

README: The Rise of Viet Nam's Solar Panel Industry: Inputs, FDI, and Spillovers

Overview

This replication package contains all data and code needed to reproduce the figures, tables, and regression results in the paper. The package covers three steps: (1) construction of the Vietnam Enterprise Survey (VES) firm panel, (2) compilation of shipment-level supply chain data from Panjiva merged with firm characteristics, and (3) generation of all descriptive statistics, figures, tables, and econometric results.

Package Structure

```
Replication/
├── Code/
│   ├── Data_Compiation_Main.R          # Step 2: Supply chain data
├── compilation
│   ├── Figure_Table_Replication_Code.R # Step 3: All figures and tables (R)
│   └── Regression_SolarVietnam_FDI.do  # Step 3: Regression analysis
├── (Stata)
│   └── VES_Replication/                # Step 1: VES firm panel
├── construction (Stata)
│   ├── README.txt
│   ├── code/
│   │   ├── 0_main_create_firm_data.do
│   │   ├── create_firm_data.do
│   │   └── prep_deflators.do
│   └── raw/                            # Raw firm and price data (see Step
1)
├── Data/                               # Input and intermediate data files
│   ├── map/                            # GADM shapefiles for Vietnam
│   └── Event_Study/                    # Event study output CSVs (from
Stata)
│   └── robust/                         # Robustness check datasets
├── Descriptive/
│   ├── Figure/                        # Output figures (PDF)
│   └── Table/                         # Output tables (TeX)
└── Solar_spillovers_manuscripts.pdf
```

Data Availability

Note: Some data cannot be made publicly available due to confidentiality restrictions or commercial licensing. These are marked **CONFIDENTIAL** or **COMMERCIAL ACCESS REQUIRED** below.

Step 1 – VES Firm Panel (Raw Inputs, placed in Code/VES_Replication/raw/)

File Name	Description	Source	Availability
gso.dta	Vietnam Enterprise Survey (VES) firm-level panel, 2016–2022. Firm financials, employment, sector (VSIC 4-digit), location, FDI status.	GSO Vietnam	CONFIDENTIAL – acquired through the Industrial Statistics Department, GSO Vietnam
import_firms.dta	Firm-level annual import aggregates (taxid, year, import_total)	Vietnam Customs Authority	CONFIDENTIAL – acquired through the Industrial Statistics Department, GSO Vietnam
export_firms.dta	Firm-level annual export aggregates (taxid, year, export_total)	Vietnam Customs Authority	CONFIDENTIAL – acquired through the Industrial Statistics Department, GSO Vietnam
prices/Annual average CPI (Previous year = 100).csv	Annual average CPI and core inflation	GSO Vietnam	Public – https://www.gso.gov.vn/en/prices/
prices/export_price_index_2023.xlsx	Merchandise Export Price Index (USD, base year 2010)	GSO Vietnam	Public – https://www.gso.gov.vn/en/prices/
prices/import_price_index_2023.xlsx	Merchandise Import Price Index (USD, base year 2010)	GSO Vietnam	Public – https://www.gso.gov.vn/en/prices/
prices/Producer price index for agriculture, forestry and fishing (...).csv	PPI for agriculture, forestry, and fishing (base year 2010)	GSO Vietnam	Public – https://www.gso.gov.vn/en/prices/
prices/Producer price index for industry	PPI for industry (base year 2010)	GSO Vietnam	Public – https://www.gso.gov.vn/en/prices/

File Name	Description	Source	Availability
(...).csv prices/Producer price index for services (...).csv	PPI for services (base year 2010)	GSO Vietnam	Public – https://www.gso.gov.vn/en/prices/
prices/sector_correspondence.xlsx	Concordance between 2-digit VSIC codes and PPI/CPI/GDP sectors	Authors' construction	Included in package

Outputs of Step 1 (included in package):

File Name	Description
Data/firm_data.dta	Cleaned VES firm panel with deflated financial variables, trade indicators, sector and location identifiers (base year 2014)
raw/_cpi.dta, _ppi.dta, _expimp.dta, _exchange_rate.dta, _sector_correspondence.dta	Deflator intermediates created by prep_deflators.do

Step 2 – Supply Chain Data (in Data/)

