creating a practical XML format that RSS readers could consume. It was only later that the group recognized the opportunities the RDF model offered, as this is not a domain with which central bankers are generally conversant. While RSS-CB is now valid RDF, it does not fully exploit that richness of that model, and work therefore continues.

6.2. Process for Change

At first, the group used discussion pages within the wiki to propose changes, edits, and additions. In 2007, the group added a discussion forum to its set of communication tools. In current practice, someone will propose a change on the forum and attempt to gain consensus there before applying that consensus to the wiki. The refinement of 'location', described in section 4.3, is an example of this process. In late 2007, the forum held several competing proposals for specifying location. Through discussion, four contending options were identified, and an on-line vote (with a deadline) was conducted among participants. After the vote, the successful proposal was incorporated into the specification, user guide, and application guides.

Participants also use the forum to seek clarification of recommended practices, and to raise new issues for the group's consideration. Some new issues lead to refinements of the specification, as for version 1.2. Others simply use the medium for central bank cooperation.

7. Using RSS-CB

7.1. Adoption and Domains

As of early 2010, fourteen institutions produce RSS feeds following the RSS-CB specification. Some use it for only a portion of their RSS feeds, and some follow it more closely than others. The European Central Bank, for example, does not prefix a country code to the titles of its RSS feeds for statistical data. (As a multinational central bank, it is not clear what country code or similar abbreviation the ECB should use.)

This is an unordered list of institutions that produce RSS-CB feeds, with urls leading to those feeds and indications of their domains.

- Banco de México, <http://www.banxico.org.mx/sitioingles/RSS/SuscripcionRSS.html>, for exchange rates, interest rates, inflation measures, revenues, reserves, indexes, and bank costs.
- Bangko Sentral ng Pilipinas, <http://www.bsp.gov.ph/rss/bsprss0.asp>, for exchange rates, media releases, official notices, and public advisories.
- Bank of Canada, http://www.bankofcanada.ca/en/rates/rss_fx.html, for exchange rates.
- Bank of Finland, http://www.bof.fi/en/suomen_pankki/ajankohtaista/rss/rss.htm, for exchange rates and interest rates (Euribor).
- Bank of Thailand, <http://www.bot.or.th/English/RSS/Pages/index.aspx>, for exchange rates, press releases, and speeches.
- Bank for International Settlements, <http://www.bis.org/rss/index.htm>, for press releases, research papers, updates to statistical releases, and its compilations of central bank research, speeches, and articles, about which more will be said in 7.2.
- Bank Negara Malaysia, <http://www.bnm.gov.my/index.php?ch=107>, for press statements, notices and announcements, speeches, exchange rates, and procurement notices.
- European Central Bank, <http://www.ecb.int/stats/exchange/eurofxref/html/index.en.html>, for exchange rates.
- Federal Reserve Bank of New York, <http://www.newyorkfed.org/rss/>, for news, speeches, events, circulars, research reports, interest rates, market operations, and survey results.
- Federal Reserve Board, <http://www.federalreserve.gov/feeds/>, for press releases, speeches and testimony, credit and liquidity programs and the balance sheet, research papers, commercial paper rates and amounts outstanding, interest rates, foreign exchange rates, and data download announcements.
- Reserve Bank of Australia, <http://www.rba.gov.au/updates/index.html#rss>, for exchange rates.
- Swiss National Bank, http://www.snb.ch/en/for/media/id/media_rss, for news, speeches, schedule announcements, interest rates, and exchange rates.
- Monetary Authority of Singapore, http://www.mas.gov.sg/news_room/, for policy statements and speeches, press releases, parliamentary questions, letters, announcements, and enforcement actions.
- Deutsche Bundesbank, http://www.bundesbank.de/info/info_newsletter.php, for press releases, speeches, monthly and annual reports, and publications.

7.2 Aggregation

Among the RSS-CB feeds that the Bank for International Settlements (BIS) offers is one for the Central Bank Research Hub (<http://www.bis.org/cbhub/index.htm>), which aggregates links to central bank research. In producing it the BIS consumes RSS-CB. The BIS currently uses five RSS sources, from the European Central Bank, the Swiss National Bank, the Atlanta Fed, and two from the New York Fed. The New York Fed feeds are RSS-CB. The BIS gets information from most of its sources (65 of 70) by crawling HTML sites, using processes long in place. When screen-scraping fails, as it will after a site redesign, the BIS looks for RSS feeds to replace it.

The BIS is automating its aggregation of central bankers' speeches (<http://www.bis.org/list/cbspeeches/index.htm>). For this, it has six RSS-CB sources (Deutsche Bundesbank, Bank Negara Malaysia, Swiss National Bank, Central Bank of Thailand, Federal Reserve Board, and New York Fed), and four unextended RSS sources (European Central Bank, Bank of Finland, Monetary Authority of Singapore, and Reserve Bank of India).

7.3 Linked Data

When the New York Fed takes an action in the financial markets, it creates two RSS-CB files, an announcement of the action and a report of the results. At present, there is nothing that links these two files. With the adoption of RSS-CB 1.2, the New York Fed is adding cross-references. Each announcement will include an instance of `dc:references`, e.g. `<dc:references rdf:resource="http://www.newyorkfed.org/markets/pomo/display/index.cfm/07082009/1"/>`. Each transaction will include an instance of `dc:isReferencedBy`, e.g. `<dc:isReferencedBy rdf:resource="http://snipurl.com/f5h8c"/>`. The two links (or either one alone) enable navigation between the two files, and enable the files to be combined into one RDF graph. When stored in an RDF repository, there is one set of RDF triples, not two files. Any RDF files with a common node form a connected graph. The cross-references, plus the technical corrections discussed in 6.1, support the semantic web.

