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ASSESSING INTEL CORPORATION'S COMPETITIVE POSITION IN THE MICROPROCESSOR INDUSTRY: A COMPARATIVE ANALYSIS OF INTEL AGAINST NVIDIA AND AMD

Evaluación de la posición competitiva de Intel en la industria de microprocesadores: Un análisis comparativo de Intel frente Nvidia y AMD

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ABSTRACT

Fierce competition has arisen in the last years within the microprocessor industry. Companies like AMD, Qualcomm, MediaTek, Apple, and Taiwan Semiconductor Manufacturing Company Limited are some of the major global microprocessor suppliers. Intel Corporation, since its foundation back in 1968, remains one of the major players in the industry. Although there are challenges which include a high degree of competition in the industry as well as recent security breaches that have affected the business. Despite the challenging landscape lead by Nvidia and AMD popularity, Intel continues to hold a good portion of the marketplace, due to heavy investment in R&D in the last fifty years.

This paper analyzes Intel Corporation's competitive position, from multiple business advantages. This paper concludes that these elements give Intel a competitive edge despite the dramatic decline in profitability, Intel year over year sales declined 14% while EPS dropped from $1.94 in 2022 to 0.40 USD in 2023. The strategic initiatives and acquisitions undertaken by Intel such as Tower Semiconductor, Granulate as well as Moovit will be expected to spur future profitability along with increased operational efficiency.

Keywords: Corporate Strategy, Financial Performance, Market Analysis, Intel Corporation, Microchip Industry.
JEL: M15, O32

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RESUMEN

En los últimos años ha surgido una competencia feroz en la industria de los microprocesadores. Empresas como *AMD, Qualcomm, MediaTek, Apple, y Taiwan Semiconductor Manufacturing Company Limited* son algunos de los principales proveedores mundiales de microprocesadores. *Intel Corporation*, desde su fundación en 1968, sigue siendo uno de los principales actores de la industria. Aunque existen desafíos que incluyen un alto grado de competencia en la industria, así como recientes violaciones de seguridad que afectaron al negocio. A pesar del panorama desafiante liderado por la popularidad de *Nvidia* y *AMD*, Intel sigue manteniendo una buena parte del mercado, debido a la fuerte inversión en investigación y desarrollo en los últimos cincuenta años.

Este documento analiza la posición competitiva de *Intel Corporation*, a partir de múltiples ventajas comerciales. Este documento concluye que estos elementos le dan a Intel una ventaja competitiva a pesar de la dramática caída en la rentabilidad; las ventas interanuales de Intel cayeron 14%, mientras que las ganancias por acción cayeron de $1,94 en 2022 a $0,40 en 2023. Se espera que las iniciativas estratégicas y adquisiciones realizadas por Intel, como *Tower Semiconductor, Granulate y Moovit*, estimulen la rentabilidad futura junto con una mayor eficiencia operativa.

Palabras clave: estrategia corporativa, rendimiento financiero, análisis de mercado, Intel, industria de microchips.

JEL: M15, O32

I. Introduction

Intel Corporation was founded in 1968 by two important people in the technology realm of their age, Gordon E. Moore, and Robert Noyce. At present, Intel still holds a prime position in the technological field and ranks among the largest chip producers globally.

Aspray (1997) argues that the first commercial microchip was made in 1971 and was called Intel 4004, which made Intel remarkably successful in the beginning. This microchip was able to convert electrical impulses into computer signals for that time. After launching the Intel 4004, Intel did not rest on its laurels but kept on inventing and producing new microchips like 8086 and 8088 processors (Aspray, 1997). During this period, Intel formed strategic alliances with major business partners such as Microsoft, IBM, Dell Technologies, HP, and Lenovo, among others.

Ahead, each microchip industry's force is described. Followed by conclusions based on the Porter's analysis and finally some strategic recommendations are listed.

1. **Diversification and Expansion**

   Intel is not only a player in the microprocessor market but also operates in different markets, some of which are integrated graphics cards, chip sets, increased demand for sports cars with zero emissions, among others. Intel has a wide commercial reach since it operates in all this diverse market. The company's technology-based product offering has however been diversified. For a long time, microprocessor business has been an income earner for the company as it has increased tremendously since its inception in 1971 (Intel, 2024d). Today, you will find Intel processors doing tasks in various electronic devices like personal computers (PCs), laptops, mobile phones and many others.

   The major competitors of Intel are Advanced Micro Devices (AMD), Qualcomm and Apple, among others. Even though there are many companies competing with it such as integrated graphics processors which have gained increasing popularity over time; still, it remains one of major players on the market today. At present, this sector faces several challenges including growing acceptance rates towards competing chips produced by AMD as well as its recent purchases related to AI technology like Mobileye (acquired for $15 billion in 2017) or Habana Labs (purchased for $2 billion in 2019).[2] With recent acquisitions, Intel is trying to increase their ¿ investments in the artificial intelligence processor market, Intel is taking increased interest in this area.