File Name	Description	Source	Availability
Export_Panjive_Solar/ (folder of CSVs)	Shipment-level export records for Vietnamese solar panel exporters under HS codes 85414021 and 85414022, 2018–2022	Panjiva / S&P Global Trade Intelligence	COMMERCIAL ACCESS REQUIRED – requires Panjiva subscription
PanjivaRaw_Import/, Panjiva_Import/	Shipment-level import records for solar panel input suppliers into Vietnam	Panjiva / S&P Global Trade Intelligence	COMMERCIAL ACCESS REQUIRED – requires Panjiva subscription
Rosenow&Mealy(2024)_map.csv	HS code classification of solar and EV value chain inputs from Rosenow & Mealy (2024)	Rosenow, B. & Mealy, P. (2024)	Included in package
apinet_solar_17.xlsx, Apinet_Score.xlsx	Apinet solar panel input product codes and relevance scores	Apinet	Included in package
GTA_SUB.xlsx	Global Trade Alert	Global Trade	Included in package

File Name	Description	Source	Availability
	interventions (subsidies) targeting solar products	Alert (GTA)	
agg_baci.csv	Aggregated bilateral trade flows for HS 854140 (solar panels)	BACI, CEPII	Included in package
hs2017_hs0.CSV	HS 2017 to HS 1992 product concordance	UN Statistics Division	Included in package
hs12_hs17.csv	HS 2012 to HS 2017 product concordance	UN Statistics Division	Included in package
hs12isic3.csv	HS 2012 to ISIC Rev. 3 concordance	UN Statistics Division	Included in package
isic3_4.csv	ISIC Rev. 3 to ISIC Rev. 4 concordance	UN Statistics Division	Included in package
df_exporter_fdi_list.csv	Manually verified FDI status and CEO nationality for solar panel exporters	Authors' construction (verified via thuvienphapluat.vn and masothue.com)	Included in package
export_list_hq_nationality.csv	Solar panel exporters with headquarters nationality and representative information	Authors' construction	Included in package
WebScrape_Shipper_ID_April_29th.csv	Web-scraped tax IDs for local Vietnamese suppliers (from masothue.com), April 2025	Authors' construction	Included in package
shipper_link2018.csv	Firms supplying solar producers in 2018 (excluded from main analysis)	Authors' construction	Included in package

Intermediate datasets produced by Step 2 (included in package):

File Name	Description
df_exporter_fdi_list.csv	Extracts solar producers from Panjiva data, which are then searched by CEO name and

File Name	Description
	saved as Export_list_hq_nationality.csv.
Viet_Export(solar)_Panjiva.csv	Cleaned solar panel export transactions merged with FDI status
Viet_SolarGVCImport_Rosenow&Mealy.csv	Vietnam solar GVC imports per Rosenow & Mealy classification
Viet_SolarGVCImport_apinet.csv	Vietnam solar GVC imports per Apinet classification
Import_Panjiva_Full.csv	Merged import dataset (Rosenow & Mealy + Apinet)
Rosenow&Mealy_Apinet_solar.csv	Combined solar input classification (Rosenow & Mealy + Apinet)
ActiveGTA.csv	Countries providing subsidies to solar products (filtered from GTA)
hs_solar_mic25.csv	Solar products targeted by Made in China 2025 industrial policy
DataViet_PanjivaFirm_exim.csv	Main analysis dataset – solar producer input transactions with subsidies, MIC25, and FDI flags
shipper_id.csv	Local suppliers with matched tax IDs
shipper_year_link.csv	Year when each local supplier first linked to a solar producer
shipper_year_link_stata.csv	Regression-ready panel with treatment/control indicators
Export_Direct_Outcome.csv	Solar producers merged with VES balance sheet data
census_with_custom_full.dta	VES firm panel merged with Panjiva trade records, 2016–2024

Step 3 – Geographic Data (for Figure 14, in Data/map/)

File Name	Description	Source	Availability
gadm41_VNM_1.*	Vietnam province-level shapefile (63 provinces)	GADM Project v4.1	Public – https://gadm.org/download_country.html
gadm41_VNM_2.*	Vietnam district-level shapefile	GADM Project v4.1	Public – https://gadm.org/download_country.html
gadm41_VNM_3.*	Vietnam commune-	GADM	Public –

File Name	Description	Source	Availability
	level shapefile	Project v4.1	https://gadm.org/download_country.html
<code>district.dta</code>	District-level code concordance for Vietnam	Authors' construction	Included in package

Instructions for Replicators

The replication proceeds in three sequential steps. Steps 2 and 3 depend on outputs from Step 1.

Step 1 – Construct VES Firm Panel ([Code/VES_Replication/](#))

This step constructs the cleaned Vietnam Enterprise Survey firm-level panel (`firm_data.dta`) used throughout the analysis.

