Production Subsidies and Agricultural Trade

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PNREC May 19–21, 2025 Bellingham, WA

Motivation

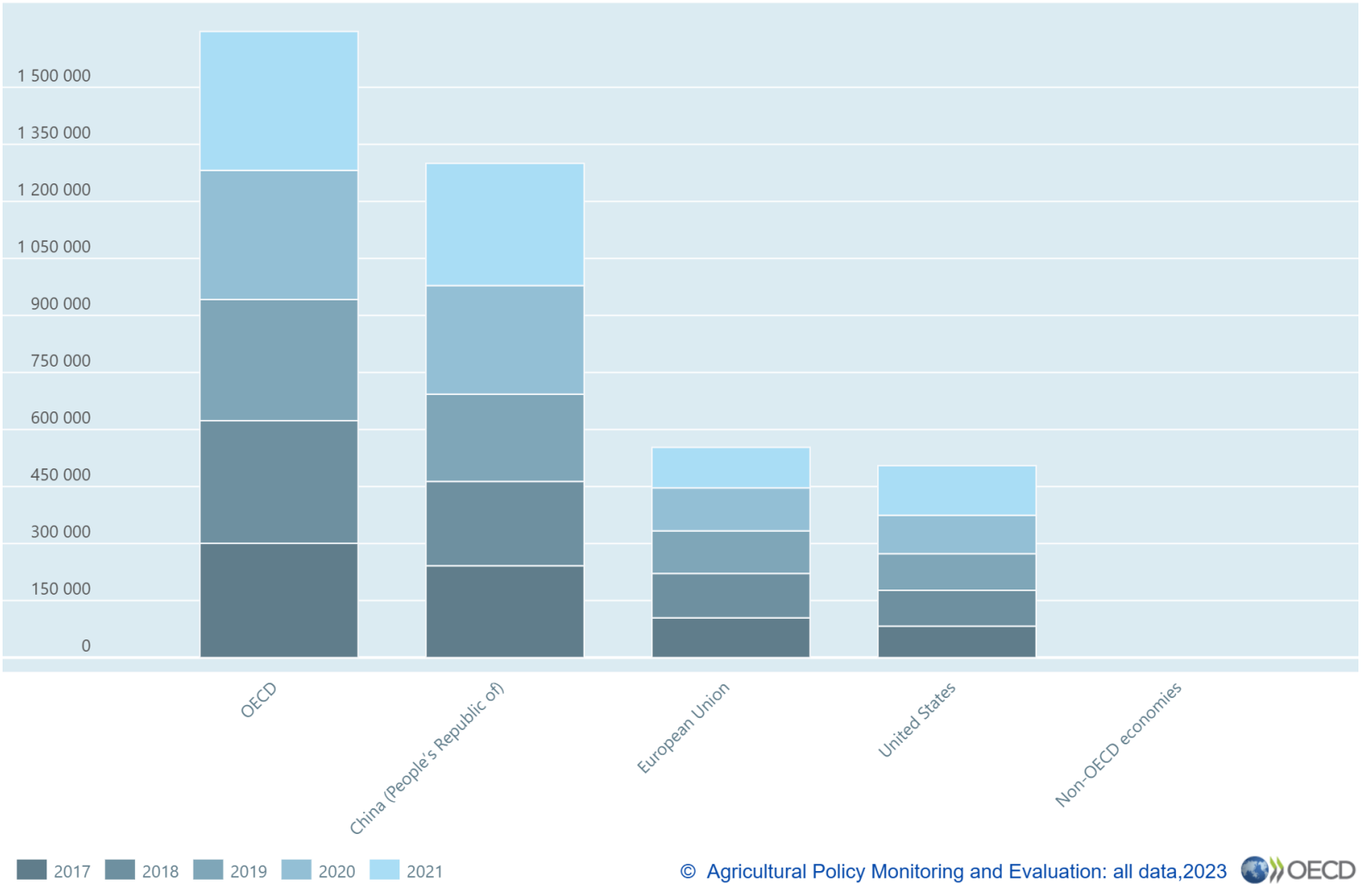
- According to OECD reports (OECD 2024, 2023), the Total Support Estimate (TSE) for the agricultural sector across 54 countries averaged $842 billion annually between 2021 and 2023.
  - Slightly lower than the $851 billion per year reported for 2020–2022
  - Still well above pre-pandemic levels ($817 billion per year in 2019–2021).
- Producer Support Estimate (PSE) declined marginally—from $630 billion in 2020–2022 to $629 billion annually in 2021–2023.
- PSEs make up approximately 75% of total support, while General Services Support Estimates (GSSE) and Consumer Support Estimates (CSE) account for 12.5% each.

