Economic Impact of Technological Decoupling

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Outline

Introduction

- Growing trade tensions in between China and the US
- Trade war in tariffs since 2018
  - started with Trump administration
  - Continues with Biden administration
- This project:
  - What is the effect of the US technological decoupling initiatives on global trade?

International Export Control Regimes

- Four regimes:
  1. **Wassenaar Arrangement**
     - Conventional arms
  2. **Missile Technology Control Regime**
     - Missiles and missile technology
  3. **Nuclear Suppliers Group**
     - Nuclear
  4. **Australia Group**
     - Chemical and biological weapons
- Common Elements:
  - Maintain lists of controlled items
    - **Strategic Export Control Lists**
  - Have **catch-all controls**
    - Allow for the control of nonlisted items if they are to be used for a military or proliferation-related purpose
  - Share information
  - Hold regular meetings
  - International delegations

Dual-Use Goods and Technologies

	Civilian applications	Defense-related applications
Carbon fibers Light in weight, strong and durable fiber material whose key element is carbon	 Golf club shafts, fishing rods, tennis rackets	 Main wing material for fighter jets
Active control suspensions A mechanism to damp vibration by electrically adapting the suspension characteristics	 Formula 1 race cars	 Armored combat vehicles
Gallium nitride (GaN) semiconductors Semiconductor material for highly efficient power control/ conversion	 Amplifier for a satellite's radiowave transmission	 Radars for fleet escort vessels

Japan

- Legal framework:
  - Foreign Exchange and Foreign Trade Act
- The Japan's export control system is managed by the **Ministry of Economy, Trade and Industry (MIETI)**
  - The exporter has the responsibility to figure out whether the export item is subject to control list
  - If the item is in the control list, the exporter needs to apply for an export license from MIETI

1. Arms

Number	Item
(1)	Firearms, ammunitions
(2)	Explosives, explosive dispensers
(3)	Propellants, military fuels
(4)	Stabilizers for propellant powders, other explosives
(5)	Directed-energy weapons
(6)	Kinetic energy weapons and projectiles
(7)	Military vehicles, bridges, etc.
(8)	Military vessels, etc.
(9)	Military aircraft, etc.
(10)	Anti-submarine nets, anti-torpedo nets
(11)	Armor plates, military helmets, body armors
(12)	Military searchlights or control equipment
(13)	Bacterial/chemical warfare agents
(13 - 2)	Chemical compounds for clarifying bacterial/chemical warfare agents
(14)	Biopolymers for chemical agents, etc.
(15)	Equipment for the production/test of warfare low explosives
(16)	Equipment or device for the production of arms
(17)	Military satellites or components thereof

2. Nuclear Power

Number	Item
(1)	Nuclear fuel or nuclear source materials
(2)	Nuclear reactors or power-generating equipment for nuclear reactors
(3)	Deuterium or deuterium compounds
(4)	Artificial graphite
(5)	Equipment for the separation/reprocessing of nuclear fuel materials
(6)	Equipment for the separation of lithium isotopes
(7)	Equipment for the separation of uranium/plutonium isotopes
(8)	Frequency changers
(9)	Nickel powder, nickel porous metal
(10)	Equipment for the production of deuterium or deuterium compounds
(10- 2)	Equipment for the production of uranium/plutonium
(11)	Flow-forming machines
(12)	1. Numerically-controlled machine tools 2. Measurement equipment
(13)	Induction furnaces, arc furnaces or melting furnaces or components thereof
(14)	Isostatic presses
(15)	Robots
(16)	Vibration test systems
(17)	Structural materials for gas centrifuge rotors
(18)	Beryllium
(19)	Substances used as alpha sources for the detonation of nuclear weapons
(20)	Boron 10
(21)	Substances used as reducing or oxidizing agents for the production of nuclear fuel materials
(22)	Crucibles
(23)	Hafnium
(24)	Lithium
(25)	Tungsten
(26)	Zirconium
(27)	Electrolytic cells for fluorine production
(28)	Equipment for the production of gas centrifuge rotors
(29)	Centrifugal balancing machines
(30)	Filament winding machines
(31)	Laser oscillators
(32)	Mass spectrometers or ion sources
(33)	Pressure gauges or bellows valves
(34)	Superconducting solenoid electromagnets
(35)	Vacuum pumps
(35- 2)	Scroll-type compressors and vacuum pumps
(36)	Direct current power units
(37)	Electron accelerators or X-ray generators
(38)	Impact testing machines
(39)	High speed cameras
(40)	Interferometers, pressure gauges, pressure transducers
(41)	Goods used for the detonation (testing) of nuclear weapons
(42)	Photomultiplier tubes
(43)	Neutron generators
(44)	Remote control manipulators
(45)	Radiation shielding windows or frames
(46)	TV cameras or lenses specially designed for protection from the influence of radiation
(47)	Tritium
(48)	Equipment for the production, collection or preservation of tritium
(49)	Platinized catalysts
(50)	Helium-3
(51)	Primary products of rhenium
(52)	Containers with explosion-proof construction

