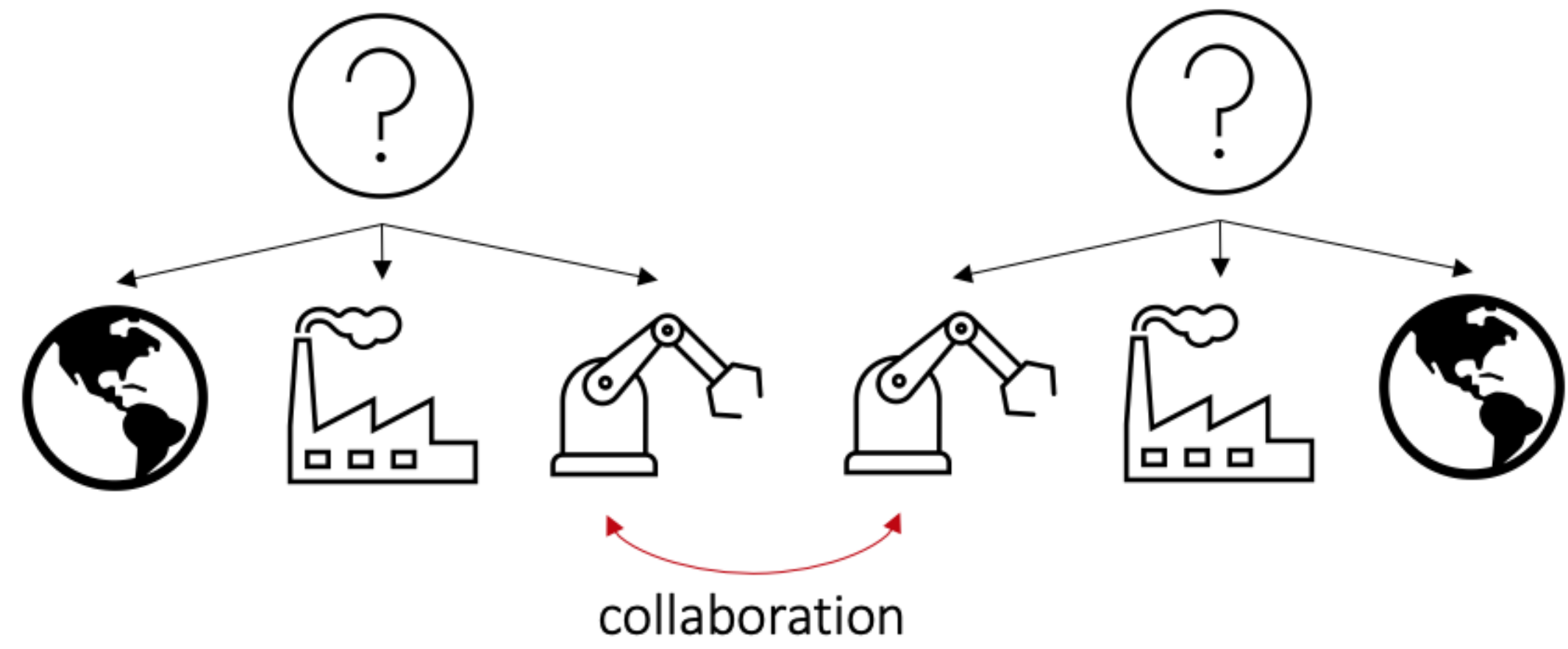


Collaboration in Multinational Production

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Firms collaborate by sharing technology and assemblies

- Multinational firms make complex decisions facing high (fixed) cost: entry costs, operation of plants, technology



- Collaboration through licensing or joint ventures allows firms to economise on costs
- Traditional models of multinational production (MNP) agnostic to technology choices and collaboration miss these important mechanisms that shape global production

RQ: How does collaboration shape firms' multinational production decisions?

