The developmental state's legacy and corporate carbon emission performance: evidence from Taiwanese firms between 2014 and 2018

Chung-pei Pien, Chia-wei Chao & Kuei-tien Chou

Taylor & Francis
Taylor & Francis Group

RESEARCH ARTICLE

Check for updates

The developmental state's legacy and corporate carbon emission performance: evidence from Taiwanese firms between 2014 and 2018

Chung-pei Pien[a,b], Chia-wei Chao[c] and Kuei-tien Chou[b,d]

[a]International College of Innovation, National Chengchi University, Taipei, Taiwan; [b]Risk Society and Policy Research Center, National Taiwan University, Taipei, Taiwan; [c]The International Degree Program in Climate Change and Sustainable Development, National Taiwan University, Taipei, Taiwan; [d]Research Center for Environmental Changes, Academia Sinica, Taipei, Taiwan

ABSTRACT
Despite international efforts to address human-caused climate change, greenhouse gas emissions continue to rise. However, existing literature often overlooks the role of the state and social actors in exacerbating or mitigating emissions. This study adopts the political-economic embeddedness perspective to argue that the role of the state and social actors cannot be separated in the greenhouse gas economy. Specifically, we explore how the embeddedness within the Taiwanese state and private corporations enables resistance to greenhouse gas reduction policies. Through an analysis of greenhouse gas emissions data and examination of corporate characteristics among major emitters in Taiwan, we find that two key legacies of Taiwan's developmental state period, family-controlled firms and private corporations with more governmental directors, tend to have higher emissions levels. Importantly, these legacies persist even after neo-liberal reforms. This study's findings have implications for developing countries, particularly in Asia, that employ developmental state strategies. It underscores the need for countries to consider the potential negative impacts of state intervention and market dynamics on greenhouse gas emissions.

1. Introduction

The role of greenhouse gas (GHG) emissions in contributing to climate change has been the subject of intensive study for decades. Although international institutions and governments have announced numerous policy interventions to abate these emissions, they continue to rise. According to the Global Carbon Project, GHG emissions grew by 1.5%, 2.1%, and 0.6% in 2017, 2018, and 2019, respectively (Friedlingstein et al., 2019).

The continued growth in GHG emissions tends to undermine international commitments to limit global warming to an increase of 1.5°C. Accordingly, even the target for reducing global warming by 2.0°C above pre-industrial levels is proving to be a challenge (United Nations Environment Programme, 2019). The difficulty of promoting pragmatic climate interventions poses challenges to both prevailing theoretical and practical approaches aimed at understanding barriers to the enactment of climate policy.

The first approach, developmental statism, suggests that market failure primarily exacerbates GHG emissions (Dent, 2017; Gil & Jung, 2009; Kim, 2015). Hence, the state plays a crucial role in overcoming social actors' resistance to general and efficient climate change policies, especially in countries where governments have a history of formulating and implementing macroeconomic planning. For example, developmental statism expects East Asian countries to reform their existing economic plans to align with combating climate change (Arnall, 2018; Kim, 2015).

In contrast, the second approach, corporate environmentalism, promotes the efficiency of private transactions and innovation within the free market economy. This approach integrates the neo-liberalist claim that self-regulating markets create incentives for corporations to distribute common goods efficiently (Andersson et al., 2018). Furthermore, it argues that public regulations imposed by the governments often damage corporations' motives for addressing climate change (Dauvergne & Lister, 2012).

In recent years, a third approach known as neo-developmentalism has emerged. a combination of the aforementioned approaches known as neo-developmentalism has emerged. This approach combines aspects of the previous approaches and posits that collaboration between the state and social actors, especially corporations, can tackle climate change. Neo-developmentalism argues that the establishment of collaborative relationships will promote the recruitment of power actors to participate in the decision-making processes (Biagini & Miller, 2013; Mol, 2007; Mol & Spaargaren, 2002; Wang, Liu, et al., 2017; Zhong et al., 2008). Climate change policies produced under this process should be somewhat easier to implement because they are established when the state and social actors reach a consensus (Abreu et al., 2021; Wang, Liu, et al., 2017). However, the first two approaches tend to overemphasize the capacity of either the state or corporate actors to mitigate climate change, while the third approach assumes the positive effects of collaboration between the state and social actors. None offer an explanation for the

continued rise in GHG emissions, especially after countries have implemented these three approaches separately.

In this paper, we argue that a key weakness of existing theoretical approaches is their failure to appropriately examine relationships among the state and social actors. By drawing upon political and sociological research that emphasizes the embeddedness of the state and society (Granovetter, 1985; Polanyi, 1944/2001), we argue that corporations' political relationships with the state affect their environmental behavior, which includes the release of pollutants, the enactment of corporate social responsibility, and carbon emissions (Grant et al., 2018; Prechel, 2012; Prechel & Zheng, 2011; Scott et al., 2017; Willyard, 2020; Wishart, 2019). This line of research analyzes the state as a complex organization involving diverse sub-units. In order to promote their agendas and aims, these sub-units forge political coalitions with each other and with social actors. These coalitions allow social actors to influence decision-making processes and environmental regulations. Additionally, following Perrow's argument that organizations are the 'most intensive and effective environmental destroyers', (Perrow, 1997) we examine these powerful organizations in modern society (Berrone et al., 2010; Cadez et al., 2019; Doda et al., 2016; Grant II et al., 2002; Hassan & Romilly, 2018; Lewis et al., 2014; Post et al., 2011; Stanny, 2013). For example, since corporations have become the most powerful social actors in modern society, scholars have explored factors that affect corporate GHG emissions (Cadez et al., 2019; Doda et al., 2016; Grant & Vasi, 2017; Hassan & Romilly, 2018). Therefore, in this study, our primary objective is to analyze how relationships between the state and corporations influence the latter's GHG emission protocol.

Also, a growing number of studies have investigated corporate-state relationships, together with their environmental behavior (Grant et al., 2018; Prechel, 2012; Prechel & Zheng, 2011; Scott et al., 2017; Sullivan, 2010; Willyard, 2020; Wishart, 2019). However, much of this research has been confined to Western countries, partly because of a lack of environmental and political data regarding non-Western countries. Consequently, it has been difficult to conduct quantitative environmental research on non-Western countries. Therefore, the existing research leaves a gap for conducting further involving the embeddedness of the state and corporate environmental behavior in developing countries. This is especially true considering the fact that those entities appear to conform to the concept of the developmental state in which state intervention in society is pervasive. To fill this gap, we focus on Taiwan, which has a long history of developmental statism, especially from the 1950s till 1980s. We collect facility greenhouse gas emission data released by the Taiwanese government for the years 2014 to 2018. We also access a database of Taiwanese corporations from the Taiwan Economic Journal. While Taiwan has transitioned towards neoliberalism since the 1980s, the Taiwanese government has retained a certain degree of capacity to intervene in the economy. By examining the legacies of the developmental state in Taiwan during the neoliberal era from 2014 to 2018, we can gain a deeper understanding of the roles that both the state and corporations play in determining environmental outcomes. By combining these two sources of data, we applied the methods of political-sociological

research to answer the following question: To what extent does the embeddedness of Taiwanese private corporations within the state influence GHG emissions?

The contributions of this research are as follows. First, we explore empirical evidence for political connections between corporations and the government, and their influence on corporate environmental behavior. Second, Taiwan was a typical developmental state prior to the 1980s. Although the politics of the Taiwanese state have undergone a dramatic shift after democratization during the neo-liberalist period, it maintained several important institutions that intervened in corporate operations. Since many developing countries continue to employ the developmental state strategy, analyzing the case of Taiwan affords key insights into the potential for environmental protection and GHG emissions control in these countries. Third, we examine the influence of political connections between the state and corporations in non-Western countries concerning GHG emissions. Our research provides evidence that different types of political connections are indeed vital.

In the subsequent sections, we first discuss our study's theoretical framework: the political-economic embeddedness perspective. Next, we introduce the data, method and model used in this study. Third, we discuss the results and findings, and we reserve the final section for the conclusion.

2. Theoretical framework: the political-economic embeddedness perspective

To address the shortcomings of existing theoretical approaches, particularly in the context of non-western countries' state-society relationships, we draw from the disciplines of organizational, economic, and political sociology. Our aim is to construct a comprehensive theoretical framework, which we refer to as the political-economic embeddedness perspective. This perspective synthesizes two critical traditions – the embeddedness of social structures approach and path dependency theory – offering a novel framework for evaluating the interactions between the state and social actors.

The initial theoretical tradition informing our perspective is the embeddedness of social structures approach. Over the years, political and economic sociologists have questioned the explanatory power of studies in which social groups are separated (Granovetter, 1985; Polanyi, 1944/2001). These scholars suggest that social structures are embedded and cannot be separated from one another (Polanyi, 1944/2001; Weber, 1968). In line with this theoretical tradition, the embeddedness of social structures approach suggests that the intertwining of corporate-state relations provides a variety of opportunities for social actors to exercise power and define new agendas that align with their interests (Jessop, 1982; Poulantzas, 1973). We incorporate insights from organizational sociology to assert that these pivotal corporate-state relations constitute the state structure (Prechel, 1990).

Accordingly, state structures are important since they possess diverse political-social institutions that influence political-legal arrangements. First, based on organizational sociological research, the state is a complex organization composed of

structures that include diverse departments and sub-units (Pellow, 2016; Prechel, 1990). Thus, when a political agenda emerges, these units establish various coalitions to support or oppose the agenda (Poulantzas, 1973). For example, environmental agencies frequently have conflicts with trade and economic departments (Feiock & Stream, 2001; Lo, 2010).

Second, during policy-decision processes, state structures act as channels that allow social actors both inside and outside the state to exercise power and pursue their interests (Prechel, 2012; Woods & Morris, 2006). Following Weber's argument, state structures are not neutral but provide power groups with access to policy-making processes (Weber, 1968).

Third, state structures are not static; they evolve over time. In modern capitalist societies, periodic crises establish the historical conditions, which tend to encourage social actors' motivation to make changes in state structures. When the existing state structures cannot ensure social actors' interests during various crises, it creates incentives for corporations to mobilize politically to change corporate-state relations (Prechel, 1990, 2012). During the 1970s, ongoing economic crises in Western countries led to the emergence of neo-liberalism, which extolled the merits of self-regulating markets and denounced state inefficiency (Schaeffer, 2009; Turner, 2008). Since neo-liberalism became a dominant driver of state agendas in Western countries, it has provided legitimacy to corporate attempts to mobilize politically, with the aim of establishing new state structures and defining new political-legal arrangements worldwide (Fieldman, 2011; Vaara & Tienar, 2008).

