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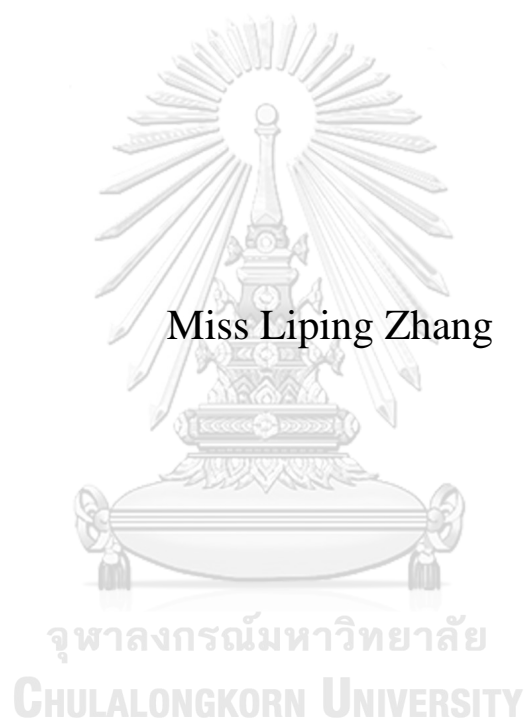
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Europe—a Battleground over Huawei's 5G: The Possibility of
Economic Coercion by both the US and China to Make a
Change on the Battlefield



An Independent Study Submitted in Partial Fulfillment of the
Requirements
for the Degree of Master of Arts in European Studies
Inter-Department of European Studies
GRADUATE SCHOOL
Chulalongkorn University
Academic Year 2019
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ยุโรปและสนามรบ 5G ของ Huawei:
ความเป็นไปได้สำหรับการบังคับทางเศรษฐกิจจากทั้งสหรัฐอเมริกาและจีน
เพื่อเปลี่ยนสนามรบ



สารนิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาศิลปศาสตร
มหาบัณฑิต
สาขาวิชายุโรปศึกษา สหสาขาวิชายุโรปศึกษา
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Independent Study Title	Europe—a Battleground over Huawei's 5G: The Possibility of Economic Coercion by both the US and China to Make a Change on the Battlefield
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Field of Study	European Studies
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Accepted by the GRADUATE SCHOOL, Chulalongkorn University in Partial Fulfillment of the Requirement for the Master of Arts

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CHULALONGKORN UNIVERSITY

ลี้ผิง จาง : ยุโรปและสนามรบ 5G ของ Huawei:

ความเป็นไปได้สำหรับการบังคับทางเศรษฐกิจจากทั้งสหรัฐอเมริกา

ริกาและจีนเพื่อเปลี่ยนสนามรบ. (Europe—a Battleground

over Huawei's 5G: The Possibility of Economic

Coercion by both the US and China to Make a Change

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สรรพศรี

ห้ ว เ ว ย

(Huawei) ได้กลายเป็นหัวข้อข่าวระดับโลกท่ามกลางสงครามการค้าระหว่างสหรัฐอเมริกากับจีนที่ทวีความรุนแรงมากยิ่งขึ้น โอกาสในการบีบบังคับทางเศรษฐกิจจากจีนและสหรัฐอเมริกา บทความนี้สำรวจความสัมพันธ์ของสหภาพยุโรปโดยเฉพาะอย่างยิ่งความสัมพันธ์ทางการค้ากับสองมหาอำนาจและวิเคราะห์ความเป็นไปได้ของการบีบบังคับทางเศรษฐกิจต่อสหภาพยุโรปและผลที่ตามมาจากการกระทำของพวกเขาจากการวิเคราะห์เชิงพรรณนาของสถิติการค้าและการลงทุนพบว่าสหภาพยุโรปมีความเสี่ยงต่อการถูกบีบบังคับทางเศรษฐกิจจากจีนและสหรัฐอเมริกาอย่างไรก็ตามหากการบีบบังคับทางเศรษฐกิจเกิดขึ้นสหรัฐอเมริกาจะต้องแบกรับผลกระทบทางเศรษฐกิจเมื่อจีนต้องแบกรับผลกระทบด้านการทูตและเศรษฐกิจดังนั้นทั้งจีนและสหรัฐอเมริกาก็จะไม่บังคับให้มีการบีบบังคับทางเศรษฐกิจในสหภาพยุโรป แต่ใช้เครื่องมืออื่น ๆ หรือทำให้อีกฝ่ายเกิดความเอกสารถบ้นี้พบว่ามีโอกาสสูงที่สหภาพยุโรปจะใช้สื่อกลางของหัวเว่ย (Huawei)

สาขาวิชา ยุโรปศึกษา

ชา

ปีการศึกษา 2562

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ลายมือชื่อนิสิต

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ลายมือชื่อ

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KEYWO Huawei, 5G, US-China Trade War, Economic

RD: coercion, EU

Liping Zhang : Europe—a Battleground over Huawei's
5G: The Possibility of Economic Coercion by both the
US and China to Make a Change on the Battlefield.
Advisor: Assoc. Prof. CHAYODOM SABHASRI, Ph.D

Huawei has been a global headline amid the intensifying US-China trade war, the potential for economic coercion from China and the US to deter the European Union (EU) from pursuing an unfavorable policy on Huawei's involvement in 5G network shall be examined. This paper explores EU's relations, notably its trade ties with the two powers and analyses the possibility of an economic coercion against the EU and the consequences of their actions. Through descriptive analysis of the trade and investment statistics, the paper finds that the EU is vulnerable to economic coercion from the US as well as China, however, if economic coercion is initiated, the US has to bear political, diplomatic, economic consequences; China has to bear diplomatic and economic consequences, therefore, neither the US nor China would impose economic coercion on the EU but rather use other tools or make threats. And the paper finds that it's highly likely that the EU would take a middle way on Huawei.

Field of Study:	European Studies	Student's Signature
		...
Academic Year:	2019	Advisor's Signature
		..

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Liping Zhang

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LIST OF ABBREVIATIONS

3GPP	The 3rd Generation Partnership Project
5G	The 5th Generation
ICT	Information and communications technology
NACE	Nomenclature of Economic Activities
RAN	Radio Access Network
CPE	Customer Premises Equipment
FDI	Foreign Direct Investment
LREE	Light Rare Earth Elements
HREE	Heavy Rare Earth Elements
GATT	General Agreements on Tariffs and Trade
ZTE	Zhongxing Telecommunication Equipment
LG	Lucky Goldstar

CHAPTER | INTRODUCTION

As the US - China trade war heightened in 2018, the Chinese company Huawei, the 5G infrastructure provider, has become a high-value target of the U S policy makers to further undermine China's increasing advancement in technology and its global technological prowess. The objective of phase two of the Trump's campaign was to cite national security imperatives to try to edge the Chinese companies like Huawei out of global tech supply. The President issued an executive order in May 2019 which effectively locked the company out of the country's 5G development. To further refrain it from growing stronger, the US spearheaded at its allies to align with its policy. The world is seeing a US-China decoupling. Amid the clear signal of a ban on Huawei in the build-out of the 5G mobile network by Australia, Canada and Japan, as the key allies of the U.S. and the home of many of the world's wealthiest and most technologically advanced countries in the world, Europe has become the battleground in the race between the two big powers. Both the US and China have been pushing Europe to follow their objectives respectively by threat of sanction or retaliation. Chinese ambassador threatens to retaliate Germany's investment in China (Czuczka & Arons, 2019) and a punishment on UK for trade and investment (Bernal, 2019). In a missive to UK government, US Senate wrote "...We do not want to feed post-Brexit anxieties by threatening a potential US-UK free trade agreement when it comes to Congress for approval....." (Rogin, 2020), although the tone is negative, but we still cannot rule out trade retaliation on the UK by US. The UK in January this year decided to grant the company a limited role in its 5G networks, however in July, it reversed its decision by announcing that Huawei's role would be reduced to zero within the next few years.

Hufbauer, Schott, Elliott, and Oegg (2007) defines sanction as "deliberate, government inspired withdrawal, or threat of withdrawal, of customary trade or financial relations". According to Drury (2005), economic coercion is defined as "the use of economic instrument to cause a target nation some harm or economic loss with the purpose of coercing the target to cease, reverse, or not adopt some policy". In the case of Huawei, the US threatened the EU to shun the company's equipment, and conversely, its rival, China pushed it not to adopt the policy. And in his book *Currency and Coercion: The*

Political Economy of Monetary Power, Jonathan Kirshner identifies the four types of economic coercion: Foreign Aid, Monetary Power, Financial Power, and Trade power which mostly summarize the measures identified by World Economic Forum (2016) in Appendix-1. Therefore, the sanction and retaliation above-mentioned is within the definition of economic coercion. And as economic sanction is widely used in the literature and the media, in the following text, the term sanction and coercion will be used interchangeably.

The US government has been a frequent initiator of economic coercion to achieve its foreign policy objectives throughout the history. Since 1807, during the Napoleonic Wars, a trade embargo in retaliation for British harassment of U.S. merchant ships, was employed by the U S, more than 200 years has elapsed, during which the world sees more and more economic coercion by the US to other countries especially after the Second World War and during the Cold War period. Much the same as the practices adopted by the US during the Cold War, today's rivalry is not so much about the trade but about the occupation of high lands, the technology dominance. Much literature has covered the tools the US applied in its economic coercion to other states (Harrell & Rosenberg, 2019; Rediker, 2016) and China's increasing application of the coercion to its neighbors (e.g. Philippines, South Korea, Japan) (Chheang, 2018; Lai, 2017; Zhang, 2019). There is to date no work studying the possible interaction of the coercion by both power on the same target to win the political support for their policy on one target (Huawei). Although it's quite impossible that both powers apply the economic coercion at the same time on the same receiver, there is still chance of retaliation on different sectors of the Europe from both sides to gain the leverage over the same proxy. And this is critical for the European governments to consider when deciding Huawei's involvement in the 5G network development.

Studying the possibility of economic coercion by both sides against the EU is also significant for the fourth parties to draw lessons and factor this in their decision-making when they are caught in a dilemma like what the EU's faced with currently.

Therefore, this project will center on the potential for economic coercion by both powers to win over Europe on Huawei and the possible change of scenario on the battleground if both parties impose the coercion.

To study this topic, four questions will be discussed: What are the economic incentives behind the battle? What economic leverages do both the US and China have to coerce the EU? How could the economic coercion tip the balance? What consequences do the US and China have to bear?

The following paper is structured as follows: the second section discusses the key scholarly debates on the economic coercion and balance of power theory, then the introduction of methodology. In the third section, the key Huawei disputes, the economic incentives behind the battle, the relations between the EU and the US and China, the potential for coercion, compliance that both sides need from the EU will be presented and examined. The fourth section explores the impact of the coercion. The conclusion summarizes the key arguments and limitation of the study.



CHAPTER II LITERATURE REVIEW AND METHODOLOGY

2.1 Economic Coercion

Traditionally, most of the sanction works center around the US, the sender as case studies or analyze coercion based on the data of US sanction against other states throughout the history (Drezner, 2003; Drury, 2005; Harrell & Rosenberg, 2019; Hufbauer et al., 2007; Peterson, 2018). According to Harrell and Rosenberg (2019), the US is expanding its use of coercive toolkit to pursue foreign policy goals thanks to the important role of dollar, the strength of the economy and global footprint of its companies. Now it seems China is going on the same path. With the increasing role of China as a large economy in the world, and its growing economic influence on its neighbors, there is quite a number of research studying its coercive instruments against neighboring countries to gain leverage on territorial or political disputes or others in which the government perceives national interest is harmed (Chheang, 2018; Lai, 2017; Reilly, 2013; Zhang, 2019). Lai (2017) finds that China's concern for its regional or global image it attempted to shape in the past years restrain its execution of economic leverage and in some cases where coercive measures were initiated, public perception of China in the target nation turned rather negative. She further points out that in many circumstances, China denied the linkage between its practice of coercion and the relevant political disputes, in comparison to this ambiguous way of coercion, other senders of coercion, including the US, the EU and Russia were quite explicit in sending the messages to the target.

Most of the literature concerned with the US sanction or coercion deals with the efficacy of the tool (Drezner, 2003; Drury, 2005; Peterson, 2018; Reilly, 2013). Drury (2005) identifies five conditions for an effective sanction:

- (i) Grievous target tends to acquiesce to sanctions more often
- (ii) Sanction is more effective when the target bears costly sanction
- (iii) The absence of the help of international organization in multilateral sanctions on one target make it less effective
- (iv) When national security is concerned by the sender when sanctioning, the effort is less effective
- (v) Coercive measures against a democratic regime is more successful than an

authoritarian one, which can also be found in other scholarly works(Allen, 2005; Hufbauer et al., 2007)

Hufbauer et al. (2007) suggest that under the following conditions coercion may fail:

- (i) Sanctions play a limited role in achieving foreign policy objective that relies on forcing the target to take steps it firmly resists.
- (ii) When the primary purpose is undeclared—namely, showing resolve at home, signaling disapproval abroad, or simple punishment—may have been fully achieved, these sanctions fail to effect a real change in the target's behavior.
- (iii) If the sender and target have cross interests and conflicting goals in their overall relations, sanctions would fail sometimes.

Those literatures on the efficacy of sanction usually considers two general variables, the economic variables and political variables. While Hufbauer et al. (2007) also includes the sanction cost as a variable to examine the effectiveness, other variables include relative economic size(Hufbauer et al., 2007; Neuilly, 2008), economic health and political stability of the target, the type of sanctions practiced, and cost to sender(Hufbauer et al., 2007), trade linkage between the sender and the target (Hufbauer et al., 2007; Peterson, 2018) has been put forward by scholars. The political variables identified by Hufbauer et al. (2007) range from modest changes in policy, regime change, disrupting military adventures, the Cold War, and sanctions targets.

Previous sanction decision studies focused on sender-target relations and domestic politics of both sides. But with the development of regional and global value chain, more and more states are expanding their trade networks, therefore the role of third party(s) in the sanction literature also draws an increasing attention(Krustev, 2010; Peksen & Peterson, 2015). Peksen and Peterson (2015) assert that the sender's coercion decision would be to some extent affected by its anticipation of whether there are wealthy allies of the target to redirect its sanction cost even when the target is highly dependent on the trade with the sender. Peterson (2018) further examines how the structure of global trade network would make the target vulnerable to economic sanctions, and at the same time avail senders of the chance to initiate sanctions. He

concludes that a target with low value to its trading partners that are highly linked to the broader international trade network tends to surrender to the sanctions, while a target with a high value to its trading partners that are weakly linked to the network is more likely to initiate sanction threat.

Research finds that coercive attempts are most likely to succeed at the threat stage before actual sanctions are imposed (Drezner, 2003; Krustev, 2010; Lacy & Niou, 2004). Krustev (2010) argues that the sender would require more substantial concession from a weaker target, and the sender is more likely to impose economic coercion against a weaker target. After the sanction is initiated, the target would change their action or policy once they realize the sender is not bluffing. Therefore, it's equally significant to study the threat stage and the follow-through or implementation stage of the coercion.

Regarding the Huawei disputes, it seems that the parliament of Germany has already considered the coercion threat from China and heated debate about the gain and loss for ostracizing the company in its 5G mobile network deployment is ongoing in the parliament.

Therefore, it's significant to know how the threat may affect the balance of power among the US, the EU, China if both the US and China employ coercion to pressure the EU on Huawei policy.

