

Export induced R&D-expenditures in Germany

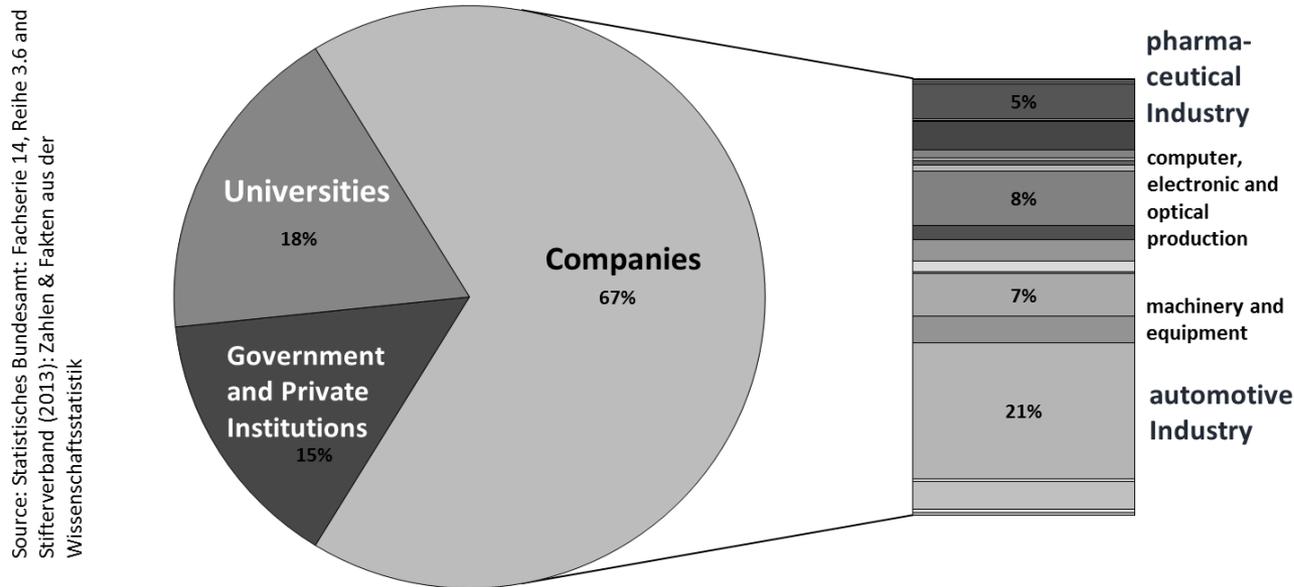
- Effects of a changed export structure to the USA and to China of German automotive industry products and of German pharmaceuticals -

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1. Introduction
 - Actual R&D-expenses in Germany
 - R&D in the IOT
 - German export structure
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 - Pharmaceutical-Scenario: Results
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R&D-expenditures by sector in 2011



- In 2011 German R&D expenditures nearly reached 75 bn € (almost 3% of GDP)
 - 2/3 were invested by companies
 - nearly 20% by universities
 - Government spendings only amount to 15%
- Out of the companies the automotive industry is the major investor in R&D with nearly 16 bn € (2011)
- The pharmaceutical industrial sector spends almost 4 bn € (2011)

inputs

- The strongest demand of **R&D-Input** after public administration and defence are the pharmaceutical (14%) and the automotive Industry (9%)
- For pharmaceutical production R&D is the third largest **intermediate input** (12%)
- For the vehicle production R&D-intermediates only make 0.5%

