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CHAIR CMA CGM PSE TAN GRAM Globalization

Collaboration in Technology and Multinational Production Choices

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In this policy brief, Sophia Praetorius explains how technology sharing and collaboration significantly impact global manufacturing decisions. Her study shows that conventional models overlook a crucial reality: manufacturing plants can't produce every product without the right technology platforms. This limitation increases production costs by nearly 25% compared to what traditional models predict. The study demonstrates that when companies share technology platforms with each other, they reduce costs, offer more product variety, and ultimately benefit consumers. The research also examines how technology-focused policies (like export restrictions on specific technologies) compare to traditional trade measures such as tariffs. While both approaches can cause similar overall economic shifts, technology policies affect different companies and countries more selectively. For example, restricting US technology exports particularly impacts US-owned factories abroad rather than all foreign producers equally. These findings highlight why policymakers need to consider technology constraints and collaboration when designing trade and industrial policies for today's interconnected global supply chains.

Collaboration in Technology and Multinational Production Choices

Multinational firms today face complex production decisions shaped by market entry costs, operational frictions, and technology constraints. Traditional models of multinational production explain sourcing and market entry as a balance between trade frictions, wage differentials, and fixed costs of foreign operations, assuming firms can freely shift production across locations. While effective for analyzing trade barriers, these models overlook critical realities like production technology compatibility and plant specialization.

Recently, governments have increasingly used non-tariff measures—such as restrictions on technology sharing, intellectual property controls, and localization mandates—to shape industrial competitiveness. These policies directly affect production costs and firm behavior but are inadequately captured by standard multinational production frameworks. Understanding the link between technology and production choices is thus key to analyzing the full (un-)intended consequences of these policies.

Technology Constraints Increase Production Costs

Among the most globalized and technologically advanced manufacturing sectors, the automotive industry relies heavily on standardized modular production technologies, or "platforms." These platforms define essential structural attributes that enable firms to streamline automated assembly lines to manufacture. Crucially, a platform is not just an R&D blueprint; it is embedded in a plant's physical infrastructure. Switching platforms entails costly and time-intensive retooling or equipment replacement. Platforms typically remain in use for over 17 years within the same plant and produce up to 15 model varieties across a 22-year lifecycle. With only 10 plants typically equipped with a given platform, this creates a long-term constraint on where production can occur.

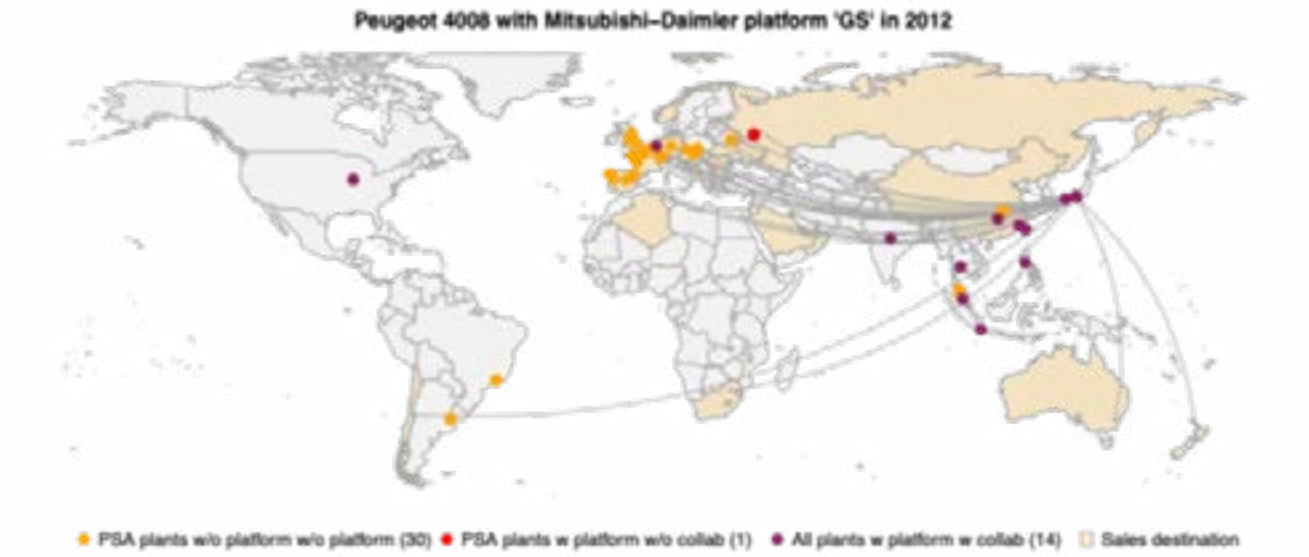
As a result, firms cannot freely allocate production for each model variety; instead, they are limited to plants already equipped with the appropriate platform. This restriction significantly narrows the range of viable production locations, increasing the cost of serving global markets. The analysis shows that standard multinational production models—which ignore these constraints—underestimate true production costs by an average of 24.65%.