Full instructions are in `Code/VES_Replication/README.txt`. A brief summary follows:

1. Prepare raw data. Place the following files in `Code/VES_Replication/raw/`: - `gso.dta` – VES census firm panel (confidential) - `import_firms.dta` – firm-level import aggregates (confidential) - `export_firms.dta` – firm-level export aggregates (confidential)

Place GSO price index files (CPI, PPI, export/import price indices) in `Code/VES_Replication/raw/prices/`. Download from <https://www.gso.gov.vn/en/prices/>.

2. Run. In Stata, `cd` to the `Code/VES_Replication/` folder and run the master script. The directory is resolved automatically from the working directory — no path editing required:

```
stata    cd "path/to/Replication/Code/VES_Replication"    do
"code/0_main_create_firm_data.do"
```

This runs: - `prep_deflators.do` – builds CPI, PPI, export/import price deflators and exchange rate files from raw GSO price data (exchange rates retrieved via World Bank Open Data API) - `create_firm_data.do` – merges VES firm panel with trade data and deflators to produce `firm_data.dta`

Output: `firm_data.dta` (approximately 5 GB) containing firm-year observations 2016–2022 with deflated financial variables, trade indicators, sector codes, and location identifiers. See `Code/VES_Replication/README.txt` for a full variable dictionary.

Step 2 – Compile Supply Chain Data (Code/Data_Compilation_Main.R)

This step builds all intermediate and final datasets needed for the analysis. It is implemented in R and runs sequentially from top to bottom. The script requires Panjiva data access to regenerate the raw transaction files; all intermediate and final outputs are included in the package for replicators without a Panjiva subscription but data is not for redistribution

Set the working directory at the top of the script (line 12) to your local Replication/Data/ path:

```
setwd("~/Dropbox/GreenTrade_Price_WBank/Replication/Data")
```

The script constructs datasets in the following order:

- 1. Rosenow&Mealy(2024)_map.csv** Creates the HS code classification of solar and EV supply chain inputs based on Rosenow & Mealy (2024). This table of HS codes (converted from HS 1992 to HS 2017) serves as the classification framework for all input identification.
- 2. Viet_SolarGVCImport_Rosenow&Mealy.csv** Compiles Vietnam's imports of solar GVC inputs (HS 2017) downloaded from Panjiva, using the Rosenow & Mealy input list as the download filter.
- 3. Viet_SolarGVCImport_apinet.csv** Second set of solar GVC imports using Apinet's solar input classification. HS codes not already covered by Rosenow & Mealy were downloaded separately from Panjiva and compiled here.
- 4. Import_Panjiva_Full.csv** Merges Viet_SolarGVCImport_Rosenow&Mealy.csv and Viet_SolarGVCImport_apinet.csv into a single import dataset.
- 5. Rosenow&Mealy_Apinet_solar.csv** Combined solar input classification file, assembled from Rosenow&Mealy(2024)_map.csv and apinet_solar_17.xlsx. Used throughout subsequent steps to identify solar-related inputs.
- 6. ActiveGTA.csv** Identifies countries that provide subsidies to solar products, based on Global Trade Alert (GTA) data filtered following Ruta & Rutunno (2024). Required inputs: GTA_SUB.xlsx, Rosenow&Mealy_Apinet_solar.csv, hs12_hs17.csv
- 7. hs_solar_mic25.csv** Identifies which solar panel products correspond to Made in China 2025 (MIC25) industrial policy targets, using industry-level ISIC codes. Required inputs: Rosenow&Mealy_Apinet_solar.csv, isic3_4.csv, hs12isic3.csv, hs12_hs17.csv
- 8. DataViet_PanjivaFirm_exim.csv (main analysis dataset)** Merges import records (Import_Panjiva_Full.csv) with solar panel export firms (Viet_Export(solar)_Panjiva.csv) to retain only input transactions from suppliers to solar panel producers. Further merged with GTA subsidy indicators, MIC25 policy flags, and FDI representative classification. Required inputs: Import_Panjiva_Full.csv,

Viet_Export(solar)_Panjiva.csv, ActiveGTA.csv, hs_solar_mic25.csv,
df_exporter_fdi_list.csv

9. WebScape_Shipper_ID_April_29th.csv (*web scraping – see note below*) Tax IDs for Vietnamese local suppliers, retrieved by scraping the masothue.com business registry.

