CHARLES UNIVERSITY

FACULTY OF SOCIAL SCIENCES

Institute of Economic Studies

Bachelor's Thesis

2022 **Martin Talán**

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Analysis of the Interconnectedness of Economies of European Union and People's Republic of China: An Input Output Analysis

Bachelor's Thesis

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Study program: Politics, Philosophy and Economics

Supervisor: Ing. Vilém Semerák M.A., Ph.D.

Year of the defence: 2022

Declaration

1. I hereby declare that I have compiled this thesis using the listed literature and resourcesonly.
2. I hereby declare that my thesis has not been used to gain any other academic title.
3. I fully agree to my work being used for study and scientific purposes.

Prague 3.5.2022 **Martin Talán**

Bibliographic note

TALAN, Martin. *Analysis of the Interconnectedness of Economies of European Union and People's Republic of China: An Input Output Analysis*. Praha, 2022. 38 pages. Bachelor's thesis (Bc). Charles University, Faculty of Social Sciences, Institute of Economic Studies. Supervisor Ing. Vilém Semerák M.A., Ph.D.

Length of the Thesis: 67 621 characters

Abstract

This thesis aims to empirically determine the degree of interconnectedness between the economies of European Union and People's republic of China. These two countries are two of the largest economies on Earth and have significant trade relationships with each other. However, in the recent years their political relationship has been worsening. The PRC has increasingly pursued a more aggressive foreign policy, as well as abusing human rights of its own population. Some of the EU member state have vocally criticized this, and PRC has responded by coercive economic measures. The results of this work will empirically determine how the two economies are interconnected, and thus what damage are capable of causing to each other through economic sanctions.

Keywords:

Input Output analysis, Global Extraction Method, European Union, People's republic of China, Economic interconnectedness

Acknowledgements

I would like to sincerely thank my advisor Ing. Vilém Semerák M.A., Ph.D. for his helpful advice and insightful comments during the writing of this thesis.

I would also like to sincerely thank my family and friends for incredible support they have given me along this journey.

Bachelor's Thesis Proposal

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The scope of work will be as follows

Proposed Topic:

Analysis of the Interconnectedness of Economies of European Union and People's Republic of China: An Input Output Analysis

Motivation towards the topic:

The motivation behind this work is to determine the degree of interconnectedness of the economy of European Union (EU) and the economy of People's Republic of China (PRC). European Union and PRC are two of the biggest trading partners in the world. With the use of global value chains data, it aims to analyze to what degree industry sectors and supply chains in EU and PRC are dependent on each other. Furthermore, it wants to evaluate the consequences and spillover effects in EU industry caused by supply or demand shocks originating from PRC, such as during the COVID 19 pandemic, or heightened geopolitical tensions. It aims to determine which EU supply chains are critically dependent on PRC's economy, and how they could be diversified to be made more resilient.

Hypotheses:

Hypothesis

1. Economy of the European Union and PRC are interconnected to a large degree, and supply or demand shocks in either of these economies would cause serious problems for both of these economies.
2. The direct export dependence small and medium sized EU economies is small, and they are more likely to be negatively influenced by supply shocks to their supply chains.

Contribution:

This work will provide valuable information on how the EU's industry sectors and their supply chains are organized and structured, and to what degree the EU economy as a whole is dependent on the PRC. This work can provide valuable information of new possibilities for expansion and growth of EU supply chains. Furthermore, information obtained through this analysis can be valuable for the European leaders, were they to decide to diversify the supply chains of their economies, in order to

make them strategically more resilient. This has proven to be important in retrospect to the COVID 19 pandemic, or towards the future as there are rising geopolitical tensions between EU and PRC.

Methodology:

Data for this analysis will be obtained from several sources of world trade input output databases such as WIOD 2014, OECD TiVA, along with newer entries such as FIGARO tables. It will analyze these global value chains data through the Leontief Multi Regional Input Output Model (MRIO) to evaluate the demand shocks to EU industry. Furthermore, it will use Ghosh Input Output model to determine the degree of supply shocks originating from PRC. With the use of these and other models, the structure and organization of EU supply chains will be evaluated.

Outline:

1. Introduction
2. Outline of the Data Sources
3. Description of the Models
4. Analysis
5. Results
6. Conclusions
7. Literature sources

Academic literature:

Miller, R. E., & Blair, P. D. (2009). Input–Output Models at the Regional Level. In *Input-output analysis foundations and extensions* (pp. 69–118). chapter, Cambridge University Press.

Borin, A., & Mancini, M. (2015). Follow the Value Added: Bilateral Gross Export Accounting. *Bank of Italy Temi Di Discussione (Working Paper)*. https://doi.org/http://dx.doi.org/10.2139/ssrn.2722439

Dietzenbacher, E., Los, B., Stehrer, R., Timmer, M., & de Vries, G. (2013). THE CONSTRUCTION OF WORLD INPUT–OUTPUT TABLES IN THE WIOD PROJECT. *Economic Systems Research*, *25*(1), 71–98. https://doi.org/https://doi.org/10.1080/09535314.2012.761180

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Introduction

This work aims to estimate the degree of interconnectedness of economic sectors of the People's Republic of China (PRC) and European Union (EU) with the use of Input - Output (IO) analytical methods. These include both the Standard Leontief IO framework, as well as more modern approaches such as the Global Extraction Method. These IO methods will be used on two kinds of models. The first one will be representing trade between aggregate of EU member states and PRC. This model is mainly used to obtain an overall assessment of the EU - PRC interconnectedness. The second model will be more detailed, consisting of individual EU member states. This model will be used to obtain more precise results of which EU countries are most interdependent with PRC. Foreign policy of the PRC has in recent years became more aggressive towards its immediate neighbours, as well as to the rest of the states of the world who have been criticising its actions. These results can be valuable for policymakers in today's turbulent geopolitical climate stemming from increased political tensions between EU and PRC.

This thesis is divided into six parts. Literature review, describing the existing IO methodology origins as well as its applications and recent advancements. Data section, describing the source of the data used for the analysis in this work. Methodology section, describing the mathematical basis of the IO analysis. The creation of IO models used and the work on the code is described in this section as well. Geopolitical section describes the current geopolitical environment and how it influences the current and future EU-PRC economic relations. Analysis of results section, where the results and their implications are discussed. Then follows the Conclusions as the final part of this thesis.

Literature review

This thesis builds upon and contributes to an extensive amount of work done in the field of Input - Output (IO) analysis. Interconnectedness between different sectors of economy has been discussed in academic literature for several centuries, one of the most prominent early examples was Le Tableau Économique by French physician and economist Francois Quesnay. (Quesnay, 1759) This work has described flows between sectors in an economy and their interdependencies on each other. However, it has lacked any mathematical description of these flows and thus could not be used for empirical research.

Founder of the modern IO analysis is considered Wassily Leontief, for his breakthrough work Quantitative input and output relations in the economic systems of the United States (Leontief, 1936) In this works he has built the mathematical foundation describing the flows between sectors of an economy, which was lacking in all previous works, and used this foundation to conduct an empirical research.

Since its inception in 1936, the IO models have grown and encompassed a wide range of applications, in a great deal thanks to the availability of modern computing power. One of the first cases of use of regional IO Models was by Petersen and Moore, when they have developed a regional model for the economy of US state of Utah and have used it to estimate the relative importance of its industries.(Moore and Petersen, 1955). Another example is by Miller, where he has studied what were the impacts of entrance of aluminium production industry into the economy of pacific northwest of the US during the World War II. (Miller, 1957)

The first use of large scale multi regional IO models (MRIO) was the model created by Polenske, which contained 50 US states and Washington D.C. (51 regions) for the year of 1963. Each region of this model contained 79 sectors.(Polenske, 1980)

Examples of multi-regional IO models with regions representing different countries of the world and thus representing international trade include OECD Inter-Country Input-Output (ICIO) Tables, which contain data from 1995 until 2018 and are used in this analysis. (OECD, 2021) Another example of such model are World Input-Output Tables (WIOT), which capture flows between 43 countries of the world for the period between 2000-2013(Timmer et al., 2015). The newest addition to the selection of MRIO are the FIGARO tables, which for the years 2010-2017 cover 64 sectors of 27 EU countries.

One of the evolutions of the standard Leontief IO framework has been the Hypothetical Extraction Method (HEM), which was first developed by (Paelinck et al., 1965) and (Miller, 1966) HEM has been frequently used to estimate an importance of a particular industry within an economy, by hypothetically extracting this industry and computing the resulting decrease of output of the economy.

Song et. at. have used HEM to estimate the importance of the construction sector in various countries with the use of the OECD data over the course of 20 years.(Song et al., 2006) Same team has done the similar HEM analysis using the OECD data and measuring the changes of interdependence of the real estate sector with the rest of the various nations' economies over the period of 30 years. (Song et al., 2006) A recent research by Keček et. al. has estimated the importance of the ICT sector to the growth of the Croatian economy in the period of 2010 - 2015, with the use of the data from Croatian IO table for 2010. (Keček et al., 2019) A general use of HEM for estimating importance of particular sectors for a given economy has been discussed in (Dietzenbacher and Lahr, 2013) and (Dietzenbacher and Miller, 2015)

One application of the HEM has been recently the study of disaster analysis, where a natural disaster is simulated by extracting a sector using HEM. The resulting decrease of output simulates what would have happened in the case of said disaster in economic damages. An excellent overview of the use of HEM in this manner is provided by (Okuyama and Santos, 2014) A very useful comparison of the HEM and CGE disaster impact models has been analysed in article by (Koks et al., 2016)

Recent research has also focused on estimating the industry CO2 linkages, gaining a deeper insight into the production of CO2 in an economy, which is very relevant for the current worsening climate change. Wang et. al. have estimated the CO2 linkage of various Chinese industries with using the IO data for China from 2007. (Wang et al., 2013) An analysis with the use of the same data has been done by Zhao et. al., but they have decomposed this analysis into different regions of the PRC and estimated their CO2 industry linkages. (Zhao et al., 2016) Another recent paper by Sajid et. al. estimated the industry carbon linkages for the different sectors of Indian economy, studying their direct and indirect impacts. This paper uses WIOD data from 2009 for its analysis. (Sajid et al., 2020)

The Global Extraction Method is an evolution of the HEM, where the redistribution of demand for the extracted sectors is done on a global scale, as proposed by a recent paper by (Dietzenbacher et al., 2019) This allows to estimate the impacts of hypothetical extraction on

the global scale. This work applies the methodology of GEM to estimate the interconnectedness of the EU and PRC economies.

Data

Data used for this analysis is the newest version of OECD Inter-Country Input-Output (ICIO) Tables published in 2021 and capturing the trade flows from 1995 up to the year 2018. (OECD, 2021) As this work aims to determine just the degree interconnectedness between EU and PRC and not its changes over time, only data for the year 2018 are used. This data contains 45 unique sectors which are based on the ISIC Revision 4 classification of the industry trade for 66 countries of the world, and one rest of the world aggregate (ROW). The data is arranged into this format as provided by ICIO, shown by Figure a.

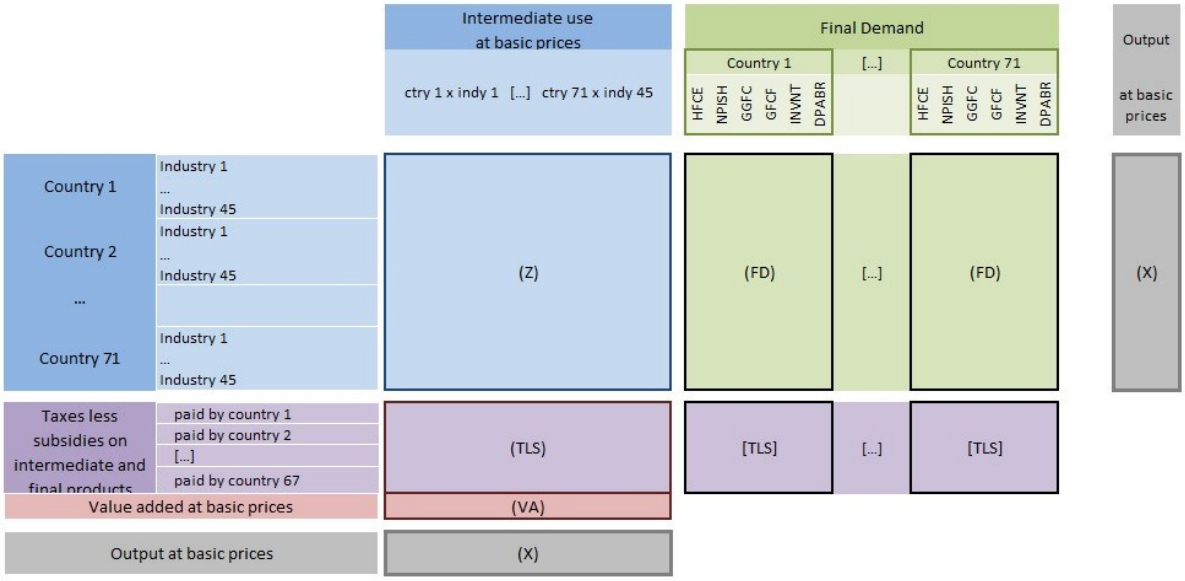


Figure a. Structure of ICIO Table. Source: (OECD, 2021)

Matrix Z is and *Nn* by *Nn* matrix capturing flows between *N* countries, each consisting of *n* industries. These flows represent the intermediate use of output of one sector as an input into the other sector. Matrix of final demand, FD, represents the final demands for products of each industry of each country. TLS matrices represent the Taxes less subsidies on intermediate and final products, and the VA vector represents the values added by each industry to the inputs it has received from another industry.

Figure b contains descriptions of each of the 44 sectors, and links them to the ISIC Rev. 4 category of trade statistics.

Code	Industry	ISIC Rev.4
D01T02	Agriculture, hunting, forestry	01, 02
D03	Fishing and aquaculture	03
D05T06	Mining and quarrying, energy producing products	05, 06
D07T08	Mining and quarrying, non-energy producing products	07, 08
D09	Mining support service activities	09
D10T12	Food products, beverages and tobacco	10, 11, 12
D13T15	Textiles, textile products, leather and footwear	13, 14, 15
D16	Wood and products of wood and cork	16
D17T18	Paper products and printing	17, 18
D19	Coke and refined petroleum products	19
D20	Chemical and chemical products	20
D21	Pharmaceuticals, medicinal chemical and botanical products	21
D22	Rubber and plastics products	22
D23	Other non-metallic mineral products	23
D24	Basic metals	24
D25	Fabricated metal products	25
D26	Computer, electronic and optical equipment	26
D27	Electrical equipment	27
D28	Machinery and equipment, nec	28
D29	Motor vehicles, trailers and semi-trailers	29
D30	Other transport equipment	30
D31T33	Manufacturing nec; repair and installation of machinery and equipment	31, 32, 33
D35	Electricity, gas, steam and air conditioning supply	35
D36T39	Water supply; sewerage, waste management and remediation activities	36, 37, 38, 39
D41T43	Construction	41, 42, 43
D45T47	Wholesale and retail trade; repair of motor vehicles	45, 46, 47
D49	Land transport and transport via pipelines	49
D50	Water transport	50
D51	Air transport	51
D52	Warehousing and support activities for transportation	52
D53	Postal and courier activities	53
D55T56	Accommodation and food service activities	55, 56
D58T60	Publishing, audiovisual and broadcasting activities	58, 59, 60
D61	Telecommunications	61
D62T63	IT and other information services	62, 63
D64T66	Financial and insurance activities	64, 65, 66
D68	Real estate activities	68
D69T75	Professional, scientific and technical activities	69 to 75
D77T82	Administrative and support services	77 to 82
D84	Public administration and defence; compulsory social security	84
D85	Education	85
D86T88	Human health and social work activities	86, 87, 88
D90T93	Arts, entertainment and recreation	90, 91, 92, 93
D94T96	Other service activities	94,95, 96
D97T98	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	97, 98

Figure b Description of industries used in ICIO Table. Source: (OECD, 2021)

The following Figure c describes the 67 countries present in the Dataset.