Definitions

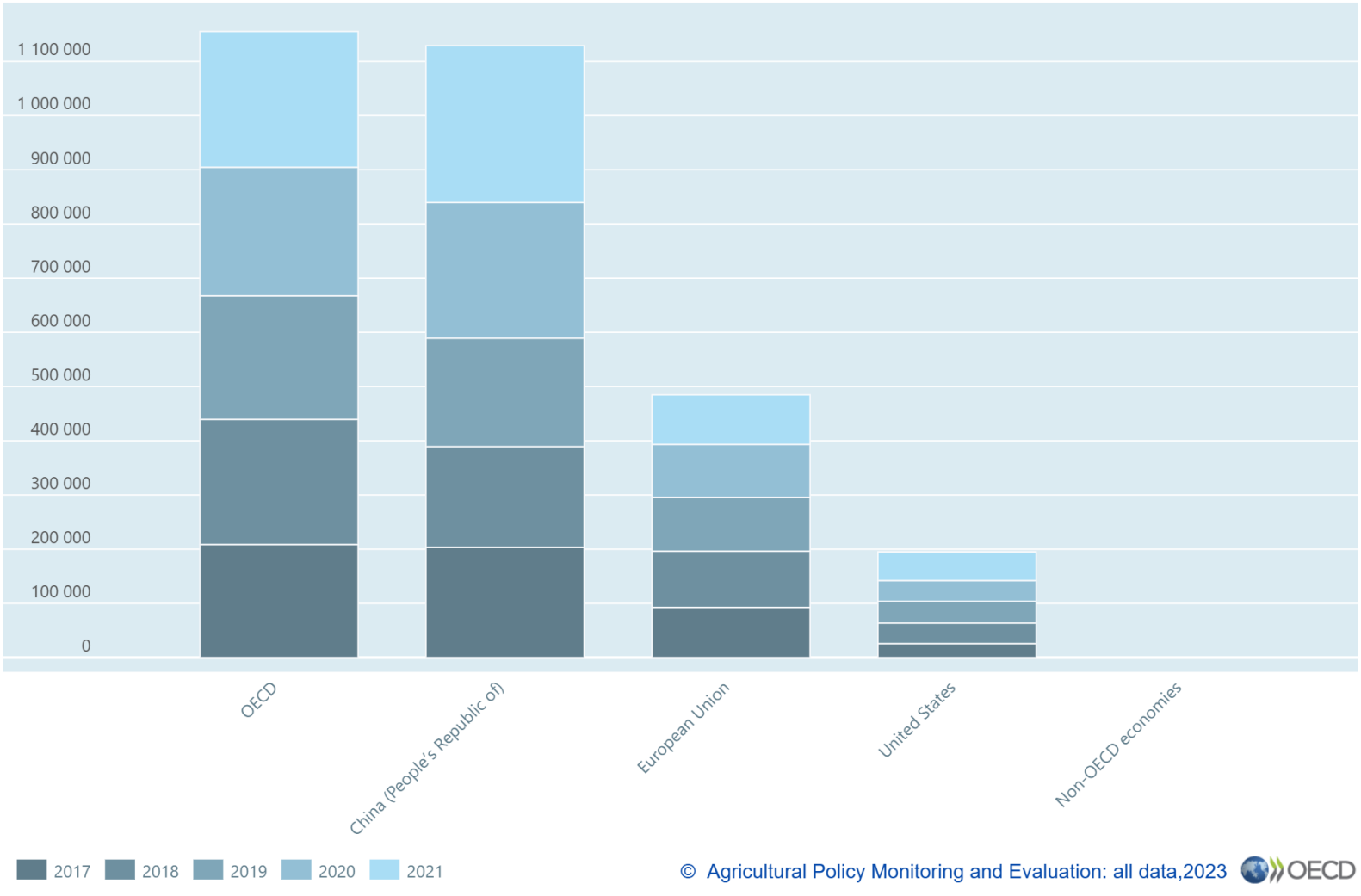
TSE transfers represent the total support granted to the agricultural sector, and consist of

