black hat USA 2022

Dragon Tails: Preserving Supply-Side Vulnerability Disclosure

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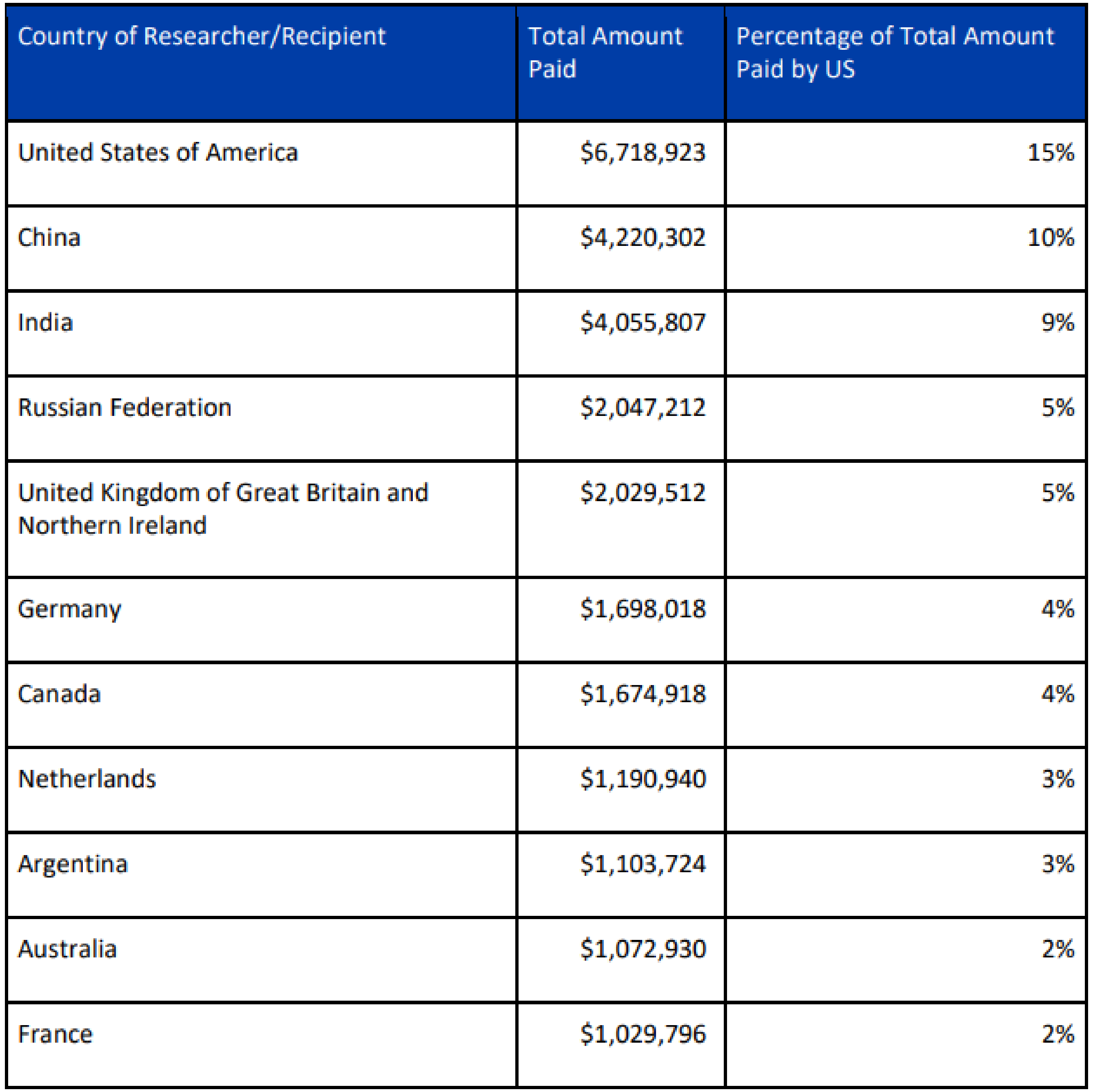
Supply-Side Vulnerability Research

- What are sources of security?
- Global bug-bounty market size projected to reach **$5.5 billion by 2027**
- Manifests the ‘many eyes’ theory of security
- Increasing adoption by government agencies and departments
- Proliferation of bug-bounty platform companies
- Governed by Coordinated Vulnerability Disclosure processes (CVD)

Supply-Side Vulnerability Research



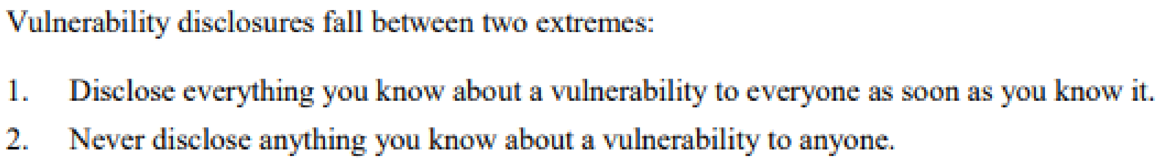
Country of Researcher/Recipient	Total Amount Paid	Percentage of Total Amount Paid by US
United States of America	$6,718,923	15%
China	$4,220,302	10%
India	$4,055,807	9%
Russian Federation	$2,047,212	5%
United Kingdom of Great Britain and Northern Ireland	$2,029,512	5%
Germany	$1,698,018	4%
Canada	$1,674,918	4%
Netherlands	$1,190,940	3%
Argentina	$1,103,724	3%
Australia	$1,072,930	2%
France	$1,029,796	2%

Anonymized bug-bounty platform revenue streams by country, from Congressional Testimony—Dakota Cary, February 17, 2022

Supply-Side Vulnerability Research

Can bad policy ‘break’ this ecosystem, and can we detect those supply shocks?

Good CVD in Log4Shell



Vulnerability disclosures fall between two extremes:

1. Disclose everything you know about a vulnerability to everyone as soon as you know it.
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CMU SEI CERT CC - The CERT Guide to Coordinated Vulnerability Disclosure

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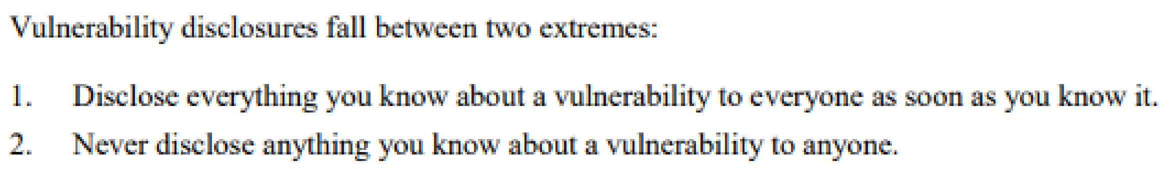

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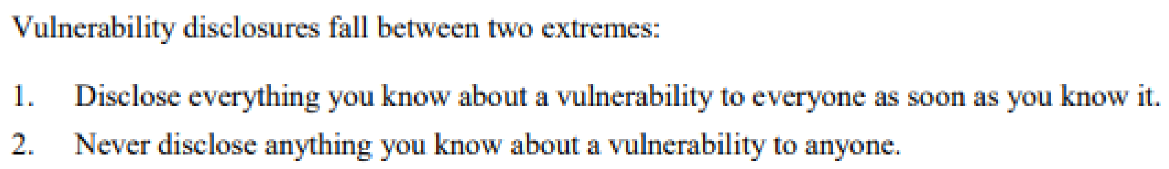

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*December 8 per Bloomberg, December 9 per the Wall Street Journal

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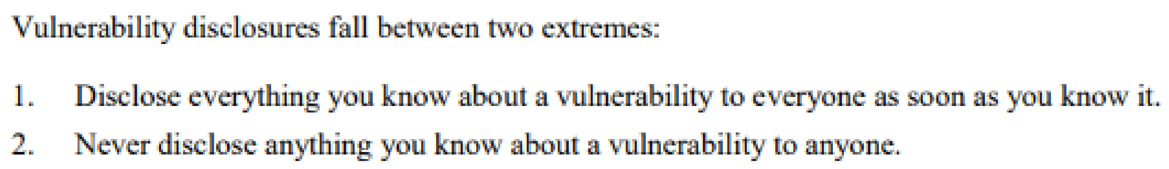

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- **December 8,* 2021**: Researcher follows up with ASF with updates.
- **December 10, 2021**: Patching and public announcements of l4s begin.