3. Chemical Weapons

Number	Item
(1)	Raw materials for chemical warfare agents or substances/raw materials having equivalent toxic ability with chemical warfare agents
(2)	Equipment or device for the production of chemical agents
(3)	Equipment of components for repair of reactors or containers

3 - 2. Biological Weapons

Number	Item
(1)	Source materials for bacterial warfare agents
(2)	Equipment for the production of bacterial agents

4. Missiles

Number	Item
(1)	Rockets or their production equipment
(1- 2)	Unmanned aerial vehicles (UAVs) or their production equipment
(2)	Guidance or testing equipment for rockets
(3)	Propulsion units
(4)	Flow-forming machines
(5)	Servo valves, pumps, gas turbines
(5- 2)	Bearings for pumps
(6)	Propellants or their raw materials
(7)	Equipment for the production/test of propellants
(8)	Powder and granular materials mixers
(9)	Jet mills or equipment for the production of metal powders
(10)	Equipment for the production of composite materials
(11)	Nozzles
(12)	Equipment, et alia, for the production of nozzle or re-entry vehicle nose tips
(13)	Isostatic presses or controllers
(14)	Furnaces or controllers for composite materials
(15)	Structural materials for rockets or UAVs
(16)	Accelerometers or gyroscopes for rockets or UAVs
(17)	Flight controllers or attitude controllers, et alia, for rockets or UAVs
(18)	Avionics equipment
(18 - 2)	Thermoelectric batteries for rockets or UAVs
(19)	Gravity meters or gravity gradiometers for aircraft or ship mounting
(20)	Launch pads or associated ground launch support equipment for rockets or UAVs
(21)	Radio telemetry equipment, radio telecontrol equipment for rockets or UAVs
(22)	Computers designed for use in a rocket
(23)	Analog-to-digital converters for rockets or UAVs
(24)	Vibration test equipment, aerodynamics testing equipment, combustion test equipment, et alia
(24 - 2)	Electronic computers used for designing rockets
(25)	Materials or equipment for reducing the level of the radio waves, acoustic waves or light
(26)	Integrated circuits, detectors, or radomes for rockets or UAVs

5. Advanced Materials

Number	Item
(1)	Fluorine compound products
(2)	(delete)
(3)	Aromatic polyimide products
(4)	Tools for forming of titanium, aluminum or its alloys
(5)	Alloys or powders of titanium or aluminum and their production equipment
(6)	Metallic magnetic materials
(7)	Uranium-titanium alloys or tungsten alloys
(8)	Superconductive materials
(9)	(delete)
(10)	Lubricants
(11)	Liquids for preventing vibration
(12)	Liquids for coolant
(13)	Ceramic powders
(14)	Ceramic composites
(15)	Polydiorgano silane or polysilazane, et alia
(16)	Bismaleimide or aromatic polyamideimide, et alia
(17)	Fluorinated polyimides
(18)	Molded products that use prepregs or preforms
(19)	Boron, boron carbide, guanidine nitrate

