

# BEYOND EXPORT CONTROLS: PROTECTING AMERICAN INVESTMENT IN THE SOFTWARE AGE

## DeepSeek-R1 & v3

*In January of 2025, DeepSeek lab publicized their new large language model that matched or exceeded top closed models in math and reasoning. They accomplished this through:*

### Hardware Procurement:

Working around export restrictions through utilizing compliant GPUs to increase computing power.

### High-Perform. Computing:

Allreduce hybrid CPU-GPUs, pipeline parallelism overlapping GPU processes to increase speed, and interlinked GPU clusters.

### Software Optimization:

Using customized GPU kernels and careful dequantization strategies, they had the necessary memory and processing control.

### Distillation Pipelines:

Reinforced specialized models without having to individually train them, utilizing parent DeepSeek-RZero to extract knowledge, skill transfer, and verticalize model-weights and response preferences without human interference.

## Hardware Protections

Countries like China face strict license requirements and have limited access to exceedingly performing GPUs and AI Accelerators

## Software Protections

Bureau of Industry and Security offers red-flags and stopgaps to trigger permit requirements for militarized or shell-company activity

## Lagged Responses

Abrupt market changes cause these protections to fall short since policy cannot respond quick enough.

## POLICY IMPLICATIONS

*Evolving strategies employed by actors like DeepSeek reveal that America's existing export control regime is no longer sufficient.*

*Hardware constraints are being outmaneuvered through legally ambiguous procurement strategies, while software protections remain virtually nonexistent despite their growing centrality in model replication and capability transfer.*

*As AI development increasingly relies on software ingenuity and knowledge distillation, U.S. policy must broaden its scope beyond chips to address the full AI development stack.*

*Failing to act holistically risks allowing adversaries to match or exceed U.S. capabilities using the very tools American researchers pioneered.*

