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ECON 408 - Law and Economics of Intellectual Property Rights

Promising and Concerning Aspects of NVIDIA's Intellectual Property Governance

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## **I. Introduction**

NVIDIA Corporation (Nvidia) is a global manufacturer of commercial and consumer-grade graphics processing units (cards, GPUs). These GPUs are complex goods consisting of a vast constellation of open-source, patented, and secret innovations. Nvidia exists in an oligopoly market for GPUs (NVIDIA Corporation, 2025). Despite the oligopoly market, Nvidia has significant market power because of how they have governed their IP to differentiate themselves from their competitors. Three aspects of Nvidia's IP governance are analyzed: IP as it relates to hold-ups, complex IP allowing Nvidia to capture more benefit than a single IP protection strategy, and the potential hindrance of IP development by the global climate, most notably US national security concerns. The first two aspects analyzed are promising for Nvidia, and the third aspect presents concern, as well as a potential solution.

## **II. Nvidia's IP governance insulates them from hold-ups**

Nvidia, similarly to the majority of major tech companies, outsources the production of the chips for their graphics cards (NVIDIA Corporation, 2025). As described by Coase (1937), this boundary makes sense, as the immense cost of a purpose-built chip fabrication facility greatly outweighs the transaction costs in the market. While this method fits within traditional economic theory, it creates the risk that Nvidia could be held-up by their chip supplier (NVIDIA Corporation, 2025). A hold-up is when a supplier charges a marked up price because they know the customer is fully reliant on them (Holmström and Roberts, 1998). Nvidia is very reliant on their suppliers, especially due to there being a limited number of companies worldwide that can provide Nvidia with the quality and quantity of chips they need (NVIDIA Corporation, 2025). Nvidia insulates themselves from a hold-up by properly protecting their IP, a method described in Holmstrom and Roberts (1998). Nvidia's IP governance further solidifies their position in an

oligopoly market, making the chip suppliers just as reliant on Nvidia as Nvidia is on them. If the suppliers ruin their relationship with Nvidia by increasing prices, there are no other competitors that can give the supplier as much business as Nvidia.

An alternative look at Nvidia's IP as it relates to hold-ups reveals Nvidia's treatment of their customers. 34% of Nvidia's revenue in FY2025 resulted from sales to only three customers (NVIDIA Corporation, 2025). Nvidia's business model involves providing base cards to other manufacturers, who then customize the card to their liking. Because these companies have no valuable IP of their own, if Nvidia decides to not license their card, they give themselves a monopoly over their product.

These two perspectives fully illuminate the importance of the ownership of IP as insulation from hold-up problems. Because Nvidia does all of the research and owns the IP relating to their chips, the suppliers are reliant upon Nvidia for business. Furthermore, the third-party sellers that Nvidia distributes to demonstrate how the lack of ownership of IP leaves a company open to hold-ups.

### **III. Nvidia's products are comprised of multiple strands of IP, allowing them stronger protection and monopolistic profit than patents or trade secrets alone**

Nvidia relies upon a complex constellation of public domain (patented or open-source) and private domain (trade secret) technologies. Their cards are generally considered superior to competitors' cards because of the intersection of specialized software and hardware. Bessen (2020) describes a direct link between investment in proprietary software and industry concentration. The value of either part without the other is very little, if not zero. Thus, CUDA, the software that enables GPU acceleration on Nvidia cards, is free, but only runs on Nvidia cards. The card itself, including the design and manufacturing process, are kept as patents and

secrets. Under this framework, Nvidia's GPUs are classified as complex goods, as defined by Sim (2021). According to Sim (2021), Nvidia's development of a complex product enhances their monopoly on the market beyond the one afforded by patents or trade secrets alone. This is because the easily copied components are patented, giving them legal protection, while the harder to copy components are naturally protected secrets (Anton and Yao, 2004; Sim, 2021). This results in what Sim (2021) calls an over-reward for Nvidia: by spreading different parts of their GPUs out across multiple patents and trade secrets, Nvidia is rewarded more than they would be if they used only one method of IP protection.

