European Department

# TRADE TENSIONS, GLOBAL VALUE CHAINS AND SPILLOVERS
## INSIGHTS FOR EUROPE

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on behalf of a team formed by:
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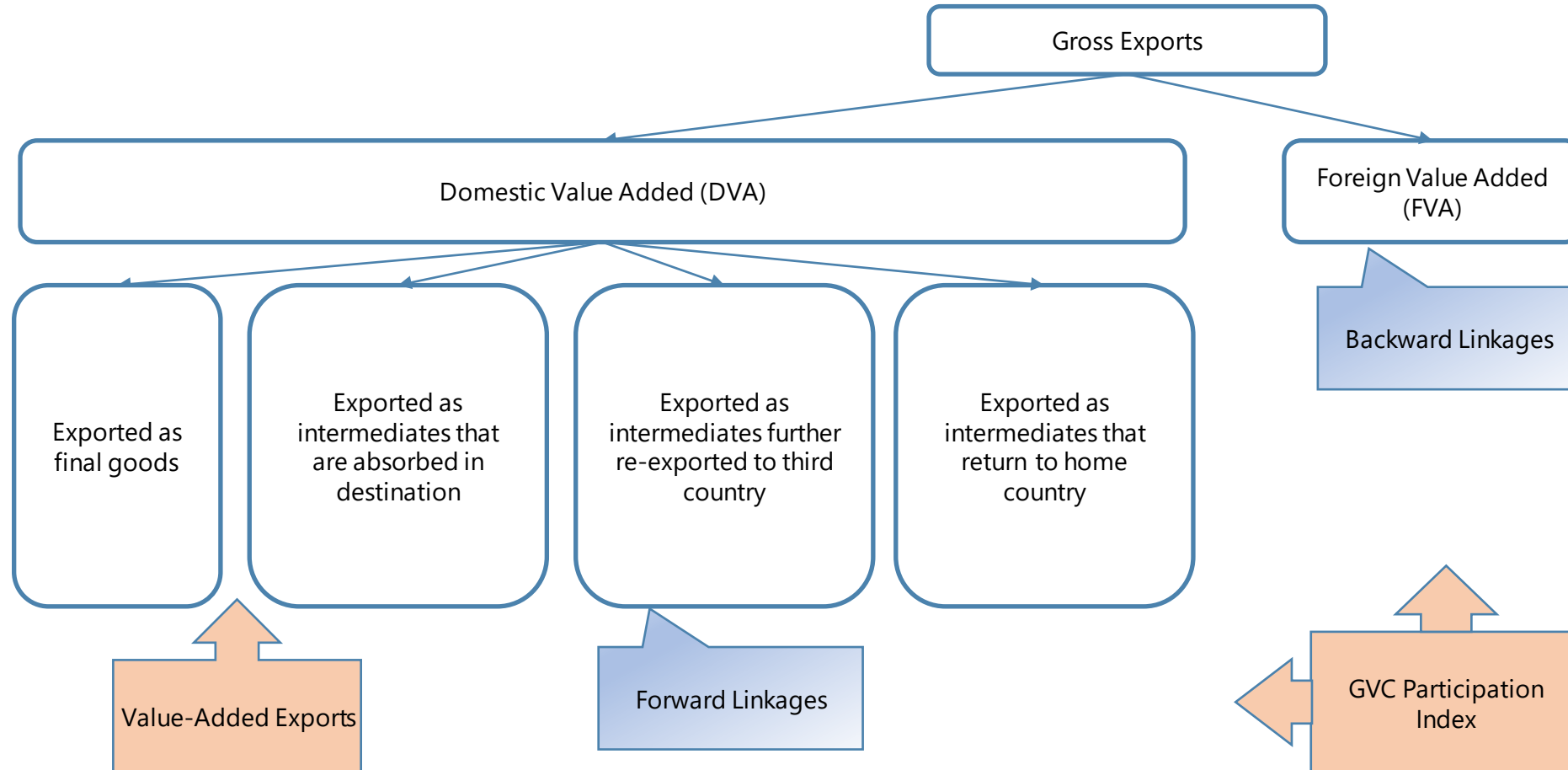
# This project in a nutshell:

- **Motivation**: recent trade tensions raise the question of how tariff and other trade-related shocks could impact Europe

- **Objective:** estimate the impact of these shocks on activity in Europe using a GVC perspective.

- **Tools**: 2 databases (WIOD and EORA) and 3 different analytical frameworks (network analysis; demand model; and 2-step macroeconometric model)

- **Main conclusion**: (i) using value-added data offers a better picture of the impact of trade shocks; (ii) Germany is not as crucial as an independent shock source, while US and China can have larger impact on Europe

I. BASIC CONCEPTS AND STYLIZED FACTS

# Decomposition of gross exports by value-added

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                          ┌─────────────────────┐
                          │    Gross Exports     │
                          └─────────────────────┘
                            ╱                  ╲
┌──────────────────────────────────────┐   ┌──────────────────────┐
│       Domestic Value Added (DVA)      │   │  Foreign Value Added  │
│                                       │   │         (FVA)         │
└──────────────────────────────────────┘   └──────────────────────┘
```

| Exported as final goods | Exported as intermediates that are absorbed in destination | Exported as intermediates further re-exported to third country | Exported as intermediates that return to home country |
|---|---|---|---|

Backward Linkages

Value-Added Exports

Forward Linkages

GVC Participation Index

Sources: Authors' elaboration, based on Koopman, Wang, and Wei (2013); Rahman and Zhao (2013); Aslam, Novta, and Rodriguez-Bastos (2017).

# Sources of data used in this project

- **Dataset 1**: EORA MRIO database, which provides data on input-output linkages for 190 countries and 26 sectors.

- **Dataset 2**: World Input-Output Database (WIOD), which covers 43 countries and 56 sectors

- **We combine them** in the stylized facts section, and we mostly use EORA MRIO in all chapters (except for chapter 4, making it consistent with Bems & Johnson,2018)

# Europe is widely integrated into Global Value Chains:
## About 70 percent of total European exports participate in GVCs

**GVC Participation**
(Percent of exports, sum of forward and backward linkages)

■ 2000 ■ Latest
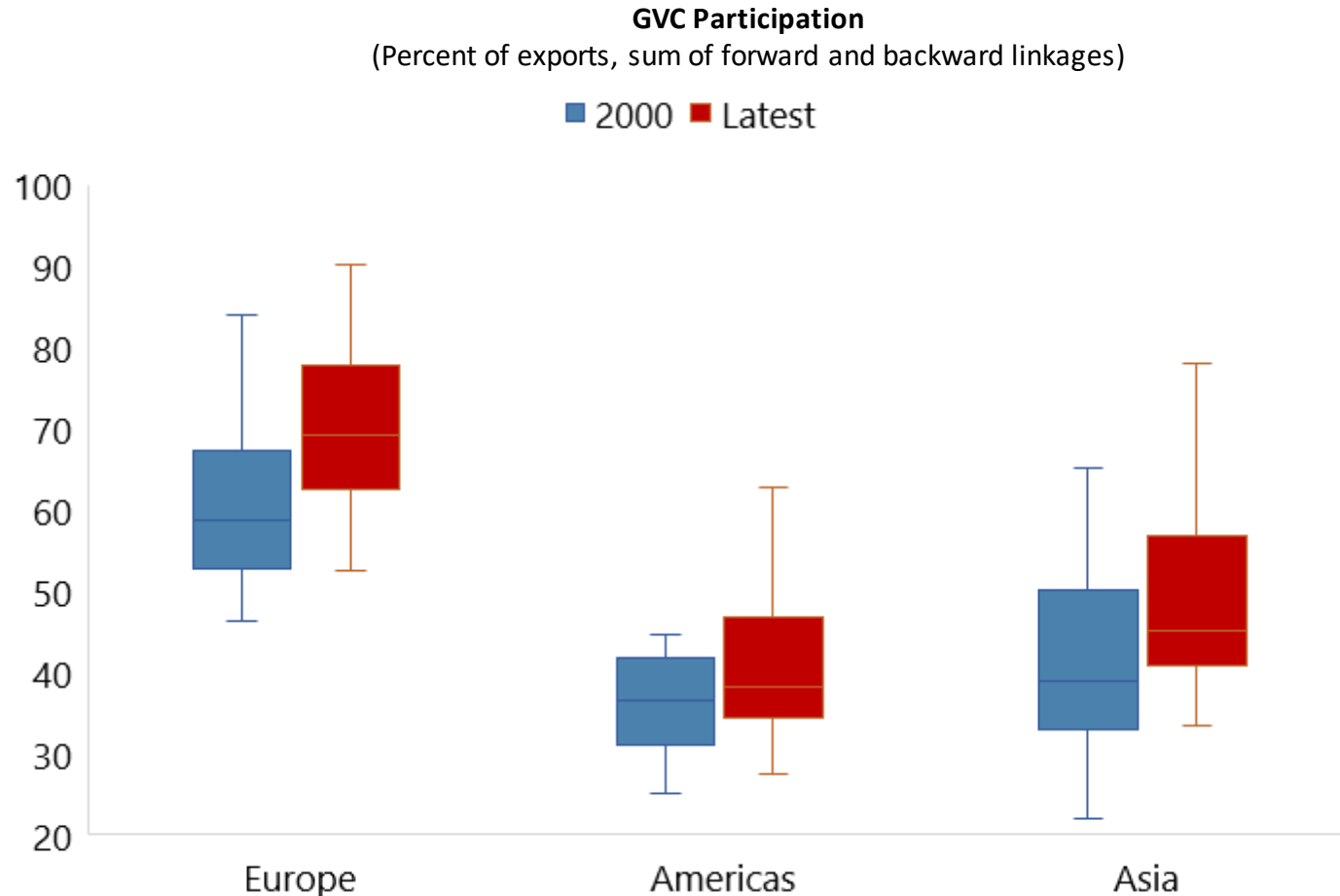


Sources: EORA database; and IMF staff calculations.
Note: The line refers to the median, the box to the 25–75 percentile range, and the error bars to the min-max range. Latest data available in EORA are 2013.

# Europe's GVCs are concentrated in few sectors (manufacturing, transport and, communications, and retail and wholesale trade), some growingly automated.