The second theoretical tradition that forms the cornerstone of our perspective is the path dependency theory. This theory is encapsulated in the argument of the political-economic embeddedness perspective that 'history matters'. (Aklin & Urpelainen, 2013; Pierson, 2014) Path dependency theory states that there are 'locked-in' effects of technological and institutional systems (Pierson, 2014; Sydow et al., 2009). Scholars also argue that climate change issues provide prominent examples of path dependence. Cognitive, institutional, technical, and economic systems generate a mutual equilibrium of societal responses to climate change. For example, the transition from fossil-fuel dependency to sustainability confronts diverse obstacles, which include not only enormous transformation costs, but also the resistance of the fossil fuel and transport industries when it comes to change. However, path dependency has been widely criticized as an ambiguous concept that fails to explain why some institutions change and others do not (Capano, 2009; Kay, 2005; Vergne & Durand, 2010).

Our research extends and refines path dependency theory. We argue that technological and policy locked-in effects are derived from political processes. Change or continuity in political-legal institutions is likely to depend on the behavior of social actors. In response to the historical conditions that impact existing political-legal arrangements, social actors pursue change or maintenance of existing institutions in order to maximize their own interests. In brief, the continuity of political-legal arrangements is predicted on social actors' success in mobilizing political influences to transfer the long-term history of state structures and corporate-state relations to adopt new protocols that benefit their interests. These arrangements have accumulated from the previous history of the state and developed into state structures that allow and embrace social actors to affect policies.

In summary, by integrating the embeddedness of social structures approach and path dependency theory, the political-economic embeddedness perspective provides aims to elucidate not only how the channels between the state and corporations influence corporate behavior, but also to examine the historical process that forms these channels. Guided by this perspective, we put forth the following interconnected propositions. Firstly, in the aftermath of the 1980s, the advent of neoliberalism transformed corporate-state dynamics, with historically interventionist states retreating from direct economic involvement in recent decades. Secondly, corporations maintaining long-standing relationships with the state can leverage state structures to resist environmental enforcement. In certain instances, existing state infrastructures provide opportunities and channels for corporations to exert influence, thereby enabling them to circumvent environmental regulations.

3. Hypotheses

We develop two hypotheses based on the political-economic embeddedness perspective to test the extent to which corporate characteristics and political embeddedness within the state affect corporations' greenhouse emissions. The first is the political embeddedness hypothesis, and the second is the family-controlled corporation hypothesis.

3.1 Political embeddedness of corporations

Scholars have demonstrated that Taiwan employed developmental state strategies from the 1950s to the 1980s to promote economic growth (Amsden, 1989; Chu, 2011; Chu & Huang, 1998; Wade, 1990). During this period, the Taiwanese government employed several strategies of intensive state intervention in the economy. First, the ruling party of the Taiwanese government, the Kuomintang, established a party-state system in which the state and party elites not only exercised one-party authoritarian rule but also controlled crucial industries and resources (Amsden, 1979; Chen et al., 1991). In the party-state system, the government stipulated that economic pillars, such as steel, petroleum, water, energy, and finance, were to be nationalized so as to better allocate key materials and capital to the private sectors (Cheng, 1993). For example, the private automobile industry in Taiwan depended on the state-owned steel company and banks to provide rolled steel and loans (Wade, 1990).

Second, the Taiwanese government exploited the sectoral needs of economic development to cultivate strategic industries (Chu, 2017). Hence, by using diverse instruments, such as introducing foreign technologies, providing low-interest loans, investing in shares, and implementing import substitutions, the Taiwanese government succeeded in building several industries from scratch (Amsden, 1979; Wade, 1990).

A notable example was the development of the Taiwanese semiconductor industry. In the late 1970s, Taiwan's major economic pillars were the labor-intensive textile and

electronics assembly industries, which were responsible for a large proportion of Taiwanese exports. Anticipating a decline in these industries' profits, the Taiwanese government decided to promote a new capital-intensive industry (Chu, 2001; Chu & Huang, 1998). By collaborating with Texas Instruments, the Taiwanese government established a semiconductor workshop in the Industrial Technology Research Institute, which was a state-funded research center with the mission of promoting the application of industrial technology (Chu, 2001; Hsu, 1999). When the workshop finally produced a high-yield semiconductor, the Taiwanese government used state funding, the Development Fund, to invest in new technological corporations and to corporatize the workshop as the Taiwan Semiconductor Manufacturing Company (TSMC) (Pien, 2001). As a result, TSMC's corporate structure was composed of foreign, state, private, and managerial actors on the board of directors and as shareholders (Lin & Hsung, 2018).

Nonetheless, the case of TSMC is not unique. Many firms in Taiwan have followed similar developmental pathways. Wang, Lee and Chen argue that the Taiwanese party-state system's extensive involvement in corporate operations enhanced the state's influence over Taiwanese society. The state employs several mechanisms, including the Development Fund, state-owned banks, and public pension funds to hold shares in such operations and assign governmental directors to private corporations (Wang, Lee, et al., 2017). This placed the state in a pivotal position to collect corporate information and influence corporate decisions. Wade also suggests that the Taiwanese government's instruments for controlling corporations even allow the state to govern the market (Wade, 1990).

However, the state economic power of the Kuomintang authoritarian regime was impacted by two interrelated challenges in the 1980s. These were related to the nascent democratic movement and neo-liberalism (Chu, 2007; Wong, 2016). Although the developmental state strategy succeeded in promoting dramatic economic growth, it also produced social problems, such as the restriction of political participation, environmental pollution, and social inequality. These problems spurred the democratic, labor, and environmental movements in the 1980s (Chen, 2011), which claimed that the Kuomintang's monopoly over political and economic systems caused these social problems (Chen et al., 1991). By incorporating the neo-liberalist claim that government and state-owned firms were inefficient, the Taiwanese democratic movement collaborated with private and foreign corporations to advocate for the privatization of Taiwanese state-owned firms, along with the withdrawal of government influence (Chen et al., 1991; Chu, 2011). These challenges threatened the Kuomintang regime to offer general economic plans, causing legitimate risks to the regime (Lee & Lin, 2017; Wang, Lee, et al., 2017).

In response to these risks, the Kuomintang regime decided to reform decision-making processes to include private corporate leaders. In the mid-1980s, the Kuomintang government established 'the Economic Reformation Committee' and 'the Industrial Counseling Committee'. Private corporate leaders who served on these committees played a key role in promoting ideas which eventually became economic policies, including liberalization and internationalization. Wang argues that while private corporate leaders could only employ lobbying, petitions, or personal relationships to influence policies before the 1980s, the two committees enabled them to directly participate in state decision-making processes (Wang, 1995). This change in the Taiwanese state after the 1980s enabled private corporations to exploit these new state structures to influence policies. Lee demonstrates that corporate political contributions to legislators enhanced their political influence (Lee, 2016). Chu argues that after the 1980s, corporations acquired the power to promote policies that benefited their interests (Chu, 2011). For example, the Taiwanese government followed the aforementioned two committees' recommendations to privatize state-owned enterprises (SOEs) in the late 1980s. Private corporations used their influence within the administration to ensure that SOEs were indeed privatized (Chang, 2002). Hsu and Hsu record that land developer groups also promoted several urban regeneration policies post-1980s. These policies changed the role of the state in urban renewal, shifting it from a wholly state-funded model prior to the 1980s to a public-private partnership (PPP) in subsequent years (Hsu & Hsu, 2013).

Although the change in the state structures of Taiwan after the 1980s was dramatic, some state-controlled structures remained. First, post-democratization labor movements resisted privatization. Accordingly, while SOEs were responsible for allocating public goods, such as telecommunication, petrochemicals, electric power, water, and so on, unions and labor groups conducted political campaigns urging the government to maintain controls over SOEs (Chang, 2002; Lee, 2008; Liu, 2012). These campaigns posed challenges to the privatization processes; however, they only succeeded in blocking a few cases of privatization. Nevertheless, the government bowed to pressure to maintain some shares within these privatized SOEs and retained the right to assign governmental directors to boards (Sue, 2008).

Second, since neo-liberal advocates urged the Taiwanese government to open up domestic markets, private Taiwanese corporations faced severe international competition (Wang, Lee, et al., 2017). These corporations mobilized politically to lobby the government to continue providing capital and technological support. For example, when the Development Fund was due to expire in 1990, private corporations mobilized politically to continue the fund as a means of providing technological upgrades for industries (Hsu, 1999; Hsu & Hsu, 2013; Wang, Lee, et al., 2017). As a result, many private corporations did not disconnect the relationships with the state, maintained governmental shares, and had directors on corporate boards to garner further financial and technological supports.

Based on the political-economic embeddedness perspective, it seems that governmental directors in Taiwanese private corporations do not play a large role in monitoring corporate behavior. Rather, they provide a channel through which corporations pursue their own self-interest. During the period of neo-liberalism period, private sectors have been given the legitimacy to downscale the government's intervention and exercise their power to influence policy-making processes as well as policy implementation.

The political-economic embeddedness perspective also suggests that the state is a complex organization. Different departments have their own responsibilities and agendas,

and they have different ties to a diverse set of social actors. Unsurprisingly, departments responsible for economic development may also conflict with environmental authorities (Pellow, 2016; Prechel, 1990). In Taiwan, the government passed the Greenhouse Gas Reduction and Management Act in 2015 (Chou, 2018; Lin et al., 2018), which stipulated that corporations with high carbon emissions must report their annual GHG emissions. The Taiwanese Environmental Protection Administration (TEPA) attempted to implement the act to reduce these corporations' GHG emissions. However, many directors of large carbon emitters are assigned by developmental funds, pension funds, and state-owned banks controlled by economy-related government departments. Based on the political-economic embeddedness perspective, these governmental directors are channels for corporations and government economic departments to pursue common interests. Therefore, we suggest the following hypothesis:

> H1: Corporations with a higher number of governmental directors on the boards are more likely to maintain high levels of GHG emissions.

3.2 Family-controlled corporations

After China ceded control of Taiwan to Japan in 1895, family-controlled firms provided an important means for Taiwanese entrepreneurs to resist the Japanese colonial monopoly (Lee, 2007). After World War II, the relationship between the Taiwanese state and family-controlled firms became one of typical clientelism. The Kuomintang government placed families with close ties to the regime in key positions in crucial industries (Lee, 2017). For example, the Yan family owned a large textile firm in Shanghai, China, and maintained close ties to the Kuomintang elites. After the Yan family fled to Taiwan with the Kuomintang, the latter not only allowed them to reestablish their textile factories, but also authorized the family to build the only automobile factory in Taiwan (Hsu, 2013). Many other families also gained huge resources and benefits from the government based on their clientelistic relationships with the Kuomintang (Chu, 2017; Lee, 2017).