- Build a structural framework of multinational production, which:
 - Models the firms' joint decision of input technology and assembly location
 - Allows for inter-firm collaboration in technology and assemblies
- Estimate effect on MNP choices using rich data on technology use and production pattern of the entire Auto industry from 2000-2019
- Determine gains from collaboration in variable cost and profits

Collaboration in platform technology is common and sizeable

Platform = Production blueprint of chassis, development involves *high fixed cost*

- Serve as basis for ~ 13 different varieties over 16 years
- Define organisation of assembly lines

Collaboration = owner and user of a platform have *no ownership ties*

- 23% of all platforms are used collaboratively per year
- 70% of firms use a licensed platform, 45% of firms offer platform licenses
- Reliance on licensing varies by firm size and segment

Probability to collaborate in technology increases in probability to share plant and access new markets

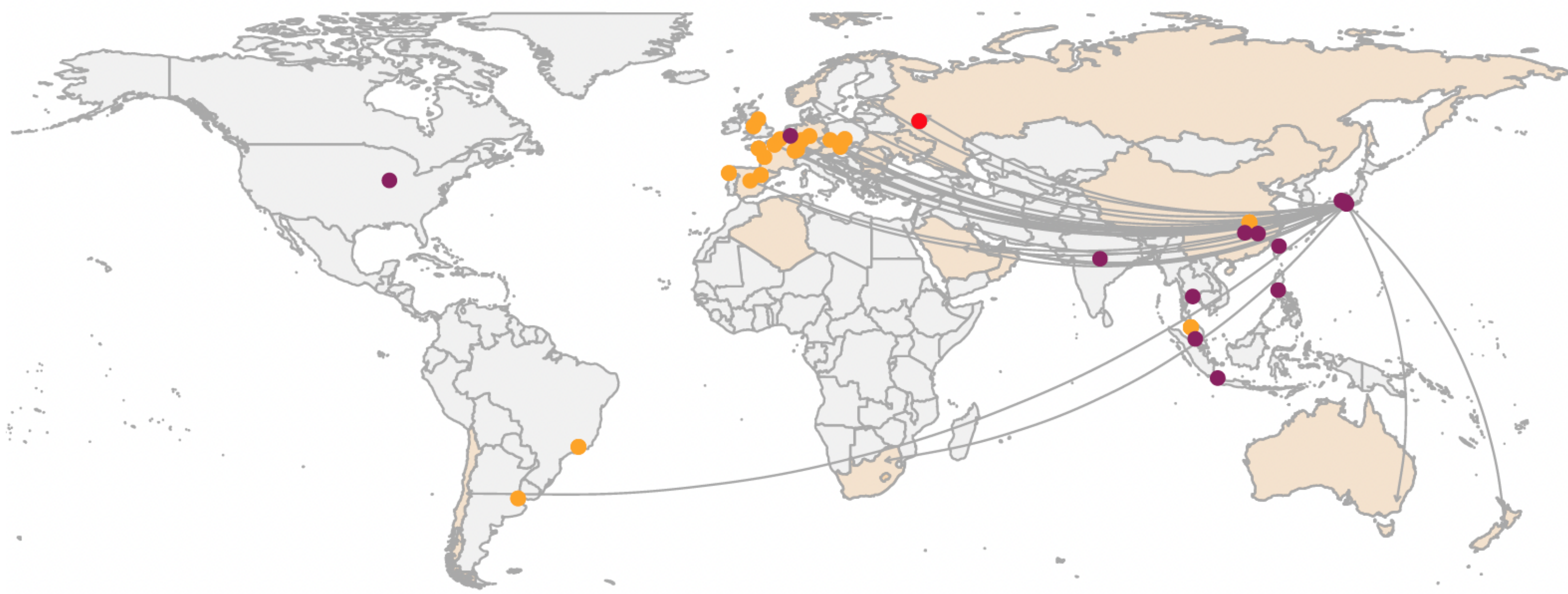
$$\mathbb{P}[\text{collab}_{fvp} = 1 \mid \text{new variety} = 1] = \beta_0 + \beta_1 \text{new plant}_f \times \text{plant collab}_f + \beta_2 \text{new market}_{f/s} + \text{FE} + \epsilon_{fvp}$$

	Pr(Platform collab)	
new plant _f =0 × plant collab=1	0.151*** (0.01)	0.152*** (0.01)
new plant _f =1 × plant collab=0	0.018*** (0.01)	0.016*** (0.01)
new plant _f =1 × plant collab=1	0.262*** (0.03)	0.257*** (0.03)
new market _f	0.023** (0.01)	
new market _{f/s}		0.039*** (0.01)
N	13230	13230
R ²	0.873	0.874
Within R ²	0.113	0.117

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
All regressions control for year, firm, owner platform and segment fixed effects.