2. **Market Presence**

   Intel is a public company on the NASDAQ stock market (National Association of Securities Dealers Automated Quotation) under the ticker INTC. Due to Intel's size, the company is part of the popular NASDQ-100 and Standard's and Poor 500 indexes.

   The company has been involved in strong media scandals. In recent years, certain vulnerabilities in Intel ARM processors have caused several comput-

[2] See Lunden (2017) for Mobileye and Karl Freund (2019) regarding Habana Labs acquisition.

er manufacturers to opt for in-house alternatives. Apple in the late 2010s specified that it would «betray» Intel technologies (Brewster, 2020).

Intel has been an innovative force in technology for over five decades. The firm has remained a leader in the global supply of microprocessors, despite numerous challenges and increased competition. Looking forward, it has expanded into artificial intelligence and self-driven cars. Despite some recent challenges and increased competition, Intel remains a major player within the global tech industry owing to its remarkable history and constant commitment towards innovation.

Ahead, a competitive analysis for Intel Corporation is presented. Using *Porter's Five Forces* Intel's competitive advantages and challenges will be described. First, the concepts that Porter (2008) proposes are listed. Second, how these concepts are applied to Intel are described. Third, some conclusions applying *Porter's Five Forces* are shown.

2. The power of buyers

According to *Porter's Five Forces* (Porter, 2008a), the power of buyers refers to the ability of customers to affect pricing, quality, or services. «Buyers are powerful if they have negotiating leverage relative to the industry participants» (Porter, 2008a). Some factors that could affect Intel's buyers' leverage are:

1. **Buyer Concentration and volume**: Intel has many buyers, ranging from individual consumers to large corporations. This large customer base can potentially increase the power of buyers, as a mass shift away from Intel products could significantly impact the company's revenue. However, the diversity of its buyers reduces the power of any single buyer. Intel's buyers are spread across different sectors such as personal computers, data centers, and Internet of Things (IoT) devices, offering products such as microprocessors for most manufacturers of computer systems, chipsets, network interface controllers, flash memory, graphics processing units (GPUs), field-programmable gate arrays (FPGAs), deep learning processors (AI accelerators), and other devices related to communications and computing (Intel, 2024a). This reduces the power of individual buyers to influence Intel's pricing or quality. However, Intel had three major buyers. As of 2023,

Dell accounted for about 19% of Intel's total revenues, Lenovo accounted for 11% of total revenues, and HP Inc. accounted for 10% of total revenues (Intel, 2024b). Additionally, the U.S. Department of Defense (DOD), is joining as a large new customer for Intel as of May 2024 (Intel, 2024c).

2. **Buyer's Information**: In today's digital age, information is more symmetric and available through the internet, including companies' websites, YouTube reviews, etc. Intel's customers (individuals, and large organizations), have access to detailed information about Intel's products and their competitors. This increases the power of buyers as they can make informed decisions and in the case of large businesses, have more power and negotiate better.
3. **Product Standardized or Undifferentiated**: Intel's products are differentiated, especially their high-end processors. This reduces the power of buyers as there are few direct substitutes that match Intel's offerings. Intel's continual investment in R&D also helps maintain this product's differentiation. However, there are substitutes available in the market, such as AMD, VIA Technologies, Silicon Integrated Systems, and Nvidia. The presence of substitutes increases the power of buyers as they can switch to other products if they are not satisfied with Intel's offer.
4. **Switching Costs**: Switching costs can be high, especially for businesses and data centers where changing processors can involve considerable time, resources, and potential disruption. This reduces the power of some buyers as it makes it more difficult for them to switch to a different product. However, for individuals who use intel products independently, their demand is more price sensitive. If Intel increases its prices, these buyers might switch to cheaper alternatives, giving them some power over Intel.
5. **Buyers Threatening to Integrate Backward**: The threat of buyers integrating backward and producing the products themselves is low in Intel's case for individuals and small businesses. The production of microprocessors requires significant expertise, resources, and investment in R&D. This is a barrier for most buyers, reducing their power. However, Intel also has large customers that could potentially start a process of backward integration as happened in 2021 when Apple shifted from Intel to its own M1 chips for better control over its production process (Apple, 2020).
6. **Intel's products have insignificant effect on buyers' other costs**: If the industry's product has insignificant effect on the buyer's other costs, this can

reduce the power of buyers. In Intel's case, their products (microprocessors, GPUs, motherboards, etc.) represent a significant part of the cost of a computer, they do not negatively affect other costs of a buyer, such as operating costs. They are perceived as high-quality products, and most customers believe they could save money overall by purchasing intel products.