**1. Europe's GVC Participation by Sector, 2014**
(Average forward & backward linkages, share of exports)
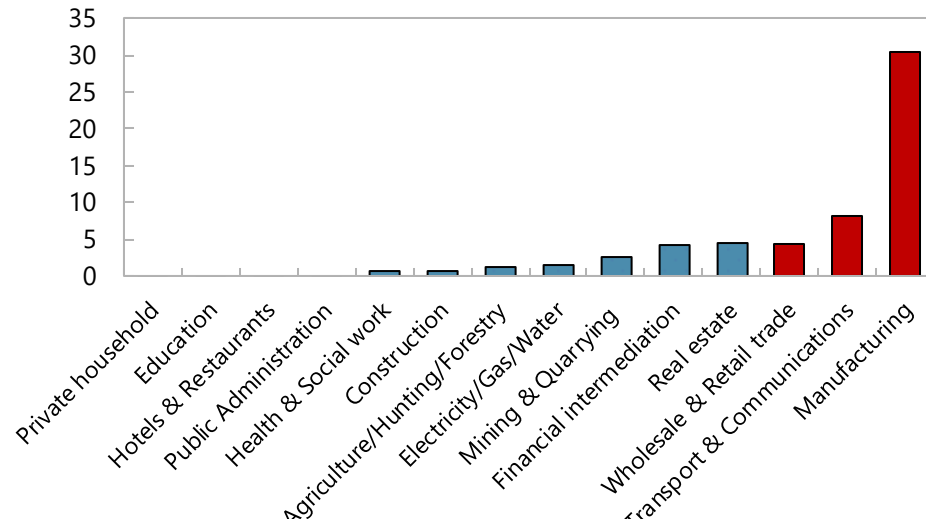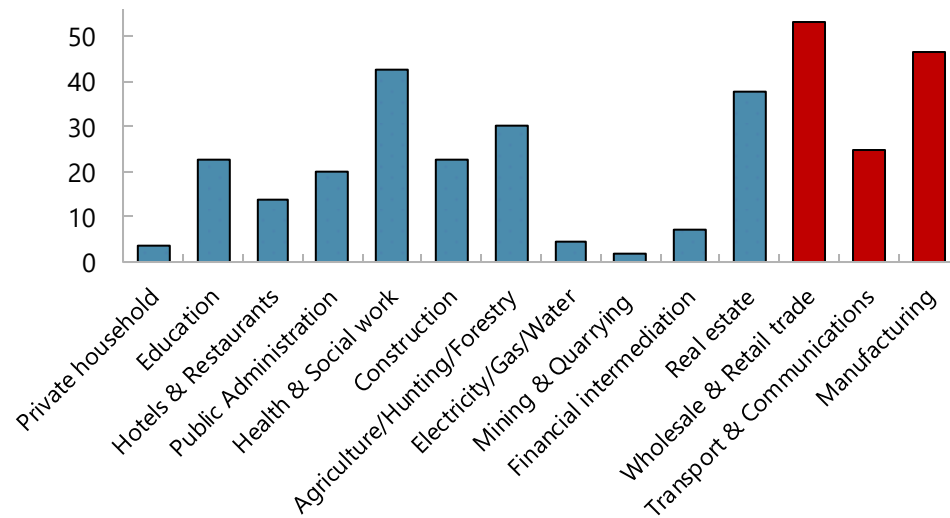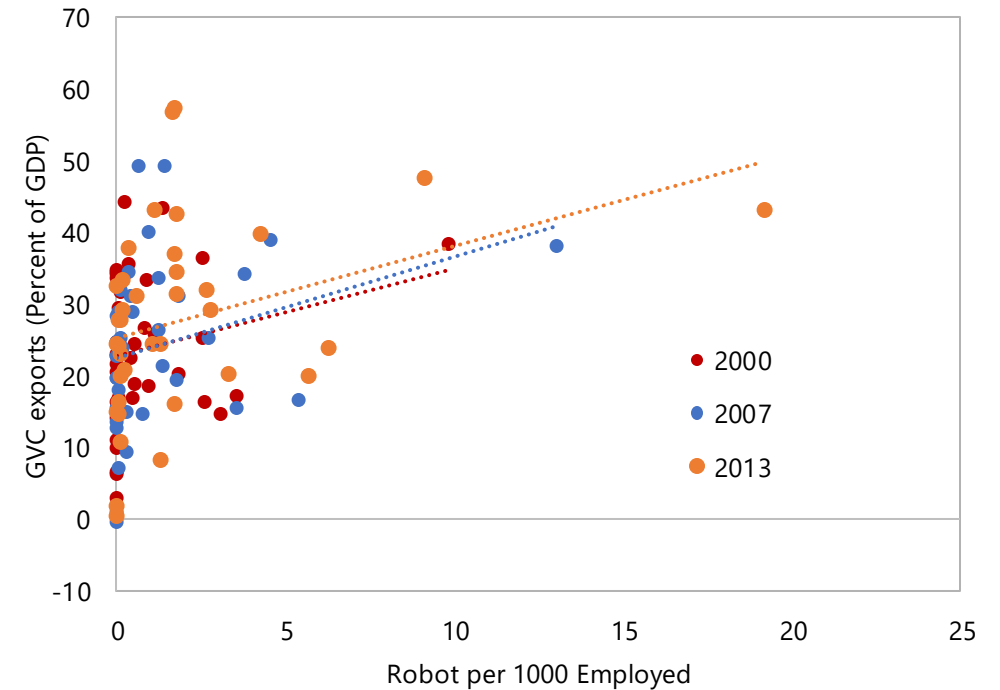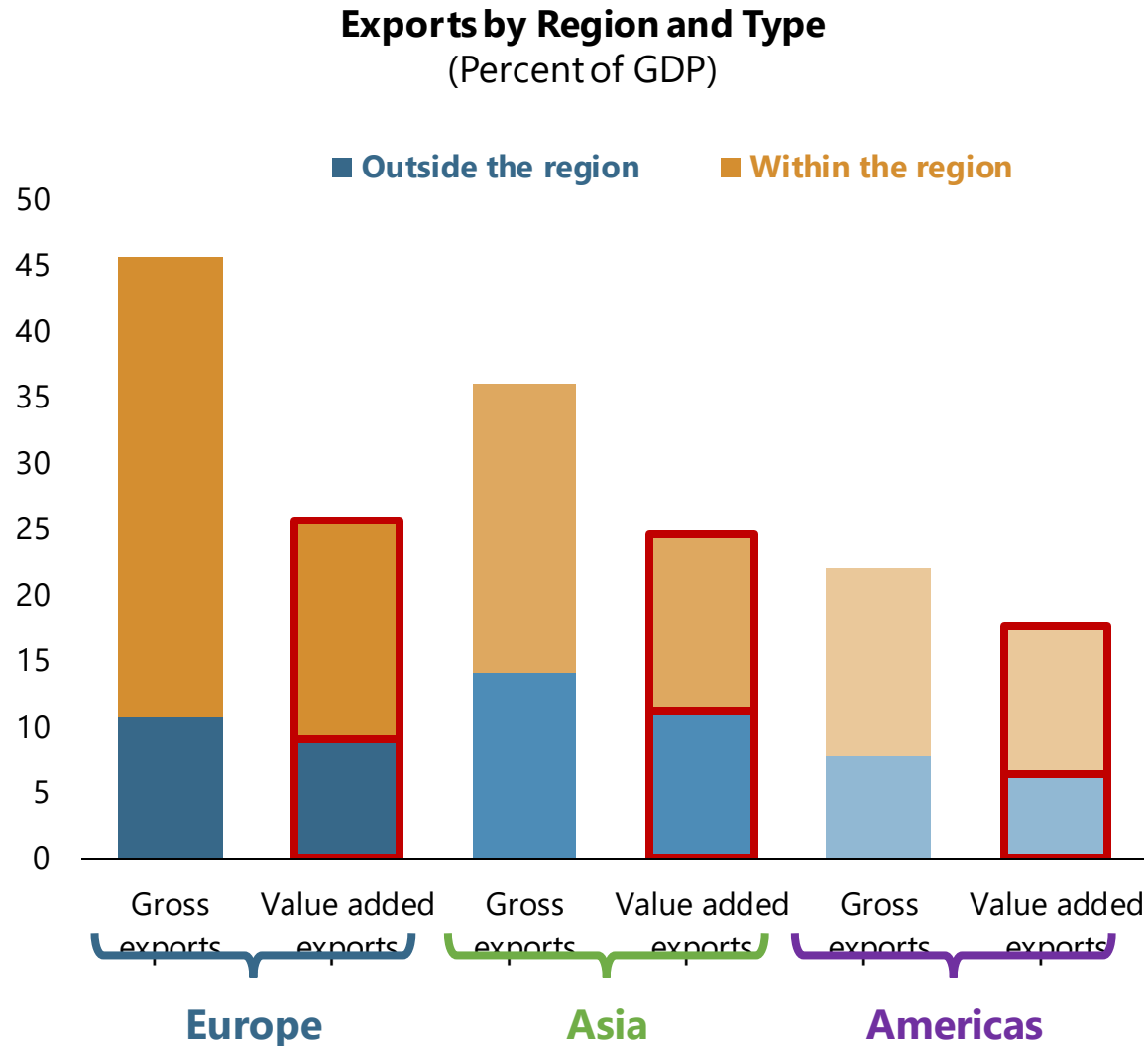


**2. Employment, 2014**
(Millions of people)



**Figure. Europe's GVCs Exports and Robot Exposure, 2000–2013**

# Europe is quite open, but not as much as gross trade suggest. Therefore not using a value-added perspective could lead to greater mistakes



**Exports by Region and Type**
(Percent of GDP)
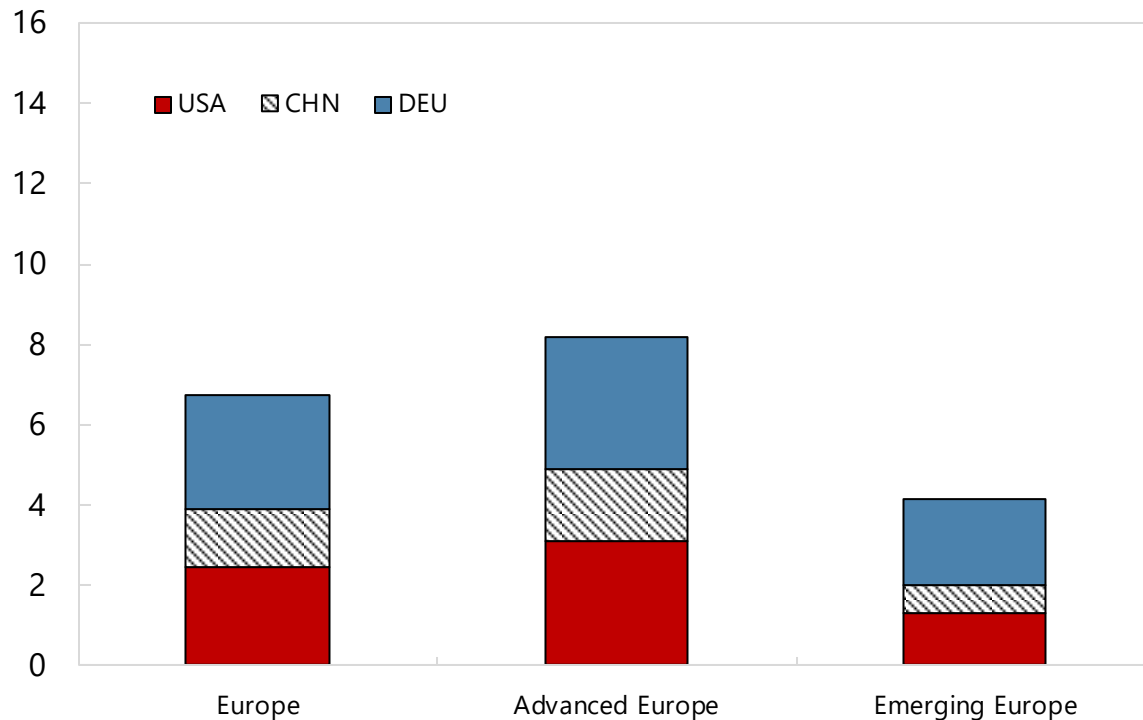
■ Outside the region ■ Within the region

Sources: EORA database; and IMF staff calculations.
