2° Investing Initiative
PACTA for Banks Training Webinar III
Analysis and Visualisation
June, 2022
Agenda

Methodology recap
Matching process recap
Analysis Workflow
Visualization
Final comments
Methodology Recap
PACTA for Banks
Methodology Recap

Corporate lending portfolios

Alignment of loan books is benchmarked against climate change scenarios and the market.

Climate Change Scenarios

Loans are mapped to the physical assets in the real economy and their corresponding production values.

Physical Assets in the Real Economy

Metrics

- Technology mix
- Volume trajectory
- Emission Intensity

Figure SPM.5 from page 9 of the IPCC AR5 Summary for Policymakers:
The Matching Process Recap
PACTA for Banks
The Matching Process Recap

• Step 1: Importing necessary files
  • Importing loan book
  • Importing Asset-Based Company-Level Data (ABCD)

```r
# option 1
your_loanbook <- r2dii.data::loanbook_demo

your_abcd <- r2dii.data::abcd_demo

# option 2
your_loanbook <- readr::read_csv("...enter file path.../lbk.csv")

your_abcd <- readr::read_csv("...enter file path.../abcd.csv")
```
PACTA for Banks
The Matching Process Recap

• Step 2: Matching

```r
# match lbk to abcd
match_file <- r2dii.match::match_name(your_loanbook, your_abcd)
```

• Optional advanced matching

```r
# match lbk to abcd
match_file <- r2dii.match::match_name(your_loanbook, your_abcd, by_sector == TRUE,
    min_score = 0.8, method = "jw", p = 0.1, overwrite = NULL)
```

- **min_score** allows you to set the matching score threshold
- **method** allows you to use different algorithms to determine the score of the matching
- **by_sector** allows you to match any names irrespective of the sector classification
PACTA for Banks
The Matching Process Recap

• Step 3: Manual matching
  • Export the “match_file from R to Excel,
  • Allocate 1 = match, 0 = no match to each loan in the score column

```r
# export match_file to excel
write_csv(match_file, "...file path.../match_file.csv"
```
PACTA for Banks
The Matching Process Recap

• Step 4 (optional): Overwrite file
• Step 5: Prioritize matches
  • Read the “matched_file” file back into R

```r
matched_file_ready <- readr::read_csv("...enter file path.../matched_file_ready.csv")
```

• The prioritize function selects the best match for the loan at the Direct Loan Taker level, when found. Otherwise the Ultimate Parent is used.

```r
loanbook_demo_ready <- r2dii.match::prioritize(matched_file_ready)
```

• If instead, you would like the production values of the Ultimate Parent:

```r
loanbook_demo_ready <- r2dii.match::prioritize(matched_file_ready, priority = rev)
```
Analysis Workflow
PACTA for Banks
Analysis Workflow

• Step 1: Importing and loading necessary files and tables
  • Importing scenarios
  • Loading regions

# scenario data for fossil fuel, power and automotive sectors
scenario_isf_nz <-
    read_csv("…file path/ISF-NZ-2020-Fossil-Fule-Power.csv")

scenario_nz_iea <-
    read_csv("…file path/NZ-IEA-2021-Fossil-Fuel-Power-Auto.csv")

scenario_weo_2019 <-

scenario_weo_2020 <-
    read_csv("…file path/WEO-2020-Fossil-Fuel-Power.csv")
PACTA for Banks
Analysis Workflow

• Step 1: Importing and loading necessary files and tables
  • Importing scenarios
  • Loading regions

```r
# scenario data for cement, steel and aviation sectors
scenario_etp_2017_co2 <-
    read_csv("...file path.../ETP-2017-CO2-Intensity-for-Steel-Cement.csv")
scenario_isf_nz_co2 <-
    read_csv("...file path.../ISF-NZ-2020-CO2-Intensity-for-Steel-Cement-and-Aviation.csv")

# regions
regions <- r2dii.data::region_isos
```
Step 2: Calculate targets

Attributing macro carbon budgets to micro-economic actors

Step 2.1.: Market share approach

- The target set out by the scenario will be met collectively, with all the players responsible for their market share within the sector

- Market share is calculated as the companies’ share of the sector’s total production in a given technology
PACTA for Banks
Analysis Workflow