7. **Intermediate Customers**: Intel has several Intermediate customers, primarily computer manufacturers, such as Dell, HP, and Lenovo; and partnerships with large companies like Microsoft. These powerful companies have some power as they can choose to switch to a different microprocessor manufacturer. To cite an example, during the 1990s, Intel's partnership with Microsoft was a strong alliance known as «Wintel» and became significant in shaping the PC industry (Tilley, 2017). Intel invested heavily in new microprocessor designs in the mid to late 1990s, fostering the rapid growth of the computer industry, and becoming a dominant supplier of PC microprocessors. Nowadays, its partnership with Microsoft allows Intel to be competitive in the market and hopes to regain its former position at the top of chip manufacturing (Castro, 2024).

3. The Threat of Potential Entrants

The threat of potential entrants, or new entries, refers to the possibility of new competitors that could affect the market share and jeopardize the position a company has (Porter, 2008b). High barrier entrance establishes a better setting for the current companies that are in this industry. In Intel's case, the threat of new entrants in the semiconductor industry is low, because of the high barriers to entry. However, the dynamic nature of this industry, which is characterized by rapid innovation and change, can create opportunities for new entrants, especially those that can focus on specific sectors of the market (niches). The following factors could lower or raise the threat of new entry:

1. **Changes in Technology and customers' needs:** The technology industry is characterized by rapid and continuous changes. These changes present both challenges and opportunities for Intel. Established companies like Intel are well-positioned to adapt to these changes due to their resources and R&D capabilities. However, a switch in technology and customer trends could give opportunities to new companies that are focused on a specific

feature or niche (e.g., AI, or quantum computing) or that they can adapt faster due to their smaller size. Intel must keep investing in research and ensure that it is up to date on recent technologies and customers' tendencies to prevent this threat.

2. **Patents:** Intel holds approximately 700 000 patent assets worldwide (Intel, 2024d), that protects its technological innovations and designs. This extensive intellectual property portfolio provides a competitive advantage and creates legal barriers for new entrants who would need to navigate around these patents or develop alternative technologies. The potential for patent disputes or the expensive development of innovative technologies can discourage new entrants due to the legal and financial risks associated.
3. **Required capital and economies of scale:** The semiconductor industry requires significant capital investment for manufacturing facilities, equipment, research, and development. This high capital requirement acts as a barrier to entry, reducing the threat of new entrants. Additionally, established companies like Intel benefit from economies of scale, which allows them to spread its fixed costs over a large volume of production, reducing the cost per unit as production volumes increase. Intel's large-scale operations and optimized manufacturing processes contribute to a significant cost advantage, allowing Intel to offer lower prices, or have higher margins compared to new entry companies, making it difficult for the new entrants to compete initially.
4. **Expertise:** Computer components' industry is highly technical, requiring extensive knowledge in materials science, chip design, manufacturing processes, etc. Intel is at the forefront of developing new semiconductor technologies, products, and solutions (Intel, 2024e); it has been a leader in the semiconductor industry for decades, and it has accumulated a vast amount of technological expertise and intellectual property. Intel's long-standing expertise in these areas is a major barrier for new entrants who lack similar experience. In addition, this industry demands specialized skills and talent. The new entrants would need to attract or develop a skilled workforce proficient in advanced semiconductor technologies, which can be challenging in the short run.
5. **Brand Recognition and loyalty:** Intel has strong brand recognition and a reputation for quality and reliability, being the third company with the highest customer loyalty in 2022 (Jackson, 2023). New entrants would need

to invest heavily in marketing to build a comparable brand, which might be a big barrier to entry. Additionally, Intel has built strong relationships and partnerships with its customers over the years. One of the most famous partnerships is the one established with Microsoft, which defined the PC era in the 1990s (Tilley, 2017). These kinds of partnerships could be extremely challenging for new entrants to overcome due to established contracts or better prices, due to economies of scale.

6. **Distribution Channels:** Companies like Intel have well-established distribution networks and relationships with key stakeholders, including Original Equipment Manufacturers (OEMs) and technology integrators (Intel, 2024f). New entrants would need to establish their own distribution channels, which can be challenging in the short run.
7. **Supplier Relationships:** Intel has over 10 000 suppliers worldwide (Intel, 2025g), having a strong power of negotiation due to the volume they order. This leverage allows Intel to establish ties and conditions with its suppliers, having lower prices, or exclusive supplier contracts. The new entry companies would have a disadvantage in dealing with suppliers until they become significant customers.
8. **Regulatory Requirements:** The semiconductor industry is subject to various regulatory requirements related to safety environmental impact, and more. The Semiconductor industry Association seeks to strengthen U.S. leadership of semiconductor manufacturing, design, and research by working with Congress, the Administration and other key industry stakeholders to encourage policies and regulations (Semiconductor Industry Association). Intel complies with the US regulations, allowing them to have a comparative advantage (Intel, 2024h). Additionally, Intel has export assurances from its business partners and customers that they will comply with the required laws and regulations as it applies to Intel products (Intel, 2024i). («Intel Export Compliance») Complying with these regulations, and the international trade policies and restrictions (such as export assurance controls on semiconductor technology) can be costly and extremely complex. These barriers can impact the new entrants' ability to access global markets.

