The Cash Cycle Partnership
Powered by DLR Analytics™

Frequently Asked Questions

Updated 15th February 2018

This document is split into the following sections. Please contact nikki.strickland@delarue.com if you have questions that aren't answered here.

1. About the Service

What is the difference between the Cash Cycle Partnership and DLR Analytics?

The Cash Cycle Partnership is the community of DLR Analytics users. The Cash Cycle Partnership is a supportive forum where you have access to webinars, conferences, global trends and insight, as well as the opportunity to interact with other central banks via the Cash Cycle Partnership app. DLR Analytics is the software tool that carries out the calculations on your data and provides you with insight into your note life and cash cycle behaviours.

Features of DLR Analytics	• Cash cycle and banknote lifetime trends over time. • Descriptive statistics for banknote lifetimes and circulation velocities. • Novel ways of visualising your banknote lifetime and circulation velocities. • Easy assessment of forecasting models, such as time series, growth models, X-13, Arima and ETS. • Ability to select different forecasts for different denominations. • Ability to reconcile individual forecasts to an overall forecast of the value of cash in circulation. • Visibility of IMF projections for GDP and PCPIE. • Accessible via a web interface. • Simple monthly data entry. • Bulk data upload using excel data.
Features of the Cash Cycle Partnership	• Access to monthly webinars. • Access to annual seminars. • Access to aggregated and anonymised data showing global and regional trends. • Analytical support available for questions relating to the cash cycle, forecasting and banknote lifetimes. • Online user group and app.

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What will the software show me?

It should provide you with a useful way of visualising and understanding your data, with potential insights into:

- Banknote velocity and trends
- Statistically robust banknote life analysis and distributions
- Statistically robust replacement rates to drive better forecasts
- Relative banknote lifetime
- The impact of historical decisions
- Forecasting (IMF forecasts for NGDP and PCPIE, forecasts of the total value of cash in circulation, forecasts for individual banknote denominations that can be linked back to your total value of cash in circulation forecast)

What are the benefits?

1. Have the data and graphs available to help answer questions regularly asked of the issue department:
    - How long do banknotes last, what are predicted order volumes etc
    - How do you compare to the others in your region (available via the aggregated and anonymised data that is available to users of DLR Analytics)
    - What has happened to others who have made the decisions you are considering. With permission of other users we can put you in contact with others who have similar cash cycles. You can also view the anonymised data.
2. Standardised approach – consistency and 'same language' when talking internally and to other central banks.
3. Extension or sounding board for your analytics section – ask us questions, compare your analysis to our analysis, request a deeper investigation into something emerging from DLR Analytics.

How do we interact with other central banks using DLR Analytics?

As part of the Cash Cycle Partnership you will be able to join monthly webinars. You can raise questions and start discussion on the Cash Cycle Partnership app/webpage (which you can join via the following link: http://band.us/n/a5a1U2p4P631T). We will share global and regional trends and insight as it becomes available (please contact the product team, nikki.strickland@delarue.com or emma.grey@delarue.com) if you have specific areas you would like us to address). We will hold an annual seminar in the UK for all members of the Cash Cycle Partnership, dates for 2019 seminar to be finalised. If you have specific challenges or we spot a potential area of interest for you we may suggest putting you directly in contact with another central bank (assuming both parties approve of this being initiated).

2. Software as a Service Overview and Data Security

How does the DLR Analytics application work?