2.2 Balance of Power in Realism

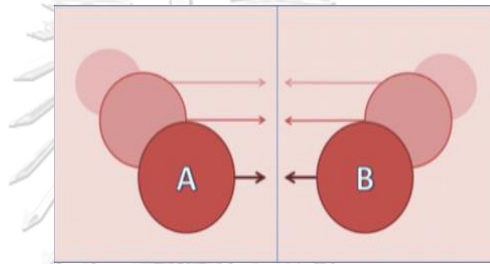
Balance of power is regarded as the most important contribution to the school of realism in international relations. In general, it refers to an old concept of equilibrium in the political sense, but also in the sense of economics, biology, physics and other scientific disciplines. For its meaning in politics, Friedrich List believed that it is politics' goal to preserve the balance of power among nations and that it has always been nothing but the efforts of the weaker state to constrain the encroachment of the stronger. Balance of power centers on topics including security, sphere of influence, and explores how the balance of power transforms. Power is the foundation of the theory. As globalization develops, the current world witnesses the increasing importance of economic power which has been sought after by key players in the world.

Morgenthau (1948) claims in his seminal text that states as well as individual actors in

domestic politics essentially follow “threefold pattern of international politics.” By following these patterns, states can either choose to challenge or stabilize the current distribution of power in the international system. According to Waltz (2000), states need to pursue balancing as a strategy for survival and for an autonomy.

Morgenthau (1948) identified that the power struggle exhibit two patterns: direct opposition or competition. As shown in Figure 1, there are 2 states A and B, the first balancing emerges directly from the attempt by one state to impose its will on another; State A attempts to increase its power to influence State B's policies, State B in turn attempts to contend with such efforts through a comparable build-up.

Figure 1: Balancing of nation states

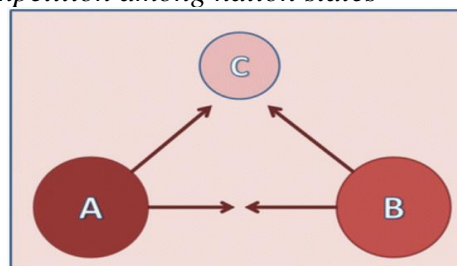


Source:(Fels, 2017)

This balancing is quite dynamic in nature as countries will try the attempts one after another and the receiver will accordingly resist the attempts. Mearsheimer (2001) contends that If the forthcoming change favors another state power, a great power will strive to keep the current balance of power and tries to disrupt the balance when the course of change benefits itself.

For the competition pattern, another state is included into the picture as shown in Figure 2.

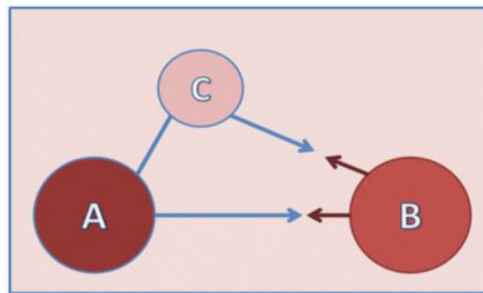
Figure 2: Pattern of competition among nation states



Source:(Fels, 2017)

This competition pattern may involve 3 scenarios: Firstly, when A and or B is trying to gain influence over the policies of C. A could succeed and win over C (Figure 3), thereby changing the overall balance of power in its favor ($A > B$).

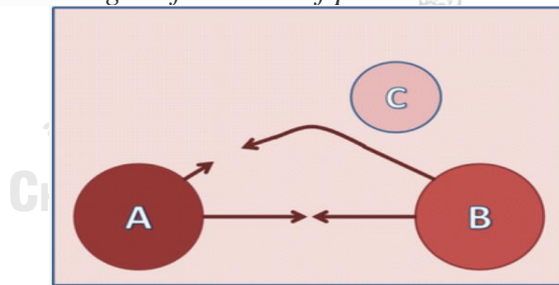
Figure 3: Change power balance resulted from either A's dominance over C or C's voluntary loyalty to A.



Source:(Fels, 2017)

Secondly, B could effectively prevent C from prevailing by A (without attempting to dominate C itself) and thus obtain an advantage that could change the balance of power again ($B > A$) (Figure 4).

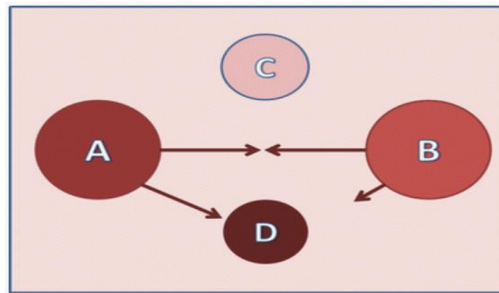
Figure 4: B prevents changes of balance of power



Source:(Fels, 2017)

Finally, when A stops its efforts to dominate C and perhaps concentrates its imperialist policies on another actor (D), C's autonomy will be guaranteed temporarily, while D's interdependence develops into a function of two powerful bilateral power relationships. (Figure 5)

Figure 5: C remains neutral, A and B focus on another actor



Source:(Fels, 2017)

Therefore, as the US and China both attempt to win over the EU on the 5G policy, this paper intends to apply the theory to see how economic coercion may alter the existing power of balance dynamics on the battlefield.

2.3 Methodology

The paper draws on 3 sources of information. First, it builds upon the secondary literature on economic coercion, power of balance. Second, the article analyses 5G through reports, working papers, policy papers, strategies, guidelines, intergovernmental communications, EU resolutions. Thirdly, the general and sectoral trade and investment statistics of the concerned parties on governmental websites or international organization websites or provided by the consulting agencies. Based on the economic coercion theory and the power of balance patterns, this paper will use the descriptive analysis method to study the research questions.

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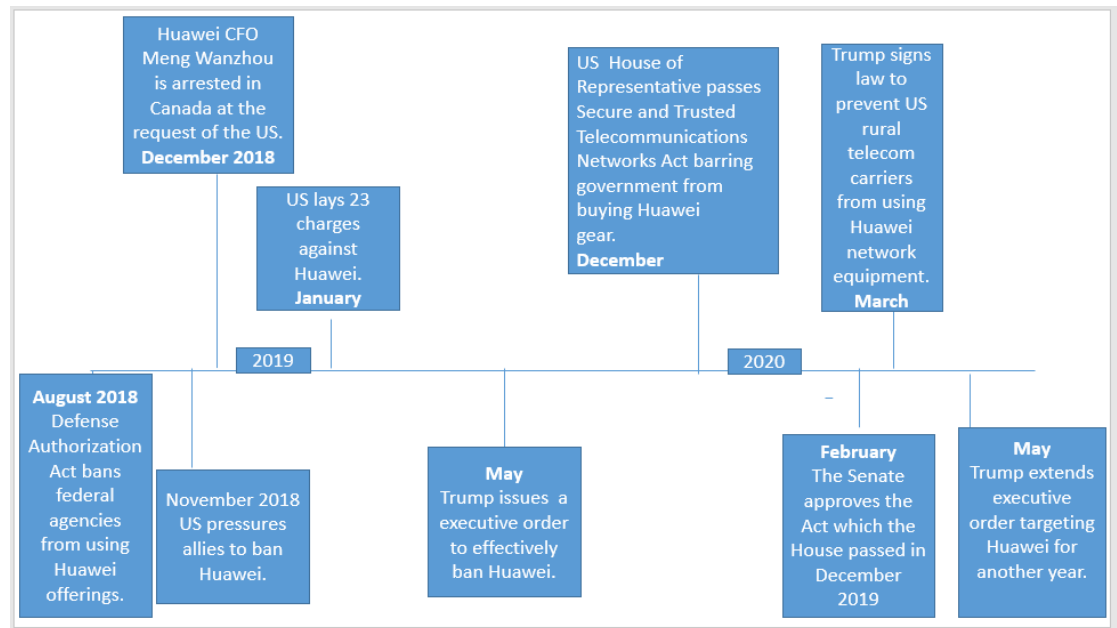
CHAPTER ||| ANALYSIS

3.1 The Huawei Disputes

As the Sino-US Trade War started in July 2018 with the US collecting a 25 percent

tariff on 34 billion \$ worth of goods from China, the issues concerning Huawei before this time, although important, will not be discussed here. Figure 6 illustrates the timeline of the disputes from July 2018 to date. The Huawei 5G disputes are unique for the following 3 reasons: the massive security concerns; huge economic incentives behind it; the dispute has turned into a power struggle between China and the US with European countries caught in the middle. The trigger of the disputes and the focus of attention on Huawei has been the security concern which is emphasized or even exaggerated by Trump to elbow out the company from the US and its allies' market. It's argued that the US fails to provide concrete evidence to prove Huawei pose threat to national security and therefore it's difficult to assess the severity of the threat (Tomaschek, 2020). But Washington steps up its efforts to diminish Huawei's role in its market and the technological sphere. Though it adopted actions against Huawei before the trade war, it's during the trade war period when the US scales up its application of legislative and diplomatic tools to the company. The series of measures starts with an act banning the federal agencies from using the Huawei gear in August 2018, and then the ban extends to the state government, followed by the rural telecom sector. From Figure 1, we can see a top-down (federal to local), full scale (government to commercial) blow to Huawei, not only excluding Huawei from 5G participation, but also preventing it from doing business with all US firms, nearly cutting off every lease of life for the company on the US market. The dispute caught global headlines following the arrest of Huawei's CFO, Meng Wanzhou who has still been on house arrest in Canada to date. And this May, Trump's decision to extend the executive order pertaining to the company has added some uncertainties to the future of Chinese tech giant and Sino-US relations.

Figure 6: US actions towards Huawei since the start of the trade war



Source: self-compilation

Against the backdrop of the US ban on Huawei, many of its allies or pro-US countries in the world follow in line to exclude Huawei in the 5G infrastructure (Appendix-2), but most of the European countries remain constrained and tried to formulate a midway solution to the dispute. Therefore, we need to examine the factors that may lead to their cautiousness in their Huawei tactics, among which economic incentives and their economic ties with both the US and China shall be examined.

3.2 Economic incentives behind the battle

Long before 2018, there were security concerns and accusation of technological theft surrounding Huawei in the US and some have ended up in the US court. It's worth noting that, since the trade war, the scale of crackdown on Huawei and the resistance the company and its origin country put up are unprecedented, compared with the similar approach towards Alstom, a French power and transportation conglomerate and Toshiba, Japanese semiconductor producer by the US, which were finally edged out of the dominance position in their field. One may argue the economic incentives behind this scale of the crackdown on the company and why the issue has been highly politicized since the trade war in 2018 when Trump proceeded to persuade its allies to follow suit with both diplomatic and alliance pressure. It's also significant to explore how its allies calculate the cost to phase out Huawei.

3.2.1 Macro Economic gains brought by 5G

The economic gain of 5G is lucrative, it's not only an employment generator but also and incubator of new devices, technologies and business models which would significantly spur the world economy. Campbell et al. (2017) at IHS Markit estimates that in 2035, 5G will make \$12.3 trillion in global economic value possible which amounts to 4.6% of total global real output. This is almost equal to US consumption in 2016 and to combined consumer expenditure in 2016 in China, Japan, Germany, the UK and France. The global value chain of 5G alone will drive \$ 3.5 trillion output, generating 22 million jobs in 2035. This value is greater than the entire mobile value chain today. In addition, 5G rollout will drive long-term, sustainable growth to real global GDP. Between 2020 to 2035, the IHS forecasts global GDP will grow at 2.3% annually, 0.2% of which will be contributed by 5G. The overall contribution of 5G to actual global GDP would match the scale of India's economy, which is the seventh largest in the world today.

3.2.2 Economic incentives of the EU on acquiring the 5G technology

What 5G distinct from any other previous generations of communications is that, besides realizing person-to-person or person-to-device communication, 5G enables machine-to-machine communication. It's characterized by higher data speed, low latency and Massive machine-type communications (Rühlig & Björk, 2020). Therefore, it can deliver huge benefits across industries, not least the manufacturing sector, which would see the largest share of economic activity enabled by 5G, value at \$3.4 trillion output, followed by ICT sector, creating over \$1.4 trillion output (Appendix-3).

Both Manufacturing sector and ICT sectors are significant for the EU's Economy. Eurostat (2020b) recorded the EU is home to 2 million enterprises specialized in manufacturing sector, approximately one tenth of all enterprises in the non-financial business economy in 2017. It employed 28.5 million people, the second largest NACE sections within EU's non-financial economy regarding its contribution to employment (22.8%) and the largest contributor to the non-financial economy value added. In the same year, ICT sector contributes to 3.6 % of the EU's GDP, employed around 5.4 million people. ICT service constitutes most of the ICT activity which is more than 10 times as high as ICT manufacturing in terms of value added. ICT service sector alone

numbered over 1 million enterprises, contributed 4.6 % of the persons employed and 7.7 % of the value added to the non-financial business economy. In the value added of the service sector, telecommunications provided 30.3 % of the value added. ICT manufacturing was dominated by the manufacture of electronic components and boards, providing 57.2 % of the total added value by ICT manufacturing, followed by the manufacture of communication equipment which accounted for 25.9 % of the total added value. If 5G is deployed, these two sectors will benefit a lot in the EU. Besides, Europe has the highest percentage of GDP growth attributable to mmWave 5G than any other region (2.9%), generate \$ 55 billion tax, 135 \$ billion GDP boost by 2034.

3.2.3 Huawei's incentive to involve in 5G rollout in the EU

Huawei has a strong presence in the region. It has been supplying access network equipment to fixed and mobile networks in Europe for nearly 20 years. In 2019, 34.5% of its total revenue comes from carrier business, second to consumer business (54.4%). Europe has become Huawei's largest and significant overseas market and now become the largest overseas market for the company to deploy 5G network equipment. It used to supply network kits to EU's top operators—Deutsche Telekom (Germany), Orange (France), Telecom Italia (Italy), Telefonica (Spain). Whether in Germany, Spain, and many other European countries, Huawei has participated in building up the second-, third-, and fourth-generation mobile networks. Each generation of equipment supplied by Huawei runs stably with smooth signal.

The proportion of internet users among the whole population in the EU is, 89.4%, significantly higher than the world average, 59.6%. The potential for those internet users to use 5G is huge. Therefore, the carriers in the EU have the eagerness to deploy 5G and make a huge portion of the population access to the fast-mobile network.

Table 1: Internet Usage in the European Union - 2020

WORLD REGION	Population	% Pop.	Internet Users, 30-June-2020	Penetration
	(2020 Est.)	of World		(% Population)
European Union	445,250,514	5.70%	397,988,114	89.40%
Rest of World	7,351,699,196	94.30%	4,251,884,667	57.80%
Total World	7,796,949,710	100.00%	4,649,872,781	59.60%

Source: Internet World Stats

Therefore, due to the massive market potential and its penetration into the previous generation of networks in Europe, Huawei has high incentives to play a part in building 5G in the region.

3.2.4 The Cost to replace Huawei gears for 5G rollout

Global Data (2019), a leading data and analytic company, unveiled a report assessing the competitiveness of 5G RAN vendors Huawei, Ericsson, Nokia, Samsung, ZTE. It applies 4 indexes, baseband unit capacity, radio unit portfolio, installation ease and technology evolution to assess the RAN products, Huawei remained the clear leader across all criteria (Appendix-4). According to the report, Huawei's baseband unit capacity is the largest and is ready for operators to increase the volume of users; Its radio unit portfolio covers the most spectrums with small size and light weight and can cater to various scenarios of network deployment for operators; in terms of technological revolution, Huawei gears are more ready to smoothly evolve to 5G and can save the investment cost for operators. The 4-competitiveness index is critical for mobile operators to select vendors and for the vendors to steer their future development to compete with the other players.