Required Inputs: - DataViet_PanjivaFirm_exim.csv >  **Time-Intensive Step – Web Scraping (skip recommended)** > > The output file

WebScape_Shipper_ID_April_29th.csv is **already provided** in the replication package.

You do not need to re-run this step. > > If you wish to reproduce the web scrape from

scratch: > - **Method:** Headless HTTP scraping using DuckDuckGo search + masothue.com page parsing. No Selenium or Chrome is required. > - **R libraries:** rvest, httr, stringdist

> - **Input:** Unique shipper names from DataViet_PanjivaFirm_exim.csv (filtered to Vietnam-origin, piece-unit, ≤ 2022 shipments) > - **Rate limiting:** The script waits 20–30 seconds between requests to avoid rate limiting. With the full list of unique shipper names, the complete run takes **several hours to over a day**, depending on network conditions. > -

Manual corrections: After the automated scrape, a set of mismatched or ambiguous tax IDs are corrected manually. These hard-coded corrections are already in the script (lines ~1457–1483) and reflect the April 2025 scrape. If you re-run the scrape, you should review the output and update these corrections accordingly. > - **Internet connection** must remain stable throughout the run. Partial results are saved every 50 rows to tax_id_matches_partial.csv.

10. shipper_id.csv Merges local input tax IDs WebScape_Shipper_ID_April_29th.csv with DataViet_PanjivaFirm_exim.csv to identify local suppliers and their transactions.

11. solar_industry_isic3&4.csv Links solar products to ISIC Rev. 3 and Rev. 4 industry classifications. Required inputs: isic3_4.csv, hs_isic_solar.csv

12. firm_data_2016_2022.dta VES firm balance sheet data (2016–2024) merged with Panjiva supply chain records. This file is generated using Stata – see Step 1 (firm_data_2016_2022.dta) and Code/VES_Replication/code/create_firm_data.do.

13. Export_Direct_Outcome.csv Merges solar panel producers with VES balance sheet data to extract producer-level financial outcomes (revenue, employment, assets). Required inputs: firm_data_2016_2022.dta, export_list_hq_nationality.csv, DataViet_PanjivaFirm_exim.csv

14. supplier_categori.csv Categorizes identified local suppliers by type: supplying local solar producers, FDI solar producers, Chinese solar producers, or both types of FDI. shipper_id.csv, firm_data_2016_2022.dta, solar_industry_isic3&4.csv, export_list_hq_nationality.csv

15. shipper_year_link.csv Identifies the year in which each local supplier first begins supplying a solar panel producer, broken down by the nationality/type of the solar producer (representative). Required inputs: shipper_id.csv, firm_data_2016_2022.dta, export_list_hq_nationality.csv, solar_industry_isic3&4.csv

16. shipper_year_link_stata.csv Regression-ready panel dataset with treatment (Chinese FDI link or any FDI link) and control group indicators. Firms already supplying solar producers in 2018 are excluded; the analysis focuses on new supply relationships formed between 2019 and 2024. Required inputs: shipper_year_link.csv, DataViet_PanjivaFirm_exim.csv, shipper_link2018.csv, shipper_id.csv

17. Robust 1) To run the Robust test, we need to rerun the entire code again, as we only focus on Rosenow&Mealy Input only 2) The test Robust test we test is to remove Chinese FDI with unclear Nationality being mention in MASOTHUE —

Step 3 – Generate Figures, Tables, and Regression Results

Run the two code files below after completing Step 2. Figures are saved to Descriptive/Figure/ and tables to Descriptive/Table/.

Code/Figure_Table_Replication_Code.R (R)

Set the working directory at the top of the script (line 44) to your local Replication/ path. Install all required packages listed at the top of the file (see Requirements section below). The script runs sequentially and produces all figures and tables.

Descriptions of each section:

