

dbnomics

Stata client for DBnomics, the world's economic database

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- 1 The DBnomics platform
- 2 Stata's `dbnomics` command
- 3 Use cases
- 4 Why should you use `dbnomics`?

Ways to improve data handling processes in macroeconomic research:

- Simplifying retrieval of economic data from multiple (public) data sources;
- Automatically providing updated data;
- Allowing reproducible results.

In 2016: the idea of DBnomics, born out of a partnership between the CEPREMAP and France Stratégie (and the financial support of the Investments for the Future Programme).

● **Fred:**

- ▶ Simple user Interface;
- ▶ Archive system (ALFRED);
- ▶ Limited coverage of public data sources (2/3 of the 589,000 series come from the U.S. Census, BLS, BEA, FED);
- ▶ Free, but not open-source.

● **Quandl:**

- ▶ Simple user Interface;
- ▶ Wide(r) coverage of public data source (UNO, BIT, national institutes, etc.), but not systematic within each data provider;
- ▶ Free for some services only.

● **Datastream:**

- ▶ Heavy user interface;
- ▶ Good (i.e., automatised) updating system, especially for financial series;
- ▶ Costly.

Goal: Create a free, *open-source* (and Euro-centric) server to aggregate publicly-available data series provided by national and international statistical institutions.

Four important principles of the project:

- Data series are taken directly from providers and kept unchanged;
- Data series are stored in a tree similar to the provider's;
- Data series are automatically updated via provider-specific functions;
- *Archive system*: each revision of the data series is archived.

Value added:

- A unique economic database with wide, systematic coverage of economic data (605 million series at present);
- The *free and open-source* nature¹ aims at facilitating the creation of a community:
<https://forum.db.nomics.world/>.

¹GNU Affero General public License.

The DBnomics platform

Database coverage to date

Figure 1: Public data providers covered, by quarter

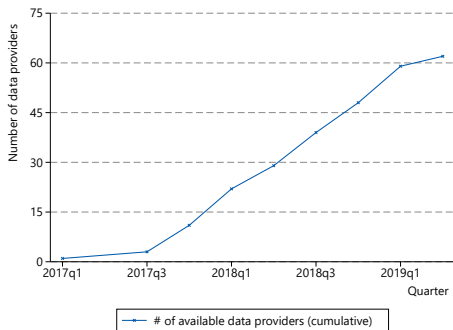
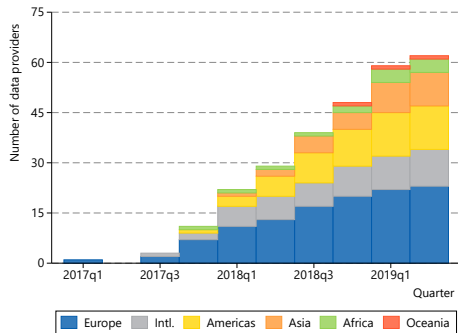


Figure 2: Data providers by geographic scope



How to use it?

- **A website:** <https://db.nomics.world/> with different search capabilities;
- **A RESTful² API** (Application Programming Interface) based on the **JSON** (JavaScript Object Notation) data exchange format: <https://api.db.nomics.world/>;
- **The API allows for automated database access from statistical packages like:**
 - ▶ Python/R;
 - ▶ Julia;
 - ▶ Gretl;
 - ▶ **Stata.**

²Representational State Transfer, a set of recommendations defining a flexible and lightweight architectural style for machine-to-machine communication (e.g., server to client).

- Stata routine to browse, find and extract DBnomics data series;
- Composed of seven sub-commands, handling the various endpoints of its API;
- Mata back-end to parse JSON responses, using the `libjson` library (Lindsley, 2012b);
- Available from SSC (`ssc install dbnomics`);
- Source code available on github.com.

- **Explore and search for data across multiple providers:**
 - ▶ Browse available data providers (`dbnomics providers`);
 - ▶ Load the “table of contents” for a provider of interest (`dbnomics tree`);
 - ▶ Search for data across providers (`dbnomics find`).
- **Explore dataset structure, contents and format:**
 - ▶ Browse dataset structure (`dbnomics datastructure`);
 - ▶ Load list of series related to a dataset (`dbnomics series`).
- **Load data into Stata:**
 - ▶ Import data from DBnomics (`dbnomics import`).
- **Show recently updated data** (`dbnomics news`).