Prior to the 1980s, the extent of the relationships with the Kuomintang ensured family corporations' survival and granted them the privilege of operating regulated industries. As a result, despite the existence of SOEs, most large firms in Taiwan remained family-controlled up until the 1980s (Chung & Chan, 2017; Lee, 2017).

More importantly, family-controlled corporations actually increased in power after the Taiwanese government began the withdrawal of state intervention in the economy in the late 1980s. First, family-controlled corporations became the biggest winners of the privatization process. When the government instituted neo-liberal deregulations, family-controlled corporations with more extensive resources and more governmental relationships seized the opportunity to garner more access to regulated industries (Chu, 2011, 2017; Chung & Chan, 2017). For example, the Wang family, supported by the Kuomintang government, established plastic and chemical fiber plants in the 1950s. The raw materials of Wang's plants were supplied by naphtha cracking plants, which were monopolized by CPC the Corporation, a state-owned corporation. Nonetheless, in the late 1980s, the Wang family succeeded in obtaining permission from the Taiwanese government to establish its own naphtha cracking plant (Chu & Huang, 1998). After the 1980s, other state-controlled industries, such as financial services, telecommunication, petroleum, transportation, and the media also fell under the control of various elite and influential families (Chung & Chan, 2017).

The increased power of family-controlled enterprises was accompanied by a parallel decline in governmental policy-making initiatives. Hence, family-controlled corporations mobilized politically to pass several policies which benefited their interests. There were two crucial policies that determined family-controlled corporations' expansion. The first policy involved amendments to the Company Act in 1980 and 1990. These two amendments reduced the size of the board of directors and relaxed limitations on investments. Obviously, the small board made it difficult to elect minority shareholders as directors. As a result, family relatives were able to gather shareholder support to become majority directors, thereby acquiring a controlling interest in these corporations.

Before relaxing the investment rules, a corporation's investments in other companies could not exceed 40% of its own paid-up capital. The amendment allowed unlimited investments in other companies (only by consent) at shareholders' meetings. This amendment was important because it provided a legal means for corporations to invest in state-controlled industries (Chung & Chan, 2017; Lee, 2009).

The second policy change came with amendments to the Income Tax Act and Estate and Gift Tax Act. These two amendments allowed firms to donate assets worth up to 10% of their annual incomes to non-profit foundations as as to gain tax deductions. This provision allowed family-controlled corporations to transfer equity stakes controlled by family members to foundations. Such direct or indirect holdings in group firms may allow a foundation to become the ultimate owner of a corporate group (Chung & Chan, 2017; Chung & Yeh, 2010). For example, the Wang family established three foundations to hold eight investment companies, which in turn control two public corporations: VIA Technologies and HTC corporation (Yao, 2016). One of the largest financial holding companies in Taiwan, Cathay Financial Holdings, is controlled by three foundations of the Tsai family (Chung & Chan, 2017).

According to the political-economic embeddedness perspective, this study posits that corporations with long-term relationships with the state are able to create the political-legal arrangements of the neo-liberal era in a manner that benefit their interests and generally resist environmental regulations. Specifically, we argue that numerous Taiwanese family-controlled corporations, having established close relationships with the state following World War II, played a crucial role in shaping the political-legal arrangements of the neo-liberal period. Several arrangements have been established to create opportunities for all family-controlled corporations that are more inclined to oppose environmental regulations. First, existing channels with the state have enlarged the influence of family-controlled corporations over decision-making processes and policy practices. Second, family-controlled groups have established corporate structures that enlarged

the size of corporations and spread their activities into more areas within the economy. And finally, families have engineered the use of foundations as ultimate corporate owners to allow the direct or indirect control of subsidiaries through ownership chains. The use of foundations in this way has erected a liability firewall for ultimate owners because it creates organizational distance between those owners and polluting facilities (Prechel & Zheng, 2011).

Drawing from the above arguments, our analysis reveals two sets of interaction effects: 1) between family-controlled corporations and close ties to the state, and 2) between foundation ownership and close ties to the state. The closeness of these ties can be quantified by the proportion of governmental directors on their boards. These interaction effects contribute to the resistance of policies aimed at reducing carbon emissions. Therefore, we suggest the following hypotheses:

> H2.1: Family-controlled corporations are likely to have higher GHG emissions.
>
> H2.2: The positive relationship between corporations' GHG emissions and the proportion of governmental directors on their boards is strengthened in the context of family-controlled corporations.
>
> H2.3: The positive relationship between corporations' GHG emissions and the proportion of governmental directors on their boards is stronger when there is a higher proportion of foundation-based directors on their boards.

4. Data and models

4.1 Data and driving variables

In order to examine the hypotheses, we established above, this research utilizes the following measures and data sources. The definitions and sources of the variables are also depicted in Table 1.

Dependent variable (GHG Density)[1]: We apply the density of GHG emissions as the dependent variable, after which we calculate GHG density by dividing GHG emissions of each firm by the annual revenues. Following the Greenhouse Gas Reporting Program of the USA, TEPA announced in 2013 that facilities in five industries[2] with GHG emissions greater than 25,000 metric tons per year would be required to report those emissions (Chang, 2016). Following the audit, around every April, TEPA releases the GHG emissions data of the facilities for the year before last. This data is made available for public download on TEPA's Environmental Information Open Platform[3]. To date, there are approximately 430 facilities on the reporting list annually. Because many facilities are subsidiaries of firms, we refer to the corporate group database of the Taiwan Economic Journal to identify the owners of these facilities in the stock market of Taiwan.

Furthermore, this study excludes the dataset from power plants. Since non-energy sector facilities utilize electrical energy produced by power plants, the former's GHG emissions are calculated based on their usage of this electrical energy. Including the GHG emissions from power plants would result in double-counting. Therefore, we have omitted the GHG emission records of power plants from our analysis. We then calculate the total GHG emissions of each firm and divide this figure into its annual revenues. Moreover, to examine the state's influence on private corporations, government-controlled firms (as classified by the Taiwan Economic Journal) are removed from our observations. This filtering process leaves around 140 annual firm-level observations of GHG emissions to be analyzed. Finally, to eliminate the impact of Covid-19 on industries, we collect data from the years 2014–2018.

4.1.1. Independent variables

1. The ratio of governmental and foundation directors (Gov. Dir. Ratio and Foundation Dir. Ratio)

The ratio of governmental and foundation directors is calculated by dividing the number of governmental and foundation directors sitting on the board of each firm by the total number of directors. The data on these governmental and foundation directors are retrieved from the Taiwan Economic Journal.

1. The ownership structure of corporations (Family-controlled)

The Taiwan Economic Journal uses family, professional managers, mixed (family and professional managers), and the government as corporate control categories. Because family-controlled firms are our primary objects of investigation, we establish ownership as a dummy variable (family-controlled firms are scored as 1, while all other ownership types are scored as 0).

Table 1. Description variables.

Variable	Definition
GHG Density*	The density of GHG emissions is calculated by dividing the GHG emissions of each firm by their annual revenues
Gov. Dir. Ratio	The ratio of governmental directors sitting on the board of each firm
Family-controlled	The dummy equals one if family members are de facto controllers of the firm and zero otherwise
Manager-controlled	The dummy equals one if professional managers are de facto controllers of the firm and zero otherwise
Mix-controlled	The dummy equals one if both family and professional managers professional managers are controllers of the firm and zero otherwise
Foundation Dir. Ratio	The ratio of the foundation directors sitting on the board of each firm
Dir. Shareholding Ratio	The ratio of the number of shares held by company directors to the total number of company shares
Dir. Compensation (log)	Log of directors' compensation (NT dollars)
Profit after Tax	The earnings of a firm after taxes are deducted
Asset(log)	Log of the firm's assets
Debt Ratio	The ratio of debt of the firm to the assets
R&D	The research and development ratio is measured by dividing the operating income by the research and development expenses
Gov. Share	The ratio of the number of shares held by governments to the total number of company shares
Revenue Growth Rate	The annual percentage change in revenue
Age	Company age

*Data source is TEPA; Others are the Taiwan Economic Journal.

4.1.2. Control variables

Several other variables that may have affected GHG emissions are selected as control variables, and their data are obtained from the Taiwan Economic Journal. We present the important control variables below.

Director-shareholding ratio (Dir. Shareholding Ratio): Research suggests that director ownership affects these individuals' willingness to practice social responsibility. Barnea and Rubin demonstrate that because directors' company shareholdings are linked to their financial compensation, an increase in their proportional ownership will reduce their willingness to engage in corporate social responsibility (CSR) activities (Barnea & Rubin, 2010). This variable is calculated by dividing the number of shares held by company directors by the total number of company shares.

Director compensation (natural log transformed to correct for skewness) (Dir. Compensation): Based on resource dependence theory, the compensation received by directors is associated with corporate environmental behavior. This figure also includes salaries and bonuses received by the directors.

Manager-controlled and mix-controlled corporate types (Manager-controlled and Mix-controlled): It has been argued that manager-controlled firms are less likely to engage in environmental protection because, unlike family-controlled firms, they ignore firm reputation (Berrone et al., 2010). This research employs a dataset on corporate control acquired from the Taiwan Economic Journal. We exclude government-controlled firms from our sample and designate family-controlled firms as our independent variable. The remaining corporate control categories, specifically manager-controlled and mixed-controlled corporations, serve as our control variables. The measure of manager-controlled versus mix-controlled firms is selected as a dummy variable on the corporate control type.

Debt ratio (Debt Ratio): Based on capital dependence theory, indebted firms have financial incentives to ignore environmental protection (Prechel & Zheng, 2011). This co-variable is calculated by dividing the debt of a given firm by its assets.

Research and development ratio (R&D): Firms with substantial research and development investments have higher production efficiency and cause less pollution comparable to companies that invest less in R&D. This variable is measured by dividing research and development expenses by operating income.

 Company age: Population ecologists argue that inertia in older organizations causes them to defer pro-environmental behavior (Hannan & Freeman, 1984).

Company profit (Profit after Tax): Capital dependence theory suggests that the variance of profits in a firm offers its incentives to employ pro-environmental behaviors (Prechel & Zheng, 2011). For example, corporations with lower profits are more likely to pollute (Prechel & Zheng, 2011). We use the profit after tax as our measure of profitability.

In addition to the aforementioned variables, we also account for the following control variables in our analysis: the ratio of governmental shareholding (Gov. Share), total assets (Asset), and the rate of revenue growth (Revenue Growth Rate).