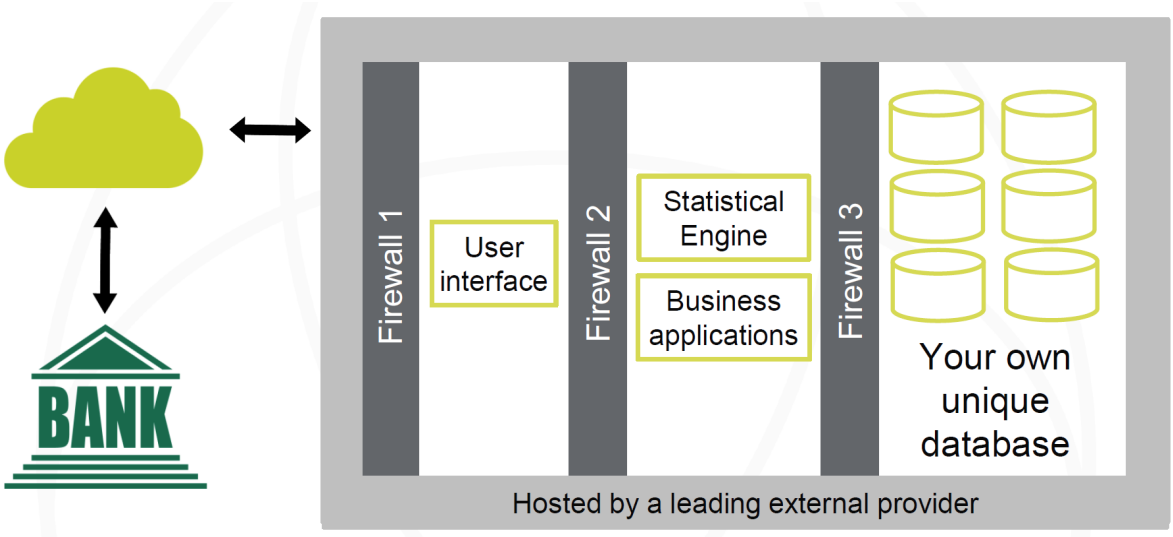
DLR Analytics is a multi-tenanted application that can be accessed by authorised users via a web browser. Data for each issuing authority is stored securely in a unique, dedicated, encrypted database. Calculations are carried out in the application and the results of the analysis are returned for you to view in the browser, with the option to download charts and tables of interest for incorporation into reports.

Who owns my data?

This is your data and you retain full ownership of it while using the DLR Analytics service. In order to support you and maximise the insight you get, De La Rue also has access rights to your data. Your data and conclusions from the analysis of the data are treated confidentially by us and not shared with any third party without your express permission. Upon your first log on you will be asked to view and accept the standard terms and conditions. These T&Cs lay out how we protect your data in detail.

How safe and secure is my data?

De La Rue treats the security of your data as seriously as we treat all other aspects of security. The DLR Analytics application and our chosen hosting provider have passed third party penetration testing, which will be routinely repeated. Additionally, our chosen hosting provider's procedures and operations have been subject to De La Rue's Information Security team's assessment. All sensitive data is encrypted, all communications are encrypted and your data is stored in a database that is unique to your central bank. Your data and the application are backed up, and access to the DLR Analytics application requires authentication with all communications over SSL. We recommend that you maintain your own copy of your data.



When the DLR Analytics team aggregates and anonymises the data from DLR Analytics what are the principals that they follow?

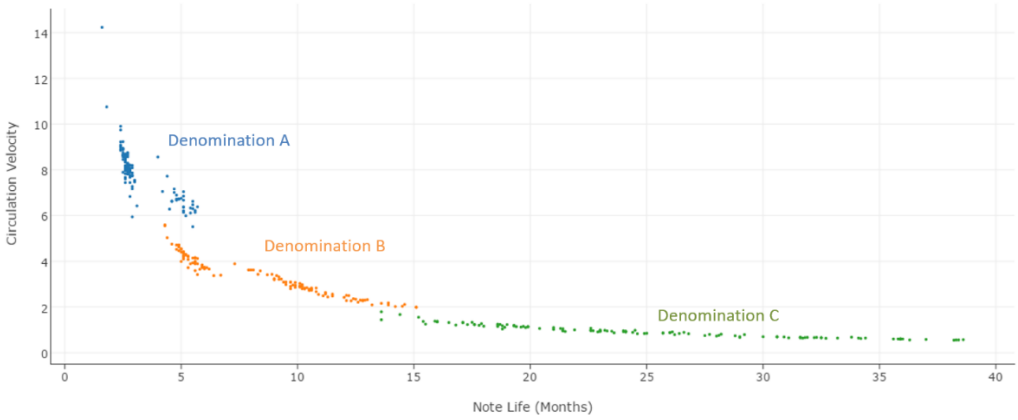
Published data:

If data has been published or is in the public domain De La Rue may use this without any aggregation or anonymization. In these instances the source data will be acknowledged. If mathematical manipulations are carried out on the source data this will be stated. A font size of 8 or above will be used in written documents when acknowledging the source (unless publishing in a journal article where the journal template will be adhered to). Please inform us if you would also like us include a sentence such as "sharing of data from this source does not imply endorsement of DLR Analytics or the methodology used here by the central bank" or similar.

Data from DLR Analytics that hasn't been published:

Direct input data (circulation volumes, new issue volumes, re-issue volumes, declared unfit volumes, deposit volumes and comments) will not be shared in isolation. Direct output data (banknote lifetimes, replacement rates, recovery % and frequency distribution charts) will not be shared in isolation. For instance we will not produce communications saying "this is a graph of new issues over time from the central bank XXX" or "the average % of volumes declared unfit per month from the central bank XXX is 50 %" where XXX is a named central bank or issuing authority.