• Step 2: Calculate targets
• Step 2.1.: Market share approach
  • At portfolio level:

```r
market_share_targets_portfolio <- lbk_ready %>% target_market_share(
  abcd = abcd, scenario = scenario, region_isos = regions)
```

• Optional to use credit_limit

```r
market_share_targets_portfolio <- lbk_ready %>% target_market_share(
  abcd = abcd, scenario = scenario, region_isos = regions, use_credit_limit = TRUE,
  weight_production = TRUE)
```

Production is weighted by relative loan-size

Use loan_size_credit_limit instead of loan_size_outstanding
PACTA for Banks
Analysis Workflow

• Step 2: Calculate targets
• Step 2.1.: Market share approach
  • At company level:

```r
market_share_targets_portfolio_company <- lbk_ready %>% target_market_share(
  abcd = abcd, scenario = scenario, region_isos = regions, by_company = TRUE,
  weight_production = FALSE)
```
How the results should look like:

<table>
<thead>
<tr>
<th>sector</th>
<th>technology</th>
<th>year</th>
<th>region</th>
<th>scenario_source</th>
<th>metric</th>
<th>production</th>
<th>technology_share</th>
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</thead>
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</tr>
</tbody>
</table>

sectors: power, oil and gas, automotive

technologies: vary depending on the sector

year: 2020 - 2040

scenario_source: vary depending on the scenario used

region: vary depending on the sector

metrics: projected, targets, and corporate_economy
PACTA for Banks
Analysis Workflow

• Step 2: Calculate targets

  Attributing macro carbon budgets to micro-economic actors

• Step 2.2.: Sectoral decarbonisation approach

  • All portfolio intensity targets will converge to equal the sector intensity target at the end of the date prescribed by the scenario
PACTA for Banks
Analysis Workflow

• Step 2: Calculate targets
• Step 2.2.: Sectoral decarbonisation approach
  • At portfolio level:

```r
sda_targets_portfolio <- lbk_ready %>% target_sda(
  abcd = abcd, co2_intensity_scenario = scenario, region_isos = regions)
```

• Optional to use credit_limit

```r
sda_targets_portfolio <- lbk_ready %>% target_sda(
  abcd = abcd, co2_intensity_scenario = scenario, region_isos = regions,
  use_credit_limit = TRUE)
```

Use loan_size_credit_limit instead of loan_size_outstanding
How the results should look like:

<table>
<thead>
<tr>
<th>sector</th>
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<th>emission_factor_metric</th>
<th>emission_factor_value</th>
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<td>adjusted_scenario_demo</td>
<td>0.37794984</td>
</tr>
</tbody>
</table>

sectors: cement, steel and aviation
year: 2020 – 2025 are used, 2013 – 2050 is extra
emission_factor_metric: projected, corporate_economy, target_b2ds, adjusted_scenario_b2ds
Visualisation
PACTA for Banks
Visualisation

Set up
  • Installing packages

```r
# installation
install.packages("r2dii.plot") / library("r2dii.plot")

# other packages that go well with r2dii.plot
install.packages(ggplot2) / library(ggplot2)
install.packages(dplyr) / library(dplyr)
```

• Making sure your data has a similar structure to that of the demo datasets

```r
loanbook <- loanbook_demo
abcd <- abcd_demo
scenario <- co2_intensity_scenario_demo
region <- region_isos_demo
```
PACTA for Banks
Visualisation

• Sector level technology mix

```r
market_share_targets_portfolio %>%
  subset(
    sector == "power" &
    region == "global" &
    scenario_source == "scenario_source" &
    metric %in%
      c("projected", "corporate_economy", "target_sds")
  ) %>%
  qplot_techmix()
```

• Various sectors
• Various regions
PACTA for Banks
Visualisation

• Technology level volume trajectory

```r
market_share_targets_portfolio %>%
subset(
  technology == "renewablescape" &
  region == "global" &
  scenario_source == "scenario_source"
) %>%
qplot_trajectory()
```

• Various technologies
• Various regions
PACTA for Banks

Visualisation

• SDA target

\[
sda\_targets\_portfolio \%>\%\n  \text{subset(}\n    \ sexe\_td == "cement" & \n    \text{region == "global" &}\n    \text{scenario\_source == "scenario\_source"}\n  ) \%>\%\n  \text{qplot\_emission\_intensity()}
\]