Number	Item
6. Material Processing	
(1)	Bearings
(2)	Numerically-controlled (N/C) machine tools
(3)	Machine tools for the production of gears
(4)	Isostatic presses
(5)	Coating devices
(6)	Measurement equipment
(7)	Robots
(8)	Feedback devices, et alia
(9)	Spin-forming machines
7. Electronics	
(1)	Integrated circuits
(2)	Devices using microwaves or millimeter waves
(3)	Signal processing equipment
(4)	Devices using superconductive materials
(5)	Superconducting electromagnets
(6)	Primary/secondary or solar cells
(7)	High voltage capacitors
(8)	Encoders or components thereof
(8 - 2)	Thyristor devices or modules
(8- 3)	Semiconductor devices for power control
(8 - 4)	Optical modulator
(9)	Sampling oscilloscopes
(10)	Analog-to-digital converters
(11)	Digital instrumentation recorders
(12)	Signal generators
(13)	Frequency analyzers
(14)	Network analyzers
(15)	Atomic frequency standards
(15 - 2)	Spray cooling method temperature control devices
(16)	Semiconductor manufacturing equipment
(17)	Masks or reticles
(17 - 2)	Base materials for production of masks
(18)	Semiconductor substrate
(19)	Resists
(20)	Aluminum, gallium and other organic metallic compounds Phosphorus, arsenic and other organic compounds
(21)	Phosphorus, arsenic or antimony hydrides
(22)	Silicon carbides
(23)	Polycrystalline substrate
8. Computers	
(1)	Computers
9. Telecommunication	
(1)	Telecommunication transmission equipment
(2)	Electronic changers
(3)	Communication optical fibers
(4)	(delete)
(5)	Phased array antennas
(5- 2)	Radio direction finding equipment for monitoring use
(5- 3)	Wireless communication wiretapping devices
(5- 4)	Equipment capable of detecting the position of objects by observing interferences of radio waves, possessing a receiving function only
(5- 5)	Internet communication monitoring equipment
(6)	Design/production equipment for items 1) through 3), and 5) through 5-5)
(7)	Encryption equipment
(8)	Equipment designed to prevent the leakage of information transmission signals
(9)	(delete)
(10)	Communication cable systems capable of detecting surreptitious intrusion
(11)	Design/production/measurement equipment for items 7), 8) or 10)
10. Sensors	
(1)	Underwater acoustic equipment
(2)	Optical detectors or coolers thereof
(3)	Optical fibers for use in sensors
(4)	Electronic cameras
(5)	Reflectors
(6)	Optical components for space use
(7)	Controllers of optical equipment or components
(7- 2)	Aspherical optical elements
(8)	Laser oscillators
(8 - 2)	Laser microphone
(9)	Magnetometers, underwater electric field sensors or magnetic field gradiometers, or calibrating equipment thereof
(9- 2)	Underwater monitoring systems
(10)	Gravity meters or gravity gradiometers
(11)	Radars
(11-2)	Masks and reticles, specially designed for optical sensors
(12)	Equipment for measuring optical reflectance, et alia
(13)	Equipment for the manufacture or calibration equipment of gravity meters
(14)	Materials, et alia, for optical detectors or components thereof
11. Navigation Devices	
(1)	Accelerators
(2)	Gyroscopes
(3)	Inertial navigation systems
(4)	Gyro-astro compasses, global navigation satellite systems, equipment for receiving radio waves, or aircraft altimeters
(4- 2)	Underwater navigation devices using sonar
(5)	Testing/production equipment for items 1) through 4-2)
12. Marine	
(1)	Submersible vessels/vehicles
(2)	Vessel components or auxiliaries thereof
(3)	Underwater salvage systems
(4)	Underwater lighting systems
(5)	Underwater robots
(6)	Sealed power units
(7)	Circulation water tanks
(8)	Buoyant materials
(9)	Closed-circuit or semi-closed circuit self-contained diving equipment
(10)	Underwater acoustic transmitters used for obstruction
13. Propulsion Units	
(1)	Gas turbine engines
(2)	Spacecrafts for satellite or space development use
(2- 2)	Controllers designed for use in satellites
(3)	Rocket propulsion systems
(4)	Unmanned aerial vehicles
(5)	Testing/production equipment for items 1) through 4), and 10) of 15.
14. Miscellaneous	
(1)	Metallic fuel in a powder state
(2)	Substances which are additives or precursors to low explosives or high explosives
(3)	Diesel engines
(4)	(delete)
(5)	Self-contained diving equipment
(6)	Civil engineering machinery for air transportation
(7)	Robots or control equipment thereof
(8)	(delete)
(9)	Tear or sneeze gas and application equipment thereof
(10)	Simplified explosion devices
(11)	Detectors for explosives
15. Sensitive Items	
(1)	Molded goods using inorganic fibers, et alia
(2)	Radio wave absorbers or conductive polymers
(3)	Nuclear heat source materials
(4)	Digital telecommunication transmission equipment
(4- 2)	Units for obstruction of simplified explosion devices
(5)	Underwater acoustic equipment
(6)	Optical detectors for space use
(7)	Radars which utilize a transmitting pulse width less than 100 nanoseconds
(8)	Submersible boats
(9)	Soundproofing devices for vessels
(10)	Ramjet engines, scramjet engines, combined cycle engines