Note: Figures refer to simple averages across countries in each region. Latest data available in EORA are 2013.
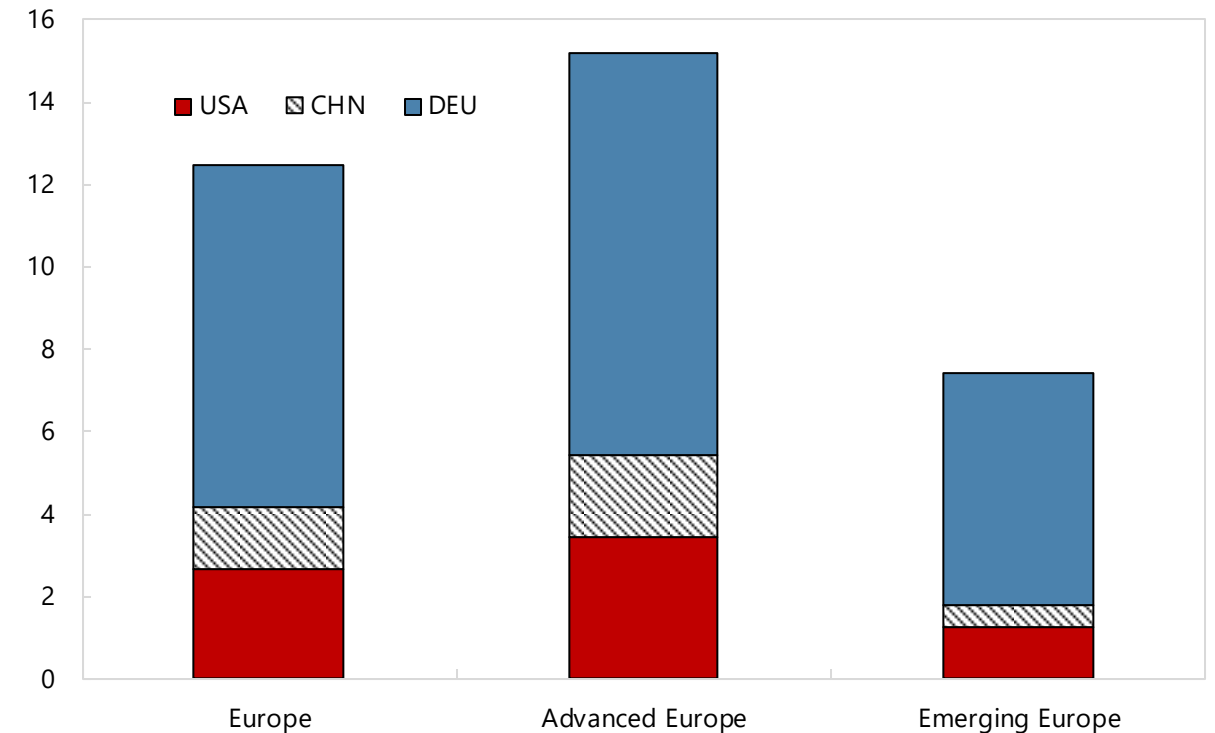
# Trade exposure of European economies to Germany is greatly exaggerated, when exports are measured in gross terms.

**Figure. Exposure to Trade Hub Countries**
(Value-added and gross exports, in percent of GDP)

(value-added exports, in percent of GDP)

(Gross exports, in percent of GDP)

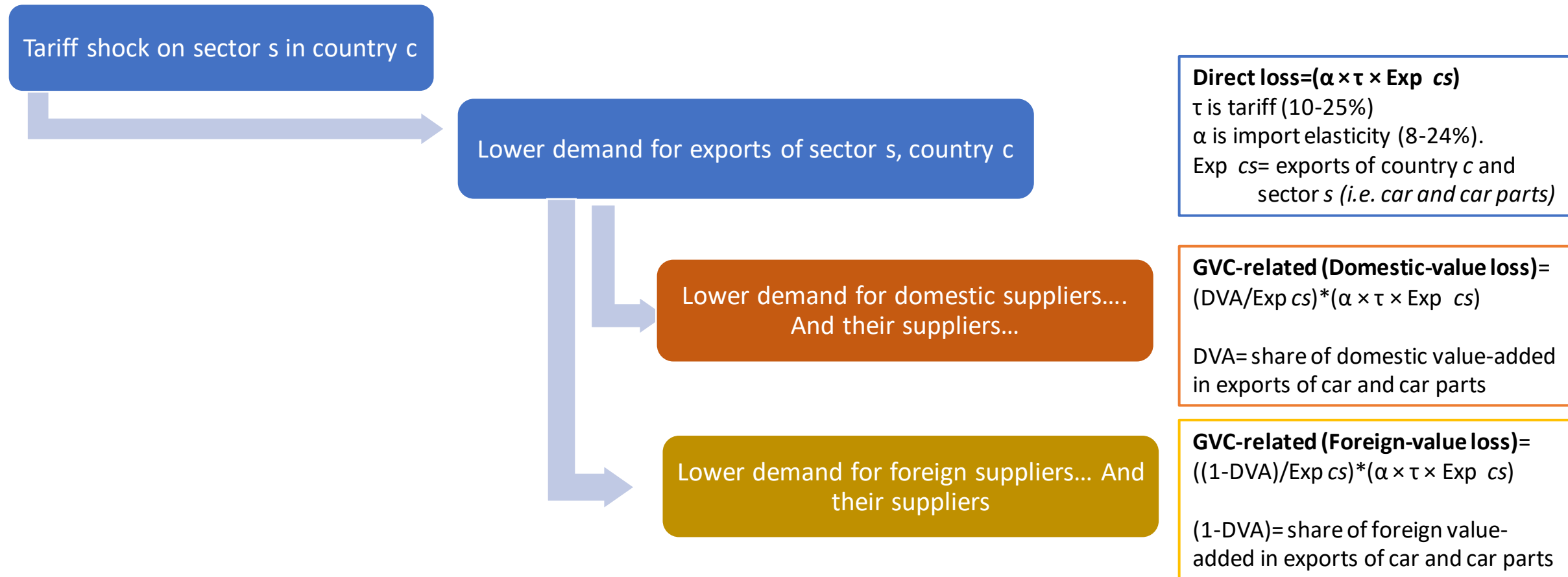

Sources: EORA database; and IMF staff calculations.
Note: Figures refer to simple averages across countries in each region. Latest data available in EORA are 2013.
CHN = China; DEU = Germany; USA = United States.

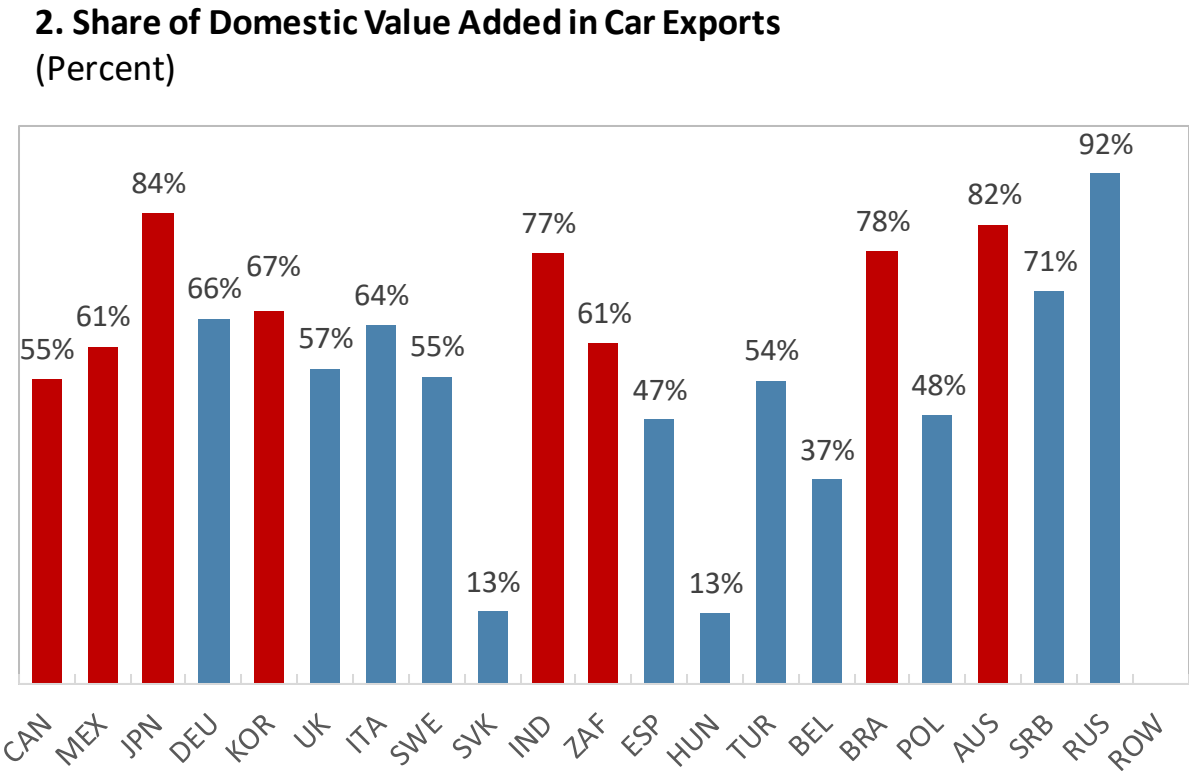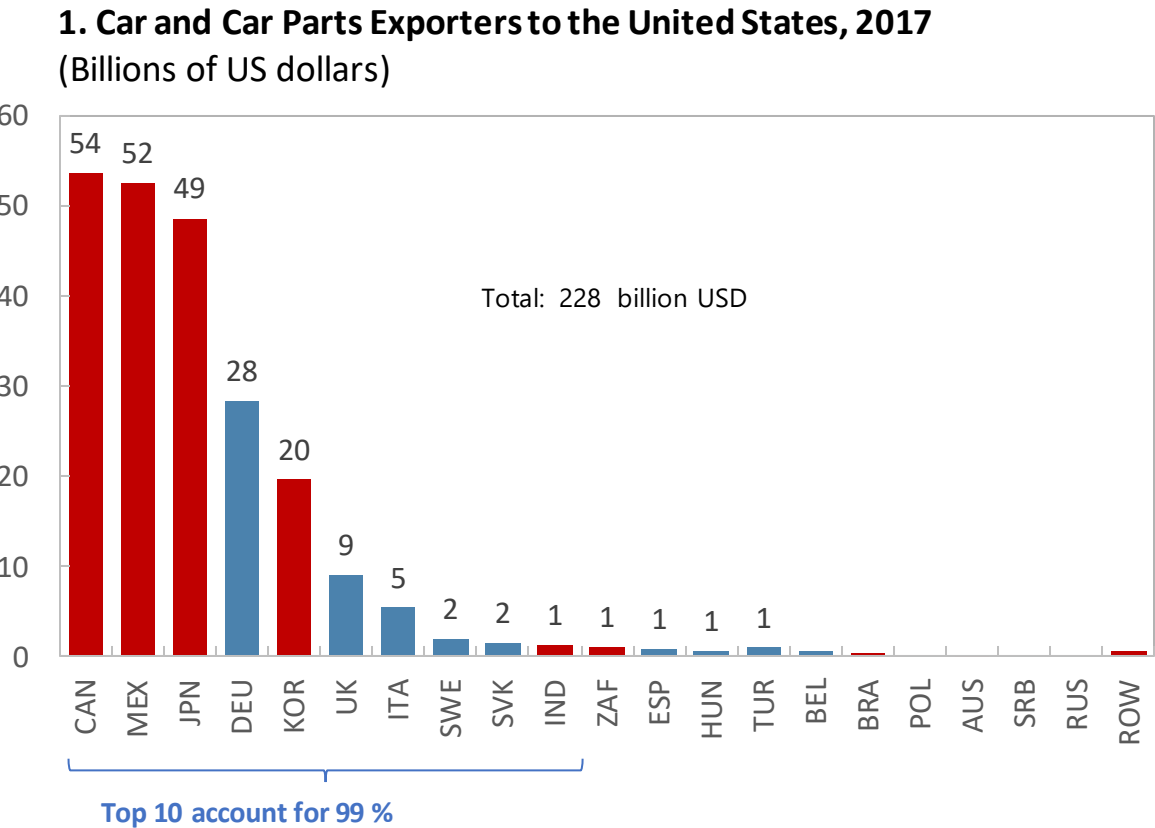# II. SHORT-TERM IMPACT OF TARIFF SHOCKS IN A SUPPLY CHAIN NETWORK

# NETWORK ANALYSIS to identify direct and GVC-related impacts

Tariff shock on sector s in country c

Lower demand for exports of sector s, country c

Lower demand for domestic suppliers…. And their suppliers…

Lower demand for foreign suppliers… And their suppliers

**Direct loss=($\alpha \times \tau \times$ Exp $cs$)**
$\tau$ is tariff (10-25%)
$\alpha$ is import elasticity (8-24%).