According to IPLytics, in the rank of 5G patent holders, as of January 1, 2020 (Appendix-5), Huawei declared 3147 5G families, the largest portfolio among its counterparts. Samsung ranked the second followed by another Chinese company ZTE, LG (Korea), the two European company Nokia and Ericsson, while the US company Qualcomm declared the least patents (Pohlmann & Blind, 2020). Another method applied by Pohlmann and Blind (2020) to assess a company's strength of 5G leadership is to analyze the company's involvement in developing 5G standards. The organization 3GPP is a collaborative activity between several organizations working on 5G specifications. How much each company contributes to the standards manifests a company's share and influence in the development of the standard. Huawei has made 26,372 contributions, accounts for one fifth of the proposal for 5G to 3GPP, the largest share of contributions, followed by Ericsson, Nokia and Qualcomm. These four companies cover over two-thirds of all 5G submissions to the body (Pohlmann & Blind, 2020).

Therefore, regarding the technological criteria critical for mobile operators, the declared patents and contribution to 5G standards development, Huawei holds the leadership position. “5G patent holders are also likely to become technology and market leaders”(Pohlmann & Blind, 2020), and it's widely agreed among European operators, vendors and experts that Huawei's 5G technology is of high quality (Rühlig & Björk, 2020). Excluding the other supply chain risks posed by US crackdown, it's highly likely that the company will dominate the world of telecommunication for some time.

Even though Huawei's network equipment is barred from the 5G communication infrastructure in the US, since Huawei holds so many key patents and as being above-mentioned, there is only one US company makes its way to the top 5G patent holder list with the least declarations, it is likely that many other US carriers will use technology patented by the Chinese firm via a third party that use the patented tech by Huawei (Kharpal, 2019). One may calculate the amount of money they must pay to the company if firms in the US wants to utilize Huawei's technology and the company gets serious in protecting its intellectual property. Pohlmann and Blind (2020) recorded that the patents Chinese firms submitted are very young, even younger than main European counterparts one can assume that Chinese telecommunications firms are still filing patents, and more will be granted in the near future. China used to be a huge buyer of American patents, but if Huawei continues to precede in the 5G sector, the trend of trade in patents in the communication may reverse. Technology dominance not only suggests a company's strength, but also signifies the profits it's going to make by taking away the market share and selling patented technology. It's seems that the US has recognized Huawei's potential to use its patent against US firms and envisaged the unfavorable situation the US firms which use 5G technology may be faced with before adopting aggressive undertakings on Huawei.

At present, there are two ways to make 5G available, one by upgrading the existent 4G infrastructure, namely, Non-Standalone(NSA) which will be adopted first in the Europe, the other is by installing the new 5G core architecture, that is Standalone (SA) (Lee & Chau, 2017). The testing results of the IMT-2020 Promotion Group released in September 2018 and January 2019 show that in 5G NSA scenario, Huawei's 5G network could offer downlink rates of up to 1.86 Gbps per user and Ericsson could only

offer 1.38 Gbps, Nokia 1.15 Gbps. Ericsson and Nokia's latencies in the user's plane are 3.5 milliseconds and 3.8 milliseconds respectively, whereas Huawei has just 2 milliseconds latency. Huawei could deliver up to a downlink rate of 14,58 Gbps per cell in SA scenarios, while Nokia has still not completed the test. The mobile network consists of two main components, the Radio Access Network (RAN) (main component—base station) and Core Network. The RAN is critical to the transmission of data between the core network and user devices and currently 3 producers are available, Huawei, Ericsson and Nokia. If Huawei is banned, the Europe is left with only two choices, as above-mentioned, Huawei's RAN products overtake the two European vendors. Now the US led Open-RAN is an alternative to the existing interfaces found in the mobile network, yet it is still an unmaturing technology. Huawei claims to be the only global supplier of end-to-end 5G products and commercial solutions, that means, it can provide elements of all ICT supply chains for 5G networks and its 5G equipment is more advanced than its competitors with 12-month to 18-month lead (Huawei, 2020). The only vendor that can provide the same range of products is Samsung, but it's much weaker in infrastructure (Horowitz, 2018). For operators, cost effectiveness is the top concern and the time they can accommodate the users and industry with the 5G internet also means the market share and the chance to foster user loyalties.

If the EU blocks Huawei, it risks far-reaching economic consequences for the mobile operators in the region. GSMA Intelligence (2019), an industry association that represents the interests of 750 mobile network operators worldwide, predicts that a Huawei and ZTE ban in the rollout of 5G would result in € 55-billion cost for mobile operators in Europe and an 18-month delay in the rollout. If Chinese vendors are squeezed out, the lessened competition would increase the price which drives the rollout cost by € 25 billion. The rest 30 billion would be generated by replacing the existing 4G infrastructure installed by Huawei for NSA 5G network. It is estimated that the replacement of Huawei base stations in Germany alone would cost €6.4 billion (Gu et al., 2019). GSMA further points out that such a delay would put the benefits the EU businesses and consumers enjoy of accessing 5G at risk—a € 45-billion loss to add in the period to 2034 if the effects are lasting. And in a world develops so fast, it's

significant to scale 5G networks faster than other countries since 5G will come with a new generation of services and business models.

Huawei beats its European competitors, Ericsson and Nokia in 5G RAN portfolio, data transfer speeds, latency. The rise of Huawei poses a challenge to the US, as in many fields Huawei is catching up or even surpass European and US firms in aspects such as the declared 5G patent families and contributions to 5G standards. The US fears its dominant position as patent holders and creditors in the communication industry at stake. For the EU, the time to replace Huawei and the fact that its equipment is 18-24 advanced than other providers, and limited production capacities result from the COVID-19 pandemic in the region would all together makes the 5G build-up project time-consuming. The exclusion of Huawei from the 5G infrastructure will have significant economic impacts for the deployment of 5 G in Europe and the realization of wider economic benefits for European citizens and businesses linked with the technology. 4G comes with digital economy, countries including China and US have reaped a lot of benefits from this generation of network. The past decade proves that, the earlier a country adopts the latest communication network, the larger digital fortune it can capture. The late runner may not be able to set the technology standards as its peers. Therefore, now countries are racing to scale 5G network. The economic implications and time cost are huge not to mention its implications on technological innovation, as higher cost makes less funding available for research and development.

3.3 EU's external relations

In his case studies, Hufbauer et al. (2007) discovers that cordial bilateral relations between the sender and the target would often improve the success rate of the economic coercion, therefore the following section will describe EU's relations with both countries in general.

3.3.1 EU's relations with the US

The EU-US relations can be traced back to their historic links, particularly since the emigration of Europeans to the continent. Then after the Second World War, U.S. involved in rebuilding Europe under the umbrella of the Marshall Plan. The formal diplomatic ties were established when the European Coal and Steel Community was created. The bilateral relations are extensive, ranging from military defense alliance to

close trade partners. The depth and width of their relations lay on the premise of shared values and interests on many fronts. The shared values render them easily to arrive at a common ground in various international affairs. Before the Trump administration, although the two sides may disagree on many matters, the unequal “Big brother, small brother” relation most of the time can find a shock absorber and resolve disputes. However, since Trump took office, his pursuit of the American First agenda and relentless defiance of the multilateral regimes alienate the country away from its European partners, which is felt and strongly disagreed by Germany and France. Despite EU's efforts to bring its ally back to the multilateral system and sustain its role in global governance in areas including combating climate change and maintaining non-proliferation, the US seemed quite unforthcoming. This year becomes more crucial as the US presidential election is 5 months away, Trump will gear up recovering the economy where he can earn more ballots; therefore, Washington will continue to uphold its American First Policy notably in trade to reap more benefits and disregard matters that don't render immediate economic gain to the country.

Both blocs have fostered extensive and globally significant trade and investment ties. These relations have deepened with expanding international supply chains and cross-border investment. The transatlantic economy is a dominant force in the world; in 2018, the US and EU-28 accounted for almost half of the world's GDP (current US dollars), 11 percent of the world's population, one-fifth of global exports of goods (intra-EU excluded) (Akhtar, 2020). The transatlantic relations are genuinely driven by bilateral investments that lead to growth and employment on both sides of the Atlantic (European Commission, 2020b). The relations also define the global economy in its entirety. For almost all other countries of the global economy, the EU or the US is the largest trade and investment partner.

3.3.2 EU's relations with China

The EU established diplomatic ties with China in 1975 and the bilateral relations had taken off since 1980s soon after the opening-up of China. Recently the EU no longer regards China as a developing economy, but a key global player and technological power (Commission, 2019). It realizes the growing influence of China, therefore it set the priorities for dialogues not only encompassing bilateral one, but also engaging

China for global governance in climate change, non-proliferation etc. on which they have the capacity to exert an influence globally. Both sides expect to conclude a comprehensive investment agreement carving a deeper sectoral agreement in 2020. The two blocs in general remain favorable to each other, as they are geographically apart from each other without territorial disputes and other conflicts, however, since they are so different in political system, economic system and values, little contrariety does happen, the main irritant is the human right concerns (Xinjiang/Hongkong), and territorial issues(Tibet/Taiwan/South China Sea). The EU in its 2016 Global Strategy report underscores the importance of principled pragmatism. Its focusses on exporting the core values, including those it accused China's insufficient respect for (human rights) has been outweighed recent years by economic interests. “Given the importance of EU-China economic relations, it is important to maintain very close trade and investment links, while developing a more balanced economic relationship” (European Union External Actions, 2019).

The economic ties which has deepened in the past two decades dominates the current EU-China relationships. In 2019, China was the EU's second-largest trading partner after the US, while the EU is China's largest trade partner, between them, over 1-billion € worth trade occurs in a single day (European Commission, 2020a). Currently the EU records a €164-billion trade deficit with China, with imports from China reached € 362 billion, and export value at €198 billion. Bilateral trade grew rapidly over the last two decades. However, this is still ample potential for growth.

3.4 The potential for economic coercion

Economic sanctions may be imposed through many ways as identified in Appendix-1. According to the Hufbauer's case studies, the method employed rests on the nature of economic links between the initiator and the receiver. How deep the receiver's economy is exposed to the initiator may be factored into making coercion decisions. Peksen and Peterson (2015) mention the role of a third party as a potential market or suppliers to the sanction-receiving country. If the alternative market(s) or supplier does exist, the receiver is less vulnerable to coercion and therefore won't cave in to the pressures from the initiator. In the case of trade restrictions, the effectiveness of sanctions depends also on the products traded between the two countries, not least products of strategic

importance for the receiver. Therefore, this section will explore the dependency of the EU on the US and China for their market and certain supplies, and the product groups which are susceptible to be used as leverage by both powers to coerce the EU on Huawei issue.

3.4.1 The potential for the US's coercion

By and large, the US and the EU's economy are highly interdependent, which contributes to the welfare of the business and citizens on both sides. Figure 1 presents the goods flows in the past decade between the two blocs and the relevant growth indexes. It shows that the US market is crucial for the EU's merchandise, with the share ranging from 11.5% to 15.2% between the period 2009 and 2019, and trade with the US to EU aggregate GDP ratio range from 2.8% in 2009, the lowest, to 4.4%, the highest in 2019, all this suggest that the EU is vulnerable to US's economic pressure.

Table 2: EU 27 trade flows in goods with the US and trade dependency

Period	Imports			Exports			Total Trade		
	Value Mio €	% Growth	% Extra-EU	Value Mio €	% Growth	% Extra-EU	Value Mio €	% Extra-EU	% GDP
2009	127,280		10.7	169,380		14.3	296,660	12.50	2.80%
2010	142,060	11.6	9.7	202,925	19.8	14.1	344,985	11.90	3.14%
2011	155,026	9.1	9.3	222,593	9.7	13.7	377,619	11.50	3.30%
2012	167,095	7.8	9.8	248,209	11.5	14	415,304	12.00	3.60%
2013	164,720	-1.4	10.1	245,984	-0.9	13.8	410,705	12.00	3.60%
2014	168,858	2.5	10.4	265,918	8.1	14.8	434,776	12.70	3.70%
2015	197,393	16.9	12	310,833	16.9	16.6	508,226	14.40	4.20%
2016	195,250	-1.1	12.2	308,818	-0.7	16.5	504,068	14.50	4.00%
2017	203,314	4.1	11.5	324,221	5	16.3	527,536	14.00	4.00%
2018	213,290	4.9	11.2	351,215	8.3	17.1	564,506	14.20	4.20%
2019	231,986	8.8	12	384,438	9.5	18	616,423	15.20	4.40%

Note: % Growth: relative variation between current and previous period; % Extra-EU: imports/exports as % of all EU partners i.e. excluding intra-EU trade; %GDP: total trade with the US as% of total EU GDP

Source: Eurostat

Table 3: Most traded products between EU-27 and the United States, 2019

Code and label	Imports	Exports
541 Medicinal and pharmaceutical products	18.6	34.2
542 Medicaments	10.6	30.6
781 Motor cars and motor vehicles	9.4	28.7
714 Engines and motors, non-electric	22	14.6
792 Aircraft and associated equipment	19.3	11.8
515 Organo-inorganic and related compounds	2.1	13.5
334 Petroleum oils other than crude	4.1	11.4
874 Measuring and other instruments	6.9	8.5
872 Instruments and appliances for medical purposes	6.2	7.5
728 Other machinery	3	9.6
333 Petroleum oils, crude	12.5	0.1
899 Miscellaneous manufactured articles, n.e.s.	4.4	6.2
764 Telecommunications equipment	4.1	5.8
784 Motor vehicle parts	2.3	7.5
112 Alcoholic beverages	0.9	8.5
598 Miscellaneous chemical products	4.8	3.8
713 Internal combustion piston engines and parts	1.7	6.2
772 Electrical apparatus for electrical circuits	2.4	5.5
776 Electronic tubes, valves and related articles	3.4	3.1
778 Electrical machinery and apparatus	2.3	4

Source: Eurostat



Table 4: Trade flows between EU27 and the US by SITC product grouping 2019

SITC Rev. 3 Product Groups	Imports				Exports			
	Value Mio €	% Total	% Extra-EU	% Growth	Value Mio €	% Total	% Extra-EU	% Growth
Total	231,986	100.0	12.0	8.8	384,438	100.0	18.0	9.5
Primary products	43,029	18.6	7.2	12.9	41,748	10.9	11.9	8.4
- Agricultural products (Food (incl. Fish) & Raw Materials)	12,813	5.5	8.0	-1.9	22,829	5.9	11.4	10.5
- - Food	9,793	4.2	7.2	-3.3	20,409	5.3	12.0	10.7
- - - of which Fish	845	0.4	3.3	4.1	598	0.2	9.6	10.4
- - - Other food products and live animals	8,948	3.9	8.1	-3.9	19,811	5.2	12.1	10.8
- - Raw materials	3,020	1.3	12.3	2.9	2,420	0.6	8.0	8.7
- Fuels and mining products	30,216	13.0	6.9	20.6	18,919	4.9	12.7	6.0
- - Ores and other minerals	4,563	2.0	12.2	26.4	1,260	0.3	7.4	11.8
- - Fuels	23,109	10.0	6.4	23.7	12,167	3.2	11.7	3.9
- - - of which Petroleum and petroleum products	17,739	7.7	6.3	32.1	12,106	3.2	12.6	4.0
- - Non ferrous metals	2,544	1.1	6.8	-8.0	5,492	1.4	19.1	9.6
Manufactures	183,892	79.3	14.1	7.4	332,016	86.4	19.2	8.8
- Iron and steel	943	0.4	2.6	-19.3	5,165	1.3	14.0	-21.1
- Chemicals	53,682	23.1	22.8	8.4	103,448	26.9	25.4	17.2
- - of which Pharmaceuticals	29,116	12.6	31.2	9.0	64,804	16.9	32.0	25.0
- Other semi-manufactures	8,937	3.9	9.1	3.1	20,123	5.2	14.2	3.7
- Machinery and transport equipment	93,690	40.4	14.7	7.2	156,257	40.7	17.9	5.9
- - Office and telecommunication equipment	11,366	4.9	5.4	1.2	13,029	3.4	12.4	4.6
- - - Electronic data processing and office equipment	3,611	1.6	5.1	-5.1	3,718	1.0	11.2	18.4
- - - Telecommunications equipment	4,398	1.9	4.3	7.0	6,250	1.6	14.1	5.1
- - - Integrated circuits and electronic components	3,356	1.5	8.6	1.3	3,060	0.8	11.1	-9.1
- - Transport equipment	33,615	14.5	19.5	8.7	61,236	15.9	17.4	-0.6
- - - of which Automotive products	11,896	5.1	12.1	42.3	37,372	9.7	16.9	-1.5
- - Other machinery	48,709	21.0	19.4	7.6	81,955	21.3	19.8	11.6
- - - Power generating machinery	23,907	10.3	51.0	9.8	18,578	4.8	31.6	30.0
- - - Non electrical machinery	15,966	6.9	15.7	7.0	45,664	11.9	18.5	6.5
- - - Electrical machinery	8,835	3.8	8.6	3.1	17,712	4.6	16.4	8.8
- Textiles	917	0.4	3.5	6.7	2,400	0.6	11.2	3.4
- Clothing	402	0.2	0.5	14.7	3,582	0.9	9.3	9.7
- Other manufactures	25,322	10.9	13.4	9.2	41,038	10.7	19.1	8.9
- - of which Scientific and controlling instruments	14,167	6.1	31.2	12.0	17,294	4.5	24.2	13.1
Other products	3,066	1.3	10.4	16.8	3,420	0.9	7.5	44.8
Other	1,997	0.9	n.a.	n.a.	7,253	1.9	n.a.	n.a.