The United States

- Legal framework:
  - Arms Export Control Act (AECA)
  - The International Emergency Economic Powers Act (IEEPA)
  - The Export Controls Act of 2018 (ECA)
- The U.S. export control system is diffused among several different licensing and enforcement agencies
  - **Department of Commerce:** Dual-use goods and technologies, some military items
  - **Department of State:** Munitions
  - **U.S. Department of the Treasury:** Restrictions on exports based on U.S. sanctions
  - Administrative enforcement of export controls is conducted by these agencies
  - Criminal penalties are issued by units of the **Department of Homeland Security** and the **Department of Justice**

The United States

- In August 2009, the Barack Obama Administration launched a comprehensive review of the U.S. export control system
  - **The Export Controls Act of 2018 (ECA)**
    - Regulates dual-use exports
    - Follows the Wassenaar Arrangement's multilateral control list
    - Administered by the Bureau of Industry and Security (BIS) of the Department of Commerce (USDOC)
- Response to *Made in China 2025*
  - Especially concerning is China's mulitary-civil fusion program

Export Commerce Control List - HS codes mapping

- BIS publishes detailed list of export control items
- We mapped Export Commerce Control Number (ECCN) list to HS codes
  - Manually by checking the names of ECCN and finding the closest HS item
  - HS 6-digits - internationally recognized
    - 10.57% of total number of HS 6-digits codes
  - HS 10-digits - the US list
    - 38.51% of total number of HS 10-digits codes

Data

- January 2017 - October 2021
- Monthly export data HS 6-digits for the US, Germany and Japan (source UN Comtrade)
- HS 10-digits for the US (the US Census Bureau)

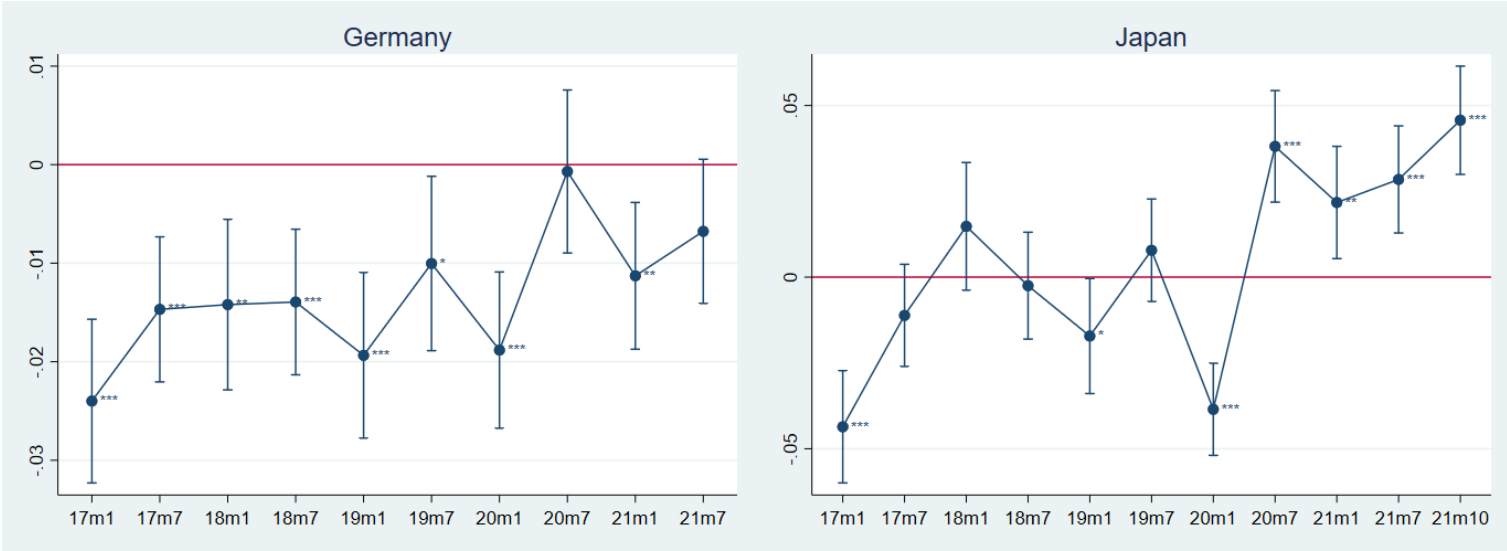
Share of mapped HS6 codes exports to China in total exports of the same HS6 code (mean)