Exp $cs$= exports of country $c$ and
   sector $s$ (i.e. car and car parts)

**GVC-related (Domestic-value loss)**=
(DVA/Exp $cs$)*($\alpha \times \tau \times$ Exp $cs$)

DVA= share of domestic value-added in exports of car and car parts

**GVC-related (Foreign-value loss)**=
((1-DVA)/Exp $cs$)*($\alpha \times \tau \times$ Exp $cs$)

(1-DVA)= share of foreign value-added in exports of car and car parts

# Illustrative case: Tariff on Exports to US of car and car parts

**Figure. Auto Exports to the United States and Domestic Value Content**

**1. Car and Car Parts Exporters to the United States, 2017**
(Billions of US dollars)

Total: 228 billion USD

Top 10 account for 99 %

**2. Share of Domestic Value Added in Car Exports**
(Percent)



Sources: EORA MRIO database; UN COMTRADE; and IMF staff calculations.
Note: Country list uses International Organization for Standardization (ISO) country codes.

# German Auto Exports to the US: domestic and foreign value-added

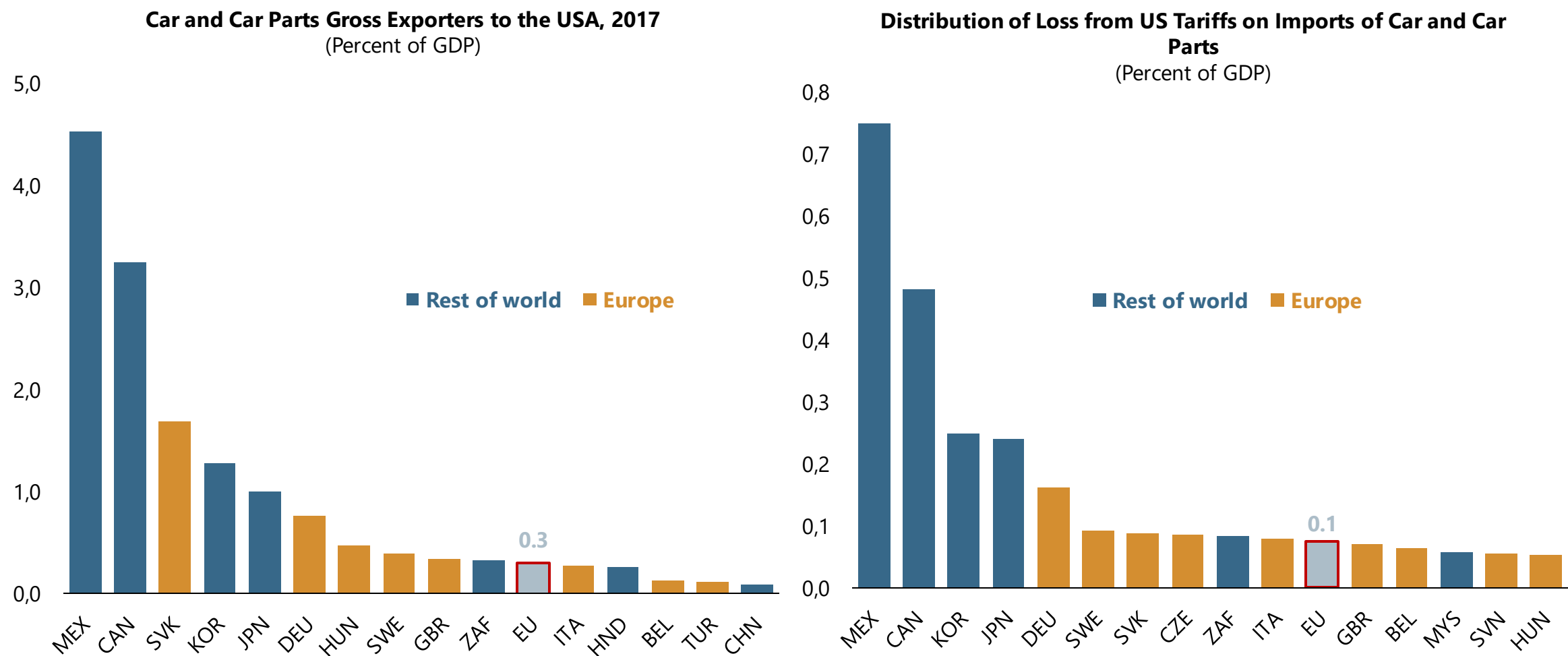**1. German Auto Exports: Domestic vs Foreign Value Added**
(Percent of total)



- Domestic value added
- Foreign value added

34%

66%
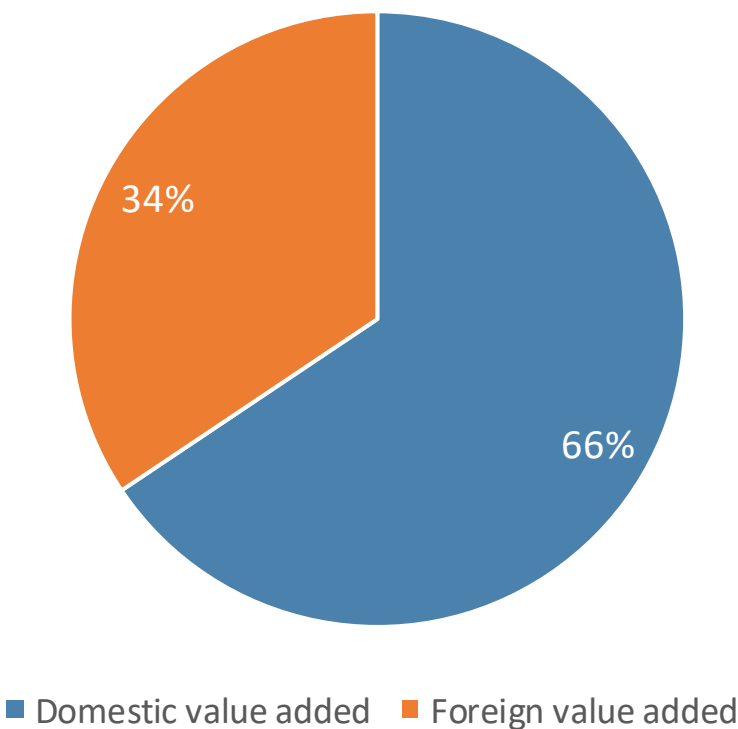
**2. Breakdown of Contributors to Foreign Value Added in Germany's Auto Exports**
(Percent of total)
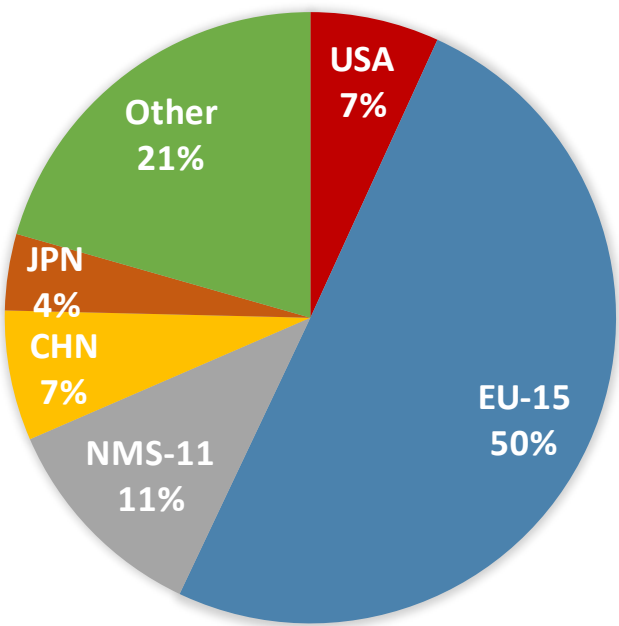


USA 7%

Other 21%

JPN 4%

CHN 7%

NMS-11 11%

EU-15 50%

Sources: EORA MRIO database; UN COMTRADE; and IMF staff calculations.
