Replication package for BLM

This git repository contains all the code to replicate the results of **Bonhomme Lamadon and Manresa "A distributional Framework for matched employer-employee data"**, forthcoming at **Econometrica**. The working-paper version is available here. Virtually all code is based on the R platform.

If you are looking for the R package to use the method of the paper, you should use the rblm package. It includes most of the estimators available here, and we keep updating it.

The present replication package is built as an R package that can be easily installed on any system. All package dependencies can be handled using packrat. This option guarantees that results can be reproduced using the exact versions of all the libraries that were used at the time the paper was written. We also provide a Docker container to ensure full portability. This provides a full linux stack with RStudio and all libraries installed and configured.

Importantly, reproducing the results on Swedish data **requires access to the administrative data from Sweden**. Researchers need to apply to get access to such data. We recommend contacting the IFAU. The institute is hosting this replication package that can be accessed and ran on the data on their servers. The reference name for our project is `"IFAU-2015-65 ("dnr65/2015")`. See at the end of this page for more info.

If you have any question or comment, please contact us or use directly the issue page on the github repository.

How do I run this?

The simplest way to use this replication package is to rely on the docker container that we have created as described in solution 1. This will get it running almost instantly.

Solution 1: get it running in less than 10 minutes, run our docker container

Make sure you have the docker app installed on your computer. Then run the following command:

```
docker run -d --rm -e PASSWORD=blm -p 8787:8787 tlamadon/blm-replicate
```

This will automatically download our docker container from dockerhub and start it. This will give you access to a fully functioning `RStudio` with the installed libraries and the code necessary to run the replication code. After completion of the previous command, this Rstudio environment should be available in your browser at http://localhost:8787, which points to your local computer. Use login `rstudio` and password `blm`.

From there calling `source("inst/main.R")` will start the full replication, create all necessary intermediate results and generates all figures and tables, saving them in the `tmp` folder. We invite the researcher however to explore the inst/main.r file.

By default, this will run all of the code using a **synthetic data set**. See below how to get access to Swedish data, and load it into the container.

Note 1: make sure the docker app does not limit memory access to less than 16Gb. See here.

Note 2: you can stop the container by running `docker stop blm-replicate`. If you want to keep working on the environment, you should not use the `--rm` argument in the original call. Such argument enforces the container to be destroyed unpon stopping.

Note 3: you can easily move files in and out of a running container using the `docker copy SOURCE DEST` command. Or you can mount a folder from your host computer. See details here.

Solution 2: install the replication package into your R environment

If you have your own running R system, and you want to run this replication package in your environment, you can directly install the package. In this case we recommend that you make use of the packrat configuration we are providing.

1. Download the replication package. We recommend to simply clone the github repository, ie: `git clone https://github.com/tlamadon/blm-replicate.git`
2. Start R inside the replication package.

In R, run the following commands:

```r
# installing the package locally in your R env.

install.packages("pakcrat") # make sure that packrat is available
install.packages("devtools") # make sure that devtools is available

source("packrat/init.R") # initialize the packrat environment
packrat::restore()       # make sure all is up to date

devtools::install(".")   # build the replication package

source("inst/main.R")    # fire up the replication
```

Overview of the replication package

The main entry point is inst/main.r. It will **automatically** run all the necessary steps in the other files in order to reproduce all the results of the paper. Note however that this would take a very long time as it will start some bootstrap procedures. The code will generate all figures and tables and put them into a folder called `tmp` .

We invite resesearchers to read through inst/main.r which has explicit calls for each subsets of the paper.

Organization of the code

- All the heavy lifting such as the estimators and simulation codes are in the R/*.r folder. This is the usual way to store functions in an R package.
- inst/server/estimation-static.r contains the code that runs the estimations for the **static** version of the model
- inst/server/estimation-dynamic.r contains code that runs the different estimations for the **dynamic** version of the model.
- inst/server/fig-blm.R contains functions that generate all of the **figures and tables** in the paper.