- PSE transfers to individual agricultural producers are measured at the farm gate level
  - a consistent measure of government support across countries
- CSE transfers from consumers of agricultural commodities are measured at the farm gate level.
  - If negative, the CSE measures the burden (implicit tax) on consumers through higher prices
- GSSE transfers are linked to measures creating enabling conditions for the primary agricultural sector through development of private or public services, institutions and infrastructure.
  - does not include any payments to individual producers.

Agricultural Policy Monitoring and Evaluation - TSE



Agricultural Policy Monitoring and Evaluation - PSE



Research Question, Objective and Contribution

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Contribution

Analyzing the effects of aggregated and disaggregated PSEs on aggregate agricultural commodity trade,

Econometrics

- By design, subsidies can directly affect production, and through their effect on production, can indirectly influence trade.
- Certain subsidies depend on current or historical production levels,
  - Payments based on current and non-current Area (A), Animal Numbers (AN), Receipts (R) or Income (I), which require production
- As a result, directly estimating the effects of subsidies on production can lead to simultaneity bias.
- To address this endogeneity issue, we use the lag of an endogenous variable as an instrumental variable for endogenous variable (Todd and Wolpin, 2003)

Analysis

The analysis is conducted in three steps:

- linking subsidies to production,
- examining the effect of production on non-discriminatory outward and inward effects (e.g., multilateral resistance terms (MRT), production, consumption etc.), and
- assessing the influence of non-discriminatory outward and inward effects on bilateral trade.

Econometric Model: Step 1

PPML estimator by Silva and Tenreyro (2006) is used to estimate the structural gravity model defined as

$$T_{ijt} = \exp\{\beta_1 FTA_{ijt} + \beta_2 WTO_{ijt} + \eta_{ij} + \eta_{it} + \eta_{jt}\} \times \varepsilon_{ijt}$$

- T_{ijt} is a bilateral trade flow for country pair i, j in year t;
- η_{ij}, η_{it}, and η_{jt} are country-pair, exporter-time, and importer-time fixed effects
- ε_{ijt} is a standard mean-zero error term.

Econometric Model: Step 2

Using 2SLS, we estimate the effect of subsidy on the total value of production, $Y_{it}(S_{it})$, for exporter i in year t and the total value of consumption, $Y_{jt}(S_{it})$, for exporter j in year t as follows

$$\begin{aligned} \ln Y_{it}(S_{it}) &= \alpha_1 \ln S_{it} + \epsilon_{it}, \\ \ln Y_{jt}(S_{it}) &= \beta_1 \ln S_{it} + \epsilon_{jt} \end{aligned}$$

Econometric Model: Step 3

In step three, we retrieve the estimates of the exporter-time $\hat{\eta_{it}}$ and importer-time $\hat{\eta_{jt}}$ fixed effects from the equation in step 1 and regress these fixed effect on $Y_{it}(S_{it})$ and $Y_{jt}(S_{it})$ as

$$\begin{aligned} \hat{\eta_{it}} &= \alpha_1 \ln Y_{it} + \mu_{it}, \\ \hat{\eta_{jt}} &= \beta_1 \ln Y_{jt} + \mu_{jt} \end{aligned}$$

Data Description

- Years: 2000–2019
- Countries: 72 exporters and 256 importers
- Commodities: Aggregate of 26 agricultural commodities
  * Wheat, fresh fruit and vegetables, live cattle, dairy, etc.
- Bilateral international and intra-national trade flows
  * Source: International Trade and Production Database for Estimation
- Policy Variables: FTAs, WTO joint membership, and frictions
  * Source: Dynamic Gravity Dataset
- Subsidies: Producer Support Estimates (PSE)
  * Unit: USD (Millions)
  * Sources: OECD and Inter-American Development Bank

