International Investments in Artificial Intelligence: Determinants and Effects

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Abstract

Artificial Intelligence (AI) has received much interest due to the impact it has on both personal, business, and country levels. In this paper, we examine investment in AI at the business and the country levels. We explored AI investment and its impact on unemployment using data from 45 countries. We first empirically investigated the international determinants of AI investments. Next, we investigated how these investments have an impact on country-level unemployment. Using instrumental variables regression for panel data as our methodology, we found that countries which have a higher level of innovation and a higher supply chain pressure seem to attract more AI investments. We also find that the more the AI investment in a country, the greater the unemployment rate in a country which mostly like due to skills mismatch. We hope that the results will help us better understand the factors that draw AI investments to the countries and help policymakers to understand societal impact of AI investments.

Keywords: Artificial Intelligence, Unemployment, Determinants, Investment, Multinational Corporation

Introduction

Artificial Intelligence (AI) has transformed not only the way we do things in our lives but also the way businesses operate (Iansiti & Lakhani, 2020) including marketing, finance, and human resource management. The most recent drastic change occurred after the ChatGPT was released by the company OpenAI in 2022 (Weidenfeld, 2024). Companies have raced to offer customers AI services or apply the technology in their operations. For example, AI chatbots are commonly used nowadays to provide customer support. As AI created opportunities for business, companies poured money into AI startup companies in order to capture the expected benefits. Griffith (2024) explained that investors poured $27.1 billion into A.I. start-ups in the United States from April to June in 2024, accounting for nearly half of all U.S. start-up funding in that period. Economic factors and national priorities and visions have substantial impact on AI investments (Chopra *et al*., 2024). In other words, different countries have implemented different policies to develop an AI ecosystem to attract AI investments. For example, in India the growth was driven by an increase in enterprise tech spending and the country's expanding AI talent pool. In Japan, in responding to an aging population, the government aims to integrate advanced technologies, particularly AI, into all aspects of daily life which will drive innovation and economic growth (Chopra *et al.*, 2024). In the U.S., the former US Treasury Secretary Hank Paulson said that clean energy will be critical to winning the AI race with China (Paulson, 2025). Nevertheless, due to the massive energy demands of AI, AI itself and its energy production may or may not be "clean". At the same time, AI has caused some issues and challenges for businesses. It raises concerns about job insecurity in the affected sectors as AI is perceived as a threat to some human jobs as it has taken over some tasks that humans used to perform and made firms become more efficient. Huang and Rust (2018) argued that AI constitutes a major source of innovation, yet threatens human jobs. Understanding what factors determine AI and how that will have an effect on workers could shed some light on the topic. In this paper, we will first empirically investigate what factors drive AI investments internationally. We will examine the possible impact of predictors including innovation, supply chain pressure, and real

GDP per capita. Then, we will investigate the impact of these investments on unemployment for advanced education group.

The paper is organized as follows. We will start the paper by exploring a brief history of AI. Then we will review the AI literature related to businesses, employment and investments. This is followed by the hypotheses and methodology sections. Lastly, we will present the results, conclusions, limitations and future research. We argue that the results will help us better understand the drivers of AI investments. In addition, we also believe that the findings would help countries determine their strategic competitive and economic policies they should implement in the artificial intelligence arena.

Literature

In this section, we will start by briefly discussing how AI has developed over the years. Then, we will examine the literature on the positive and negative impact of the AI adoption by businesses. Later, we will explore more in depth on the impact of AI on employment. Lastly, we will discuss the literature review on AI investments in order to see the general trend.

AI Background

According to Kaplan (2019), AI is defined as "a system's ability to correctly interpret external data, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation". Although it seems that businesses have just begun to use AI in mainstream tasks, some state its history could actually be traced back thousands of years (Sandoval, 2025). The core groundwork of modern AI, however, began in the early 1900s. During this period, the word "robot" was used for the first time in a play called Rossum's Universal Robots by Karel Čapek in 1921 (Sandoval, 2025). This was followed by the creation of a robot by the Japanese professor Makoto Nishimura who watched that play in 1929 (Sandoval, 2025). Modern AI, however, is different from robotics. It is a system that replicates human intelligence and has problem-solving abilities which allow it to perform various tasks such as