Table 2. Descriptive statistics.

Statistic	N	Mean	St. Dev.	Min	Max
Carbon Density	407	0.03	0.04	0.0001	0.34
Asset(log)	407	17.19	1.58	13.83	21.41
Debt Ratio	407	43.40	18.20	6.16	109.54
Dir. Shareholding Ratio	407	21.78	17.73	2.05	81.61
Dir. Compensation(log)	407	10.29	1.08	6.55	13.55
Foundation Dir. Ratio	407	0.02	0.06	0.00	0.36
CEO Dir. Shareholding Ratio	407	0.07	0.11	0.00	0.60
R&D	407	2.50	4.56	0.00	28.92
Gov. Dir. Ratio	407	0.05	0.08	0.00	0.33
Gov. Share	407	0.76	2.25	0.00	16.76
Profit after Tax	407	4.78	15.94	-133.14	103.14
Revenue Growth Rate	407	3.75	42.89	-57.64	728.57
Age	407	38.97	14.44	6	71
Family-controlled	407	0.72	0.45	0	1
Manager-controlled	407	0.14	0.35	0	1
Mix-controlled	407	0.13	0.34	0	1
HiCarbon	407	0.88	0.32	0	1

The descriptive statistics of the variables and the correlation analysis of the variables are presented in Tables 2 and 3.

4.2 Statistical model

We use an ordinary least squares (OLS) regression model to examine the effects of governmental connection and family control on GHG emissions. The models' calculations include a pooled model and firm-year as the fixed effects (FE) model. Given the relatively short study period from 2014 to 2018, and the challenges posed by minor within-firm variations, we employ fixed-effects models to mitigate potential endogeneity issues and to control for unobserved variables that remain constant over time (Baier & Bergstrand, 2007; Sapkota & Bastola, 2017; Wooldridge, 1995). Additionally, we report the results of both the pooled model and the fixed-effect model to underscore the consistency across all model outcomes. The fixed effects model was defined as:

$$GHG_{it} = \beta_0 + \beta_1 \times GovDir_{it} + \beta_2 \times Family_{it} + \beta_3 \times Z_{it} + \alpha_i + \varepsilon_{it}$$

where i represents firms, t depicts year, GHG_{it} is the greenhouse gas emissions of firm i in year t, and while $GovDir$ depicts the ratio of governmental directors on the board (Gov. Dir. Ratio). *Family* is the family-controlled dummy variable (Family-controlled). Z_{it} represents the matrix of control variables that influences GHG emissions, α_i is the firm fixed-effect in order to control the variables that are difficult to observe and are fixed over time, and ε_{it} represents random error.

In addition. to overcome the lagged effects of independent variables and co-variables, we lag them by one year from the current year GHG emissions. To deal with the heteroskedasticity of variance, this research robustly estimates and reports the regression standard errors.

5. Results

Tables 4 and 5 present the results of five regression models which support the political-economic embeddedness perspective. The ratio of the governmental directors has a positive and

Table 3. Means, standard deviations, and correlations with confidence intervals.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. GHG Density																
2. Asset(log)	−.24** [−.33, −.15]															
3. Debt Ratio	−.12* [−.22, −.03]	−.01 [−.11, .08]														
4. Dir. Shareholding Ratio	.13** [.03, .23]	−.08 [−.18, .02]	−.15** [−.25, −.06]													
5. Dir. Compensation (log)	−.16** [−.25, −.06]	.60** [.54, .66]	−.20** [−.29, −.11]	−.18** [−.27, −.08]												
6. Foundation Dir. Ratio	.20** [.10, .29]	.17** [.07, .26]	−.01 [−.11, .09]	−.06 [−.16, .03]	.10 [−.00, .19]											
7. CEO Dir. Shareholding Ratio	−.06 [−.16, .04]	.25** [.16, .34]	−.14** [−.24, −.05]	−.03 [−.12, .07]	.25** [.15, .33]	−.06 [−.16, .04]										
8. R&D	−.14** [−.23, −.04]	.01 [−.09, .11]	−.06 [−.16, .03]	−.01 [−.11, .09]	.12* [.02, .21]	−.11* [−.20, −.01]	.14** [.04, .23]									
9. Gov. Dir. Ratio	.14** [.04, .23]	.08 [−.02, .17]	−.08 [−.18, .02]	.01 [−.09, .10]	.02 [−.08, .12]	.19** [.09, .28]	−.00 [−.10, .10]	.04 [−.06, .14]								
1. Gov. Share	−.06 [−.16, .03]	.23** [.13, .32]	−.19** [−.28, −.09]	.03 [−.06, .13]	.35** [.26, .43]	.28** [.19, .37]	.04 [−.06, .13]	.10* [.01, .20]	.18** [.09, .27]							
11. Profit after Tax	−.02 [−.12, .08]	.33** [.24, .41]	−.34** [−.42, −.25]	.06 [−.04, .16]	.38** [.30, .46]	.11* [.02, .21]	.02 [−.07, .12]	−.02 [−.12, .08]	.16** [.06, .25]	.23** [.14, .32]						
12. Revenue Growth Rate	−.01 [−.10, .09]	.04 [−.06, .13]	−.09 [−.19, .01]	.03 [−.07, .12]	.03 [−.07, .13]	.07 [−.03, .16]	−.04 [−.14, .06]	−.01 [−.11, .09]	−.02 [−.11, .08]	.09 [−.01, .18]	.33** [.24, .41]					
13. Age	.06 [−.04, .15]	.18** [.09, .27]	−.03 [−.13, .07]	−.06 [−.15, .04]	.13** [.03, .23]	.23** [.13, .32]	−.13* [−.22, −.03]	−.47** [−.54, −.39]	−.17** [−.27, −.08]	−.10* [−.20, −.01]	.01 [−.09, .11]	−.01 [−.11, .09]				
14. Family-controlled	.11* [.01, .21]	−.05 [−.15, .04]	.09 [−.00, .19]	−.03 [−.13, .06]	−.09 [−.18, .01]	.02 [−.08, .11]	−.07 [−.17, .03]	−.18** [−.27, −.08]	−.17** [−.26, −.08]	−.19** [−.28, −.09]	.10* [.00, .20]	.00 [−.09, .10]	.13** [.04, .23]			
15. Manager-controlled	−.13* [−.22, −.03]	.08 [−.02, .17]	−.10 [−.19, .00]	−.04 [−.14, .05]	.15** [.06, .25]	.01 [−.08, .11]	.26** [.16, .34]	.32** [.23, .41]	.30** [.21, .38]	.36** [.27, .44]	−.05 [−.14, .05]	.01 [−.09, .10]	−.37** [−.45, −.28]	−.66** [−.72, −.61]		
16. Mix-controlled	−.02 [−.11, .08]	−.01 [−.11, .09]	−.03 [−.12, .07]	.09 [−.01, .19]	−.05 [−.14, .05]	−.03 [−.13, .06]	−.17** [−.27, −.08]	−.10* [−.20, −.01]	−.08 [−.18, .02]	−.12* [−.22, −.03]	−.09 [−.18, .01]	−.01 [−.11, .09]	.21** [.11, .30]	−.63** [−.69, −.57]	−.16** [−.25, −.06]	
17. HiCarbon	.07 [−.02, .17]	.08 [−.02, .17]	−.01 [−.10, .09]	.06 [−.04, .16]	.01 [−.08, .11]	.12* [.02, .22]	.00 [−.09, .10]	.04 [−.06, .13]	.06 [−.04, .15]	−.00 [−.10, .15]	.05 [−.04, .15]	−.12* [−.21, −.02]	.04 [−.06, .14]	−.04 [−.13, .06]	−.07 [−.17, .03]	.12* [.02, .21]

Note. M and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. The confidence interval is a plausible range of population correlations that could have caused the sample correlation (Cumming, 2014). * indicates $p < .05$. ** indicates $p < .01$.

Table 4. OLS regression model 1-3 results.

	Results		
	Dependent Variable: The Dense of Carbon Emissions		
	Model 1	Model 2	Model 3
Gov. Dir. Ratio	0.087*	0.063*	0.152+
	(0.037)	(0.026)	(0.085)
Family-controlled	0.007	−0.007	0.021**
	(0.006)	(0.005)	(0.007)
Foundation Dir. Ratio	0.156*	0.079	0.077
	(0.071)	(0.063)	(0.061)
Dir. Shareholding Ratio	0.0003*	0.0001	−0.0004
	(0.0001)	(0.0001)	(0.0002)
Dir. Compensation(log)	0.002	−0.0003	0.002
	(0.002)	(0.002)	(0.001)
Profit after Tax	−0.0002	−0.0002	0.0003+
	(0.0001)	(0.0002)	(0.0002)
Manager-controlled	−0.008	−0.019**	0.003
	(0.007)	(0.006)	(0.011)
Asset(log)	−0.007***	−0.005***	−0.018+
	(0.002)	(0.001)	(0.009)
Debt Ratio	−0.0003*	−0.0001	0.0001
	(0.0001)	(0.0001)	(0.0001)
R&D	−0.001**	−0.001**	0.001
	(0.0003)	(0.0003)	(0.001)
Gov. Share	−0.002+	0.001	−0.002
	(0.001)	(0.001)	(0.002)
Revenue Growth Rate	0.00000	0.00001	0.00002
	(0.00003)	(0.00003)	(0.00004)
Age	−0.00004	−0.0005**	0.001***
	(0.0001)	(0.0002)	(0.0004)
Constant	0.130***	0.133***	0.254+
	(0.027)	(0.023)	(0.149)
Control Industry?	No	Yes[4]	No
Fix Effected?	No	No	Yes
Observations	407	407	407
Adjusted R^2	0.167	0.487	0.804

Note: + $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 5. OLS regression model 4-5 results.