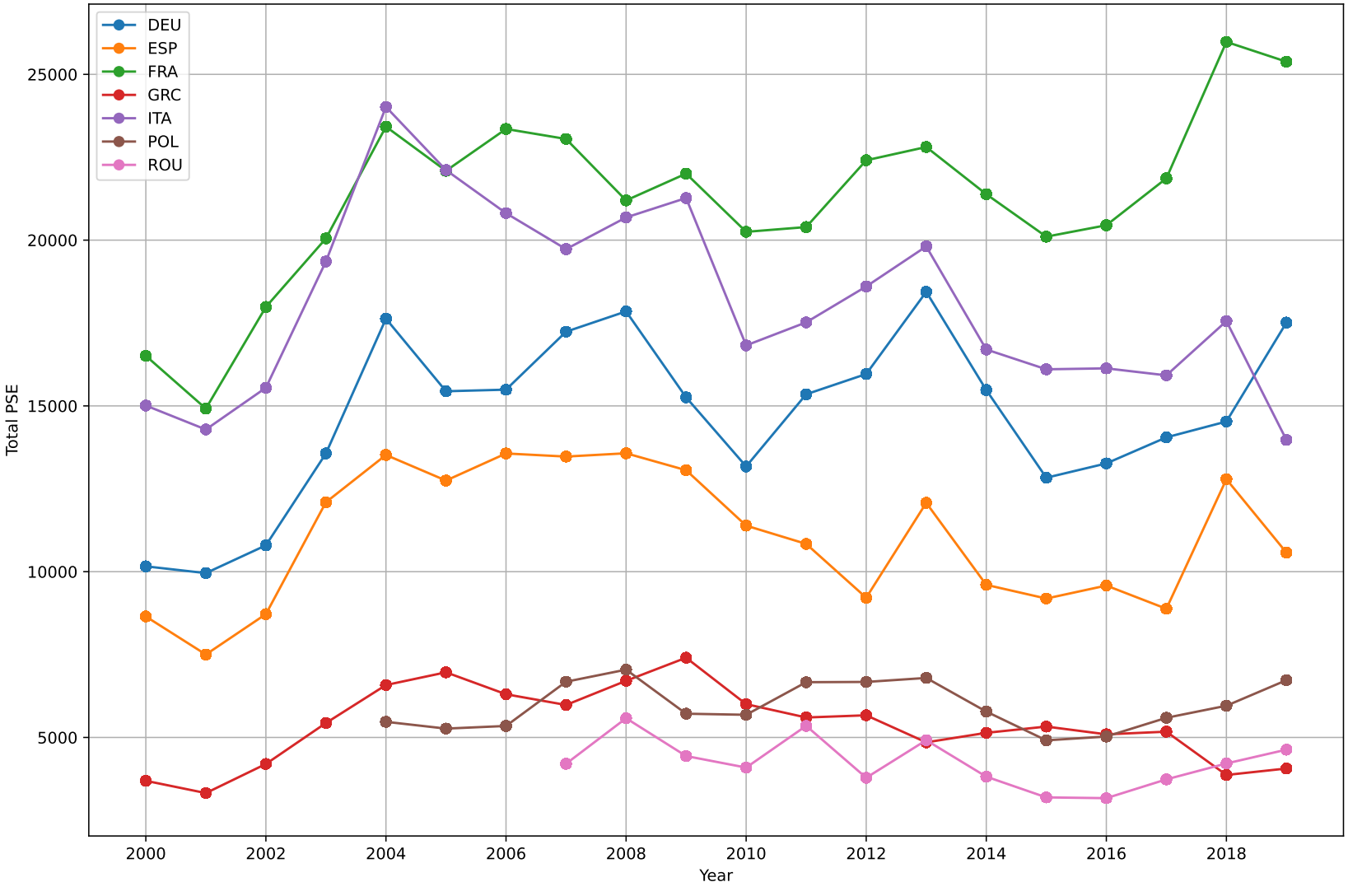
Single-Commodity Transfers (SCT)