% Growth: relative variation between current and previous period; % Total: Share in Total: Total defined as all products; % Extra-EU: imports/exports as % of all EU partners i.e. excluding intra-EU trade

Source: Eurostat

Pharmaceuticals are the major EU exports to the US. More specifically, they are SITC 541 Medicinal and pharmaceutical products and SITC 542 Medicaments, which collectively amount to 32% of EU exports of this group, 25% up year-on-year. Meanwhile, they are also major exports of the US to the EU, which account for 31.2% of extra-EU trade. Apparently, this product group is weighty when the US is considering coercion. However, both SITC 541 and 542 fall under “High-skill and technology-intensive manufactures” therefore, they cannot be substituted easily.

51% of EU's imports of Power generating machinery (mainly SITC 714 Engines and motors, non-electric) come from the US, the export share of this group in extra-EU trade is 31.6% and grows by 30%. Considering its share in EU's total trade, this group may potentially be used as a leverage and import restriction may become the tool by the US. But again, it belongs to “Medium-skill and technology-intensive manufactures” and cannot be replaced easily.

More than 31% of the imports of Scientific and controlling instruments (mainly SITC 872 Instruments and appliances for medical purposes, SITC 874 Measuring and other instruments) sourced from the US, the exports account for 24.2% of extra-EU trade. Again, they fall under the category of “High-skill and technology-intensive manufactures”, thus cannot be substituted easily.

It's worth noting that most of the top traded groups above-mentioned belong to the intra-industry trade or related-party trade, that is, trade between EU-owned US affiliates and their parents in the EU or EU affiliates of U.S. parents and their parents in the US. Since both blocs are highly advanced economies, the intra-industry trade in intermediate goods used to manufacture complex items such as vehicles and machinery, enabling companies from both sides to specialize and benefit from economies of scale by concentrating on specific parts of the supply chains. Akhtar (2020) observes that, in 2018, related-party trade constitutes 37% of U.S. goods exports to the EU-28 and 63% of U.S. goods imports from the EU-28. Therefore, if the US restricts the import or export of the above-mentioned groups, its business' investment in the EU will be hurt, the benefits the EU investment brought to the US that support jobs and exports will be undermined.

In 2019 agricultural exports to the US, wine, vermouth, cider and vinegar constitute 19.3% in all agri-food exports. As the demand from China for this product group gradually drops due to many reasons in recent years(in 2019, this group only accounts for 6% of all agri-food export to China, a 9% decrease from 2018), it's difficult to spot another consumption market as large as the US for the EU to sell this product group. Therefore, import restrictions of this group could be used as a proxy to coerce the EU and the cost for the US to initiate coercion is small.

Spirits and liqueurs account for 14.9% of all agri-food exports to the US and the value grows significantly compared with a year ago. If the US restrict the imports of this group, the EU producers are hit hard. Therefore, the coercion cost is small for the US.

In agri-food imports from US, Tropical fruit, fresh or dried, nuts and spices (23.6%), a 13.8% increase from 2018, although the share of this group is significant among all agri-food, this group can be easily substituted by other suppliers. The coercion cost is

high; therefore, it is not likely to be used as leverage by the US.

Soybeans account for 21.7% of all agri-food imports from the US, a 8.5% decrease from 2018. Since there are potential suppliers like Brazil, Argentina, Canada available, therefore, the opportunity cost of coercion is high.

Table 5 presents the cases which the EU brought to the WTO in the past. Agricultural product has often become the target of the US to coerce other economies, including the EU as this group is strongly related to constituencies of a government. Therefore, the US may apply this coercive tool to deter the Union from pursuing an unfavorable Huawei policy.

Table 5: EU-US Trade disputes in agricultural food trade

DS100: United States — Measures Affecting Imports of Poultry Products
DS166: United States — Definitive Safeguard Measures on Imports of Wheat Gluten from the European Communities
DS212: United States — Countervailing Measures Concerning Certain Products (Pasta.etc.) from the European Communities
DS320: United States — Continued Suspension of Obligations in the EC — Hormones Dispute
DS577: United States — Anti-dumping and countervailing duties on ripe olives from Spain

Source: WTO

The bilateral FDI between the EU-28 and the US account for over half of global FDI(Akhtar, 2020). Although Brexit may change US-EU trade and investment ties, but both blocs will remain each other's largest trade and investment partners (Akhtar, 2020). US FDI in EU-27 has grown significantly since 2000, it valued nearly \$ 2512 billion in 2018, while the EU-27 FDI in the US reached \$ 2035 billion. In 2018, The top EU investment in the US includes: Chemical (\$583b), Finance (\$282b), wholesale trade(\$157b)(Statista, 2020a); the US investment in the EU goes to: Holding companies(\$1798b), Finance(\$471), Information (\$195b)(Statista, 2020b). Most notably, Statista records FDI contributes to 36% of employment in the Chemical sector in the US economy. The magnitude of the FDI reflects the overall investment-friendly market environments in the two blocs and businesses' choice to meet consumer's demands via a local presence. Considering the long-lasting investment ties between the two blocs and the benefits come with it to both countries, it's unlikely that the US would coerce the EU in this regard.

In sum, regarding import or export restrictions on manufactures, considering the highly intertwined intra-industries of both blocs and two-way FDI flows in the manufactures, it's rather costly for the US to initiate coercion. Therefore, it's less likely the country will impose coercion or Washington must design the coercion rather meticulously to avoid backfire on its economic sectors (in some cases coercion may be initiated if the country can compensate the loss for companies whose economic interests are damaged by the coercion). In terms of import restrictions on primary goods such as Wine, vermouth, cider and vinegar, Spirits and liqueurs, the US has an ample economic influence over the EU, and the opportunity cost for coercion is relatively low. But for investment, the cost of implementing coercion is high.

3.4.2 The potential for China's Coercion

Undoubtedly, the US has been a long-standing largest economic power in the world, but we cannot deny the growing influence of China in the world economy. China's economic significance is demonstrated by the intangibles of its crucial position in global supply chain, which account for one third of the intermediate goods export in the global market (García-Herrero, 2020), as well as its future market potential for European companies.

Between 2009 and 2019, the trade between the EU and China increase significantly. The imports from China in 2019 grew by 95% compared to 2009, in the meanwhile the exports to China grew by 158%. China's share in extra-EU trade grows steadily on an annual basis. The total trade with China to GDP ratio reaches 4% in 2019. This suggests that the EU is vulnerable and susceptible to the Chinese trade policy changes.

Table 6: EU 27 trade flows in goods with China and trade dependency

Period	Imports			Exports			Total trade		
	Value Mio €	% Growth	% Extra-EU	Value Mio €	% Growth	% Extra-EU	Value Mio €	% Extra-EU	%GDP
2009	184,797		15.5	76,827		6.5	261,624	11	2.5
2010	245,447	32.8	16.7	105,133	36.8	7.3	350,580	12	3.2
2011	255,959	4.3	15.4	126,570	20.4	7.8	382,529	11.6	3.4
2012	250,140	-2.3	14.7	132,247	4.5	7.5	382,387	11	3.4
2013	238,932	-4.5	14.7	134,734	1.9	7.6	373,666	11	3.2
2014	256,519	7.4	15.8	145,104	7.7	8.1	401,623	11.7	3.4
2015	295,915	15.4	18.0	145,561	0.3	7.8	441,476	12.5	3.6
2016	298,933	1.0	18.7	153,416	5.4	8.2	452,349	13	3.6
2017	322,660	7.9	18.2	178,776	16.5	9.0	501,436	13.3	3.8
2018	341,847	6.0	17.9	187,961	5.1	9.1	529,808	13.3	3.9
2019	362,015	5.9	18.7	198,269	5.5	9.3	560,284	13.8	4

Source: self-compilation

Data source: Eurostat

Table 7: Most traded products between EU-27 and China, 2019

Code and label	Imports	Exports
764 Telecommunications equipment	51.6	3
752 Automatic data processing machines	33.1	0.8
781 Motor cars and motor vehicles	0.8	18.6
776 Electronic tubes, valves and related articles	9.2	8.9
778 Electrical machinery and apparatus	13.4	3.5
772 Electrical apparatus for electrical circuits	8.1	6.9
784 Motor vehicle parts	3.9	9.8
894 Baby carriages	12.4	0.4
792 Aircraft and associated equipment	0.8	10.8
775 Household-type equipment	10	0.7
821 Furniture and parts thereof	8.9	1.2
874 Measuring and other instruments	3.3	6.6
728 Other machinery	2.3	7.6
699 Manufactures of base metal	7	2.1
845 Articles of apparel of textile fabrics	8.1	0.6
542 Medicaments	0.5	8.1
851 Footwear	7.8	0.6
893 Articles n.e.s. of plastics	6.8	1.1
771 Electric power machinery and parts	5.4	1.3
743 Pumps, compressors, fans and related products	3.2	3.5

Source: Eurostat



Table 8: Trade flows between EU27 and China by SITC product grouping 2019

SITC Rev. 3 Product Groups	Imports				Exports			
	Value Mio €	% Total	% Extra-EU	% Growth	Value Mio €	% Total	% Extra-EU	% Growth
Total	231,986	100.0	12.0	8.8	384,438	100.0	18.0	9.5
Primary products	43,029	18.6	7.2	12.9	41,748	10.9	11.9	8.4
- Agricultural products (Food (incl. Fish) & Raw Materials)	12,813	5.5	8.0	-1.9	22,829	5.9	11.4	10.5
- - Food	9,793	4.2	7.2	-3.3	20,409	5.3	12.0	10.7
- - - of which Fish	845	0.4	3.3	4.1	598	0.2	9.6	10.4
- - - Other food products and live animals	8,948	3.9	8.1	-3.9	19,811	5.2	12.1	10.8
- - Raw materials	3,020	1.3	12.3	2.9	2,420	0.6	8.0	8.7
- Fuels and mining products	30,216	13.0	6.9	20.6	18,919	4.9	12.7	6.0
- - Ores and other minerals	4,563	2.0	12.2	26.4	1,260	0.3	7.4	11.8
- - Fuels	23,109	10.0	6.4	23.7	12,167	3.2	11.7	3.9
- - - of which Petroleum and petroleum products	17,739	7.7	6.3	32.1	12,106	3.2	12.6	4.0
- - Non ferrous metals	2,544	1.1	6.8	-8.0	5,492	1.4	19.1	9.6
Manufactures	183,892	79.3	14.1	7.4	332,016	86.4	19.2	8.8
- Iron and steel	943	0.4	2.6	-19.3	5,165	1.3	14.0	-21.1
- Chemicals	53,682	23.1	22.8	8.4	103,448	26.9	25.4	17.2
- - of which Pharmaceuticals	29,116	12.6	31.2	9.0	64,804	16.9	32.0	25.0
- Other semi-manufactures	8,937	3.9	9.1	3.1	20,123	5.2	14.2	3.7
- Machinery and transport equipment	93,690	40.4	14.7	7.2	156,257	40.7	17.9	5.9
- - Office and telecommunication equipment	11,366	4.9	5.4	1.2	13,029	3.4	12.4	4.6
- - - Electronic data processing and office equipment	3,611	1.6	5.1	-5.1	3,718	1.0	11.2	18.4
- - - Telecommunications equipment	4,398	1.9	4.3	7.0	6,250	1.6	14.1	5.1
- - - Integrated circuits and electronic components	3,356	1.5	8.6	1.3	3,060	0.8	11.1	-9.1
- - Transport equipment	33,615	14.5	19.5	8.7	61,236	15.9	17.4	-0.6
- - - of which Automotive products	11,896	5.1	12.1	42.3	37,372	9.7	16.9	-1.5
- - Other machinery	48,709	21.0	19.4	7.6	81,955	21.3	19.8	11.6
- - - Power generating machinery	23,907	10.3	51.0	9.8	18,578	4.8	31.6	30.0
- - - Non electrical machinery	15,966	6.9	15.7	7.0	45,664	11.9	18.5	6.5
- - - Electrical machinery	8,835	3.8	8.6	3.1	17,712	4.6	16.4	8.8
- Textiles	917	0.4	3.5	6.7	2,400	0.6	11.2	3.4
- Clothing	402	0.2	0.5	14.7	3,582	0.9	9.3	9.7
- Other manufactures	25,322	10.9	13.4	9.2	41,038	10.7	19.1	8.9
- - of which Scientific and controlling instruments	14,167	6.1	31.2	12.0	17,294	4.5	24.2	13.1
Other products	3,066	1.3	10.4	16.8	3,420	0.9	7.5	44.8
Other	1,997	0.9	n.a.	n.a.	7,253	1.9	n.a.	n.a.

Source: Eurostat

A major category of Chinese export to the EU is Telecommunications equipment. Nearly 58% of the imports of this group (mainly SITC 764 Telecommunications equipment) come from China. This product group also belongs to “High-skill and technology-intensive manufactures” which is not easily substitutable. And telecommunication is crucial for the EU economy as the region is geared towards upgrading its digital economy.

More than 60% of Electronic data processing and office equipment (mainly SITC 752 Automatic data processing machines) sourced from China. It's also “High-skill and technology-intensive manufactures”.

Nearly 24% of Electronic tubes, valves and related articles (SITC 776) is from China, and the imports' year-on-year growth reaches 70.4%. They are key components of electrical and electronic goods and “High-skill and technology-intensive manufactures”. But at the same time Chinese market accounts for 32.4% of the EU exports of this product group, which grows by 63%.