	OECD countries		Non-OECD economies
AUS	Australia	ARG	Argentina
AUT	Austria	BRA	Brazil
BEL	Belgium	BRN	Brunei Darussalam
CAN	Canada	BGR	Bulgaria
CHL	Chile	KHM	Cambodia
COL	Colombia	CHN	China (People's Republic of)
CRI	Costa Rica	CN1	China - Activities excluding export processing
CZE	Czech Republic - Czechia	CN2	China - Export processing activities
DNK	Denmark	HRV	Croatia
EST	Estonia	CYP	Cyprus[2]
FIN	Finland	IND	India
FRA	France	IDN	Indonesia
DEU	Germany	HKG	Hong Kong, China
GRC	Greece	KAZ	Kazakhstan
HUN	Hungary	LAO	Lao People's Democratic Republic
ISL	Iceland	MYS	Malaysia
IRL	Ireland	MLT	Malta
ISR	Israel[1]	MAR	Morocco
ITA	Italy	MMR	Myanmar
JPN	Japan	PER	Peru
KOR	Korea	PHL	Philippines
LVA	Latvia	ROU	Romania
LTU	Lithuania	RUS	Russian Federation
LUX	Luxembourg	SAU	Saudi Arabia
MEX	Mexico	SGP	Singapore
MX1	Mexico - Activities excluding Global Manufacturing	ZAF	South Africa
MX2	Mexico - Global Manufacturing activities	TWN	Chinese Taipei
NLD	Netherlands	THA	Thailand
NZL	New Zealand	TUN	Tunisia
NOR	Norway	VNM	Viet Nam
POL	Poland	ROW	Rest of the World
PRT	Portugal		
SVK	Slovak Republic		
SVN	Slovenia		
ESP	Spain		
SWE	Sweden		
CHE	Switzerland		
TUR	Turkey		
GBR	United Kingdom		
USA	United States		

Figure c Description of countries used in ICIO Table. Source: (OECD, 2021)

Distinction between MX1 and MX2 is that MX1 contains activities outside of global manufacturing, whereas MX2 contains only these activities for the state of Mexico. Similarly, CN1 excludes activities of export processing, and CN2 contains only these activities for the PRC. For the simplicity, the analysis in this thesis will group these distinctions into one, making CHN aggregate out of CN1 and CN2, and MEX aggregate out of MX1 and MX2

Methodology

This section briefly describes mathematical foundations on which the Input Output (IO) analysis is based, for the correct understanding of the methods used in this work. In the second part of this section the creation and use of the IO models is described.

Mathematical foundations of Input Output Analysis

An IO model describes an economy which consists of *n* sectors. Output of a sector can be expressed by the following equation, describing its distribution among the other sectors of the economy.

$$x_i = z_{i1} + \ldots + z_{ii} + z_{ij} + \ldots + z_{in} + f_i \qquad (1)$$

Term z_{ij} expresses the fraction of the total output of the sector i that is used as an input to the sector j. This is an example of intersectoral trade. Intrasectoral trade happens when the output of a sector is used as an input in the same sector, such case is expressed in the equation by symbol z_{ii}. The term f_i expresses the final demand for the output of sector i, i.e. the output which is used for final consumption and not an input to another sector.

The output of all n sectors of the economy, consisting of outputs of individual industries labelled $x_1,\ldots,x_i,x_j,\ldots,x_n$, with $1<i<j<n$, is then expressed by the following n linear equations:

$$\begin{aligned} x_1 &= z_{11} + \ldots + z_{1j} + \ldots + z_{1n} + f_1 \\ x_j &= z_{j1} + \ldots + z_{jj} + \ldots + z_{jn} + f_j \\ x_n &= z_{n1} + \ldots + z_{nj} + \ldots + z_{nn} + f_n \end{aligned} \qquad (2)$$

This could be compactly expressed as

$$\mathbf{x} = \mathbf{Zi} + \mathbf{f}\,, \qquad (3)$$

x being the vector of total outputs of sectors of the economy, **f** being the vector of final demand of these sectors. **Z** is the matrix of z_{ij} elements, when it is multiplied by **i**, which is a column vector of 1's, it will yield the column sums and thus the equation (2).

This paper uses common practice of notation of vectors with small letters in bold, and of matrices with capital letters in bold.

From the **Z** matrix is constructed matrix **A** which is matrix of technical coefficients. A technical coefficient captures the ratio between the amount of inputs from sector i to sector j, z_{ij} to the total output of sector j, x_j.

$$a_{ij} = \frac{z_{ij}}{x_j} \tag{4}$$

Using this fact, and following the rules of matrix algebra, specifically postmultiplication by a column vector, equation (2) can be rewritten as

$$\begin{aligned} x_1 &= a_{11}x_1 + \ldots + a_{1j}x_j + \ldots + a_{1n}x_n + f_1 \\ x_j &= a_{j1}x_1 + \ldots + a_{jj}x_j + \ldots + a_{jn}x_n + f_j \\ x_n &= a_{n1}x_1 + \ldots + a_{nj}x_j + \ldots + a_{nn}x_n + f_n \end{aligned} \tag{5}$$

By rearranging each of these equations by bringing x to the left side and then factoring out x in each equation, we get:

$$\begin{aligned} (1 - a_{11})x_1 - \ldots - a_{1j}x_j - \ldots - a_{1n}x_n &= f_1 \\ - a_{j1}x_1 - \ldots + (1 - a_{jj})x_j - \ldots - a_{jn}x_n &= f_j \\ - a_{n1}x_1 - \ldots - a_{nj}x_j - \ldots + (1 - a_{nn})x_n &= f_n \end{aligned} \tag{6}$$

Following the rules of matrix algebra, this equals

$$\mathbf{(I - A)x = f} \tag{7}$$

Where **I** is the identity matrix of dimension n, and x is a column vector of output postmultipliyng the (I-A) matrix.

If determinant of (**I-A**) exists, that is, of it is not 0, or the matrix is not linearly dependent, then the inverse $(\mathbf{I-A})^{-1}$ can be found and the equation can be rewritten into:

$$\mathbf{x = (I - A)^{-1} f} \text{ or } \mathbf{x = L\,f} \tag{8}$$

This is the fundamental equation of IO analysis, with the $(\mathbf{I-A})^{-1}$ or **L** being the Leontief inverse matrix.

By changing the values in the final demand vector, this equation will yield the corresponding changes in the output of all of the sectors of the economy.

This model can be easily extended to capture flows between sectors of economies of different countries or economic blocks. Specifically for the purposes of the analysis conducted in this work, where the relationships between economies of European Union (EU) and the People's Republic of China (PRC) are analysed, a three sectoral model will be used, with the regions of EU, PRC, and ROW representing rest of the world countries.

The output of a sector i of EU economy could be expressed as:

$$x_i^E = z_{i1}^{EE} + \cdots + z_{ij}^{EE} + .. + z_{in}^{EE} + z_{i1}^{EC} + \cdots + z_{in}^{EC} + \ldots + z_{i1}^{ER} + \cdots + z_{in}^{ER} + f_i \quad (9)$$

Where term z_{i1}^{EC} expresses the fraction of output of the i[th] sector of EU economy being used in the first sector of the Chinese economy. Term f_i represents the combined final demand of from all three regions.

The relationship between all sectors of all three regions could be represented by these equations

$$\begin{bmatrix} \mathbf{x^E} \\ \mathbf{x^C} \\ \mathbf{x^R} \end{bmatrix} = \begin{bmatrix} \mathbf{Z^{EE}} & \mathbf{Z^{EC}} & \mathbf{Z^{ER}} \\ \mathbf{Z^{CE}} & \mathbf{Z^{CC}} & \mathbf{Z^{CR}} \\ \mathbf{Z^{RE}} & \mathbf{Z^{RC}} & \mathbf{Z^{RR}} \end{bmatrix} * \begin{bmatrix} \mathbf{f^E} \\ \mathbf{f^C} \\ \mathbf{f^R} \end{bmatrix} \quad (10)$$

Matrix $\mathbf{Z^{CE}}$ capturing the flow of products of Chinese industry sectors as inputs into the European industry sectors.

This relationship can be again compactly captured by the same equation as equation (3) :

$$\mathbf{x} = \mathbf{Zi} + \mathbf{f} \quad (11)$$

Similarly, the technical coefficients created from this equation would be of the form

$$a_{ij}^{CE} = \frac{z_{ij}^{CE}}{x_j^E} \quad (12)$$

representing the ratio between the amount of inputs from sector i of PRC economy to sector j of EU economy, z_{ij}^{CE} to the total output of sector j of EU economy, x_j^E.

By analogous approach employed in creation of equations (5),(6) and (7), the equation (11) can be rewritten as

$$\begin{bmatrix} \mathbf{x^E} \\ \mathbf{x^C} \\ \mathbf{x^R} \end{bmatrix} = \left\{ \begin{bmatrix} \mathbf{I} & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{I} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & \mathbf{I} \end{bmatrix} - \begin{bmatrix} \mathbf{A^{EE}} & \mathbf{A^{EC}} & \mathbf{A^{ER}} \\ \mathbf{A^{CE}} & \mathbf{A^{CC}} & \mathbf{A^{CR}} \\ \mathbf{A^{RE}} & \mathbf{A^{RC}} & \mathbf{A^{RR}} \end{bmatrix} \right\}^{-1} * \begin{bmatrix} \mathbf{f^E} \\ \mathbf{f^C} \\ \mathbf{f^R} \end{bmatrix} \quad (13)$$

Creation and the use of IO models.

This section of methodology will describe the use and the creation of various IO models. In this work the standard Leontief IO model is used, as well as its more advanced and modern version, such as with the use of the Global Extraction Method (GEM). In the first part of the analysis, a model with 37 countries, one aggregate for EU, and one aggregate for the rest of the world (ROW) is used. In the second part, model with all 67 countries and ROW aggregate is used.

Use of the Standard Leontief IO Model

The first method simulates demand shocks representing economic sanctions using the standard Leontief model. Values of the total demand in the vector of final demand as well as values of the technical coefficients, representing the intermediate demand, in the A matrix are set to 0, representing a 100% economic sanction levied on both the final as well as the intermediate economic output of the targeted country. When Leontief inverse matrix, computed from this changed A matrix, is postmultiplied by the changed vector of final demand, the vector of new final output is obtained. Then the percentage difference between the original and new final output is created, representing the effect the simulated sanction would have on the targeted economy. Through this is measured the degree of interconnectedness between the two economies, as more interconnected their sectors are, the more severe will be the trade sanctions.

This analysis is conducted at various levels. Firstly, just one sector of an economy is targeted at time. Final and intermediate demand for this one sector are nullified, and the resulting new total output vector is produced. Then vector of percentage change of output of all of the sectors of the economy is computed. This vector captures what effect the targeting of just this sector has on the output of the whole economy. The more interconnected this sector is with

the sanctioning economy, the more its output will decrease, as larger part of its output normally ends up in the sanctioning economy, as opposed to the less interconnected sectors. This demand is now nullified and thus its output decreases

Furthermore, the more the targeted sector is interconnected *within* its home economy, the larger will be the spill-over effects of decreased output onto its adjacent sectors, as the decreased output by the targeted sector, caused by the sanctions, decreases its demand for products of its adjacent sectors in its home economy, thereby in turn decreasing their output. As the final step, the total decrease of economic output of the whole economy is computed, to show what is the total effect, not just the sector-wise effect of a single sanction.

The second level of this analysis is conducted by sanctioning all of the sectors of the targeted economy. This is done to measure what is the highest damage that can be caused by economic sanctions on the given industries. In this approach, all final as well as all intermediate demands for the outputs of all sectors of the targeted economy are set to zero. The Leontief inverse, computed from the changed A matrix of intermediate demands, is postmultiplied by the changed vector of the final demand. The resulting vector of total output is then compared with the original, to compute the percentage change caused by the sanctions. Then the effect on the whole economy is computed from the individual industries, to evaluate what would be the effect of the full sanction and the whole economy.

Description of the model.

The standard Leontief IO model created for the purposes of this analysis consists of 37 countries and two country aggregates EUR and ROW, representing the 28 EU economies together, and representing rest of the world countries together, respectively. This was done for easier understanding of what would be the effects of joint sanctions of EU bloc on China and vice versa. This 39 by 39 country model was created from the original data with the help of the R programming language using the R studio IDE.

For the purposes of this analysis, the sanctions have been levied only by the EU28 block, and not by its partners, such as USA, Japan, South Korea et, as was seen after the Russian invasion of Ukraine in February 2022. This was done to determine what would be effect of the EU sanctions *alone*, to better understand its interconnectedness with the Chinese economy, and thus the leverage on it EU has.

The analysis is conducted both ways. Firstly, sanctions are levied on the Chinese economy by the EU bloc. Firstly the effects of sanctions on a single industries are measured, then the effect of sanction on all industries simultaneously is simulated, to see the maximal effect possible. Then the same analysis is conducted in reverse, that is, China is levying sanction on the whole EU block.

In this analysis, only full, 100% sanctions have been applied, both in the case of targeting single, as well as all industries. In the analysis conducted in the article Expanding extractions, the authors concluded that the relationship between percentage decrease of demand, (the size of the sanction) and percentage decrease of output is "very nearly linear".(Dietzenbacher and Lahr, 2013) Thus, the analysis in this work by levying 100% sanctions can be seen as a benchmark, to see the maximum possible effects of single as well as multiple sanctions, and from this estimate partial, e.g. 60% level sanctions when needed.

Use of the Global Extraction Method

The second method used in this analysis is the application of the Global Extraction Method (GEM). GEM can be thought of as an evolution of the standard Leontief IO model, with more realistic characteristics.

In this model, when a sanctioning country (e.g., PRC) decreases its demand for intermediate and final outputs of the targeted country, its own industries will be lacking the inputs they need for their production, and this will lead to decrease of their output. The more realistic assumption of the GEM model, compared to the standard IO model, is that these industries will redistribute their demand for the targeted EU aggregate's sector into the corresponding sectors of the rest of the world., and thus replenishing the inputs they need for their production.

Mathematical basis of this model.