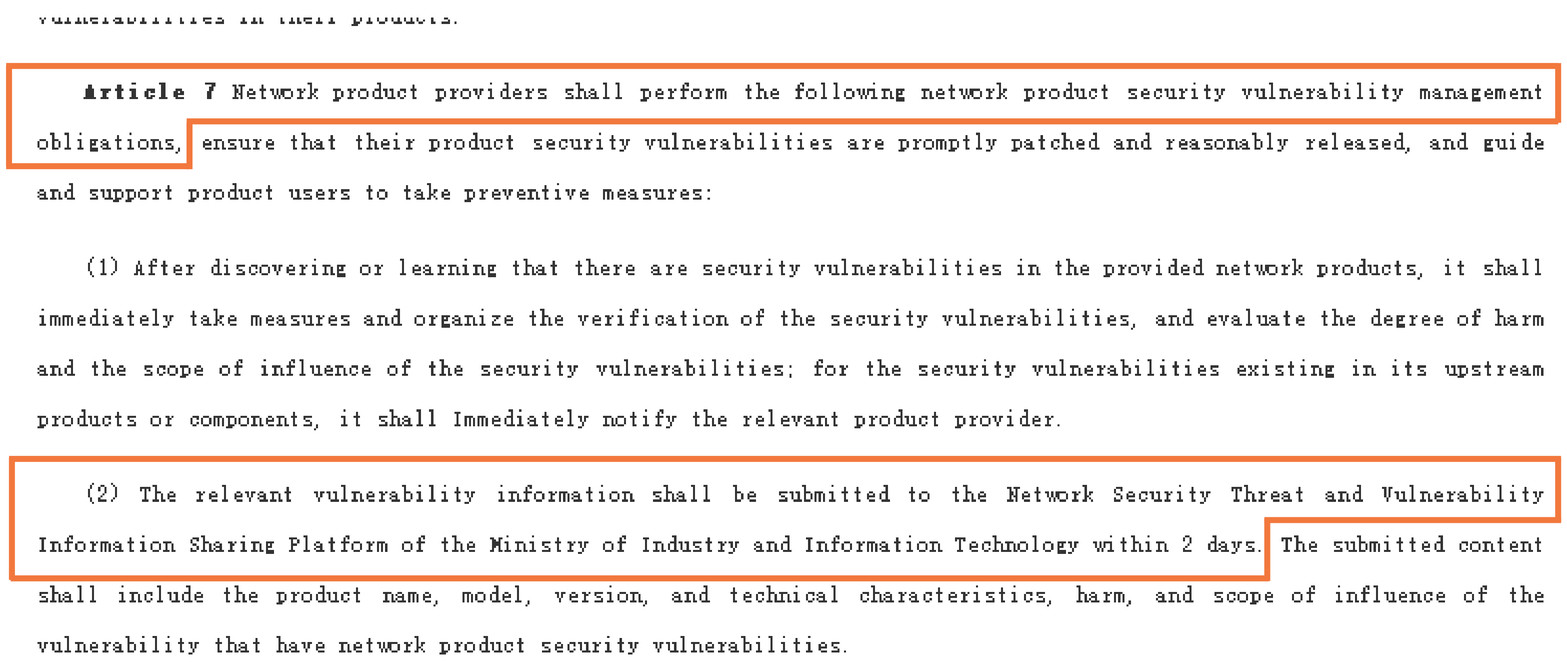
Not So Good CVD

December 22, 2021: China's MIIT suspends Alibaba Cloud from an information-sharing partnership for failing to disclose l4s to the MIIT prior to DEC9, when they received notice from a 3rd party.

- Per the Wall Street Journal and an anonymous source: **suspension was a consequence of breach of contract in the info-sharing partnership.**
- Per other reporting:* **suspension was a consequence of violating *The Regulations on Management of Security Vulnerabilities (RMSV).***

The RMSV

- Specific enforcement mechanism aside, failure to disclose earlier to the MIIT was the cause of the suspension, and the letter of the RMSV was breached.



vulnerabilities in their products.

Article 7 Network product providers shall perform the following network product security vulnerability management obligations, ensure that their product security vulnerabilities are promptly patched and reasonably released, and guide and support product users to take preventive measures:

(1) After discovering or learning that there are security vulnerabilities in the provided network products, it shall immediately take measures and organize the verification of the security vulnerabilities, and evaluate the degree of harm and the scope of influence of the security vulnerabilities; for the security vulnerabilities existing in its upstream products or components, it shall Immediately notify the relevant product provider.

(2) The relevant vulnerability information shall be submitted to the Network Security Threat and Vulnerability Information Sharing Platform of the Ministry of Industry and Information Technology within 2 days. The submitted content shall include the product name, model, version, and technical characteristics, harm, and scope of influence of the vulnerability that have network product security vulnerabilities.

Supply-Side Vulnerability Research

Very little reporting on the RMSV when it was passed or took effect, big questions about application to multinational companies.

- Only known (possible) RMSV enforcement is on Alibaba Cloud for l4s.
- Most coverage concerned with what happens to vulnerabilities after the MIIT gets early access.
- **Not the focus of this research.**

Convenient case study when searching for supply-shocks to international vulnerability research

- **Potential for a chilling effect on China's research contributions:**
- Hesitation to report vulnerabilities until more legal clarity?
- Internal policy changes regarding accepting vulnerability reports from China?
- **Clear before and after dates**
- **Large potential impact:**
- China is a significant contributor to international vulnerability research

Other CVD Practices and Reporting Laws

A lack of clear legal protections for researchers has caused problems globally:

- German researcher (almost) charged for reporting flaws in campaign app
- Missouri tried to charge a researcher for reading HTML

Some good developments here recently:

- DOJ declining to prosecute good-faith research
- ENISA push for member governments to develop CVD policies
- CISA BOD for agencies to develop reporting systems

Research Question

Did the RMSV cause a supply shock in China’s research contributions?

- If so, did that shock trickle into the overall supply of research contributions?
- Do other shocks occur correlated to unidentified events?

Research Question

Added insights:

- Better look at external contributions to vulnerability reporting
- Possible to look at density-distribution of contributors as well

Datasets: Acknowledgements from different CVE and security update databases from Microsoft, Apple, F5, VMWare, and Red Hat

- Looking across vendors to try to tease out product and ecosystem trends
- Get variety of internal practices for crediting explicitly or anonymously and for organizing data (by CVE, by update batch, by vulnerability batch, etc.)
- Open source and proprietary codebases

Key Dates

RMSV Timeline:

July 2020: Draft law containing RMSV MIIT reporting requirement first reported as known to industry and government in China

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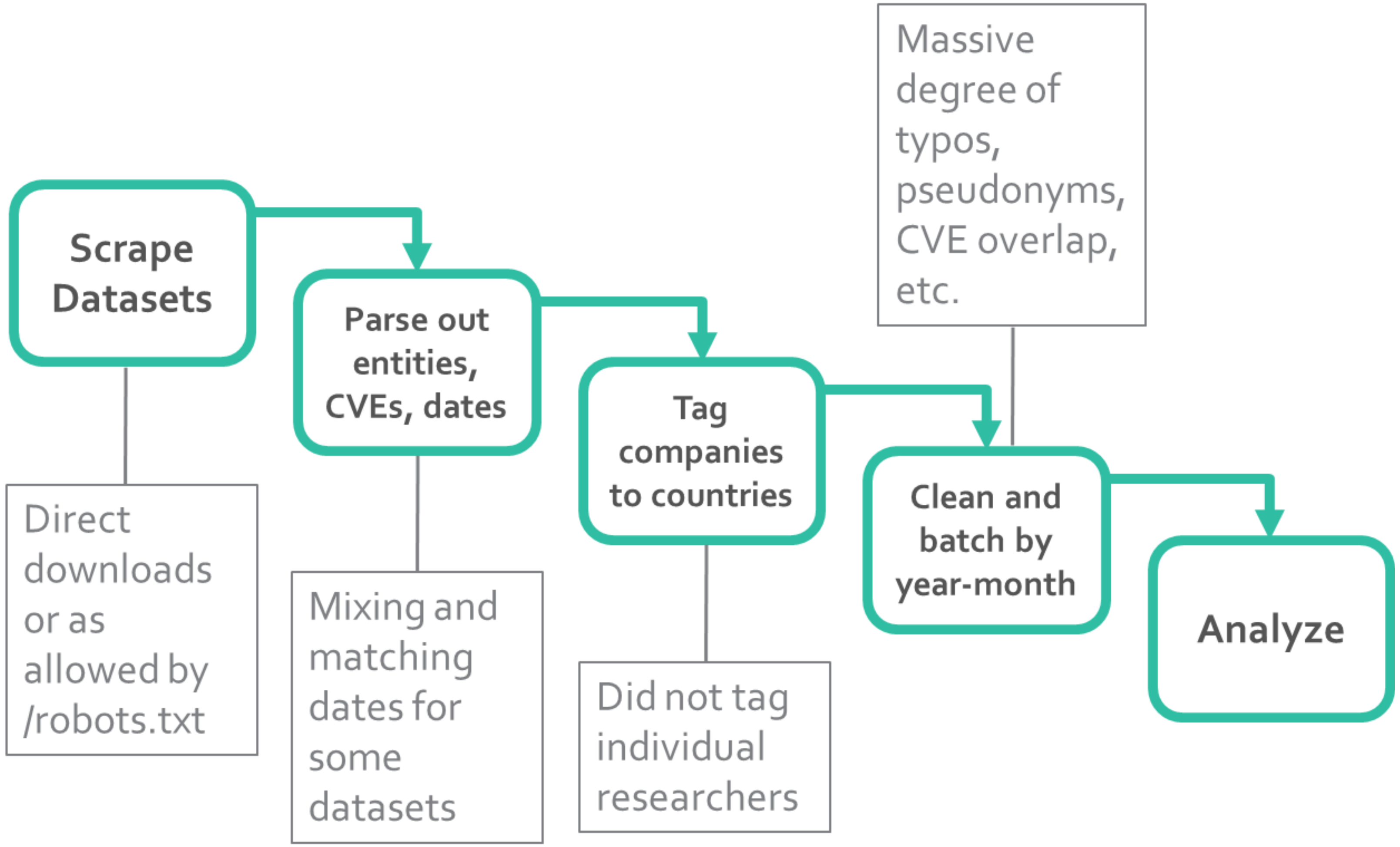
Some confounding events:

Summer 2020: Flurry of cyber regulations in China

Summer 2020: US blacklisting of companies in China accelerates

Summer 2021: More blacklisting

Methods



Scrape Datasets

Direct downloads or as allowed by /robots.txt

Parse out entities, CVEs, dates

Mixing and matching dates for some datasets

Tag companies to countries

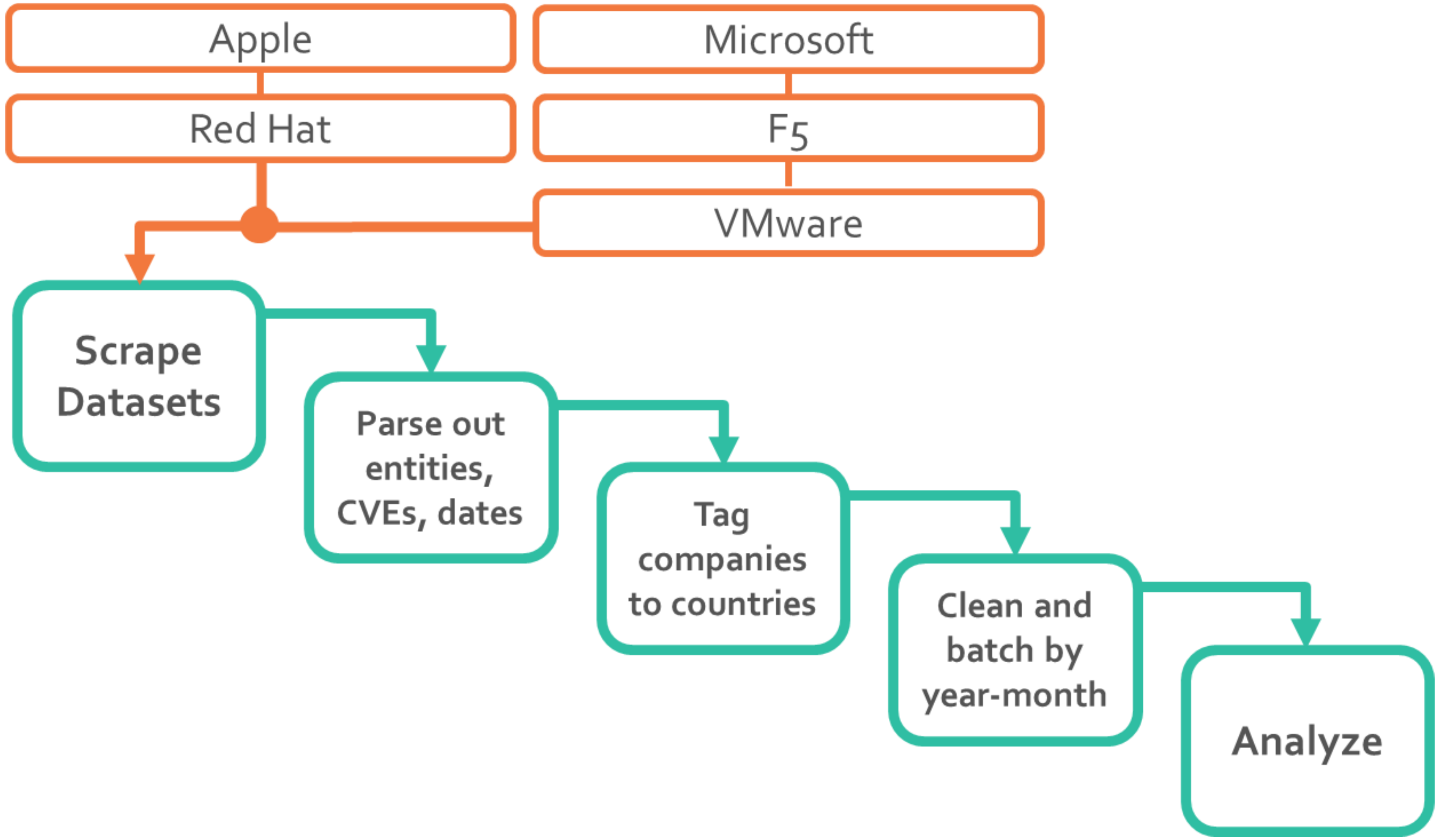
Did not tag individual researchers

Clean and batch by year-month

Massive degree of typos, pseudonyms, CVE overlap, etc.

Analyze

Methods



Apple

Microsoft

Red Hat

F5

VMware

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Some quirks:

Can’t compare between datasets directly because of overlap in CVEs.

Apple security updates often predate listed dates for CVEs found on NVD, Tenable, etc., and are organized by software update.

Unclear where credits are all for vulnerability discovery or demonstration of vulnerability application of a specific product.

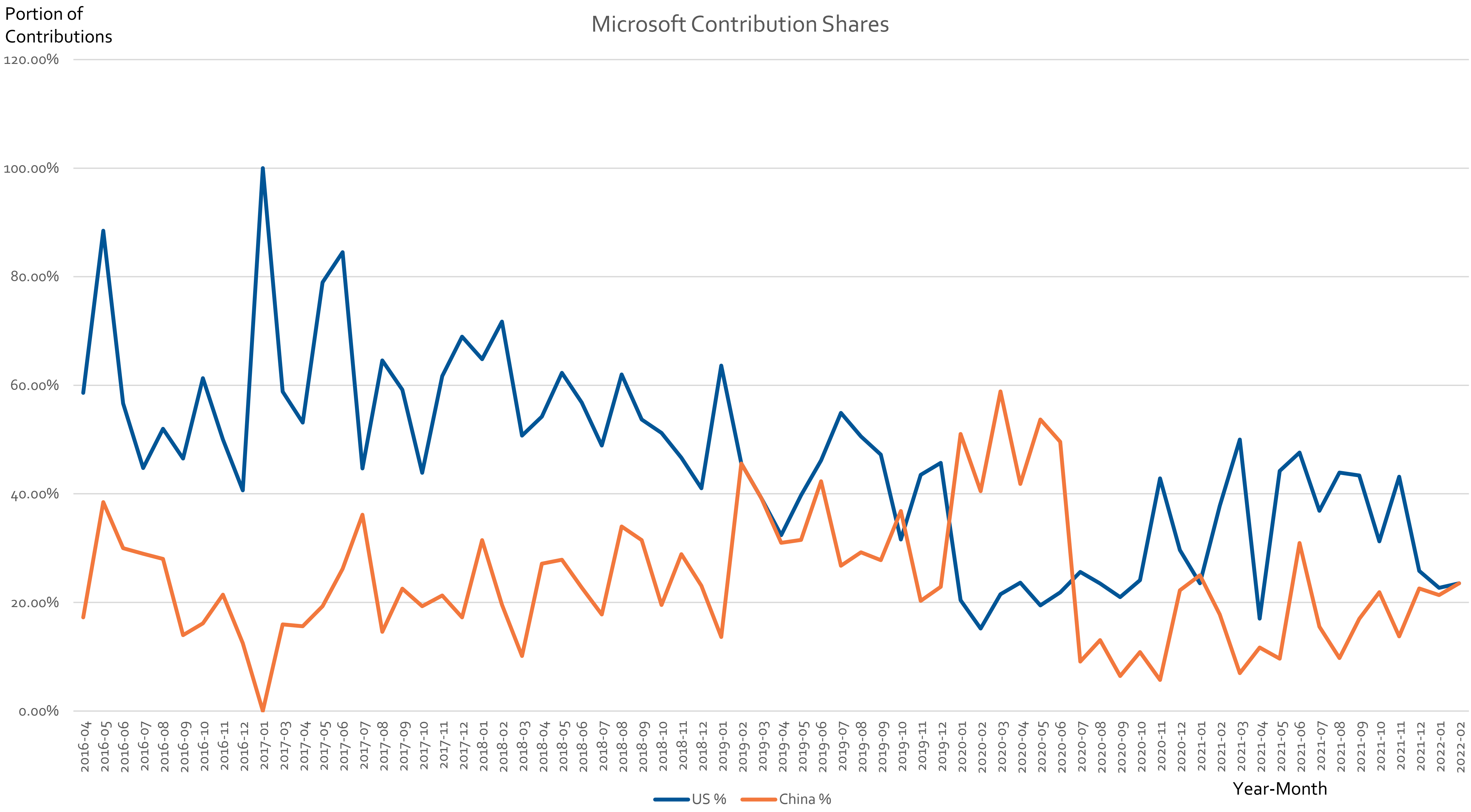
Batching by month adds noise.

Not clear how the delay between private reporting and public patching and acknowledgement plays out.

Datasets

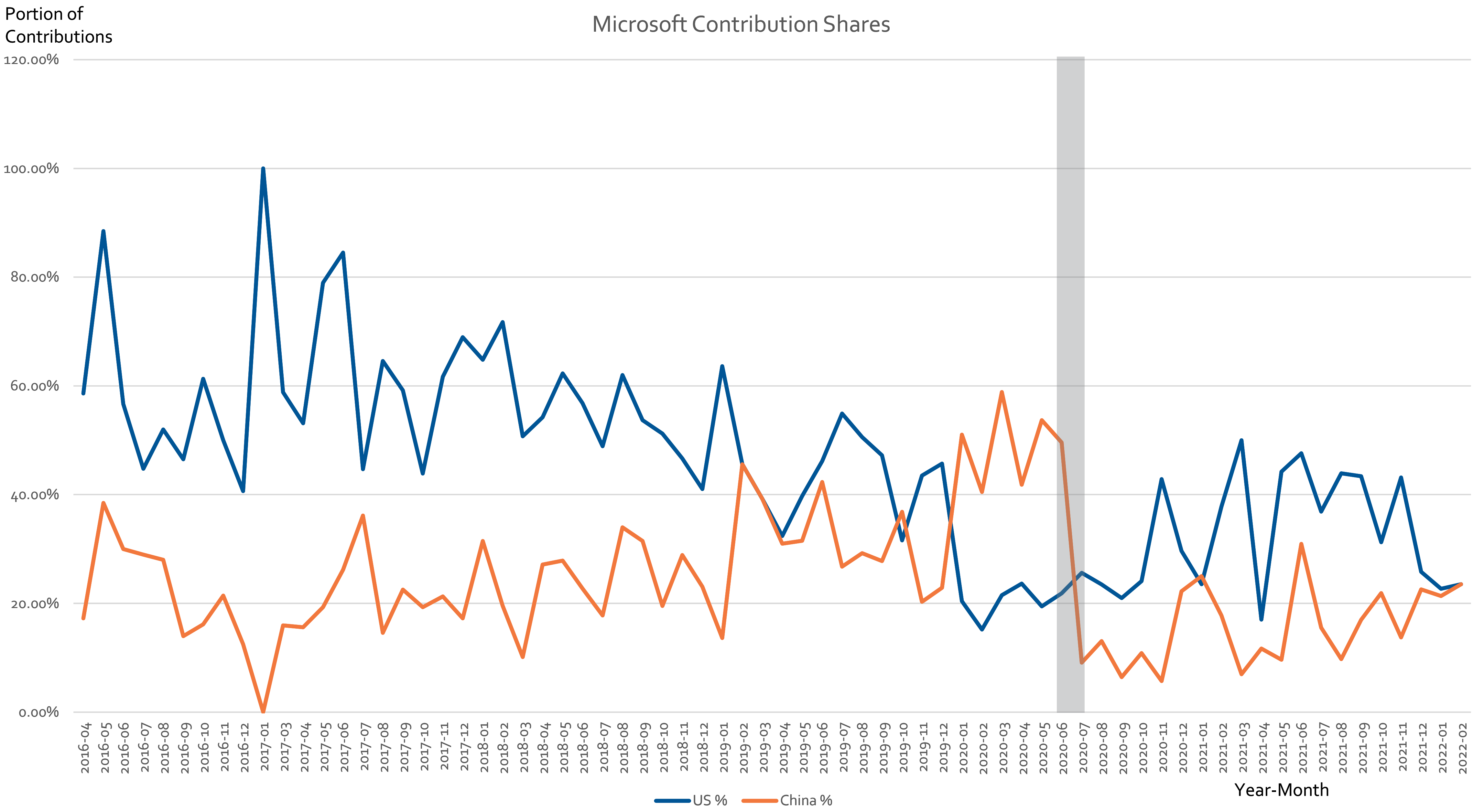
Microsoft: n =	**4355**
Apple: n =	14740
VMWare: n =	1363
F5: n =	335
Red Hat: n =	**3307**