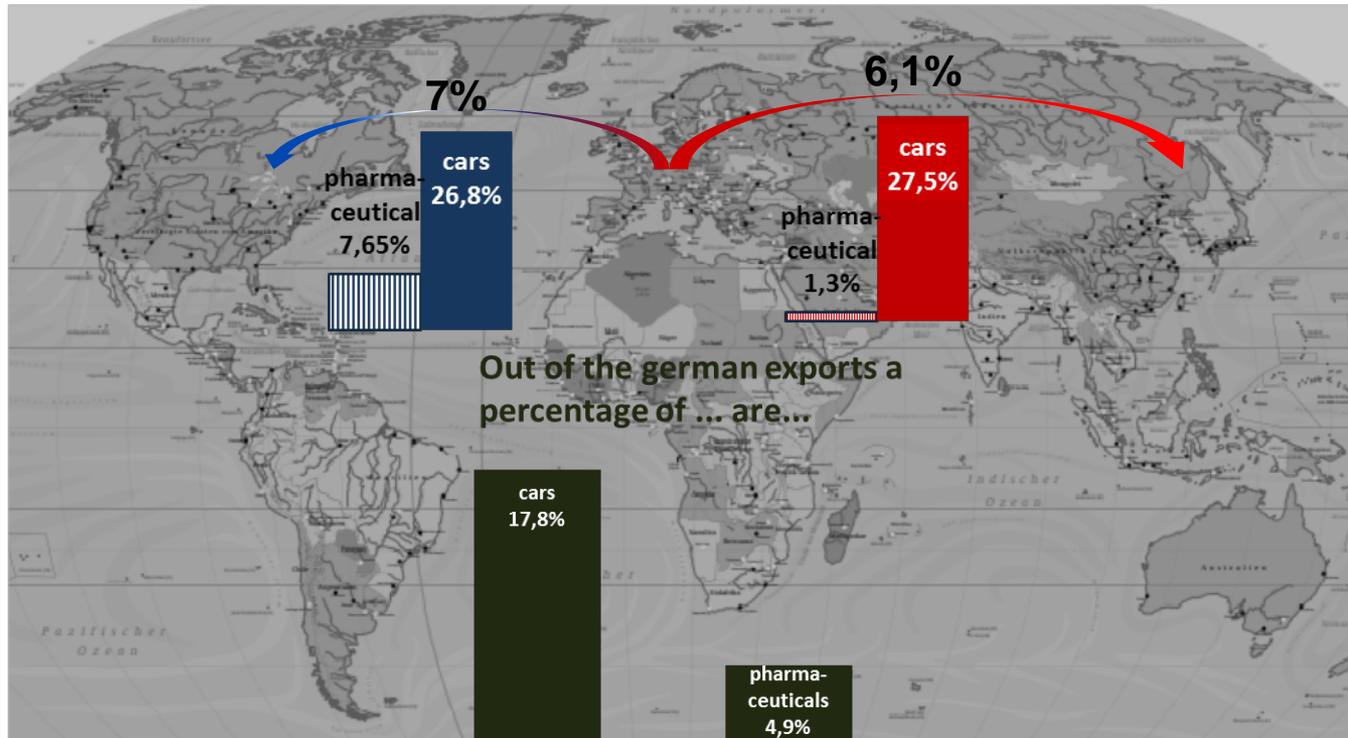
inverse coefficients

- A shift in demand of R&D is decisive for the **pharmaceutical industry**
- For the **vehicle industry** a shift in demand of R&D is in contrast not too important
- **R&D-industry** receives its most important goods from the IT and educational sector. Goods from the pharmaceutical and automotive industry lack importance

First expectation: Variation in R&D-demand should cause a measurable reaction for the pharmaceutical industry