4. The Power of Suppliers:

On the Power of Supplier as part of the competitive force that shapes strategy, Intel Corporation has a robust relationship with their suppliers through multiple programs and support avenue as well as giving awards to suppliers, examples of these awards are Supplier Continuous Quality Improvement (SCQI) Awards (Intel, 2024j), EPIC (Excellence, Partnership, Inclusion and Continuous Improvement) Supplier Program Award, which recognizes excellence exhibited by Intel's suppliers. The EPIC award is also divided into three categories, Outstanding, Distinguished and Valued (Intel, 2024k), awards which allow intel to accommodate rewarding more of their suppliers under these categories that are held yearly to reward Intel's suppliers that meet their expectations in the following areas such as Safety, Sustainability, Cost, Quality, Availability, Technology.

Analyzing the Supplier's power in Intel Corporation using the following external factors such as the number of suppliers, uniqueness, switching cost, forward integration, and industry importance. These factors will impact on the influence the suppliers will have on Intel.

1. **Number of Suppliers.**
   Intel works with over 10 000 suppliers worldwide to provide goods and services that meet their core values and ethical standards. These values include quality, customer first, diversity and inclusion, and fearless innovation. Intel also has elevated expectations for their suppliers in terms of environmental performance and transparency.

   Intel has developed their supply chain into Tier 1 and Tier 2

   The Tier 1 suppliers are companies that Intel directly purchases from, and Intel has over 9 000 of them (Intel, 2021a). Intel also identifies around four hundred of these suppliers as «critical» and collaborates with them directly through capability-building programs.

   The Tier 2 suppliers are companies that Intel's tier one suppliers directly purchase from. Intel works with critical tier two suppliers through programs on forced and bonded labor, responsible minerals, and supplier diversity. (Intel, 2021b)
2. **Intel Introducing Award to best Suppliers:**
   Intel is known to introduce award to suppliers in bit to appreciate the high flying suppliers that intel works with, even thou this is a good reward

mechanism from Intel to their suppliers, this in itself is taking away power of bargain from the suppliers as most of the suppliers will reduce their bargaining power to qualify for such reward and yield to some terms that majorly meets Intel expectation which can include cost reduction, volume, compliance with terms in their contract agreement.

3. **Uniqueness**
   Even though most of the raw materials being used by Intel are unique, the need for the semiconductors in the world with the host of other giant companies in the semiconductor industry has made more suppliers available, which allows Intel the opportunity to have various option to select from the pool of suppliers that provides similar raw materials. The uniqueness of suppliers to Intel corporation has been mutually developed between Intel and their suppliers, which is most beneficial to Intel with them expanding their option to over nine thousand suppliers worldwide which gives weak bargaining power to the suppliers. Intel diversity program also favors Intel more as they invest in multiple suppliers to ensure they have more access to diverse supplies, which can lead to weak power of bargaining for their suppliers.
4. **Switching Costs**
   The cost of switching suppliers is typically high for Intel due to the need for stringent quality control, compatibility with existing manufacturing processes, and the regulatory compliance required for new materials. Intel often signs long-term contracts with suppliers to ensure a stable supply of critical materials. While this provides security, it also locks both Intel and suppliers into relationships that can limit its flexibility, breaking even for both parties. Intel is an added advantage with their pool of thousands of suppliers that cut across their different raw materials in different countries around the world. Intel also has some in-house fabrication of some of their raw materials which gives them an edge to reduce bargaining power from supplier (McFarlane, 2024) which can save on their switching cost if a supplier tries to hold them ransom during negotiation.
5. **Forward Integration.**
   The forward integration of Intel suppliers is very unlikely as most suppliers cannot integrate into the core of what Intel is known for in production and services of the semiconductor industry. All suppliers of Intel are key players in their own industries, which is vastly different to the overall production of

what Intel is known for in the semiconductor world. An example is Siltronic company that provides Intel with silicon Wafers. They are a company that is produced by Silicon for other company and integration into semiconductor is not visible, they are also part of the beneficiary of the Intel SCQI award (Siltronic Press, 2013).

Intel as a Giant in the Semiconductor industry with their advanced technology, networking, and partnership with their buyer up to the governments will not be easy for suppliers to integrate into Intel industry. An example is Intel being a well-established force in their industry which pose a major challenge to supplier forward integration is the partnership with the United States government. In 2021, Intel was awarded a contract worth $53billion to develop microchip for the Department of Defense, also the US government recently consider partnership funding Intel with billions in future contracts (Hawkins, 2024). These are some of the factors that makes forward integration difficult for their Suppliers.

