Leveraging State-Supported AI to Break Economic Dependency: Insights from Export Diversification in Chile and Thailand

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August, 2024

Abstract

The prevailing state-supported AI advancement in developing countries has sparked debate regarding its potential to reduce developmental dependency via export diversification. While tackling dependency contributes to growth stability, the topic has been understudied. Meanwhile, the limited existing research fails to reconcile the debate, due to the use of poor proxies for export complexity or limited long-term evaluations of the diversification process. Addressing the research gaps, this study investigates of effects of 'pro-AI' policies on export complexity. It uses the Export Diversification Index (1970-2014) and focuses on developing countries with over 20 years of pro-AI policy adoptions. A synthetic control method reveals significant export-diversifying effects in Chile and Thailand, suggesting that the benefits of pro-AI policies are generalizable to the broader developing world. Consequently, export diversification weakens the dependency by bolstering state finances, thereby supporting more autonomous and stable economic development. The study provides nuanced perspectives in tackling persistent dependency by advocating state-led AI advancements. Moreover, the analysis offers practical policy recommendations that promote more harmonious tech-led growth in the Global South.

1 Introduction

Artificial intelligence (AI) encompasses smart machines and computer programs that simulate human intelligence and problem-solving capabilities (McCarthy 2007). Recently, 'pro-AI' policies are popular across developing countries[1], including state support for AI through funding research programs, investing in research infrastructure, and attracting global talents (Demaidi 2023). Given AI's problem-solving potential, this study explores the technology's capacity to address development challenges.

[1]The classification of "developed" and "developing" countries is based on the International Monetary Fund (IMF) (2023)'s classification of "advanced economies" and "emerging and developing economies," respectively.

For decades, the developing world has been facing financial-industrial dependence: the reliance on foreign consumption of exports to finance industrialization and development (Kvangraven 2023). This dependence has led to long-term income volatility and limited growth in the Global South (Harvey et al. 2017; World Bank 2023b). The root of this economic challenge lies in the developing countries' specialization in commodity exports (Dos Santos 1970), suggesting export diversification as a potential solution (Hidalgo and Hausmann 2009). Yet, academic disagrees with pro-AI policies' contributions to export diversity (Alonso et al. 2022; Mishra et al. 2023). Meanwhile, the limited amount of work lacks empirical rigor, either using poor proxy variables for export complexity (Tacchella et al. 2012) or relying on short-term evaluations to assess the long-term diversification process (Le Billon and Good 2016). Since the underexplored area may suggest practical ways towards economic autonomy and growth stability, this study explores the potential of state support for AI development in diversifying exports. It focuses on early policy adopters and examines the Export Diversification Index (EDI). The use of EDI provides a more accurate measure of export diversification, and the focus on early adopters allows for a sufficiently long-term evaluation of policy effects.

The study covers the period from 1970 to 2014, due to the data availability[2]. To ensure the generalizability in the Global South, this study examines Chile and Thailand, two early adopters of pro-AI policies in the 1980s, and assesses the changes in export complexity. These two cases are reflective of many other developing countries at the time their governments began supporting AI development – large-scale commodity dependence, limited industrialization, and fluctuating economic growth (Hussey 1993; Spilimbergo 2002). Using a synthetic control method, the study identifies significant causal effects of pro-AI policies on export diversification in Chile and Thailand. Moreover, this policy-driven diversification reduced commodity dependence, increased state income, and enhanced financial autonomy. Given the two countries' parallels with other developing countries, the findings suggest that pro-AI policies can effectively drive export diversification, thereby alleviating financial-industrial dependence across the Global South. The work, by advocating the state's strategic support of emerging technologies, offers nuanced solutions to the long-standing developmental challenges. Moreover, it provides practical policy guidelines for developing countries' national AI initiatives: (1) state-led alignment of technological growth with economic objectives; (2) support for emerging export firms that leverage AI in production; and (3) strengthening education systems with research capabilities to support the pro-AI policies.

The paper is structured as follows. Section 2 introduces the theoretical framework, positioning financial-industrial dependence as a developmental challenge and export diversification as a solution. Building on this dependency-solution framework, Section 3 reviews the literature on the relationships between pro-AI policies and export diversification, highlights the academic debate, identifies research gaps, and formulates the research question. Sections 4-6 detail the research design, present the effect of pro-AI policies on export, and assess the robustness. Finally, Sections 7 and 8 discuss the academic contributions and bridge the implications of pro-AI policies from

[2]This constitutes a minor limitation, as discussed further in Section 6.4.

export complexity to financial-industrial dependence, thereby completing the investigations of the theoretical framework.

2 Theoretical Considerations

This study constructs its theoretical framework based on dependency theory, which identifies one cause of the developing countries' growth instability. Originally, the theory describes the asymmetric economic relationships between developed and developing countries. Nowadays, dependency has evolved into a dual form, where South-South relationships are included (UNCTAD 2024). Focusing on financial-industrial dependence, wherein developing countries rely on commodity-based income from trade to finance development (Dos Santos 1970), this study proposes export diversification as a solution.

2.1 The Financial-Industrial Dependence

Interstate differences in development create a global core-periphery system (Prebisch 1950; Prebisch 1981). Within this system, the core comprises advanced economies, while the periphery consists of developing countries[3]. Dependency theorists have used this core-periphery structure to conceptualize the relationships between the two blocs, positing that the growth of the periphery is dependent on the core's economic expansion (Dos Santos 1970). According to Dos Santos, one form of dependency is financial-industrial dependence. Specifically, periphery economies typically specialize in commodity exports to satisfy the core's demands. The export of these low-value-added commodities constitutes a significant income source. As a result, developing countries rely on limited export revenues to finance development, including investments in infrastructure and productivity. In this way, the economic development of the periphery becomes financially dependent on the core's consumption of its exports. Additionally, due to technological backwardness, developing countries often consume expensive imports while selling cheap exports. These transactions increase the likelihood of trade deficits, further constraining the financial capabilities to support domestic development.

The dependency theory in the 1970s focused on the core-periphery interactions (Dos Santos 1970). In contrast, contemporary financial-industrial dependence has extended to the economic interactions within the periphery. Today, developing countries such as China, India, and Vietnam have emerged as significant importers (UNCTAD 2024), reducing the dominance of core's consumption patterns in global trade. However, dependency persists due to the ongoing commodity dependence (Kvangraven 2023). Currently, exports constitute a critical income source for most developing countries (UNDP 2010; World Bank 2023a). Meanwhile, the commodity shares much of the exports for these export-dependent economies. For instance, 83% of African countries and 41% of Latin American countries remain commodity-dependent (UNCTAD 2022a;

[3]The following discussion may fluctuate in its use of the terms "developing countries" and "periphery economies," which refer to the same concept.

UNCTAD 2022b). Consequently, a substantial number of developing countries have income reliance on the foreign (both core and periphery) consumption of the commodity exports. This financial dependency results in economic volatility due to fluctuating commodity prices and insufficient economic autonomy (Johnson 1972; UNCTAD 2023). Therefore, the contemporary trade arrangement fosters a dual financial-industrial dependence on both core and periphery importers. Meanwhile, the root of this dependence lies in the commodity specialization. Given the ongoing developmental dependency, addressing the periphery's specialization in commodity is imperative.

2.2 Export Diversification

The solution to financial-industrial dependence lies within its root: the periphery's export concentration in commodities (Hidalgo and Hausmann 2009). In converse to specialization, a potential solution is export diversification; this study focuses on extensive diversification[4], which involves expansion into more advanced markets with higher value additions (Hummels and Klenow 2005). This structural upgrade not only fosters the accumulation of domestic capital (Bustos, Garber, and Ponticelli 2020) but also increases revenues from international trade (Mania and Rieber 2019). The improvements would ultimately contribute to economic autonomy, enabling states to strengthen their financial capacity to support growth. Thus, extensive export diversification could serve as a solution to financial-industrial dependence, with further economic implications for addressing volatile income growth.

In summary, contemporary financial-industrial dependence in developing countries has evolved into a dual reliance on advanced economies and large periphery importers. The dependency is primarily rooted in persistent commodity dependence (UNCTAD 2022a; UNCTAD 2022b). Meanwhile, export diversification has emerged as a promising solution (Bustos, Garber, and Ponticelli 2020; Mania and Rieber 2019). Building on this dependency-solution framework and regarding the rising popularity of pro-AI policies in the periphery (Demaidi 2023), the study aims to explore whether state support for AI advancement could effectively assist export diversification, which ultimately weakens the financial-industrial dependence.