Circulation velocity versus banknote life time graphs may be shared (see below), as long as they are not attributed to a central bank or issuing authority and are anonymized by removal of the currency symbol and replacement of the denominational values with letters of the alphabet.

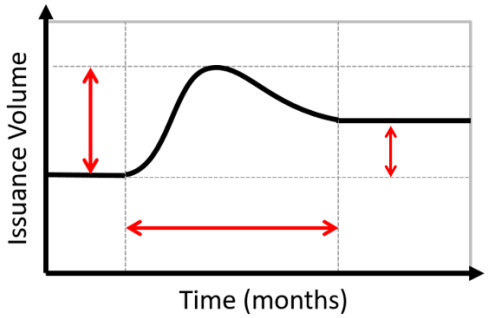


General Observations and Anecdotes Based on Private Data

General observations and anecdotes may be shared. For instance "we're aware of a central bank or issuing authority who did X and found that Y declined by 50 % and this is / isn't representative of other central banks who made a similar change" or equivalent. In these instances "X" would be normal currency department activities (issuing a new series, calibrating sorters, changing their clean note policy, introducing a new high value banknote denomination) and Y would be a data input or data output metrics. Discussions would use %, not absolute numbers.

The cartoon style graphs like the one shown below are based on the curves of actual data and will be used to illustrate patterns and types of behaviours seen. These graphs would be shown without

values on the axes and would be used to drive discussions, propose hypotheses and demonstrate empirical formulas. As an example, variants of the type of curve below could be used to illustrate the different types and lengths of transition periods following the issuance of a new banknote.



Aggregated Data

Aggregated input and output data will be shared in the form of graphs, total values, average values and ranges, as long as data or trends from individual graphs cannot be identified as belonging to an individual central bank or issuing authority.

When aggregated data is shown over time outliers will be detected using a time series outlier detection method. If outliers are identified that can be attributed to an issuing authority or central bank then either the graph will not be shared, or if the data can be removed whilst retaining a representative trend or conclusion the graph will be shown without the data from that central bank or issuing authority. It should not be possible to identify a peak in an aggregated graph as belonging to a central bank or issuing authority.

If the overall trend coming from aggregated data (e.g. upwards, downwards, declining, accelerating or random) changes due to addition or exclusion of one set of central bank data or issuing authority data then this trend would not be shared.

Segmentation of Private Data

Data may be segmented by classifications such as region, time periods, circumstances, policies or substrate type. A segment will always contain data from more than one central bank or issuing authority. For central banks or issuing authorities with concerns about anonymity within aggregated data sets then statistical tests for equal variance and two sample t-tests will be used to ensure that the inclusion or exclusion of their data does not change the conclusion about whether the segments are statistically different or not. If there are outliers in the data that can be reasonably linked back to the central bank then the graphs or trends would not be shared.

3. Getting Started

What documentation is available to support DLR Analytics users?

Links to video demonstrations are available on the Dashboard in the DLR Analytics software and detailed user guides documents are also available (in English and in Spanish). Please contact emma.grey@delarue.com if you haven't received this information.

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How do we get access the software?

Please email us the details of people who would like access to the software. We require the information in the table below. They will then receive a URL link to the software and log in details. As long as you have internet access and use either Mozilla Firefox or Google Chrome you should then be able to access the software.

First Name	Last Name (Family Name)	Email address	SMS*	Administration level**

*The software uses two-factor authentication upon log on. This means that a six-digit code will be sent to your email address or mobile phone every time you log in. You only need to enter your mobile phone (SMS) number into the table if you wish to receive your six-digit code as a text message. Otherwise the default will be to your email.

** Administration levels:

- Admin – can do everything (including adding or removing users, changing permissions of users, editing data, viewing and manipulating all the graphs and the statistical analysis). We recommend having one administrator.
- SuperUser – can edit data and view or manipulate all the graphs and statistical analysis. We recommend having one or two SuperUsers.
- Subscriber – can view or manipulate all the graphs and statistical analysis. You can have unlimited subscribers within the central bank.

How will I know how to use the software?

User guides and quick reference guides are available.

Links to video tutorials are also available on the Dashboard of the DLR Analytics software (for instance a demonstration of the software).

If you are struggling to use the software then please get in touch with your DLR contact and they will organise some training for you with the DLR Analytics team.

Who can I contact if I have any questions about the software?

Our help desk is available 09:00 –17:00 GMT, the email address is dlranalyticssupport@uk.delarue.com. We will monitor this and check whether it is suitable for your needs.