playing games, planning surgery, driving a vehicle, suggesting a shopping list (Garg, 2021). The idea of creating systems capable of reasoning and problem-solving using logical rules in machines that have the aspect of intelligence began around 1950s (Feigenbaum and Feldman, 1963). The word 'artificial intelligence" was used at a workshop held by John McCarthy at Dartmouth College in 1955 (Sandoval, 2025). In 1959, Arthur Samuel created the term "machine learning" in the context of presenting a computer program that played checkers (Samuel, 1959). The creation of expert systems in 1965, which were designed to mimic the decision-making abilities of human experts in specific fields, was considered as one of the most significant developments in AI (Rojas, 2024). Later on in the early 1970s, the industry experienced what many called the AI winter which is the period of disappointment, decrease in the AI interests and the research funding (Harguess and Ward, 2022). Then the rise in the usage of expert system and funding contributed to the AI boom period in the 1980s. The industry encountered the second AI winter in around 1990s (Oravec and Travis, 1992). Later the AI research focus has shifted toward developing more sophisticated machine learning algorithms, such as support vector machines and deep neural networks which led to breakthroughs in computer vision, speech recognition, and natural language processing (Rojas, 2024). AI applications began to be used in different areas such as on our phones, inside our homes, cars, and will be in just about every product and service we buy and use (Chui, Manyika, & Miremadi, 2018). This also is true in businesses.

AI and Impact on Businesses

Evolution in AI led to its recent widespread adoption across various business sectors (Guler *et al*., 2024). Almost 85% of executives believe AI will allow their companies to obtain or sustain a competitive advantage (Ransbotham *et al.*, 2017). Ransbotham *et al.* (2017) explained that this is because there is a disparity between expectation and action. In other words, businesses like the idea of AI adoption but at that time not many firms had actually done it. If all the firms adopt the AI, that competitive advantage might disappear. Furthermore, the rise

in AI has drawn the attention of researchers in every field including information systems, marketing, and management. Nguyen *et al.* (2022) found that business academic research has predominantly focused on designing and applying early AI technologies. Ginsburg (2023) stated that for the international business context, factors that foreign investors used to select locations and methods of business expansion will change as AI will impact project profile. Ginsburg (2023) also explained that AI will have an impact on specific stakeholders and their business models in the short and medium term. This can be both positive and negative. On the positive side, AI adoption could improve businesses' performance and efficiency in many ways such as by reducing costs, solving business problems, creating competitive advantages, and improving employees' innovation capabilities to say the least (Ransbotham *et al*., 2017, Climent *et al*., 2024, Ali *et al.*, 2024). Sarala *et al.* (2025) stated that optimists would argue that new jobs are likely to appear, created by entirely new markets and entrepreneurial opportunities. However, on the negative side, AI replacement in a given industry could create an excess supply of labor which could reduce the negotiation power for workers (Ginsburg, 2023). Many firms that are investing in AI fail to create economic value (Haftor *et al*., 2024). Some AI investments will generate zero net benefits to the firm. There also are concerns about job displacement, and increased dependency on technology (Guler *et al*., 2024; Arntz *et al*., 2016, Rawashdeh, 2025). Tingbani (2025) identified that many AI research studies have focused on how AI can power firm growth but less attention has been paid to labor market conditions.

AI and the Impact on Total Employment

The literature on the impact of AI on businesses tend to focus on how AI can increase firm value and growth but it has given less attention to labor market conditions (Tingbani *et al*., 2024). The impact on employment seems to be unclear. Bessen (2018) stated that the effect on employment depends on the nature of demand. In the past, employment grew even in industries that had rapid technological change (Bessen, 2018). Xiaomin (2019) explained that

the aggregate impact depends on several factors including skills, availability of open source data, and technological progress with some countries expected to gain more than others. On the other hand, Shen (2024) found that AI technology is correlated with increasing the total number of jobs on the market. Shen (2024) further explained that AI offsets the negative effect of robots on employment and considerably increases manufacturing enterprises' market size and production scale, with a significant job creation effect. Yet, Sarala *et al*. (2025) explained that unlike previous rounds of technological development, the current one will likely affect traditionally secure middle-class 'white collar' jobs.