* Based on commodity outputs (CO):
  - Market price supports
  - Loan deficiency payments
* Payments based on non-current production (production required) (PNCR):
  - Historical base payments tied to production activity

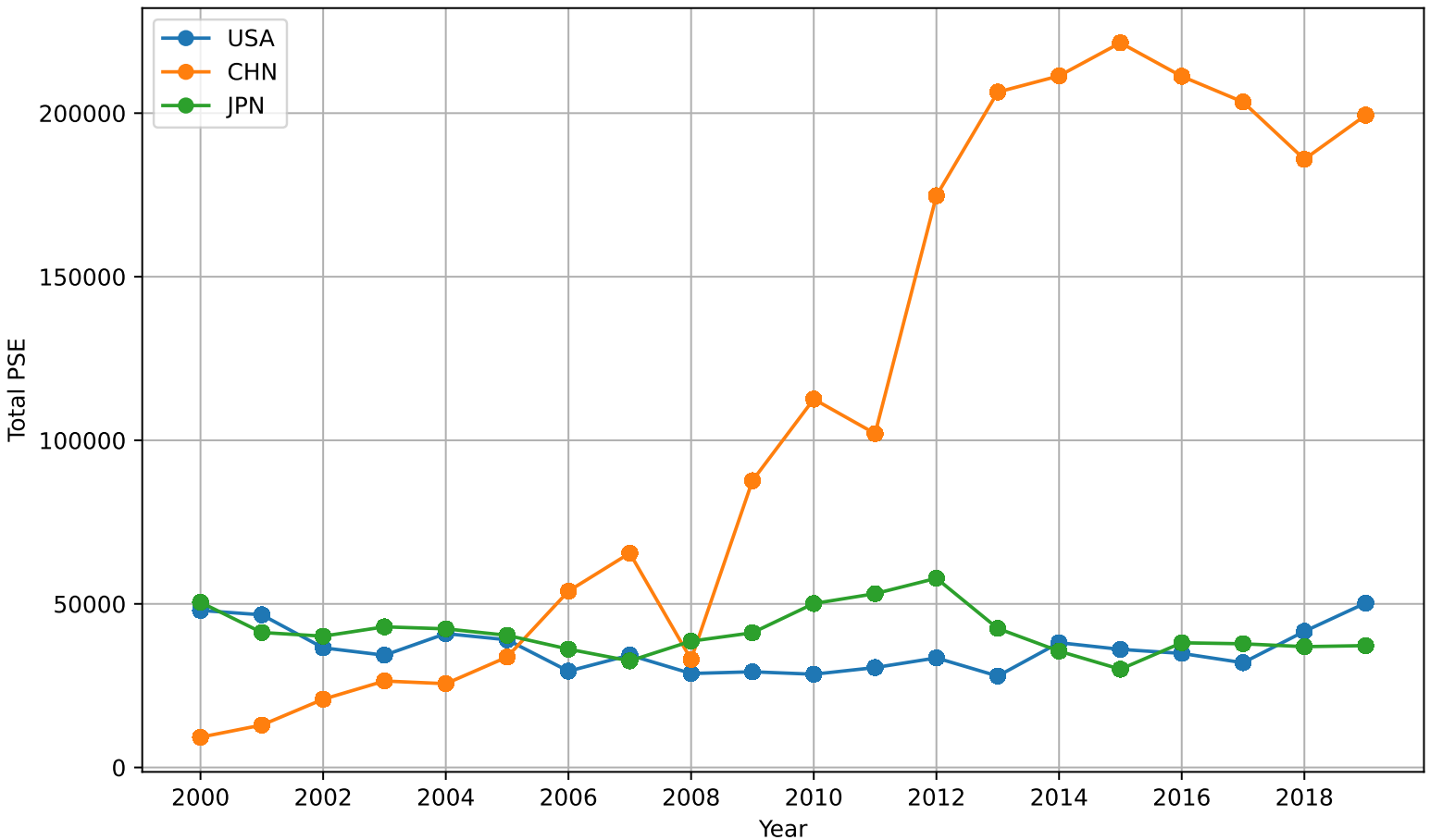
Non-Single-Commodity Transfers (SCT)