The dbnomics command

Challenge #1: syntax (1/2)

- The design of `dbnomics` is heavily inspired by `sdmxuse` (Fontenay, 2018) for the sub-command structure and Stata's `freduse` for the handling of metadata;
- **However**, Fontenay's `sdmxuse` relies on the SDMX standard, which conveniently allows to "slice" and filter data through "SDMX masks", e.g.:

```
. sdmxuse data ECB, clear dataset(SAFE) dimensions(H.T2.SME.A.0.0.0.Q4.FFAC..AL.WP)
```

- Not all DBnomics providers support SDMX (many do!);
- How to make the following query Stata-friendly?

```
https://api.db.nomics.world/v21/series?provider_code=ECB&dataset_code=SAFE&limit=500&offset=0&dimensions="REF_AREA":["T2"],"SAFE_QUESTION":["Q4"],"FIRM_SIZE":["SME"],"FIRM_SECTOR":["A"],"FIRM_AGE":["0"],"SAFE_DENOM":["WP"],"SAFE_FILTER":["AL"],"SAFE_ITEM":["FFAC","FEQI"],"FBLN","FLEH","FOVD","FTCR"]
```

The dbnomics command

Challenge #1: syntax (2/2)

- **Solution:** turn dimension labels into option names and dimension filters into contents of the options:

```
https://api.db.nomics.world/v21/series?provider_code=ECB&dataset_code=SAFE&
limit=500&offset=0&dimensions={" REF_AREA ": ["T2"], " SAFE_QUESTION ": ["Q4"],
" FIRM_SIZE ": ["SME"], " FIRM_SECTOR ": ["A"], " FIRM_AGE ": ["0"], " SAFE_DENOM ": ["WP"],
" SAFE_FILTER ": ["AL"], " SAFE_ITEM ": ["FFAC", "FEQI", "FBLN", "FLEH", "FOVD", "FTCR"]}
```

```
. dbnomics import, pr(ECB) d(SAFE) REF_AREA (T2) ///
SAFE_QUESTION (Q4) FIRM_SIZE (SME) FIRM_SECTOR (A) ///
FIRM_AGE (0) SAFE_DENOM (WP) SAFE_FILTER (AL) ///
SAFE_ITEM ("FFAC", "FEQI", "FBLN", "FLEH", "FOVD", "FTCR") clear
.....
36 series found and imported
```

- **Advantage:** queries are stored (e.g., in a do-file) in a human-readable format and the command retains a Stata-like syntax.

The dbnomics command

Challenge #2: parsing JSON (1/3)

- Can Stata parse the following JSON payload? *Hint: yes.*

```
{
  "_meta": {
    "python_project_name": "DBnomics-API",
    "python_project_version": "0.21.6"
  },
  "series": {
    "data": [
      {
        "Firm age (SAFE)": "All ages included",
        "Firm economic activity (SAFE)": "All sectors",
        "period": [
          "2009-S1",
          "2009-S2",
          ... (omitted)
        ],
        "SAFE question": "Q4. Financing structure",
        "FIRM_SIZE": "SME",
        "series_name": "Half-yearly ...",
        "FIRM_TURNOVER": "0",
        "FIRM_SECTOR": "A",
        "Frequency": "Half-yearly",
        "SAFE answer": "Not applicable to the firm",
        "period_start_day": [
          "2009-01-01",
          "2009-07-01",
          ... (omitted)
        ],
        "FIRM_AGE": "0",
        "series_code": "H.T2.SME.A.0.0.0.Q4.FBLN.N7.AL.WP",
        "Reference area": "Euro area countries ...",
        "SAFE_FILTER": "AL",
        "@frequency": "bi-annual",
        "SAFE_QUESTION": "Q4",
        "SAFE_ITEM": "FBLN",
        "value": [
          3.858787,
          10.14487,
          ... (omitted)
        ],
        "SAFE question related item": "Bank loan",
        "SAFE filter - applicable answer": "Including ...",
        "Firm other breakdowns (ownership, export) (SAFE)": "SAFE",
        "dataset_code": "SAFE",
        "SAFE_DENOM": "WP",
        "Firm turnover (SAFE)": "All turnover ...",
        "REF_AREA": "T2",
        "Denomination in SAFE context": "Weighted ...",
        "provider_code": "ECB",
        "SAFE_ANSWER": "N7",
        "FIRM_OWNERSHIP": "0",
        "dataset_name": "Survey on the Access ...",
        "Firm size (SAFE)": "Small and medium-sized ...",
        "FREQ": "H"
      }
    ],
    "limit": 1,
    "num_found": 36,
    "offset": 0
  }
}
```