8. Conclusions

As part of their mission, central banks strive to make economic information more easily and usefully available. RSS is one of the means to accomplish this. This paper reports the work of a group of central banks to create uniform RSS feeds augmented with semantically transparent rich metadata. Aggregators of central bank RSS feeds such as the BIS can take information from different central banks and present it together, to offer a more global economic picture. To accomplish their goal, the group created an extension of RSS 1.0. The group recognized that this is an unconventional approach to RSS, but hopes that more consumers of central bank data will take advantage of it.

Appendix: RSS-CB Sample

As noted in section 6.1, while RSS-CB 1.2 is valid RDF, it does not fully exploit the RDF model. Work therefore continues on the RSS-CB 1.2 schema. Nonetheless, the supporting documentation for RSS-CB 1.2 contains a sample instance file, which follows.

```
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns="http://purl.org/rss/1.0/"
  xmlns:dc="http://purl.org/dc/elements/1.1/"
  xmlns:dcterms="http://purl.org/dc/terms/"
  xmlns:cb="http://www.cbwiki.net/wiki/index.php/Specification_1.2/"
  xmlns:yourinstitution="http://yoursite/yournamespace/"
  xmlns:georss="http://www.georss.org/georss"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
```

```

<channel rdf:about="http://yoursite/press.rss">
  <title>Your Institution Press Releases</title>
  <link>http://yoursite/mainRSSpage/</link>
  <description>Press releases issued by Your
Institution.</description>
  <image rdf:resource="http://yoursite/your_image.gif"/>
  <items>
    <rdf:Seq>
      <rdf:li
rdf:resource="http://yoursite/press_release1.html"/>
      <rdf:li
rdf:resource="http://yoursite/press_release2.html"/>
    </rdf:Seq>
  </items>
  <dc:language>en</dc:language>
  <dc:date>2006-11-30T20:24:55Z</dc:date>
</channel>
<image rdf:about="http://yoursite/your_image.gif">
  <title>The title of your channel</title>
  <url>http://yoursite/your_image.gif</url>
  <link>http://yoursite/mainRSSpage/</link>
</image>
<item rdf:about="http://yoursite/press_release1.html">
  <title>Here is the title of press release 1. 40 characters
maximum.</title>
  <link>http://yoursite/press_release1.html</link>
  <description>Here is the description of press release 1. 500
characters maximum.</description>
  <dc:date>2005-11-01</dc:date>
  <dc:language>en</dc:language>
  <dcterms:audience>general</dcterms:audience>
  <cb:news rdf:parseType="Resource">
    <cb:simpleTitle>News!</cb:simpleTitle>
    <cb:occurrenceDate>2005-11-01</cb:occurrenceDate>
  </cb:news>
  <cb:custom rdf:parseType="Resource">
    <yourinstitution:contact>Paul
Roberts</yourinstitution:contact>
  </cb:custom>
</item>
<item rdf:about="http://yoursite/press_release2.html">
  <title>Here is the title of press release 2. 40 characters
maximum.</title>
  <link>http://yoursite/press_release2.html</link>
  <description>Here is the description of press release 2. 500
characters maximum.</description>
  <dc:date>2005-11-01</dc:date>
  <dc:language>en</dc:language>
  <georss:point>23.1223 -53.1123</georss:point>
  <cb:statistics rdf:parseType="Resource">
    <cb:country>US</cb:country>
    <cb:institutionAbbrev>NYFed</cb:institutionAbbrev>
    <cb:exchangeRate rdf:parseType="Resource">
      <cb:observation rdf:parseType="Resource">
        <cb:value>1.1240</cb:value>
        <cb:decimals>4</cb:decimals>
      </cb:observation>
    <cb:baseCurrency>CNY</cb:baseCurrency>
    <cb:targetCurrency>CHF</cb:targetCurrency>
  </cb:statistics>
  </item>

```

```

        <cb:rateType>noon buying</cb:rateType>
        <cb:observationPeriod rdf:parseType="Resource">
            <cb:frequency>daily</cb:frequency>
            <cb:period>2005-11-01</cb:period>
        </cb:observationPeriod>
    </cb:exchangeRate>
</cb:statistics>
<cb:custom rdf:parseType="Resource">
    <yourinstitution:contact>Paul
Roberts</yourinstitution:contact>
</cb:custom>
</item>
</rdf:RDF>

```

Acknowledgements

This paper describes work done by the Federal Reserve in conjunction with other central banks and central banking institutions. Some of these institutions have been recognized in the paper itself, either in the discussions or in the list in section 6.3; they include the Bank for International Settlements, the European Central Bank, the Bank of Canada, the Bank Negara Malaysia, the Banco de México, the Swiss National Bank, the Reserve Bank of Australia, the Bangko Sentral ng Pilipinas, the Deutsche Bundesbank, the Monetary Authority of Singapore, the Bank of Finland, and the Bank of Thailand. The Fed also acknowledges the help and support of others who have participated in discussions with it on how best to deliver RSS. These additional institutions include the Centro de Estudios Monetarios Latinoamericanos (CEMLA), the Reserve Bank of India, the Reserve Bank of New Zealand, and the Central Bank of Nigeria. Finally, Mike Eltsufin of the New York Fed was especially helpful and insightful in the effort to take more advantage of RDF.

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