Replicating the results on Swedish data

Data availability requirements – requests for replication

From the IFAU:

> Due to strict regulations regarding access to and processing of personal data, the Swedish microdata cannot be uploaded to journal servers. However the IFAU ensures data availability in accordance with requirements by allowing access to researchers who wish to replicate the analyses.
>
> Researchers wishing to perform replication analyses can apply for access to the data. The researcher will be granted remote (or site) access to the data to the extent necessary to perform replication, provided he/she signs a reservation of secrecy. The reservation states the terms of access, most importantly that the data can only be used for the stated purposes (replication), only be accessed from within the EU/EEA, and not transferred to any third party. The authors will be available for consultation.
>
> Apart from allowing access for replication purposes, any researcher can apply to Statistics Sweden to obtain the same data for research projects, subject to their conditions.

Researchers can directly apply for access to `data-static.dat` and `data-dynamic.dat` by contacting us and the IFAU. These two files are the inputs to the replication code and a copy is stored as part of the replication package on the servers at the IFAU. Our two data sets (data-static.dta and data-dynamic.dta) will be stored on a server at IFAU, as part of the project`"IFAU-2015-65 ("dnr65/2015")`. The files will be in a separate folder that can be accessed by anyone who gets clearance from IFAU.

Researchers could also re-construct these data sets from the original files, which are available on a server at IFAU, as part of the project `dnr167/2009` that was put together by Benjamin Friedrich, Lisa Laun, Costas Meghir, and Luigi Pistaferri. This project and ours are linked. The main data source should be the following list of files: `selectedf0educ1.dta`, `selectedf0educ2.dta`, `selectedf0educ3.dta`, `selectedf1educ1.dta`, `selectedf1educ2.dta`, `selectedf1educ3.dta`, `selectedfirms9708.dta`.

The following two scripts use these data sources to construct the two data files `data-static.dat` and `data-dynamic.dat`:

- inst/server/data-section-static.r contains the code that **processes the data inputs** to prepare the data for the static estimation.
- inst/server/data-section-dynamic.r contains the code that **processes the data inputs** to prepare the data for the dynamic estimation.

Using your own data source

This is similar to using the Swedish data. You only need to provide two data sources in the form of a `data.frame`. One should be called `sdata` and contain information on all workers, and one should be called `jdata` and contain information only about the movers. The sdata and jdata frames should be saved into `data-tmp/data-static.dat` and `data-tmp/data-dynamic.dat` for the static and the dynamic estimation.

We recommend to have a look at the function `generate_simulated_data` in inst/server/server-utils.R. It creates synthetic data simulated from our main specifications and saves files to the same format as the actual data. This is your best source to match the structure exactly.

Here is what `sdata` looks like:

```
   k        y1        y2 j1 j2 j1true    f1   f2 move
1: 1  9.846396  9.747927  5  1      5 F1335   F1    1
2: 2 10.040879 10.075224  5  1      5  F135   F1    1
3: 5 10.638532 10.744525  3  1      3  F143   F1    1
4: 3  8.894678 10.195521  4  1      4  F144   F1    1
5: 3  9.718155  9.438086  1  1      1  F181   F1    1
```

```
   ---
77571: 2  9.983228 10.219231  8  8      8  F998 F998    0
77572: 4 10.471325 10.398645  8  8      8  F998 F998    0
77573: 4 10.331180 10.516750  8  8      8  F998 F998    0
77574: 6 11.375500 11.292524  8  8      8  F998 F998    0
77575: 4 10.399596 10.501993  8  8      8  F998 F998    0

       birthyear x    wid              ind1
    1:      1961 1 W64819 Construction etc.
    2:      1963 1 W64807      Retail trade
    3:      1979 1 W60513      Retail trade
    4:      1963 1 W62818 Construction etc.
    5:      1965 1 W58054          Services
   ---
77571:      1964 1 W51166          Services
77572:      1971 1 W51331          Services
77573:      1967 1 W51434          Services
77574:      1968 1 W51496          Services
77575:      1973 1 W51543          Services

             va1          ind2       va2 educ size1
    1:  3.3505830 Manufacturing 3.8792234    1    17
    2: 13.7959329 Manufacturing 3.8792234    3    24
    3:  0.2839520 Manufacturing 3.8792234    2    13
    4:  3.0592294 Manufacturing 3.8792234    1    12
    5:  1.0255445 Manufacturing 3.8792234    3    27
   ---
77571:  0.4115116      Services 0.4115116    3    64
77572:  0.4115116      Services 0.4115116    1    64
77573:  0.4115116      Services 0.4115116    2    64
77574:  0.4115116      Services 0.4115116    3    64
77575:  0.4115116      Services 0.4115116    1    64
```