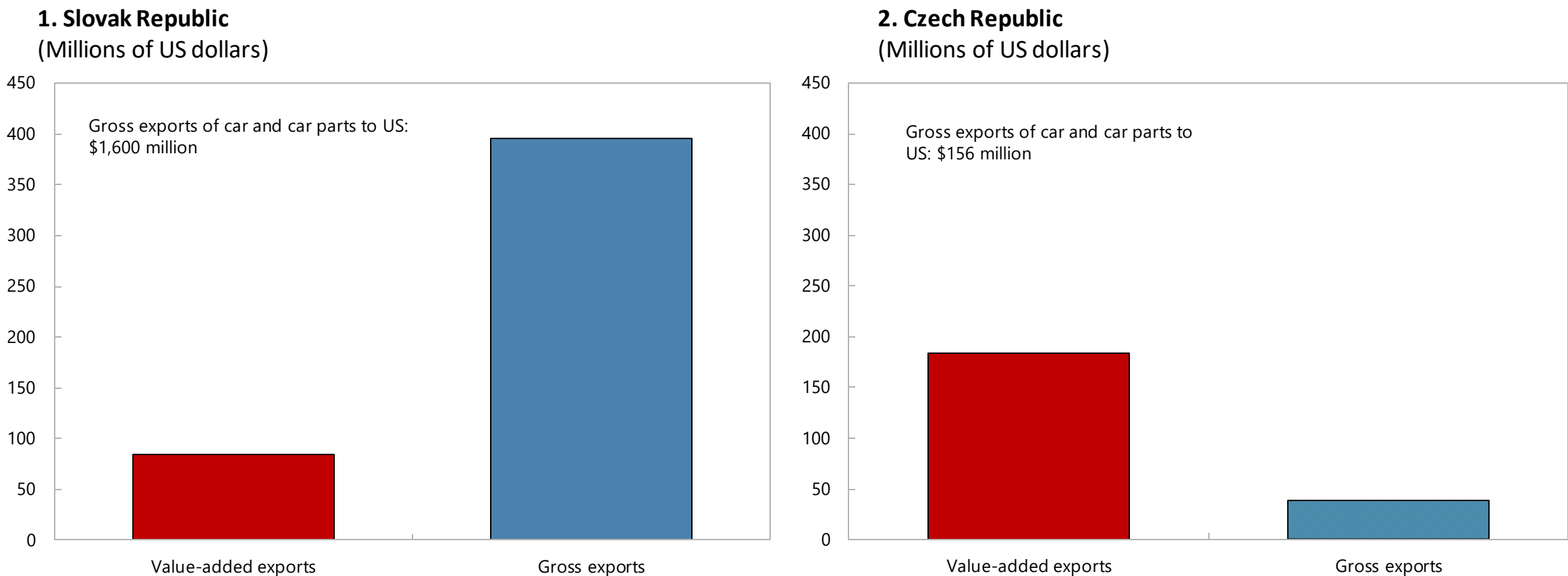Note: The scenario assumes a 25 percent tariff imposed on US imports of cars and car parts.

# Impact of car tariffs on the Europe is limited, but concerns several countries in different ways



**Car and Car Parts Gross Exporters to the USA, 2017**
(Percent of GDP)

■ Rest of world  ■ Europe

0.3

MEX CAN SVK KOR JPN DEU HUN SWE GBR ZAF EU ITA HND BEL TUR CHN

**Distribution of Loss from US Tariffs on Imports of Car and Car Parts**
(Percent of GDP)

■ Rest of world  ■ Europe

0.1

MEX CAN KOR JPN DEU SWE SVK CZE ZAF ITA EU GBR BEL MYS SVN HUN

Sources: EORA database; UN Comtrade; and IMF staff calculations.
Note: The scenario in the right chart assumes a 25 percent tariff imposed on U.S. imports of car and car parts.

14

# The cases of Slovak Republic and Czech Republic

**Figure. Losses resulting from US Car Tariffs**

**1. Slovak Republic**
(Millions of US dollars)

Gross exports of car and car parts to US:
$1,600 million



**2. Czech Republic**
(Millions of US dollars)

Gross exports of car and car parts to
US: $156 million



Sources: EORA database; UN COMTRADE; and IMF staff calculations.
Note: The scenario assumes a 25 percent tariff imposed on US imports of cars and car parts. The red bars denote losses estimated using value-added exports, whereas the blue bars denote losses estimated using gross exports.

# Caveats:

- We have made a strong case in favor of using valued-added export measures instead of conventional trade measures when analyzing tariff shocks

- But network analysis mostly represents a short-term estimation, based on several assumptions.

- It abstracts from the potential policy responses to the introduction of tariffs, confidence effects, nonlinearities, and other potential spillovers that may kick in at some threshold level of disruption.

  - It also abstracts from the trade diversion effect that may take place when exporting countries face higher tariffs in their preferred destinations.

# III. PRICE SHOCKS, DEMAND FOR VALUE ADDED, AND GLOBAL VALUE CHAINS

# DEMAND SYSTEM to identify the effect of tariff shocks on demand for value-added

- Countries compete over supplying value added to world markets rather than only over final goods or gross exports alone (Bems & Johnson, 2017).

- Therefore, we should use alternative measures of trade openness to capture the degree of countries' exposure to shocks (i.e. GE/GT vs VAX/GDP).

- Also use VA-REER. This differs from conventional indices of gross output REER (GO-REER) along three main dimensions:

  -Weights assigned to trading partners are based on value-added trade.

  -The degree of substitutability between imports from various partners reflects trade of of value-added in intermediate and final goods.

  -The degree of openness to trade is redefined in terms of value-added exports

# In VA-REERs partner weights reflect the extent of trade in value added. Higher integration in value chains leads to lower weights
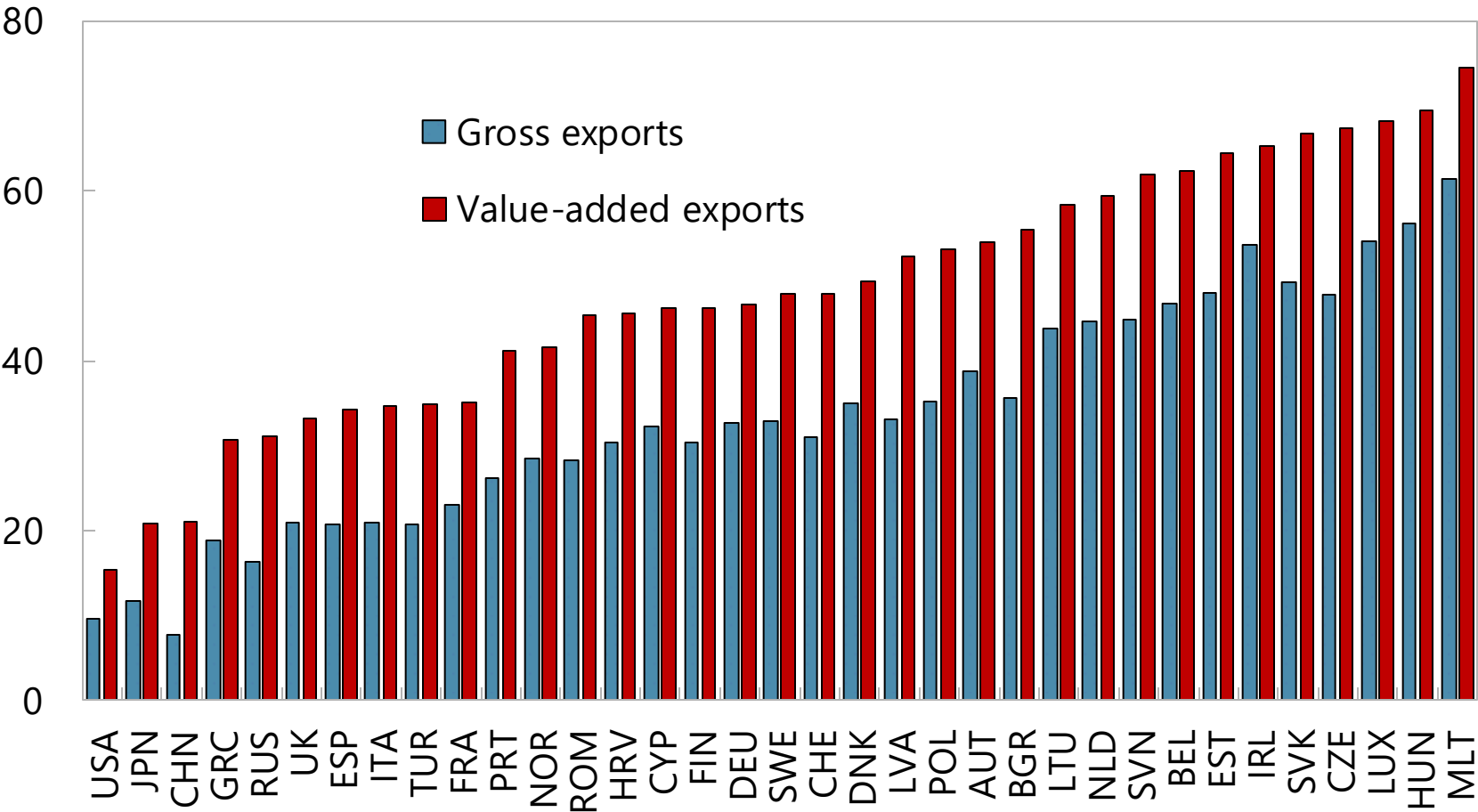


Figure. VA-REER vs GO-REER Partner Weights
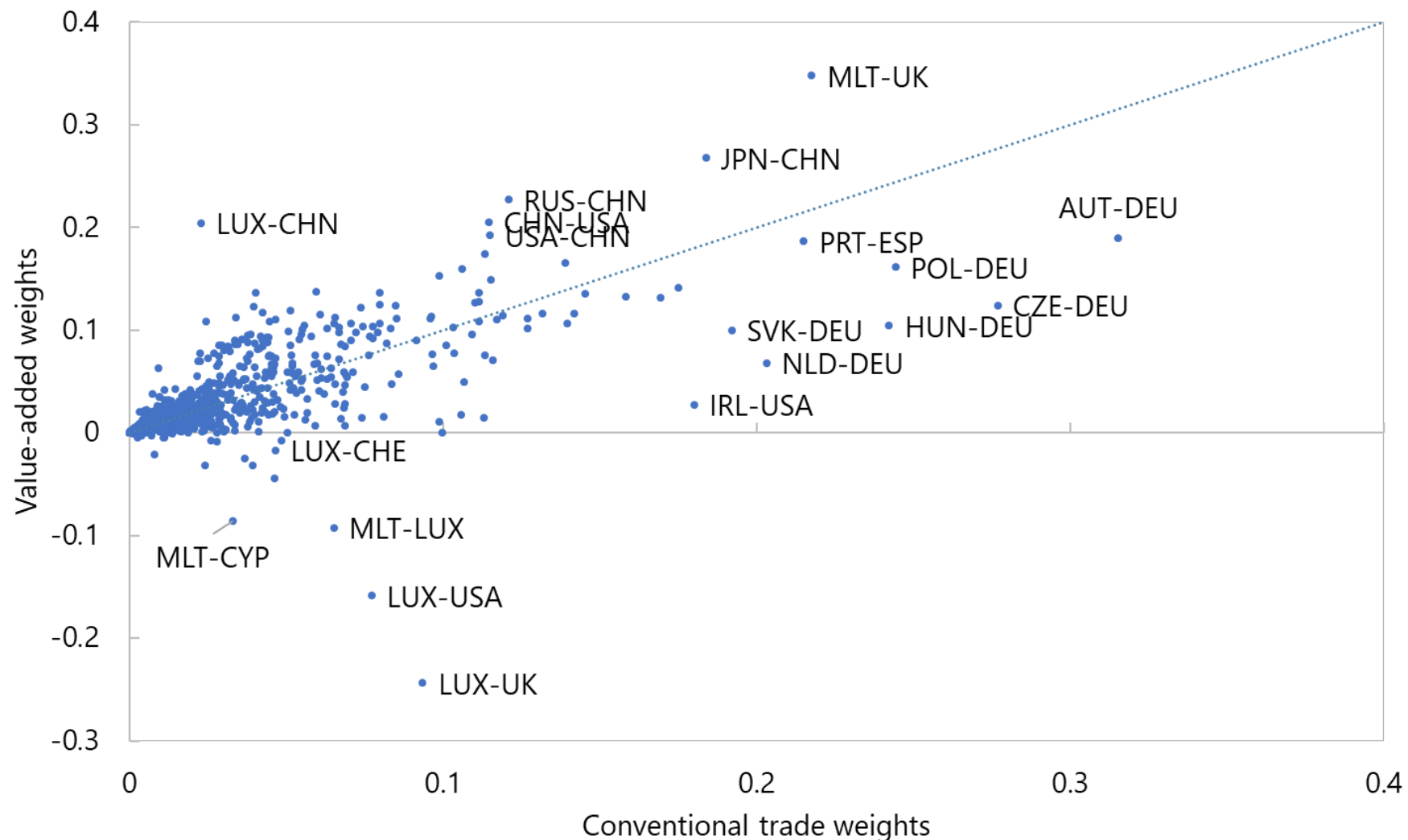
# The effective EoS varies by country, and it is lower for countries that trade relatively more in intermediate goods



Figure. Effective Value-Added Elasticity of Substitution
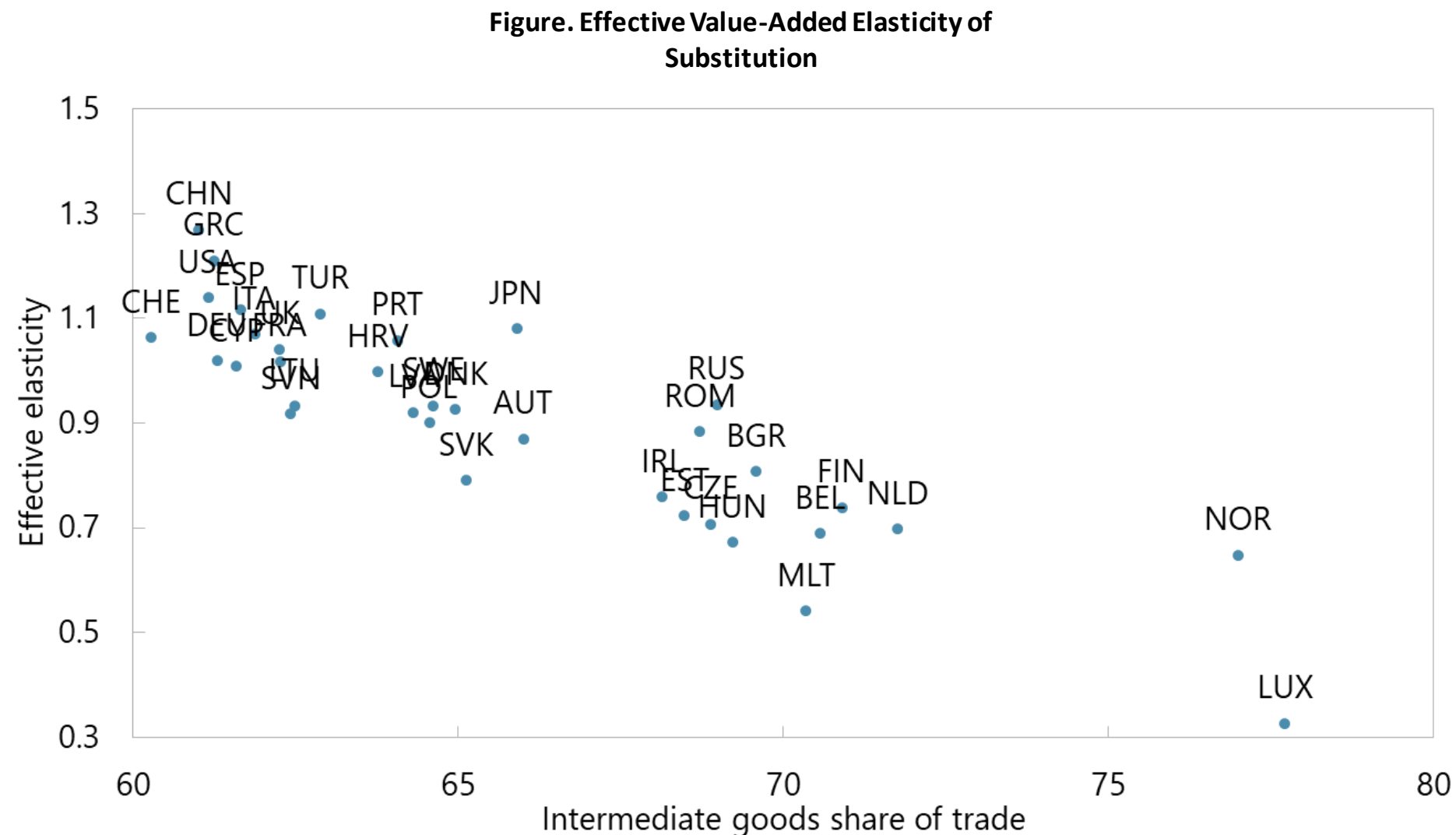
# Countries are more open in value-added terms than in gross trade flow terms.

**Figure. Trade Openness in Value-Added and Conventional Terms**
(Percent)



Legend:
- Gross exports
- Value-added exports

Countries (x-axis): USA, JPN, CHN, GRC, RUS, UK, ESP, ITA, TUR, FRA, PRT, NOR, ROM, HRV, CYP, FIN, DEU, SWE, CHE, DNK, LVA, POL, AUT, BGR, LTU, NLD, SVN, BEL, EST, IRL, SVK, CZE, LUX, HUN, MLT

Sources: Bems and Johnson 2017; Timmer and others 2015; and IMF staff calculations.
Note: Gross exports denotes the ratio of gross exports over gross turnover. Gross turnover is the sum of all intermediate and final goods transactions that occur across sectors in an economy. Value-added exports denotes value-added exports over gross value added. Country list uses International Organization for Standardization (ISO) country codes.

# In a 5% tariff hike scenario, the decrease in demand for European value-added reaches 0.2 percent

**Figure. Change in the Demand for Valued Added of Advanced and Emerging Europe after a 5 percent US Tariff**

(Change in demand, percent)



Legend:
- Gross exports
- Value-added exports

X-axis categories: Advanced Europe, Emerging Europe
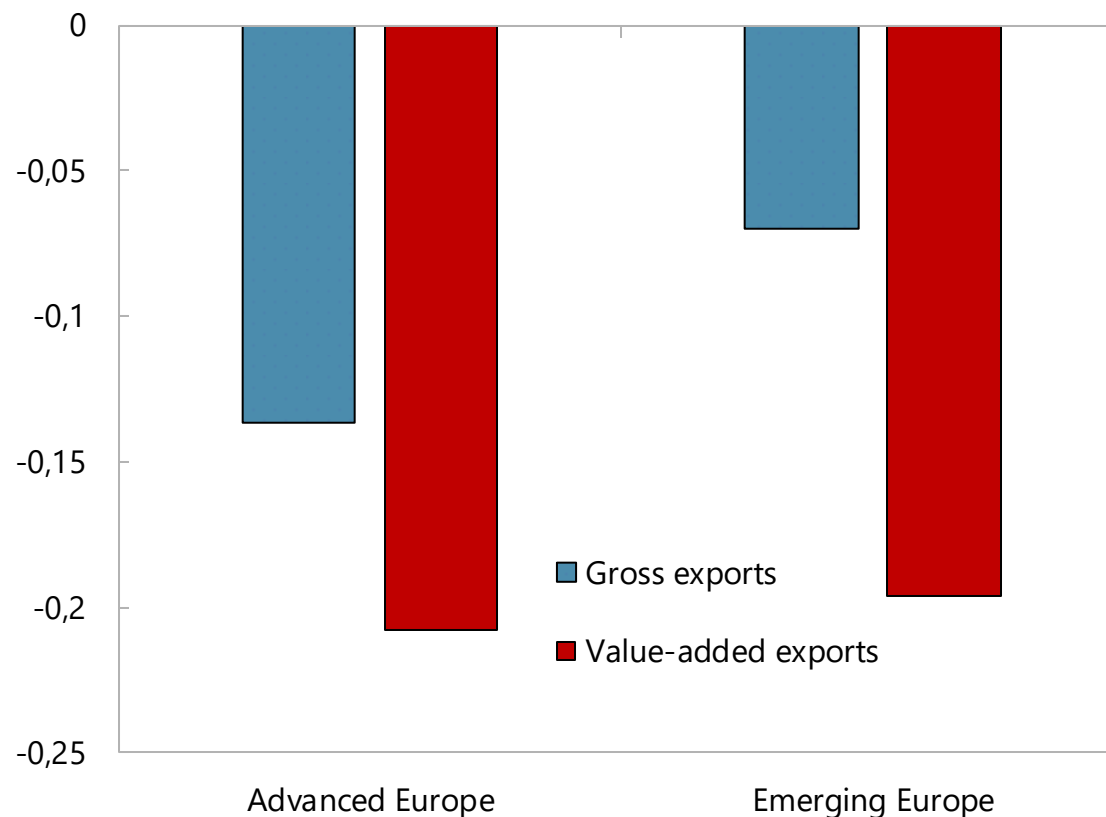
Sources: World Input–Output Database, November 2016 release; IMF, World Economic Outlook; and IMF staff calculations based on Bems and Johnson (2017). The scenario assumes a 5 percent US tariff across the board, with retaliation from all trading partners and without trade diversion. The effect though gross exports reflects the direct exposure of partner countries to the US and vice versa, and is measured in percent of gross turnover. The value added exports are divided by GDP.

# On average the decline in the demand for Europe's output is 50 percent higher when shock is measured in value-added terms.