	Results	
	Dependent Variable: The Dense of Carbon Emissions	
	Model 4	Model 5
Gov. Dir. Ratio	−0.007	0.008
	(0.040)	(0.033)
Family-controlled	0.003	0.009
	(0.006)	(0.019)
Foundation Dir. Ratio	0.063	−0.028
	(0.049)	(0.038)
Gov. Dir. Ratio × Family-controlled	0.234***	
	(0.132)	
Gov. Dir. Ratio × Foundation Dir. Ratio		3.733***
		(0.317)
Dir. Shareholding Ratio	−0.0004	−0.0002
	(0.0002)	(0.0002)
Dir. Compensation(log)	0.003+	0.0003
	(0.002)	(0.002)
Profit after Tax	0.0004+	0.0004**
	(0.0002)	(0.0001)
Manager-controlled	0.013	0.017
	(0.009)	(0.026)
Asset(log)	−0.021*	−0.008
	(0.011)	(0.008)
Debt Ratio	0.0001	0.0001
	(0.0001)	(0.0001)
R&D	0.001	0.0003
	(0.001)	(0.001)
Gov. Share	−0.001	0.0002
	(0.001)	(0.002)
Revenue Growth Rate	0.00002	−0.00001
	(0.00003)	(0.00004)
Age	0.002***	0.001**
	(0.0004)	(0.0004)
Constant	0.329*	0.116
	(0.171)	(0.136)
Control Industry?	No	No
Fix Effected?	Yes	Yes
Observations	407	407
Adjusted R^2	0.809	0.867

Note: + $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

significant effect on GHG emissions during 2014–2018 in Models 1 to 3 (though only Model 3 achieves a significance level of $p = 0.1$). These results reveal that the effects of the governmental directors' ratio on GHG emissions are consistent and robust in the pooled regression (Model 1), in the industry-controlled regression (Model 2), and firm fixed effects regression (Model 3).

The coefficient values in Models 1–3 show that for each additional percentage adds to the ratio of the governmental directors, the density of GHG emissions would increase by 0.085, 0.062, and 0.155, respectively. These regression results therefore support H1 (corporations with more governmental directors will have higher GHG emissions). Additionally, we control for industry effects in Model 2. The findings indicate that the cement, petrochemical, and paper industries exert a positive and statistically significant impact on GHG emissions.

The family-controlled dummy variable is significant in the fixed effect model. Although family control is not significant in the pooled model and is negative in the industry-controlled model, the result from the fixed effect model, which controls omitted variables, is more valid. Thus, H2.1 is partly supported by Model 3. In addition, the ratio of foundation directors is only significant in Model 1 and, therefore, non-significant in Models 2 and 3. Although firms with more foundation directors emit more GHGs in the pooled regression of Model 1, the relationships between foundation directors and GHG emission disappear when we control against other variables.

These results suggest that the influences of family control and the ratio of foundation directors on GHG emissions are inconsistent. The results from Models 1–3 provide limited evidence that family control and the ratio of foundation directors independently influence GHG emissions, prompting speculation about potential interactions with other variables.

Models 4 and 5 explore this speculation by including two interaction terms ($Gov. Dir. Ratio \times Family-controlled$ and $Gov. Dir. Ratio \times Foundation Dir. Ratio$). These terms are designed to test the hypotheses that government directors, in conjunction with family-controlled firms, and a higher proportion of foundation directors, may exacerbate GHG emissions. As can be seen, $Gov. Dir. Ratio \times Family-controlled$ in Model 4 is positive and significant ($p < 0.001$). The marginal effects plot of the governmental directors and family-controlled firms (Figure 1) suggests that family-controlled of firms significantly increase the tendency of governmental directors to allow for more GHG to be emitted. However, because the confidence intervals of non-family-controlled firms' marginal effect line crosses zero, the effect is non-significant.

Model 5 illustrates the positive and significant interaction term of $Gov. Dir. Ratio \times Foundation Dir. Ratio$. Figures 2 and 3 depict the detailed results. Figure 2 illustrates that a

Marginal Effect of the Ratio of Governmental Directors on GHG by Family-controlled
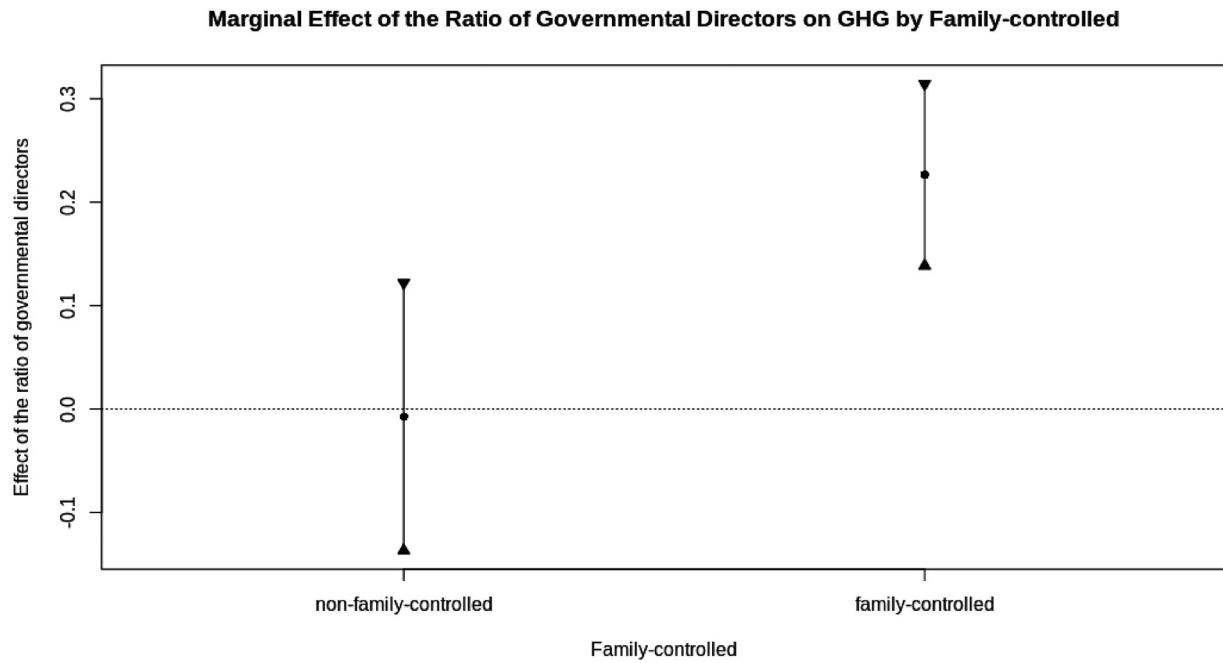

Figure 1. Marginal effect of the ratio of government directors on GHG by family-controlled.

higher foundation director ratio amplifies the association between governmental directors and exacerbates carbon emissions. Also, Figure 3 indicates that an elevated ratio of governmental directors is associated with increased GHG emissions, particularly in firms with larger proportions of foundation directors. The results of Models 4 and 5 demonstrate that both higher ratios of family-controlled and foundation directors tend to amplify and validate the positive association between the proportion of governmental directors and increased GHG emissions (H2.2 and H2.3).

6. Robustness check

To test for consistency in our results, we employed a robustness check. Table 6 represents the results of the robustness check. By replacing the dependent variable with the natural logarithm of carbon emissions in the original fixed-effect model (Model 3), the ratio of governmental directors achieves the same significance level and positively affects the natural logarithm of carbon emissions. In addition, H2.1–H2.3 are also supported by the models (Models 4
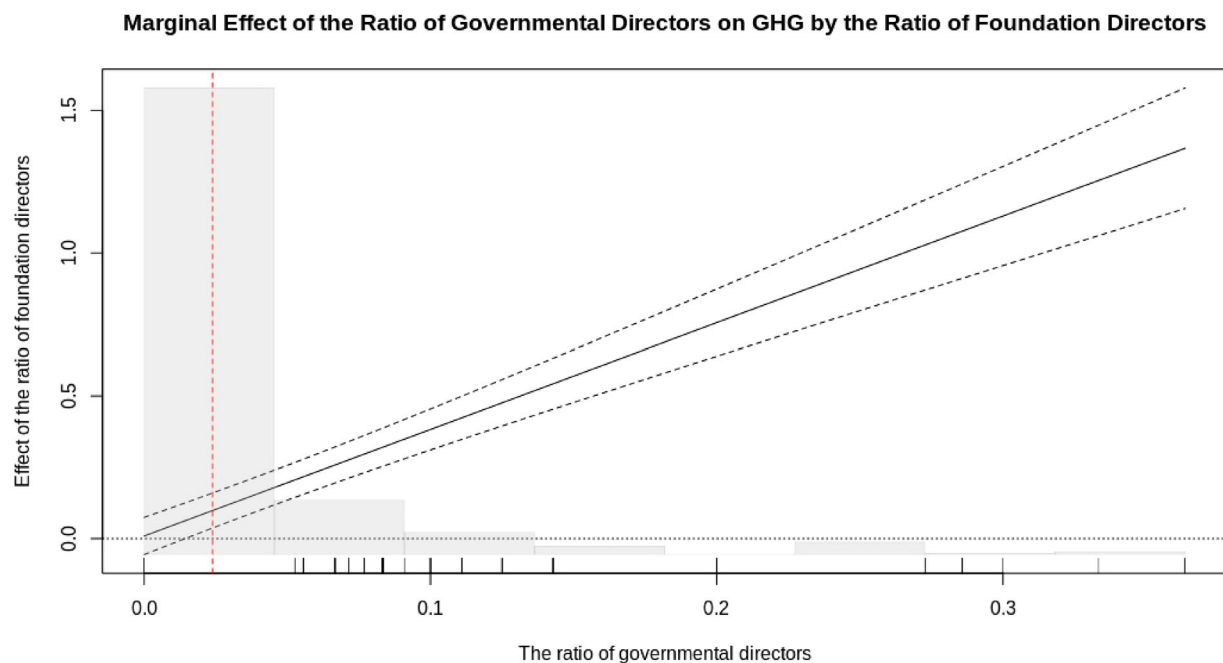
Marginal Effect of the Ratio of Governmental Directors on GHG by the Ratio of Foundation Directors

Figure 2. Marginal effect of the ratio of government directors on GHG by the ratio of foundation directors.