The demands of the industries of the sanctioning country, in this case PRC, will be redistributing their demand according to this equation:

$$\bar{a}_{kj}^{SC} = a_{kj}^{SC} + a_{kj}^{EC} * \frac{a_{kj}^{SC}}{\sum_{R \neq E,C} a_{kj}^{RC}}$$

Term a_{kj}^{SC} represents ratio of dollar amount of inputs from industry k in country S, representing any country aside from EU and PRC to the total amount of output produced by industry j of the PRC valued in monetary terms. The term $\bar{a}_{kj}^{SC}$ represents the change in the original coefficient, caused by the redistribution of the original demand of PRC for the k[th] EU sector among the rest of the world countries.

Similarly, the demand for the final products of the [kth] industry is redistributed as well.

$$\bar{f}_k^{SC} = f_k^{SC} + f_k^{EC} * \frac{f_k^{SC}}{\sum_{R \neq E,C} f_k^{RC}}$$

However, as these sanctions are levied only by China, and not the other countries of the world, and the demand of the EU for its own industries realistically will not change, these intermediate as well final demands will remain unchanged.

$$\bar{a}_{kj}^{EA} = a_{kj}^{EA} \ \forall A \neq C$$

$$\bar{f}_k^{EA} = f_k^{EA} \ \forall A \neq C$$

Analysis with the use of GEM IO model is conducted in a similar fashion to the method using standard Leontief IO model. The individual sectors are targeted first, to see the relative importance as well as interconnectedness of each sector with the targeted economy.

However, the percentage decreases of the output of the targeted sectors should be according to theory lower than in the standard case. This is because although the intermediate, as well as final demand for the products of the targeted industry is nullified, the demand for the corresponding industries in the rest of the countries of the world are increased (except for the sector of the targeting industry). As the industries are connected with each other world-wide, this increase of demand for the corresponding sectors will inadvertently lead to albeit small, but still a non-zero increase of demand these sectors of the rest of the world have for the original targeted sector. This increase of demand will not replenish fully the lost demand

caused by the sanctions, but it will still lead to a higher demand that in the case of the standard Leontief model, and thus a lower loss of output.

Similarly to the standard IO method, in the second part of the analysis sanctions on all sectors of the targeted economy are levied, and the demand for the final and intermediate outputs of the targeted sectors are redistributed among the corresponding sectors of the rest of the world. The resulting change in the output of the whole economy is computed, to draw comparison with the first method.

Use of the GEM IO Model with individual 28 EU member states

As a last step of this analysis, an additional IO model has been created. This model consists of 66 countries of the world and one rest of the world (ROW) aggregate. It is essentially the raw ICIO data, but the MX1 and MX2, CN1 and CN2 are still compiled into one aggregate for each country as with the previous models.

The previous models helped to create a general picture of what would Chinese sanctions cause to the EU economy at large, and this model will help to illuminate these effects more precisely, by looking at each member state individually.

In this analysis, each member state will in turn be hit in all of its sectors by 100% Chinese sanctions and PRC's sectors will redistribute demand lost caused by targeting these sectors. However, this will be done by increasing demand for the corresponding industries in the countries outside of the EU, as it is not likely that China would sanction one EU country, and at the same time would increase its demand for the products of the other.

Mathematical notion is similar, but stressing that the redistribution of demand is not applicable to the member states of the European Union, with EU being the set of 28 member states in the following equations:

$$\bar{a}_{kj}^{SC} = a_{kj}^{SC} + a_{kj}^{EC} * \frac{a_{kj}^{SC}}{\sum_{R \neq E,C,EU} a_{kj}^{RC}} \; , S \notin EU$$

$$\bar{f}_{k}^{SC} = f_{k}^{SC} + f_{k}^{EC} * \frac{f_{k}^{SC}}{\sum_{R \neq E,C,EU} f_{k}^{RC}} \; , , S \notin EU$$

The results will then compare how much is each EU member state economy susceptible to Chinese sanctions, as well as show what would be the spillover effects between the member states.

Geopolitical context

Measuring the degree of interconnectedness between world economies has become more and more important in the recent decades. The event of globalisation and the second unbundling has caused rapid distribution of supply chains across the many countries of the world. Nowadays, the vast majority of goods is produced from inputs from different countries of the world. The rapid decrease of transportation costs has significantly helped to this.

Traditional measures of economic performance, such as trade balance between countries, are no longer being sufficient, as the goods in their production process travel through borders multiple times, and these traditional measures do not capture this fact, and even distort it. New values, being based on the value added in the manufacturing country, are being considered as a much better alternative. (Timmer et al., 2013)

The effect of increased internalisation of production and trade has had a positive impact overall and has increased the growth of the world GDP.

However, there is also other side to this fact of interconnectedness. The more two countries are interconnected with each other, the more they share both positive and negative impacts. The decrease of output in one economy, for instance caused by a natural disaster, will cause decrease of output in the economy which is interconnected with it to a large degree.

This fact is not only a passive occurrence but can be also used actively by policy makers as a coercive measure.

Recent geopolitical events

The ongoing invasion of Ukraine by the Russian federation has prompted rapid and significant implementation of economic sanctions by multiple countries of the world on the various sectors of the Russian economy. These sanctions are aimed to cause significant economic damage in Russia and remove its capability of waging a prolonged war conflict. Furthermore, these sanctions also send a message to Russian Federation, that the international community will not tolerate its actions breaching the international law and its norms existing since the end of the second world war. (“A new age of economic conflict,” 2022)

But this is not the first case of the use of economic sanctions in the recent history. Economic sanctions have been used in various instances by international community over the past few decades, usually targeting dictatorial, or dangerous states for the international community, the likes of North Korea and Islamic republic of Iran, with their aggressive rhetoric and proactive nuclear armament programs. But the sanctions against RF have been the biggest in history, and rightfully so, for its attack of another sovereign country, and the atrocities its soldiers commit on the occupied territory.

Geopolitics of China

In the recent years, China has become more assertive in its foreign policy, in diplomatic ties, and in its power projection. It has expanded its military control over the South China Sea. It has sought control over its special administrative region (SAR) of Hong Kong, has abused human rights of its minority group of Uyghurs and has actively threatened Taiwan, both by aggressive rhetoric and frequent displays of military power across the Taiwan strait. These actions raise concerns about the future actions of PRC, and their consequences for the world.

Since the middle of 2010s, PRC has reclaimed more than 2000 acres of land by building numerous islands in the South China Sea (SCS). This comes as PRC is claiming 90% of the waters of the SCS, known as the 9 or 10 dash line, a claim which is being contested by other surrounding countries such as Vietnam, Philippines etc. (Clover, 2015) The Chinas' claim was furthermore overruled by the Arbitral Tribunal, stating that PRC had no basis in international law for its claims. (Blinken, 2021)

In spite of this, in the recent years PRC has fully militarised at least three of these newly build islands, by equipping them with anti-ship and anti-aircraft systems, fighter jets and other advanced military technology, as reported by AP interview with U.S. Indo-Pacific commander Adm. John C. Aquilino.(Gomez and Favila, 2022) These actions can have a strategic reason both from an economic standpoint, as a large volume of international trade flows though the SCS, therefore securing it is of vital importance for PRC, as well as military reason, PRC securing its southern sea border and expanding its power projection in this region.

PRC's actions in HK

Another case of PRC's desire of control is the passage of new legislative bills in Hong Kong. Hong Kong (HK) has been PRC's special administrative region (SAR) since 1997, when it was handed over from the United Kingdom, under the system of one country, two systems. This system was guaranteed by the Joint Declaration signed by both United Kingdom and PRC. The conditions of this declaration were to ensure that the economic and social systems guaranteeing the freedom of speech, assembly, press etc. will remain unchanged at least for 50 years, that is, until 2047. ("The Joint Declaration," 1984) This arrangement has allowed HK some degree of independence from the mainland and has kept many parts of the legal system and administrative structure it has inherited from the times of being colony of United Kingdom. (Chan, 1997)

However, the recent actions of PRC have eroded this agreement. In early 2019, the Hong Kong (HK) administration started working on so called Extradition bill, which would allow to extradite Hong Kong citizens to mainland China for a criminal trial. This has caused serious fears in the Hong Kong society, as it was widely seen that this law could allow PRC to curb dissent against it by prosecuting democratic opposition in HK in the mainland Chinese courts, operating under a different and harsher legal system towards protest and dissent. Furthermore, this law could be used to extradite PRC's political dissidents who have fled to KH back to mainland China.

This proposed bill has caused early protest in May 2019, which were numbering by thousands of people. (Liu and Wong, 2019) Only after months of protests, HK government under the leadership of Chief Executive Mrs. Carrie Lam has indefinitely delayed the bill but has not withdrawn it. This has sparked new wave of opposition, and the protests grew to encompass not only the public disagreement with the new proposed bill, but also against what the public has perceived as erosion of its freedoms, after years of proposed legislative amendments aimed to curb dissent of the public.

Throughout the summer, the HK police became increasingly using excessive force by frequent use of pepper spray or rubber bullets on both violent as well as peaceful protestors.(Purbrick, 2019) The police brutality was especially visible when police has attacked protesters returning home at Prince Edward Station.(Jha, 2020)

Eventually, the violent protests have led to the withdrawal of the bill on the 23rd of October 2019(Pang and Siu, 2019) However, in June 30th 2020, the national security law was passed

by the parliament in Beijing which effectively replaces the shelved extradition bill. This bill was crafted without the knowledge of HK administration, as the leadership grew frustrated with its failure of passing of the extradition bill, and the subsequent lack of action.

This bill is even more radical and enables serious charges to be pressed against people who would be demonstrating against government in HK. The penalties for these charges could extend up to life in prison, furthermore, serious cases could be again extradited to mainland China, where they could face execution.(“A new national-security bill to intimidate Hong Kong,” 2020)

This shows that the political leadership of CCP is determined to cement its rule over HK, disregarding the agreement it has signed with UK regarding HK legal structure. It will do so despite popular unrest, by curbing it with police brutality.

PRC's actions in its province of Xinjiang

In the autonomous province of Xinjiang in the northwester part of PRC lives currently about 11 million of ethnic minority of Uyghurs. From these, approximately one to two million have been detained in detention camps, which Chinese authorities have called "vocational training centres", since April 2017. Many of people in these detention centres do not have any formal charges pressed against them, and neither they have any legal means of challenging their detention. Detainees are required to pledge loyalty to the CCP, renounce Islam and learn mandarin. Many of these detention centres practice forced labour, which was controversially used by many brands. Uyghurs who have not been detained are subjected to mass surveillance, with frequent ID and fingerprint checks by police officers inside of cities. Mass use of surveillance cameras has been also applied, and the resulting data is fed into the AI neural net, which is to flag suspicious behaviour.(Maizland, 2021) These actions have arisen as a response to terrorist attacks, but has since according to many rights groups as well as US and EU outgrown into genocide. (Cameron-Chileshe and Shepherd, 2021; Sevastopulo and Williams, 2021)

This case shows that is the CCP perceives some ethnic group as a threat, it will subject its members to a very hard conditions, either detaining them or subjecting them into life in a surveillance state.

Both of these cases, the violent suppression of dissent in HK and the treatment of Uyghurs, are important to bear in mind when assessing the Chinese policy towards Taiwan, as they

provide a glimpse of what would be the CCP's treatment of popular dissent in Taiwan were it to gain sovereignty over the island.

Relations between PRC and Taiwan

PRC has since the beginning of its statehood in 1949 claimed that it has rule over all Chinese territories and has thus considered Taiwan to be its province and not a sovereign country of its own, but it has not invaded Taiwan in the last 70 years and has over time stated to build mutually beneficial economic ties with it.

However, the PRC's rhetoric of One China policy is once again increasing in its intensity, and now it is backed up by show of military force. In 2015, Chinese broadcaster has shown the images of Chinese army, PLA, practicing a drill of invading what resembled presidential palace in Taipei, the capital of Taiwan.("Palace Intrigue," 2015) Between 1st and 4th October 2021, PRC has flown over a hundred of military aircraft into the Taiwan's air defence indication zone (adiz). In response, Taiwan had to scramble fighter jets multiple times to respond to this threat. ("Too close for comfort," 2021) Recently, a Chinese naval aircraft carrier has sailed thought the Taiwan strait, as a show of force, just hours before the Xi Biden call. (Lee, 2022)

These actions and many more could be seen as desire of CCP to projects its power and signify that it is capable of successfully invading Taiwan, should its government drift too far off from what CCP deems acceptable. Furthermore, to signify the PRC readiness to engage foreign forces in pursuit of reunification, Chinese air force was also simulating attacking US aircraft carrier earlier that year.(Hille and Sevastopulo, 2021a) All of these actions have been raising alarm bells in Taipei, fearing that although the imminent invasion of Taiwan by PRC is not most likely, in a few years PRC will have more military capabilities and would suffer less costs by attacking Taiwan, thus making the attack more likely. (Hille and Sevastopulo, 2021b)

All of these actions could be seen as a desire of China to seem capable of invading Taiwan, to pressure Taiwanese political scene into compliance and submission, as well as to send a message to the United States and European Union, to mark its sphere of influence, while at the same time not conducting the invasion itself, as it could have daring consequences.

However, the same line of thinking was applied to the case of Russian relations towards Ukraine. Majority of experts thought that Russia was just creating pressure on the Ukrainian

government by the large manoeuvres of the military technology near its borders, and by recognising the separatist regions in the east of Ukraine.

If the PRC would decide and eventually succeed in the invasion of Taiwan, the consequences for the Taiwanese democracy would be very grim. CCP has shown though its treatment of Uyghurs and the democratic movement in HK that it will not stop at anything in pursuit of keeping order in society, adherence to the values of the CCP by the population, and curbing of dissent. Similar measures which were conducted in HK would be most likely deployed in Taiwan and its democratic nature would disappear.

This begs the question, what should be the response of the international community, were the PRC directly attack Taiwan, as Russia has attacked Ukraine? What would be the most efficient response in terms of the economic sanctions? The results of this thesis help to find some answers to this kind of problem. By empirically analysing which sectors of the Chinese economy are most interconnected with the economy of the EU, EU policymakers can gain knowledge of on which sectors the sanction should be applied, as to cause the most of economic damage.

Geopolitics of EU

The opposite site of the analysis is also relevant. In recent years, China has frequently expressed displeasure of the EU member states' warm relations with Taiwan, or their criticising of PRC's record of curbing democratic dissent and violating human rights of its minorities.

PRC's relations with Lithuania.

Lithuania has in May of 2021 as the first European country withdrawn from the 17+1 platform, a Chinese - Eastern European format of dialogue and economic ties, after it has criticised China for not delivering on its economic promises and using the platform for pr purposes. Instead, it has decided to upgrade its economic ties with Taiwan, based on the common democratic values. This has resulted in Lithuania and Taiwan jointly agreeing to establish representative offices in each other's capital cities. The Taiwanese office was ought to be called " Taiwanese Representative Office", which is in contrast to other Taiwanese representative offices in EU which bear name Taipei instead of Taiwan. This has angered PRC, as it suggests de jure Lithuania creating diplomatic relations with Taiwan as an

independent country, and not Taipei as the capital of PRC's province. Because of this, China has decided to recall its ambassador from Lithuania.(Shepherd et al., 2021) This dispute has further intensified in the coming months, with PRC further downgrading its diplomatic relations with Lithuania and culminating into de facto imposing a ban on exports from Lithuania since December 2021. This move by PRC was challenged by Brussels at WTO. (Bounds et al., 2022) This shows that PRC will use coercive economic measure to punish countries which go against its increasingly hard-line One China Policy, by showing any recognition of Taiwan as an independent country.