The `dbnomics` command

Challenge #2: parsing JSON (2/3)

- Lindsley's `insheetjson` unfortunately far too limited to handle DBnomics' JSON;
- Buchanan's `jsonio` offers plenty of capabilities, but requires external dependencies (i.e. the Jackson Java library), a rather laborious set-up and a non-trivial RegEx-based syntax for JSON consumption;
- In line with the project's spirit, I wished to build an open-source tool, minimising the number of necessary external dependencies;
- **Solution?** Lindsley's `libjson` Mata library — more than meets the eye:
 - ▶ Mata's `libjson` class comfortably handles most JSON read operations;
 - ▶ Custom parsing Mata functions (e.g. `json2table`, `fetchjson`) help navigate through and convert JSON payloads;
 - ▶ `dbnomics`'s parsing yields a table structure that replicates the output of DBnomics' own official Python client (`pip install dbnomics`);
 - ▶ On the flip side, `libjson` is not the fastest JSON library out there...
- The command `moos` (Picard and Cox, 2011) deals with the necessary residual string cleanup (e.g. encoding).

The dbnomics command

Challenge #2: parsing JSON (3/3)

```
. dbnomics import, pr(ECB) d(SAFE) REF_AREA(T2) SAFE_QUESTION(Q4) ///  
FIRM_SIZE(SME) FIRM_SECTOR(A) FIRM_AGE(O) SAFE_DENOM(WP) SAFE_FILTER(AL) ///  
SAFE_ITEM("FFAC", "FEQI", "FBLN", "FLEH", "FOVD", "FTCR") clear  
.....  
36 series found and imported  
  
. browse period-firm_size in 1/20
```

period	period_start_day	value	firm_age_safe	firm_economic_activity_safe	safe_question	firm_size
2009-S1	2009-01-01	3.858787	All ages included	All sectors	Q4. Financing structure	SME
2009-S2	2009-07-01	10.14487	All ages included	All sectors	Q4. Financing structure	SME
2010-S1	2010-01-01	35.15501	All ages included	All sectors	Q4. Financing structure	SME
2010-S2	2010-07-01	34.84572	All ages included	All sectors	Q4. Financing structure	SME
2011-S1	2011-01-01	37.09875	All ages included	All sectors	Q4. Financing structure	SME
2011-S2	2011-07-01	35.04251	All ages included	All sectors	Q4. Financing structure	SME
2012-S1	2012-01-01	35.26051	All ages included	All sectors	Q4. Financing structure	SME
2012-S2	2012-07-01	34.46809	All ages included	All sectors	Q4. Financing structure	SME
2013-S1	2013-01-01	32.81848	All ages included	All sectors	Q4. Financing structure	SME
2013-S2	2013-07-01	32.96257	All ages included	All sectors	Q4. Financing structure	SME
2014-S1	2014-01-01	42.37593	All ages included	All sectors	Q4. Financing structure	SME
2014-S2	2014-07-01	45.33803	All ages included	All sectors	Q4. Financing structure	SME
2015-S1	2015-01-01	47.79228	All ages included	All sectors	Q4. Financing structure	SME
2015-S2	2015-07-01	44.68392	All ages included	All sectors	Q4. Financing structure	SME
2016-S1	2016-01-01	45.37493	All ages included	All sectors	Q4. Financing structure	SME
2016-S2	2016-07-01	46.51465	All ages included	All sectors	Q4. Financing structure	SME
2017-S1	2017-01-01	46.38163	All ages included	All sectors	Q4. Financing structure	SME
2017-S2	2017-07-01	47.19019	All ages included	All sectors	Q4. Financing structure	SME
2018-S1	2018-01-01	48.41314	All ages included	All sectors	Q4. Financing structure	SME
2018-S2	2018-07-01	49.46145	All ages included	All sectors	Q4. Financing structure	SME

A brief walk-through

How can `dbnomics` simplify the retrieval of macroeconomic data? (1/4)