3 Literature Review

The theoretical framework prompts the consideration of practical instruments to achieve export diversification, as a solution to the financial-industrial dependence. Regarding the developing countries' ongoing state support of AI development (Demaidi 2023), this study tries to explore the potential of such pro-AI policies. To set the stage, this section reviews the literature on the relationship between state support of AI development and export complexity.

Before further investigations, it is necessary to ensure that relevant infrastructure, such as

[4]The other kind is the intensive diversification: the product expansion in the existing markets (Jongwanich 2019)

universities and research institutions, exists and can effectively cooperate with relevant measures. Currently, there are over 600 tech hubs across African countries, providing a basis for the local AI industry (Kshetri 2020). Similarly, countries in Latin America and Asia have established the necessary infrastructure to support AI development (Arfanuzzaman 2021; Torres and Montoya 2024). Therefore, most developing countries have met the infrastructure prerequisites for pro-AI policies. The policy feasibility broadens the implications of subsequent analysis, as the potential benefits of pro-AI policies could extend to a wider range of peripheral economies.

3.1 The Diversification Puzzle

There are contentious arguments on the pro-AI policies' effects on exports. While techno-optimists contend that relevant strategies can expand domestic businesses into new sectors, some express concerns about the contextual factors that may limit the effects of state support. A recent work from Mishra et al. (2023) illustrates two export diversification mechanisms, the "conservative" and "progressive" diversification:

Conservative diversification aligns with what Albert Hirschman (1958) conceptualizes as "forward linkages". Specifically, state support for AI development facilitates the applications, potentially connecting low-skilled industries forward to higher-skilled ones. The adaptability of AI allows the technologies to be initially applied in commodity industries and then transferred to more advanced sectors requiring similar skills. For example, agrotechnology could first be used to analyze optimal conditions for crop growth. The resulting data and insights could then support forward linkages to the chemical products that enhance agricultural outputs. Thus, by promoting applications, pro-AI policies can upgrade information and skills, contributing to the forward linkages that connect low-skilled commodity sectors to more advanced industrial productions.

In contrast, progressive diversification does not need forward linkages to expand export markets. Instead, pro-AI policies can directly support industries that produce exportable AI products. The policies can foster the growth of various AI-related technologies, such as robotics, virtual reality, data analytics, and natural language processing (NLP). The integration of these technologies can drive the development of new sectors. For instance, the combination of robotics, computational technology, and image/language processing can build machinery capable of autonomous information processing and analysis. Put simply, AI itself is (part of) an exportable good. Therefore, with state support for AI development, developing countries have the potential to expand into more profitable AI industries, thereby increasing their export complexity.

While both mechanisms recognize the potential of pro-AI policies, these arguments rest on two critical assumptions: the effective support of AI development and promotion of AI applications. However, Alonso et al. (2022) challenge these assumptions, arguing that contextual constraints in developing countries may impede the export-diversifying effects of pro-AI policies.

First, the capacity of pro-AI policies in developing countries to support AI development may be undermined by limited R&D resources. Efficient AI modeling requires extensive training datasets within domestic markets to optimize analytical performance. However, developing countries often face challenges in acquiring the necessary datasets to develop robust AI models. This deficiency in R&D resources may, therefore, curtail the effectiveness of policies that foster AI development. Although the technology has the potential to create forward linkages, such R&D limitations could restrict the effectiveness of pro-AI policies to support technological progress, thereby diminishing the potential export diversification from AI advancements.

Second, even if R&D efforts are successful, pro-AI policies in developing countries may face limited uptake of AI applications due to cost considerations. In advanced economies, where labor costs are high, firms are incentivized to replace human labor with robots or algorithms. In contrast, labor costs in the export sectors are typically low, making automation technologies appear as a more expensive alternative to human labor. This cost disparity reduces the incentives for AI adoption, thereby rendering state support less effective in application promotion in developing countries. As a result, limited AI application incentives may constrain the export diversifying potential of the pro-AI policies.

In summary, scholars hold conflicting views on the export-diversifying effects of pro-AI policies. While some argue that state support of AI could broaden export diversity (Mishra et al. 2023), others contend that contextual factors within the periphery may limit the policies' effectiveness (Alonso et al. 2022). Building on the diversification puzzle, the following subsection reviews existing empirical studies, identifies their limitations, and formulates the research question.

3.2 The Empirical Gaps and Research Question

Empirical studies examining the export impacts of pro-AI policies are limited in number and often lack analytical rigor. To begin with, some empirical analyses arbitrarily equate the expansion of comparative advantages with export diversification. For instance, Yang et al. (2023) utilize the Economic Complexity Index (ECI) developed by Hidalgo and Hausmann (2009) to demonstrate that regional AI development programs have increased the export complexity in China. However, the index overlooks the complex link between comparative advantages and actual exports. The mere calculations of comparative advantages cannot serve as a satisfactory export proxy, as changes in the monetary costs have non-linear relationships with export expansions (Tacchella et al. 2012). Similar criticisms could be applied to Mishra et al.'s case studies (2023), where comparative advantages are used to illustrate how the pro-AI policies in Mexico and Nigeria expanded export profiles. In line with Tachella et al., empirical analyses using the comparative advantages as an export proxy own limited explanatory power on the pro-AI policies' diversifying effects.

In addition, export diversification is a long-term process, yet some studies only assess short-term impacts. Le Billon and Good (2016) have shown that export diversification typically unfolds over decades, yet recent evaluations often span around ten years. For example, Al Awaidi and Madbouly (2022) covers the period from 2011 to 2019, concluding that state support of AI advancements in Oman has limited contributions to export diversification. Likewise, Crupi and Schilirò (2023) found that pro-AI policies have diversified export sectors in the United Arab Emirates since 2013, but at an inadequate pace. In line with Le Billon and Good, recent evaluations may underestimate the effects of AI strategies, and the policies could potentially yield greater diversifying effects when evaluated over longer periods.

Notably, understanding the relationship between state support of AI development and export complexity offers valuable insights for stabilizing growth through economic independence. However, research in this field is limited in both volumes and soundness. The limited empirical work either uses poor proxy variables for export diversity (e.g. Yang et al. 2023) or short-term evaluations to assess the long-term dynamics of export diversification (e.g. Al Awaidi and Madbouly 2022). As a result, the diversification puzzle of pro-AI policies remains unresolved. Therefore, this study asks, "Could the state support for AI advancement contribute to developing countries' export diversification?" It aims to evaluate the pro-AI policies by early adopters among developing countries and investigate whether these policies have led to a decrease in the Export Diversification Index (EDI)[5]. The research will fill the gaps by 1) employing a more direct measure of export diversification to avoid the complexity between comparative advantages and export, and 2) analyzing early adopters (since the 1980s) to provide longer-term assessments of pro-AI policies' effects on export diversity.

4 Research Design

This section details the research design to address the research question. I will first outline the weaknesses of previous research methods. To overcome the methodological challenges, the study introduces the synthetic control method (SCM) and elaborates on its procedure in this research setting.

4.1 Weaknesses in Previous Research Methods

Scholars have employed various research methods to elucidate the impacts of the pro-AI policies on export diversity. However, the methods of previous studies have limitations that may lead to bias in estimations. These methods include panel data analysis and qualitative studies.

The first stream of literature employs panel data analysis. One approach is panel data regression (e.g., Yang et al. 2023). Although this method controls for the time-invariant variables, researchers must identify all time-variant confounders that causally influence export complexity to establish the causal effects (de Kadt and Wittels 2019). In practice, identifying all time-variant contributors could be challenging. Another method is using the distributed lag model (e.g., Al Awaidi and Madbouly 2022). While capturing the time dynamics, studies with this model can merely establish causality beyond associations since its conceptualization of "causal" relationships is mainly from predictions (Yau and Bahadori 2012). In brief, both panel data regression and distributed lag model cannot establish persuasive causality from pro-AI policies to export diversification.

[5]A decrease in EDI represents export diversification.

Second, some studies apply qualitative analysis (e.g. Hassan 2020). Although this method provides analytical depth into policy effects, it raises concerns about transparency. In particular, qualitative research is often criticized for the intentional selection of evidence to support the authors' desired claims. One prominent criticism comes from Julia Angwin (2024), who argues for AI hype whereby authors and news selectively report AI's promising aspects to recommend supportive policies while overlooking the technology's drawbacks. Therefore, the qualitative analysis may lack transparency in presenting all available evidence on the state support of AI, which is necessary for forming a balanced and transparent causal analysis.