PRC's relations with Norway

Similar case has occurred when the Norwegian committee awarded the Nobel peace prize in October 2010 to Chinese political dissident Liu Xiaobo, who was at the time imprisoned in PRC. Liu Xiaobo has been a lifelong prominent democratic and human rights activist, both in and outside of China, and has been for his activities jailed numerous times in PRC. Awarding a Nobel peace prize to him has resulted in PRC banning the import of Norwegian salmon, causing the Norwegian market share of salmon exports to PRC falling from 92% to 29%. (Milne, 2013)

These actions signal fear that PRC might in the future use these coercive trading measures against the EU member states in order to punish them for their actions. EU policy makers should have information on what sectors of the EU economy are most interconnected with those of PRC, and thus, what sectors would be most severely hit by PRC's sanctions, responding to the actions of EU member states. This can provide a valuable insight, and an impetus for drive for EU's greater diversification of its supply chains, as to be less likely to be severely hit.

Analysis of the results

Standard IO model

Sanctions of European Union on the Peoples' Republic of China

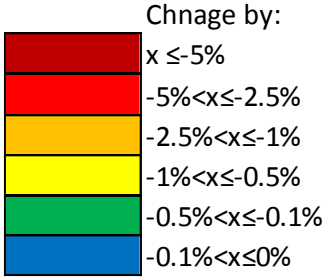
The first part of the results compares the effects of a 100% sanction on just one sector of the PRC's economy levied by the aggregate of 28 EU counties, between different sectors of the PRC economy. The full results of this format are presented in the Table 1.

Targeted sector	Resulting effect on the targeted sector	Targeted sector	Resulting effect on the targeted sector
CHN_01T02	-0.161657888	CHN_35	-8.50685E-09
CHN_03	-0.017206548	CHN_36T39	-3.4063E-08
CHN_05T06	-1.52850952	CHN_41T43	-1.37829E-10
CHN_07T08	-0.226903497	CHN_45T47	-1.33207849
CHN_09	-0.493512758	CHN_49	-1.342500145
CHN_10T12	-0.639860168	CHN_50	-2.918916713
CHN_13T15	-7.166518222	CHN_51	-2.952411339
CHN_16	-1.20514006	CHN_52	-1.42192261
CHN_17T18	-0.440199086	CHN_53	-0.006245714
CHN_19	-0.116384546	CHN_55T56	-0.171503689
CHN_20	-1.662148283	CHN_58T60	-5.053680516
CHN_21	-1.847687016	CHN_61	-0.450852434
CHN_22	-2.446620923	CHN_62T63	-3.104499487
CHN_23	-0.755999056	CHN_64T66	-0.147860396
CHN_24	-0.500027757	CHN_68	-0.051388751
CHN_25	-2.792989899	CHN_69T75	-1.103728906
CHN_26	-8.050931525	CHN_77T82	-0.456553229
CHN_27	-4.604153928	CHN_84	-9.53389E-11
CHN_28	-2.372083917	CHN_85	-0.003469084
CHN_29	-0.594822894	CHN_86T88	-0.015462117
CHN_30	-4.389298297	CHN_90T93	-0.61225379
CHN_31T33	-7.320880696	CHN_94T96	-0.031552335

Table 1. Effects singular EU sanctions on PRC industry sectors

The more the targeted CHN sector is interconnected with the sectors of the aggregate EU 28, the more severe will be the effects of the sanctions, as more of its intermediate and final output is demanded by these EU sectors.

Legend:



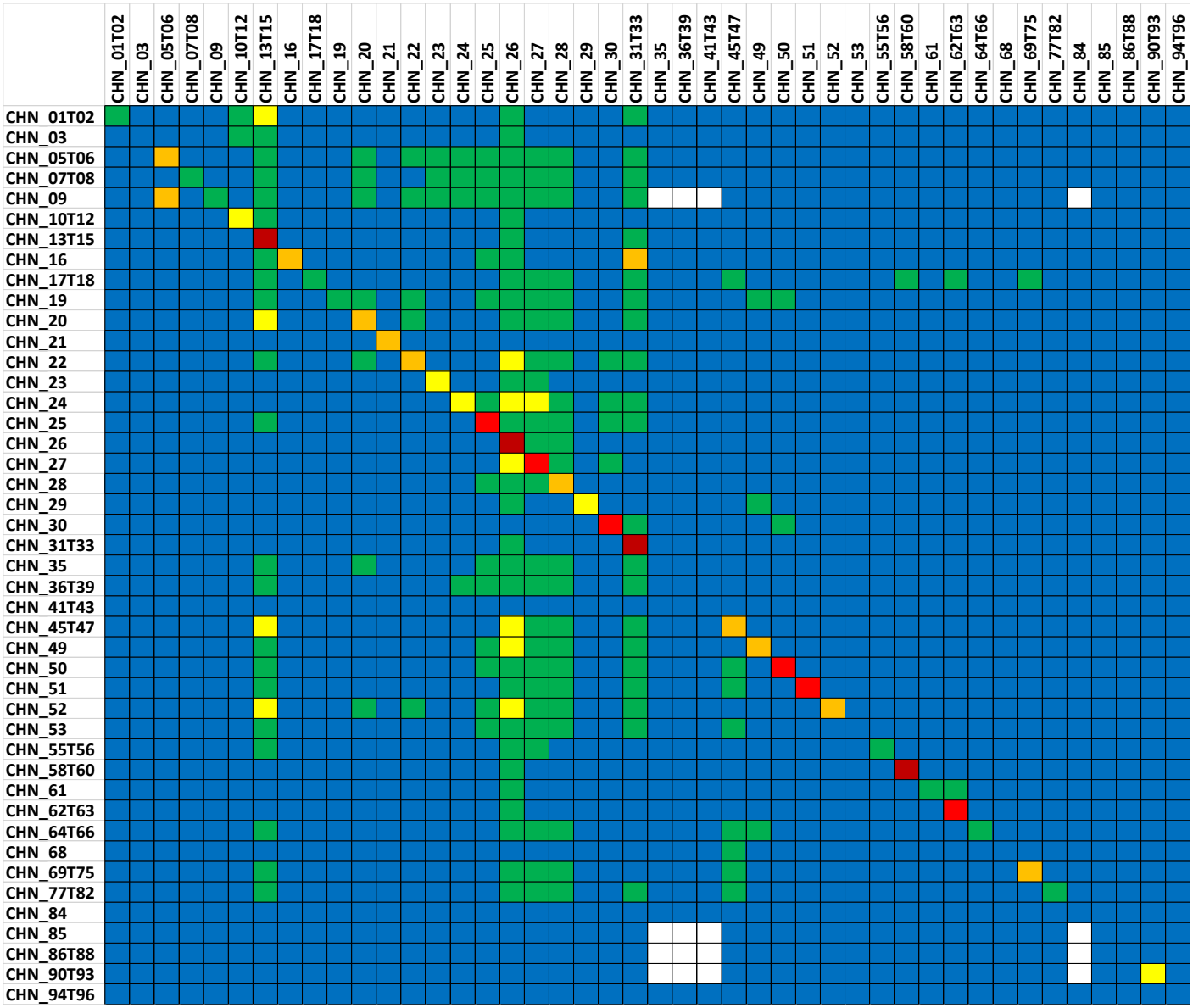


Table 2. Heatmap of the effects EU sanctions on PRC industry sectors.

The most severely affected sectors were Computer, electronic and optical equipment CHN_26, which after being sanctioned at 100% level would suffer decrease of 8.05%. Sector representing Manufacturing nec; repair and installation of machinery and equipment CHN_31T33 would decrease by 7.32%. Sector representing Textiles, textile products, leather and footwear, CHN_13T15, would decrease by 7.17%.

The results have been compiled into a heatmap in Table 2 for easier representation of complex data capturing the spillover secondary effects between sectors. The legend of the heatmap is the same as the one of the Table 1.

Each column's name represents which PRC's sector was targeted with a 100% sanction, and rows capture the effects the sanctioning of this sector had on all of the other sectors in the PRC's economy.

A clear diagonal of the most severely hit sectors from the top left to the bottom right can be seen. This is logical, as the most damaged sectors will be those which have been targeted.

Equally interesting are vertical lines, which represent the secondary, spillover effects of the sanctions. These spillover effects represent the interconnectedness of the targeted sector with the rest of the sectors in the targeted economy. The more these sectors are interconnected, the larger these effects will be.

Targeting sectors CHN_13T15, CHN_26, CHN_27, CHN_28 and CHN_31T33 causes the most spill over effects into other sectors of the economy. Sector CHN_13T15 represents Textiles, textile products, leather and footwear, and targeting this sector will cause negative spillover effects into the sectors of agriculture and hunting CHN_01T02, chemical products CHN_20 and rubber and plastic products CHN_22, which most likely produce inputs into its production. Furthermore, targeting this sector will also have negative spillover effects into the sectors of warehousing and support activities for transportation CHN_52 and sector of wholesale and retail trade CHN_45T47, representing the service sectors associated with the logistics of the goods produced by the targeted sector.

Sectors CHN_26 and CHN_27 represent Computer, electronic and optical equipment, and Electrical equipment respectively. Targeting these strategic high-tech sectors would cause decrease in production of the sectors of rubber and plastic products CHN_22, other non-metallic mineral products CHN_23 and basic metals CHN_24 which represent inputs into their production. Furthermore, as with the case of the sector CHN_13T15, sectors representing supporting logistic activities, CHN_45T47, CHN_49, CHN_52, for the products of these targeted sectors would be also negatively hit.

Another output of this model is estimation of how much would the whole CHN economy contract if just one of its sectors would be targeted with a 100% sanction from the EU. This shows a comparison of how important are individual sectors for the whole Chinese economy. These results are presented in Table 3. The sectors which would cause decrease of CHN economy by or more than 0.1% have been colour coded in red.

Targeted Sector	Resulting effect on the whole CHN economy	Targeted Sector	Resulting effect on the whole CHN economy
CHN_01T02	-0.014757098	CHN_35	-9.0492E-09
CHN_03	-0.000206061	CHN_36T39	-9.2956E-09
CHN_05T06	-0.055111858	CHN_41T43	-9.0492E-09
CHN_07T08	-0.004681838	CHN_45T47	-0.124655659
CHN_09	-0.001070779	CHN_49	-0.067238102
CHN_10T12	-0.066200516	CHN_50	-0.023217314
CHN_13T15	-0.528285317	CHN_51	-0.022962066
CHN_16	-0.01645542	CHN_52	-0.01564901
CHN_17T18	-0.01159699	CHN_53	-4.17201E-05
CHN_19	-0.003915661	CHN_55T56	-0.007313727
CHN_20	-0.112789683	CHN_58T60	-0.025583043
CHN_21	-0.040382754	CHN_61	-0.006452179
CHN_22	-0.089128974	CHN_62T63	-0.055049145
CHN_23	-0.04628584	CHN_64T66	-0.006057719
CHN_24	-0.046055217	CHN_68	-0.002102718
CHN_25	-0.146052337	CHN_69T75	-0.045535382
CHN_26	-0.668463656	CHN_77T82	-0.023985646
CHN_27	-0.287318961	CHN_84	-9.0492E-09
CHN_28	-0.190828535	CHN_85	-9.16324E-05
CHN_29	-0.041069657	CHN_86T88	-0.000370067
CHN_30	-0.069261717	CHN_90T93	-0.004113967
CHN_31T33	-0.203308931	CHN_94T96	-0.000451057

Table 3. Effects of singular EU sanctions on the whole PRC economy

Targeting sector CHN_26 would bring about the biggest contract of the CHN economy, estimated to be around -0.67%. The other most susceptible sector to aggregate EU sanctions is CHN_13T15, which would cause the contraction of the whole PRC's economy by -0.53%.

This result can be explained by the fact that these two sectors were both most interconnected with the economy of EU aggregate, as well as most interconnected within the PRC's economy.

In the second part of this analysis, all of the PRC's sectors have been targeted by 100% sanctions, to estimate the maximum possible effect the aggregate of EU can have on the PRC. These results are presented in the Table 4. Such action would cause the whole PRC's economy to contract by about -3.07%.

CHN sector	Effect of the sanctions	CHN sector	Effect of the sanctions
CHN_01T02	-2.1071459	CHN_35	-2.3367708
CHN_03	-1.0499872	CHN_36T39	-1.872372
CHN_05T06	-4.3170601	CHN_41T43	-0.0144204
CHN_07T08	-2.8487752	CHN_45T47	-3.5488612
CHN_09	-4.6829389	CHN_49	-3.7408528
CHN_10T12	-1.6694028	CHN_50	-5.1238138
CHN_13T15	-8.2187383	CHN_51	-4.9623813
CHN_16	-4.1951886	CHN_52	-4.1693673
CHN_17T18	-3.083222	CHN_53	-2.8660799
CHN_19	-3.0274598	CHN_55T56	-1.4466411
CHN_20	-4.8010958	CHN_58T60	-5.6009967
CHN_21	-2.1505287	CHN_61	-1.4430603
CHN_22	-5.578224	CHN_62T63	-3.986769
CHN_23	-1.6668773	CHN_64T66	-2.0414664
CHN_24	-3.4180234	CHN_68	-0.658685
CHN_25	-4.5793657	CHN_69T75	-2.9214457
CHN_26	-8.8863163	CHN_77T82	-2.6249832
CHN_27	-6.3750112	CHN_84	-0.0305478
CHN_28	-3.6394223	CHN_85	-0.04772
CHN_29	-1.4129271	CHN_86T88	-0.0578747
CHN_30	-5.2205057	CHN_90T93	-0.8985173
CHN_31T33	-8.0435087	CHN_94T96	-0.5819469
Total effect on the whole PRC economy:			-3.07283

Table 4 Effects of EU sanctions on all of the PRC industrial sectors simultaneously

The results of this analysis show that the most interconnected sectors of the PRC's economy with the economy of EU are the hight tech sectors, particularly the sectors of production of electrical equipment and manufacturing. This can be easily explained, large parts of electronic equipment sold in the EU is produced in the PRC. If all member states of the EU were to levy 100% sanctions on all of the sectors of CHN economy, they would cause its output to contract by 3.07%

Sanctions of the Peoples' Republic of China on the European Union aggregate

The standard IO model was used again for the case of PRC levying sanctions on the aggregate sectors of EU economy. As with the previous example, first results describe what would be the effects of a 100% sanction on just one sector of EU economy and make a comparison between the EU sectors to see their differences. Results capturing these effects are represented in the Table 5.