- The European Small Business Finance Outlook (ESBFO, Kraemer-Eis *et al.*, 2019) gives a bi-annual snapshot of the access to finance conditions of European SMEs;³
- The report compiles vast amount of data from public data sources. For instance, the ESBFO tracks the sources of external financing for Euro area SMEs. Let's use `dbnomics` to find relevant information;

```
. dbnomics find "external financing", clear
Searching for external financing in datasets and series...5 results found.
```

```
+-----+-----+-----+-----+-----+-----+-----+
Type   Provider name      Name                               Code      Nb series  Nb match-g  Indexed at
+-----+-----+-----+-----+-----+-----+-----+
dataset European Central Bank  Survey on the Access to Fina- SAFE      189501     59565      01sep2019
dataset Banco Central do Brasil V.2 - Balance of current tra-i ei-V.2    6          6          29aug2019
dataset Banque De France      Bank Lending Survey           BLS      187        3          24jul2019
dataset Banque De France      Access to Finance of SMEs     SAFE      4          2          14jun2019
dataset Statistics Canada      Central government operation-b 10100133 24         1          30jul2019
(Click on a highlighted link to load related data)
```

- Looks like our first result hits the mark. However, 189,501 series are probably more than we need, so we first browse the dataset structure in search for useful filters;
- By the way, you can click on the [SAFE](#) link to directly load the dataset structure.

³Small and Medium-sized Enterprises.

A brief walk-through

How can `dbnomics` simplify the retrieval of macroeconomic data? (2/4)

```
. dbnomics data, pr(ECB) d(SAFE) clear
```

Survey on the Access to Finance of SMEs

```
189501 series found. Order of dimensions: (FREQ.REF_AREA.FIRM_SIZE.FIRM_SECTOR.FIRM
> _TURNOVER.FIRM_AGE.FIRM_OWNERSHIP.SAFE_QUESTION.SAFE_ITEM.SAFE_ANSWER.SAFE_FILTER
> .SAFE_DENOM)
```

- Browsing through the available series, we identify the following as relevant:

```
. (intermediate output omitted)
```

```
. list dimensions-seriesnr if filter > 0, abbrev(50) noobs sep(0)
```

dimensions	values	labels	seriesnr
FIRM_AGE	0	All ages included	116921
FIRM_SECTOR	A	All sectors	131393
FIRM_SIZE	SME	Small and medium-sized enterprises	30639
REF_AREA	U2	Euro area (changing composition)	79854
SAFE_DENOM	WP	Weighted percentage of responses	138041
SAFE_FILTER	AL	Including not applicable responses	149632
SAFE_QUESTION	Q4	Q4. Financing structure	15432
SAFE_ITEM	FBLN	Bank loan	10230
SAFE_ITEM	FEQI	Equity investments in your firm	7579
SAFE_ITEM	FFAC	Factoring	1144
SAFE_ITEM	FLEH	Leasing or hire-purchase	7579
SAFE_ITEM	FOVD	Credit line, bank overdraft or credit cards overdraft	10230
SAFE_ITEM	FTCR	Trade credit	10230

A brief walk-through

How can `dbnomics` simplify the retrieval of macroeconomic data? (3/4)

- Before downloading the data (and to make sure we are downloading the right stuff), we can create a “shopping cart” of series using the command `dbnomics series`:

```
. dbnomics series, pr(ECB) d(SAFE) SAFE_QUESTION(Q4) SAFE_FILTER(AL) ///  
FIRM_SIZE(SME) FIRM_SECTOR(A) FIRM_AGE(O) SAFE_DENOM(WP) REF_AREA(T2) ///  
SAFE_ITEM("FFAC", "FEQI", "FBLN", "FLEH", "FOVD", "FTCR") clear
```

36 of 189501 series selected. Order of dimensions: ... *(output omitted)*


- We are happy with our selection, we can now proceed to loading the data in memory:

```
. dbnomics import, pr(ECB) d(SAFE) SAFE_QUESTION(Q4) SAFE_FILTER(AL) ///  
FIRM_SIZE(SME) FIRM_SECTOR(A) FIRM_AGE(O) SAFE_DENOM(WP) REF_AREA(T2) ///  
SAFE_ITEM("FFAC", "FEQI", "FBLN", "FLEH", "FOVD", "FTCR") clear
```

```
.....  
36 series found and imported
```

A brief walk-through

How can dbnomics simplify the retrieval of macroeconomic data? (4/4)