- **Figure 1** – Share of US solar panel imports (HS 854140) by exporting country, 2010–2022. Input: Data/agg_baci.csv.
- **Table 1** – Summary statistics for Panjiva transaction-level data: average number of export and import transactions per firm by year. Input: Panjiva export/import summaries computed within the script.
- **Table 2** – Comparison of Panjiva (filtered and unfiltered) with BACI Vietnam solar panel export volumes. Manually transferred to manuscript.
- **Figure 2** – Number of trade policy interventions (subsidies) per country targeting solar products. Inputs: GTA_SUB.xlsx, Rosenow&Mealy_Apinet_solar.csv.
- **Figure 3a, 3b** – Volume of input shipments and number of distinct inputs by trading partner and local supplier origin. Input: DataViet_PanjivaFirm_exim.csv.
- **Figure 4** – Share of top 12 input categories among solar producers in Vietnam by sourcing origin. Input: DataViet_PanjivaFirm_exim.csv.
- **Figure 5** – Share of subsidized vs. non-subsidized input shipments by supplier type. Inputs: DataViet_PanjivaFirm_exim.csv, ActiveGTA.csv.
- **Table 3** – Regression: role of subsidies in lowering input prices for solar producers. Inputs: DataViet_PanjivaFirm_exim.csv, Rosenow&Mealy_Apinet_solar.csv.
- **Figure 6** – Input price comparisons: (a) subsidized vs. non-subsidized, (b) Chinese vs. non-Chinese, (c) MIC25-targeted vs. non-targeted. Inputs: DataViet_PanjivaFirm_exim.csv, Rosenow&Mealy_Apinet_solar.csv.
- **Figure 7a, 7b** – Distribution of Chinese FDI and non-Chinese FDI firms by share of Chinese inputs. Input: DataViet_PanjivaFirm_exim.csv.

- **Figure 8** – Number of solar panel producer firms by ownership status (Chinese FDI, other FDI, domestic). Inputs: census_with_custom_full.dta, shipper_year_link_stata.csv, Viet_Export(solar)_Panjiva.csv, export_list_hq_nationality.csv.
- **Figure 9** – Total employment by ownership status of solar panel producers. Same inputs as Figure 8.
- **Figure 10** – Total export volume by ownership status of solar panel producers. Inputs: export_list_hq_nationality.csv, Viet_Export(solar)_Panjiva.csv.
- **Figure 11** – Difference in balance sheet outcomes between Chinese FDI and domestic solar producers. Input: Export_Direct_Outcome.csv.
- **Figure 12** – Export price differences between Chinese FDI and other solar producers when exporting to the Rest of World, USA, and EU27+UK. Input: Viet_Export(solar)_Panjiva.csv.
- **Figure 13** – Share of input shipments by solar producer type (Chinese FDI vs. other FDI). Inputs: DataViet_PanjivaFirm_exim.csv, ActiveGTA.csv.
- **Figure 14a, 14b** – Geographic maps of the solar panel cluster in northern Vietnam (2018 and 2021). Inputs: GADM shapefiles (Data/map/), census_with_custom_full.dta, shipper_year_link_stata.csv, Viet_Export(solar)_Panjiva.csv.
- **Figure 15a, 15b** – Number of local suppliers and total employment among suppliers to solar panel producers, over time. Inputs: census_with_custom_full.dta, shipper_year_link_stata.csv, Viet_Export(solar)_Panjiva.csv, export_list_hq_nationality.csv.
- **Figure 16** – Treatment group visualization showing when each firm was first linked to a solar producer. Input: shipper_year_link_stata.csv.
- **Figure 17, 22, 23** – Event study plots for local spillover effects (main, Rosenow & Mealy robust, True Representative robust). These plots are generated in R using CSV outputs from Regression_SolarVietnam_FDI.do (saved in Data/Event_Study/SA/). Run the Stata do file first.
- **Figure 18** – Mechanism: visual description of the supply chain linkage formation process. Input: DataViet_PanjivaFirm_exim.csv.
- **Figure 19** – Mechanism event study: effects on fixed assets, current assets, total assets, and asset productivity. Inputs: census_with_custom_full.dta, shipper_year_link_stata.csv.
- **Table 4** – Main regression results for local supplier outcomes (revenue, employment, wage, labor productivity). Inputs: census_with_custom_full.dta, shipper_year_link_stata.csv.
- **Table 5** – Mechanism regression results. Same inputs as Table 4.
- **Figure 20** – Additional descriptive (computed within script).
- **Table 7** – Robustness check: replication using Rosenow & Mealy input classification. Inputs from Data/robust/.

- **Table 8** – Robustness check: replication using true (verified) representative nationality. Inputs from Data/robust/.
- **Appendix A** – Full list of solar inputs used among solar producers in Vietnam, with source classification (Rosenow & Mealy, Apinet, or both).