Microsoft Portions



Information Classification: General

Microsoft Portions



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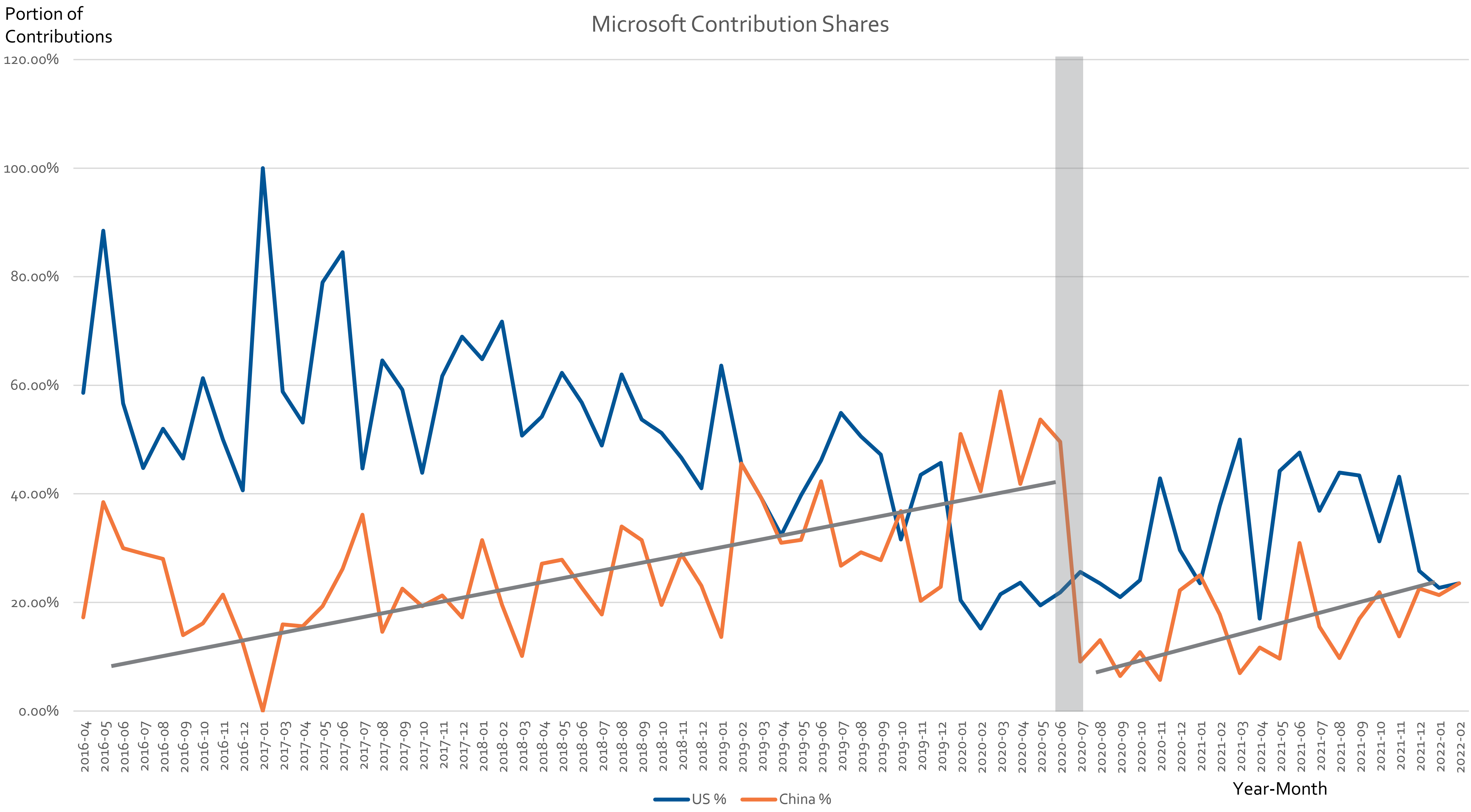
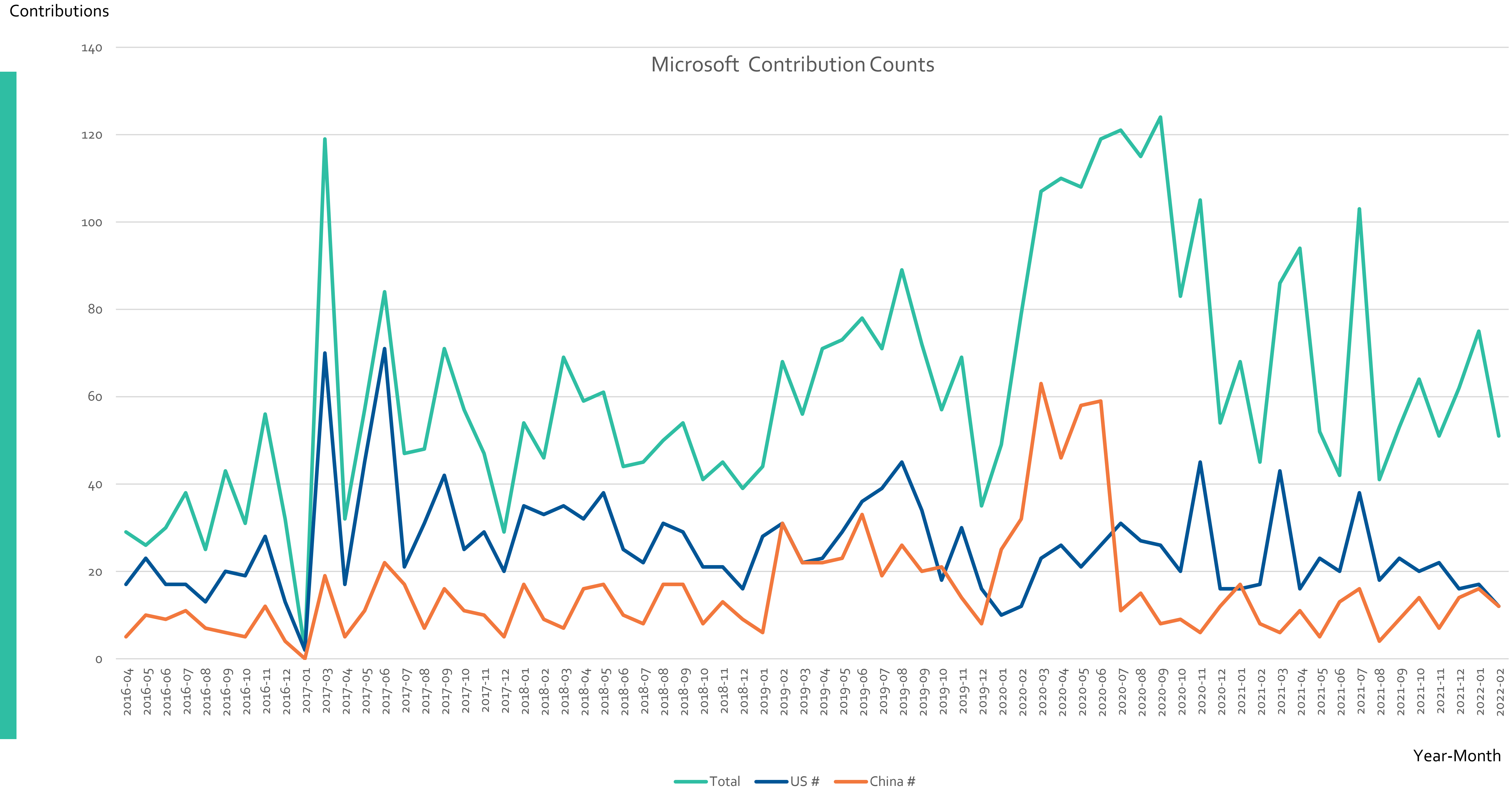