- At last, our chart (Kraemer-Eis *et al.*, 2019, p.18): [download do-file:](#) 

```
/* Download data */
dbnomics import, pr(ECB) d(SAFE) REF_AREA(U2) SAFE_QUESTION(Q4) ///
    FIRM_SIZE(SME) FIRM_SECTOR(A) FIRM_AGE(0) SAFE_DENOM(WP) ///
    SAFE_FILTER(AL) ///
    SAFE_ITEM("FFAC", "FEQ1", "FBLN", "FLEH", "FOVD", "FTCR") clear
.....
36 series found and imported

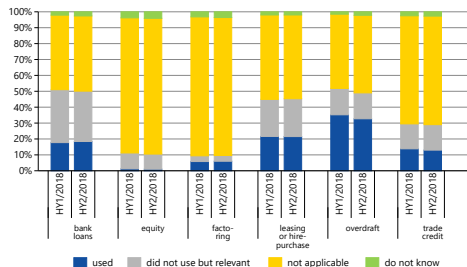
/* Few lines of code to parse and prepare the data */
quietly dbnomics_chart_prepare

/* Graph twoway bar and rbar */
qui mylabels 0(10)100, myscale(0/100) suffix("%") local(yval)
qui levelsof count if !missing(nperiod), local(xlab1) clean
qui levelsof showitem if !missing(itemstr), local(xlab2) clean
qui levelsof tcount, local(xtick1) clean
qui levelsof tcount if !missing(itemstr[_n+1]), local(xtick2) clean

#delimit ;
twoway (bar share0 count, barw(0.75) color(*51 51 153*)
    fintensity(100)) (rbar share1 share0 count, barw(0.75) color(*102
    102 178*) fintensity(100)) (rbar share2 share1 count, barw(0.75)
    color(*255 192 0*) fintensity(100)) (rbar share3 share2 count,
    barw(0.75) color(*166 166 166*) fintensity(100)) (scatter nothing
    showitem, axis(2)), scheme(sfif_official) rscale(axis(2) alt
    noline outergap(+0.5)) xlab("xlab1", valuelab angle(vertical)
    axis(1) noticks) xlab("xlab2", valuelab angle(hor) axis(2) noticks
    labsize(*0.85)) xsize(7) ylabel("yval", angle(hor))
    glpattern(solid) legend(order(4 "do not know" 3 "not applicable" 2
    "did not use but relevant" 1 "used")) symxsize(*0.35) pos(3)
    cols(1) region(lcolor(none)) xtitle("", axis(1)) xtitle("",
    axis(2)) plotregion(margin(sides)) xtick("xtick1" 18.5, nolabels
    tpos(outside) tlength(*12) axis(1)) xtick("xtick2" 18.5, add
    nolabels tpos(cross) tlength(*8) axis(2)) name{figure15_esbfo,
    replace};
#delimit cr

.
.
.
gr export "\${WORK}/chapters/03_results/figures/figure15_esbfo.pdf", ///
as(pdf) name{figure15_esbfo} replace
(file C:\Users\SIGNORE\Desktop\Ppresentations\Stata_UG_meeting_UK2019\
chapters\03_results\figures\figure15_esbfo.pdf written in PDF format)
```

Figure 3: Sources of external financing of Euro area SMEs



Source: Kraemer-Eis *et al.* (2019), based on ECB SAFE (ECB, 2019).

- Over 605 million time series from 62 data sources at your fingertips:


Provider Name	Website	Geographic area
African Development Group	https://www.afdb.org/en/	Africa
Annual macro-economic database of the European Commission's Directorate General for Economic and Financial Affairs	http://ec.europa.eu/economy_finance/ameco/user/serie/SelectSerie.cfm	Europe
Banco Central do Brasil	http://www.bcb.gov.br	BR
Banque Centrale des Etats de l'Afrique de l'Ouest	http://www.bceao.int	Africa
Banque De France	http://webstat.banque-france.fr/fr/home.do	FR
U.S. Bureau of Economic Analysis	http://www.bea.gov	US
Bank Indonesia	https://www.bi.go.id/en/	ID
Bank for International Settlements	https://www.bis.org/	International
U.S. Bureau of Labor Statistics	https://www.bls.gov/	US
Bank of England	http://www.bankofengland.co.uk/	GB
Bank of Japan	https://www.boj.or.jp/en/index.htm/	JP
Bundesbank	https://www.bundesbank.de/	DE
Congressional Budget Office macro economic database	https://www.cbo.gov/about/products/budget-economic-data	US
Centre d'études prospectives et d'informations internationales	http://www.cepii.fr/	International
Central Statistics Office of Ireland	https://www.cso.ie/	IE
Direction de l'Animation de la Recherche des Etudes et des Statistiques	https://dares.travail-emploi.gouv.fr/	FR
Federal Statistical Office Germany	https://www-genesis.destatis.de/genesis/online	DE
Direction de la recherche, des études, de l'évaluation et des statistiques	http://solidarites-sante.gouv.fr/ministere/organisation/directions/article/drees-direction-de-la-recherche-des-etudes-de-l-evaluation-et-des-statistiques	FR
European Central Bank	https://www.ecb.europa.eu/	Europe
U.S. Energy Information Agency	https://www.eia.gov/	US
Hellenic Statistical Authority	http://www.statistics.gr/en/home/	GR
Economic and Social Research Institute, Cabinet Office, Government of Japan	http://www.esri.cao.go.jp/index-e.html	JP
Eurostat	http://ec.europa.eu/eurostat/home	Europe
Food and Agriculture Organization of the United Nations	http://www.fao.org/faostat/en/	International
Federal Reserve Board of Governors	https://www.federalreserve.gov/	US
Federal Housing Finance Agency	https://www.fhfa.gov/	US
Groningen Growth and Development Center, University of Groningen	https://www.rug.nl/ggdc/productivity/pwt/	International
International Labour Organization	https://www.ilo.org	International
International Monetary Fund	https://www.imf.org/	International
Instituto Nacional de Estadística y Censos	https://www.indec.gov.ar/	AR
Instituto Nacional de Estadística	http://www.ine.es/	ES