Collaboration in Technology

To overcome platform-related constraints and expand their manufacturing options, firms increasingly collaborate. By licensing platforms and operating in shared plants, firms can access a broader array of assembly sites, improving their ability to match specific models to cost-efficient locations and reducing expected marginal costs.

A case in point is the 2012 Peugeot 4008 SUV, which was produced on a Mitsubishi-DaimlerChrysler GS platform. Figure 1 plots the set of potential assembly plants. Orange dots refer to all plants that PSA operates in that year. Traditional multinational production models would assume PSA could choose any of them to produce the model. However, only one plant operates with the right technology (indicated by the red dot), significantly reducing the true choice set for production locations to produce the 4008. In turn, the 14 purple dots represent the assembly locations with the platform installed, notably belonging to *any* firm that operates the specific GS platform. Indeed, Peugeot chose to produce the 4008 in a Mitsubishi plant in Japan.

Figure 1: **Plant locations for Peugeot 4008, w/ and w/o platform constraint and collaboration**



This type of collaboration in assembly locations is more prevalent than typically recognized. Each year, 22% of platforms are shared, accounting for 29% of total vehicle sales. Over half (54%) of firms license platforms annually, and 39% of platform owners make them available for licensing. Smaller firms tend to rely more on licensing, while larger firms are more likely to offer platforms. Sport-luxury platforms, by contrast, are the least likely to be shared.

Methodology - Going beyond traditional multinational production models

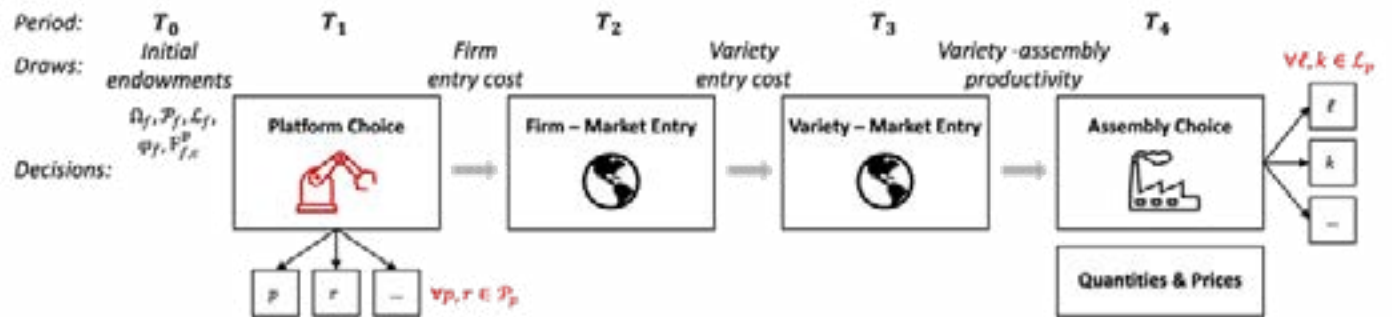
This paper extends traditional multinational production models (Eaton and Kortum, 2002; Melitz, 2003; Antràs and Helpman, 2004) by incorporating technology constraints that standard frameworks overlook. While existing models explain global production through factors like trade barriers, wage differences, and fixed costs, they typically assume firms can freely shift production across plants. This unrealistic assumption ignores critical technology platform constraints.

The new structural model adds a technology choice layer to firms' decision-making process. As shown in Figure 2, firms make decisions in four sequential stages:

1-Platform selection: Choosing optimal technology platforms for each product variety
2-Market entry: Deciding which countries to sell in, considering trade barriers
3-Product offering: Selecting which specific varieties to offer in each market
4-Assembly location: Determining where to produce each variety based on costs

Production costs depend on local wages, sourcing frictions, trade costs to final markets, and plant-specific productivity factors. This approach creates a more realistic representation of global manufacturing where technology constrains production choices, but firms can expand options through collaboration (Head and Mayer, 2019; Antràs *et al.*, 2017).