Microsoft Counts



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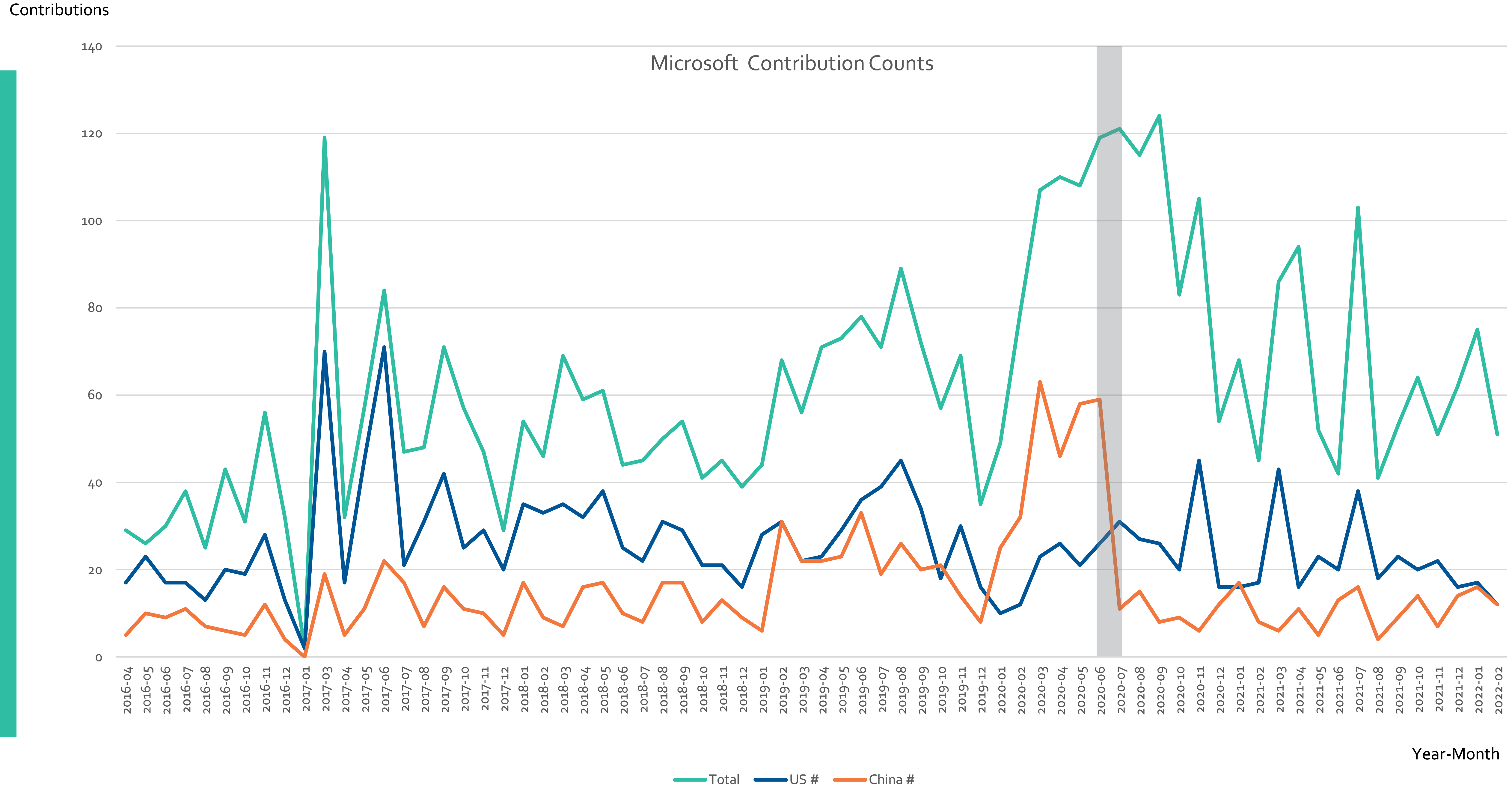

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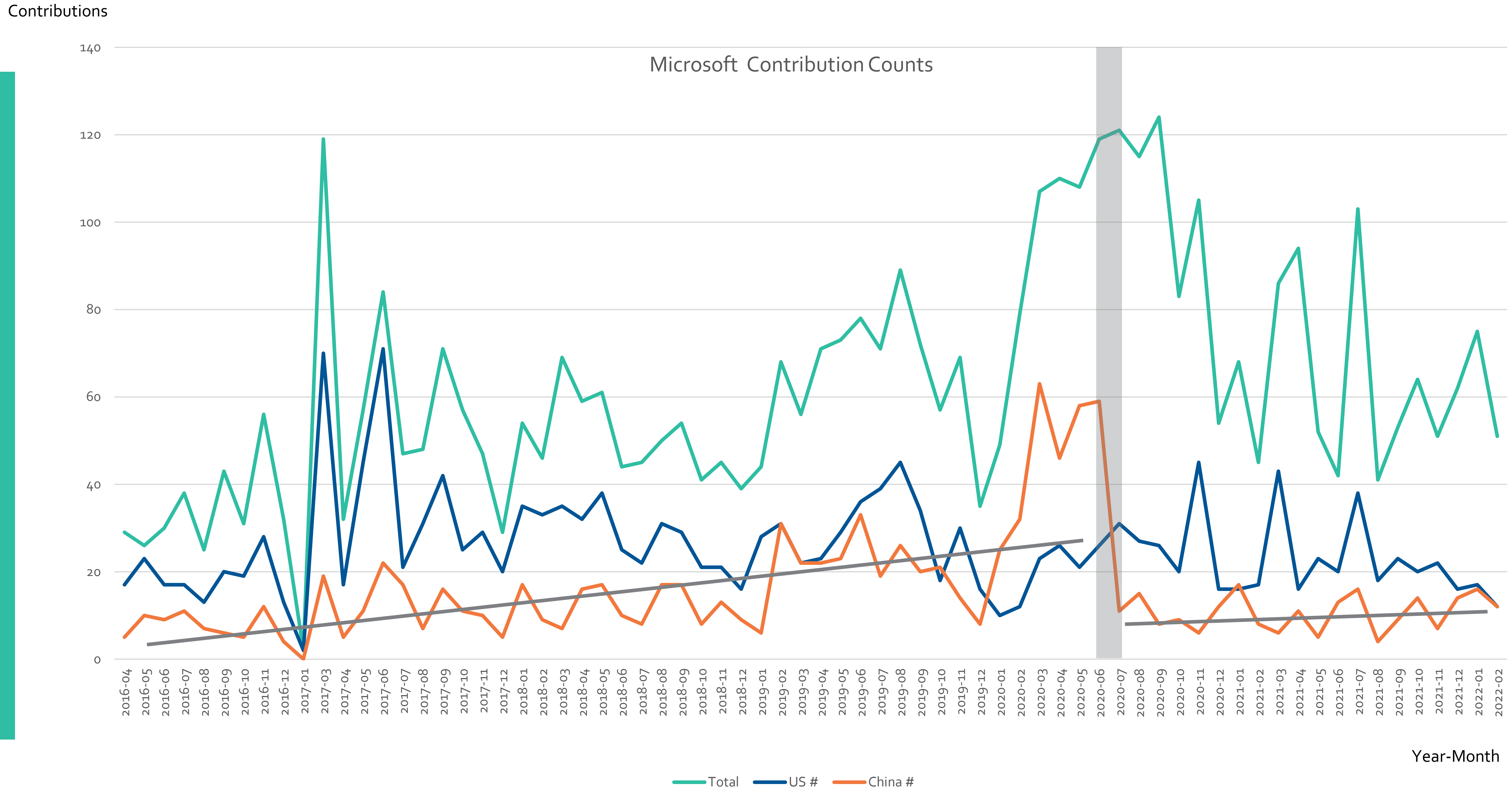
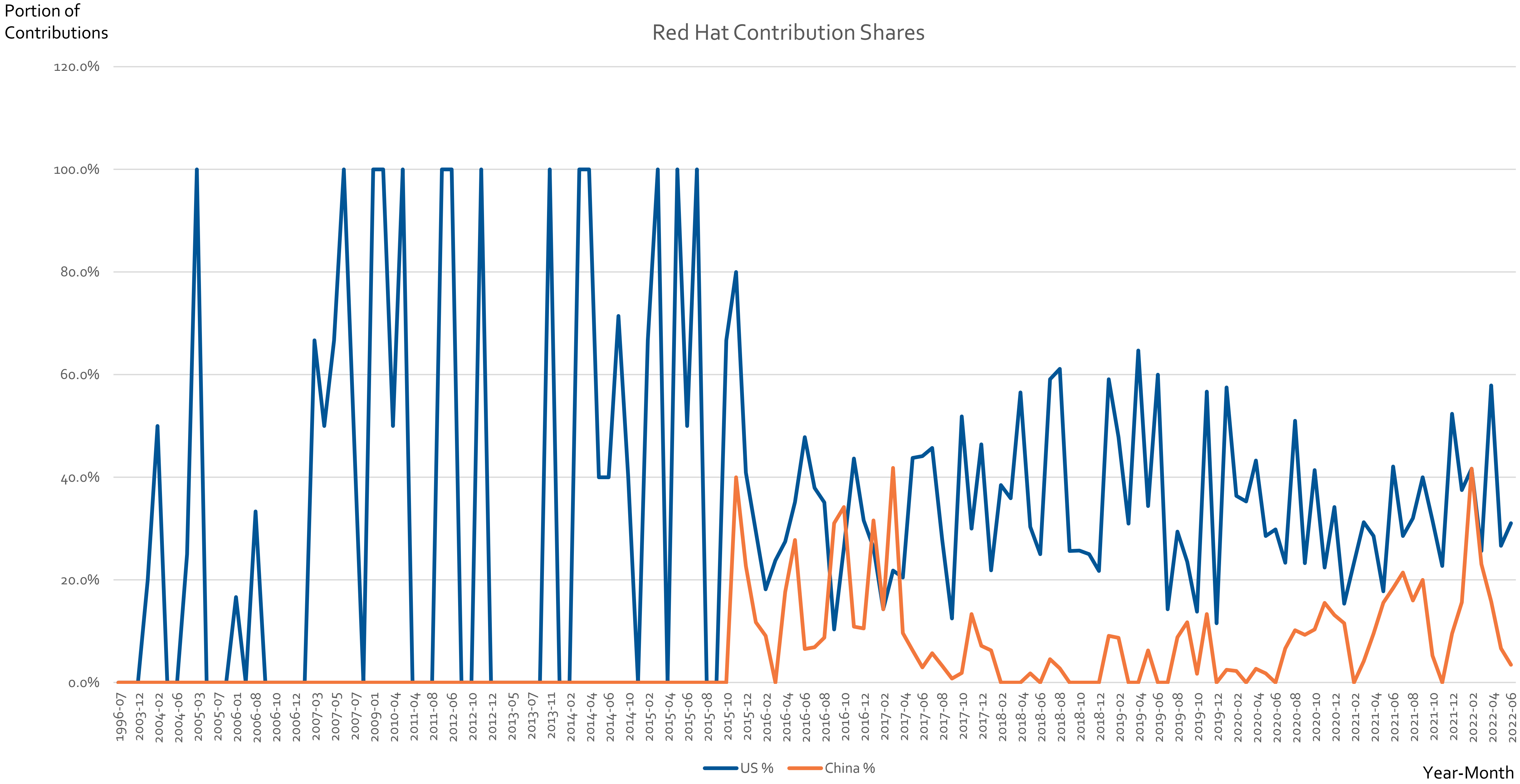