Let's recap

Why should you use dbnomics? (2/3)

(list of providers continued)

Provider Name	Website	Geographic area
Instituto Nacional de Estadística y Geografía	https://www.inegi.org.mx/	MX
Statistics Portugal	https://www.ine.pt	PT
National Institute of Statistics and Economic Studies	https://insee.fr/	FR
Institute for Supply Management	https://www.instituteforsupplymanagement.org	US
Italian National Institute of Statistics	https://www.istat.it/en/	IT
The London Bullion Market	http://www.lbma.org.uk	GB
Ministry of Economy, Trade and Industry	http://www.meti.go.jp/english/	JP
Ministry of Statistics and Programme Implementation	http://www.mospi.gov.in	IN
U.S. National Association of Realtors	https://www.nar.realtor/	US
National Bank of Belgium Online statistics	http://stat.nbb.be/	BE
National Bureau of Statistics of China	http://data.stats.gov.cn/english/	CN
Organisation for Economic Co-operation and Development	http://www.oecd.org/	International
Office for National Statistics	https://www.ons.gov.uk	GB
Pôle Emploi	http://www.pole-emploi.org/opendata/	FR
Reserve Bank of Australia	https://www.rba.gov.au/	AU
Russian Federation Federal State Statistics Service	http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/en/main/	RU
State Administration of Foreign Exchange	http://www.safe.gov.cn/en/	CN
China Africa Research Initiative	http://www.sais-cari.org/	Africa
Saudi Arabian Monetary Authority	http://www.sama.gov.sa/	SA
South African Reserve Bank	https://www.resbank.co.za/	ZA
Statistics Sweden	https://www.scb.se/	SE
Surveys of Consumers, University Michigan	https://data.sca.isr.umich.edu/	US
State Secretariat for Economic Affairs, Switzerland	https://www.seco.admin.ch/seco/en/home.html	CH
Statistics Canada	https://www.statcan.gc.ca/	CA
Statistics Japan, Statistics Bureau, Ministry of Internal Affairs and Communication	http://www.stat.go.jp/english/	JP
Statistics Poland	https://stat.gov.pl/en/	PL
Türkiye Cumhuriyet Merkez Bankası	http://www.tcmb.gov.tr/	TR
United Nation Conference on Trade and Development	https://unctad.org/en/Pages/Home.aspx	International
United Nations	http://data.un.org/	International
World Bank	http://www.worldbank.org/	International
World Trade Organization	https://www.wto.org/	International

- **A command that adapts to the specificities of each data provider...**
 - ▶ Store queries (e.g., in a do-file) in a human-readable format, using Stata's native option syntax;
- **...requiring minimal dependencies**
 - ▶ `ssc install libjson` and `ssc install moss`;
- **Limitations:**
 - ▶ `dbnomics` is not a bulk download tool. There is a hard-coded limit of 500 maximum downloadable series (which can be lifted via the `limit()` option). In any case, the server only yields a maximum of 1000 series per query; [here are some work-arounds](#) 
- **To dos:**
 - ▶ Update the `dbnomics` command to support version 22 of the DBnomics API (released December 2018);
 - ▶ Add option to request specific versions of time series (both from the front-end and back-end);
- **Bugs?** s [dot] signore at eif [dot] org (or signoresimone at yahoo [dot] it);
- **Want to help?** Fork <https://dreameater89.github.io/dbnomics/>.

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