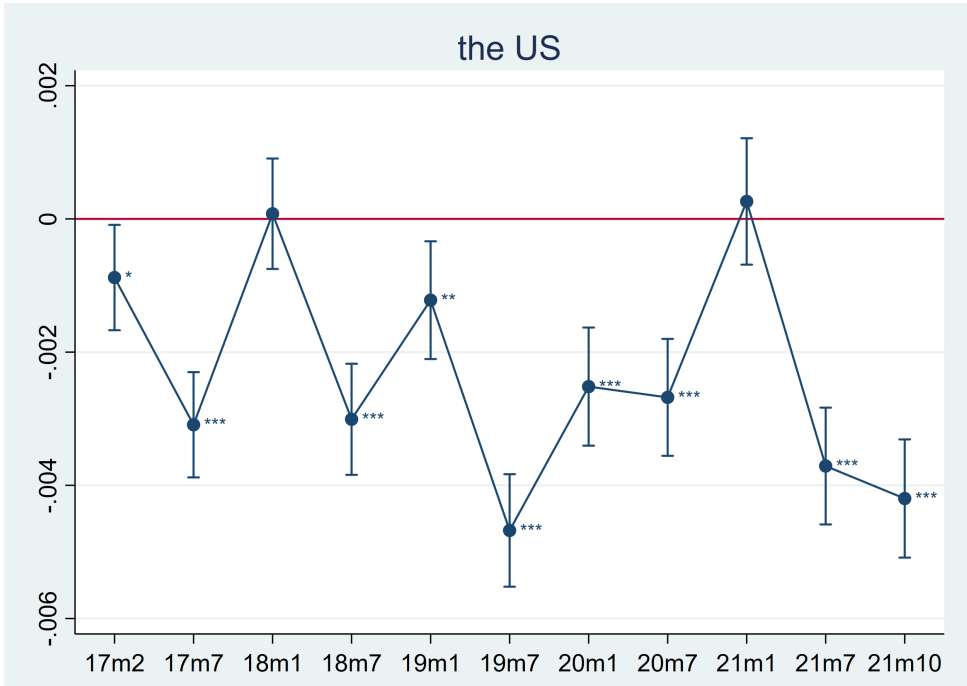
	2017	2018	2019	2020	2021
the US (HS6)	0.061	0.059	0.056	0.06	0.057
the US (HS10)	0.0132	0.0127	0.0118	0.0133	0.0133
Japan	0.18	0.19	0.19	0.2	0.21
Germany	0.065	0.065	0.068	0.075	0.074

Time effect on the share of exports to China

- Monthly level estimation
- Panel data: hs code - year-month
- Dependent variable: Share of mapped HS6 codes exports to China in total exports of the same HS6 code