Red Hat Portions



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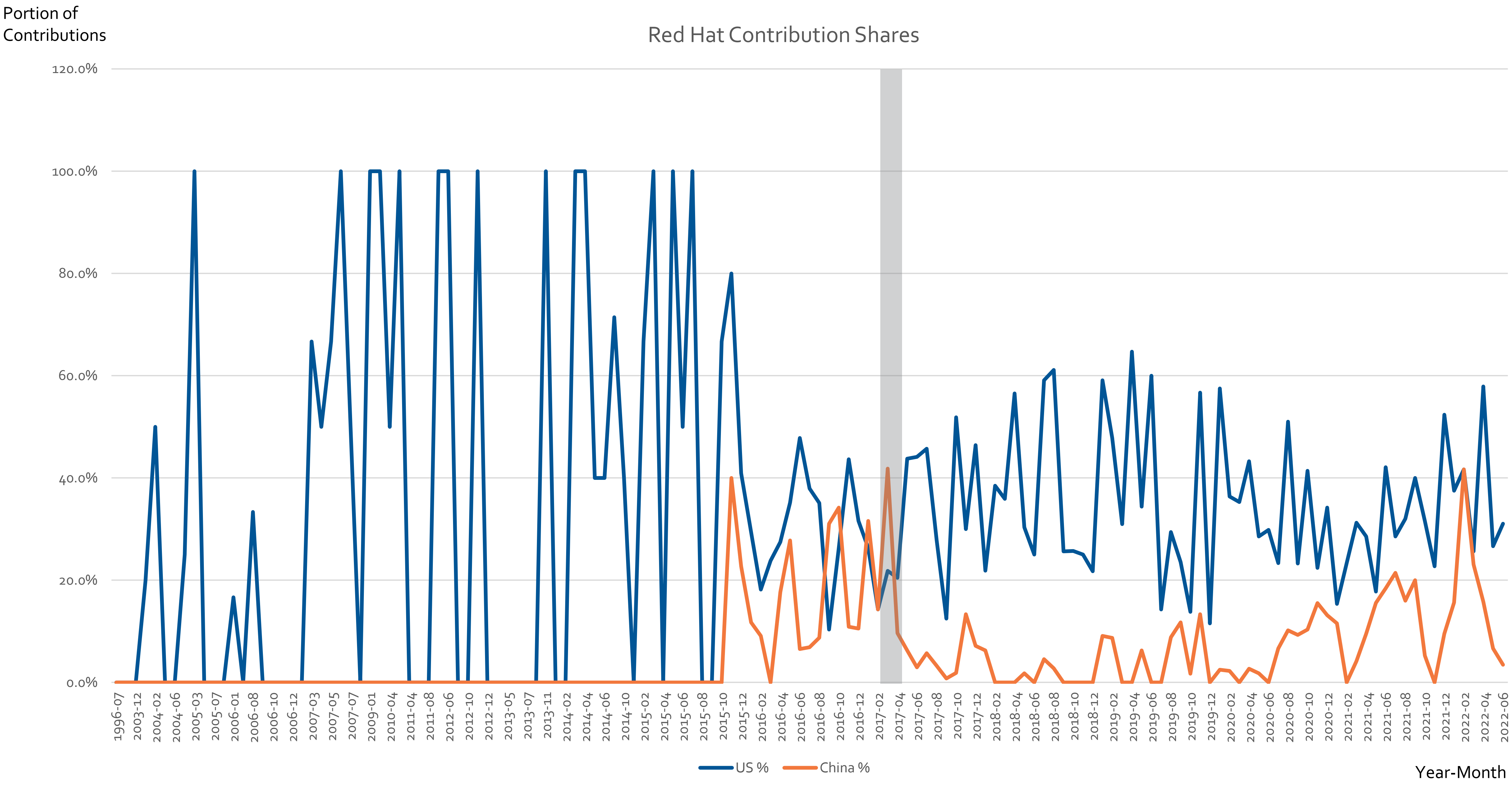

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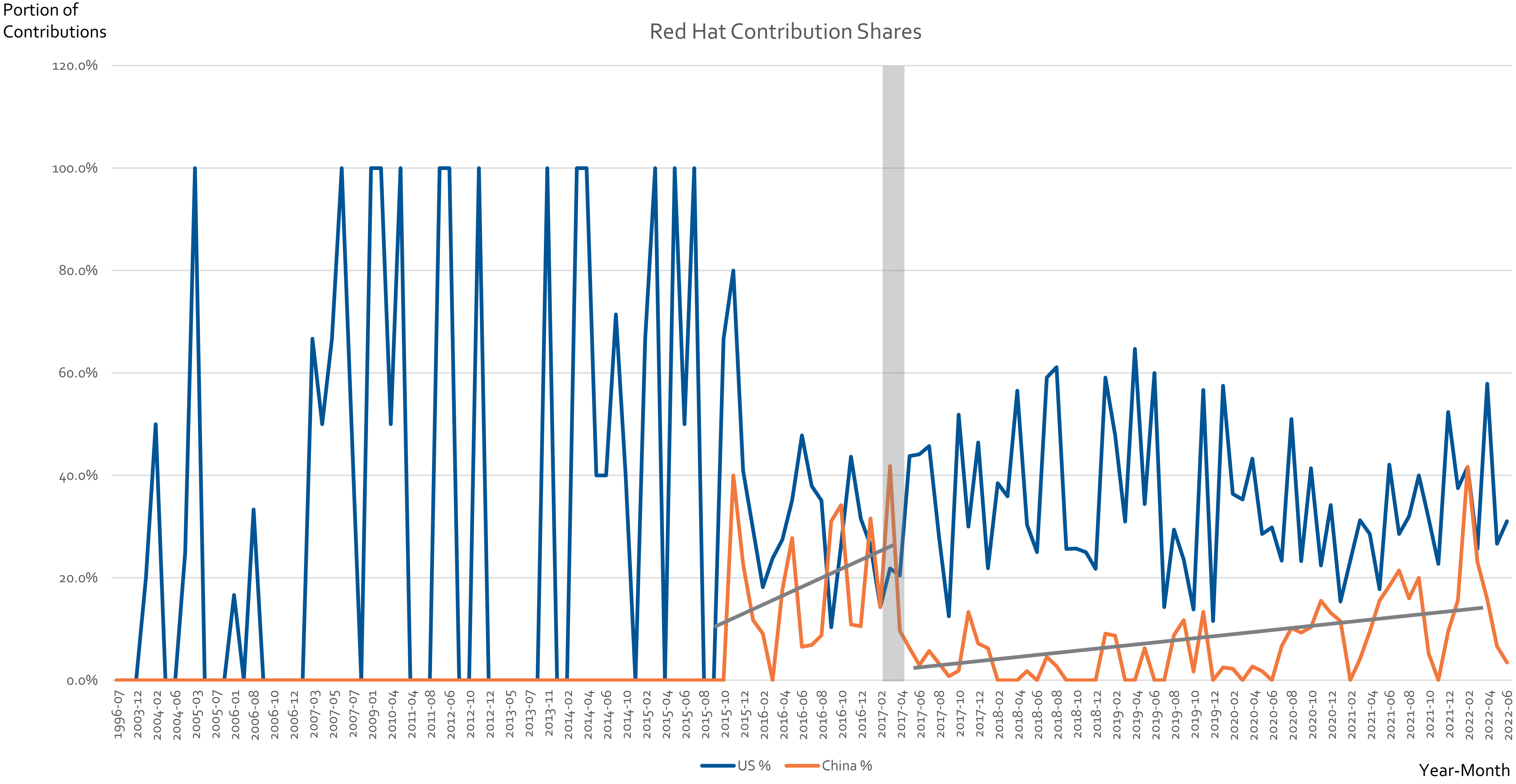