4.2 Synthetic Control Method

To overcome the methodological challenges, this study employs the synthetic control method (SCM) to investigate the case-specific causal relationships between state support for AI development and export diversification. Unlike traditional methods that assume equal usefulness of the untreated units, SCM constructs counterfactuals for each treated unit by synthesizing weighted combinations of untreated units. The method integrates both quantitative and qualitative evidence. The quantitative analysis could offer a more robust and transparent causal inference. Meanwhile, qualitative evidence provides a detailed exploration of the causal mechanisms linking policies to export outcomes. This approach offers several advantages over previous research methodologies: (1) no requirement to identify all time-variant confounders; (2) the causality based on the comparisons between the treated units and the counterfactuals, not the prediction relationships, and (3) more transparent causal inference through the data-driven comparative cases, rather than researcher-directed case selections. The following paragraphs will outline the SCM procedure to study the impact of pro-AI policies on export diversification.

The study focuses on developing countries and evaluates the Export Diversification Index (EDI) from the International Monetary Fund (IMF). The analysis spans from 1970 to 2014, due to the availability of EDI data. Each developing country constitutes a unit. The treatment is the state's support of AI development. The selection of treated units is based on four key considerations:

a. Having continuous pro-AI policies since the 1980s or 1990s for long-term evaluations.

b. With well-documented pro-AI policy records of the treatment date for later causal analysis.

c. No significant AI development existed before the implementation of pro-AI policies.

d. Exclude large developing economies to guarantee the generalizability of the findings.

Based on the criteria, Chile and Thailand, two early adopters of pro-AI policies, are selected as the experimental units. Developing countries without state-led AI advancements during the study period form the control group[6].

[6]Detailed examinations of control group shown in Appendix.1.

Mathematically, the quasi-experimental setting creates a set of J treated cases ($J = 2$) that started to support AI development in the 1980s, and K control units that did not throughout the study period. The treatment time differs across periods $t = 1, \ldots, T$. For each treated unit $j = 1, 2$, there is a unique pre-treatment period $1 \leq t \leq T_{j,0}$, a one-off treatment year of $T_{j,0}$, and a post-treatment period of $T_{j,0} \leq t \leq T$.

4.3 Estimations

The EDI prediction is the first step of SCM, which is later used to construct synthetic counterfactuals. The forecast uses predictors from the export diversification framework by Giri, Quayyum, and Yin (2019). The use of a uniform prediction framework is necessary for SCM, which assumes the same outcome-generation process in treated and untreated groups (Abadie 2021). The EDI prediction framework is from a global analysis, with a particular focus on developing countries (Giri, Quayyum, and Yin 2019). The framework includes the following predictors: resource endowment reflected by natural resource rents, primary school enrollment and completion, trade participation, foreign direct investment (FDI), governance quality (in terms of promoting equality), growth rate, and geographical locations in latitudes.

It is important to note that the model is purely predictive, and I do not draw causality directly from it. Therefore, the specification is designed to maximize model fit during the pre-treatment period rather than to satisfy assumptions about the conditional distribution of errors. Meanwhile, the SCM aims to estimate the unique effects of pro-AI policies in Chile and Thailand, so the estimation is not built on entire populations. Instead, I fit 2 models to 2 different samples, each with one treated unit j and the entire K control group.

The prediction model helps identify how the covariates contribute to export diversification during the pre-treatment period. Then, the covariates' coefficients will be compared between the treated and untreated units. Weights will be assigned to different untreated units according to their similarity to countries with pro-AI policies, in terms of how different covariates contribute to export complexity. The combination of the weighted untreated units allows for the construction of a synthetic counterfactual that does not have state support of AI but is the most similar to Chile or Thailand. The synthetic hybrid mirrors the treated units' EDI in the pre-policy period, predictive covariates' values, and unobserved time-variant confounders. As a result, comparing the treated units' actual EDI and the synthetic counterfactuals' projected EDI in the post-treatment period could reveal the effects of pro-AI policies on export diversification.

4.4 Data

This research draws on both quantitative and qualitative data for causal inference. The treatment, which consists of the pro-AI policies in the selected early adopters, is extracted from documents on the AI development history. This ensures that no significant prior AI development actions bring bias to later estimations. Table 1 shows the treated units, along with the timing and contents of their first pro-AI strategies.

Table 1. **Country, Treatment Year, and the Treatment**

Country	Year	Policies/Interventions
Chile	1985	The government started to financially support AI research and applications in mining, forestry, and industrial automation (Atkinson and Solar, 2009).
Thailand	1988	The government, in cooperation with the domestic universities, initiated the first national-level research and application of AI (Kawtrakul and Praneetpolgrang, 2014).

The EDI data is collected from the IMF database. The index is a continuous variable ranging from 0 to 6.5, **with lower values representing higher export complexity**. The index calculation considers not only the variety of exports but also their prices. The inclusion of prices addresses the concern that a country may diversify its exports, but most are primary commodities. As a result, if a country diversifies into higher value-added sectors, the EDI will decrease more significantly, indicating a more economically beneficial export diversification.

Most of the predictors in the prediction model – including natural resource rents, primary school enrollment and completion, trade, FDI, population, growth rates, and latitudes – are from the World Bank Database. The EPII (Economic Policy and Institutional Index) is provided by the Varieties of Democracy Institute, based at the University of Gothenburg in Sweden.

5 Results

In this section, I present the effects of pro-AI policies on export diversification in Chile and Thailand. I will first offer general conclusions on the export impacts of policies. Then, I will provide case-specific analyses of Thailand and Chile. The case studies would provide in-depth analyses of how the two countries achieved increases in export complexity, and why the effects in Chile were less lasting.

5.1 Aggregate Results

Figure 1 presents separate synthetic counterfactual analyses for Chile and Thailand. In all cases, the mean squared prediction error (MSPE) is small (less than 0.1), demonstrating a close fit between the treated units and their respective synthetic controls during the pre-treatment period. The fitness suggests that the synthetic Chile and Thailand serve as good counterfactuals; these hypothetical countries closely resemble the actual Chile and Thailand in terms of export complexity, with the distinction that they have not implemented pro-AI policies.

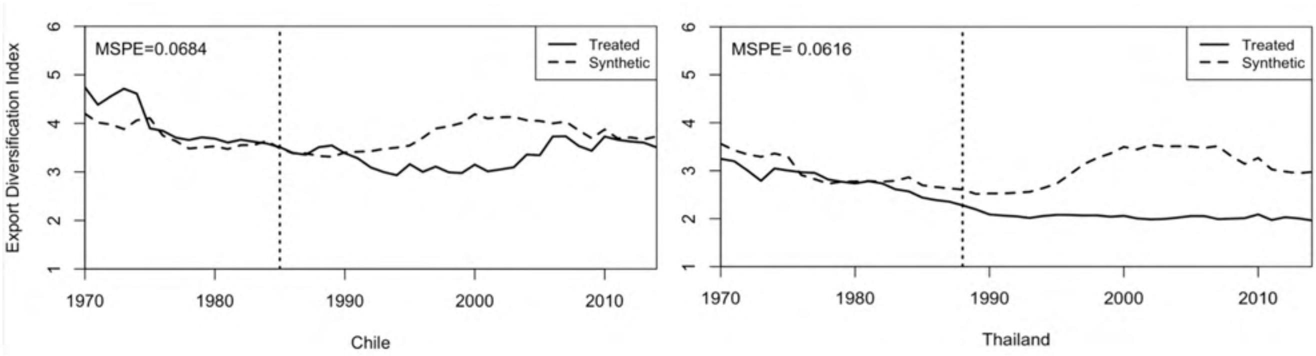

Figure 1: Synthetic Control Results
Dashed vertical lines represent treatment years.

Following the state support of AI development, the two countries experienced a decline in their EDIs. In the post-treatment periods, the actual EDIs in Chile and Thailand are lower than those of the synthetic counterfactuals. This finding suggests that the pro-AI policies in these countries contributed to an increase in export complexity. Moreover, in both cases, there was a projected periodic decline in export complexity, likely due to a series of global recessions and financial crises throughout the 1990s (Allen 2016). Notably, pro-AI policies in both countries effectively mitigated the shocks on export complexity. In Chile, state-supported AI development transformed a potential decline into smaller fluctuations. In Thailand, pro-AI measures reverted the decline in export complexity into a slow but steady increase.