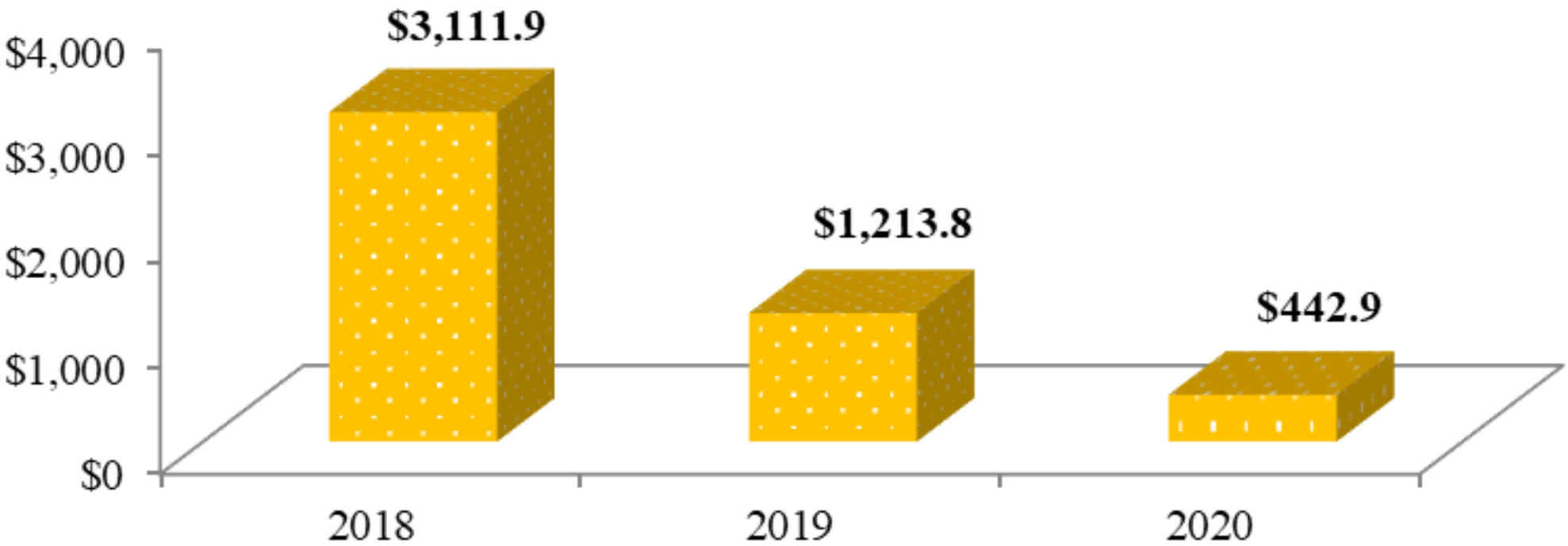
Time effect on the share of exports to China