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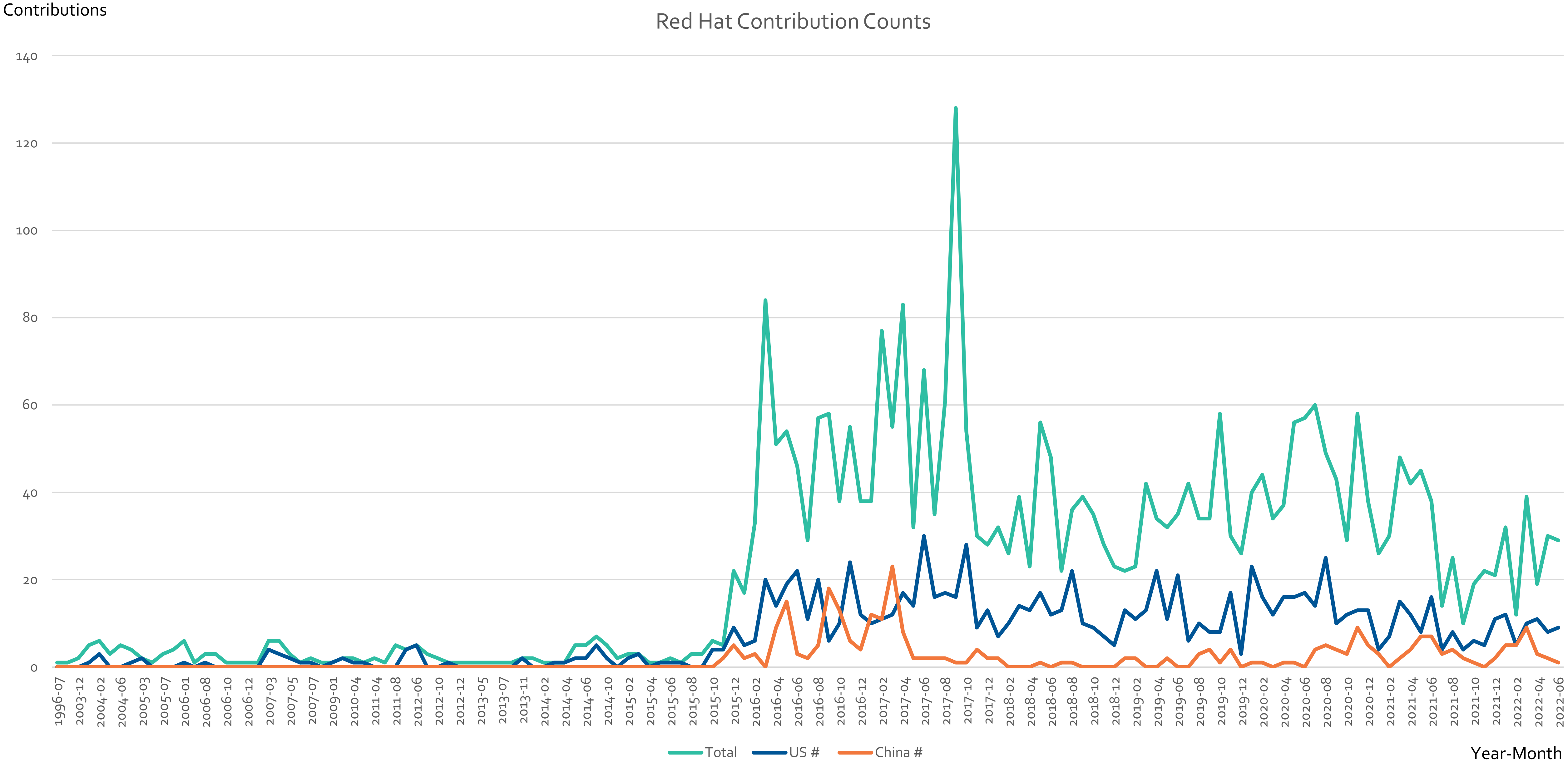

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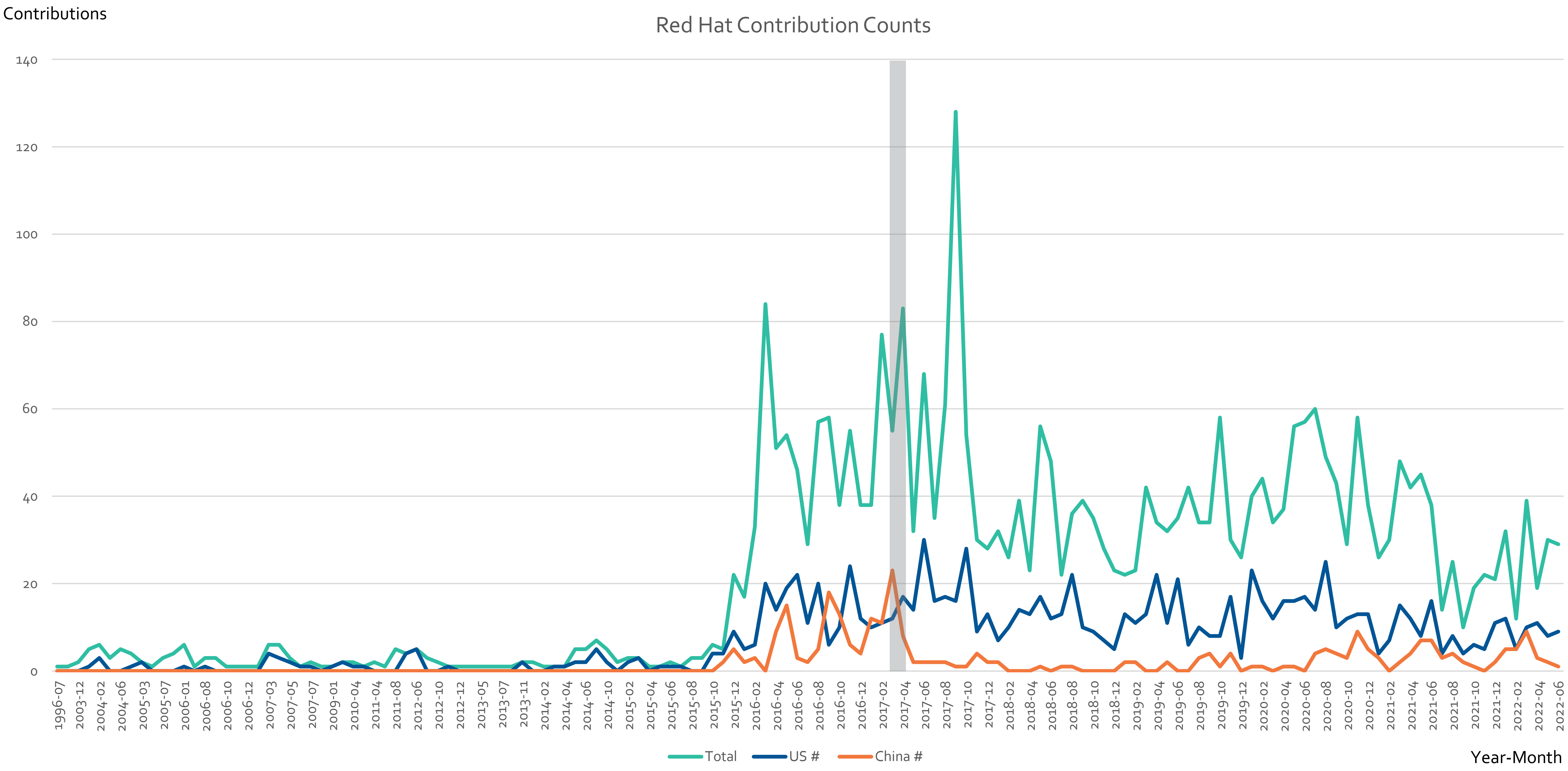