Marginal Effect of the Ratio of Foundation Directors on GHG by the Ratio of Governmental Directors
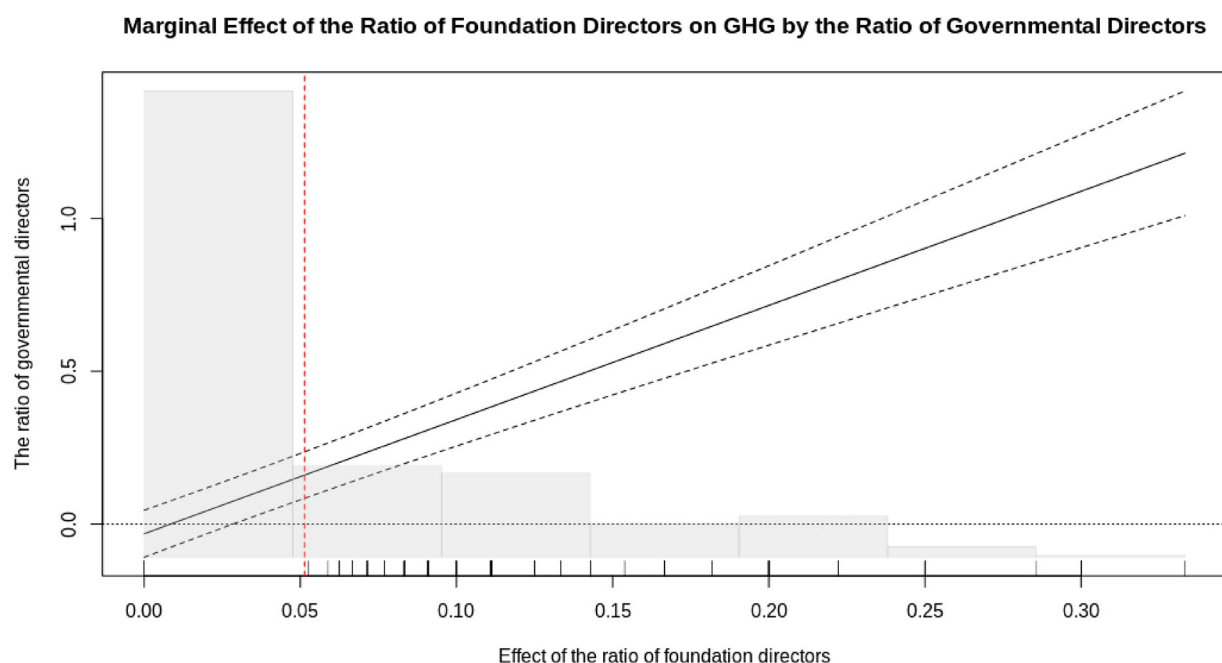

Figure 3. Marginal effect of the ratio of government directors on GHG by the ratio of government directors.

Table 6. Robustness check for OLS regression model 3-5 results.

	Results		
	Dependent Variable: Natural logarithm of Carbon Emissions		
	Robustness Check of		
	Model 3	Model 4	Model 5
Gov. Dir. Ratio	1.566[+]	−0.049	0.376
	(0.847)	(0.494)	(0.443)
Family-controlled	0.661*	0.484[+]	0.565[+]
	(0.306)	(0.294)	(0.300)
Foundation Dir. Ratio	0.349	0.203	−0.527
	(0.556)	(0.516)	(0.519)
Gov. Dir. Ratio × Family-controlled		2.368[+]	
		(1.373)	
Gov. Dir. Ratio × Foundation Dir. Ratio			30.933*
			(14.923)
Dir. Shareholding Ratio	−0.012**	−0.012**	−0.010*
	(0.004)	(0.004)	(0.004)
Dir. Compensation(log)	0.133*	0.140*	0.118[+]
	(0.067)	(0.068)	(0.068)
Profit after Tax	0.004*	0.004*	0.005*
	(0.002)	(0.002)	(0.002)
Manager-controlled	1.155	1.255[+]	1.272[+]
	(0.723)	(0.716)	(0.727)
Asset(log)	0.183	0.145	0.259[+]
	(0.122)	(0.120)	(0.136)
Debt Ratio	0.001	0.002	0.001
	(0.002)	(0.002)	(0.002)
R&D	0.003	0.004	−0.001
	(0.014)	(0.014)	(0.014)
Gov. Share	−0.009	0.004	0.011
	(0.018)	(0.016)	(0.014)
Revenue Growth Rate	0.001	0.001	0.001
	(0.001)	(0.001)	(0.0005)
Age	0.033***	0.034***	0.032***
	(0.006)	(0.005)	(0.006)
mix_control			
Constant	7.379***	8.139***	6.237**
	(2.008)	(1.977)	(2.229)
Fix Effected?	Yes	Yes	Yes
Observations	407	407	407
Adjusted R^2	0.972	0.972	0.975

Note: + $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

and 5) of the robustness check (Only the interaction term *Gov. Dir. Ratio × Family − controlled* becomes statistically insignificant, although its *p*-value remains below 0.1). These similarities between our original models and those of the robustness check suggest that our findings are both consistent and robust.

7. Discussion

The neo-liberalist literature tends to work from the assumption that as markets expand and corporate power increases, the capacity of the state declines (Chu, 2007; Cox, 1996; Jernnäs et al., 2019; Schaeffer, 2009). Our research on the Taiwanese industry suggests that this dynamic is partly true. In the neo-liberalist period, corporations do indeed seize more power. However, they do not abolish state involvement in industry; rather, they co-opt the managerial structures of the state, which benefits their interests. The results presented in this paper reveal that the role of the state has shifted from managing various activities of corporations to serving their interests. Governmental directors, which are an important legacy of the developmental state, have shifted from monitoring corporate activities to becoming facilitators of firms' resistance to GHG emissions reduction policies.

This research also provides evidence for embeddedness in the relationship between the state and corporations. Advocates of the benefits of free markets for the environment argue that market expansion weakens inefficient public regulations, thereby helping to generate a willingness on the part of firms to promote environmental protection (Jermier et al., 2006; Jordan et al., 2005; Khanna, 2002; Lyon & Maxwell, 2004; Tietenberg, 1998). Our research demonstrates that corporate efforts to seize power and enlarge their markets during the neo-liberal period have not produced enhanced environmental performance. In fact, corporations used their channels with the state

to avoid public regulations. Thus, corporate environmental behavior cannot be separated from the relationships between corporations and the state.

Advocates of neo-liberalism have also associated close ties between family-controlled firms and the state with what is described as cronyism. They suggest that market reforms can establish a fair trading system and foster improved transparent decision-making processes (Forbes, 2005; Stiglitz & Yusuf, 2001). However, our results suggest that the post-1980s market reforms in Taiwan failed to undermine the connections between family-controlled firms and the state. Contrariwise, family-controlled firms have established new corporate structures that enlarged the size of corporate groups and established ultimate owners (e.g. foundations) to control subsidiaries via ownership chains, tax reforms, and other policies. This corporate structure allows foundations to establish liability firewalls between owners and GHG-emitting facilities and, thus, exploit relationships with the state to resist emission-reduction policies.

Our research reconfirms conclusions from other studies involving state structures that the state should not be treated as a monolithic block but as a complex organization with diverse agencies and institutions. Different state agencies have a variety of connections with various social actors. For example, while TEPA passed the Greenhouse Gas Reduction and Management Act in 2015 and collaborated with ENGOs to urge firms to reduce GHG emissions, the Ministry of Economic Affairs, Ministry of Finance, and other economy-oriented departments have embraced different agendas. One way in which they have pursued their agendas is to use contacts within the firms, such as governmental directors, in order to inhibit or interfere with the reduction of GHG emissions.

Obviously, embeddedness within the state and corporations challenges environmental governance. Neo-liberalism offers incentives for corporations to pursue their economic interests and connections between corporations and the state, allowing corporations to resist interventions that reduce emissions. Furthermore, the fragmentation of administrative entities damages the credibility and ability of the state to offer a general agenda or to create consensus policies among diverse state departments and social actors. When the risks and damages produced by climate change become severe, and international pressures to employ aggressive climate-mitigation actions are reinforced, governments without consistent and practicable policies will confront crises of legitimacy.

8. Conclusion and policy implications

This research explored the factors which influence GHG emissions by Taiwanese corporations. Our findings support the political-economic embeddedness perspective and led us to conclude that the embeddedness within the state offers channels for companies to exert power in resisting GHG reduction policies. Additionally, firms with more governmental directors tend to emit more GHGs. Furthermore, the effects of governmental directors on GHG emissions appear to be enhanced in family-controlled firms, especially in

those that have more foundation directors controlled by family relatives.

Our findings carry three policy implications. First, corporations in the neo-liberal era do not typically undertake direct actions to undermine the regulatory capacity of the state. Instead, they seek to reform state structures from within to benefit their own interests. Partnerships between the state and corporations are established through embeddedness mechanisms. We determine that governmental directors who sit on corporate boards are important embedded actors who can affect GHG emissions. Consequently, there is a demand for regulations to realign the ways in which state agencies assign governmental directors.

Second, supporters of the developmental state suggest that restoring state intervention could mitigate the negative influences of neo-liberalism on the environment, inequality, and the markets. However, our research demonstrates that although channels of state interventions still exist in Taiwan, they have provided corporations with opportunities to exercise power to resist environmental regulations. When developing countries, especially Asian countries, attempt to employ developmental state strategies (Clark et al., 2022), our findings suggest that the claim to rebuild state interventions at a superficial level may produce severe pollution.

Third, family-controlled corporations in Taiwan tend to resist reducing GHG emissions. They are also more likely to resort to cronyism and connections with the state to generate benefits for their firms. Hence, policies to downscale the influence of family-controlled corporations over policy are important for future environmental governance.

Our research provides new insights into how the developmental state has left a legacy of failed initiatives to reduce GHG emissions. Our research protocol only involved facilities with annual emissions greater than 25,000 tons, together with public corporations that control these facilities. We made this decision because large GHG emitters account for three-fourths of Taiwanese carbon emissions. Thus, it is crucial to explore the factors that drive these corporations' emissions for better future emissions control. At present, Taiwanese ENGOs and research institutions are promoting a new policy to force the disclosure of GHG emissions from all Taiwanese companies. Future research may therefore be able to explore the full spectrum of GHG emitters in the Taiwanese economy.

Notes

1. The terms in parentheses are abbreviated names for the variables as they appear in the models and Tables 1–6.
2. The five industries are cement, semiconductor, electricity, steel, and liquid crystal display.
3. The permanent link to the data is: https://data.epa.gov.tw/en/dataset/detail/GHG_P_01
4. We categorize the firms into eleven distinct industry sectors: cement, food, petrochemical, textile, chemical, paper, semiconductor and liquid crystal display, electricity, steel, tire rubber, and a miscellaneous group for remaining industries. Due to the table design for our models, we excluded the industry results in the table. The coefficients of several industries are statistically significant: Cement (0.104, $p < 0.001$), Petrochemical (0.012, $p < 0.05$), Food (-0.019, $p < 0.001$), and Paper (0.015, $p < 0.01$).

Disclosure statement

No potential conflict of interest was reported by the author(s).

Notes on contributors

Chung-pei Pien is an Assistant Professor at the International College of Innovation, National Chengchi University, and an Adjunct Assistant Research Fellow at the Risk Society and Policy Research Center, National Taiwan University. His research primarily revolves around environmental sociology, political sociology, computational social science, and organizational theories.

Chia-wei Chao serves as the Research Director at the Taiwan Climate Action Network, a collective initiative started by five environmental NGOs aimed at expediting net-zero policy actions in Taiwan. Dr. Chao's research interests include sustainability transition and industrial ecology. He has been actively engaged in climate and energy policy since 2007. In addition to his research work, Dr. Chao is an Adjunct Assistant Professor, teaching "Pathways towards Net-Zero" at National Taiwan University and National Chengchi University.