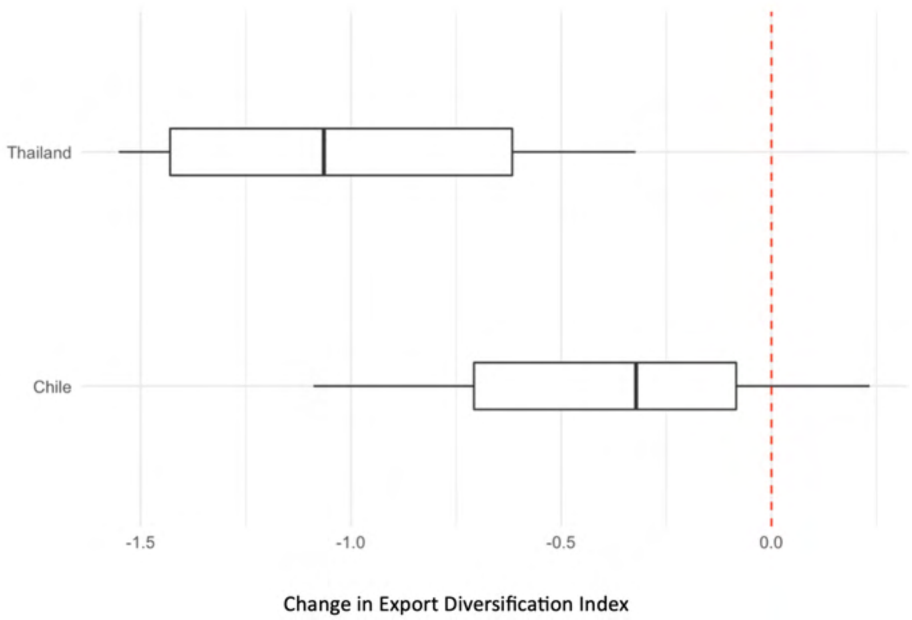

Figure 2: Heterogeneous Export-Diversifying Effects of Pro-AI Policies

Despite the overall positive effects, heterogeneity persists. As illustrated in Figure 2, the distribution of the treatment effects varies between countries. Thailand, for instance, experienced a more pronounced improvement in export diversity following state support for AI. The time-averaged effect of the pro-AI policy is -1.024, indicating that, on average, Thailand's EDI is 1.024 points lower than it would have been in the absence of the AI policies. By 2014, after 26 years of active government support for AI advancements, the country's export complexity increased by 13%. In contrast, Chile's time-averaged policy effect is smaller, with the country's EDI averaging 0.426 points lower than it would have been without pro-AI measures. The effects were strongest from the 1990s to the mid-2000s, demonstrated by a large distance between the synthetic and actual EDI trends. Although there was a decline in export complexity after 2000, the situation would be worse without pro-AI measures.

5.2 Inference

Notably, the aforementioned treatment effects remain questionable without proper inference. In particular, placebo tests are necessary to ensure that the identified relationships between state support of AI and export diversification are not due to chance. To this end, I follow the procedure of Abadie, Diamond, and Hainmueller (2010), which hypothesizes that the control group had the pro-AI policies (the placebo). If these placebo units experienced similar "treatment effects", it would suggest that Chile and Thailand could experience export diversification in the absence of pro-AI policies. As a result, the causal links from the state support of AI to export complexity are insignificant.

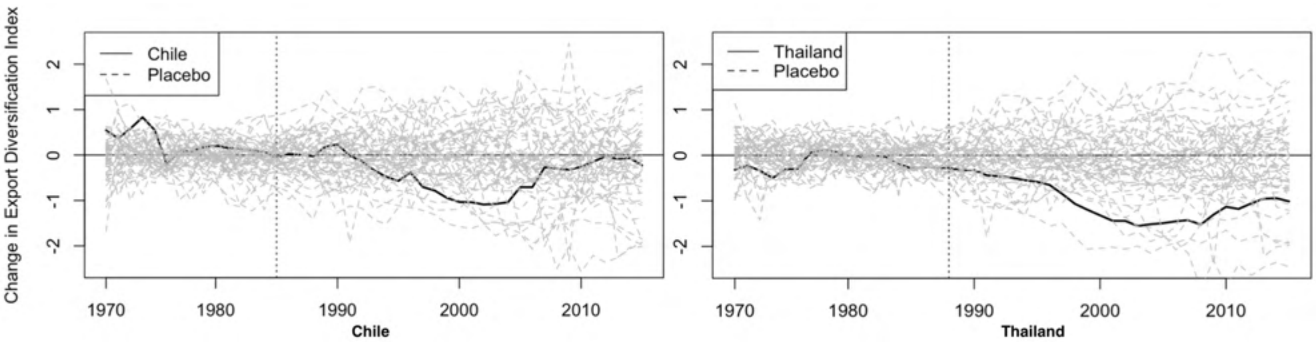

Figure 3: Placebo Tests
Dashed lines represent treatment years

In Figure 3, I present the treatment effects (black thick lines) alongside the placebo effects (dashed grey lines). The significant impact of pro-AI policies on exports is evident from the departure of Chile and Thailand's EDI changes from the placebos'. In Thailand, the EDI variations show a consistent divergence, indicating that Thailand's support for AI development has significantly diversified exports throughout the post-treatment period. In Chile, a notable deviation from the placebos occurred between the 1990s and the mid-2000s, suggesting that AI policies played a significant role in export diversification during this period.

In summary, the results indicate generally positive and significant effects of pro-AI policies on export diversification in Chile and Thailand. To derive valuable policy insights, the next subsection examines the case-specific causal mechanisms while discussing the reasons behind the less enduring export diversification in Chile.

5.3 Case Study: Thailand

The export diversification in Thailand exemplifies the progressive diversification by Mishra et al. (2023): expansion to the AI-related markets. Thailand was similar to most developing countries before embracing the pro-AI policies. The economy was mostly based on agricultural production and the export of commodity goods (Hussey 1993). Moreover, the early 80s marked a severe economic downturn. As a petroleum importer, the oil shock led to a consistent trade deficit. At the same time, international prices for rice, coconut oil, and rubber collapsed, causing a plunge in the country's income (Phongpaichit 1989). In brief, before having its AI strategies, Thailand was not a strong developing economy, and the economic shocks created even more difficulties for growth. This setting potentially makes later discussions on the key components of pro-AI policies more generalizable to the rest of the developing world.

Following the recession, the Thai government initiated structural and fiscal reforms that helped restore growth (Robinson et al. 1991), laying a foundation for AI policies. In 1988, the government began to support AI research and expanded AI development at the national level (Kawtrakul and Praneetpolgrang 2014). The state organization National Electronics and Computer Technology Center (NECTEC) collaborated with various domestic AI research programs in natural language processing (NLP), information systems, and mechanical instruments (Kijsirikul and Theeramunkong 1999). The government intervention not only increased the research scale but also facilitated the integration of AI into industrial productions at a well-matched pace. As a result, the policy progressively transformed dominant exports from agricultural to AI-related manufactured goods (Kawtrakul and Praneetpolgrang 2014). From the synthetic control analysis, the government's pro-AI policy played an important role in the diversification process. Remarkably, the export diversification continued when there were multiple negative shocks. In the 1990s, there were different regional recessions and financial crises transmitted through trade (Allen 2016). During this period of anticipated decline, pro-AI policies not only prevented a loss in export diversity but also promoted a steady expansion into industries producing AI-related machinery and electronic products. Thus, state support for AI development in Thailand not only diversified exports but also safeguarded these diversification trends from external shocks.

A distinctive aspect of Thailand's pro-AI policy is that the funded AI research is mostly directed by the government. Specifically, the state solely determined the objectives of AI research collaborations between NECTEC and universities. This state-led approach ensures that AI development not only yields fruitful academic publications but also contributes to income generation, industrial production, and structural transformations (Kawtrakul and Praneetpolgrang 2014). As a result, the policies aligned technological growth closely with the national goal of pursuing an export-led growth model (Jongwanich 2019). A notable example is Thailand's medical device industry. The pro-AI policies have fostered advancements in profitable technologies such as speech processing, machine learning, image processing, and robotics. Combining different AI technologies, Thailand has enhanced its competitiveness in high-tech medical devices such as health sensors, mobile devices for preventive medicine, and wearable health devices (Thailand Board of Investment (TBOI) 2021). More broadly, AI algorithms have contributed to refining Thailand's business models, while robotic technologies have bolstered growth in major export sectors in machinery, electronics, and vehicles (Kawtrakul and Praneetpolgrang 2014). As a result, the country has climbed to the world's top exporter of biodiesel, automotive, medical devices, and hard disks (TBOI 2022), following the state support of AI development.

To summarize, Thailand presents a case of progressive diversification from agriculture (Hussey 1993) to the AI-related manufacturing industries (TBOI 2022). The government played an active role in designing policies to support AI development. The intervention has directed the technological progress towards the growth of AI-related manufacturing sectors. Before the pro-AI policies, major exports were primarily agricultural products such as rice, rubber, and coconut oil. Following state interventions, top export sectors have shifted towards AI-related and profitable industries like machinery and electronics (Kawtrakul and Praneetpolgrang 2014). Combining the literature with the synthetic control analysis, the state-led AI development since 1988 has emerged as a significant driver of Thailand's export diversification from commodities to high-tech goods.