Introduction: Export structure

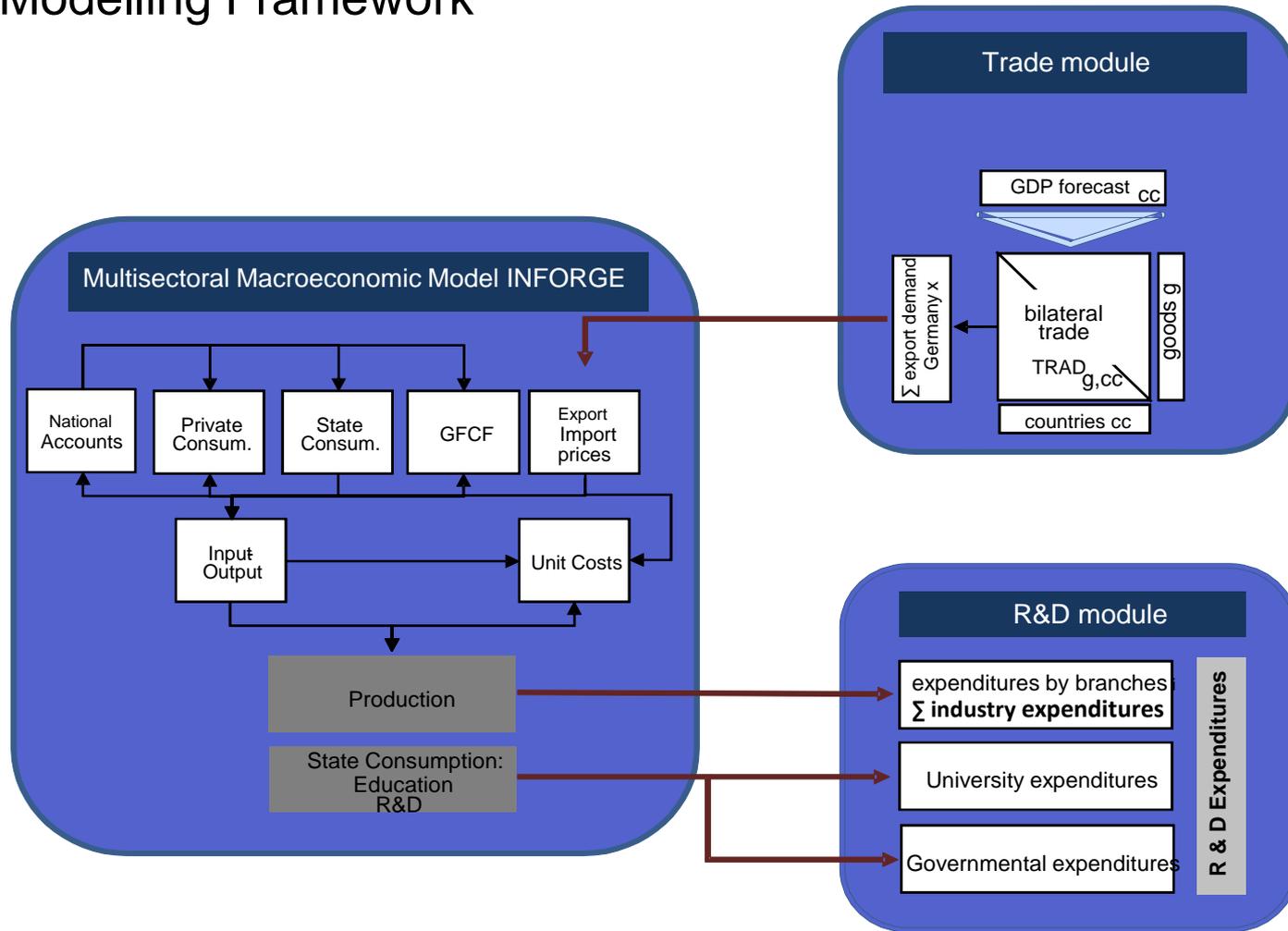
USA is still the strongest single trading partner but the importance of China grew much faster lately



Second expectation: Variation in German exports should cause a measurable reaction

- How strong is the reactivity of R&D on an export-shift?
- What predominates: the export structure - with a dominance of vehicles - or the higher reactivity of pharmaceuticals versus the input of R&D?
- Is the actual higher export volume to the USA decisive or the higher evolution of the Chinese importance for German exports?
- Does international trade have an importance for R&D?
- Capability of INFORGE to move R&D

Modelling Framework

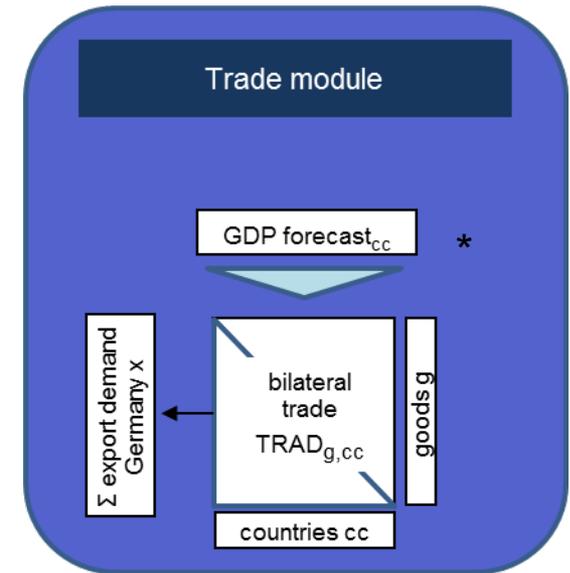


Source: Mönning, A.: Trade and qualification. Linking qualification needs to Germany's export flows, in: IAB-Discussion Paper July, 2013; own composition

The **Export-Modul** is driven by exogenously given world trade dynamics for German goods.