* Based on input use (PI):
  - Irrigation maintenance payments
  - Pest and disease control
* Payments based on current production (production required) (PCR):
  - Income tax concessions tied to current output
* Payments based on non-current production (not required) (PNCNR):
  - Land set-asides, decoupled support
* Payments based on non-commodity criteria (PNC):
  - Afforestation or conservation programs
* Miscellaneous payments (MP)
  - Disaster relief

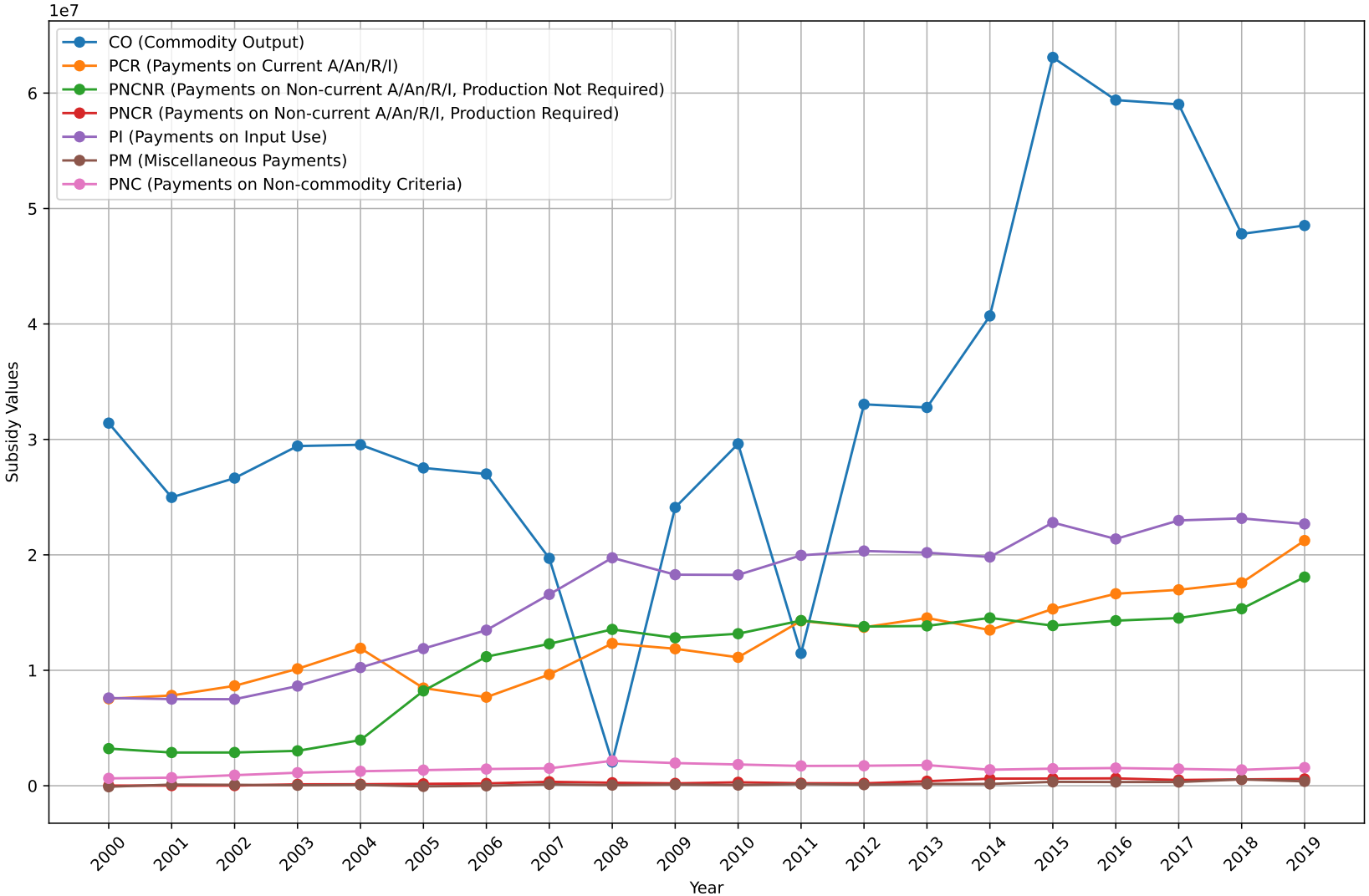
Countries with most subsidies: EU Countries