Intel power of diversity enables investment support to multiple suppliers under different groups across different races, region etc. which makes their industry's importance weak as there are multiple suppliers now in their industry. The diversity program allows diverse and multiple participation in the Supplier list where Intel can choose from (Intel, 2023).

On the power of bargaining, the power of suppliers of Intel is very weak due to the volume of order suppliers received from Intel, and the supply chain Intel has developed over the years having over 10 000 suppliers around the world gives an edge to Intel over their suppliers.

5. Intensity of Rivalry /Competition

Rivals for Intel come from many different places and even from different countries; because of the scope of Intel's business, they have several very capable competitors coming after any one of their lines of business at any given time. For example, they hold a 63.5% market share compared to AMD in the CPU for the personal laptop market (Intel). On the other hand, they face stiff competition from Samsung in the mobile phone and data-center markets. With a mix of custom-built equipment with CPUs and GPUs at their core, these data centers and high-performance government computer contracts can run hundreds of millions. Intel helped with the Aurora supercomputer based in Illinois. With the help of Cray (Hewlett-Packard, 2024),

building supercomputers is one way that Intel has expanded into high-performance computing, a national priority.

Nvidia and Samsung are both competent competitors; while worthy adversaries, they do not compete in the supercomputing CPU domain at the level of Intel. As Nvidia focuses on GPUs, Intel remains the king of CPUs. It is Unfortunate for the top brass at Intel that the ongoing AI movement relies on the parallel processing offered by top-tier GPUs, and the need for CPUs is less mission-critical. While Intel offers capable GPUs, they are not on par with their rivals Nvidia's top-of-the-line A100 hopper units and soon-to-be-released B200 GPUs. (Nvidia, 2024) Intel's Headquarters is only a 3-minute drive from Nvidia; it could be very reasonable to assume many engineers have considered a career change or even worked at both; this opens the door for potential information dismantling across the Bay Area. On top of this, the market has recently given Nivida a three trillion-dollar valuation, so it is reasonable for them to eye their neighbor and look to expand into Intel's markets.

The intensity of Rivalry can help keep firms more honest. The ebb and flow of the markets as tastes change and technologies change can make new avenues open and shutter once profitable business. Intel Corporation, headquartered in Santa Clara, California, is a behemoth that has pivoted with that market, lobbied hard with the government, and worked to stay globally competitive even as the total share of US chip manufacturing has weakened. They face and are at the center of a global arms race for dominance in the chip industry and the Biden Administration's efforts to reshore. A good portion of the dynamics around semiconductors that Intel, a leading designer of chips, is at the center of. In tandem with ASML, a Dutch firm that builds the world's best lithography devices, and Taiwan Semiconductor Manufacturing Company Limited (TSMC), the world's premier chip fabricator, Intel is a mammoth player that consistently ranks in the top 500 US companies by revenue. The semiconductor industry and supply chains are indeed global; there were many cracks in the supply line, and Intel, along with the US Military, does not want their business to be cut off by another theoretical shutdown. It could be COVID lockdowns, sanctions, or even war; either way, with the effort to restore Intel, it is looking to develop redundancies into its supply chain to fabricate many more chips at home.

Not every country abides by US laws or even believes in a free market economy. When faced with these state-backed firms, it could be good to imagine the capabilities of any United States-based firm with a blank check from the Pentagon

baking it. These are the realities of computing against newer and more hungry Chinese competitors. When building world-beating firms, as Intel has, they need to compete against every entering the world. These incentives them to build high barriers, huge cost barriers, and a talent gap filled in part by their ability to import incredibly talented people who wish to relocate to the United States. By competing with firms that have state-backed help, openly or covertly, and have access to espionage or, at cost, access to state-directed banks, Intel must navigate a tricky global environment (CSIS, 2024).

These world-beating firms are in constant struggle to take market share from each other and carve out as much as possible in the trillion-dollar chip industry. These chips, highlighted by the COVID restrictions and breakdown in supply lines, are why Intel was granted twenty billion federal dollars to build US domestic Chip fabrication plants. The act of fabrication is the actual creation and final step in the process of a semiconductor. Intel holds much of the IP and works closely with global Foundries, chief among them TSMC, to build these advanced chips. As the security of the fabrication has been encroached on by a prominent foreign geo-political rival Intel and the US have moved to shore up their most vulnerable areas (JP Morgan, 2022).

Additionally, Intel faces stiff competition in the chips used in data centers. They hold a legacy position in many data centers; however, the demand for highly efficient and energy-efficient data centers due to the large energy requirements can strain the local grid. With ARM architecture working to reduce the energy consumption of these data centers, their partnership with Nvidia poses a credible threat to Intel's business. As data centers become increasingly critical, Intel is in a good spot. It is merely that new and initiative-taking competitors are working to take some of their market share. Intel is a large corporation with deep political ties; they lobby hard and push the envelope on innovation in the CPU business. The world's premier business in CPUs. Intel have such a significant and well-recognized brand that they have moved into many adjacent businesses as other entrants rise to challenge them.