Kuei-Tien Chou serves as the Director at Risk Society and Policy Research Center, National Taiwan University and lead teams to conduct policy oriented researches on climate change, energy transition and net-zero emissions transformation, as well as on emerging technology risks. Among his most recent book publications include Sociology of Climate Change: the High Carbon Society and its transformation challenge in 2017, Energy Transition in East Asia – A Social Science Perspective in 2018, Climate Change Governance in Asia in 2020 and Air Pollution Governance in East Asia in 2022.

References

Abreu, M.C.S.d., Webb, K., Araújo, F.S.M., & Cavalcante, J.P.L. (2021). From "business as usual" to tackling climate change: Exploring factors affecting lowcarbon decision-making in the Canadian oil and gas sector. *Energy Policy*, 148, 111932.

Aklin, M., & Urpelainen, J. (2013). Political competition, path dependence, and the strategy of sustainable energy transitions. *American Journal of Political Science*, 57(3), 643–658. https://doi.org/10.1111/ajps.12002

Amsden, A.H. (1979). Taiwan's economic history. *Modern China*, 5(3), 341–379. https://doi.org/10.1177/009770047900500304

Amsden, A.H. (1989). *Asia's next giant: South Korea and late industrialization*. Oxford University Press.

Andersson, F.N.G., Opper, S., & Khalid, U. (2018). Are capitalists green? Firm ownership and provincial CO emissions in China. *Energy Policy*, 123, 349–359. https://doi.org/10.1016/j.enpol.2018.08.045

Arnall, A. (2018). Resettlement as climate change adaptation: What can be learned from state-led relocation in rural Africa and Asia? *Climate and Development*, 11(3), 253–263. https://doi.org/10.1080/17565529.2018.1442799

Baier, S.L., & Bergstrand, J.H. (2007). Do free trade agreements actually increase members' international trade? *Journal of International Economics*, 71(1), 72–95. https://doi.org/10.1016/j.jinteco.2006.02.005

Barnea, A., & Rubin, A. (2010). Corporate social responsibility as a conflict between shareholders. *Journal of Business Ethics*, 97(1), 71–86. https://doi.org/10.1007/s10551-010-0496-z

Berrone, P., Cruz, C., Gomez-Mejia, L.R., & Larraza-Kintana, M. (2010). Socioemotional wealth and corporate responses to institutional pressures: Do family-controlled firms pollute less? *Administrative Science Quarterly*, 55(1), 82–113. https://doi.org/10.2189/asqu.2010.55.1.82

Biagini, B., & Miller, A. (2013). Engaging the private sector in adaptation to climate change in developing countries: Importance, status, and challenges. *Climate and Development*, 5(3), 242–252. https://doi.org/10.1080/17565529.2013.821053

Cadez, S., Czerny, A., & Letmathe, P. (2019). Stakeholder pressures and corporate climate change mitigation strategies. *Business Strategy and the Environment*, 28(1), 1–14. https://doi.org/10.1002/bse.2070

Capano, G. (2009). Understanding policy change as an epistemological and theoretical problem. *Journal of Comparative Policy Analysis: Research and Practice*, 11(1), 7–31. https://doi.org/10.1080/13876980802648284

Chang, C.-F. (2002). *The privatization of state-owened enterprises in Taiwan: A critique of the economic myth*. Institute of Sociology, Academia Sinica.

Chang, Y.-l. (2016). Carbon EMISSION LEVELS, GREEN INVESTMENT STRATEGY AND FIRM PERFORMance. *Journal of Management & Systems*, 23, 197–222.

Chen, S.-m., Lin, C.-c., Chu, C., Chang, C.-h., Shih, J.-j., & Liu, J.-t. (1991). *Disintegrating KMT-state Capitalism: A closer look at privating taiwan's state- and party-owned enterprises*. Taipei Society.

Chen, Y.-L. (2011). New prospects for social rental housing in Taiwan: The role of housing affordability crises and the housing movement. *International Journal of Housing Policy*, 11(3), 305–318. https://doi.org/10.1080/14616718.2011.599133

Cheng, T.-j. (1993). Guarding the commanding heights: The state as banker in Taiwan. In S. Haggard, C.H. Lee, & S. Maxfield (Eds.), *The politics of finance in developing countries* (pp. xi, 334). Cornell University Press.

Chou, K.-T. (2018). Tri-helix Energy Transition in Taiwan. In K.-T. Chou (Ed.), *Energy transition in East Asia: A social science perspective*. Routledge.

Chu, W.-w. (2001). The effects of Taiwan's industrial policy: A preliminary evaluation. *Taiwan: A Radical Quarterly in Social Studies*, 67–117.

Chu, W.-w. (2011). Democratization and economic development: The unsuccessful transformation of Taiwan's developmental state. *Taiwan: A Radical Quarterly in Social Studies*, 243–288.

Chu, W.-w. (2017). *The causes of Taiwan's postwar economic growth: The why and how of late development*. Linking Press.

Chu, W.-W., & Huang, C.-Y. (1998). Industrial policy and ladder-climbing: A study of Taiwan's plastic-material industry. *Taiwan: A Radical Quarterly in Social Studies*, 83–124.

Chu, Y.-h. (2007). Re-engineering the developmental state in an age of globalization: Taiwan in defiance of neoliberalism. In J.-e. Woo (Ed.), *Neoliberalism and Institutional Reform in East Asia* (pp. 91–121). New York: Palgrave Macmillan.

Chung, H.-m., & Chan, S.-t. (2017). The evolution of the ownership structure in Taiwan's family business groups: A consequence of institutional context and organizational expansion. In Z.-R. Lee, & T.-H. Lin (Eds.), *Unfinished miracle: Taiwan's economy and society in transition* (pp. 268–311). Institute of Sociology, Academia Sinica.

Chung, H.-m., & Yeh, C.-h. (2010). The role of family linkage and political linkage on diversification decision over time: An empirical study in Taiwan's family business groups. *Organization and Management*, 3, 67–106.

Clark, A., Benoit, P., & Walters, J. (2022). Government shareholders, wasted resources and climate ambitions: Why is China still building new coal-fired power plants? *Clim Policy*, 1–16.

Cox, R.W. (1996). A Perspective on Globalization. In J.H. Mittelman (Ed.), *Globalization: Critical reflections* (pp. xii, 273 p). Lynne Rienner Publishers.

Cumming, G. (2014). The new statistics. *Psychological Science*, 25, 7–29.

Dauvergne, P., & Lister, J. (2012). Big brand sustainability: Governance prospects and environmental limits. *Global Environmental Change*, 22(1), 36–45. https://doi.org/10.1016/j.gloenvcha.2011.10.007

Dent, C.M. (2017). East Asia's new developmentalism: State capacity, climate change and low-carbon development. *Third World Quarterly*, 39(6), 1191–1210. https://doi.org/10.1080/01436597.2017.1388740

Doda, B., Gennaioli, C., Gouldson, A., Grover, D., & Sullivan, R. (2016). Are corporate carbon management practices reducing corporate carbon emissions? *Corporate Social Responsibility and Environmental Management*, 23(5), 257–270. https://doi.org/10.1002/csr.1369

Feiock, R.C., & Stream, C. (2001). Environmental protection versus economic development: A false trade-off? *Public Administration Review*, 61(3), 313–321. https://doi.org/10.1111/0033-3352.00032

Fieldman, G. (2011). Neoliberalism, the production of vulnerability and the hobbled state: Systemic barriers to climate adaptation. *Climate and Development*, 3(2), 159–174. https://doi.org/10.1080/17565529.2011.582278

Forbes, K.J. (2005). Capital controls: Mud in the wheels of market efficiency. *Cato Journal*, 25, 153–166.

Friedlingstein, P., Jones, M.W., O'Sullivan, M., Andrew, R.M., Hauck, J., Peters, G.P., Peters, W., Pongratz, J., Sitch, S., Le Quéré, C., Bakker, D.C.E., Canadell, J.G., Ciais, P., Jackson, R.B., Anthoni, P., Barbero, L., Bastos, A., Bastrikov, V., Becker, M., … Zaehle, S. (2019). Global carbon budget 2019. *Earth System Science Data*, 11(4), 1783–1838. https://doi.org/10.5194/essd-11-1783-2019

Gil, J.B., & Jung, B.K. (2009). Green growth and the integration of environment and economy: Between modification and transition. *Journal of Governmental Studies*, 15, 45–70.

Granovetter, M. (1985). Economic Action and social structure: The problem of embeddedness. *American Journal of Sociology*, 91(3), 481–510. https://doi.org/10.1086/228311

Grant, D., Jorgenson, A., & Longhofer, W. (2018). Pathways to carbon pollution: The interactive effects of global, political, and organizational factors on power plants' CO2 emissions. *Sociological Science*, 5, 58–92. https://doi.org/10.15195/v5.a4

Grant, D.S., II, Bergesen, A.J., & Jones, A.W. (2002). Organizational size and pollution: The case of the U.S. chemical industry. *American Sociological Review*, 67(3), 389–407. https://doi.org/10.1177/000312240206700304

Grant, D., & Vasi, I.B. (2017). Civil society in an age of environmental accountability: How local environmental nongovernmental organizations reduce U.S. power plants' carbon dioxide emissions. *Sociological Forum*, 32(1), 94–115. https://doi.org/10.1111/socf.12318

Hannan, M.T., & Freeman, J. (1984). Structural inertia and organizational change. *American Sociological Review*, 49(2), 149. https://doi.org/10.2307/2095567

Hassan, O.A.G., & Romilly, P. (2018). Relations between corporate economic performance, environmental disclosure and greenhouse gas emissions: New insights. *Business Strategy and the Environment*, 27(7), 893–909. https://doi.org/10.1002/bse.2040

Hsu, H.-j. (2013). *A study on Yan Qingling and Taiwan's automobile industry (1953–1981)*. Graduate Institute of History. National Central University.

Hsu, J.-y. (1999). Floating embeddedness: The labor market and high technology development in the Hsinchu science-based Industrial Park. *Taiwan: A Radical Quarterly in Social Studies*, 75–118.

Hsu, J.-y., & Hsu, Y.-h. (2013). State transformation, policy learning, and exclusive displacement in the process of urban redevelopment in Taiwan. *Urban Geography*, 34(5), 677–698. https://doi.org/10.1080/02723638.2013.778581

Jermier, J.M., Forbes, L.C., Benn, S., & Orsato, R.J. (2006). The new corporate environmentalism and green politics. In S.R. Clegg, C. Hardy, T. Lawrence, & W.R. Nord (Eds.), *The SAGE handbook of organization studies* (2nd ed, pp. 618–650). SAGE.