You can also email emma.grey@delarue.com or nikki.strickland@delarue.com with general questions and for general support.

Does the software work on any operating platform?

We recommend that you use Google Chrome or Mozilla Firefox to view the software. Please get in touch with us if you have concerns about this.

What screen resolution do I need?

The minimum resolution that we recommend is 1366x768.

How many computers can the software be installed on?

The software is accessed via a web browser and therefore does not have to be installed onto a computer, however internet access will be required. Although we recommend restricting the number of Admin and SuperUsers, you can have unlimited numbers of people in the central bank registered as subscribers and so able to view all of the graphical and statistical outputs.

What data do I need to use the software?

You will be asked to provide data on a monthly basis for every denomination. The data requested is:

- Circulation: the number of banknotes classified as being in circulation at the end of the period defined.
- New Issues: the number of new banknotes put into circulation in the period defined. This movement of notes is referred to by many different terms, for example issuance, withdrawals, outflow.
- Re-Issues: the number of used/processed banknotes put into circulation in the period defined. This movement of notes is referred to by many different terms, for example issuance, withdrawals, outflow.
- Declared Unfit: the number of processed banknotes declared unfit (notes rejected from the sorting process, which might be awaiting destruction) in the period defined. The notes do not have to be destroyed during the period, just the classified as unfit.
- Deposits: the number of banknotes returned to the central bank from circulation in the period defined.
- Comments: this is the opportunity for you to make any comments you want to be stored with the data you have entered for the period defined. These comments will be visible in the software as part of the chart tooltips, which will provide additional information for all users.

We recommend that you first collect data for one or two denominations for one year to check if your data validates. Many central banks find it is helpful to contact the product team (nikki.strickland@delarure.com or emma.grey@delaure.com) to check the data at this point. The majority of central banks do not consider the data used in DLR Analytics as particularly sensitive and email us the data directly. However we can provide you with a secure file transfer link upon request or we can check your data once it has been uploaded securely into the software. If you have any issues with data validation please get in touch with your De La Rue contact and we will organise a call or a visit to help you get started.

How do I input my data into the software?

If you have a large amount of data to update then there is a bulk data upload function using a CSV template (excel file) that can be downloaded from within the software. If you only have a couple of details to update then you are also able to enter data manually. We recommend starting off with a bulk upload of your historical data then updating manually on a monthly basis.

How often do I need to update the data?

After uploading your historical data onto the software, you will only need to update the data on a monthly basis. This should take ten to fifteen minutes.

How much data do I need to provide?

We recommend that you provide at least five years of historical data, and we need the data to be provided for each month. If you can go back further in time it increases the probability that you will discover more. The descriptive statistics calculations within the software will provide you with an indication of the error bars on the calculations being carried out and this can help to inform whether you want to include more historical data (or whether you can get away with fewer than five years of data).

Please get in touch if you are not sure and we can assess whether you have enough data for the DLR Analytics service to be useful.

What if I don't have all the data points you require?

Please get in contact. We can assess whether you have enough data for the DLR Analytics service to be useful. We can also work with you to help you find a way to capture this information. We are finding that a number of central banks haven’t historically separated out newly issued and re-issued banknotes and in these instances we can apply some logical equations to help model approximately what the split would have been each month.

Can you input a single denomination only into the software?

The denominations inputted into the system are up to you, however we recommend inputting all denominations to understand any interactions between the denominations.

In order for the forecasting module to work, all denominations need to be uploaded onto the software.

Will everyone get to edit the data in the software?

Admin Users and SuperUsers will be able to edit the raw data in the software. We recommend that you limit the number of people assigned to these user types. Only members of your central bank can view or access your data.

I can't log in – what do I do?

If the software is not working we ask that you provide a screenshot of the software and send it to the dlranalyticssupport@uk.delarue.com. One of our support team will then get in touch with further steps to take. The help desk is available 09.00 – 17.00 GMT.

What if I have forgotten my password?

There is a forgotten password function on the login screen where you will be able to request to change your password. If you attempt to login more than six times with the wrong password your account will be disabled for security reasons. If this happens please email dlranalyticssupport@uk.delarue.com to get your password re-set.

Why can't I change my password?

If you are unable to change your password send an email to the dlranalyticssupport@uk.delarue.com. One of our support team will then get in touch with further steps to take. The help desk is available 09.00 – 17.00 GMT.

4. Forecasting

How do you recommend I use the forecasting toolkit?

The forecasting toolkit is designed to take you through a logical process that makes forecasting easier and enables you to explore the forecasting models typically used by central banks around the world.