It is modeled in two dimensions:

1. By goods and services
2. by export demanding countries
 - allows calculations for diverging speeds in economic developments as well as for different demand structures by countries
 - Changing export dynamics and patterns
 - By trading partners [68]
 - By products [63]
 - Effects on domestic economy [production, ...]
 - Direct and indirect effects
 - By products [63]



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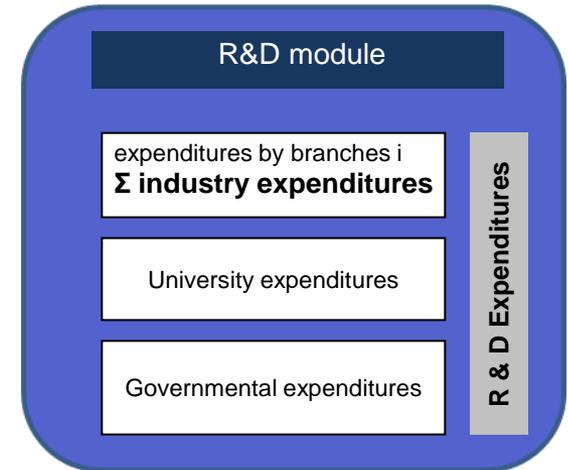
cc = country (1-68)
g = goods (1-63)
TRAD = bilateral
trade
matrices

The **R&D-Module** is top down

It receives its impulses from production and governmental consumption.

Three different types of expenditures are considered:

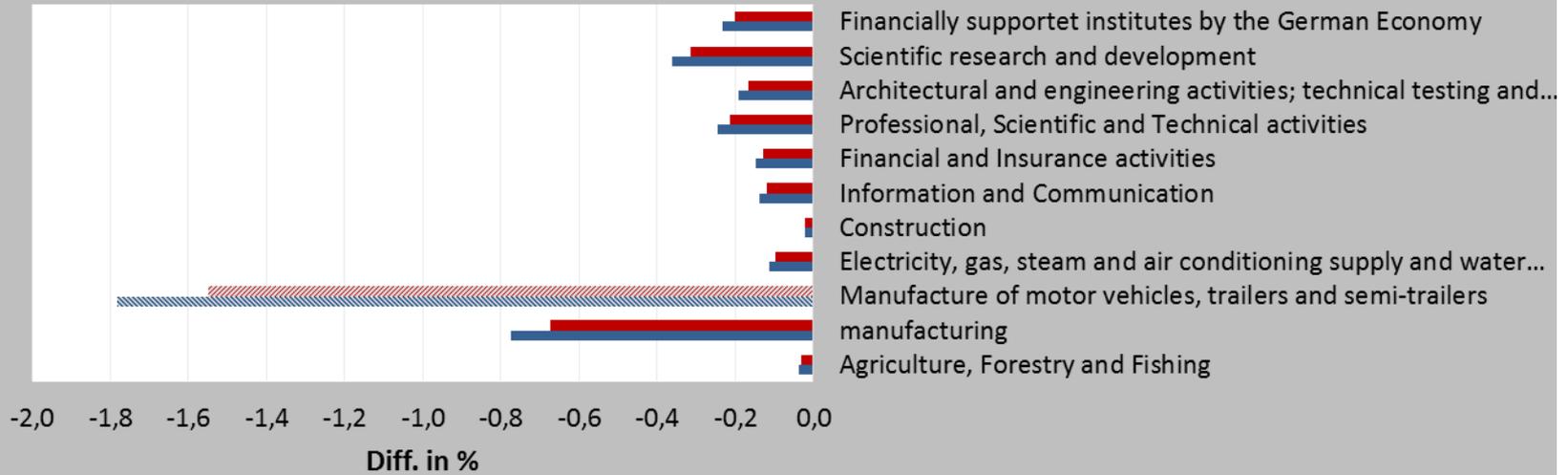
1. Total of industrial expenses
2. Expenses by universities and institutions
3. Expenditures by government



Changing Germany`s export structure to the USA and to China:

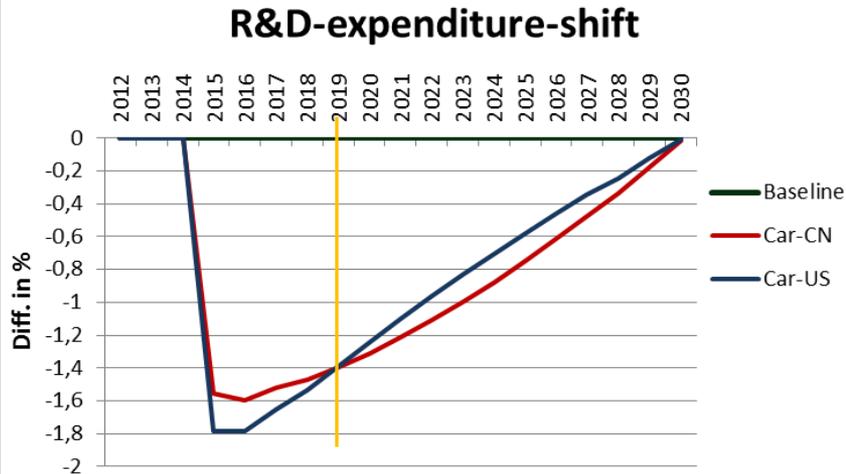
- Automotive industry and pharmaceutical products **decline by 30% in 2015 and 2016**
 - Import shares change in the respective countries
- The baseline will be approached in 2030
- The total import demand for German products by the USA and China remain constant

R&D-expenditure shift by industries in the first year of export reduction of vehicles to the USA and to China



- Within the manufacturing sector the R&D-expenses of the automobile industry itself decline strongest, followed by the professional, scientific and technical activities and service industries
- Reaction on the R&D-expenses of other industries are poor
- The export decline towards the USA affects the R&D-expenses stronger than the export reductions towards China

- R&D-expenditure shift of the motor vehicle industry



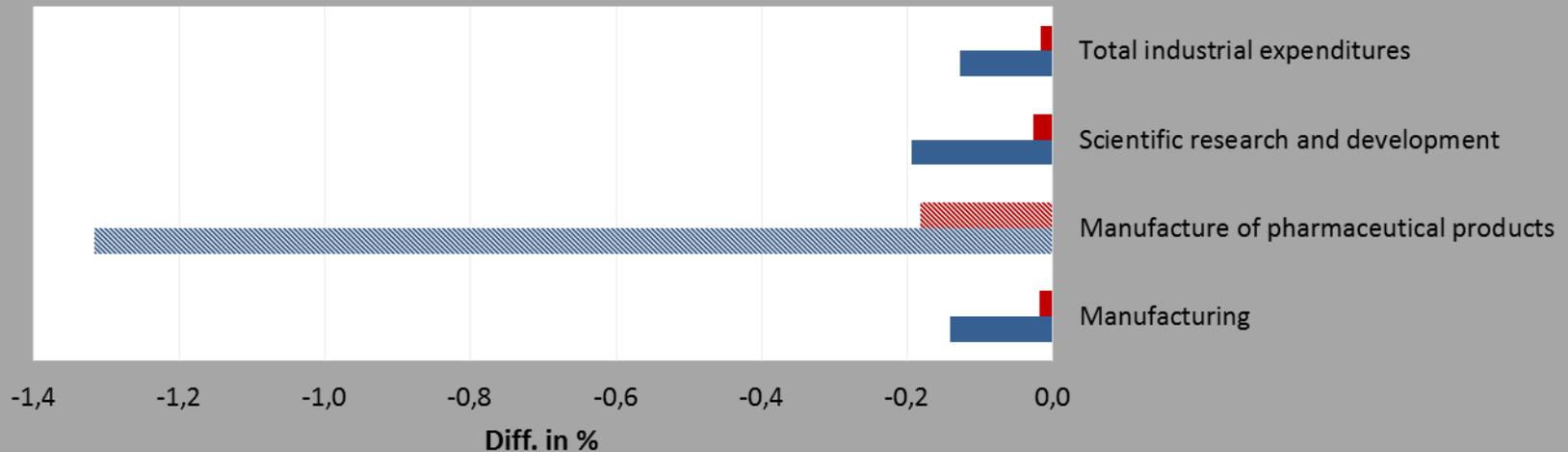
An export reduction to the **USA** provokes a stronger decline of R&D-expenditures of the automotive industry in the first four years after the shock.

On a long run, a shift of automobile exports to **China** have a lasting effect.