5.4 Case Study: Chile

Instead of the expansions to AI-related industries, Chile's export diversification exemplified conservative diversification (Mishra et al. 2023) by building forward linkages. The country's commodity dependence and truncated growth before pro-AI measures also mirror most of the developing countries. In the 1960s, Chile highly specialized in mining, which constituted 86.5% of total exports (Álvarez and Lemus 2001). This reliance on natural resources and the volatility of international mineral prices resulted in truncated income growth (Spilimbergo 2002). During this period, the Chilean government began to support AI development through funding research programs (Atkinson and Solar 2009). The policy has resulted in a continual increase in export diversity from 1990 to the early 2000s, as shown in the synthetic control analysis. Building on this quantitative finding, this case study investigates the mechanism behind the increase in export complexity and the less-lasting diversification after the mid-2000s.

The pro-AI policy in Chile effectively facilitated the emergence of forward linkages from its large, low-value-added mining industry. Initially, state-led AI development ensured steady mineral extraction, which later provided a stable supply of inputs for the higher value-added manufacturing sectors. This process built forward linkages by reducing the operational costs of new manufacturing firms. A prominent example is the copper industry. Chile possesses substantial copper reserves, accounting for more than a quarter of the global supply (Leiss and Yeluri 2021). The value addition in the copper industry typically involves three stages: (1) the extraction of copper ores, (2) the processing of these ores into metal or metal compounds, and (3) the industrial production of goods using the processed metal (Gutiérrez, Paz, and Vite 2022). Historically, Chile's economy was heavily dependent on copper mining. Following state support for AI development, the copper industry began to establish connections to higher value-added industries. In particular, the government supported the development of an AI-based Expert

System (ES) at the University of Chile. At first, the ES was employed to control quality and manage copper extraction. While this system benefited copper mining firms, it also offered advantages to copper processing firms by lowering the costs of accessing high-quality copper, thereby enhancing their international competitiveness (Atkinson and Solar 2009). As a result, the pro-AI policies facilitated forward linkages from copper ore extraction to the production of copper products, such as copper cathodes, which are more marketable and profitable (Álvarez 2004). Similarly, the AI-based system connected copper processing to the copper products (e.g. cables, wires, and pipes), representing an additional forward linkage from the second to the third stage of copper value addition (Gutiérrez, Paz, and Vite 2022). Overall, from the 1980s to the early 2000s, the share of mining in total exports decreased by over 20%, while the share of manufacturing nearly doubled, reaching 41.9% (Álvarez and Lemus 2001). Synthetic control analysis suggests that the pro-AI strategy was a significant factor in driving this export diversification.

The diversification, however, did not continue after the mid-2000s. Two main factors contributed to the decline of export complexity. Domestically, the emerging export companies remained occasional and lacked staying power in international markets. From 1995 to 2002, approximately 35% of export firms exited the market each year (Álvarez 2004). The large volume of short-term surviving export firms could not sustain the exploration of new products and markets. Consequently, this lack of sustainability in export firms led to a pause in export diversification by the mid-2000s (Álvarez 2004). Meanwhile, external conditions also contributed to the stagnation in Chilean export diversification. In particular, the growing demand for copper from China, as well as other countries, incentivized more firms in Chile to concentrate on copper mining and processing (Pardo Piñashca 2020). As a result, the selective export focus on copper mining limited the contributions of the pro-AI policies to export diversification. Although the commodity boom may bring short-term economic benefits, it harms long-term growth stability (Mohommad et al. 2023). Therefore, after the mid-2000s, the limited staying power of Chilean firms in international markets and the growing global demand for copper diminished the export diversifying effects of AI policies.

In summary, the case of Chile illustrates that pro-AI policies can have export diversifying effects, but the sustainability of these effects is dependent on contextual factors such as the export firms' competitiveness and external demand for domestic products. The result implies the need for managing the domestic economy, including supporting new export firms and preventing over-concentration in highly demanded export goods. Such measures would enhance the effectiveness of pro-AI policies in exports, leading to larger and more lasting impacts on increasing export complexity.

6 Robustness and Limitation

To demonstrate the robustness of the results, this section examines key SCM assumptions on post-treatment shocks exclusively in the untreated group, spillover effects from the treated to the untreated group, and reverse causality. Additionally, this section acknowledges a limitation of this work and outlines a potential solution for future research.

6.1 Post-Treatment Shocks in the Control Group

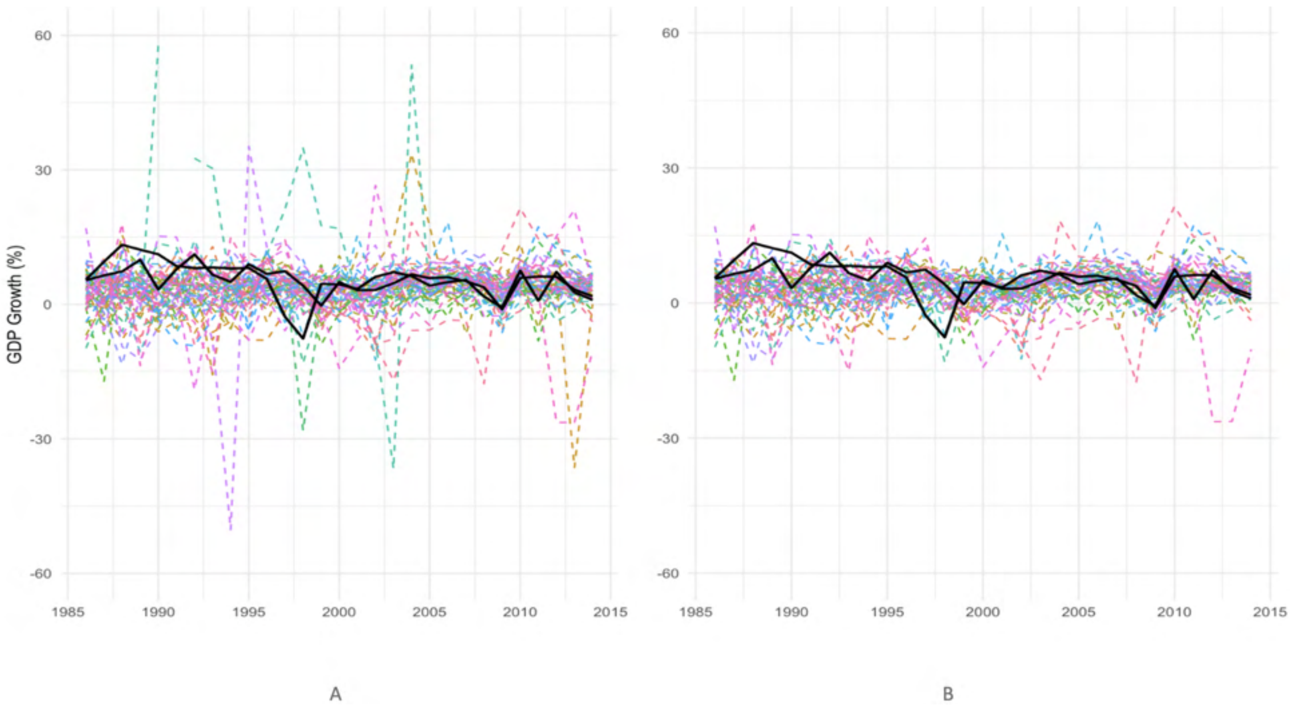

Figure 4: GDP Growth (%) by Countries 1985-2014
Black lines are treated units; colored lines are untreated units.

No significant post-treatment shocks related to export diversification occurred within the control group. If present, the synthetic counterfactual would experience changes in export complexity that are not present in Chile or Thailand, rendering the unbalanced EDI comparison for causal inference. Shocks of various kinds can be indicated by changes in growth rates (Abere and Akinbobola 2020; Leepipatpiboon, Castrovillari, and Mineyama 2023) and growth variations correlate with export complexity (Giri, Quayyum, and Yin 2019). Thus, a straightforward method to verify the control-group-only shocks is to observe if GDP growth in the control units exhibited unusual patterns compared to the treated groups. Figure 4 presents a comparison of the growth trends between the treated units (thick lines) and the untreated units (colored dashed lines)[7]. The fluctuations in countries with pro-AI policies align with those in countries without such measures, despite a few instances of large fluctuations (Figure 4A). Upon further examination, the highly fluctuating countries contributed minimally to the weighted synthetic counterfactuals (weights $< 10^{-8}$) and, hence, have little impact on causal inferences. When these countries are excluded, as shown in Figure 4B, it becomes clearer that the treated units experienced similar variations in GDP growth during the post-treatment periods. Therefore, there were no significant post-treatment shocks that occurred only in the countries without the pro-AI policies.