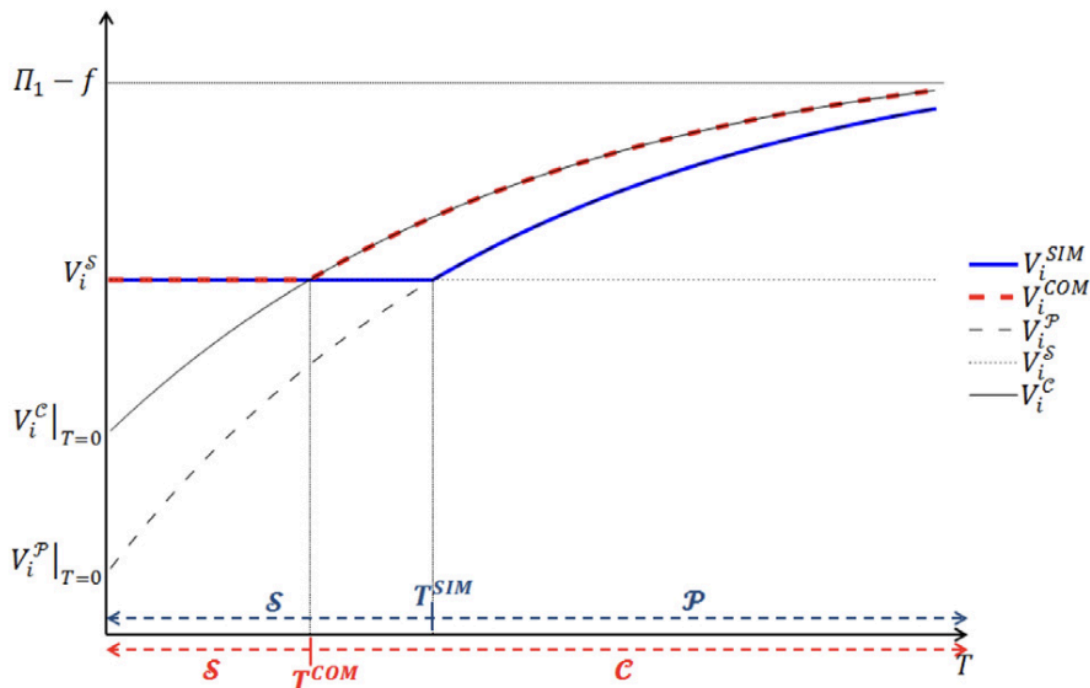


Figure 1: Firm Payoff vs. Patent Length for Simple and Complex Inventors (Sim, 2021)

Ottoz and Cugno argue in their 2011 paper that the over reward Nvidia experiences from their complex IP is socially beneficial, as it incentivizes them to undertake more R&D. Ottoz and Cugno (2011) also argue for strong trade secret protections, stating that strong trade secret

protections disincentivize reverse engineering. In essence, Nvidia's competitors could have access to every individual part of their GPU through open-source software and hardware patents, but they would not be able to crack the secret of how to put it all together before the technology is obsolete. Franzoni and Kaushik (2016) also argue for stronger trade secret protections, citing increased R&D investment incentive and less expense involved with IP protection as positive aspects of strong trade secrets. Franzoni and Kaushik (2016) especially argue for optimal trade secret protection being as strong as possible in markets where competition is weak, such as the market Nvidia is involved in. This is because, even if a competitor were to completely copy Nvidia's product, competition would still be weak and consumers would barely benefit (Franzoni and Kaushik, 2016). Overall, the complex IP strategy Nvidia implements actually increases social welfare by incentivizing Nvidia to undertake bigger, more costly R&D efforts because of the over-reward payoff, and disincentivizing competing firms from wasteful duplication because of strong trade secret protection (Ottoz and Cugno, 2011).

#### **IV. Nvidia's development of IP can be negatively influenced by the global climate, notably concerning national security**

NVIDIA Corporation (2025) identifies export restrictions on their products as a threat. While the US government's concern that in a time of war, high-powered GPUs could be weaponized is valid, the AI-driven research enabled by the hardware has significant spillover benefits. A recent study claims that AI can perform 6 months worth of R&D in just 12 hours (Mitchener et al., 2025). Cutting off a significant portion of the world's scientists from cutting-edge technology reduces the speed of research and development in critical fields.

The unilateral export ban on Nvidia's high-powered GPUs to certain countries reduces global competition (Bloom et al., 2019). This causes Nvidia to invest less in R&D, as the return

on the resulting innovations is less. This decrease would negatively affect a market in which R&D investment is already at a socially suboptimal rate (Bloom et al., 2013). Bloom et al. (2013) claim that this is because social spillover benefits are greater than private. This analysis implies that, if Nvidia invests even less in R&D, social welfare decreases. Thus, Nvidia should be working with the US government to find a solution that both increases the privately optimal rate of R&D, increasing social welfare, while still protecting national security interests. Increasing global trade is critical for promoting innovation without having to shell out money for R&D credits, according to Bloom et al. (2019).

One potential solution to this problem follows The Brussels Effect, introduced by Bradford (2020) and reviewed by Levin (2021). The Brussels Effect analyzes how the EU indirectly brought about worldwide compliance to their domestic laws through market forces by only allowing foreign companies to do business in the EU if they upheld said regulations (Bradford, 2020; Levin, 2021). In a similar manner, the US could globally enforce ethics regulations regarding the use of high-powered GPUs such as Nvidia's by cutting off business to a foreign company or country if those laws are broken. This effect works through traditional market power: access to state-of-the-art hardware generates too much welfare for any company or government to risk breaking the US' ethical standards. The only issue with this solution is that current legislation for the ethical use of high-powered computer hardware and technologies that it enables - most notably, AI - is not complete, despite the rapid recent proliferation of ethical guidelines (Fjeld et al., 2020). Thus, for this strategy to work, Nvidia would likely need to lobby for stronger policies regarding the ethical use of their products.

Overall, Nvidia needs to work with the US government to lift trade restrictions if they want to achieve a privately optimal level of R&D, and the US government should be interested

in increasing the privately optimal level of R&D to meet the socially optimal level, potentially following the solution discussed above.

## **V. Conclusion and Future Directions**

Overall, Nvidia's IP governance has solidified them as an industry leader, allowing them to operate as a monopoly in many scenarios, despite existing in an oligopoly market. To continue holding this position, Nvidia should continue to leverage their IP to insulate themselves from supplier hold-ups, and continue developing complex goods so that they can capture a larger reward than patents or trade secrets alone. Finally, the best way Nvidia can improve on their IP governance to achieve profit maximization is to work with the US government to find a way to loosen the export ban on their high-powered GPUs to certain countries.

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