**Figure. Change in the Demand for European Countries' Value Added after a 5 percent US Tariff**
(Change in demand, percent)
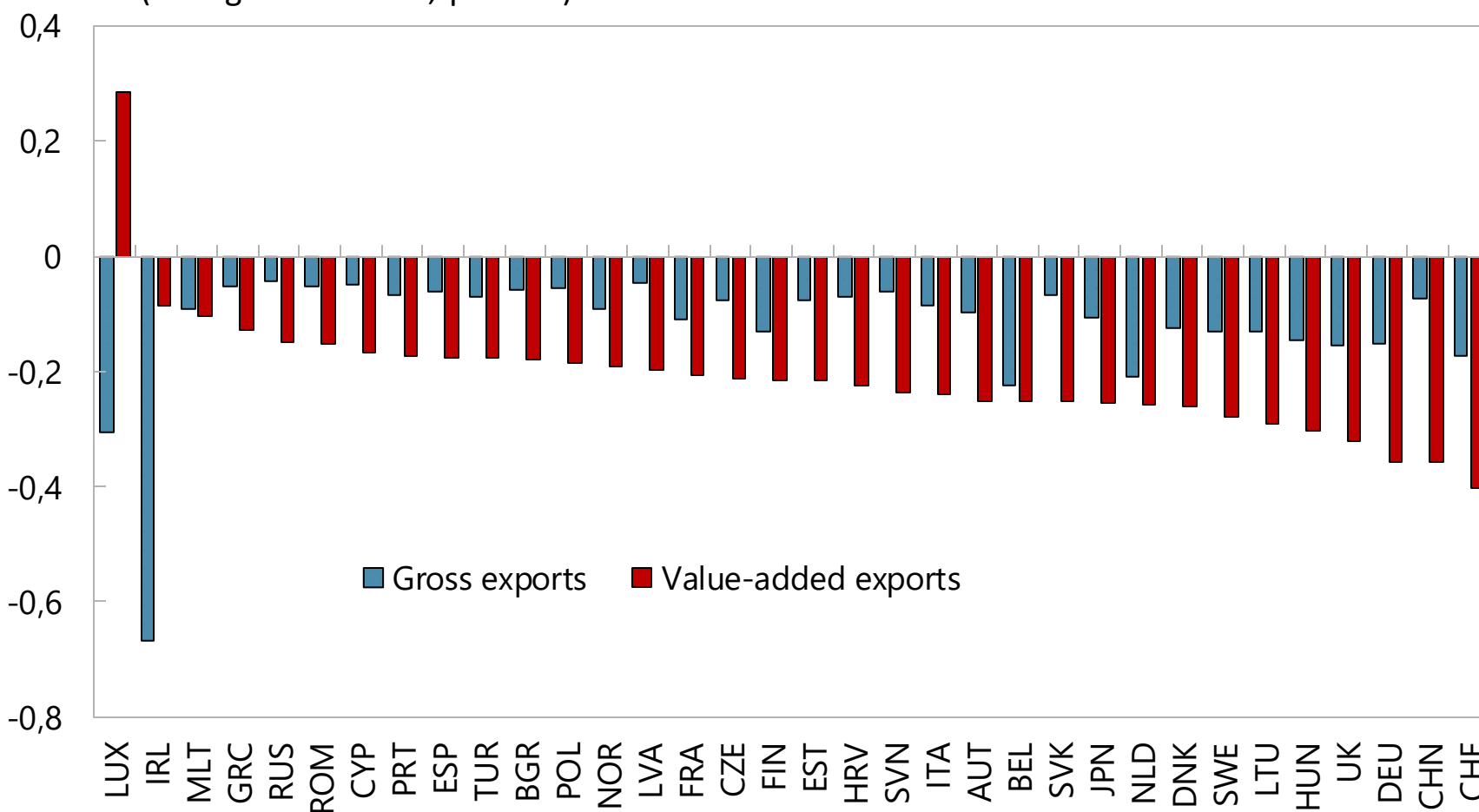
# Caveats:

- Since the model considers only the demand side of trade—holding the supply side fixed—the impact of price changes across countries should be viewed as short-run partial equilibrium effects

- The model omits other considerations that can be important at a business cycle frequency, such as confidence effects

- It incorporates a simplifying assumption that prices and demand for countries' exports are not affected by the tariffs imposed on other countries.

- Importantly, such limitation in this approach precludes an analysis of trade diversion, which is potentially important (IMF 2019)

# IV. GROWTH SPILLOVERS IN PRESENCE OF GLOBAL VALUE CHAINS

# Motivation: GVC linkages matter for growth spillovers
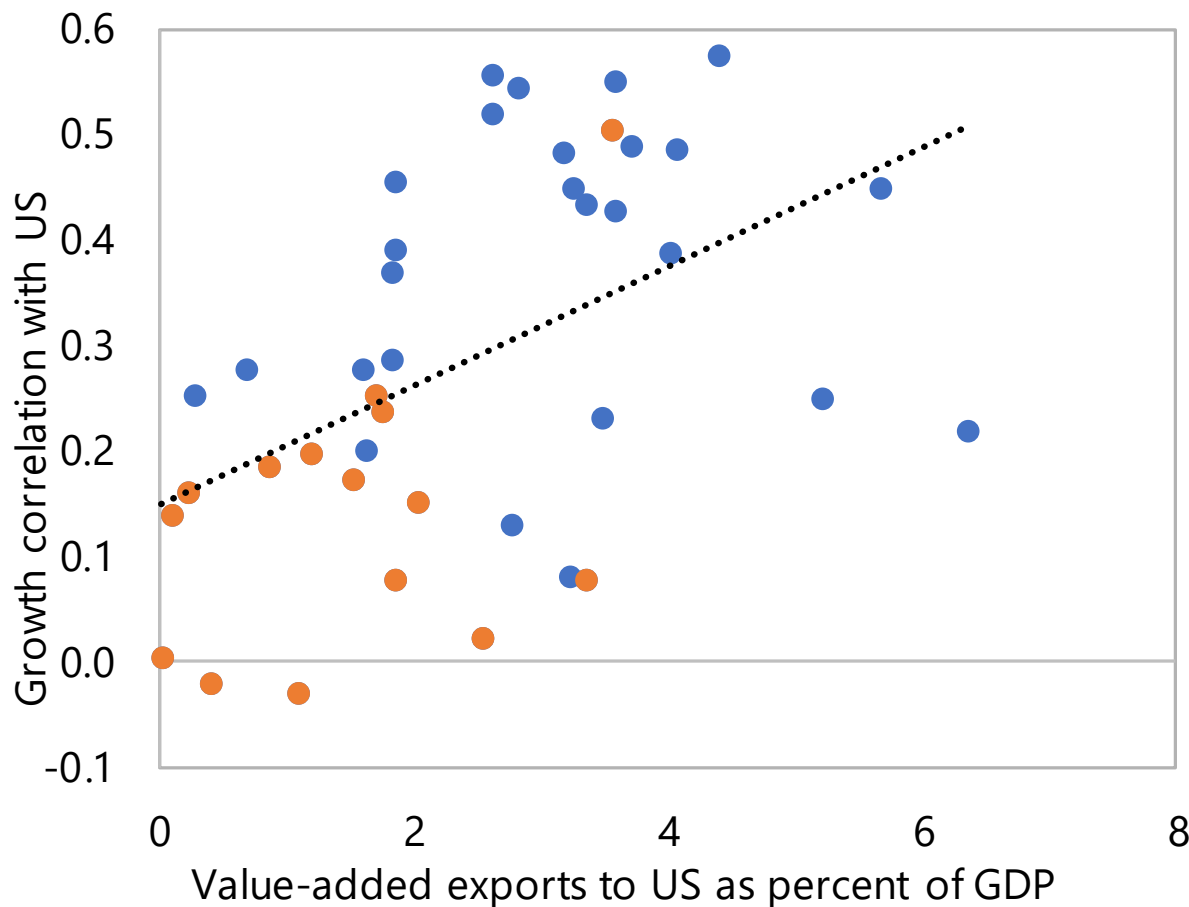


Sources: EORA MRIO database; and IMF staff calculations.
Note: The *x*-axis shows value-added exports to the US as percent GDP. The *y*-axis shows correlations between US quarter-over-quarter growth and growth in European economies during 1995–2018.

# Methodology

Spillovers: transmission of a country-specific shock to other countries

## 1. Estimate country-specific growth shocks

➢ Estimate a common component model using GDP growth for a panel of countries
➢ Country-specific shocks are the residual growth for each country after taking out the effects of the common factors.

## 2. Trace the spillover effects of these shocks

➢ Use a local projections model to trace the effects of these shocks on growth in other countries.
➢ ***Key innovation***: include GVC exposure as interaction terms. Spillover from US to other countries depends (up to a scale) on their GVC exposure to the US.
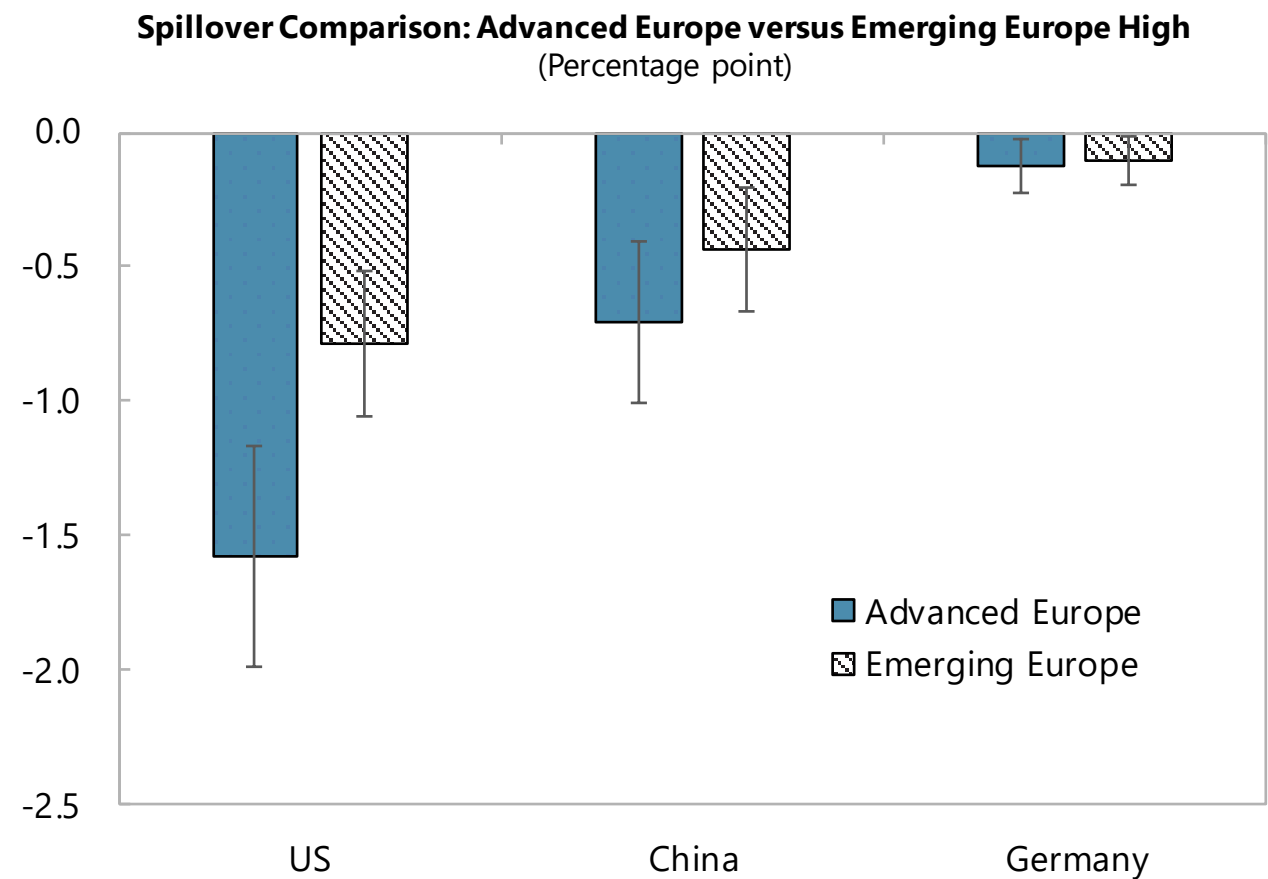
# Growth spillovers from the United States and China are sizable. Growth spillovers from Germany are much smaller

**Spillover Comparison Across Sources**
(Percentage point)
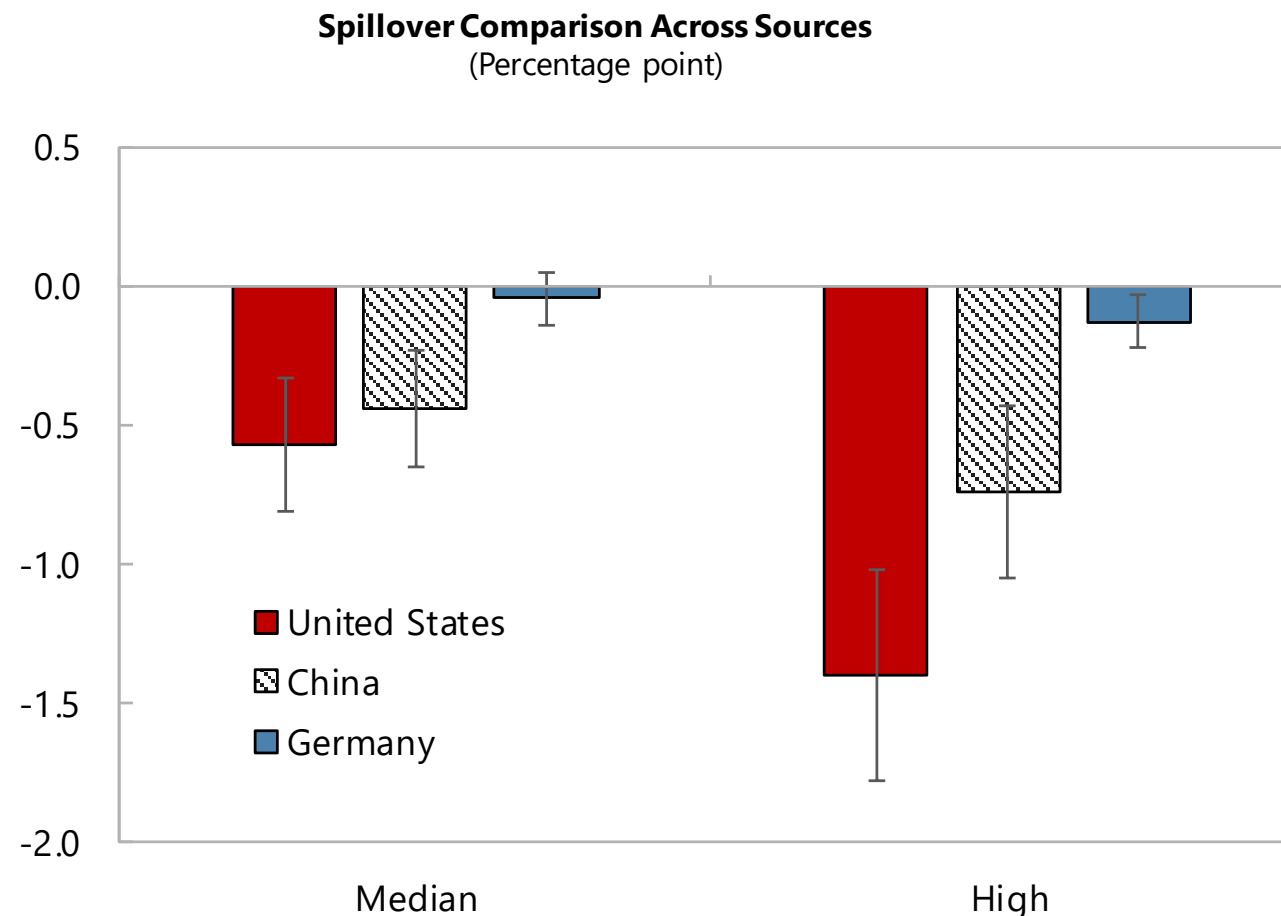


Sources: IMF, *World Economic Outlook*; EORA database; Haver Analytics; and IMF staff calculations.