[7]The corresponding countries represented by the colored lines are listed in Appendix 2.

6.2 AI Spillovers

Spillover effects are insignificant. If presented, the comparison would be between countries with the policies and those without, yet still experiencing similar effects on export complexity. Consequently, spillovers would lead to underestimations of the pro-AI policies' effects. For examinations, I employ multiple linear regressions (MLR) to test the significance of EDI changes in the control group. The MLR could assess differences in the pre- and post-treatment EDI while controlling for covariates. In practice, I create a dummy variable (*group*) to differentiate between the pre- ($group = 0$) and post-treatment ($group = 1$) periods. A significant coefficient for this variable would suggest that countries without pro-AI policies experienced a significant increase in export complexity as Chile or Thailand began to implement AI development strategies. The results, presented in Table 2, indicate that the coefficients of the group dummies are insignificant at the 5% significance level. This finding implies that the control units did not experience significant spillovers in export complexity after Chile and Thailand started to support their AI development.

Table 2. Significance Test of the Pro-AI Policies' Spillover Effects

	(1)	**(2)**
Spillovers from...	Chile	Thailand
Pre-/Post-Treatment	0.0790	0.00663
EDI Differences	(0.0423)	(0.0407)

*Significance Code: *** (p-value<0.001); ** (p-value<0.01); * (p-value<0.05).*
Standard errors are shown in the brackets

6.3 Reverse Causality

Reverse causality is unlikely. If exists, the increase in export complexity would not be driven by pro-AI policies, making relevant policy assessments problematic. To address the concern, I plotted the EDI for two treated units and observed whether there had been significant declines before these countries implemented AI strategies (Figure 5). If the EDI dropped to a low level, it may suggest that the treated units experienced export diversification, leading to concerns about whether the economic repercussions of the export diversity contributed to pro-AI measures. In Thailand, no prominent export diversification occurred before the state started to support AI development. In Chile, although there was a temporal sharp decline in EDI in the late 70s, the index remained high on the 6.5 scale, implying relatively strong export concentrations. Therefore, it is unlikely that significant reverse causality exists, whereby previous export diversification, along with its economic benefits, fostered the pro-AI policies.

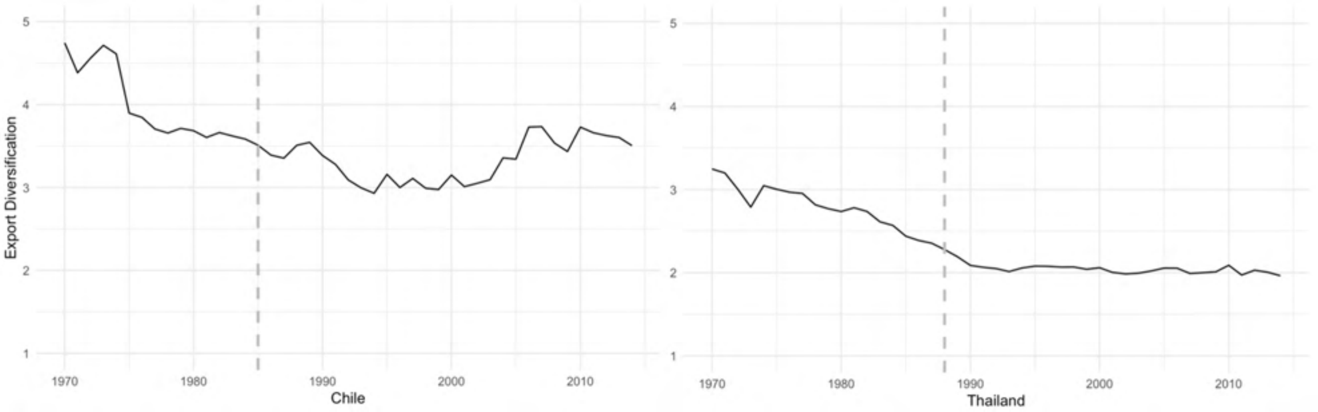

Figure 5: Trends in Export Diversification Index (EDI) in the Treated Units
Dashed lines represent treatment years.

6.4 Limitation

While the previous robustness checks mitigate concerns regarding the use of the SCM, the data in this study present a limitation. Due to the availability of the EDI data, the study period ends in 2014. Although the 45-year timeframe offers substantial historical data for robust causal inference, the growth rate of AI after 2014 is significantly faster than that observed before 2014 (Kiela 2023). Consequently, the same measures of state support for AI development may yield more rapid export diversification. Currently, the EDI is calculated with different formulas before and after 2014. Future research should consider standardizing the calculation to enable statistical analyses that better capture recent trends in how pro-AI policies are influencing export complexity.

Despite the data limitation, the causal effects identified in this analysis are robust and they should enhance confidence in the pro-AI policies' export diversifying potential. The slower pace of AI growth in the past still led to successful diversification in Chile and Thailand. Therefore, it is reasonable to anticipate that similar policies could have even greater diversifying effects in today's developing world.

7 Academic Contributions

The findings and robustness check suggest that state support for AI in Thailand and Chile has, at least during certain periods, significantly increased export diversity. Such promise of pro-AI policies is generalizable to the Global South because 1) Chile and Thailand were similar to most developing countries before policy implementations (Hussey 1993; Spilimbergo 2002) and 2) most periphery economies today possess the capacity to support AI development (e.g., Kshetri 2020). Thus, the study could answer the research question that state-supported AI advancement can diversify exports in developing countries.

As the topic remains underexplored, and previous analyses remain empirically unsound, the study enriches the academic understanding of pro-AI policies' contributions to export diversification. Moreover, the conclusion helps resolve the diversification puzzle surrounding pro-AI strategies. Specifically, the cases of Thailand and Chile align with Mishra et al. (2023)

proposed diversification mechanisms. When successfully implemented, the state support of AI development could lead to a progressive expansion into high-tech sectors (e.g. electronics industry in Thailand), or conservatively build linkages from existing low-tech sectors to high-tech counterparts (e.g. copper mining to manufacturing in Chile). Moreover, policy-led diversification can address the concerns raised by Alonso et al. (2022) regarding the effectiveness of pro-AI policies in developing countries.

First, R&D limitations exist but remain insignificant. Thailand's use of NLP and robotics in the medical device industry (Kawtrakul and Praneetpolgrang 2014) and Chile's use of analytical algorithms in copper manufacturing (Atkinson and Solar 2009) demonstrate that initial data deficiencies do not constrain the merits of these technologies. Instead, the practical way to enrich the database, as well as other R&D resources, is to use the technology rather than avoid it. Second, both countries have used automation technologies in the new export sectors (Kawtrakul and Praneetpolgrang 2014; Atkinson and Solar 2009), where labor costs are low (Hussey 1993; Campero 2004). Therefore, the evidence mitigates the concern that developing countries lack incentives to apply AI in production. Notably, while the skeptic views human labor and AI as substitutes, they can be complements. Algorithms and machines, instead of replacing labor, could assist labor and can help new export firms overcome industrial challenges (Acemoglu and Restrepo 2019), thereby attracting more incentives for application. Alonso et al.'s concern should thus not be a hindrance to pro-AI policies in developing countries.

In summary, this research advances the academic understanding of the relationship between state support for AI development and export diversity, broadening the literature volume in this understudied field. It reconciles the academic debate on the export implications of pro-AI policies. The study also confirms of economic benefits of such policies (Mishra et al. 2023) while mitigating the concerns about the contextual challenges in the developing countries (Alonso et al. 2022). Consequently, the study establishes a robust empirical basis for advocating state support for AI across a broader spectrum of developing countries. Regarding the theoretical framework, the empirical analysis affirms the role of pro-AI policies in supporting the solution of financial-industrial dependence. In line with the dependency-solution framework, the next section will discuss the further developmental implications, including how pro-AI policies weaken financial-industrial dependence through export diversification and what policy attributes could facilitate these economic benefits.

8 Towards Financial-Industrial INdependence

The theoretical framework in this study encompasses a problem (dependency) and a solution (export complexity). While previous analysis demonstrates that pro-AI policy supports export diversification, this section starts to complete the investigation of the theoretical framework by discussing the pro-AI policies' implications on dependency. It first illustrates how the state support of AI development weakens the financial-industrial dependence by diversifying the exports. Since export diversification is a critical first step in reducing dependency, the final subsection will discuss some key attributes of the export-diversifying pro-AI policies. In this way, the discussion provides practical policy recommendations for the rest of the developing countries to overcome the financial-industrial dependence and its associated challenges.