Gains from collaboration w.r.t. MNP choice

Peugeot 4008 with Mitsubishi & Daimler platform 'GS' in 2012



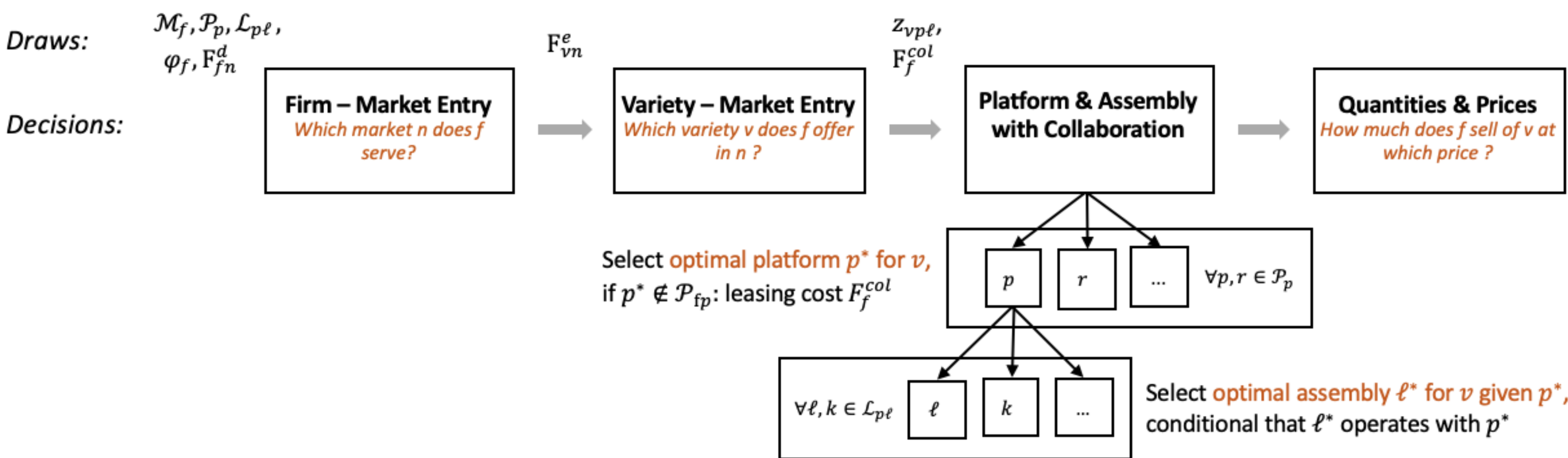
● PSA plants w/o platform w/o platform (30) ● PSA plants w platform w/o collab (1) ● All plants w platform w collab (14) ■ Sales destination

- Varieties are produced using specific platforms
- Assemblies operate with already installed platforms
→ Choice of platform **constrains** set of potential plants
- Collaboration allows to **relax** constraint on assembly choice set

	Mean	SD	Median	Max
# w/o platform constraint, w/o collab	18.132	7.26	18	34
# w platform constraint, w/o collab	2.146	3.31	0	16
# w platform constraint, w collab	2.318	3.46	1	17
Loss w platform constraint	-15.986	7.56	-16	0
Gain w collab	0.172	0.89	0	16

Model of endogenous technology and assembly choice

Firms choose optimal assembly conditional on optimal technology choice such that unit cost are minimised given GEV-distributed location - platform - variety productivities → **inclusive values** capture implied cost-advantage of each technology in terms of assembly choice sets



Collaboration trade-off

Larger set of platforms and assemblies to choose from → lower average cost to serve a market & higher expected profits
vs.
Cost of licensing

New mechanism in MNP: Comparative advantage in technology and collaboration → propagates through to expected profits, variety and firm entry

Main Findings

- Positive correlation of technology collaboration with sharing of assembly plants and access to new markets
- Technology constraints increase** the firms' costs of serving a market by 5% vis-a-vis traditional MNP models agnostic to technology choices
- Collaboration** relaxes constraints and **reduces** costs to serve a market by 16%