Targeted Sector	Resulting % effect in the targeted sector	Targeted Sector	Resulting % effect in the targeted sector
EUR_01T02	-0.490148908	EUR_35	-0.052822202
EUR_03	-0.32222603	EUR_36T39	-0.080213305
EUR_05T06	-7.363873375	EUR_41T43	-0.029493835
EUR_07T08	-2.767879986	EUR_45T47	-1.217121242
EUR_09	-0.547220598	EUR_49	-2.111839255
EUR_10T12	-1.343392624	EUR_50	-7.820523823
EUR_13T15	-4.616024415	EUR_51	-3.982964149
EUR_16	-1.212937957	EUR_52	-0.887990408
EUR_17T18	-1.547060121	EUR_53	-0.082861557
EUR_19	-0.603760605	EUR_55T56	-0.84705691
EUR_20	-3.696901562	EUR_58T60	-1.52580853
EUR_21	-4.14384219	EUR_61	-0.223306146
EUR_22	-1.592604944	EUR_62T63	-1.234664043
EUR_23	-1.10060465	EUR_64T66	-0.238384096
EUR_24	-2.646632292	EUR_68	-0.116964924
EUR_25	-2.645171539	EUR_69T75	-0.69507358
EUR_26	-6.200950475	EUR_77T82	-0.76170103
EUR_27	-4.383021053	EUR_84	-0.024698336
EUR_28	-4.876851444	EUR_85	-0.506524563
EUR_29	-4.273299106	EUR_86T88	-0.024452834
EUR_30	-7.562960403	EUR_90T93	-1.410098394
EUR_31T33	-0.861443295	EUR_94T96	-0.102522423

The most affected sectors would be Water transport EUR_50, with decrease by -7.8%, Other transport equipment EUR_30, with decrease by -7.56%, Mining and quarrying, energy producing products EUR_05T06, with decrease by -7.36% and Computer, electronic and optical equipment EUR_26, with decrease by -6.2%.

Table 5. Effects singular PRC sanctions on EU industry sectors

The case of largest decreases in the Water Transport could be explained by a large current Chinese demand for the European water shipping services, e.g. many shipping companies might be registered in EU. The case of large decrease in the sector of mining of energy products will be looked into in more detail in the 3rd part of the analysis.

Another interesting result of this analysis is at the sectors ranging from EUR_26 to EUR_30, which represent the majority of the manufacturing with a high value added, such as manufacture of electrical equipment or computer technology and various machinery and vehicles. If any of these sectors would be targeted by a 100% sanction from PCR, their output would decrease at least by 4.27% in the case of EUR_29 up to 7.56% in the case of EUR_30. This suggests that a comparatively larger part of output of these sectors is exported to PRC, and thus these sectors are more susceptible to the PRC's sanctions than the other groups of sectors of EU economy. For a comparison, only part of the PRC's high tech sectors have been this badly hit, most damage was mainly in manufacture of electronical equipment, but the sectors of machinery and vehicle manufacturing would be less badly hit, they would contract by 2.37% and 0.59% respectively.

To capture the spillover secondary effects of targeting individual EU sectors, a heatmap was constructed, presented in Figure 2. The columns represent the EU sectors which have been targeted by a 100% sanction from PRC, and rows show the impact of this sanction on all of the sectors of the EU economy.

When drawing a comparison with the PRC's economy, EU economy would have a slightly less spillover effects, by the number of sectors affected. The most spillover effects would occur by targeting sectors EUR_20, EUR_28, and EUR_29.

Targeting sector EUR_20, Chemical and chemical products, would cause secondary effects among others in Mining and quarrying, non-energy producing products EUR_07T08, Coke and refined petroleum products EUR_19 and Mining and quarrying, energy producing products EUR_05T06, all of which represent inputs into its production. (oil gas, and other organic chemical s are required as an input ,along with inorganic chemical inputs produced by these sectors)

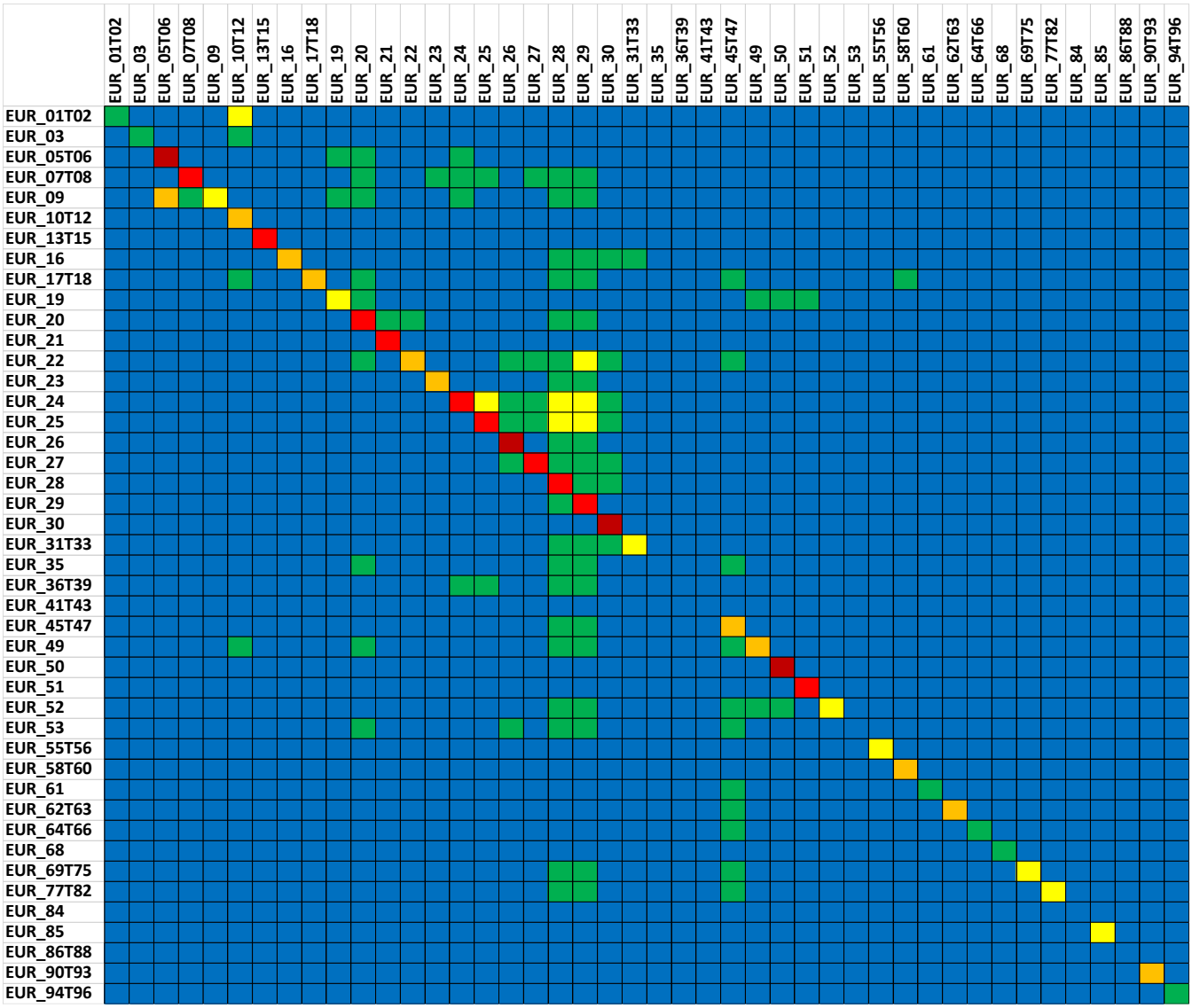


Table 6. Heatmap of the effects PRC sanctions on EU industry sectors.

Targeting sectors EUR_28 and EUR_29, which are Machinery and equipment, nec and Motor vehicles, trailers and semi-trailers respectively, would cause spillover effects among others in sectors of Rubber and plastics products EUR_22, Basic metals EUR_24, Fabricated metal products EUR_25 and Mining and quarrying, non-energy producing products EUR_07T08, which represent inputs into their production. Furthermore, targeting of these sectors will cause spillover effects into service sectors such as Warehousing and support activities for transportation EUR_52, representing their logistic services.

Next, the overall effects of sanctioning just one aggregate EU sector on the whole EU economy are analysed in the next table. The largest overall decrease of the EU economy, by 0.24%, would happen if the EUR_29 sector, Motor vehicles, trailers and semi-trailers, would be targeted. The second and third biggest contractions of 0.21% and 0.19% would be caused

by Machinery and equipment, nec, EUR_28, and Wholesale and retail trade; repair of motor vehicles, EUR_45T47, respectively.

Targeted sector	Resulting effect on the whole EU economy	Targeted sector	Resulting effect on the whole EU economy
EUR_01T02	-0.014361341	EUR_35	-0.002010041
EUR_03	-0.000306165	EUR_36T39	-0.00143806
EUR_05T06	-0.030439147	EUR_41T43	-0.003383855
EUR_07T08	-0.007423053	EUR_45T47	-0.195476128
EUR_09	-0.000371958	EUR_49	-0.086069585
EUR_10T12	-0.099787267	EUR_50	-0.076855187
EUR_13T15	-0.059133669	EUR_51	-0.040849601
EUR_16	-0.010568699	EUR_52	-0.029041634
EUR_17T18	-0.025317457	EUR_53	-0.000575921
EUR_19	-0.012815636	EUR_55T56	-0.04112952
EUR_20	-0.120556242	EUR_58T60	-0.032518555
EUR_21	-0.0761881	EUR_61	-0.004282868
EUR_22	-0.033011558	EUR_62T63	-0.046866312
EUR_23	-0.015050974	EUR_64T66	-0.017305652
EUR_24	-0.062124364	EUR_68	-0.011138091
EUR_25	-0.085625727	EUR_69T75	-0.061285996
EUR_26	-0.112584527	EUR_77T82	-0.047166248
EUR_27	-0.083143158	EUR_84	-0.001672674
EUR_28	-0.213943329	EUR_85	-0.020006497
EUR_29	-0.249502502	EUR_86T88	-0.001905919
EUR_30	-0.118560082	EUR_90T93	-0.027780013
EUR_31T33	-0.025061267	EUR_94T96	-0.001943238

An interesting result is that targeting even the aforementioned sectors of high values added manufacturing, EUR_26 to EUR_30 which would be significantly hit by PRC sanctions, would not cause the whole EU economy to contract by more than 0.25%. In contrast, there were at least to PRC sectors, CHN_13T15 and CHN_26, which when targeted would cause the contraction of the whole PRC economy by more than 0.5%.

Table 7. Effects of singular PRC sanctions on the whole EU economy

These results suggest that the EU high tech industrial sectors are more interconnected with the PRC economy than the PRC high tech sectors are with the EU economy, as EU sectors have been more badly hit with the PRC sanctions than the other way around.

However, EU high tech sectors are less interconnected within their home EU economy than the Chinese sectors are within PRC economy, as targeting EU sectors by PRC has brought about a comparatively lover decrease of total output of EU economy, than it was in the opposite case.

In the next part of the analysis, all of the aggregate EU sectors were targeted by 100% PRC sanctions, and their decreases of output, as well as the total decrease of output of the EU economy was computed. The results are presented in the Table 8.

EU sector	Effects of the sanctions	EU sector	Effects of the sanctions
EUR_01T02	-1.491924839	EUR_35	-1.459811085
EUR_03	-0.908292984	EUR_36T39	-1.655253047
EUR_05T06	-8.787199228	EUR_41T43	-0.41054081
EUR_07T08	-4.904757114	EUR_45T47	-2.412198833
EUR_09	-4.338657342	EUR_49	-3.528269504
EUR_10T12	-1.726603701	EUR_50	-8.5383604
EUR_13T15	-5.010492901	EUR_51	-4.83095932
EUR_16	-2.411650653	EUR_52	-3.050654965
EUR_17T18	-3.027495348	EUR_53	-1.992178213
EUR_19	-1.959160962	EUR_55T56	-1.254779398
EUR_20	-5.072288467	EUR_58T60	-2.32214961
EUR_21	-4.481234636	EUR_61	-1.142860311
EUR_22	-3.639495347	EUR_62T63	-2.291354873
EUR_23	-2.263233542	EUR_64T66	-1.236422323
EUR_24	-5.732699821	EUR_68	-0.579171204
EUR_25	-4.850053385	EUR_69T75	-2.137411201
EUR_26	-6.966796417	EUR_77T82	-2.455585548
EUR_27	-5.607577185	EUR_84	-0.255648184
EUR_28	-5.788222171	EUR_85	-0.710095267
EUR_29	-4.751651524	EUR_86T88	-0.07510188
EUR_30	-8.020985241	EUR_90T93	-1.751349318
EUR_31T33	-2.006982742	EUR_94T96	-0.53665054
Total effect on the whole EU economy:			-2.205666948

The resulting observation is that the overall decrease of the EU economy, when all of its sectors would be targeted by 100% sanctions would be by 2.2%, which is about 28% less than the decrease of the Chinese economy, which was estimated by the previous model to be 3.07%.

Table 8. Effects of PRC sanctions on all of the EU industrial sectors simultaneously

The overall results show that even though some EU sectors would be more badly hit by PRC sanctions then the other way around, the overall decrease of the EU economy caused by sanctioning just a single EU industry, as well as targeting all of the EU industries simultaneously by PRC would bring about a lower total decrease of the EU economy than in the opposite case, when EU was targeting PRC.

Global Extraction Method IO model

This section presents the results of the IO analysis using the GEM IO model. These results were computed to obtain a more realistic estimates of decrease of demand of economic sectors, as caused by sanctions. These results are then compared with the original estimates produced by the standard Leontief IO model, to see by how much they differ, and thus how realistic were the original estimates.

Sanctions of European Union on the Peoples' Republic of China

The first analysis simulated through the use of GME IO model PRC levying a 100% sanction on just one industrial sector of PRC and has estimated the resulting decreases of output of this sector, its neighbouring PRC sectors and the overall PRC economy.

Results of decreases of sectoral output are represented in the Table 9. The results confirm theory, that is, the decreases in the new outputs of sectors targeted by the sanctions computed with the use of the GEM model are smaller, i.e., less severe, than those computed with the use of the standard IO model. This is caused, as explained in more detail in the methodology section, by the redistribution of the demand by the targeting country, which inadvertently leads to higher demand for the targeted sectors from the rest of the world.

The difference between the sectors is usually very small except for cases of two industries, CHN_26 whose decrease of output has changed from -8.05% to -7.76%, and CHN_13T15, whose decrease of output has changed from -7.17% to -6.86%.

The difference in total effect of the sanctions on the singular industries on the whole economy is also assessed. Again, the results are very similar, but the decreases of the whole economy computed by the GEM method are always lower (less severe) the those computed by the Standard IO method. The results are presented in Table 10. The only bigger difference occurs with the same sectors as above: the total decrease of the economy caused by sanctioning CHN_26 has changed from -0.668% under the Standard model to -0.628% under the GEM model, and the total decrease of the economy caused by the sanctioning of the CHN_13T15 has changed from -0.528% to -0.497%.