Jernnäs, M., Nilsson, J., Linnér, B.-O., & Duit, A. (2019). Cross-national patterns of governance mechanisms in nationally determined contributions (NDCs) under the Paris agreement. *Climate Policy*, 19(10), 1239–1249. https://doi.org/10.1080/14693062.2019.1662760

Jessop, B. (1982). *The capitalist state: Marxist theories and methods*. New York University Press.

Jordan, A., Wurzel, R.K.W., & Zito, A. (2005). The rise of 'new' policy instruments in comparative perspective: Has governance eclipsed government? *Political Studies*, 53(3), 477–496. https://doi.org/10.1111/j.1467-9248.2005.00540.x

Kay, A. (2005). A critique of the use of path dependency in policy studies. *Public Administration*, 83(3), 553–571. https://doi.org/10.1111/j.0033-3298.2005.00462.x

Khanna, M. (2002). Non-mandatory approaches to environmental protection. *Journal of Economic Surveys*, 15(3), 291–324. https://doi.org/10.1111/1467-6419.00141

Kim, E.-s. (2015). The politics of climate change policy design in Korea. *Environmental Politics*, 25(3), 454–474. https://doi.org/10.1080/09644016.2015.1104804

Lee, Y. (2008). Divergent outcomes of labor reform politics in democratized Korea and Taiwan. *Studies in Comparative International Development*, 44(1), 47–70. https://doi.org/10.1007/s12116-008-9034-8

Lee, Z.-r. (2007). Between the state power and Chinese familism: Corporate control and intercorporate networks in Taiwan revisited. *Taiwanese Sociology*, 173–242.

Lee, Z.-r. (2009). Institutional transition and market networks: An historical investigation of interlocking directorates of big businesses in Taiwan, 1962–2003. *Taiwanese Sociology*, 101–160.

Lee, Z.-r. (2016). Corporate power and democracy: An analysis of business groups' campaign contribution in the 2008 legislator election. *Taiwanese Sociology*, 99–139.

Lee, Z.-r. (2017). The rise and consolidation of family capitalism in Taiwan. In Z.-r. Lee, & T.-h. Lin (Eds.), *Unfinished miracle: Taiwan's economy and society in transition* (pp. 314–344). Institute of Sociology, Academia Sinica.

Lee, Z.-r., & Lin, T.-h. (2017). The rise and fall of made in Taiwan (MIT): Taiwan's development and the legacy of economic sociology. In Z.-r. Lee, & T.-h. Lin (Eds.), *Unfinished miracle: Taiwan's economy and society in transition* (pp. 2–43). Institute of Sociology, Academia Sinica.

Lewis, B.W., Walls, J.L., & Dowell, G.W.S. (2014). Difference in degrees: CEO characteristics and firm environmental disclosure. *Strategic Management Journal*, 35(5), 712–722. https://doi.org/10.1002/smj.2127

Lin, C.-Y., & Hsung, R.-M. (2018). Trend of interlocking networks of corporate governance in Taiwan's semiconductor industry (2000– 2015): Toward small world network. *Survey Research: Method and Application*, 211–263.

Lin, M.-x., Lee, T.-y., & Chou, K.-t. (2018). The environmental policy stringency in Taiwan and its challenges on green economy transition. *Development and Society*, 46, 477–502.

Liu, H.-J. (2012). Comparing organized labor, comparing Korea and Taiwan. *Taiwanese Sociology*, 207–219.

Lo, A.Y. (2010). Active conflict or passive coherence? The political economy of climate change in China. *Environmental Politics*, 19(6), 1012–1017. https://doi.org/10.1080/09644016.2010.518689

Lyon, T.P., & Maxwell, J.W. (2004). *Corporate environmentalism and public policy*. Cambridge University Press.

Mol, A.P.J. (2007). Bringing the Environmental State Back In: Partnerships in Perspective. In P. Glasbergen, F. Biermann, & A.P.J. Mol (Eds.), *Partnerships, governance and sustainable development: Reflections on theory and practice*. Edward Elgar Publishing.

Mol, A.P.J., & Spaargaren, G. (2002). Ecological modernization and the environmental state. In A.P.J. Mol, & F.H. Buttel (Eds.), *The Environmental State Under Pressure* (pp. 33–52). Emerald Group Publishing Limited.

Pellow, D.N. (2016). Environmental justice and the political process: Movements, corporations, and the state. *The Sociological Quarterly*, 42(1), 47–67. https://doi.org/10.1111/j.1533-8525.2001.tb02374.x

Perrow, C. (1997). Organizing for environmental destruction. *Organization & Environment*, 10(1), 66–72. https://doi.org/10.1177/0921810697101009

Pien, C.-p. (2001). *Historical structural roots of Taiwan''s information technology "Miracle"*. Social Transformation Studies.

Pierson, P. (2014). Increasing returns, path dependence, and the study of politics. *American Political Science Review*, 94(2), 251–267. https://doi.org/10.2307/2586011

Polanyi, K. (2001). *The great transformation: The political and economic origins of our time* (2nd ed). Beacon Press. (Original work published 1944).

Post, C., Rahman, N., & Rubow, E. (2011). Green governance: Boards of directors' composition and environmental corporate social responsibility. *Business & Society*, 50(1), 189–223. https://doi.org/10.1177/0007650310394642

Poulantzas, N. (1973). On social classes. *New Left Review*, 0, 27.

Prechel, H. (1990). Steel and the state: Industry politics and business policy formation, 1940–1989. *American Sociological Review*, 55(5), 648. https://doi.org/10.2307/2095862

Prechel, H. (2012). Corporate power and US economic and environmental policy, 1978–2008. *Cambridge Journal of Regions, Economy and Society*, 5(3), 357–375. https://doi.org/10.1093/cjres/rss002

Prechel, H., & Zheng, L. (2011). *Corporate characteristics, political embeddedness, and environmental pollution by large U.S. Corporations*. Social Forces.

Sapkota, P., & Bastola, U. (2017). Foreign direct investment, income, and environmental pollution in developing countries: Panel data analysis of Latin America. *Energy Economics*, *64*, 206–212. https://doi.org/10.1016/j.eneco.2017.04.001

Schaeffer, R.K. (2009). *Understanding globalization: The social consequences of political, economic, and environmental change* (4th ed). Rowman & Littlefield Publishers.

Scott, M., Balaev, M., & Clarke, B. (2017). Political embeddedness in environmental contexts: The intersections of social networks and planning institutions in coastal land use. *Environmental Sociology*, *4*(2), 286–298. https://doi.org/10.1080/23251042.2017.1374232

Stanny, E. (2013). Voluntary disclosures of emissions by US firms. *Business Strategy and the Environment*, *22*(3), 145–158. https://doi.org/10.1002/bse.1732

Stiglitz, J.E., & Yusuf, S. (2001). *Rethinking the East Asian miracle*. The World Bank.

Sue, S.-h. (2008). The political economy of bank privatization in Taiwan. *Taiwan International Studies Quarterly*, *4*, 109–148.

Sullivan, R. (2010). An assessment of the climate change policies and performance of large European companies. *Climate Policy*, *10*(1), 38–50. https://doi.org/10.3763/cpol.2008.0591

Sydow, J., Schreyögg, G., & Koch, J. (2009). Organizational path dependence: Opening the black box. *Academy of Management Review*, *34*, 689–709.

Tietenberg, T. (1998). Disclosure strategies for pollution control. *Environmental and Resource Economics*, *11*(3/4), 587–602. https://doi.org/10.1023/A:1008291411492

Turner, R.S. (2008). *Neo-liberal ideology: History, concepts and policies*. Edinburgh University Press.

United Nations Environment Programme. (2019). *The emissions gap report 2019*. United Nations Environment Programme.

Vaara, E., & Tienar, J. (2008). A discursive perspective on legitimation strategies in multinational corporations. *Academy of Management Review*, *33*(4), 985–993. https://doi.org/10.5465/amr.2008.34422019

Vergne, J.-P., & Durand, R. (2010). The missing link between the theory and empirics of path dependence: Conceptual clarification, testability issue, and methodological implications. *Journal of Management Studies*, *47*, 736–759.

Wade, R., 1990. *Governing the market: Economic theory and the role of government in East Asian industrialization*. Princeton University Press, Princeton, N.J.

Wang, J.-h. (1995). The state and the development of Taiwan's petrochemical industry. *Taiwan: A Radical Quarterly in Social Studies*, 1–37.

Wang, J.-h., Lee, Z.-r., & Chen, T.-y. (2017a). The state's role in Taiwan's economic development: Historical and theoretical assessment. In Z.-r. Lee, & T.-h. Lin (Eds.), *Unfinished miracle: Taiwan's economy and society in transition* (pp. 50–88). Institute of Sociology, Academia Sinica.

Wang, P., Liu, L., & Wu, T. (2017b). A review of China's climate governance: State, market and civil society. *Climate Policy*, *18*(5), 664–679. https://doi.org/10.1080/14693062.2017.1331903

Weber, M. (1968). *Economy and society: An outline of interpretive sociology*. Bedminster Press.

Willyard, K.A. (2020). A license to pollute? Opportunities, incentives, and influences on oil and gas venting and flaring in Texas. *Energy Research & Social Science*, *62*, 101381. https://doi.org/10.1016/j.erss.2019.101381

Wishart, R. (2019). Class capacities and climate politics: Coal and conflict in the United States energy policy-planning network. *Energy Research & Social Science*, *48*, 151–165. https://doi.org/10.1016/j.erss.2018.09.005

Wong, J. (2016). The developmental state and Taiwan. In G. Schubert (Ed.), *Routledge handbook of contemporary Taiwan* (pp. 201–217). London: Routledge.

Woods, T., & Morris, T. (2006). Fast tracking trade policy: State STRUCTURES and NGO influence during the NAFTA negotiations. *Research in Political Sociology*, *15*, 177–204.

Wooldridge, J.M. (1995). Selection corrections for panel data models under conditional mean independence assumptions. *Journal of Econometrics*, *68*(1), 115–132. https://doi.org/10.1016/0304-4076(94)01645-G

Yao, H.-c. (2016). *Fake commonweal activities and real investment of Cher Wang, The Journalist*. The Journalist Co., LTD.

Zhong, L., Mol, A.P.J., & Fu, T. (2008). Public-private partnerships in China's urban water sector. *Environmental Management*, *41*(6), 863–877. https://doi.org/10.1007/s00267-008-9070-1