AI Investments

Businesses not only try to adopt AI, big companies also acquire AI technologies and target startups. Meta, Amazon, Alphabet and Microsoft intend to invest as much as $320 billion this year into AI technologies (Subin, 2025). Irwin-Hunt (2025) reported that 50.8% of global venture capitalists funding was deployed in AI-focused companies in the fourth quarter of 2024, almost double its share from the same quarter of 2023. By the number of deals, AI's share of deals increased from 21.4% to 25.9% worldwide (Irwin-Hunt, 2025). By countries, the United States and China lead in total AI investment (Xiaomin, 2019). A few papers in the literature have identified the drivers of the AI international investments. He (2018) studied the impact of macroeconomic variables on the AI industry and found that real GDP, real income, foreign direct investment and government budget are the driving determinants to promote the development of the AI industry. Massey (2024) identified key drivers of AI investment to be technological advancements, economic competitiveness, data explosion, and consumer expectations.

Hypotheses

Technological advancement is one of the key drivers in AI investments (Massey, 2024). Machine learning, natural language processing, and computer vision and other AI innovation are rapidly expanding the potential AI applications which encourages businesses to invest more in AI (Massey, 2024). In other words, firms with more diverse technologies increase their attractiveness to would-be investors (Santos & Qin, 2019). These diverse technologies could help developing a cluster of innovation. Innovation cluster is the concept studied extensively by Porter (1990). Clusters of innovation refer to concentrations of interconnected organizations—including suppliers, service providers, universities, and trade associations (Engel & del-Palacio, 2009). Clusters of innovation can then create new jobs, attract investments, implement effective public policies, and boost entrepreneurship (Fundeanu & Badele, 2014). In related work, country-level innovation infrastructure also was found to affect financial investments into Industry 4.0-related technologies (Hahn & Massini, 2024). Therefore, we believe that countries with higher innovation will attract more AI investments.

H_1 The higher the innovation capacity in a country, the greater the dollar-value of AI investments.

The pandemic raised awareness of supply chain disruption. At that time, firms were not prepared for this kind of the global-scale disruption. During the pandemic, people were asked to maintain social distance. As a result, any kind of operations that need physical human intervention came to a halt, or needed to be adapted or automated (Iwuanyanwu, 2021). Though the pandemic has since subsided, other factors such as climate change, geopolitics and industrial action are still exerting pressure on global supply chains (Johar, 2025). Businesses turn to technology to help refine and optimize supply chains (Johar, 2025). AI is a mechanism that firms use to improve supply chain resilience (Iwuanyanwu, 2021; Modgil, 2022). AI can help improve supply chain risk management strategies which usually depend on rapid and adaptive decision-making based on potentially large, multidimensional data sources. (Baryannis

et al., 2018). For example, machine learning can assist in automating supplier contracts by analyzing past data to draft terms, identify risks, and suggest optimal clauses, speeding up the negotiation and approval processes Modgil (2022). As a result, it helps strengthening the procurement strategy and big data can enhance the decision-making capabilities of an organization to minimize redundancy across the supply chain Modgil (2022). As such, we propose the following hypothesis.

H_2 The higher the global supply chain pressure in a country, the greater the dollar-value of AI investments.

In our next hypothesis, we will test how real GDP per capita has an impact on AI investment. Higher real GDP per capita tends to be associated with higher skilled workers (Gottlieb, 2024) which are required for development. As a result, countries with higher real GDP per capita are likely to attract more AI investment. Babina *et al*. (2023) found that in the U.S. firms with higher initial shares of highly-educated workers and STEM workers invest more in AI. In addition, an increase in real GDP per capita also could imply the economy is in the expansion phase which could lead to more AI investments. This is because businesses gain more revenues and become able to invest in new technology including AI which in turn will help increase productivity (Czarnitzki *et al*., 2023) and improve competitiveness (Menzies *et al*., 2024). AI investments do not generate instantaneous changes in output nor productivity. However, eventually, this investment will lead to further economic growth (Trabelsi, 2024).

H_3 The higher the real GDP per capita in a country, the greater the dollar-value of AI investments.

As we mentioned earlier, the impact of AI investments may be difficult to predict. Some authors have argued that technology change will not lead to mass unemployment because workers will transition to another function within the company redeployment (Susskind & Susskind, 2015). Some seemed to believe that AI will cause job replacement (Demirci, 2024).