In the last step, 100% sanctions on all of the sectors were simulated using the GEM model, and the results have been compared with those obtained by the Standard model. The resulting contraction of the whole economy, estimated by the GEM IO model, would be 2.945%, what

is 4.17% decrease from the Standard IO model estimate of 3.073%. These results are represented in the Table 11

Sanctions of the Peoples' Republic of China on the European Union

In the second part of the analysis using the GEM IO model, changes in the output of the economic sectors of EU aggregate were estimated when being sanctioned by PRC. Firstly, just individual sectors were targeted by a 100% sanction, and their new output, as well as the output of their neighbouring sectors in EU, influenced by possible spillover effects, and the decrease of the whole EU economy were estimated.

Table 12 contains estimates for single sectors of EU as well as their comparison to their standard IO model counterparts. Once again, the decreases of economic output computed through use of GME IO are slightly lower than those computed by standard model. The most visible changes have occurred in the contractions of sectors of EUR_50, which has decreased from 7.821% to 7.522%, sector EUR_30, which has decreased from 7.563% to 7.421% and sector EUR_21, whose contraction has decreased from 4.144% to 4.028%. For most of the other sectors, the differences in results obtained through GME IO or Standard IO model are smaller than these.

The changes between the contraction of the EU economy obtained though GME IO model and the standard IO model are less pronounced than it was the case with the corresponding situation with CHN economy. The new estimated decreases of economic output are, albeit always lower than those computed though standard model, not very different from them. The largest differences in the estimated economy wide effects have occurred with the sectors of EUR_29, where the contraction of the economy has decreased from 0.2495% to 0.2389%, and with the sector of EUR_29, where the contraction has decreased from 0.2139% to 0.2048%

In the last part of this section of analysis, the effects of 100% sanctions on all of the EU sectors by PRC were estimated though the use of the GME IO model, and these results were subsequently compared with those obtained through the Standard IO model. Table 14 contains these results.

If the EU economy would be hit in such scenario, it would according to the GEM IO model decrease by 2.124%, what is a 3.71% chnge from the 2.206% decrease predicted by the standard IO model.

The size of the differences in all three parts of the results suggests that the standard IO model was more realistic when estimating the results of PRC levying sanctions on EU than vice versa, as these differences are smaller than in the case of EU levying sanctions on PRC.

GEM IO Model with individual 28 EU member states.

In this part of the analysis, a GME IO model capturing the full complexity of European Union has been created. This model consists of 28 member states of EU, 38 countries of the world and one rest of the world (ROW) aggregate, together numbering 67 by 67 countries. Use of this model allows to study what effects would PRC sanctions on individual member states have on the whole economy of the EU. This will reveal their relative importance within the EU block, and their individual interconnectedness with the PRC. Furthermore, as this is a model of GME type, its estimates can be deemed more realistic than the estimates of the standard IO model.

In this analysis, 100% Chinese sanctions have been applied to all economic sectors of one EU member state in turn. Then the comparison between all of the EU member states was made, to estimate how much would their economies contract, what would be the spillover effects on the economies of the neighbouring EU member states, and what would be the resulting effect on the whole EU economy.

These results are presented in the Table 15. The columns of the table indicate which EU member state has been targeted by 100% sanctions, and the rows indicate the primary as well as secondary spillover effects in the other member states. The last row indicates the overall effect on the whole EU economy. This table has a different legend from all other Tables, and it is indicated below it.

The most affected country would be Malta, whose economy would decrease by 12.23%, but sanctioning this member state would decrease the whole economy of EU only by 0.019%. This interesting case will be dealt with later in the analysis of the results. The second and third most hit countries would be Ireland and Slovakia, whose economies would decrease by 3.65% and 3.81% respectively. The effect on the whole EU economy would be in their cases 0.101% and 0.035%.

The fourth most hit economy is the biggest economy of the EU, Germany. When being it by 100% sanctions on all of its sectors, it would suffer a decrease in economic output by 2.85%.

Targeting this EU member state would also cause the worst result for the whole EU economy, as it would contract by 0.675%. Targeting France would have caused he second biggest damage to the EU economy, as it would contract by 0.307%, and the French economy would contract by 1.88%. These two EU member state will be looked into more deeply to discover their interconnectedness with other EU member states sector-wise.

Intriguingly, results of this analysis show that Lithuania would have suffered the smallest consequences of full blow sanctions on its industries, as its economy would contract only by 0.554%. This suggests that Lithuania is least interconnected with PRC out of all member states of the EU. This could provide one of the potential explanations into Lithuania's daring behaviour towards PRC. Lithuanian policy makers might be aware of this fact, and seeing that PRC sanctions would not cause them significant harm, they have decided to upgrade their relations with Taiwan.

The role of Germany in EU

The role of Germany as the centre of the European economy has been looked into more deeply in this analysis, by examining its spillover effects to the other member states industry wise. Table 16 captures what would happen to individual industries of all 28 member states of EU if all of the economic sectors of Germany would be targeted by 100% sanctions from PCR. Data has been transformed into a heatmap, to better visualise the relationships between the sectors.

It can be seen that targeting the DEU_24 sector of Basic metals would cause spillover effects into the corresponding _24 sectors in most of the neighbouring member states. Targeting Germany's industrial sectors ranging from DEU_25 to DEU_29, which represent the metal, electronic, and automotive industries, would cause decreases in the corresponding industrial sectors of Czechia, Hungary, Slovakia, Poland, Slovenia and Romania. This signifies the strong industrial ties these countries have with Germany. Targeting German transportation services sectors ranging from DEU_49 to DEU_52 would bring about decrease of corresponding sectors in Luxemburg.

The role of France in EU

A similar closer look has been done with the case of France, as the economy whose targeting would cause the second biggest contract of the whole EU economy by 0.307%. The

intersectoral relationship between France and its neighbouring states has been compiled into a heatmap, for easier representation of the data.

From the first look it can be seen that targeting French sectors would cause less spillover effects into the neighbouring member states' sectors when compared to the case of Germany. When all of the French industries would be targeted, the biggest decrease in output of 16.23% would occur in the sector FRA_30, which represent manufacture of Other transport equipment. This sector would cause the most of the spillover effects of out any French industry. These would be most noticeable in corresponding _30 sectors of Germany, Lithuania, Portugal, Spain and others.

Horizontal green lines represent spillover effects in the countries whose majority of their industries are closely interrelated with French ones. These spillover effects range in magnitude between 0.5% to 0.25% and occur in the majority of industries of Belgium, Luxembourg, Portugal and Spain. These economies are most interconnected with France. Interesting case is Germany, which would not be significantly affected by spillover effects, apart from DEU_30.

Spillover effects would be also to a lower degree noticeable in sectors of high end manufacturing, ranging from _26 to _30, notably in the member states Italia, Slovakia, Poland, Czechia and Bulgaria.

Another interesting result is the case of Cyprus, where the targeting of all French industries would lead to increases of output of many of its sectors. These increases range from almost zero 7.29755E-05% up to the 0.059%. After a closer analysis it seems that Cyprus conducts a lot of trade with countries surrounding it, which are not part of the EU, such as Israel. Demand for products of many of these non-EU countries has increased after the PRC has redistributed its demand from France, which has increased of their production. As Cyprus conducts trade with these countries, their increase of production has most likely led to increase of their demand for products from Cyprus, which has in turn increased its output very slightly.

The case of Malta

The aforementioned case of Malta is also rather intriguing, as to why should economy of such a small country contract so much when being targeted by the Chinese sanctions. To find some of the answers to this question, a quick data analysis has been done on the original unchanged

ICIO data, and it was found out, that in fact in many sectors of the Maltese economy PRC constitutes a rather large part of both final and intermediate demand. The most severely hit sector is MLT_26, which would contract by 29.9% when all of the Maltese sectors would the targeted. The Chinese demand for intermediate products of this sector represents 38.25% of all intermediate demand and Chinese demand for the final products of this sector represents 15.8% of all final demand. This case is similar with industries MLT_22, MLT_ 27 and others. This helps to explain why there was such a dramatic decrease of the Maltese economy, as by removing these large parts of the demand as an effect of sanctions, the economy will logically contract significantly.

Another intriguing result which was discovered at the first analysis using the standard IO model was that EU aggregate sector, EUR_05T06, representing Mining and quarrying, energy producing products, would be one of the most severely hit if it were to be targeted by a 100% sanction. Disaggregating of the original aggregate into individual member states model helped to discover that Great Britain (at the time of this data still part of the EU) had a large part of the intermediate demand for the production of sector GBR_05T06 from China. Specifically, 17.22%. This can alone be the cause of the susceptibility of this sector to the Chinese shocks on the EU level.

Conclusions

The relationship between People's republic of China and the European Union is one of the mutually beneficial trade relations on one hand, but of political strife and disagreements on the other. PRC and CCP has repeatedly shown that it will do what it sees fit in order to achieve its desired goals, both at its home territory as well as in the international arena. This has caused EU member states to voice opposition and take action. In this turbulent geopolitical climate, it is useful the understand the complex economic relationship between the EU and PRC, as its implications can prove valuable.

This thesis has empirically estimated the degree of interconnectedness between the economies of PRC and EU. It has found out that PRC is more susceptible to EU sanctions in most measures than vice versa. Although EU sectors of high-tech manufacturing industry are more vulnerable to simulated Chinese sanctions, these sanctions would cause lower overall decrease of the whole EU economy then in the opposite case. Furthermore, according to estimates obtained through a fairly realistic GEM model, the maximal contraction of whole EU economy that PRC could cause by economic sanctions would be 2.12%. On the contrary, the maximal contraction of PRC economy EU could cause as an effect of sanctions would be 2.94%, suggesting that EU has more capability to damage PRC economy than vice versa.

By simulating the PRC economic sanctions of the individual EU member states, this thesis has found out that targeting Germany would cause the most damage to the overall EU Economy. Germany is both the largest as well as the most interconnected state within EU. Levying sanctions on it would cause spillover effects in majority of industries of the remaining member states. Targeting of France and United Kingdom would cause the 2nd and 3rd largest contractions of the EU economy, respectively. These countries are not as heavily interconnected with the rest of EU as Germany is, but they are still large economies and their decrease of output would hurt the EU economy overall.

According to the empirically obtained results, this thesis concludes that People's republic of China is more interconnected with the economy of the European Union, and thus is more susceptible to its sanctions than vice versa.

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Appendix

Table 9. Comparison of effects of EU sanctions on single PRC industries

Targeted sector	Resulting % effect - GEM	Resulting % effect - Standard	Change
CHN_01T02	-0.161447759	-0.16165789	-0.0002101
CHN_03	-0.017201486	-0.01720655	-5.062E-06
CHN_05T06	-1.527762836	-1.52850952	-0.0007467
CHN_07T08	-0.22678389	-0.2269035	-0.0001196
CHN_09	-0.493359161	-0.49351276	-0.0001536
CHN_10T12	-0.638316968	-0.63986017	-0.0015432
CHN_13T15	-6.861577275	-7.16651822	-0.3049409
CHN_16	-1.200881242	-1.20514006	-0.0042588
CHN_17T18	-0.438604368	-0.44019909	-0.0015947
CHN_19	-0.116234311	-0.11638455	-0.0001502
CHN_20	-1.636476878	-1.66214828	-0.0256714
CHN_21	-1.841918288	-1.84768702	-0.0057687
CHN_22	-2.429276912	-2.44662092	-0.017344
CHN_23	-0.75255713	-0.75599906	-0.0034419
CHN_24	-0.493365928	-0.50002776	-0.0066618
CHN_25	-2.766173203	-2.7929899	-0.0268167
CHN_26	-7.759792311	-8.05093153	-0.2911392
CHN_27	-4.525968642	-4.60415393	-0.0781853
CHN_28	-2.344677635	-2.37208392	-0.0274063
CHN_29	-0.590772333	-0.59482289	-0.0040506
CHN_30	-4.357250234	-4.3892983	-0.0320481
CHN_31T33	-7.284162644	-7.3208807	-0.0367181
CHN_35	-8.50685E-09	-8.5068E-09	0
CHN_36T39	-3.4059E-08	-3.4063E-08	-4.042E-12
CHN_41T43	-1.37829E-10	-1.3783E-10	0
CHN_45T47	-1.329053905	-1.33207849	-0.0030246
CHN_49	-1.341192471	-1.34250014	-0.0013077
CHN_50	-2.843395219	-2.91891671	-0.0755215
CHN_51	-2.948744137	-2.95241134	-0.0036672
CHN_52	-1.420262599	-1.42192261	-0.00166
CHN_53	-0.0062449	-0.00624571	-8.131E-07
CHN_55T56	-0.171463681	-0.17150369	-4.001E-05
CHN_58T60	-5.04556984	-5.05368052	-0.0081107
CHN_61	-0.450506349	-0.45085243	-0.0003461
CHN_62T63	-3.092966355	-3.10449949	-0.0115331
CHN_64T66	-0.147564452	-0.1478604	-0.0002959
CHN_68	-0.051382546	-0.05138875	-6.205E-06
CHN_69T75	-1.102422777	-1.10372891	-0.0013061
CHN_77T82	-0.456124718	-0.45655323	-0.0004285
CHN_84	-9.53389E-11	-9.5339E-11	0
CHN_85	-0.003469071	-0.00346908	-1.355E-08
CHN_86T88	-0.015461995	-0.01546212	-1.228E-07
CHN_90T93	-0.612097515	-0.61225379	-0.0001563
CHN_94T96	-0.031548816	-0.03155234	-3.519E-06

Targeted Sector	Resulting effect on the whole CHN economy -GEM	Resulting effect on the whole CHN economy -Standard	Change
CHN_01T02	-0.014529369	-0.014757098	-0.000228
CHN_03	-0.000203102	-0.000206061	-2.96E-06
CHN_05T06	-0.054779675	-0.055111858	-0.000332
CHN_07T08	-0.004610125	-0.004681838	-7.17E-05
CHN_09	-0.001054329	-0.001070779	-1.65E-05
CHN_10T12	-0.065077701	-0.066200516	-0.001123
CHN_13T15	-0.496982325	-0.528285317	-0.031303
CHN_16	-0.016134809	-0.01645542	-0.000321
CHN_17T18	-0.011335114	-0.01159699	-0.000262
CHN_19	-0.003861462	-0.003915661	-5.42E-05
CHN_20	-0.109524153	-0.112789683	-0.003266
CHN_21	-0.039837916	-0.040382754	-0.000545
CHN_22	-0.08573588	-0.089128974	-0.003393
CHN_23	-0.045303167	-0.04628584	-0.000983
CHN_24	-0.044734581	-0.046055217	-0.001321
CHN_25	-0.140521677	-0.146052337	-0.005531
CHN_26	-0.628295203	-0.668463656	-0.040168
CHN_27	-0.273836404	-0.287318961	-0.013483
CHN_28	-0.183420119	-0.190828535	-0.007408
CHN_29	-0.039047101	-0.041069657	-0.002023
CHN_30	-0.066313237	-0.069261717	-0.002948
CHN_31T33	-0.195561989	-0.203308931	-0.007747
CHN_35	-9.0492E-09	-9.0492E-09	0
CHN_36T39	-9.2912E-09	-9.2956E-09	-4.4E-12
CHN_41T43	-9.0492E-09	-9.0492E-09	0
CHN_45T47	-0.121582752	-0.124655659	-0.003073
CHN_49	-0.066245345	-0.067238102	-0.000993
CHN_50	-0.02200803	-0.023217314	-0.001209
CHN_51	-0.022513999	-0.022962066	-0.000448
CHN_52	-0.015241085	-0.01564901	-0.000408
CHN_53	-4.08234E-05	-4.17201E-05	-8.97E-07
CHN_55T56	-0.007216847	-0.007313727	-9.69E-05
CHN_58T60	-0.025142931	-0.025583043	-0.00044
CHN_61	-0.006233378	-0.006452179	-0.000219
CHN_62T63	-0.054067795	-0.055049145	-0.000981
CHN_64T66	-0.00594597	-0.006057719	-0.000112
CHN_68	-0.002079346	-0.002102718	-2.34E-05
CHN_69T75	-0.044959782	-0.045535382	-0.000576
CHN_77T82	-0.023648337	-0.023985646	-0.000337
CHN_84	-9.0492E-09	-9.0492E-09	0
CHN_85	-9.06692E-05	-9.16324E-05	-9.63E-07
CHN_86T88	-0.000360603	-0.000370067	-9.46E-06
CHN_90T93	-0.004030529	-0.004113967	-8.34E-05
CHN_94T96	-0.000430102	-0.000451057	-2.1E-05