Conclusions

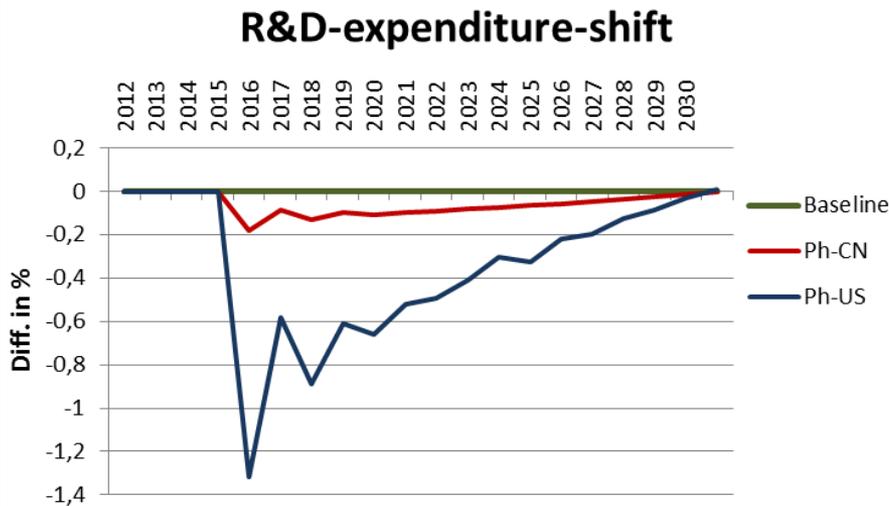
- The German R&D-expenses react for a short term stronger on the export reduction to the USA
- The increasing importance of the Chinese market for German exports predominate on a long run
- The export reduction to both economies have an impact on services

R&D-expenditure shift by industries in the first year of export reduction of pharmaceuticals to the USA and to China



- The R&D-expenses shift concentrates on the pharmaceutical industry
- Reaction on the R&D-expenses of other industries is very weak
- The expenditure shift due to an export decline is very poor in both countries, especially in China

- Expenditure shift on pharmaceutical industry



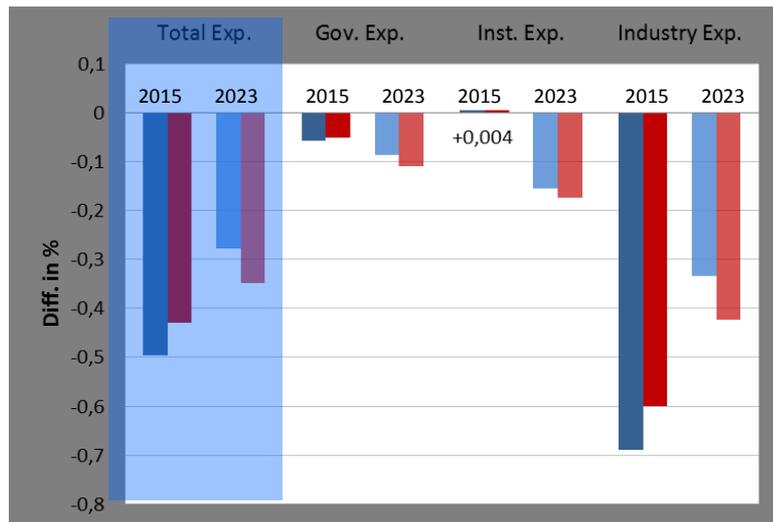
Due to the almost 6 times higher export share of pharmaceuticals to the USA, the German R&D-expenditures of the pharmaceutical industry react much stronger on an export reduction to the US-market than to the Chinese one.

Conclusions

- The German R&D-expenses react generally stronger on the export reduction to the USA
- The export shock to the Chinese market induces a hardly perceivable shift on expenses
- The higher export volume to the USA predominates

Expenditure-shift in...

... the automotive scenario



- For overall expenditures the impact of the export-shock to the Chinese market, also manifests in the long-run
- Decline of the governmental and institutional expenditures is low

... the pharmaceutical scenario



- Total expenditures for R&D are driven by the industrial expenses
- Looking at the scale: Reaction is nearly not measurable

- The export reduction to both economies have an impact on R&D-expenses
- Reactivity is measurable
 - INFORGE is capable to move R&D
 - Lack of feedback from the R&D-Modul to INFORGE impedes to analyse how R&D-expenses affect production - probably pharmaceuticals would be influenced strongly by a shift of R&D-supply
- Export volume is decisive for R&D-response
 - Automotive scenario shows in each analysis the stronger reaction
 - Decline of pharmaceutical exports induces a very poor reaction
 - USA have a stronger impact than the variation of export structure to China
 - The increasing importance of the Chinese market for German exports predominates on a long run
- Research carried out by industries is affected directly through the missing exports while the research expenses by government and institutions are lagging behind export shifts

- Find the missing path from the R&D-Modul to INFORGE to enable analysis from the R&D-expenses to production
- Extend the analysis to country groups like BRICS or EU

Thank you for your attention

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