6. Risks of Complementary Goods and Geo-political context

Twenty years following the initial introduction of Porter's Five Forces Model, the model was amended in the 1990s to specifically address a competitive factor in the rapidly growing technology industry around the same time as the start to

the Dot Com Bubble (Kenton, 2023). This added force to Porter's model is the risk of complementary products. Complementary products are commonly known as products used in conjunction with another good or service.[3]

A simple example of how risk can be associated with complementary goods would be if the demand for coffee fell due to a price increase resulting in the demand for coffee cups falling as well. This example assumes that coffee and coffee cups are complementary products and that demand for coffee is elastic. Given the Six Forces Model was specifically created to address the ever changing, innovative technology industry which leads to increasingly complementary products, some elements from the Six Forces Model can enrich the *Porter's Five Forces Model*, when analyzing Intel.

Intel is among the world's leading semiconductor manufacturers and considered the creator of the first commercially sold semiconductor which naturally positions the company to offer a wide array of complementary goods that can be sold when considering the suite of products that complement the semiconductor chip such as CPUs, GPUs, peripherals, as well as other hardware and software. As mentioned above, throughout the company's history, beginning with helping to create the initial semiconductor design, Intel has developed more and more products to complement its core business of manufacturing semiconductors while many other companies in the broader semiconductor industry have chosen to focus on more niche roles in the semiconductor supply chain such as Kokusai Electric in Japan, Taiwan Semiconductor in Taiwan, and Qualcomm in the U.S., to name a few. This decision by Intel, while capital intensive, has resulted in Intel continuously being one of the largest and most influential companies in the world. This is one such testament to the power of offering a broad range of complementary goods in a company's industry and how this can positively impact demand.

Turning to the core business and the complementary products that Intel offers its clients, the core vertical is referred to as the Client Computing Group which produces semiconductors as well as closely related complementary goods that are broadly referred to as PC processors. This core business vertical was responsible for 51.8% of Intel's 2020 revenues according to the company's 2020 10-K

[3] For example, Apple provides a variety of complementary goods such as iPhones, iPads, Apple Watches, MacBooks. The main characteristic is that these products add an increased value to the user if used together.

filing.[4] Further away from this in scope, however still closely related and complementary is the Data Center Group which produces hardware components and was responsible for 33.7% of Intel's 2020 revenues according to the same source. The remaining two verticals of Intel are the Internet of Things Group (IoT) and Programmable Solutions Group which make up 5.2% and 2.4% of the company's 2020 revenues, detailed by the U.S Securities Exchange Commission (2024) 10-K filling. All these products offer complementary solutions to their clients such as Dell and Microsoft. Additionally, Intel recently spun off its autonomous vehicle business called Mobileye, via an Initial Public Offering (IPO). Recent years have shown AMD and NVIDIA rise in prominence through their ability to innovate and offer similarly competitive goods and services. All these goods are complementary to each other and have helped to position Intel as a giant in space.

Looking at Intel's market share and competitive landscape, while Intel created the first commercially sold semiconductor in the 1970s, the company did not achieve the market dominance that positioned it as the leading chip producer it is today until the 1990s. In fact, in 1987, the New York Times noted that Intel was the 10th largest seller of semiconductors, while today, Intel controls 70% of the PC processor market placing it as the top of the industry (New York Times, 1992). During this period, Intel developed a strategy for addressing the risks associated with complementary goods, specifically looking at AMD as its closest competitor, which was and still offers both substitute and complementary products. The massively strong profit-generating strategy was to form a partnership with Windows that was colloquially referred to as «Wintel» which allowed Intel to offer its products in every Windows operating system; thus, positioning Intel products to be sold to most of the PC market. Notably, Porter's Five Forces Model has been criticized for not addressing partnerships and alliances, however it is common knowledge that a partnership strategy can be a key factor in addressing risks of complementary goods as seen in the widespread success that Intel achieved through this alliance with Windows. This partnership was instrumental in shaping the PC industry as well as positioning Intel as the World's leading chip producer for PCs. Today, AMD and NVIDIA continue to challenge Intel's industry dominance with ever-growing promises. The risks of complementary goods here

[4] 10-K filling is publicly available information online. In the US is referred as the company's tax filling that can be reviewed at any given publicly traded company in the US. See U.S. Securities Exchange commission (2024).

are that while AMD might be able to offer some products in this space at a phenomenally successful rate, Windows operating systems offer Intel despite what AMD might do.