Countries with most subsidies: US, China, Japan



Subsidy sub categories' distribution



Step 1: Structural Gravity Model

Dependent Variable:	Trade
Policy Variables:	
FTA	0.128^{***}
	(0.039)
WTO Joint	0.530^{*}
	(0.198)
Fixed Effects:	
Country Pair	Yes
Exporter Time	Yes
Importer Time	Yes
N of Observations	212,807
Adjusted Pseudo R^2	0.997

Step 2: Impact of Subsidies on Production and Consumption (2SLS)

Dependent Variable:	Production Value $Y_{it}(S_{it})$		Consumption Value $Y_{jt}(S_{it})$	
Log(PSE)	0.764***		-0.165*	
	(0.001)		(0.004)	
Log(SCT)		0.080***		-0.041***
		(0.001)		(0.003)
Log(NSCT)		0.558***		-0.097***
		(0.001)		(0.004)
Adjusted Pseudo R^2	0.705	0.604	0.009	0.006
Wu-Hausman	12,266	10,772	552.2	423.1
p-value	0.000	0.000	0.000	0.000

Step 2: Impact of Subsidies on Production and Consumption (2SLS)

Dependent Variable:	Prod Value $Y_{it}(S_{it})$	Cons Value $Y_{jt}(S_{it})$
Log(CO)	0.039***	-0.0179***
	(0.001)	(0.003)
Log(PNCR)	-0.106***	0.020***
	(0.001)	(0.003)
Log(PCR)	-0.0052	-0.001
	(0.001)	(0.004)
Log(PNCNR)	0.004***	-0.002
	(0.001)	(0.002)
Log(PI)	0.677***	-0.119***
	(0.002)	(0.006)
Log(PM)	0.001***	0.016***
	(0.001)	(0.003)
Log(PNC)	0.035***	-0.004
	(0.001)	(0.003)

Step 3: Impact of Production/Consumption on Fixed Effects

Dependent Variable:	$\hat{\eta_{it}}$	$\hat{\eta_{jt}}$
Size Variables:		
Production Value $Y_{it}(S_{it})$	0.033***	
	(0.001)	
Consumption Value $Y_{jt}(S_{it})$		-0.007***
		(0.001)
Adjusted Pseudo R^2	0.021	0.001

Conclusion

- This study examines how domestic production subsidies influence agricultural trade, highlighting their indirect yet meaningful impact on global trade patterns.
- Policy implications suggest a need for more targeted subsidy reforms—ones that reduce trade distortions without undermining domestic agricultural resilience.
- Future research could investigate sector-specific effects of subsidies and evaluate the long-term consequences of reform efforts on trade stability.
- As international discussions on agricultural support intensify, finding a balance between national policy objectives and global market efficiency will be key to developing more sustainable and equitable trade frameworks.

Why Is This Important for the Pacific Northwest (PNW)?

The PNW accounted for 4.5% of all U.S. farm subsidies between 1995–2023, ranking 8th nationally, after Iowa, Texas, Illinois, Nebraska, Minnesota, Kansas, and Arkansas.