Note: Peak cumulative impulse response to a 1 percent negative growth shock in US, China, and Germany. Median refers to response of a median European economy with median level of value-added exports. High refers to a "high-exposure" European economy with exposure at the 90th percentile of the distribution. Bars denote the point estimates and errors bars denote 2 s.d. deviation confidence bands.

# Spillovers to Advanced Europe are slightly larger than to Emerging Europe

**Spillover Comparison: Advanced Europe versus Emerging Europe High**
(Percentage point)



Legend:
- ■ Advanced Europe
- ⊠ Emerging Europe

X-axis categories: US, China, Germany

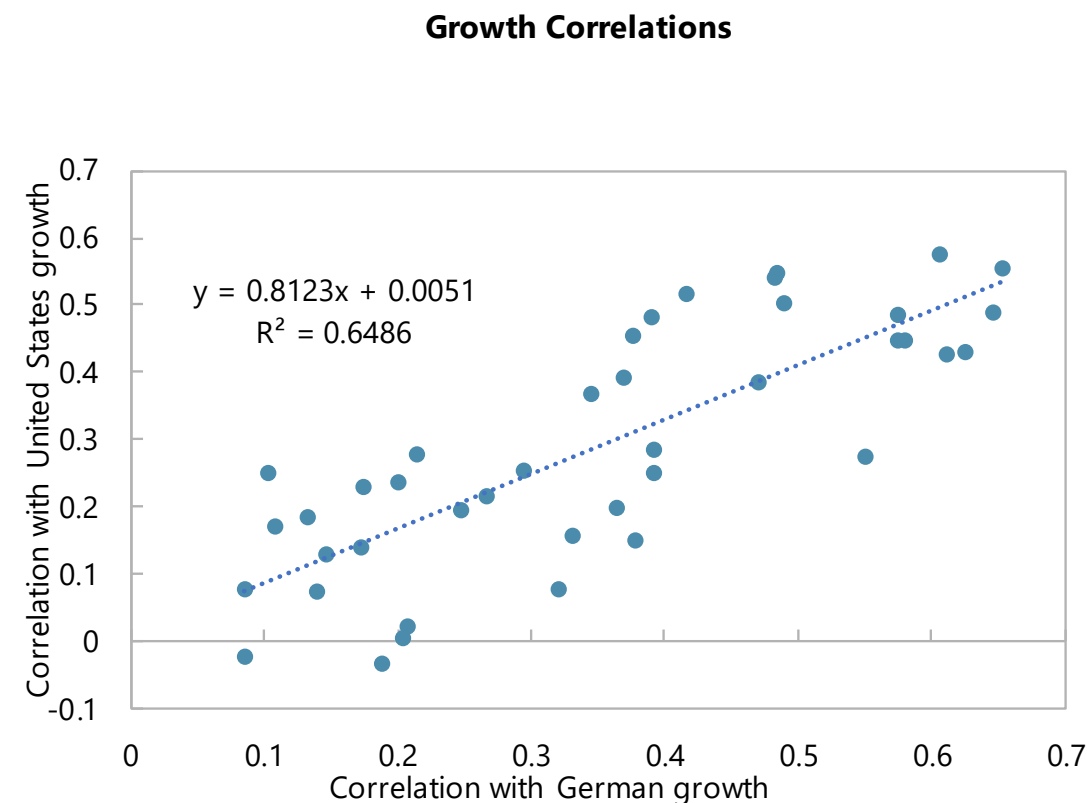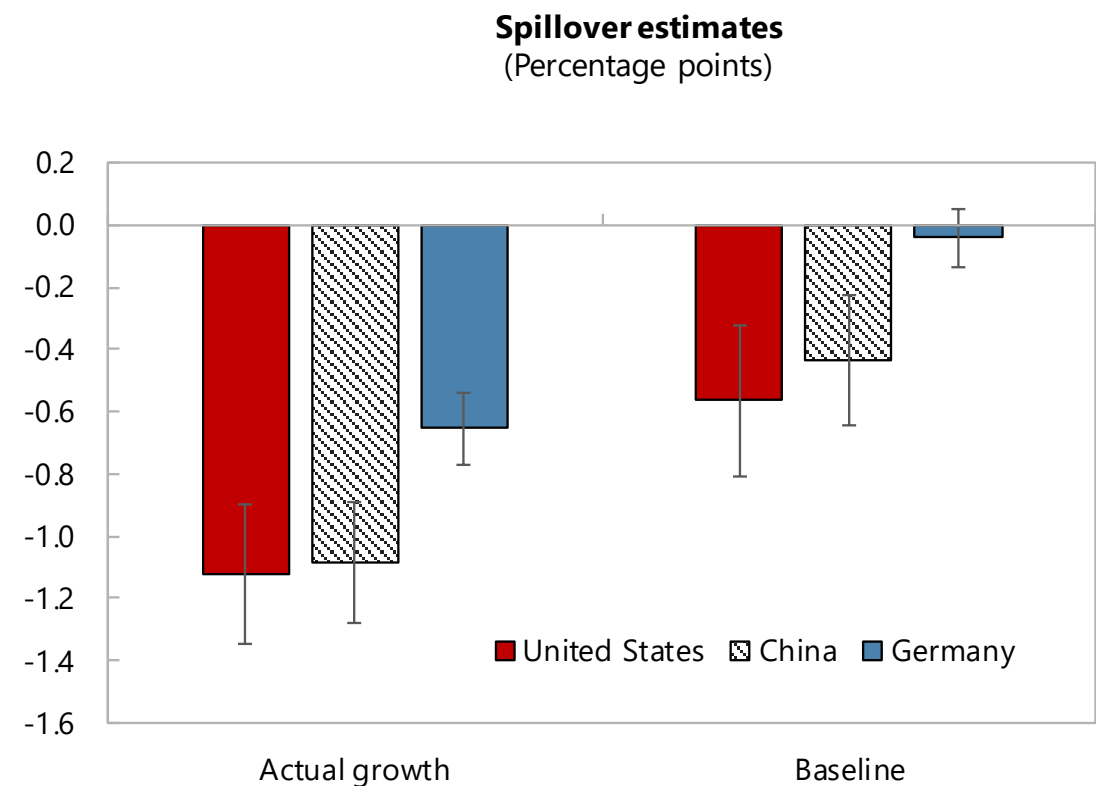Y-axis: 0.0, -0.5, -1.0, -1.5, -2.0, -2.5

# Main takeaways:

- **GVCs matter**: they are an important channel of transmission of trade shocks and the distribution of losses using value-added data differs from what gross trade flows suggest.

- **Germany is not as crucial as an independent source of shocks:** its importance as a key hub in Europe's trade is smaller when measured in value-added compared to gross trade terms.

- **US and China can have larger impact**: The size of growth spillovers from the US and China on Europe's growth are larger than those from Germany after purging common factors.

# APPENDIX

# Spillovers without controlling for common shocks

**Spillover estimates**
(Percentage points)



**Growth Correlations**



$$y = 0.8123x + 0.0051$$
$$R^2 = 0.6486$$

Sources: IMF, *World Economic Outlook*; Haver Analytics; and IMF staff calculations.
Note: Figure 20.1. shows peak cumulative impulse response to a 1 percent negative actual growth in the United States, China, and Germany. This is the response of a median economy in Europe. Bars denote the point estimates and errors bars denote 2 s.d. deviation confidence bands. Baseline refers to spillovers based on growth shocks as in the baseline specification. Figure 20.2 shows a scatter plot of correlations of growth in European countries with actual German growth (horizontal axis) against the corresponding correlations with US growth (vertical axis).