Recent industry headlines and stock performance have focused on technological landscape shifts with NVIDIA overtaking Intel in the space considering optimism surrounding the growth of AI. This has positioned NVIDIA as the world's largest publicly traded company by market cap. Many research analysts have cited NVIDIA's massive growth as a growing threat to Intel's market dominance. When looking at the risks of offering complementary goods, it is conceivable that AI along with IoT may allow NVIDIA to achieve greater market dominance than Intel through NVIDIA's ability to offer AI products as a complementary good to its core semiconductor business. This perfectly embodies why the six force was added to Porter's original model showing how emerging technological innovations can dramatically alter an industry with a specific regard to complementary goods.

7. Threat of Disruptive Technology, the AI battle.

Intel has not faced as disruptive technology as AI since they switched from D-ram being driven out of the market by the newer competitive Japanese firms in the 1980s. They are missing the biggest boom in their industry even though they offer a competitive line of GPU's. Intel's ARC Pro 40A does not advertise AI for their GPUs other than «edge» use cases that only require weaker, as in less capable GPUs.

Nvidia is an incredible contender in the GPU race, however, and as the price for GPUs stays high, it provides ample incentive for others, including Intel, to join this market. The high price of Nvidia GPUs will make them consider switching to Intel's new Gaudi 3 GPUs. In a CNBC report, Intel is claiming they offer a significant speed up compared to Nvidia H100 chips (Leswing, 2024). These chips would be considered second gen at this point as Nvidia moves to develop and ship their B100 and B200 chips. The high resale price of these chips, along with the ongoing development of AI that looks to be here to stay, implies that by offering a slightly lower-priced alternative to Nvidia, Intel can erode the lead and work to make a large scope in the competitive lucrative GPU market.

Intel is a truly innovative firm and with a supportive administration, giving Intel about twenty billion US dollars, to help reshore factories to reduce the Unites States of America's dependency on Taiwan. While Intel has become synonymous

with CPUs, the boom is in the GPU market. The reason Intel will get about twenty billion in U.S. government funds and place their fabrication plant in a swing state is because of the geopolitical importance of their products. (Mason, 2024)

As geopolitical relations deteriorate with China, the United States is working hard to reduce its reliance on TSMC, the semiconductor manufacturer located in Taiwan. With Intel moving into fabrication, more capable GPUs, and getting money from the government, it is difficult to see why their stock is trading flat until they miss their earnings. (Fitch, 2024) Falling 26%, bringing their market cap below one hundred billion and laying off 15% of their workforce.[5]

According to Tarasov (2022b), Nvidia's market valuation stands at three trillion dollars, while Intel receives twenty billion dollars in government support. For some, receiving priority support from the U.S. government can be perceived as protectionists.

Another potentially disruptive technology to Intel would be the advent of Quantum computers, which were brought on by large potential rivals IBM and Google. (TU Delft Research Portal, 2024). Fortunately, for the company, Intel already has a quantum department, and they leverage on the cumulative knowledge they built over decades of experience in the semiconductor industry to help them gain ground on some of the larger, more experienced competitors in this industry.

Intel is a truly innovative firm, being backed up by the U.S. government, Intel could receive about 20 billion US dollars to help restore factories to reduce dependency on Taiwan. They have an advantage over most foreign competitors. There are, however, a few large and well-run organizations that do pose some credible challenges to Intel's Dominance. For one, Nvidia is currently the darling of Wall Street, with a valuation comparable of India, the United Kingdom or France annual Gross Domestic Product. Nvidia specializes in GPUs, while Intel has become synonymous with CPUs. The boom in Nvidia and not for Intel is that Intel has seeded its leadership to Nivida in the GPU department.

8. Conclusions

Using Michael Porter's Five competitive forces that shape strategy to analyze Intel Corporation, reveals that the bargaining power of buyers or customers, bargaining

[5] See Kharpal (2024) and Leswing (2024)

power of suppliers and threat of substitutes or substitution are all considered as weak force, while the threat of new entrants and competitive rivalry or competition are at a moderate force. Table 1 describes a summary of the industry forces and how Intel's position in this industry.

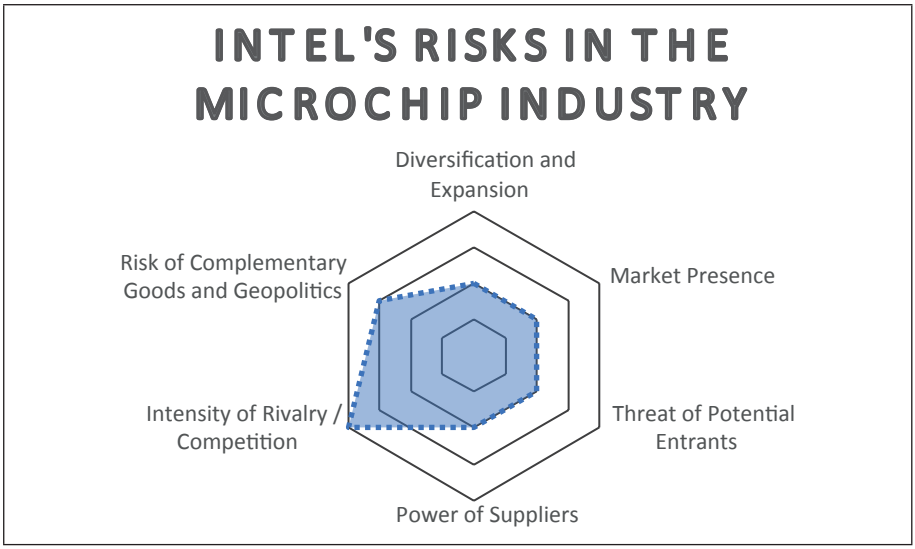
Table 1. Summary of Porter Force analysis on the microchip industry.