Figure 2: **Firm's sequence of choices**



The structural parameters that guide the platform, entry and assembly choices are estimated using rich micro-level data from the global automotive industry from 2000 to 2023. The data documents the production technology and other features of each car model, as well as its assembly and sales location. Sales quantities in units of vehicles allow mapping of bilateral trade volumes between plants. Furthermore, the data is complemented with time-varying information of ownership of technologies, models and plants, which yields a precise measure of inter-firm collaboration.

The estimation proceeds in four steps: First, the substitution elasticity between production locations is estimated based on observed sourcing patterns and tariffs. Second, demand elasticities are recovered from market shares for each model. Third, firms' market entry decisions are modeled based on profitability and technology costs. Finally, platform and collaboration choices are estimated by analyzing how firms balance profits against fixed and licensing costs. Together, this structural estimation strategy captures how technology constraints and collaboration shape global sourcing patterns, production costs, and market access.

The Impact of Platform Constraints and Collaboration

Using the structural model, the impact of platform constraints and collaboration on multinational production is assessed.

To isolate the economic relevance of platform technology constraints and collaboration, the model is first compared to a traditional multinational production framework that ignores technology choices, effectively assuming firms can produce any variety at any plant. Overall, the technology constraint raises firms' market-serving costs by 24.65%, highlighting how conventional models overstate sourcing flexibility. Figure 3 shows that ignoring these constraints distorts even aggregate output, particularly for China, Germany, and France. Second, the importance of inter-firm collaboration is documented: Restricting collaboration increases marginal production costs of firms on average by 2.9%, and hence reduces market entry and product variety, resulting in overall consumer surplus losses of 0.57%. China, where platform sharing is common, would experience output losses of up to 2% (Figure 4). Overall, both platform rigidity and collaboration are key determinants of production costs, market access, and product diversity.

Figure 3: **Percentage change in output w/o platform constraint**

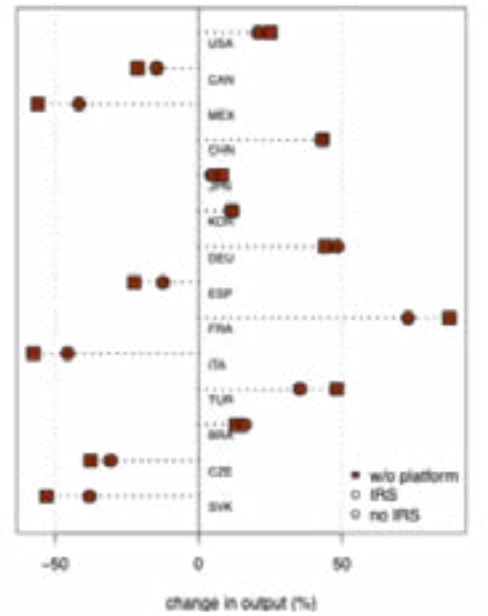
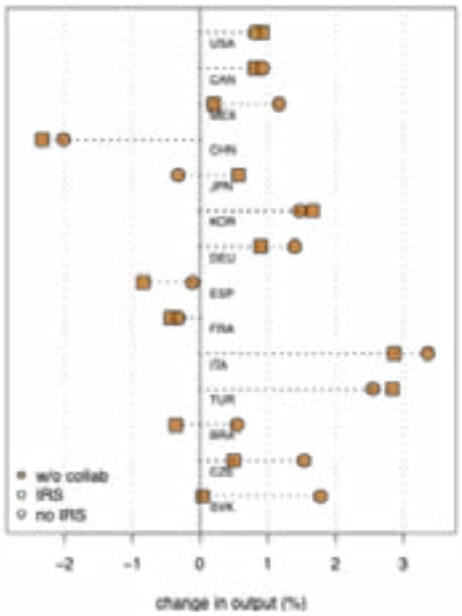


Figure 4: **Percentage change in output w/o allowing for collaboration in platforms**



Technology restriction vs. Trade policy

The model's key contribution, however, is its ability to capture not just the effects of trade policy, but also the global implications of unilateral industrial policies. Thus, the model allows for comparison of outcomes across different policy scenarios limiting access to technology to traditional trade policy results. In particular, the simulations include (1) unilateral technology export bans, where the US restricts using US platform technologies abroad; (2) technology import bans, where the US prohibits using foreign-developed platforms within its borders; and (3) bilateral technology decoupling, where the US and China mutually restrict platform transfers between them. These are contrasted with traditional trade policy scenarios, such as tariffs, to evaluate differences in aggregate and distributional effects.