Table 10 Comparison of effects of EU sanctions on the whole PRC economy

CHN sector	Effect of the sanctions - GEM	Effect of the sanctions - Standard	Change
CHN_01T02	-2.03466031	-2.107145852	-0.07249
CHN_03	-1.01682572	-1.049987163	-0.03316
CHN_05T06	-4.14996691	-4.317060125	-0.16709
CHN_07T08	-2.69065283	-2.848775163	-0.15812
CHN_09	-4.50767623	-4.682938875	-0.17526
CHN_10T12	-1.62172875	-1.669402799	-0.04767
CHN_13T15	-7.844783	-8.218738294	-0.37396
CHN_16	-4.08714255	-4.195188608	-0.10805
CHN_17T18	-2.97125452	-3.083221994	-0.11197
CHN_19	-2.84614218	-3.027459844	-0.18132
CHN_20	-4.51548783	-4.801095811	-0.28561
CHN_21	-2.12749786	-2.150528743	-0.02303
CHN_22	-5.34499052	-5.578223975	-0.23323
CHN_23	-1.60428913	-1.666877276	-0.06259
CHN_24	-3.20275009	-3.418023434	-0.21527
CHN_25	-4.3785292	-4.579365739	-0.20084
CHN_26	-8.47031343	-8.886316287	-0.416
CHN_27	-6.09386893	-6.375011214	-0.28114
CHN_28	-3.51506295	-3.639422291	-0.12436
CHN_29	-1.37150055	-1.412927097	-0.04143
CHN_30	-5.12983084	-5.220505662	-0.09067
CHN_31T33	-7.9016533	-8.043508701	-0.14186
CHN_35	-2.22658209	-2.336770811	-0.11019
CHN_36T39	-1.77332443	-1.872371975	-0.09905
CHN_41T43	-0.01385821	-0.014420387	-0.00056
CHN_45T47	-3.40681819	-3.548861245	-0.14204
CHN_49	-3.59531211	-3.740852849	-0.14554
CHN_50	-4.83281234	-5.1238138	-0.291
CHN_51	-4.8376619	-4.962381257	-0.12472
CHN_52	-4.00317913	-4.169367277	-0.16619
CHN_53	-2.75174987	-2.866079856	-0.11433
CHN_55T56	-1.39784439	-1.446641113	-0.0488
CHN_58T60	-5.52172805	-5.600996735	-0.07927
CHN_61	-1.40507595	-1.443060345	-0.03798
CHN_62T63	-3.90832321	-3.986769023	-0.07845
CHN_64T66	-1.95982529	-2.041466359	-0.08164
CHN_68	-0.63604508	-0.658684995	-0.02264
CHN_69T75	-2.82398421	-2.921445651	-0.09746
CHN_77T82	-2.53016074	-2.62498316	-0.09482
CHN_84	-0.02932034	-0.030547804	-0.00123
CHN_85	-0.04604191	-0.047719995	-0.00168
CHN_86T88	-0.05604425	-0.057874701	-0.00183
CHN_90T93	-0.8865848	-0.898517279	-0.01193
CHN_94T96	-0.56075118	-0.581946872	-0.0212
Total decrease	-2.94384446	-3.072834106	-0.12899

Table 11 Comparison of effects of EU sanctions on all PRC sectors

Targeted Sector	Resulting % effect - GEM	Resulting % effect - Standard	change
EUR_01T02	-0.48959545	-0.490148908	-0.000553
EUR_03	-0.32199193	-0.32222603	-0.000234
EUR_05T06	-7.36150524	-7.363873375	-0.002368
EUR_07T08	-2.76728999	-2.767879986	-0.00059
EUR_09	-0.54415615	-0.547220598	-0.003064
EUR_10T12	-1.33819643	-1.343392624	-0.005196
EUR_13T15	-4.58246276	-4.616024415	-0.033562
EUR_16	-1.20775519	-1.212937957	-0.005183
EUR_17T18	-1.53446461	-1.547060121	-0.012596
EUR_19	-0.60193477	-0.603760605	-0.001826
EUR_20	-3.63135104	-3.696901562	-0.065551
EUR_21	-4.02782822	-4.14384219	-0.116014
EUR_22	-1.58750543	-1.592604944	-0.0051
EUR_23	-1.09688854	-1.10060465	-0.003716
EUR_24	-2.61866418	-2.646632292	-0.027968
EUR_25	-2.63121485	-2.645171539	-0.013957
EUR_26	-6.13737957	-6.200950475	-0.063571
EUR_27	-4.3517917	-4.383021053	-0.031229
EUR_28	-4.80734256	-4.876851444	-0.069509
EUR_29	-4.18111449	-4.273299106	-0.092185
EUR_30	-7.42117026	-7.562960403	-0.14179
EUR_31T33	-0.85696691	-0.861443295	-0.004476
EUR_35	-0.05278871	-0.052822202	-3.35E-05
EUR_36T39	-0.0801919	-0.080213305	-2.14E-05
EUR_41T43	-0.02946573	-0.029493835	-2.81E-05
EUR_45T47	-1.21295272	-1.217121242	-0.004169
EUR_49	-2.10716688	-2.111839255	-0.004672
EUR_50	-7.52214298	-7.820523823	-0.298381
EUR_51	-3.96956128	-3.982964149	-0.013403
EUR_52	-0.88216115	-0.887990408	-0.005829
EUR_53	-0.08259947	-0.082861557	-0.000262
EUR_55T56	-0.84682249	-0.84705691	-0.000234
EUR_58T60	-1.51634691	-1.52580853	-0.009462
EUR_61	-0.22269671	-0.223306146	-0.000609
EUR_62T63	-1.2233837	-1.234664043	-0.01128
EUR_64T66	-0.23568742	-0.238384096	-0.002697
EUR_68	-0.1169149	-0.116964924	-5E-05
EUR_69T75	-0.69063391	-0.69507358	-0.00444
EUR_77T82	-0.75945023	-0.76170103	-0.002251
EUR_84	-0.0246908	-0.024698336	-7.54E-06
EUR_85	-0.50648747	-0.506524563	-3.71E-05
EUR_86T88	-0.02445022	-0.024452834	-2.61E-06
EUR_90T93	-1.40836681	-1.410098394	-0.001732
EUR_94T96	-0.10250509	-0.102522423	-1.73E-05

Table 12 Comparison of effects of PRC sanctions on single EU industries

Targeted sector	Resulting effect on the whole EU economy - GEM	Resulting effect on the whole EU economy - Standard	change
EUR_01T02	-0.013989899	-0.014361341	-0.0003714
EUR_03	-0.000297056	-0.000306165	-9.109E-06
EUR_05T06	-0.029830274	-0.030439147	-0.0006089
EUR_07T08	-0.007201306	-0.007423053	-0.0002217
EUR_09	-0.000355154	-0.000371958	-1.68E-05
EUR_10T12	-0.097138436	-0.099787267	-0.0026488
EUR_13T15	-0.056961357	-0.059133669	-0.0021723
EUR_16	-0.010179857	-0.010568699	-0.0003888
EUR_17T18	-0.024367826	-0.025317457	-0.0009496
EUR_19	-0.012384668	-0.012815636	-0.000431
EUR_20	-0.115289644	-0.120556242	-0.0052666
EUR_21	-0.071333875	-0.0761881	-0.0048542
EUR_22	-0.031784316	-0.033011558	-0.0012272
EUR_23	-0.01455517	-0.015050974	-0.0004958
EUR_24	-0.060125072	-0.062124364	-0.0019993
EUR_25	-0.082737669	-0.085625727	-0.0028881
EUR_26	-0.107364747	-0.112584527	-0.0052198
EUR_27	-0.079605564	-0.083143158	-0.0035376
EUR_28	-0.204846613	-0.213943329	-0.0090967
EUR_29	-0.238861659	-0.249502502	-0.0106408
EUR_30	-0.113533455	-0.118560082	-0.0050266
EUR_31T33	-0.02390965	-0.025061267	-0.0011516
EUR_35	-0.001977964	-0.002010041	-3.208E-05
EUR_36T39	-0.001412369	-0.00143806	-2.569E-05
EUR_41T43	-0.003258797	-0.003383855	-0.0001251
EUR_45T47	-0.190871888	-0.195476128	-0.0046042
EUR_49	-0.083732711	-0.086069585	-0.0023369
EUR_50	-0.070683893	-0.076855187	-0.0061713
EUR_51	-0.03920654	-0.040849601	-0.0016431
EUR_52	-0.028031715	-0.029041634	-0.0010099
EUR_53	-0.000557968	-0.000575921	-1.795E-05
EUR_55T56	-0.040023736	-0.04112952	-0.0011058
EUR_58T60	-0.031510642	-0.032518555	-0.0010079
EUR_61	-0.004157872	-0.004282868	-0.000125
EUR_62T63	-0.045247937	-0.046866312	-0.0016184
EUR_64T66	-0.016874762	-0.017305652	-0.0004309
EUR_68	-0.010978961	-0.011138091	-0.0001591
EUR_69T75	-0.059819138	-0.061285996	-0.0014669
EUR_77T82	-0.046235027	-0.047166248	-0.0009312
EUR_84	-0.00161428	-0.001672674	-5.839E-05
EUR_85	-0.019700825	-0.020006497	-0.0003057
EUR_86T88	-0.001838125	-0.001905919	-6.779E-05
EUR_90T93	-0.027054965	-0.027780013	-0.000725
EUR_94T96	-0.001866396	-0.001943238	-7.684E-05

Table 13 Comparison of effects of PRC sanctions on the whole EU economy

EU sector	Effects of the sanctions - GEM	Effects of the sanctions - Standard	change
EUR_01T02	-1.454971658	-1.491924839	-0.03695
EUR_03	-0.875792462	-0.908292984	-0.0325
EUR_05T06	-8.553573732	-8.787199228	-0.23363
EUR_07T08	-4.668762533	-4.904757114	-0.23599
EUR_09	-4.072649239	-4.338657342	-0.26601
EUR_10T12	-1.695307387	-1.726603701	-0.0313
EUR_13T15	-4.930596355	-5.010492901	-0.0799
EUR_16	-2.321202234	-2.411650653	-0.09045
EUR_17T18	-2.90631308	-3.027495348	-0.12118
EUR_19	-1.805775975	-1.959160962	-0.15338
EUR_20	-4.804706991	-5.072288467	-0.26758
EUR_21	-4.320624978	-4.481234636	-0.16061
EUR_22	-3.48828151	-3.639495347	-0.15121
EUR_23	-2.179803836	-2.263233542	-0.08343
EUR_24	-5.433071522	-5.732699821	-0.29963
EUR_25	-4.699400994	-4.850053385	-0.15065
EUR_26	-6.79402649	-6.966796417	-0.17277
EUR_27	-5.437753419	-5.607577185	-0.16982
EUR_28	-5.60084503	-5.788222171	-0.18738
EUR_29	-4.603676788	-4.751651524	-0.14797
EUR_30	-7.789134408	-8.020985241	-0.23185
EUR_31T33	-1.911499751	-2.006982742	-0.09548
EUR_35	-1.401031879	-1.459811085	-0.05878
EUR_36T39	-1.58775918	-1.655253047	-0.06749
EUR_41T43	-0.394495712	-0.41054081	-0.01605
EUR_45T47	-2.3279682	-2.412198833	-0.08423
EUR_49	-3.424343881	-3.528269504	-0.10393
EUR_50	-8.015454606	-8.5383604	-0.52291
EUR_51	-4.706875078	-4.83095932	-0.12408
EUR_52	-2.88013931	-3.050654965	-0.17052
EUR_53	-1.896627411	-1.992178213	-0.09555
EUR_55T56	-1.238371576	-1.254779398	-0.01641
EUR_58T60	-2.237812199	-2.32214961	-0.08434
EUR_61	-1.092272442	-1.142860311	-0.05059
EUR_62T63	-2.206379377	-2.291354873	-0.08498
EUR_64T66	-1.165025301	-1.236422323	-0.0714
EUR_68	-0.561054012	-0.579171204	-0.01812
EUR_69T75	-2.03770893	-2.137411201	-0.0997
EUR_77T82	-2.352503322	-2.455585548	-0.10308
EUR_84	-0.245491917	-0.255648184	-0.01016
EUR_85	-0.701310935	-0.710095267	-0.00878
EUR_86T88	-0.072788201	-0.07510188	-0.00231
EUR_90T93	-1.732261547	-1.751349318	-0.01909
EUR_94T96	-0.519122746	-0.53665054	-0.01753
Total effect	-2.123920241	-2.205666948	-0.08175