Another big exports from China to the EU is Electrical machinery, more specifically

SITC 778 Electrical machinery and apparatus, 772 Electrical apparatus for electrical circuits, 775 Household-type equipment, 771 Electric power machinery and parts, etc. They account for 40% of those sourced from China. They are “Medium-skill and technology-intensive manufactures” and therefore not easily substitutable.

As China has climbed up the industrial value chain, the share of machinery and electrical equipment sourced from China in EU's imports has grown from below 40 % to over 50% from 2002 to 2018. In 2018, Capital goods have outstripped consumer products as the main category imported from China, comprising half of total EU imports from the country; the share of capital goods in total EU exports to China dropped by around 15%, while the portion of consumer goods grew by approximately the same proportion, consistent with Chinese rebalancing (Dadush, Domínguez-Jiménez, & Gao, 2019). In 2019, among all product categories, 'machinery and vehicles', 'chemicals' and 'other manufactured goods' stand out in the trade, they all together constituted 87% of EU exports of goods to China and 97% of EU imports of goods from China in 2019 (Eurostat, 2020a). And a high portion of the manufactures is intermediate goods which are essential for production in the EU-based companies. China, in the meanwhile steps up to develop those high-value industries, aiming at transforming the country from a “manufacturing hub” into an “innovation hub”. Therefore, any disruption of those exports would raise the costs for its economy as well as the EU's.

The exports of EU agri-food to China is substantial. In 2019 alone, the EU exports 14.5-billion € value of agri-food to China, while imports only € 5.3 billion from the country. In its agri-food exports to China, nearly 23 % is Pork meat, fresh, chilled and frozen. This group is highly demanded as pork meat has been a traditional food for Chinese and the import increases 232.5% in 2019 partly due to the swine flu outbreak in China.

Nearly 17% of agri-food exports to China is Infant food and other cereals, flour, starch or milk preparations. China also imported € 242 million of Cereals, other than wheat and rice, a 130.5% growth from 2018. 11% of EU agri-food exports to China is Offal, animal fats and other meats, fresh, chilled and frozen. China also imports € 168-million of wheat from the EU, a 522.25% year on year growth.

China's middle class is expected to reach 1.2 billion in 2030, the aggregate purchasing power of this group will significantly exceed that of the EU (Dadush et al., 2019). It's a group that pursues high quality food, therefore the demand for this product is huge. But China very often applies coercion to food imports to achieve certain policy goals, most recently, it has imposed tariffs on several agricultural products from Australia in response to the country's call for in-depth investigation of the origin of COVID-19 and compensation for the damage done. Therefore, in this regard, China would employ the non-tariff barriers in the form of import quota, import approval or quarantine and safety standards on those agricultural imports from the EU.

The effect of trade on conflict shall be disaggregated since some goods are of more importance to the security of a state (Dorussen, 2016). Recent decades proved the strategic significance of oil and high-tech industries to each country. As some raw materials are crucial to the EU's economy, especially for the modern high-tech industries, the role of energy security as well as a reliable supply of raw materials in EU's relation with a third country have garnered lots of attention within the region. A list of Critical Raw Materials (Appendix-9) was created and subject to assess and update. Therefore, it prioritized the access to raw materials in its agenda and has initiated the Raw Material Diplomacy by engaging with different non-EU suppliers including China for a reliable access to the resources. I argue that trade in raw materials weigh in the bilateral ties in which China has been the principal supplier of the CRMs to the EU and may become the bargain chip for China on the Huawei involvement in the 5G rollout of European countries. Therefore, the possibility of China employing the coercion threat to restrict the exports of raw materials to the EU shall be examined.

Critical Raw Materials are important because they are “critical” for EU's mega sectors including green technology, telecoms, space exploration, aviation, medical equipment, defense, and other high-tech sectors. The EU relies on metals and minerals to develop the economy, where 30 million jobs rest on the CRMs (European Commission, 2017). Critical Raw Material Alliance (2017) mentions that “As a result, EU industry, the environment, and our quality and modern way of life is reliant on access and use of these Critical Raw Materials.” It has been a growing concern in the Union to secure access to them in the international market since the EU only produces very few CRMs

identified in its list (Appendix-10). Hafnium is the only CRM that is mainly supplied by an EU Member State to the world due to either the lack of the resources on the European ground or limited exploration due to some societal and economic factors. As a result, its economy is substantially reliant on third countries for raw materials. In many cases, they are concentrated in one country, particularly China. China accounts for 95% of the global supply of LREE and 95% of HREE, 87% of Magnesium, 87% of Antimony and a large share of supply of other materials that are not supplied or yet explored by other countries. Appendix-11 shows the share of supply of CRMs to the EU by country. China is the only country which can supply the EU with the most CRMs. In total, 62% of CRMs supply to the EU which covers rare earth elements, magnesium, antimony, natural graphite, etc. are sourced from China (European Commission, 2019).

The European Commission (2019) determined the criticality of the raw materials by two variables: economic importance and supply risk. LREE, HREE are identified with high supply risk and moderate economic importance, Antimony with a modestly higher economic importance and lower supply risk, and Magnesium with a modestly lower supply risk but highest economic importance (Appendix-12). The concentration of production in China for those materials pose a high risk for the EU due to the low the substitution rate. John Mearsheimer, “nations that depend on others for critical economic supplies will fear cutoff or blackmail in time of crisis or war...Interdependence, therefore will probably lead to greater security competition”(Copeland, 1996). The EU's reliance on China for CRMs supply to some extent render it's vulnerable to China's policy changes in the export of those materials. The world had felt the pain when in 2010 China employed export quota on its rare earth exports on the ground of environmental protection. The high-tech firms in Japan suffered during the embargo. China's application of coercion (threat) seemed to achieve its goal as Japan finally released the Chinese captain. The EU brought the case to the WTO in March 2012 against China for its export restrictions on rare earth, but it took three years for the WTO to settle the dispute during which supply instability occurred (Blengini et al., 2017).

It's widely feared by the US that, during the trade war, China may again restrict rare earth export to gain leverage in the negotiation, though China hasn't applied yet.

Meanwhile, there are possibilities that China may wield this strategic tool in the future to coerce the EU and others to achieve immediate goals such as a loose restriction on Huawei as:

i)The general exception in the GATT (WTO) allows countries to impose restrictions on the ground of protection of national essential security interests or conservation of exhaustible natural resources, etc. In the assessment of CRMs, researchers regard bilateral trade agreement and regional agreement as more capable of ensuring stability for trade than international trade agreements(WTO) as many restrictions on the raw materials critical for industries have been imposed by countries under the existing WTO agreements (Blengini et al., 2017). China could design export restrictions which is entirely WTO compatible.

ii)The WTO currently has been paralyzed. At present, the panel responsible for dispute settlement in the WTO is understaffed which result in the malfunctioning of the body.

iii) In China, the central government exert a strong control over the production of rare earth and has applied export quotas and production quotas to avoid the jumping prices since 2006(Balomenos et al., 2017).

iii) China is dominant in the global supply chain of certain CRMs. Although the EU attempts to diversify its CRM supply chain, given the dominant position of China in some CRMs, it's difficult for the EU to steer clear of China in seeking sources of CRMs. It's powerful position in the global supply chain of rare earth can be demonstrated in two aspects: high reserves and advanced processing techniques.

China used to impose restrictions on several raw materials export to the European Union, particularly rare earth, the below table lists the trade disputes between the two blocs in this regard. Therefore, it's highly likely the same product groups will be used as leverage to influence EU's Huawei policy in the future.

Table 9: EU-China Trade disputes in raw materials

Case	Product in question
DS395: China — Measures Related to the Exportation of Various Raw Materials	bauxite, coke, fluorspar, magnesium, manganese, silicon carbide, silicon metal, yellow
DS432: China — Measures Related to the Exportation of Rare Earths, Tungsten and Molybdenum	
DS509: China — Duties and other Measures concerning the Exportation of Certain Raw Materials	antimony, chromium, cobalt, copper, ferronickel, graphite, lead, magnesia,

Data source: WTO

In terms of foreign direct investment, the EU has been the largest and most stable source of investment in China, in 2018, the two EU countries—Germany and Netherlands, ranked in the top ten investor list in China, in which Germany invests \$ 3.68 billion, followed by U.S. \$ 3.45 billion and Netherlands \$ 1.29 billion (Foreign Investment Department of the Ministry of Commerce of PRC, 2019). Between 2013 to 2017, China earned € 8.3 billion from its investments in Europe, while the EU earned €81 billion from investments in China, according to Eurostat and the top beneficiary is Germany. The return on investment of EU companies in China is very high: during this period, the average annual return of EU direct investment in China was 10.1%, higher than the its investment in other countries such as Japan (8.9 %), India (7.2%), Russia (6.8 %) and the United States (2.9 percent), whereas return rate of Chinese investment in the EU was 4.2% (Dadush et al., 2019). The incentives for foreign companies to invest in the manufacturing sector in China evolved from cheap labor cost to huge consumption power. China is among the top 3 markets for 50% of German companies; For over 60% of German firms in China one of the top 3 priority markets is China(Otto & Heck). German firms are based in China, but the business radiates to the rest of Asia, reaching South Korea, Japan and ASEAN countries. As there are still sectors restrained from FDI in China, now the EU attempts to conclude the comprehensive investment agreement which guarantee market access will surely unlock the enormous potential of the Chinese market. Under the framework of the ambitious Made in China 2025, the country strives to secure its position as a global powerhouse in some high-tech sectors and is developing its brands and boost domestic investment in manufacturing sectors, seriously affecting the German investments in the automobile sectors in the country. Therefore, if the EU's investment in manufactures is restricted by China, Chinese

domestic firms can fill the void and grab the market shares in the expanding market. In 2019, China dropped out of the top three investors in Germany for the first time in over a decade(Wagner, 2020) , relatively, German investment in China is on the rise(CIPA, 2019). Therefore, the harm of disruption of its investment in Germany won't be as huge as Germany's investment in China. It seems that China could use the investment as a leverage to affect the EU's policies on Huawei, or its member states', notably Germany and Netherlands as it pays rather low opportunity cost. However, due to the disruption of COVID-19 pandemic, countries are calling for reorganization of global value chain and reshoring plants to elsewhere outside China, particularly ASEAN countries like Vietnam whose FTA with the EU comes into force in 2020 stands for a promising business prospect. China doesn't want to lose more by signaling that it intends to formulate further restrictions to make life hard for foreign-funded businesses operating in China. In addition, Chinese companies also invest a lot under the BRI umbrella in some EU countries, as global image shaping projects China needs recognition and reputation, if the coercion on FDI sourced from the EU is initiated, China may face retaliation too, not to mention the fact that there are already complaints and negativity about the Chinese investment in some Member States(Brînză, 2020). In sum, in terms of investment, it's less likely that Beijing would carry out the measure but rather making a threat to the EU (or Member States, e.g. Germany).

In the first half of 2019, Europe is the second most popular destination for Chinese tourists after Asia, accounting for 10% of outbound trips by Chinese tourists(Xu, 2019). They made over 3 million trips to Europe in the first half of 2019, grew by 12.3% compared to the same period in 2018. Besides, EU member states have been the popular destinations for Chinese students to study overseas, notably Germany, whose 13% of International students are from China. In the contest of tightened visa issuance to Chinese students by the US and the anti-Chinese sentiment provoked by Trump and the media, it's expected that in the foreseeable future, Chinese students may prefer to study in countries other than the US. Australia is another case in point, Chinese government officially warned its citizens not to travel or study in Australia this year. Therefore, China would encourage its citizens to travel or study in the European countries, therefore the chance of the government to restrict traveling to the Europe is

small.

Therefore, on the Huawei issue, the Chinese government will only threaten to deter certain EU member states. Beijing would pick the one whose business invest a great deal in China, or the one that consumes most and is highly reliant on critical raw materials from it, or export Agri-product significantly to the country. China may target at certain countries in which Huawei has a strong presence and which already adopted a non-complete ban on Huawei but tend to edge out it gradually. To date, there are still many European countries that haven't weighed in on the issue and some countries which tend to ban it. For them, coercion is possible, not least Germany. For Germany, China would resort to measures potentially disrupting rare earth supplies since it's an industrial country which heavily relies on industrial raw material.

In conclusion, China holds strong economic leverage over the EU in terms of investment restrictions, export restrictions of crucial raw materials, import restrictions on some agricultural products which can inflict serious damage to business in some EU member states. But for investment restrictions, the timing matters, COVID-19 pandemic makes it less likely for China to initiate the coercion.

3.5 Capitulation that may be demanded

With China's ambition to embark on the path to global technology dominance and the efforts to encourage its business to go global, the ideal scenario for China to strive for is that the EU can allow the Huawei involve in building up the 5G network in the region without further restrictions; While the acceptable scenario is partial involvement of Huawei or at least approving its involvement on paper. After Washington's several attempts at pressing the European countries to exclude the company, a partial ban on Huawei by them by formulating regulations which do not explicitly pertain to the tech giant is at least a face-saving scenario for Beijing; On the other hand, accepting this situation is to some extent a demonstration of China's determination for a level playing field for its companies in the international market.

Washington undoubtedly pursues an outright ban on Huawei by its allies. A great deal of measures has been applied domestically to crack down the company which could potentially and indirectly affect its allies' decision to adopt a neutral policy towards the

company. And the administration seems not to accept a partial ban on Huawei by its European allies, and they are likely to see further clamping pressure from Washington.



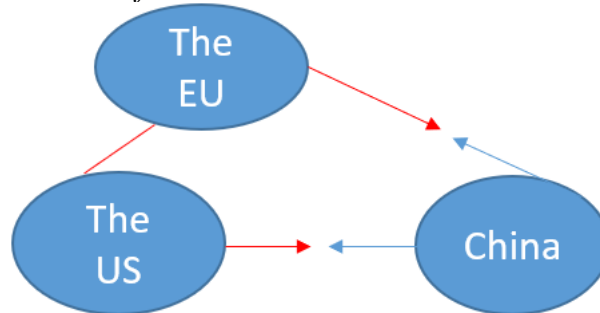
CHAPTER IV IMPACT OF COERCIONS

4.1 The change in the battleground due to the coercion

Based on the balance of power theory and the above analysis, there are four possible

scenarios on the battlefield. The following scenario is what Washington is most likely pursuing where the EU chooses to ostracizing Huawei completely and in which the US wins the battle:

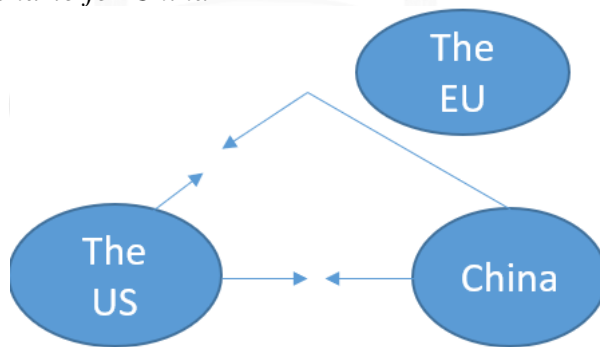
Figure 7: Expected scenario for the US



Source: self-compilation

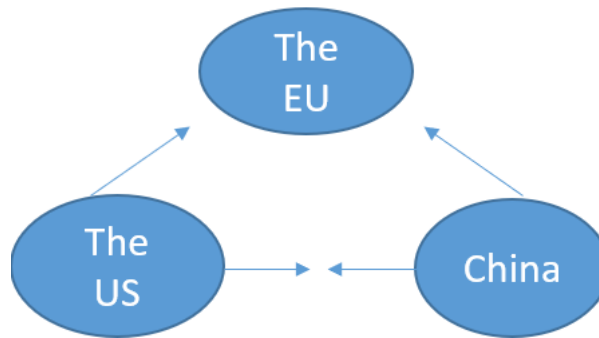
While China would pursue and accept the following two scenarios. In the first scenario, the EU allows full Huawei involvement in the 5G rollout in the region. In the second scenario, the EU adopts restrictions on Huawei's involvement without banning it completely. In this case, the Chinese government believes in Huawei's strength in grabbing a bigger pie in the market share in the EU even if it has to compete with Erickson and Nokia. Therefore, in both cases China wins the battle.