In the US export ban scenario—modeled after recent US restrictions on advanced technology transfers—the average global production cost increases by 0.75%, but this is disproportionately borne by US multinationals, whose overseas affiliates lose access to key platform technologies. As a result, US domestic production increases by 20%, as firms reshore some operations, but this reallocation comes at the expense of mainly Canada and Mexico, whose integrated assembly plants experience dramatic output declines of 35% to 75%, depending on the level of exposure to US platform use, as shown in Figure 6.

In the reverse case of the US import ban, the cost burden shifts to foreign firms operating in the US, who face up to 10% higher marginal costs due to the inability to source cost-effective platform technologies, yielding a shift of production away from the US.

On the other hand, a US–China technology decoupling has almost no global impact, as the number of affected firms is minimal. US firms experience a 4% cost increase when selling in China, while Chinese firms see costs increase of 6% when shipping to the US. Therefore, while the overall implications are minimal, such technology restrictions can serve as precise tools to target single firms or countries, enlarging the policy space of governments compared to traditional trade policies.

Figure 5: **Percentage change in output industrial policies**

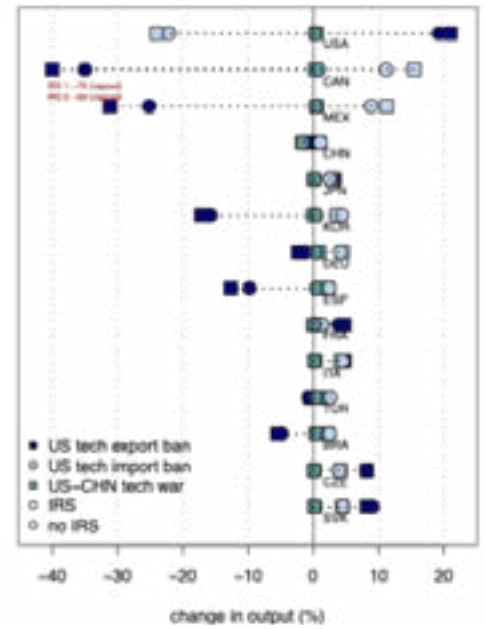
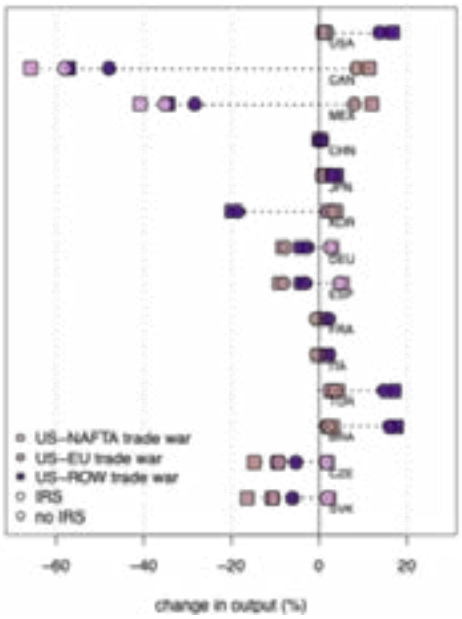


Figure 6: **Percentage change in output trade policies**



Lastly, running simulations of an increase of 25% in bilateral tariffs between the US and its major partners shows that technology restrictions can replicate the aggregate reshuffling effects of trade policy, such as reshoring and cost increases. A US technology export ban, for example, achieves similar output losses in Canada and Mexico as a NAFTA trade war. The reason is simple: the majority of production in those countries comes from US firms, thus, a US technology export ban has the same effect as raising the cost of production in those countries through tariffs. A major difference is that the US output is not increasing at all - this is due to the retaliation effects. Instead, production shifts to Germany and Spain, countries which can increase the production of platforms for GM and Ford more easily. Thus, industrial policies might achieve similar aggregate outcomes but affect a more targeted group of countries and even single out firms.

Conclusion

This research underscores the importance of technology collaboration in multinational production. Traditional models that ignore platform constraints underestimate production costs and the flexibility of firm behavior. The findings demonstrate that collaboration reduces costs and expands production options, making it a crucial strategy for firms in competitive global markets. This has important implications for policymakers, as it adds an additional layer of adjustment to trade and industrial policies. Industrial policies directed at restricting access to technologies can have similar (un-)intended aggregate consequences as trade policy, but with more targeted distributional effects, which should concern global policymakers. The novel framework and estimation in this paper allow for simulation of the multinational dimension of such policies.

References

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