• Various sectors
PACTA for Banks
Visualisation

• Sector level technology mix by company

```r
results_yukon <- market_share_targets_portfolio_company %>%
  filter(name_abcd == "yukon development corp")

results_yukon %>%
  subset(
    sector == "power" &
    region == "global" &
    scenario_source == "scenario_source" &
    metric %in%
      c("projected", "corporate_economy", "target_sds")
  ) %>%
  qplot_techmix()
```
PACTA for Banks
Visualisation

- Technology level volume trajectory by company

```r
results_yukon <- market_share_targets_portfolio_company %>%
  filter(name_abcd == "yukon development corp")

results_yukon %>%
  subset(
    technology == "renewablescape" &
    region == "global" &
    scenario_source == "scenario_source"
  ) %>%
  qplot_trajectory()
```
Plots can be customised in three ways:
1. Use parameters of plot_*() function
2. Modify the input data
3. Use “ggplot2” functions.

Some typical options are:
• Change the time span.
• Add custom labels by modifying the column ‘metric’ and technology of the results data.
• Add a title and a subtitle.
• Change x and y axis labels.
• Customize the colours and legend labels with ggplot2::scale_colour_manual() or r2dii.plot::scale_*() functions
PACTA for Banks
More on Visualisation

• Sector level technology mix

```r
data <- market_share %>%
  filter(
    metric %in% c("projected", "corporate_economy", "target_sds"),
    sector == "power",
    region == "global",
    year >= 2021,
    year <= 2040) %>% # custom time range
  mutate(
    label = case_when(
      metric == "projected" ~ "Your Portfolio",
      metric == "corporate_economy" ~ "Corporate Economy Benchmark",
      metric == "target_sds" ~ "SDS Scenario"))

plot_techmix(data) +
  scale_fill_manual(
    values = c("black", "brown", "grey", "yellow", "blue", "green4"),
    labels = paste(c("Coal", "Oil", "Gas", "Nuclear", "Hydro", "Renewables"), "Cap."))
```
PACTA for Banks
More on Visualisation

• Technology level volume trajectory

```r
data <- matched %>%
  target_market_share(ald, scenario = scenario_demo_2020, region_isos = region) %>%
  filter(
    technology == "renewables_cap",
    region == "global",
    year <= 2030
  ) %>%
  mutate(
    label = case_when(
      metric == "projected" ~ "Your Portfolio",
      metric == "corporate_economy" ~ "Benchmark (Corp. Economy)",
      metric == "target_sds" ~ "Sustainable Development Scen.",
      metric == "target_sps" ~ "Stated Policies Scen.",
      metric == "target_cps" ~ "Current Policy Scen.",
      TRUE ~ metric)
  )
plot_trajectory(data) +
  scale_x_continuous(n.breaks = 3) +
  labs(
    title = "Portfolio Scenario Alignment for Renewables Technology",
    x = "Year",
    y = "Production normalized to start year") +
  theme(plot.margin = unit(c(0.5, 6, 0.5, 1), "cm"))
```
PACTA for Banks
More on Visualisation

• SDA target

```
data <- sda %>%
  filter(
    sector == "cement",
    year <= 2030)

plot_emission_intensity(data) +
  labs(
    title = "Emission intensity plot for cement",
    x = "Time",
    y = "Tons of CO2 per ton of cement produced") +
  scale_color_manual(
    values = c("#4a5e54", "#a63d57", "#78c4d6", "#f2e06e"),
    labels = c("Proj.", "Corp. Economy", "Target (demo)", "Adj. Scenario (demo)"))
```
Final comments
Final comments

• This Webinar is the final on a series of three published webinars for the implementation of PACTA for Banks.

• All relevant PACTA for Banks information is published in the Capital Transition Monitor website:
  • https://www.transitionmonitor.com/pacta-for-banks-2020/

• Documentation of the packages functionalities is also available online.

• If you have any questions, please do not hesitate to contact us by writing an email to any of these emails:
  • banks@2degrees-investing.org
  • contact@2degress-investing.org
Thank you for your attention.