Porter Force	Microchip industry	Intel's risk in this industry	Intel advantages and disadvantages in the industry
Diversification and Expansion	Strong	Low	Intel has expanded beyond its traditional PC market into AI, autonomous vehicles, data centers, and high-performance computing. Strategic acquisitions (e.g., Habana Labs, Mobileye, Altera) support this diversification.
Market Presence	Strong	Low	Intel has a global footprint with subsidiaries in Israel, Ireland, Costa Rica, and Malaysia. Brand strength and wide international operations support competitive positioning.
Threat of Potential Entrants	Low	Moderate	Barriers to entry are high due to technological complexity, R&D investment, and patent protection (over 700 000 IP assets). Vertical integration and hardware/software ecosystems also deter new players.
Power of Suppliers	Strong	Low	Intel owns most of its production infrastructure and has invested in U.S. manufacturing (e.g., Ohio fab), minimizing dependency on third-party suppliers.
Intensity of Rivalry and Competition	Strong	High	Strong rivalry with AMD (CPU), Nvidia (AI/GPU), Qualcomm (mobility), and Apple (in-house chip design). Intel is losing ground in several segments, particularly AI and mobile.
Risk of Complementary Goods and Geopolitics	Moderate	High	Apple moved away from Intel's architecture. The U.S.–China chip war and the CHIPS Act affect Intel's global operations. Intel has secured U.S. government funding to support domestic resilience.

These external factors, being weak to moderate force, give Intel a competitive advantage to be on the right track. Even though in 2023, Intel experienced a significant decline in profitability, with annual revenue decreasing to approximately $54.23 billion, a 14% drop from year 2022. The company's earnings per share (EPS) also fell drastically from $1.94 in 2022 to $0.40 in 2023 (Stockanalysis, 2024).

The profitability of Intel Corporation is expected to recover in the coming years as their revenue is projected to increase by 4.96% to $56.92 billion in 2024 and by another 12.25% to $63.89 billion in 2025. The EPS is also anticipated to grow by mayor analysts (See: Stockanalysis (2024) and Google Finance (2024)), with forecasts of $1.12 in 2024 and $1.99 in 2025 (Intel Press, 2024a, 2024b)

Figure 1. Potential risks Intel is facing given the current microchip industry. The figure shows that Intel is facing severe competition and high risk of companies who manufacture complementary goods.



Intel's strategic initiatives, including its transition to an internal foundry model and investments in advanced semiconductor technologies are expected to drive future profitability with recent acquisitions of the following:

- **Tower Semiconductor:** In a deal valued at approximately $5.4 billion, Intel agreed to acquire Tower Semiconductor (Intel Press, 2024b). This acquisi-

tion is expected to enhance Intel's foundry business by integrating Tower's expertise in analog semiconductor solutions, which is anticipated to drive profitability and operational efficiency upon completion.

- **Granulate**: Intel recently acquired Granulate for $650 million dollars, a provider of real-time continuous optimization software, to enhance its capabilities in AI and data center optimization (Tracxn, 2024). This move aligns with Intel's focus on AI and performance improvement across its product lines.
- **Moovit:** Acquired for $900 million, Moovit is a mobility-as-a-service (MaaS) solutions company. This acquisition is part of Intel's strategy to expand its presence in the autonomous vehicle and smart city sectors through its subsidiary Mobileye (Tracxn, 2024).

9. Future of Intel Corporation

As a key player in the semiconductor industry, the future of Intel is extraordinarily strong with no forecast for a future merger or acquisition by any of their competitors, or other industries as they've partner with other key players in other industries such as Microsoft, the US government, and Department of Defense, among others. Their continuous acquisitions of other start-ups with potential forward integration also positioned them to keep leading their industry with the potential of Intel acquiring some of their key suppliers such as Siltronic in future like they recently bought Silicon Mobility

In this Analysis, the strongest of the five forces are competitive rivalry and the threat of new entry, even though they came in as a moderate force (See Figure 1). Intel must prioritize these two forces in strategy formulation and ensure that decision making reflects on these factors by absorbing new entrants and continue in their R&D in technology advancement and AI integration.

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