On the other hand, some believed that AI will create new jobs (Shen, 2024). Regardless of the outcome, one direction that seems to have many agreed on is it will have a greater impact on white-collar workers rather than blue-collar workers (Sarala *et al*., 2025, Susskind & Susskind, 2015, Kinder *et al*., 2024). Kinder *et al*. (2024) explained that a variety of "cognitive" and "nonroutine" work will probably be disrupted by AI, particularly in middle- to higher-paid occupations. Sharps *et al*. (2024) explained AI-enabled software that handles cognitive tasks give businesses the majority of time savings compared to more expensive AI-enabled hardware that focuses on physical tasks. Therefore, those who work in data-intensive sectors where it is simpler to train new AI models (like banking and finance) and those who undertake repetitive cognitive tasks (especially in administrative jobs) are probably more exposed to AI (Sharps *et al*., 2024). Susskind & Susskind (2015) pointed out these workers are not trained to perform the skills and abilities needed for their employment. These educated workers might not have appropriate skills for their jobs because of rapid technological advancement. As Acemoglu and Restrepo (2018) explained, the mismatch between technology which was being implemented at an excessive rate and workers' skills could cause the slowdown of the adjustment of labor demand and decreases productivity. In other words, this mismatch of skills causes structural unemployment to increase. The last hypothesis is thus as follows.

H_4 The greater the dollar-value of AI investments, the higher the unemployment with advanced education.

Data

We collected data on AI investments data in 45 countries from the year 2019-2022 from the OECD website (Organization for Economic Co-operation and Development) website (OECD.AI, 2025). OECD.AI estimates venture capital (VC) financial investment in AI and data firms worldwide based on private-source data from Preqin (OECD.AI). Our variable for innovation is GII. GII is developed by World Intellectual Property Ecosystem (WIPO). WIPO

ranks 132 economies using 81 indicators from international public and private sources. Some of the 81 indicators are Expenditure on education, % GDP, Government's online service, and University–industry R&D collaboration. GSCPI is developed by the Applied Macroeconomics and Econometrics Center (AMEC), Federal Reserve Bank of New York. As explained by NY Fed, the index tracks the state of global supply chains using data from the transportation (such as airfreight cost indices) and manufacturing sectors (such as Purchasing Managers' Index (PMI) surveys). Real GDP per capita data were collected from the World Development Indicator. We used GDP per capita (constant 2015 US$). Lastly, unemployment with advanced education data are retrieved from the World Development Indicators by World Bank. This is the percentage of the labor force with an advanced level of education who are unemployed. Here, according to the World Bank, advanced education comprises short-cycle tertiary education, a bachelor's degree or equivalent education level, a master's degree or equivalent education level, or doctoral degree or equivalent education level. We collected the GII, GSCPI, real GDP per capita, and unemployment with advanced education data during the same period of time with a total of 289 data points across the 45 countries.

Methodology

The methodology used in this paper is instrumental variables regression for panel data. At the first level, we have Global Innovation Index (GII), Global Supply Chain Pressure Index (GSCPI), and real GDP per capita as the independent instrumental variables and the logarithm of AI investments as the endogenous dependent variable. We used the log transformation because of the depreciating marginal utility of an additional dollar at increasingly large values. These financial investments in AI, in turn, have an impact on the unemployment among those with an advanced education in a country. As such, at the second level, we have logarithm of AI investments as an independent variable and unemployment with advanced education as the dependent variable. We also control for Year at both levels and treat this as an exogenous variable that may be related to both the logarithm of AI investments and to the endogenous

variable. The panel aspect of our data involves repeated yearly measurements on a country over the years 2017 to 2023. Our methodology can be expressed below. Here, *i* indexed individual countries and *j* indexed the number of years.

Stage I:

$$\log(AI\ Investments)_{ij} = \varphi + \xi_1 GII_{ij} + \xi_2 GSCPI_{ij} + \xi_3 RealGDPpercapita_{ij} + \xi_4 Year_{ij} + \omega_{ij}$$

Stage II:

$$Unemployment = \alpha + \gamma_1 \log(AI\ Investments)_{ij} + \gamma_2\ Year_{ij} + \upsilon_i + \varepsilon_{ij}$$