Table 14 Comparison of effects of PRC sanctions on all EU sectors

	AUT	BEL	BGR	HRV	CYP	CZE	DNK	EST	FIN	FRA	DEU	GRC	HUN	IRL	ITA	LVA	LTU	LUX	MLT	NLD	POL	PRT	ROU	SVK	SVN	ESP	SWE	GBR
AUT	-1.7585	-0.005	-0.0035	-0.0028	-0.0007	-0.0166	-0.0069	-0.0002	-0.0043	-0.0346	-0.2683	-0.0005	-0.0332	-0.0051	-0.0326	-0.0001	-0.0002	-0.0015	-0.0163	-0.0111	-0.0097	-0.0017	-0.0057	-0.0221	-0.006	-0.0052	-0.0099	-0.0087
BEL	-0.0087	-1.1234	-0.001	-0.0003	-0.0002	-0.0062	-0.0332	-0.0003	-0.0056	-0.1022	-0.1664	-0.0005	-0.0071	-0.0303	-0.0294	-8E-05	-0.0003	-0.0122	-0.0071	-0.0569	-0.0073	-0.0039	-0.0019	-0.0057	-0.0009	-0.0093	-0.0174	-0.0295
BGR	-0.0183	-0.0199	-2.2395	-0.0012	-0.0013	-0.0129	-0.0068	-0.0002	-0.0014	-0.0318	-0.1647	-0.0116	-0.0158	-0.0037	-0.0509	-0.0001	-0.0002	-0.0007	-0.0071	-0.0113	-0.0092	-0.0022	-0.0206	-0.0119	-0.0026	-0.0101	-0.0047	-0.0086
HRV	-0.0231	-0.0048	-0.0013	-0.8173	-3E-05	-0.003	-0.0029	-4E-05	-0.0016	-0.0066	-0.0432	-8E-05	-0.0084	-0.0046	-0.0318	-1E-05	-1E-04	-0.0007	-0.057	-0.0036	-0.0017	-0.0008	-0.0019	-0.0047	-0.0134	-0.0043	-0.0056	-0.0017
CYP	-0.0085	-0.0036	-0.002	-7E-05	-1.3676	-0.002	-0.023	-0.0012	0.0011	0.00856	-0.0577	-0.022	-0.0042	0.00055	0.00208	-0.0009	-0.0014	-0.0024	-0.0352	-0.0013	-0.0058	0.00015	-0.0023	-0.0028	-0.0001	0.0026	-0.0014	-0.0077
CZE	-0.0367	-0.0096	-0.0029	-0.001	-0.0003	-1.3597	-0.011	-0.0005	-0.0043	-0.0489	-0.3477	-0.0002	-0.0413	-0.0115	-0.0295	-0.0002	-0.0004	-0.0015	-0.0016	-0.0137	-0.0235	-0.0038	-0.0057	-0.1237	-0.0027	-0.0098	-0.0149	-0.0211
DNK	-0.0032	-0.0079	-0.0005	-0.0002	6.5E-05	-0.0018	-2.563	-0.0005	-0.0127	-0.0075	-0.0572	-0.0015	-0.0044	-0.011	-0.0035	-0.0003	-0.0004	-0.0008	-0.0025	-0.0099	-0.004	-0.0007	-0.0001	-0.0027	-0.0003	-0.0021	-0.0491	-0.0158
EST	-0.0077	-0.005	-0.0008	-5E-05	-0.0009	-0.0037	-0.083	-0.964	-0.1185	-0.0106	-0.0628	-9E-05	-0.0036	-0.004	-0.0032	-0.0133	-0.0083	-0.0009	-0.0834	-0.0097	-0.0085	-0.0009	-0.0012	-0.003	-0.0004	-0.0018	-0.0696	-0.0047
FIN	-0.0045	-0.0036	-0.0006	-7E-05	-3E-05	-0.0026	-0.0147	-0.0049	-2.1638	-0.0165	-0.0836	-0.0001	-0.0029	-0.0191	-0.0052	-0.001	-0.0009	-0.0007	-0.0052	-0.0145	-0.0061	-0.0008	-0.0003	-0.0019	-0.0004	-0.0036	-0.0643	-0.0074
FRA	-0.0037	-0.0128	-0.0005	-1E-04	-3E-05	-0.0032	-0.0024	-9E-05	-0.0014	-1.8788	-0.0713	-0.0002	-0.004	-0.0182	-0.0191	-1E-05	-8E-05	-0.0036	-0.0017	-0.0084	-0.0032	-0.0039	-0.0015	-0.0065	-0.0005	-0.0121	-0.0051	-0.0143
DEU	-0.0247	-0.007	-0.0011	-0.0004	-5E-05	-0.0126	-0.0097	-0.0002	-0.004	-0.0561	-2.8527	-0.0007	-0.0158	-0.0104	-0.02	-9E-05	-0.0002	-0.0037	-0.0027	-0.0149	-0.0097	-0.0039	-0.0025	-0.0186	-0.0012	-0.007	-0.011	-0.0164
GRC	-0.0023	-0.0012	-0.0197	-0.0004	-0.0036	-0.0023	0.00534	3.3E-06	0.00091	0.00289	-0.035	-0.8093	-0.0019	-0.0003	-0.0189	-2E-05	-2E-05	-0.0003	-0.0095	-0.0009	-0.003	-0.0007	-0.0038	-0.003	-0.0008	-0.0026	-0.0006	-0.001
HUN	-0.0444	-0.009	-0.0048	-0.003	-0.0003	-0.0256	-0.0161	-0.0004	-0.0042	-0.0416	-0.2878	-0.0005	-1.9279	-0.0138	-0.0334	-0.0002	-0.0003	-0.0017	-0.002	-0.015	-0.0163	-0.0044	-0.0153	-0.0838	-0.0038	-0.0116	-0.0132	-0.0141
IRL	-0.0055	-0.0183	-0.0005	-0.0001	-0.0003	-0.0033	-0.0067	-0.0002	-0.0121	-0.046	-0.1142	0.00026	-0.0057	-3.6536	-0.0259	-0.0001	-0.0002	-0.0066	-0.0047	-0.0309	-0.0044	-0.0022	-0.0008	-0.0021	-0.0003	-0.0052	-0.0092	-0.0544
ITA	-0.0092	-0.0038	-0.0017	-0.0007	-0.0001	-0.0048	-0.0061	-0.0001	-0.0016	-0.0425	-0.072	-0.001	-0.0072	-0.009	-1.4389	-4E-05	-0.0001	-0.0013	-0.0039	-0.0047	-0.0053	-0.0031	-0.0026	-0.0072	-0.0023	-0.01	-0.0037	-0.0092
LVA	-0.0051	-0.0047	-0.0021	-7E-05	-0.0015	-0.0033	-0.0756	-0.0195	-0.0195	-0.0095	-0.0541	-0.0004	-0.0042	-0.0068	-0.006	-0.6612	-0.0149	-0.0006	-0.0063	-0.0113	-0.0089	-0.0005	-0.0008	-0.0033	-0.0006	-0.0037	-0.0474	-0.0174
LTU	-0.0115	-0.0097	-0.0011	-0.0002	-0.0006	-0.0055	-0.1168	-0.0112	-0.0148	-0.0341	-0.0884	-0.0002	-0.0064	-0.0081	-0.0137	-0.0181	-0.554	-0.0012	-0.0026	-0.0146	-0.0241	-0.0016	-0.001	-0.0052	-0.001	-0.0054	-0.031	-0.0094
LUX	-0.0212	-0.0531	-0.0032	-0.0008	-0.0024	-0.0057	-0.0114	-0.0005	-0.008	-0.0966	-0.2239	-0.0009	-0.0056	-0.1987	-0.0861	-5E-05	-0.0002	-0.8436	-0.0101	-0.0419	-0.0072	-0.0026	-0.0013	-0.0069	-0.0018	-0.0113	-0.0239	-0.0608
MLT	-0.0556	-0.0029	-0.0046	-0.0006	-0.001	-0.0015	-0.0247	-0.0004	-0.0005	-0.0208	-0.0957	-0.0006	-0.0027	-0.0327	-0.0136	-0.0002	-0.0004	-0.0028	-12.226	-0.0042	-0.0017	-0.0009	-0.0011	-0.002	-0.0003	-0.0009	-0.0118	-0.055
NLD	-0.0078	-0.0342	-0.001	-0.0003	-9E-05	-0.0052	-0.0224	-0.0004	-0.0071	-0.0477	-0.1399	-0.0003	-0.0111	-0.0556	-0.0191	-9E-05	-0.0003	-0.0024	-0.002	-1.3825	-0.0057	-0.0045	-0.0018	-0.0061	-0.0004	-0.0085	-0.0154	-0.0265
POL	-0.0183	-0.008	-0.0023	-0.0008	-0.0003	-0.0302	-0.0255	-0.0009	-0.008	-0.0436	-0.2278	-0.0004	-0.0234	-0.0102	-0.0245	-0.0007	-0.0016	-0.0021	-0.0048	-0.0171	-0.8496	-0.0026	-0.0054	-0.0346	-0.0019	-0.0084	-0.0204	-0.0192
PRT	-0.0046	-0.0074	-0.0003	-0.0001	-9E-05	-0.003	-0.0096	-0.0001	-0.0044	-0.0575	-0.066	-0.0003	-0.003	-0.0095	-0.0125	-1E-05	-0.0001	-0.001	-0.0017	-0.0088	-0.0029	-1.3685	-0.0014	-0.0064	-0.0005	-0.052	-0.0055	-0.0197
ROU	-0.0174	-0.0069	-0.0145	-0.0004	-0.0005	-0.0104	-0.0043	-0.0003	-0.0017	-0.0404	-0.1455	-0.0016	-0.0257	-0.0029	-0.0388	-3E-05	-0.0001	-0.0009	-0.0009	-0.0103	-0.0065	-0.0017	-0.9226	-0.0224	-0.0017	-0.0067	-0.004	-0.0119
SVK	-0.0566	-0.0084	-0.0035	-0.0015	-0.0001	-0.0784	-0.0065	-0.0005	-0.0038	-0.0508	-0.2745	-0.0003	-0.0673	-0.0033	-0.0379	-0.0002	-0.0004	-0.0011	-0.001	-0.011	-0.0294	-0.0041	-0.0092	-3.182	-0.004	-0.0116	-0.0114	-0.0205
SVN	-0.0716	-0.0053	-0.0038	-0.0181	-0.0002	-0.0177	-0.0154	-0.0003	-0.0025	-0.0373	-0.2493	-0.0004	-0.0436	-0.0045	-0.07	-1E-04	-0.0002	-0.0024	-0.0019	-0.0097	-0.0108	-0.002	-0.0054	-0.0258	-1.0955	-0.0071	-0.0087	-0.007
ESP	-0.0039	-0.0056	-0.0007	-0.0002	-0.0002	-0.0033	-0.0082	-0.0001	-0.0018	-0.0642	-0.0688	-0.0006	-0.0037	-0.0067	-0.0228	-3E-05	-8E-05	-0.0012	-0.004	-0.0083	-0.0036	-0.0254	-0.0013	-0.0069	-0.0004	-1.0407	-0.0038	-0.0161
SWE	-0.0079	-0.0074	-0.0006	-0.0001	-0.0001	-0.0043	-0.074	-0.0017	-0.0317	-0.0227	-0.0828	-0.0004	-0.0041	-0.0117	-0.0104	-0.0003	-0.0006	-0.001	-0.0128	-0.0122	-0.0082	-0.0016	-0.0005	-0.0041	-0.0005	-0.0038	-2.1965	-0.016
GBR	-0.0016	-0.0055	-0.0002	-5E-05	-0.0004	-0.0011	-0.0054	-8E-05	-0.002	-0.029	-0.0294	-0.0007	-0.0014	-0.0394	-0.0044	-1E-05	-5E-05	-0.0032	-0.0071	-0.0124	-0.0014	-0.0009	-0.0003	-0.0015	-0.0001	-0.0029	-0.0055	-1.2466
EU	-0.0545	-0.0452	-0.0101	-0.0029	-0.002	-0.0296	-0.0568	-0.0021	-0.0368	-0.3072	-0.6746	-0.0088	-0.0272	-0.1013	-0.1821	-0.0014	-0.0017	-0.0092	-0.0189	-0.0835	-0.0354	-0.0215	-0.0143	-0.0346	-0.0044	-0.0841	-0.0697	-0.1904

Table 15. PRC sanctions on individual EU member states.

Change by:

-1.36762	x≤-1
-0.81726	-1<x≤-0.75
-0.66124	0.75<x≤-0.5
-0.34766	-0.5<x≤-0.25
-0.10217	-0.25<x≤0

Table 16. Heatmap of spillover effects caused by sanctions on Germany

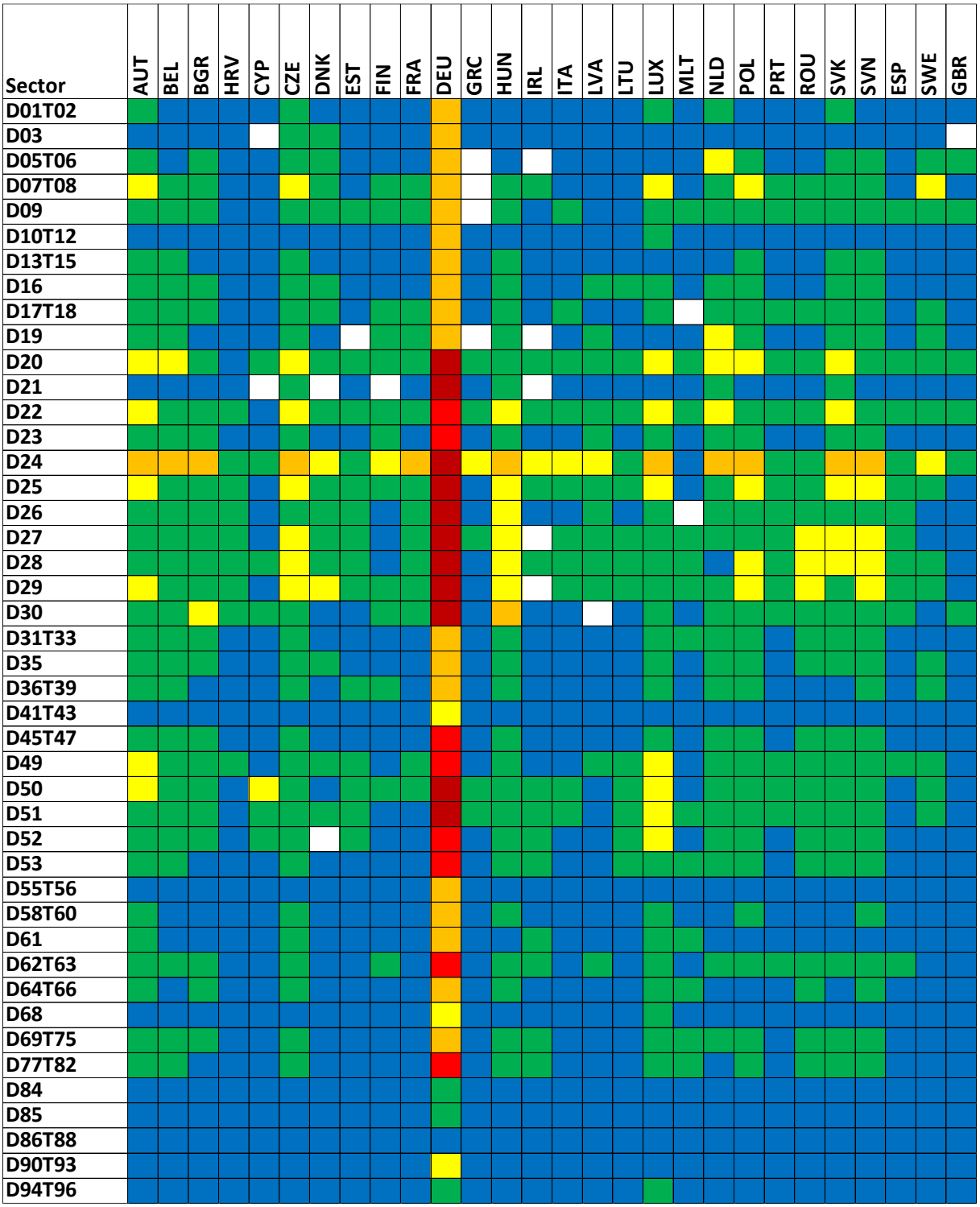

Table 17. Heatmap of spillover effects caused by sanctions on France