Code/Regression_SolarVietnam_FDI.do (Stata)

Set the working directory to your local Replication/Data/ path (line 23 for the main specification). The script implements Sun & Abraham (2020) staggered difference-in-differences event studies with the following specifications:

Baseline Regression- – effect of linking to any Chinese FDI solar producer (main specification) - **SA ChinaFDILINK - CS FULLChinaFDI Link - SDID ChinaFDILINK - Robustness: using Rosenow & Mealy input-based identification (from Data/robust/) - SA ChinaFDILINK Rosenow & Mealy - CS FULLChinaFDI Rosenow & Mealy - SDID ChinaFDILINK Rosenow & Mealy - Robustness: using verified representative nationality (from Data/robust/shipper_year_link_stata_true.csv) - SA ChinaFDILINK True Rep - CS FULLChinaFDI True Rep - SDID ChinaFDILINK True Rep**

Outcomes: log revenue, log employment, log wage per employee, log labor productivity.

Output event study CSVs and ATT files are saved in Data/Event_Study/SA/ and read back by Figure_Table_Replication_Code.R to produce Figures 17, 22, and 23.

Mechanism Outcomes: Current Asset, Fixed Asset, Total Asset, Total Asset Productivity —

Code to Output Mapping

Code File	Output
Figure_Table_Replication_Code.R	Figure 1
Figure_Table_Replication_Code.R	Table 1
Figure_Table_Replication_Code.R	Table 2
Figure_Table_Replication_Code.R	Figure 2
Figure_Table_Replication_Code.R	Figure 3a, Figure 3b
Figure_Table_Replication_Code.R	Figure 4
Figure_Table_Replication_Code.R	Figure 5
Figure_Table_Replication_Code.R	Table 3
Figure_Table_Replication_Code.R	Figure 6
Figure_Table_Replication_Code.R	Figure 7a, Figure 7b
Figure_Table_Replication_Code.R	Figure 8
Figure_Table_Replication_Code.R	Figure 9
Figure_Table_Replication_Code.R	Figure 10
Figure_Table_Replication_Code.R	Figure 11

Code File	Output
Figure_Table_Replication_Code.R	Figure 12
Figure_Table_Replication_Code.R	Figure 13
Figure_Table_Replication_Code.R	Figure 14a, Figure 14b
Figure_Table_Replication_Code.R	Figure 15a, Figure 15b
Figure_Table_Replication_Code.R	Figure 16
Regression_SolarVietnam_FDI.do → Figure_Table_Replication_Code.R	Figure 17 (Event Study – FDI Link, main)
Figure_Table_Replication_Code.R	Figure 18
Figure_Table_Replication_Code.R	Figure 19
Figure_Table_Replication_Code.R	Table 4
Figure_Table_Replication_Code.R	Table 5
Figure_Table_Replication_Code.R	Figure 20
Regression_SolarVietnam_FDI.do → Figure_Table_Replication_Code.R	Figure 22 (Robust – Rosenow & Mealy)
Regression_SolarVietnam_FDI.do → Figure_Table_Replication_Code.R	Figure 23 (Robust – True Representative)
Figure_Table_Replication_Code.R	Table 7 (Robust – Rosenow & Mealy)
Figure_Table_Replication_Code.R	Table 8 (Robust – True Representative)
Figure_Table_Replication_Code.R	Appendix A

Figures 17, 22, and 23 require Regression_SolarVietnam_FDI.do to be run first to generate the event study CSVs in Data/Event_Study/SA/. The R script then reads those CSVs to produce the plots.

Requirements

R

Required packages (install once):

```
install.packages(c(
  "dplyr", "tidyr", "readr", "readxl", "haven", "purrr",
  "stringr", "lubridate", "ggplot2", "scales", "patchwork",
  "viridis", "ggrepel", "gridExtra", "forcats", "fixest",
  "plm", "car", "sandwich", "modelsummary", "broom",
  "xtable", "knitr", "sf", "stringdist", "tibble", "glue",
  "tidyverse", "rvest", "httr"
))
```

Stata

Required for Steps 1 and 3. Install community packages:

```
ssc install reghdfe, replace
ssc install ftools, replace
ssc install ivreg2, replace
ssc install eventstudyinteract, replace
ssc install csdid, replace
ssc install drdid, replace
ssc install sdid_event, replace
```

Estimated Run Times

Step	Software	Estimated Time
Step 1 – VES firm panel	Stata	~30 minutes
Step 2 – Supply chain compilation	R	~1–2 hours
Step 2 – Web scraping (optional)	R	Several hours to >1 day
Step 3 – Figures and tables	R	~1–2 hours
Step 3 – Regressions	Stata	~30 minutes

Storage

Approximately 10–15 GB total (including Panjiva raw data folders).