8.1 Reverting Financial-Industrial Dependence to Independence

As elaborated in Section 2, contemporary financial-industrial dependence extends beyond the traditional core-periphery trade relationship: the commodity trade within the periphery also contributes to financial and growth reliance (UNCTAD 2024). Therefore, resolving financial-industrial dependence begins with tackling export specialization in commodity goods.

As a critical first step, pro-AI policies can foster extensive export diversification into higher-skilled industries, thereby reducing the reliance on commodities as a major source of income. For instance, 26 years of pro-AI policy implementation in Thailand facilitated the transformation of its economy from agrarian to industrialized, leading to a reduction in the commodity share of exports to 27% (UNCTAD 2014). Similarly, in Chile, pro-AI measures contributed to a decline in the commodity share of exports from over 60% in the 1980s to 30% in the early 2000s (Álvarez and Lemus 2001; World Bank 2002). Despite a consistent income dependence on exports (World Bank 2023a), the state support of AI advancements reduces the importance of cheap commodities as an income source, increasing income and bridging towards financial-industrial independence

Following weaker commodity dependence, state finance improves, reverting financial-industrial dependence to independence. Both external and internal markets contribute to the improvement in financial autonomy. In international markets, the shift to a higher proportion of high-skilled manufacturing sectors generates higher surpluses. This is because manufactured goods are typically more profitable, with more stable prices in the international markets (Harvey et al. 2017). As a result, the engagement in the trade would accumulate more wealth. For instance, the AI-policy-led export diversification in Chile and Thailand has contributed to consistent trade surpluses, despite occasional small deficits caused by external shocks. In contrast, the trade balance before such policies showed prolonged periods of deficit (World Bank 2023b; World Bank 2023c), limiting the states' ability to finance economic development. In the domestic market, pro-AI policies can strengthen state financial capabilities by increasing tax revenues without sacrificing production incentives. The case of Thailand well illustrates this process. Normally, an increase in taxation implies a discouragement of production, as the producers keep fewer revenues. However, the state support for AI development in Thailand led to the growth of a larger and more robust manufacturing sector, which contributed to higher tax revenues without increasing tax rates. This parallel growth in manufacturing and tax revenues created a virtuous cycle, where the expansion of manufacturing boosted government finances, which were then reinvested to further stimulate economic growth (Patmasiriwat 1995). Therefore, by reducing commodity dependence, pro-AI policies contribute to higher state revenues. The consequential improvement in the state's financial capabilities transform financial-industrial dependence to autonomy.

In effect, the decline of dependency stabilizes income growth. Specifically, the improvement in economic independence facilitates the accumulation of domestic capital that was later used to finance development projects (Phongpaichit 1996; Hurtado 2006). Based on stronger financial autonomy, Thailand had progressed from a lower-middle-income to an upper-middle-income country, becoming the 22nd largest economy in the world (Asian Development Bank 2015). Likewise, coordinated development policies in Chile since the 1990s contributed to an unprecedented economic expansion, with an average annual growth rate of 6.5% (Aninat 2000). While multiple factors contributed to the growth successes in Thailand and Chile, pro-AI policies played a crucial role by contributing to financial-industrial independence.

Given the implications of pro-AI policies for financial-industrial independence, it is advisable for developing countries to incorporate technological growth into their development strategies. Currently, most developing countries are both export- and commodity-dependent (UNDP 2010; UNCTAD 2022a; World Bank 2023a). These economies' income often relies on the sale of large volumes of commodities, which are typically low in value and subject to price volatility (UNCTAD 2023). By adopting pro-AI policies, these countries could potentially upgrade their production structures to include the manufacturing of higher value-added goods. Such a shift away from commodity dependence would reduce financial reliance on foreign consumption, thereby enhancing the economic capabilities to support structural transformation and development. Since export diversification is the first step of this transition, the final subsection will explore the specific characteristics of pro-AI policies that could effectively diversify exports.

8.2 The Export-Diversifying Pro-AI Policies

While the previous analysis reveals the potential of AI policies in alleviating financial-industrial dependence, the periphery economies should recognize that the mere support of AI R&D is insufficient. Instead, the policies should parallel with proper management. The following subsection will review the case-specific experience in Thailand and Chile and extract the properties that form the export-diversifying pro-AI policies.

First, pro-AI policies should not only encourage technological progress but align advancement with the development agenda. One unique measure seen in the case of Thailand is the government directly designing the goals of national AI research. This directive role potentially avoids using policies to support AI technologies with limited practical values. Today, a continual challenge in AI R&D is the imbalances between theoretical and applied research. Färber and Tampakis (2024) have criticized that many research projects in AI have limited practical values, competing purely for academic publications. Such imbalance demonstrates that without state governance, research institutions tend to place more importance on publications rather than applications. The Thai government's previous role in designing the research goals, on the other hand, effectively aligned the technological expertise with the export-led growth strategies (Kawtrakul and Praneetpolgrang 2014). As a result, the AI policies directly supported the export expansion to high-tech industries, contributing to a continual high growth rate after the 80s. Therefore, the case of Thailand illustrates the need for a proactive role of states in aligning the research with the development agenda, as a component of pro-AI policies.

Critics may argue that the state intervention could potentially distort the researchers' incentives for innovation. Specifically, the state's intervention in AI research sacrifices the academic ambitions of the researchers and harms the academia's long-term motivations to contribute to the economy (Wang 2018). However, state intervention in AI research does not necessarily exclude the consideration of publications. As Kawtrakul and Praneetpolgrang (2014) specified, the Thai government's research goal designs considered both publication incentives and economic implications. As a result, NLP and machine learning were prioritized for the publications and their potential to apply in new profitable machinery and electronics industries. Indeed, the authoritative state intervention in the research could diminish the vitality of academia in terms of their economic contributions. Nevertheless, more comprehensive state-designed research, as shown in the case of Thailand, could motivate academia while fueling economic development.

Second, pro-AI policies should extend to supporting export firms that apply AI technologies. One reason for the temporary export diversification in Chile was the limited staying power of new manufacturing firms. Sustained export diversification, along with broader developmental benefits, is more likely when new export firms can firmly establish themselves in international markets. Without this staying power, exports could potentially revert to a concentration in commodity goods (Álvarez 2004). During the diversification period, the state support for new export firms in Chile was insufficient to bolster their international competitiveness (Hurtado 2006). Therefore, to sustain export diversification, pro-AI policies should include targeted support for enterprises integrating AI into their production processes. A critical element of staying power is increasing market relevance (Vermeulen 2016). Achieving this requires more than just financial support; it also demands the provision of essential consulting services. These services could help firms understand international market demands and guide them in establishing their relevance when competing globally (Kumar and Singh 2023). By supporting AI-using firms in conjunction with broader support of AI advancements, the state can enhance the competitiveness of these new companies, thereby sustaining export diversification trends over the long term.

Some may worry about the potential inefficiencies of the firm support measures. For instance, O'Neill (2010) argues that relevant support can distort market efficiency by incentivizing businesses to focus on subsidized areas rather than addressing the actual needs of the economy. However, these concerns primarily target the monetary aspect and often fail to consider the full scope of support policies. Beyond financial assistance, export firm support programs typically include technical assistance, such as consulting, mentoring, and training. According to Kumar and Singh (2023), the combination of various forms of assistance positively impacts the competitiveness and growth of startups. While the monetary assistance might distort market incentives to some extent, the overall performance of firms receiving technical assistance from the state suggests that this distortion is minimal. Therefore, to sustain export diversification, pro-AI policies could incorporate support – particularly consulting services – for AI-using export firms to build their long-term competitiveness in global markets.

Finally, state support for AI development should include the improvement of the education system. In both Chile and Thailand, higher education played an important role in promoting AI applications and export diversification. In Thailand, universities collaborated with government-led research projects to integrate AI into the economy (Kawtrakul and Praneetpolgrang 2014). Similarly, in Chile, applied AI research conducted in universities facilitated the development of new copper manufacturing and chemical industries (Atkinson and Solar 2009). Therefore, higher education institutions serve as essential infrastructure for export-diversifying pro-AI policies. For developing countries aiming to implement their own AI strategies, it is vital to prioritize the education system to support both technological strategies and their economic applications. Based on this infrastructure foundation, the next stages of pro-AI policy should include state interventions that channel AI research into practical fields and support AI-using startups to upgrade and diversify exports. By doing so, other developing countries can harness the pro-AI policies to reduce economic dependency and achieve stable income growth.