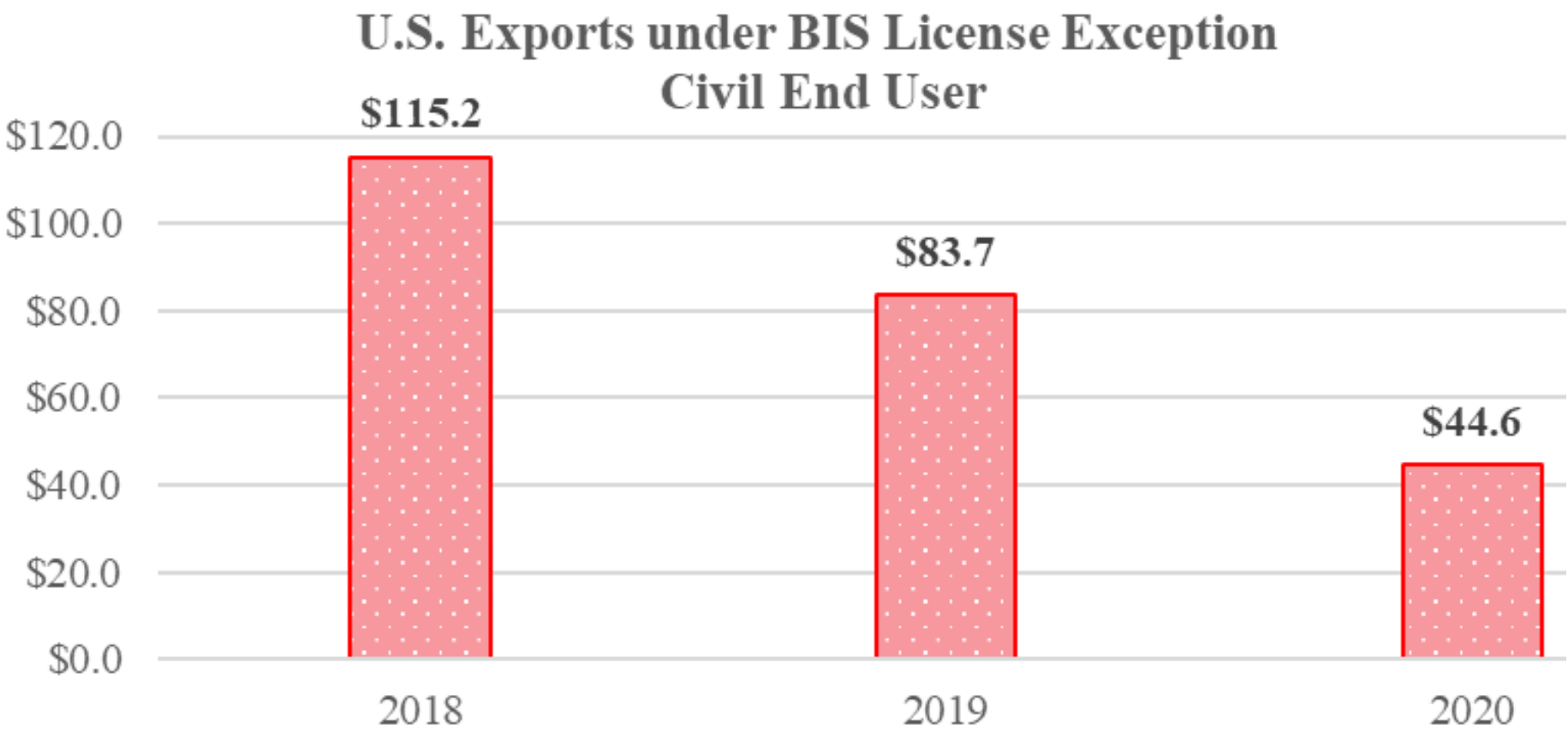


Value of Total BIS License Exceptions for U.S. Exports to China

($millions)



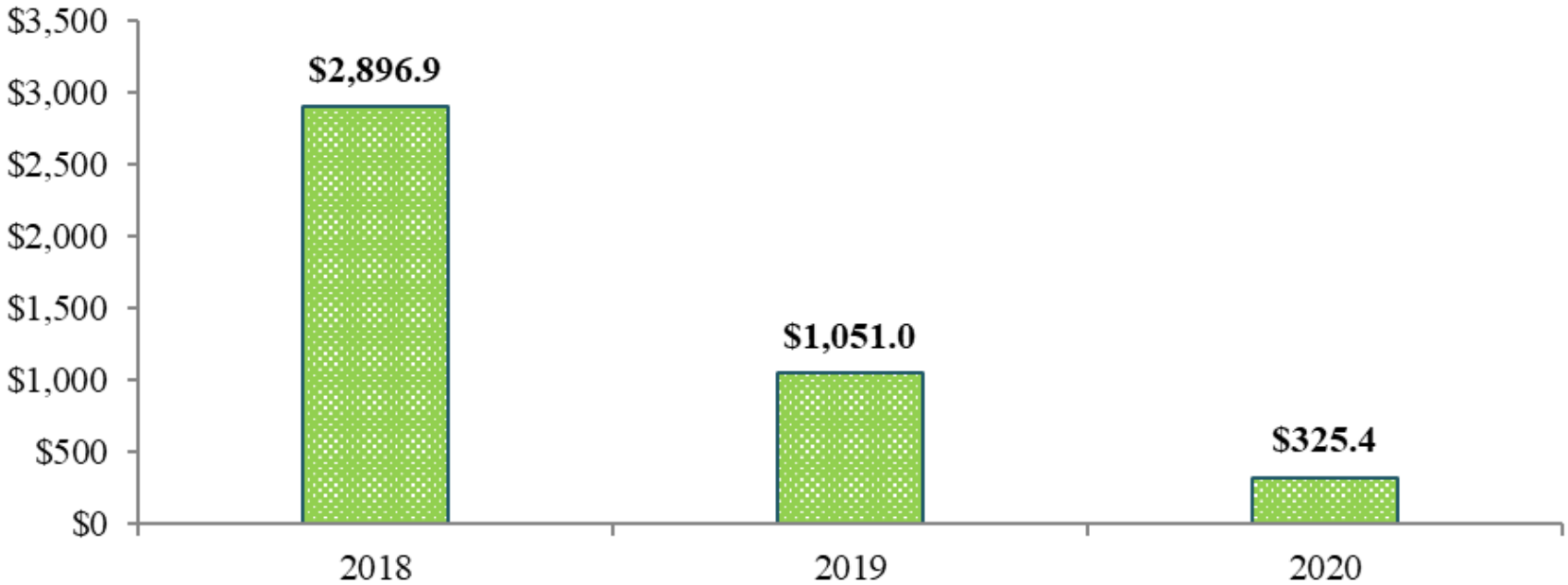
Source: Automated Export System, 1 March 2021



Source: Automated Export System, March 15, 2021

U.S. Exports to China under BIS License Exception:Encryption Commodities & Software

($millions)



Values in Millions of U.S. Dollars. Source: Automated Export System, 1 March 2021