Step 1. Carry out a forecast for the total value of cash in circulation. DLR Analytics pulls in IMF projections for NGDP and PCPIE and you can view these projections as graphs directly in the software. For the vast majority of central banks the value of cash in circulation is correlated to either NGDP or PCPIE. Using the drop down menus in DLR Analytics you can view how well your historical value of cash in circulation fits to models based on NGDP or PCPIE. You can fit linear, linear regression, exponential and logarithmic variants. In total there are eight combinations of models that you can try to fit to your data.

Step 2. Carry out a forecast for individual banknote denominations. DLR Analytics provides two approaches, one utilises annual data and one utilise monthly data.

Step 2a. The annual forecast enables time series and growth models to be fitted to your annual data. You can also combine the model together, for instance 10 % time series and 90 % growth or 50 % of each. The annual forecast is powerful for central banks who have more annual data available.

Step 2b. The monthly forecasts enable different seasonality models, X-13, Arima and ETS, to be fitted to your monthly data. For each model there are a variety of options to select. The monthly

forecast is powerful for central banks who have access to a large amount of monthly data available and are interested in forecasting seasonality patterns.

Step 3. Carry out a combined forecast by scaling monthly forecasts for individual banknote denominations (selected in Step 2b) so that they add up to the total value of cash in circulation forecast (selected in Step 1).

For all the forecast models we recommend you select the one that visually best fits your data and makes the most sense based on your knowledge of your cash cycle. A statistical assessment of fit is also available if you would prefer numerical guidance. Once you have chosen your preferred model you can save it as your default.

What data do I need in place to run the forecasting models?

For the annual forecast to work there needs to be at least three years of data for all denominations that have been set up as 'Include in forecast' and at least five years for 70% of these. This is because the annual forecasts in DLR Analytics are mathematical models that run by establishing trends from historical data. If you have recently introduced a new denomination and don't have three year's worth of data then please feel free to contact us if you would like support with adapting your DLR Analytics forecasts. We are experienced at helping central banks with forecasting under these circumstances.

What if I don't think the forecasting toolkit works for my central bank?

Please get in contact with nikki.strickland@delarue.com because DLR Analytics users are entitled to additional off-line support. Our statisticians are happy to support you if the current forecasting toolkit isn't giving you what you need.

5. The Cash Cycle Partnership

I've tried to access the Cash Cycle Partnership app. What is BAND? How does this work?

The Cash Cycle Partnership app is a private group that is contained within a publicly available app called BAND. We have used BAND because it is a well-respected app that provides the Cash Cycle Partnership group with everything that was needed (it gives us a private group where we can ensure that only members of central banks have access, it gives us the ability to post and share content privately, it gives us the ability to schedule events and it gives you the ability to participate). When you click on http://band.us/n/a5a1U2p4P631T for the first time you will have the option to download the BAND app, which will contain the Cash Cycle Partnership app. You can also access the user group via a webpage instead.

Will others know that we have joined the Cash Cycle Partnership?

We are not sharing the names of any central banks who have joined the Cash Cycle Partnership. However we think you will get more out of the partnership if you are able to interact and collaborate with other users of DLR Analytics. You will be able to use DLR Analytics anonymously for the purpose of the trial and beyond if you so choose.

However please be aware that the following will make you visible to other users:

- Members of the Cash Cycle Partnership app will be able to see other users of the app and we will welcome you when you join the app.
- When you register for webinars only we will see who has registered but if you ask questions during the webinar this will be visible to others who have also joined.
- Users who attend a Cash Cycle Partnership Seminar will meet other users.

What happens at the Cash Cycle Partnership Seminar?

In February 2018 the first Cash Cycle Partnership Seminar was held in De La Rue Head Office. The global and regional trends, and insights were shared back during the seminar based on a snapshot of data in the software taken at the end of December 2017.

The agenda for the 2018 Cash Cycle Partnership seminar is below

Day 1.

The volume and value of cash in circulation.

- Global trends and regional trends.
- Analysis of factors impacting the growth and decline of cash, including population, ATM machines, POS machines, mobile money, digital currency and other macro-economic factors.

Banknote lifetimes

- Global trends and regional trends
- Impact of denominational values and substrate types on banknote lifetimes.
- Other factors impacting banknote lifetimes.

Day 2. Wednesday 7th February 2018

Circulation velocity (also known as return frequency).

- Global trends and regional trends.
- Considerations for different cash cycle models.

Banknote demand forecasting.

- How to get the most out of DLR Analytics for your forecasting.
- The DLR Analytics roadmap.

Further details about the 2019 seminar will be available July 2018.