To this point, the study completes its investigations under the dependency-solution framework. Within this theoretical framework, the analysis shows that state support of AI is a viable instrument of export diversification, which ultimately resolves the problem of financial-industrial dependence. Moreover, the study offers practical recommendations for developing countries to implement pro-AI policies effectively. These include proactive state alignment of AI development with economic objectives, comprehensive support for AI-using firms, and improvement in education systems. Notably, the emphasis on these three critical components – state governance, business competitiveness, and education – is already evident in AI advancement plans across the developing world (African Union 2024; Muschett and Opp 2024). It is therefore reasonable to expect a wider range of periphery economies to expand their export complexity and get rid of the financial-industrial dependence by harnessing export-diversifying pro-AI policies.

9 Conclusion

This paper argues that state support of AI development could be an effective instrument in export diversification in developing countries, which ultimately weakens the development dependency. The study positions itself within the dependency theory, an explanation of developing countries' long-standing growth instability. Specifically, the dual financial-industrial dependence on developed and developing importers limits economic autonomy and results in fluctuating income growth (Dos Santos 1970; Kvangraven 2023). Drawing on the rising popularity of national AI initiatives in the Global South (Demaidi 2023), this study investigates whether such pro-AI policies could increase export diversity to weaken financial-industrial dependence. To ensure generalizability, the research chooses Chile and Thailand as two early adopters of pro-AI policies that share much of similarities with other developing countries (Hussey 1993; Spilimbergo 2002). The synthetic control analysis found that the state support of AI development had significant causal effects on export diversification. In Thailand, state intervention in national AI research projects aligned technological growth with the goal of export-led growth, facilitating progressive export diversification into the AI product markets (Kawtrakul and Praneetpolgrang 2014). In Chile, state support for AI research promoted applied AI technologies in industrial productions, building forward linkages from low-value-added mining sectors to more profitable manufacturing of minerals (Atkinson and Solar 2009; Gutiérrez, Paz, and Vite 2022). As a result, pro-AI policies in both countries diversified exports, decreased commodity dependence, and strengthened financial-industrial independence, ultimately stabilizing income growth (Aninat 2000; Asian Development Bank 2015). Given the similarities between these two countries and the rest of the developing world when they adopted the pro-AI policies (Hussey 1993; Spilimbergo 2002), the Global South could use national AI development strategies to resolve the growth challenges associated with commodity dependence and financial dependency.

Primarily, the findings reconcile the academic debate on the export effects of pro-AI policies in developing countries (Alonso et al. 2022 vs. Mishra et al. 2023). It mitigates the concerns that developing countries may lack the application incentives and R&D foundations to maximize the effectiveness of the state-led AI development. Moreover, this study contributes to a relatively understudied yet important area: the pro-AI policies' impact on export diversification. It offers nuanced perspectives on addressing truncated growth by leveraging emerging technologies and demonstrating the associated benefits. Since most developing countries now have the infrastructure basis to develop AI (Kshetri 2020; Arfanuzzaman 2021; Torres and Montoya 2024), pro-AI policies are worth pursuing. Importantly, the experiences of Chile and Thailand offer several policy lessons: 1) Governments should take an active role and align AI advancement with the national economic development agenda to guarantee the technology's practical values (Kawtrakul and Praneetpolgrang 2014); 2) Pro-AI policies should include support for export firms applying relevant technologies to sustain long-term export diversification (Álvarez 2004); 3) Education systems are crucial to ensure sufficient research capabilities that contribute to technological growth under pro-AI policies (Atkinson and Solar 2009; Kawtrakul and Praneetpolgrang 2014). Today, these three elements are increasingly evident across different developing countries' AI development strategies (African Union 2024; Harvey et al. 2017). Thus, it is reasonable to expect more developing countries could seize the opportunities from AI development to overcome the persistent financial-industrial dependence.

Looking forward, the pro-AI policies not only contribute to economic development in peripheral countries but also provide supportive evidence for a paradigm shift away from the neoliberal doctrine of free markets, which Joseph Stiglitz (2024) describes as a forty-year experiment of failure. The case studies of Chile's and Thailand's support of AI R&D offer a state-intervention perspective on the growth miracle in the two countries, contrary to the neoliberal prescriptions (Lebdioui 2019). Meanwhile, the discussion of the export-diversifying policies reflected the interplay between state interventionism (Hurtado 2006; Kawtrakul and Praneetpolgrang 2014) and neoliberalism (Wang 2018; O'Neill 2010). Technological progress does not automatically translate into prosperity but depends on how it is directed. Without the Thai government's intervention in national research, AI development might prosper without creating economic benefits for the public (Färber and Tampakis 2024). Meanwhile, insufficient state support for export firms in Chile resulted in unsustainable export diversification, limiting the growth benefits from mitigating financial-industrial dependence (Álvarez 2004). These examples illustrate that neoliberal economic practices are insufficient to support tech-led growth in the periphery. In contrast, state interventions, like the pro-AI policies in Thailand and Chile, as well as similar strategies in the rest of the developing world, show promise in achieving technological growth that addresses long-standing growth challenges from economic dependency. This ideology shift away from the doctrine of minimal state intervention may mark the beginning of not only more harmonious global tech-led growth but also an era of new economic practices that revert global economic divergence towards convergence.

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11 Appendices

11.1 Appendix.1: Examinations of the Control Group

No control group countries had AI development policies during the study period. The inclusion of countries with such policies in the control group could result in an underestimation of the causal effects. However, it would be challenging to examine the policies for each of the 60 untreated units in the datasets. Moreover, it would be unnecessary to check the poor economies that had limited economic foundations to adopt AI strategies and/or economies that contribute little to the synthetic counterfactuals (with weights less than 10^{-7}). Therefore, a convenient and effective approach is to examine whether there were AI policies in control units that were fast-growing economies in the 80s (United Nations 1987) and/or significant contributors to the synthetic counterfactuals during the period from 1970 to 2014. These countries include Argentina, Gabon, Indonesia, Jordan, Malaysia, Mauritius, Mexico, Panama, the Philippines, and Uruguay. No evidence suggests that the governments in these countries adopted AI development strategies during the study period, as shown below.

Categories	**Country (Year of Implementation)**
No recorded state support for AI development	Gabon, Jordan, Panama, Uruguay
With recorded measures outside the study period (later than 2014)	Argentina (2019), Indonesia (2020), Malaysia (2021), Mauritius (2018), Mexico (2018), Philippines (2023)
Source: Malaysian Science and Technology Information Centre (2021) and Observatory (2024) and Philippines National Economic and Development Authority (2024)	

11.2 Appendix 2: Country Illustration for Figure 4

Figure 4 presents colored lines that represent the growth trend in the control units. This illustration presents the corresponding countries for Figures 4A and 4B.

<u>Country List for Figure 4A</u>

Algeria	Ghana	Oman
Argentina	Guatemala	Panama
Bahrain	Guinea-Bissau	Paraguay
Benin	Guyana	Peru
Burkina Faso	Honduras	Philippines
Burundi	Indonesia	Rwanda
Cameroon	Iran, Islamic Rep.	Saudi Arabia
Central African Republic	Iraq	Senegal
Chad	Jamaica	Seychelles
Colombia	Jordan	Sierra Leone
Comoros	Kenya	Solomon Islands
Congo, Rep.	Madagascar	Sri Lanka
Cote d'Ivoire	Malaysia	Syrian Arab Republic
Dominican Republic	Mali	Togo
Ecuador	Mauritania	Tunisia
Egypt, Arab Rep.	Mauritius	Uganda
El Salvador	Mexico	Uruguay
Fiji	Mongolia	Venezuela, RB
Gabon	Morocco	Zimbabwe
Gambia, The	Niger	

<u>Country List for Figure 4B</u>

Algeria	Ghana	Oman
Argentina	Guatemala	Panama
Bahrain	Guyana	Paraguay
Benin	Honduras	Peru
Burkina Faso	Indonesia	Philippines
Burundi	Iran, Islamic Rep.	Saudi Arabia
Cameroon	Jamaica	Senegal
Colombia	Jordan	Seychelles
Comoros	Kenya	Solomon Islands
Congo, Rep.	Madagascar	Sri Lanka
Cote d'Ivoire	Malaysia	Syrian Arab Republic
Dominican Republic	Mali	Togo
Ecuador	Mauritania	Tunisia
Egypt, Arab Rep.	Mauritius	Uganda
El Salvador	Mexico	Uruguay
Fiji	Mongolia	Venezuela, RB
Gabon	Morocco	Zimbabwe
Gambia, The	Niger	