Figure 8: Ideal scenario for China



Source: self-compilation

Figure 9: Acceptable scenario for China



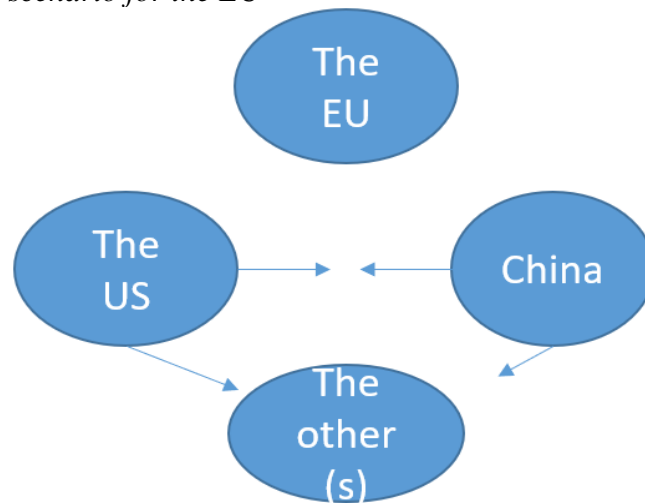
Source: self-compilation

The EU also pursues Figure 9 scenario as China does. The region has long realized the problem of too much dependency on both the US (for software) and China (for hardware) for some crucial technology and has held heated discussions on European strategic autonomy and European sovereignty (Rühlig & Björk, 2020). And the fact that two companies Ericsson and Nokia that can compete with Huawei, are European companies leaves ample room for the EU to do so. For the past two decades, it strives to achieve technology autonomy by launching lots of support programs to foster innovation capability of the EU-based business, particularly the SMEs. Therefore, the current situation is the best trigger to nurture technology autonomy or sovereignty in the EU by diversifying its 5G equipment suppliers, and if the EU can strike a balance on the dynamic on the battlefield, gains would be greater than loss in the long run.

Meanwhile, it seems the following scenario may benefit the EU in which the US can “pivot” from the EU on Huawei issue to other countries or regions—the rest of the Five Alliance countries or India, ASEAN or South America where there are potential emerging economies in dire need to deploy 5G for massive economic gains or are of strategic importance to the US in its overall national strategy so that the EU feels less pressure and can make decision without interference. What's more, this scenario would deliver the most opportunities and create the best environment for the EU to achieve technological autonomy. However, due to the mass potential of the EU consumers, the significance of the region to telecom equipment providers makes this scenario less likely to happen. The US would mount its pressure on the EU instead of “pivoting” to other countries or regions due to the fact that most of the countries have already publicized their Huawei Policy and chose to side with the US. More importantly, this

scenario on the other hand means the EU cannot compete in the technological race which does no good to technological innovation in the region.

Figure 10: Ideal scenario for the EU



Source: self-compilation

Lake (1988) argues that the state is an objective-oriented rational actor, when formulating policies, its objective is to achieve the overall national interest. On Huawei issue, before adopting a policy, the EU and its member states will take all factors into account, including national security, the time and cost to replace Huawei kits, technology gap between Huawei and its competitors Nokia and Ericsson, the loss inflicted by coercion from both sides and the EU's strategic objective of achieving technological autonomy and sovereignty. Therefore, the most likely scenario on the battlefield would be Figure 9.

4.2 The consequences of the coercion on the sender's side

The effects of coercion extend beyond short-term economic concerns. The coercion would deteriorate the bilateral relations and often come with growing distrust from the target to the sender. And from the macro perspective, it may also affect the global strategy of the sender. The consequences will be explained in detail as follows.

4.2.1 The consequences for China

Coercing the EU is contrary to China's diplomatic demands – the needs to shape its role on the global stage. Unilateral economic coercion against the EU conflicts with China's diplomatic philosophy, which is first and foremost a political decision rather than an

economic policy for Beijing. China has been striving to build a better global image politically and economically. Since the former President Hu Jintao's time, China has claimed to be a "responsible big country", and devoted to shape a positive image, especially in the western world. In the era of Xi Jinping, the concept of "A community of shared future for mankind" was put forward, indicating that China will continue to grow and develop in a peaceful way so that it can assume more global responsibilities. However, countries including the US, notably after the BRI Initiative and AIIB were created, framed the country's future negatively by casting it as a threat to world peace and security. And the world sees more and more attempts from Beijing to coerce other countries to achieve political gains, although it sometimes denies the nature of coercion to stay in line with its diplomatic philosophy. Through the series of actions from Beijing, the world already takes a more hardline view of China's rise. Therefore, amid the vast global condemnation of Beijing's wrongdoings at the very beginning of the COVID-19 outbreak, China's economic coercion against the EU will further reduce its global image. The US has been trying to portray China a bad boy who should be responsible for the huge loss worldwide, threatening the world economically, politically and militarily, just like Russia did a few years ago. In case of vast media coverage in the EU concerning the coercion, its public would increasingly perceive China as an unfriendly nation which is harmful for the communications between people of the two nations. China is clearly aware of the dangers ahead and is avoiding the "global denunciation" led by the US in various ways, for example by "mask diplomacy" in European countries, actively responding to the UN's call for debt relief for a large number of poor countries, and making donations to important international institutions such as WHO. If China appears with the image of coercing the whole EU at this time, the effect of the above efforts to exchange money and resources for support will be greatly reduced. Currently, China cannot risk seeing EU's public opinion of it turns sharply negative.

For the past decades, if the other countries or blocs didn't undermine its core sensitive interests in the political system and territorial disputes, China has been willing to sacrifice a portion of its economic interests in exchange for more support from the Western world. China's one-party system determines that this principle, it upholds in its foreign policy will not change rapidly as that in democratic countries due to the

political transitions or social changes. In this sense, even if the EU partially bans Huawei, but doesn't interfere China's core interests, it's hardly possible that China will impose economic coercion on the EU. Conversely, if the EU adopts a half ban on Huawei and voice out a strong stance about Hongkong, South China Sea, Taiwan or Xinjiang issue, it's very likely that China would take actions firmly.

Coercing the EU is contrary to China's economic demands. At present, China's economic ties with the EU is more important to China than to the EU. With the decoupling of the powers, China needs to carry out more and wider economic activities with European countries to maintain its own economic development, such as vigorously developing BRI leading to Europe, which is also one of China's basic national policies. Coercing the EU will inevitably lead to the cooling of economic activities, which is not consistent with China's current economic interests.

China's implementation of coercive attempts can hardly make the target completely concede but will lead to long-term deadlock and even counter-effect. In its past sanction experiences, its economic sanctions imposed on South Korea, Vietnam, the Philippines whose economic size are far smaller, and capacity are weaker than the EU did not lead to surrender, but rather worsened the bilateral ties, making it hard for bilateral dialogues. Therefore, in recent years, although China has not given up using the coercive tools, its purpose is more about “beat the dog before the lion”, showing muscles to the world and showcasing potential risks or consequences to the potential target who may choose to oppose China on certain issues rather than requesting for the target's capitulation. The recent sanction against Australia is an example. China has demonstrated its ability to retaliate against it which touched on its sensitive interests by coercing it economically, but China has not actively started a dialogue with Australia to solve the friction. On the 5G issue, China's strategy is to influence the EU's decision, instead of using it as an excuse to show its sanctions might. Therefore, assuming that Chinese leaders are always rational, China should not impose economic coercion against the bloc. Unlike the US which most of the time implemented economic coercion paired with military operations to achieve efficacy, once the Sino-EU ties breaks down, the bilateral ties are not as deep as the US-EU ties, and there is not as many dialogue mechanisms as between the US and EU that can ease the relationship. This means that once China does

so and the EU chooses to cross the red line set by China, China will fall into its own strategic dilemma.

If China impose a forceful coercion against the EU, the EU may tilt closer towards the US, and China will carefully evaluate this risk. If the EU can't stand the pressure brought by the economic coercion, instead of giving up its own principles and succumbing to China, it is more likely to seek the support of its true ally, the US. If the EU is willing to follow Washington to encircle China, the country may face unbearable retaliation. It may not have the courage to pay such a price to initiate economic coercion. In fact, the strategic consistency between the US and EU in dealing with China's investment and trade has not changed, and both sides have made preliminary preparations for forming a unified front against China (Schneider-Petsinger, 2019). Once the EU completely abandons the possibility of cooperation with China, the process of completing the cooperation mechanism with the US will be faster than expected.

China's economic coercion against the EU will lead to the EU's counterattack. China has invested a lot in the EU, and the EU can easily find China's economic pain points. It will not be a win-win situation in the end. The first target that may bear the brunt is Huawei. The EU may explore ways to block the company by only allowing its home company Erickson and Nokia and other non-Chinese vendors in its network infrastructure. China's goal is to influence the EU to support Huawei's 5G construction in the EU, and economic coercion is likely to destroy this hope.

In a word, China must bear political, economic consequences and its business's presence in the EU and its current goal to win more international support may be undermined if it initiates coercion against the EU.

4.2.2 The consequences for the US

For the US, economic coercion is not the only tool in its toolbox to influence the EU. Although Trump seems to like this tool, coercion against a big power like the EU has rarely been the first choice. The US is still the most important ally of the EU. Seeking common strategic goals through development, or deterring or cooperating on other affairs, may influence the EU's decision on 5G deployment more efficiently than

economic coercion. Compared with China, there are more tools available for the US to coerce the EU. For example, the US once demanded stronger support from the EU on the South China Sea issue in exchange for US investing resources in Ukraine by saying “ we helped you out in Ukraine, now you have to help us out with China and the South China Sea ” (Riddervold & Rosén, 2018).

On the contrary, if the US constantly uses economic sanction against the EU, it will continue to play down its role as a key ally of the EU, making the recent turbulent Atlantic relations more fragile, and increase the uncertainties for other matters requiring more dialogues and cooperation, such as the Iranian Nuclear Deal and Syria issue. In addition, at present, various trade negotiations between the US and Europe are ongoing. Washington hopes to strive for greater economic benefits at the negotiating table. If economic coercion is used, it will affect the negotiation process too.

Similarly, the US also needs to examine that if economic coercion is imposed too often it may provoke the EU to act more aggressively (Trump already waged trade war against the EU). In recent years, the US government has continued to prejudice the interests of the EU while maximizing its own interests under the American First principle introduced by Trump. The EU citizens have become increasingly resentful according to a recent survey conducted by European Council on Foreign Relations(Ellyatt, 2020). From the Iranian Nuclear Deal, the trade conflict entangled with the Nord Stream 2 project, the EU has shown that it does not always yield to the US pressure, but will adopt various evasion and even retaliatory tools to strive for parity with Washington to defend its interests. In the case of 5G, if the EU takes a hedging reaction due to the loss of profits under the economic coercion from the US, the US will lose the opportunity to achieve its strategic goals (Huawei being excluded by the EU). In this 5G race, even if the EU does not side with China, but only chooses not to stand with the US as shown in Figure 9, in terms of the three-party game theory, it still constitutes a blow to the US, a failure that Trump administration is grumbling with since it's mounted so much effort on lobbying the EU for the issue. The EU is different from the small countries that suffered economic coercion (threat) from the US. As the world's second-largest economy, the EU will worry about the loss caused by the economic coercion. The EU may adopt a series of policies to reduce losses, counter

coercion, and even retaliate. Although the sender can cause economic losses to the EU, it cannot achieve its true strategic purpose—influencing EU's decision-making on 5G.

US's wielding of economic coercion will give China the opportunity to influence the decisions of the EU. If China can provide enough investment and market chips to make up for the loss resulting from US economic sanctions, the EU may tend to support China. It will be more effective for the US to apply other coercion tools that China cannot involve, such as the termination of military cooperation in the case of the UK.

The severe current pandemic in the US, the “Black lives matter” protests are detrimental to Trump's reelection. At this time, Trump will not adopt more drastic policies to anger its key allies to add uncertainty to his election. And if Trump loses the election, the new president may change its policy slightly towards its ally.

To sum up, considering its current domestic situation, the fear of retaliation, and the wish for cooperation and talks on other topics, its global strategy to contain China and the availability of other tools, Washington won't easily apply economic coercion against the EU to change its Huawei policy.



CHAPTER V CONCLUSION

This paper discusses the incentives of the EU to deploy 5G and Huawei's eagerness to involve in the rollout and the possibility of economic coercion by China and the US against the EU to pressure it to modify its Huawei policy. It finds that the EU has high incentives to deploy 5G concerning the massive gains that it can bring to its population

and business. Due to the time, cost and technology gap, it's very pricy for the European operators to replace Huawei gears unless the governments can compensate the difference if they chose other vendors. The transatlantic relations were cordial before but now turns sour due to the President Trump's unilateral actions based on American First principle, while the EU and China maintain good economic partnership. Both powers have a high degree of trade and investment linkages with the EU. The Union is highly vulnerable to the US's import restrictions on primary goods as well as China's export restrictions of critical raw materials and import restrictions on some agricultural products and investment restrictions for EU businesses. Above factors will affect the dynamics on the battleground over Huawei disputes, it's most likely that the EU will choose a middle way by adopting policy which doesn't ban Huawei completely but also welcomes other 5G vendors, including Nokia and Ericsson to play a part.

However, the possibility of China coercing the entire EU is very low, in the context of the current pandemic, the deteriorating Sino-US relations, the confrontation in all round between the two powers take longer time to pacify. Even if Trump fails to secure next presidency, Sino-US relations will still be difficult in recent years. The US also hopes that the Sino-EU relationship will deteriorate and fully encircle China. Therefore, for strategic considerations, China needs to strive for more cooperation, and the cooperation with the EU carries much weight. In order to consolidate its rule, the government should vigorously develop the economy. From the compromise in its trade war with the US, we can also see that the Chinese government is willing to make timely compromises for long-term interests. Therefore, as long as the EU doesn't stand up to China and maintains restraint on publicizing policies or stance on issues involving human right, territorial sovereignty. Beijing is willing to temporarily sacrifice a small portion of its economic interests to achieve long-term EU cooperation and won't initiate coercion on the EU merely for Huawei.

For the Washington too, it's not the best time and best tool to impose economic coercion against the EU to influence its Huawei policy. Trump would focus on economic interest and win an immediate gain that can underpin his election where he just has 5 months to make an influence. Economic coercion on Europe for Huawei issue may add to uncertainty to his election.

Due to the complicacy and novelty of 5G technology, the relevant statistics sourced from one organization may not accurately demonstrate the whole picture of the competition thus affect the judgment of the real strength Huawei possesses.