Results

Table 1 shows the results of the regression. We can interpret the results as follows. Stage 1 consists of the relationships between the instruments and the instrumented variable, the logarithm of AI investments. We find that after controlling for other variables in the models, the logarithm of AI investments increases as GII increases (by 0.0857 on the log scale for a one-unit increase in the predictor). The *p*-value here is 0.042 which is statistically significant. Hypothesis 1 is supported. Fernández (2023) explained that businesses seek innovation in the home country and abroad and they also incorporate this concept into their international strategies. For the second hypothesis in which we looked at the GSCPI variable, we can interpret the result as follows. As the GSCPI increases, the logarithm of the AI investments also increases (by 0.4275 on the log scale per one-unit increase of the predictor). The *p*-value here is <0.0001 which is significant. That means Hypothesis 2 is supported. AI tools could help building more proactive, adaptable supply chains (Nurkic, 2025). They can recommend changes and strengthen supply chains before they are strained (Cohen & Tang, 2024). For the third hypothesis, we tested the relationship between the real GDP per capita and the log of AI investments. Our *p*-value here is 0.912 which is not statistically significant. As a result, this hypothesis is not supported. We also notice that our exogenous variable, Year, is

significant. This means that the logarithm of AI investments is increasing over time after controlling for other variables in the model.

Table 1 – Panel Instrumental Variables Regression Results

	Parameters	*Coef.*	*s.e.*	*z*	*p*
Stage 1	(Intercept)	13.948	1.825	--	--
log(AI Investment)	Year	0.3994	0.0726	5.50	**< 0.0001**
	GII	0.0857	0.0422	2.03	**0.042**
	GSCPI	0.4275	0.0750	5.70	**< 0.0001**
	Real GDP per capita	-5.2E-06	5E-05	-0.11	0.912
Stage 2 Unemployment (advanced education)	(Intercept)	-0.0018	0.007	-0.25	—
	Year	-0.2680	0.0566	-4.74	**< 0.0001**
	log(AI Investment)	0.3396	0.0750	4.53	**< 0.0001**
	σ_v	3.610			
	σ_ε	1.545			
	N = 289.				

As for the second level, we see that there is a significant positive relationship between the instrumented variable, the logarithm of AI investments, and the dependent variable unemployment with advance education. The *p*-value is < 0.0001. This means that the greater the logarithm AI investment is in a country, the greater is the unemployment with advanced education. The fourth hypothesis is supported. We also can see the exogenous variable, Year, has a negative relationship with the unemployment with advanced education ($p < 0.0001$). This indicates that the unemployment with advanced education has tended to decrease over time in the countries examined here. Sharps *et al*. (2024) explained that unemployment may increase at the beginning and may be gradual as companies adopt AI. Eventually the increase in unemployment is likely to offset as AI creates new demand for workers, which pulls displaced workers back into the workforce (Sharps *et al*., 2024). As a result, the increase in unemployment is probably going to be limited and eventually reversed according to Sharps *et al*. (2024).

Implications, Limitations, and Future Research

AI has a great potential for both businesses and countries. AI can improve competitiveness and competitive advantage for businesses. As a result, businesses should be flexible and design a system that can support AI. It also should use AI to improve supply chain resilience. Moreover, companies should provide their employees with some training in order for them to develop necessary skills. We also hope that this paper will help managers in strategic decision making in terms of AI investment location.

In the meantime, innovation can play important role in economic planning in order to improve the market position of the country in competing to attract AI investments. In turns, AI investments can improve development. In addition, governments also can provide the education system that will support workers and ensure that they are equipped with the right skillsets in order to solve the issue of skills mismatch. They also should provide some safety net or protection for those who are facing layoffs.

We hope that this paper will bridge a gap in the literature as to date there seem to be little empirical analyses on this topic. Nevertheless, the paper has some limitations. According to the OECD website, "The data did not capture every deal and required some extrapolation, and the data does not cover the internal investments in AI made by public companies" (OECD.AI). In addition, we can only have one variable as a dependent variable at the second stage. Though AI investments might have impact on other variables such as AI hiring growth rates or AI concentration, we only considered this one variable at this time. Lastly, we note that our data predate most of the current surge in AI investments. It is possible that more recent trends in AI investment differ from those we have presented. AI investment has been going on for decades but recent increases may be larger and different than those we examined.

In terms of future research, introducing some lag variables might help shed some lights in terms of the impact of AI investments on the second level as impacts might not happen right away. In addition, in order to see if the increase in unemployment is a short-term or a long-term phenomenon, the time period also could be extended when the data become available. Exploring the impact of AI investments in specific industries also would be insightful.

Declarations

All authors declare that they have no conflicts of interest.

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