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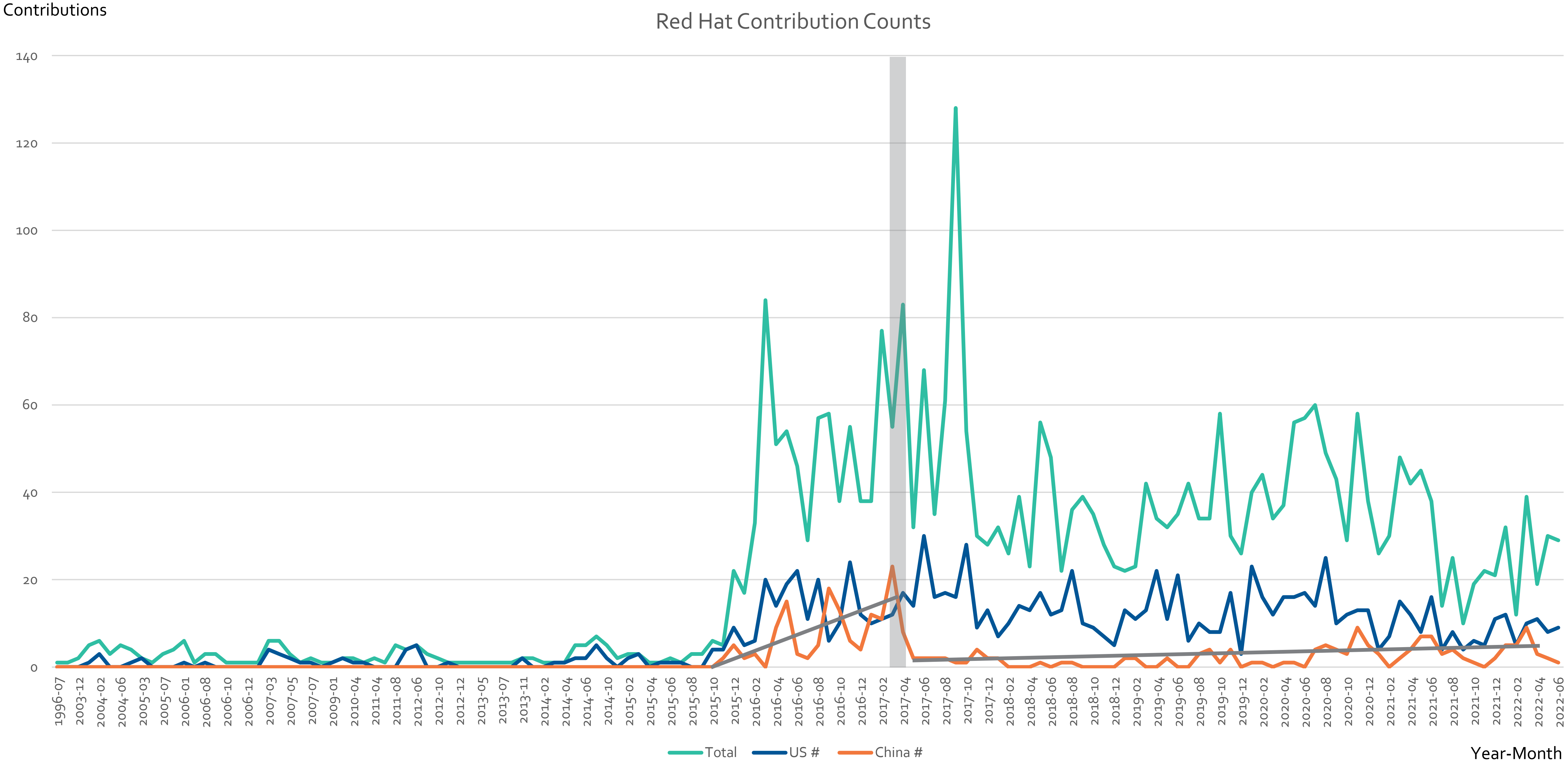
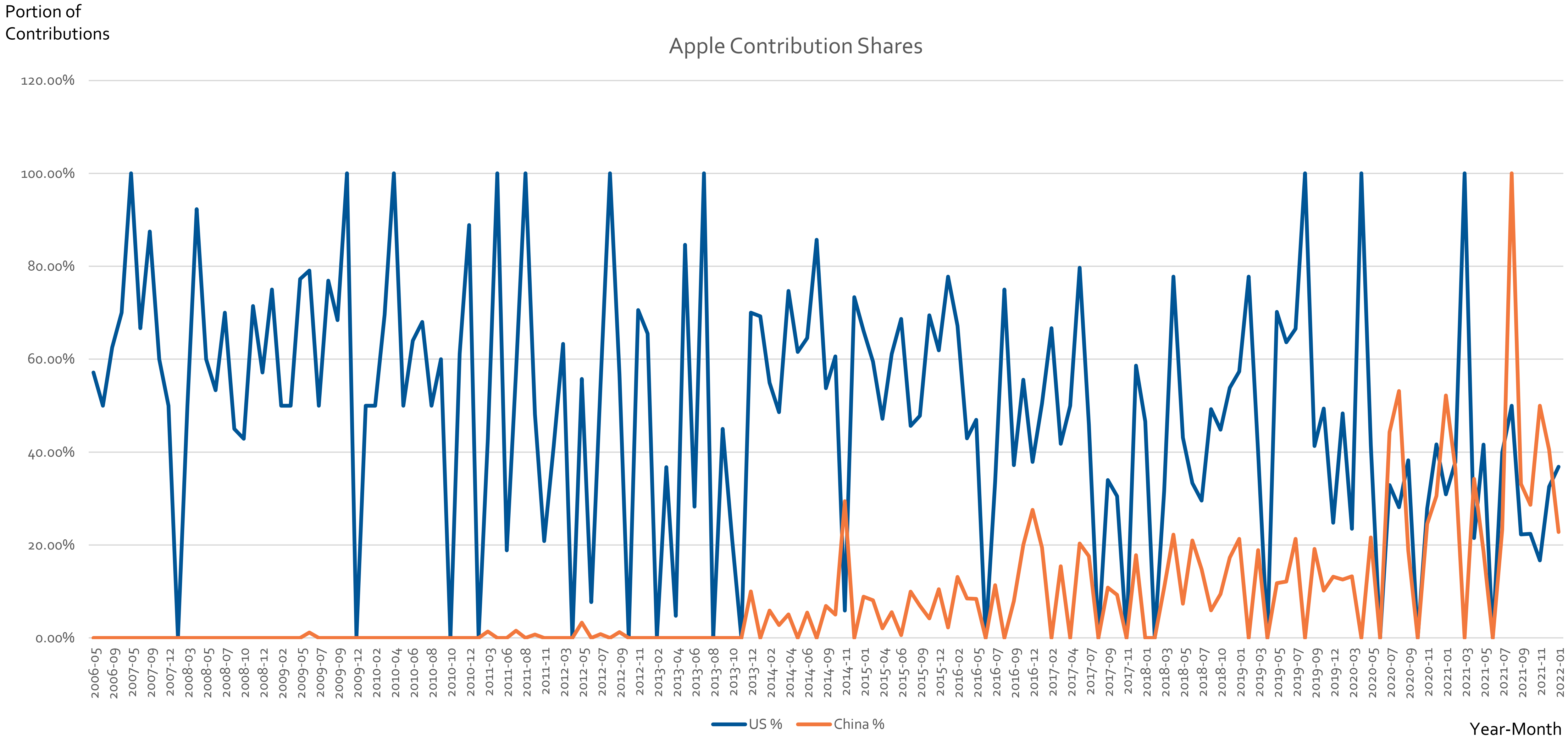


Apple Portions



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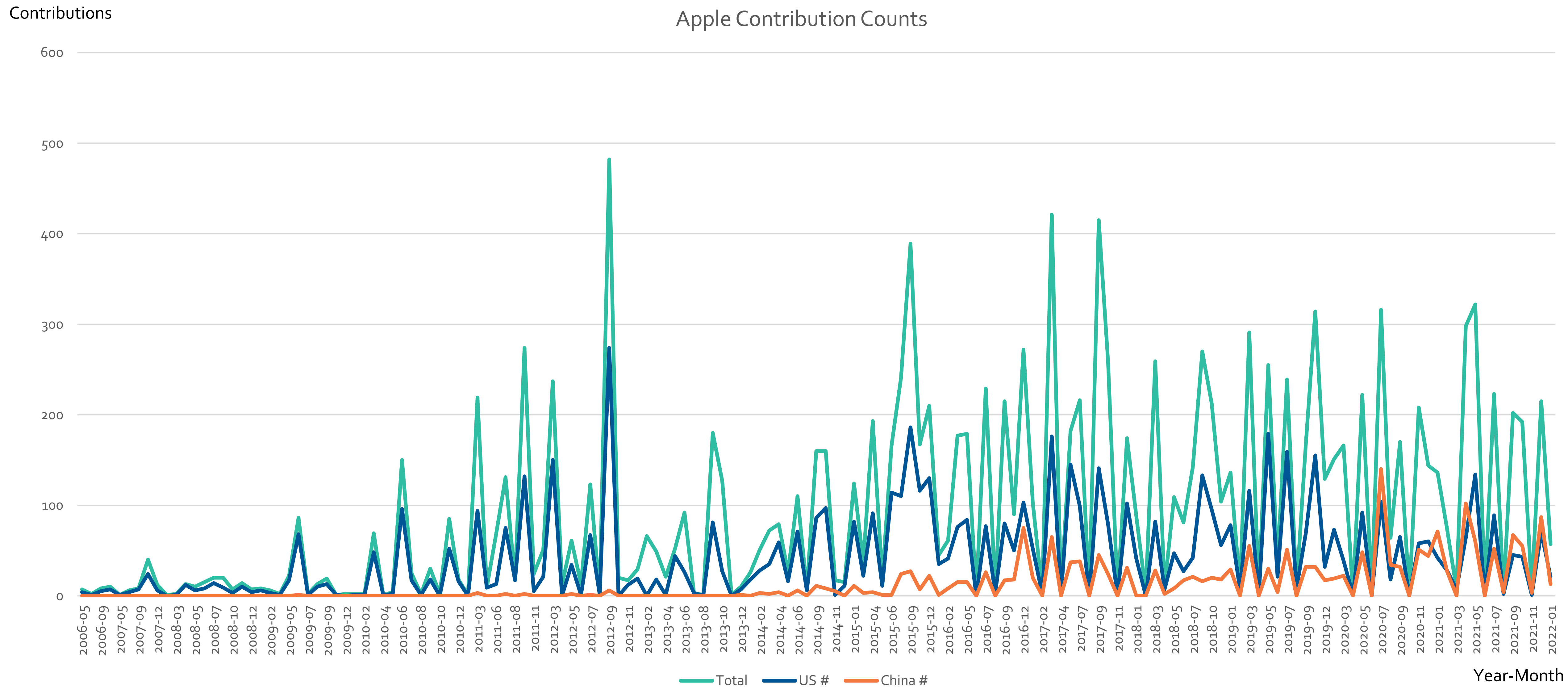

Takeaways

1. **No clear, universal supply shock from the RMSV in China**, though **maybe a local one** in the Microsoft data.
2. Something that looks like a supply shock happened in the Red Hat data but not at a time with a clear correlated event.
3. Contribution trends differ greatly among company, code, and product environments.
4. A supply shock in a specific legal context doesn't necessarily trickle into the whole ecosystem, though loss of growth is difficult to assess.
5. **Companies and government can better protect research communities and insure against shocks—can't assume their absence.**

Recs

Opportunity for a policymaking reset: **invest in research community to increase its resilience**

- **Clear protections in and processes for CVD and relevant laws**
- **Lower barriers to entry for researchers**
- **Emphasize process over provenance**

Better understand the ecosystem

- Better identify and protect **sources of security**
- Clearer communication of needs and priorities between policymakers and practitioners

Summary

- Consider vulnerability research as a source of security, a supply and a community to be invested in and protected.
- Is the research community vulnerable to supply shocks? Probably, but the mechanisms are still unclear, especially over long timeframes.
- There is some limited evidence for local supply shocks, though they did not seem to spread from one set of researcher entities to the larger ecosystem or even between code and product environments.
- There are ways to invest in the research community and build in resilience. Fragmenting it is also possible and would hurt overall security.

Thank you!