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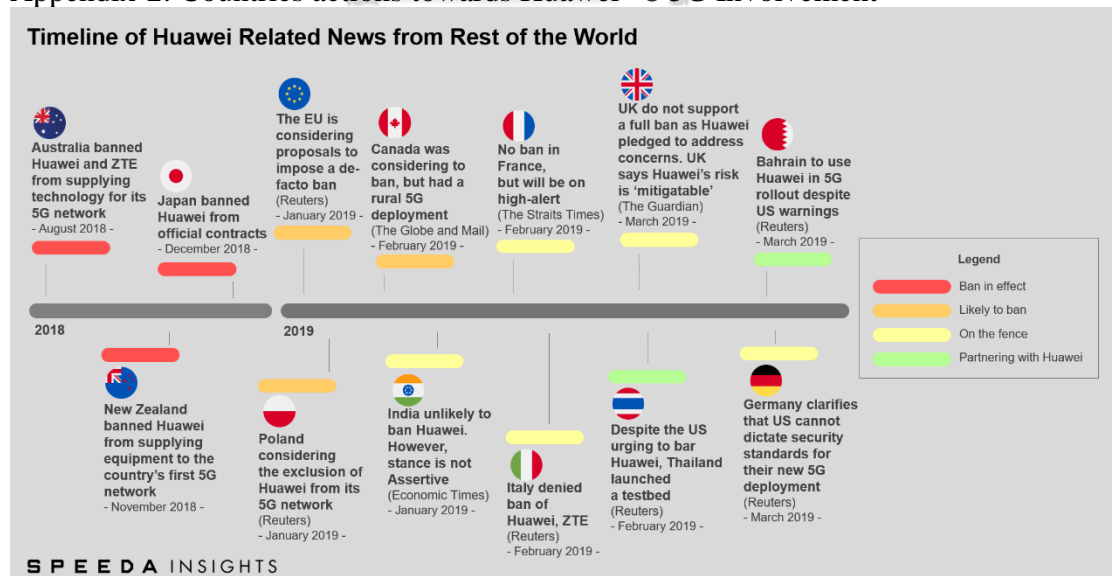
APPENDIX

Appendix-1: The Range of Economic Coercive Measures

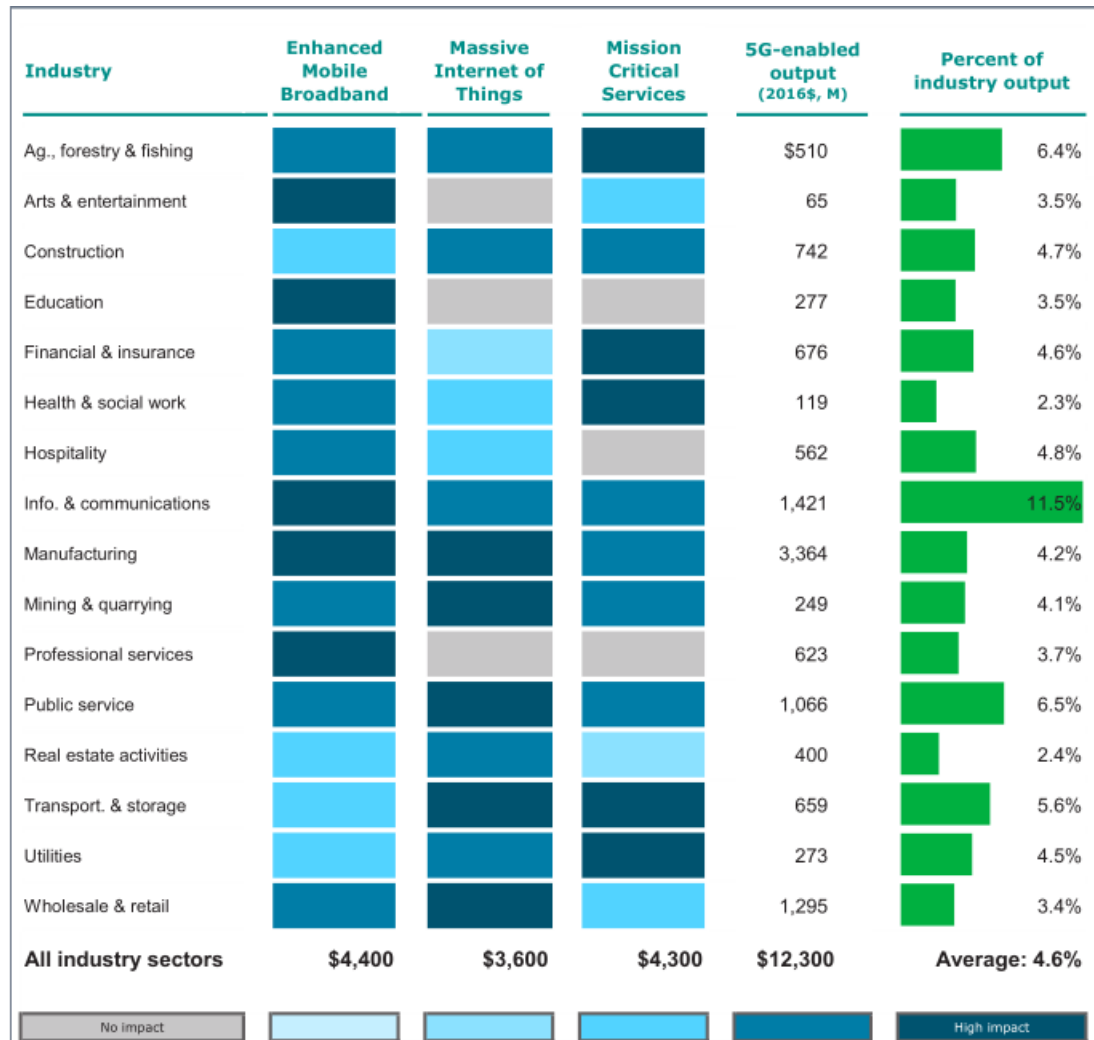
- Full economic blockade/ embargo
- Travel/visa bans
- Freezing of financial assets
- Financial sanctions
- Import bans/reductions
- Export bans/reductions (includes Arms embargo)
- Tariff increase/ tariff discrimination
- Unfavourable taxation
- Increase import/ export inspections
- Withholding of previously agreed loans, orders, projects
- Cancelling/interruption of international negotiations/meetings
- Closing of businesses/Expropriation
- Encouraging public boycotts
- Denying regulatory approval/ licenses
- Cutting transportation links
- Aid suspension

Source: World Economic Forum

Appendix-2: Countries actions towards Huawei 's 5G Involvement

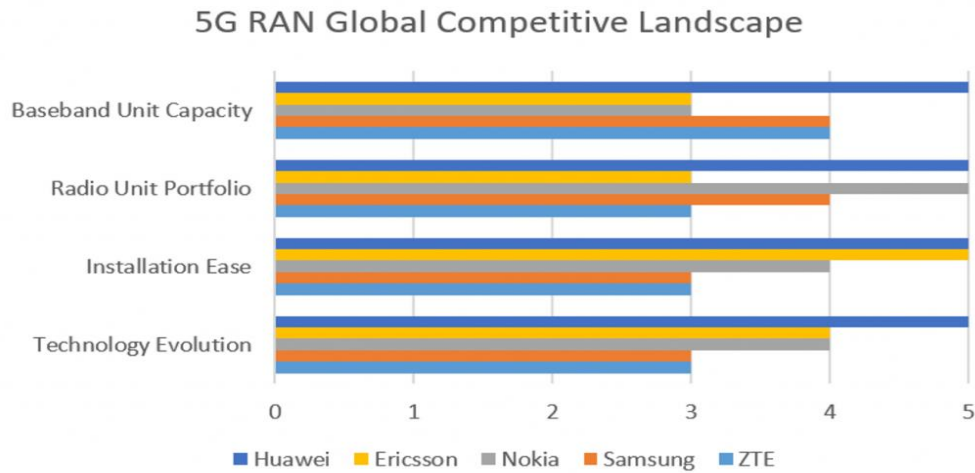


Appendix-3: 5G will enable \$ 12 trillion of global economic activity in 2035



Source: IHS

Appendix-4: 5G RAN Competitive Landscape



Source: Globaldata

Appendix -5: Number of declared 5G patent families by declaring company

Declaring company	Number of 5G patent families (INPADOC)	Thereof filed at least the at the USPTO, EPO or PCT	Thereof at least granted in one office
Huawei Technologies (CN)	3,147	2,342	1,274
Samsung Electronics (KR)	2,795	2,633	1,728
ZTE Corporation (CN)	2,561	1,878	837
LG Electronics (KR)	2,300	2,236	1,415
Nokia (incl. Alcatel-Lucent) (FI)	2,149	2,074	1,584
Ericsson (SE)	1,494	1,461	768
QUALCOMM (US)	1,293	1,210	831
Intel Corporation ¹² (US)	870	855	148
Sharp Corporation (JP)	747	706	449
NTT Docomo (JP)	721	642	346
Guangdong Oppo M, Telec, (CN)	647	612	36
China Aca, Of Telec, Tech, - CATT (CN)	570	353	71
InterDigital Technology (US)	486	455	299
Vivo Mobile (CN)	238	168	0
BlackBerry (CA)	139	136	132
NEC Corporation (JP)	122	115	82
ASUSTeK Computer (TW)	111	102	34
Lenovo Group Limited (CN)	97	97	22
HTC Corporation (TW)	93	94	43
KT Corporation (KR)	85	74	15
Apple (US)	77	72	48
ETRI (KR)	61	48	20
Fujitsu (JP)	58	18	54
Motorola Mobility (US)	55	54	49
MediaTek (TW)	38	38	29
WILUS Group (KR)	33	20	2
Panasonic (JP)	32	30	8
FG Innovation (CN)	30	30	4
Sony Corporation (JP)	17	17	18
ITRI (TW)	14	13	12
SK Telecom (KR)	11	8	0
Spreadtrum Communications (CN)	10	8	5

Source: IPLytics

Appendix- 6: SITC Product Groupings

Label	SITC codes	Label	SITC codes
Primary products	0,1,2,3,4,68	- Machinery and transport equipment	7
- Agricultural products (Food (incl. Fish) & Raw Materials)	0,1,2,4,excl.27,excl.28	- - Office and telecommunication equipment	75,76,776
- - Food	0,1,22,4	- - - Electronic data processing and office equipment	75
- - - Fish	03	- - - Telecommunications equipment	76
- - - Other food products and live animals	0,1,22,4,excl.03	- - - Integrated circuits and electronic components	776
- - Raw materials	21,23,24,25,26,29	- - Transport equipment	713,7783,78,79
- Fuels and mining products	27,28,3,68	- - - Automotive products	7132,7783,781,782,783,784
- - Ores and other minerals	27,28	- - - Other transport equipment	713,785,786,79,excl.7132
- - Fuels	3	- - Other machinery	71,72,73,74,77,excl.713,excl.776,excl.7783
- - - Petroleum and petroleum products	33	- - - Power generating machinery	71,excl.713
- - - Other fuels	3,excl.33	- - - Non electrical machinery	72,73,74
- - Non ferrous metals	68	- - - Electrical machinery	77,excl.776,excl.7783
Manufactures	5,6,7,8,excl.68,excl.891	- Textiles	65
- Iron and steel	67	- Clothing	84
- Chemicals	5	- Other manufactures	81,82,83,85,87,88,89,excl.891
- - Pharmaceuticals	54	- - Personal and household goods	82,83,85
- - Plastics	57,58	- - Scientific and controlling instruments	87
- - Other chemicals	51,52,53,55,56,59	- - Miscellaneous manufactures	81,88,89,excl.891
- Other semi-manufactures	61,62,63,64,66,69	Other products	891,9
		Other	Total minus sum of other categories

Source: Eurostat



Appendix-7: Evolution of EU Agri-food exports to USA, 2015 - 2019

	Value		Mio €			%	
	2015	2016	2017	2018	2019	Share in all	Change
				Agri 2019			2018-2019
Agri Food	16 933	18 263	19 535	19 847	21 851	57.00	10.1
Agricultural food and feed products	9 090	9 740	10 291	10 508	11 257	51.5	7.1
- Commodities	1 458	1 682	1 642	1 798	1 924	8.8	7
-- Wheat	0	24	0	0	1	0	
-- Cereals, other than wheat and rice	75	34	29	41	65	0.3	58.5
-- Rice	18	19	18	22	28	0.1	27.3
-- Flours and other products of the milling industry	45	50	67	80	80	0.4	0
-- Malt	34	38	50	49	53	0.2	8.2
-- Starches, inulin & gluten	180	206	200	225	226	1	0.4
-- Soyabeans	1	0	0	0	0	0	
-- Oilseeds, other than soyabeans	40	40	32	35	52	0.2	48.6
-- Palm & palm kernel oils	1	5	7	9	8	0	-11.1
-- Vegetable oils other than palm & olive oils	131	137	154	176	185	0.8	5.1
-- Oilcakes	2	3	3	4	4	0	0
-- Other feed and feed ingredients	38	59	75	105	95	0.4	-9.5
-- Beet and cane sugar	4	5	4	3	4	0	33.3
-- Sugar, other than beet & cane	58	90	22	24	35	0.2	45.8
-- Milk powders and whey	21	27	18	16	21	0.1	31.3
-- Butter	75	81	123	184	228	1	23.9
-- Gums, resins and plant extracts	274	309	310	370	367	1.7	-0.8
-- Unroasted coffee, tea in bulk & mate	262	284	287	260	248	1.1	-4.6
-- Cocoa beans	1	3	1	2	2	0	0
-- Cocoa paste and powder	188	265	234	184	209	1	13.6
-- Agricultural commodities, not specified	7	5	6	7	13	0.1	85.7
- Other primary	1 450	1 462	1 660	1 605	1 665	7.6	3.7
-- Live animals	349	330	402	390	418	1.9	7.2
-- Bovine meat, fresh, chilled and frozen	4	8	14	19	34	0.2	78.9
-- Pork meat, fresh, chilled and frozen	244	266	341	306	219	1	-28.4
-- Poultry meat, fresh, chilled and frozen	0	0	1	1	1	0	0
-- Sheep and goat meat, fresh, chilled and frozen	0	0	0	0	0	0	
-- Offal, animal fats and other meats, fresh, chilled and frozen	22	18	30	31	49	0.2	58.1
-- Fresh milk and cream, buttermilk and yoghurt	6	19	15	19	22	0.1	15.8
-- Eggs and honey	105	38	25	26	27	0.1	3.8
-- Vegetables, fresh, chilled and dried	256	303	327	323	369	1.7	14.2
-- Fruit, fresh or dried, excl. citrus & tropical fruit	80	84	72	67	79	0.4	17.9
-- Citrus fruit	29	19	20	13	8	0	-38.5
-- Tropical fruit, fresh or dried, nuts and spices	185	182	203	204	223	1	9.3
-- Miscellaneous seeds and hop cones	172	196	210	205	216	1	5.4
-- Agricultural primary food products, not specified	0						
- Processed (incl. wine)	6 182	6 596	6 989	7 105	7 669	35.1	7.9
-- Meat preparations	191	197	218	224	248	1.1	10.7
-- Cheese	835	821	818	820	893	4.1	8.9
-- Olive oil	799	1 020	1 034	924	901	4.1	-2.5