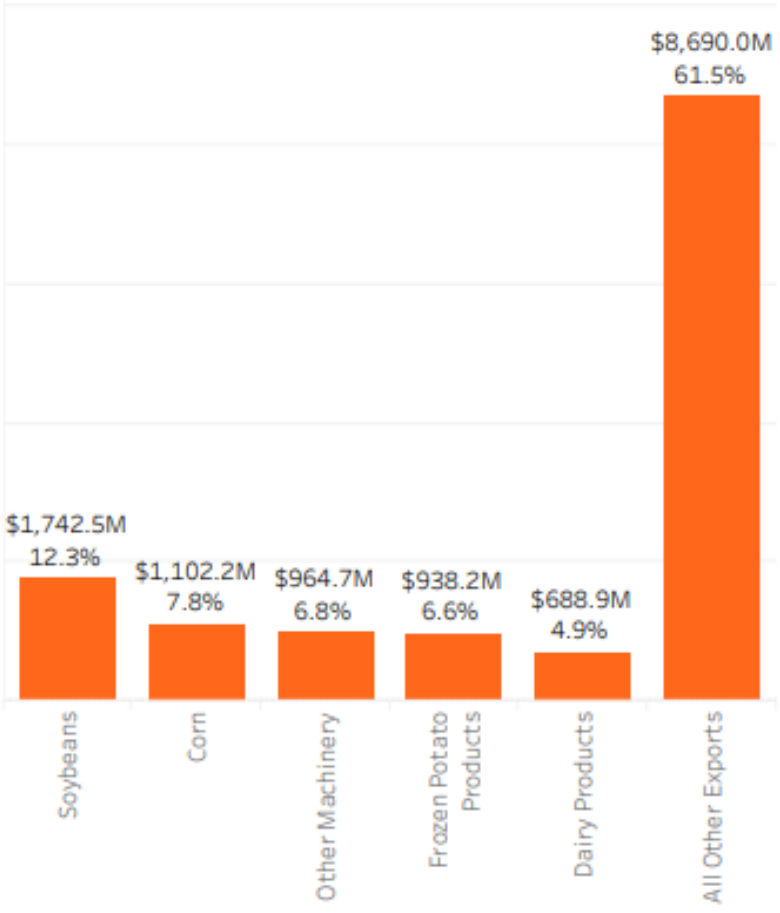
State-by-State Breakdown:

- **Washington** — Ranked #22 of 50, received 1.3% of U.S. farm subsidies farm.ewg.org – WA
- **Idaho** — Ranked #26 of 50, received 1.1% of U.S. farm subsidies farm.ewg.org – ID
- **Montana** — Ranked #21 of 50, received 1.6% of U.S. farm subsidies farm.ewg.org – MT
- **Oregon** — Ranked #33 of 50, received 0.5% of U.S. farm subsidies farm.ewg.org – OR

The Northwest Seaport Alliance

- Under a port development authority, The Northwest Seaport Alliance—a vital hub for Pacific trade—manages the container, breakbulk, auto and some bulk terminals in Seattle and Tacoma.
- According to the 2024 NWSA Annual Trade Report, 92.4% of the vessel cargo value (container and non-container waterborne imports and exports combined) was tied to Asia & Pacific regions, making China, Japan, and South Korea as the Pacific Northwest's leading trading partners.
- Understanding how subsidies influence trade is particularly important for the PNW, where agricultural exports and international trade relationships drive regional economic growth and rural livelihoods.
- It can help maintain the competitiveness of PNW agriculture in the international market.

Top Export Commodities in 2024 by The Northwest Seaport Alliance



Soybeans	$1,742.5M
Corn	$1,102.2M
Other Machinery	$964.7M
Frozen Potato Products	$938.2M
Dairy Products	$688.9M
Scrap Metal	$673.8M
Chemicals	$663.1M
Hay & Forage	$635.1M
Fish	$513.0M
Other Foodstuffs	$503.0M
Paper & Paperboard	$446.3M
Mineral Products	$385.0M
Beef	$383.0M
Apples	$371.2M
Motor Vehicle Parts	$361.6M
Legumes (Peas, Beans, Lentils)	$276.1M
Cereals (Excluding Corn)	$211.5M
Aerospace Parts	$180.0M
Animal Feed	$145.8M
Medical & Optical Devices	$144.2M
All Other Exports	$2,797.4M
Grand Total	$14,126.5M

Thank You!

Questions or comments?

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