-- Preparations of vegetables, fruit or nuts	816	848	889	917	1 053	4.8	14.8
-- Fruit juices	132	107	133	149	195	0.9	30.9
-- Wine, vermouth, cider and vinegar	3 292	3 469	3 754	3 932	4 212	19.3	7.1
-- Roasted coffee and tea	117	135	143	138	168	0.8	21.7
Food preparations and beverages	6 727	7 347	8 026	8 059	9 244	42.3	14.7
- Food preparations	2 262	2 546	2 923	2 911	3 308	15.1	13.6
-- Chocolate, confectionery and ice cream	624	688	784	812	881	4	8.5
-- Infant food and other cereals, flour, starch or milk preparations	117	128	144	146	159	0.7	8.9
-- Pasta, pastry, biscuits and bread	746	832	913	1 034	1 175	5.4	13.6
-- Soups and sauces	112	128	143	158	205	0.9	29.7
-- Coffee and tea extracts	48	41	45	50	59	0.3	18
-- Food preparations, not specified	423	553	677	497	571	2.6	14.9
-- Pet food	191	177	217	214	258	1.2	20.6
- Beverages	4 465	4 801	5 103	5 148	5 937	27.2	15.3
-- Waters and soft drinks	955	1 114	1 336	1 366	1 569	7.2	14.9
-- Beer	1 243	1 236	1 196	1 086	1 106	5.1	1.8
-- Spirits and liqueurs	2 249	2 442	2 563	2 687	3 252	14.9	21
-- Odoriferous substances	18	9	7	9	9	0	0
Non-edible	1 116	1 176	1 219	1 281	1 349	6.2	5.3
- Non-edible	1 116	1 176	1 219	1 281	1 349	6.2	5.3
-- Raw hides, skins and furskins	27	20	15	8	5	0	-37.5
-- Non-edible animal products	55	50	70	89	77	0.4	-13.5
-- Wool and silk	4	3	4	4	5	0	25
-- Cotton, flax and hemp, and plaiting materials	13	12	14	13	17	0.1	30.8
-- Cut flowers and plants	86	105	102	102	113	0.5	10.8
-- Bulbs, roots and live plants	174	183	199	207	216	1	4.3
-- Raw tobacco	47	52	43	28	34	0.2	21.4
-- Cigars and cigarettes	42	49	54	60	70	0.3	16.7
-- Fatty acids and waxes	99	85	78	97	80	0.4	-17.5
-- Sugar alcohols	11	9	9	10	12	0.1	20
-- Essential oils	195	224	273	302	248	1.1	-17.9
-- Ethanol	12	18	18	17	21	0.1	23.5
-- Casein, other albuminoidal substances and modified starches	321	331	308	328	438	2	33.5
-- Non-edible, not specified	23	24	20	6	3	0	-50
-- Products non-attributable	8	9	11	10	9	0	-10

Source: ISDB and Eurostat

	Value		Mio €			%	
	2015	2016	2017	2018	2019	Share in all	Change
				Agri 2019			2018-2019
Agri Food	9 853	10 838	11 235	10 477	14 491	100	38.3
Agricultural food and feed products	5 206	5 860	5 525	5 090	8 712	60.1	71.2
- Commodities	1 650	922	965	1 076	1 568	10.8	45.7
- - Wheat	0	0	0	27	168	1.2	522.2
- - Cereals, other than wheat and rice	816	110	38	105	242	1.7	130.5
- - Rice	0	0	0	0	0	0	
- - Flours and other products of the milling industry	13	16	13	13	13	0.1	0
- - Malt	3	2	2	4	4	0	0
- - Starches, inulin & gluten	30	29	22	12	15	0.1	25
- - Soyabeans	0	0	0	0	0	0	
- - Oilseeds, other than soyabeans	2	3	4	8	17	0.1	112.5
- - Palm & palm kernel oils	0	0	0	0	1	0	
- - Vegetable oils other than palm & olive oils	111	76	57	68	90	0.6	32.4
- - Oilcakes	0	0	0	1	1	0	0
- - Other feed and feed ingredients	59	31	39	67	81	0.6	20.9
- - Beet and cane sugar	0	1	2	2	1	0	-50
- - Sugar, other than beet & cane	11	9	16	29	29	0.2	0
- - Milk powders and whey	438	446	562	568	735	5.1	29.4
- - Butter	69	108	107	68	65	0.4	-4.4
- - Gums, resins and plant extracts	63	61	69	72	73	0.5	1.4
- - Unroasted coffee, tea in bulk & mate	3	2	2	2	3	0	50
- - Cocoa beans	0	0	0	0	0	0	
- - Cocoa paste and powder	32	27	30	30	26	0.2	-13.3
- - Agricultural commodities, not specified	0	0	0	0	2	0	
- Other primary	2 420	3 658	2 972	2 645	5 847	40.3	121.1
- - Live animals	55	42	36	28	37	0.3	32.1
- - Bovine meat, fresh, chilled and frozen	2	3	1	3	52	0.4	1633.3
- - Pork meat, fresh, chilled and frozen	899	1 704	1 204	989	3 288	22.7	232.5
- - Poultry meat, fresh, chilled and frozen	40	42	7	10	54	0.4	440
- - Sheep and goat meat, fresh, chilled and frozen	0	0	1	0	0	0	
- - Offal, animal fats and other meats, fresh, chilled and frozen	985	1 338	1 098	1 025	1 699	11.7	65.8
- - Fresh milk and cream, buttermilk and yoghurt	284	340	408	371	469	3.2	26.4
- - Eggs and honey	7	6	6	2	3	0	50
- - Vegetables, fresh, chilled and dried	5	7	11	4	9	0.1	125
- - Fruit, fresh or dried, excl. citrus & tropical fruit	68	74	73	76	86	0.6	13.2

- - Citrus fruit	4	15	23	29	45	0.3	55.2
- - Tropical fruit, fresh or dried, nuts and spices	11	14	13	9	10	0.1	11.1
- - Miscellaneous seeds and hop cones	58	74	91	98	94	0.6	-4.1
- - Agricultural primary food products, not specified	0						
- Processed (incl. wine)	1 137	1 281	1 588	1 369	1 297	9	-5.3
- - Meat preparations	8	10	13	11	21	0.1	90.9
- - Cheese	46	59	83	78	98	0.7	25.6
- - Olive oil	147	169	185	135	137	0.9	1.5
- - Preparations of vegetables, fruit or nuts	66	61	77	105	89	0.6	-15.2
- - Fruit juices	27	31	42	43	45	0.3	4.7
- - Wine, vermouth, cider and vinegar	822	929	1 159	969	876	6	-9.6
- - Roasted coffee and tea	22	22	29	27	30	0.2	11.1
Food preparations and beverages	2 763	3 345	4 090	3 928	4 248	29.3	8.1
- Food preparations	1 943	2 408	3 056	2 998	3 194	22	6.5
- - Chocolate, confectionery and ice cream	250	139	166	162	173	1.2	6.8
- - Infant food and other cereals, flour, starch or milk preparations	1 275	1 809	2 344	2 289	2 417	16.7	5.6
- - Pasta, pastry, biscuits and bread	127	145	139	125	133	0.9	6.4
- - Soups and sauces	12	14	17	14	15	0.1	7.1
- - Coffee and tea extracts	4	7	13	14	8	0.1	-42.9
- - Food preparations, not specified	204	207	268	289	329	2.3	13.8
- - Pet food	71	87	110	104	121	0.8	16.3
- Beverages	820	937	1 034	930	1 054	7.3	13.3
- - Waters and soft drinks	51	58	75	82	97	0.7	18.3
- - Beer	419	456	419	350	358	2.5	2.3
- - Spirits and liqueurs	350	422	539	496	597	4.1	20.4
- - Odoriferous substances	0	0	1	1	2	0	100
Non-edible	1 884	1 633	1 620	1 459	1 531	10.6	4.9
- Non-edible	1 884	1 633	1 620	1 459	1 531	10.6	4.9
- - Raw hides, skins and furskins	1 060	804	720	464	419	2.9	-9.7
- - Non-edible animal products	48	58	81	77	75	0.5	-2.6
- - Wool and silk	77	58	61	72	42	0.3	-41.7
- - Cotton, flax and hemp, and plaiting materials	335	357	330	437	558	3.9	27.7
- - Cut flowers and plants	15	10	14	15	20	0.1	33.3
- - Bulbs, roots and live plants	113	117	128	113	114	0.8	0.9
- - Raw tobacco	0	0	0	0	0	0	
- - Cigars and cigarettes	18	24	15	16	16	0.1	0
- - Fatty acids and waxes	34	40	58	58	50	0.3	-13.8
- - Sugar alcohols	8	3	7	8	4	0	-50
- - Essential oils	22	25	39	32	32	0.2	0
- - Ethanol	1	1	1	1	1	0	0
- - Casein, other albuminoidal substances and modified starches	146	130	162	162	196	1.4	21
- - Non-edible, not specified	0	0	0	1	1	0	0
- - Products non-attributable	6	5	1	2	2	0	0

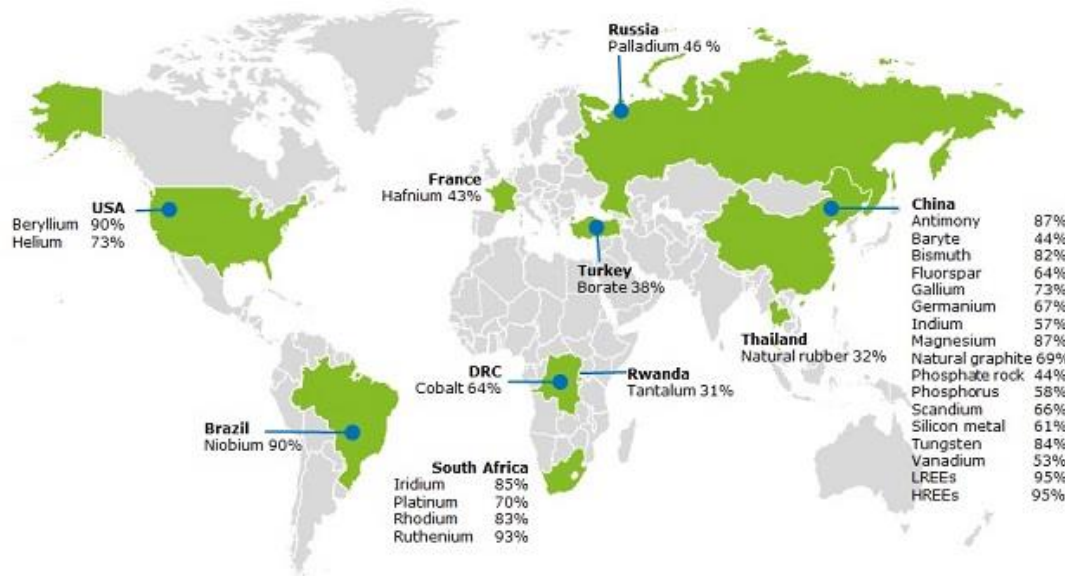
Source: ISDB and Eurostat

Appendix-9: Critical Raw Material List (2017)

Antimony	Fluorspar	LREEs	Phosphorus
Baryte	Gallium	Magnesium	Scandium
Beryllium	Germanium	Natural graphite	Silicon metal
Bismuth	Hafnium	Natural rubber	Tantalum
Borate	Helium	Niobium	Tungsten
Cobalt	HREEs	PGMs	Vanadium
Coking coal	Indium	Phosphate rock	

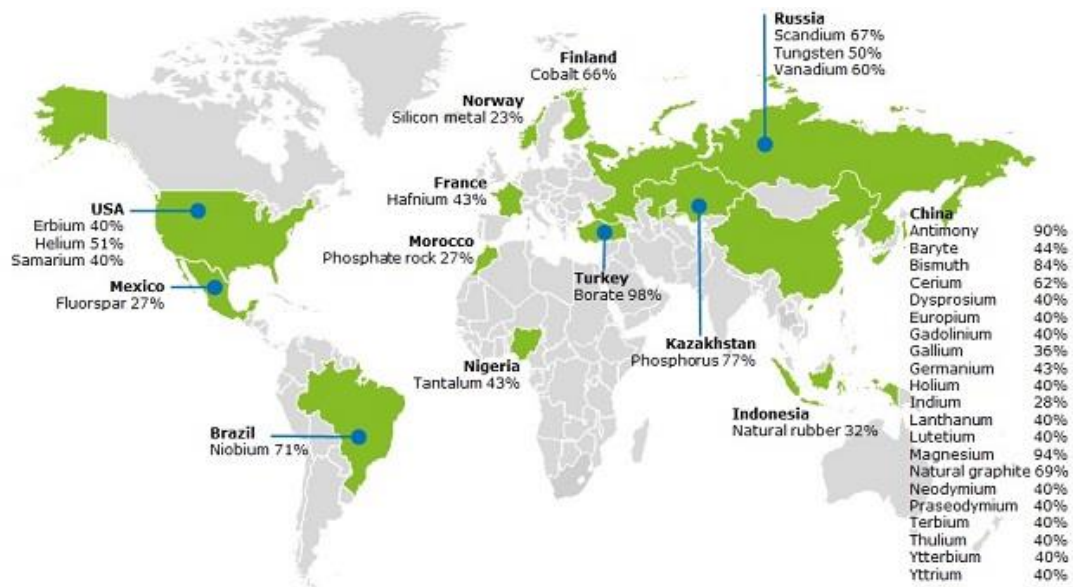
Source: European Commission

Appendix-10: Countries accounting for largest share of global supply of CRMs (2010-2014)



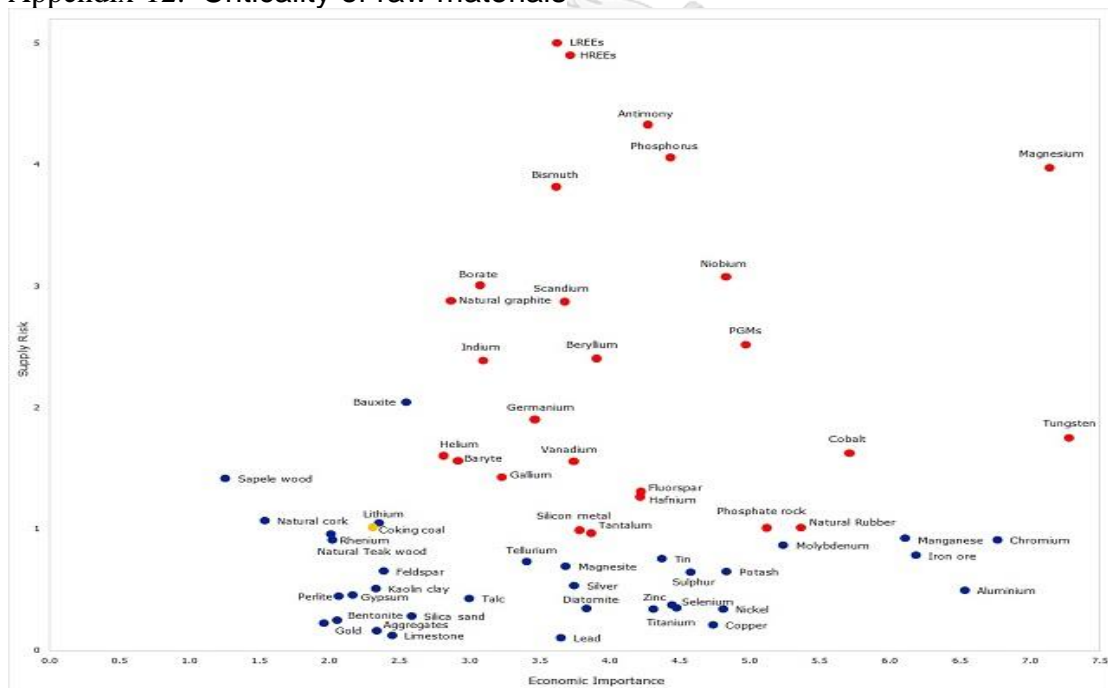
Source: European Commission

Appendix-11: Countries accounting for largest share of EU supply of CRMs



Source: European Commission

Appendix-12: Criticality of raw materials



Source: European Commission



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