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The role of the institutional context on firms' environmental strategy

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Resumen en español

El énfasis en la sostenibilidad ambiental en las empresas individuales, con especial atención a la discusión sobre los principales impulsores de la creación de valor ambiental, ha ganado más importancia, posicionándose actualmente en el centro de las estrategias comerciales estratégicas (Aragón-Correa, 1998; Rehman et al., 2020; Sawe et al., 2021). Las iniciativas medioambientales se han convertido en un elemento clave para garantizar el éxito y la operatividad de una organización y representan un factor determinante para los inversores que buscan rentabilidad a largo plazo (Bueno-García et al., 2022; Epstein & Roy, 2001). Como tal, las empresas están bajo presión para emprender acciones urgentes para abordar la emergencia climática y ambiental (Roxas, 2021) y para ir más allá del cumplimiento de las políticas y estándares regulatorios en diferentes países (Naidoo & Gasparatos, 2018).

En este contexto, la adopción de acciones ambientales basadas en la reducción del impacto de la empresa en el entorno natural (Walls et al., 2011) podría actuar como una estrategia para superar a los competidores y satisfacer las necesidades de los grupos de interés (Aragón-Correa, 1998; Berrone & Gómez -Mejía, 2009; Uyar et al., 2021). A nivel internacional, las iniciativas ambientales han sido identificadas como una fuente efectiva para aumentar la legitimación de una empresa (Babiak & Trendafilova, 2011; Bansal & Roth, 2000). Si bien hemos aprendido en los últimos años cómo las iniciativas ambientales generan resultados corporativos positivos (Bacinello et al., 2021; Dornfeld et al., 2021; Schiessl et al., 2022; Sun et al., 2022), sabemos poco sobre cómo los antecedentes a nivel de país favorecen o dificultan esta estrategia. La literatura muestra que los factores a nivel de empresa no explican completamente los comportamientos de la empresa (Hartmann & Uhlenbruck, 2015). De hecho, el desempeño de las empresas y la toma de decisiones estratégicas varían dependiendo de su país de origen debido al conjunto particular de instituciones nacionales que dan forma diferente a las percepciones culturales de las empresas (Noorderhaven & Harzing,

2003; North, 1990; Wan & Hoskisson, 2003) incluso más en su cultura ambiental (Ioannou & Serafeim, 2012). A medida que estas prácticas institucionales se integran en el comportamiento de las empresas (p. ej., Bansal & Roth, 2000; Paulraj, 2009), el perfil del país de origen les permite desarrollar herramientas específicas para gestionar sus resultados ambientales (Leyva-de la Hiz et al., 2019) que pueden fomentar o dificultar una ventaja competitiva en la competencia global (Cuervo-Cazurra, 2011).

En este sentido, la literatura previa basada en la teoría institucional (North, 1990) sugería que la supervivencia a largo plazo de las empresas que operan en un contexto internacional requiere que ganen legitimidad frente a los stakeholders internacionales (Kostova & Zaheer, 1999). Específicamente, la teoría institucional busca explicar cómo las instituciones específicas de cada país afectan las estructuras y actividades de las empresas (North, 1990; Zucker, 1987). Las instituciones se definen generalmente como las reglas del juego en un país (North, 1990). Estas reglas brindan estructura y orden en un país y guían el comportamiento y las acciones de individuos, grupos y empresas (North, 1990). La literatura previa ha argumentado que las instituciones a nivel nacional afectan los caminos ambientales tomados por las empresas (Hartmann & Uhlenbruck, 2015; Ioannou & Serafeim, 2012). Esto se debe a que las empresas siguen las presiones institucionales y se comportan de manera similar dentro de un contexto institucional determinado (Hoffman, 1999).

La teoría institucional explica por qué la decisión de una empresa de implementar ciertas prácticas no se basa en razones racionales o económicas, sino que se debe a sus adaptaciones a las reglas y normas del contexto institucional (Glover et al., 2014; Vasudeva et al., 2013). A través de las presiones de estas instituciones, en otras palabras, cada dimensión institucional incorpora una respuesta ambiental específica y, por lo tanto, proporciona a las empresas una gama particular de herramientas y conocimientos diferentes de los demás.

El objetivo general de la tesis doctoral se centra en el análisis del desempeño medioambiental de las empresas y los aspectos institucionales del país de origen. Esta tesis doctoral se ha desarrollado bajo un paraguas común referido al estudio de las diferentes dimensiones del país de origen de las empresas desde el enfoque institucional. A partir de este enfoque institucional común, se han formulado objetivos específicos. Estos objetivos específicos se han centrado principalmente en estudiar la relación entre el desempeño ambiental y la internacionalización, junto con el análisis del papel de las características del país de origen. Los objetivos específicos de esta tesis son:

• Analizar si existe una relación positiva entre las políticas medioambientales de las empresas y su grado de internacionalización.

• Determinar si la capacidad de innovación nacional modera la relación entre las políticas medioambientales de las empresas y su grado de internacionalización.

• Determinar si la capacidad de innovación de las empresas modera la relación entre las políticas medioambientales de las empresas y su grado de internacionalización.

• Analizar si existe una curva en forma de U entre la diversificación internacional y el desempeño medioambiental.

• Determinar si el nivel de competitividad del país de origen modera la relación entre la diversificación internacional y el desempeño medioambiental.

• Determinar si el nivel ambiental del país de origen modera la relación entre la diversificación internacional y el desempeño medioambiental.

• Analizar si existe una relación en forma de U invertida entre la digitalización del país de origen y el desempeño medioambiental.

• Determinar si el marco institucional nacional proporciona un efecto de transición a una forma de U invertida.

Por lo tanto, esta tesis utiliza la teoría institucional como marco teórico principal para centrarse en cómo las características institucionales dan forma a los resultados ambientales corporativos y su relación con la operación internacional.

En esta tesis doctoral se empleó la base de datos Eikon de Thomson Reuters para recopilar información sobre los datos empresariales. Esta fuente de datos ofrece una plataforma integral para establecer puntos de referencia personalizables para la evaluación del comportamiento operativo de la empresa, la gestión ambiental y el desempeño financiero (Ellimäki et al., 2021). Thomson Reuters Eikon proporciona información precisa y fiable (Cheng et al., 2014) y herramientas de análisis de inversión para inversores profesionales (Gómez-Bolaños et al., 2020). Ha sido empleado por varios estudios empíricos en el desempeño de la responsabilidad social corporativa (Hartmann & Vachon, 2018; Hawn & Ioannou, 2016; Ellimäki et al., 2021). Por otro lado, se emplearon diferentes bases de datos que contienen series de datos sobre contextos institucionales, como The World Economic Outlook, Environmental Performance Index, World Competitiveness Yearbook y Global Competitiveness Report. La base de datos de Perspectivas de la economía mundial contiene series de datos macroeconómicos seleccionados del apéndice estadístico del informe Perspectivas de la economía mundial, que presenta el análisis y las proyecciones del FMI sobre la evolución económica a nivel mundial en muchos países individuales. El Índice de Desempeño Ambiental identifica objetivos para varias categorías centrales de políticas ambientales agregando varios elementos ambientales, como el desperdicio de agua, energía, etc., y teniendo en cuenta las características de los países como su Producto Interno Bruto. El Anuario de Competitividad Mundial y el Informe de Competitividad Global son bases de datos que miden la competitividad de las naciones mediante el análisis de cómo crean un entorno empresarial competitivo.

Además, se utilizó el software STATA 15 para llevar a cabo el análisis de datos, ya que este software facilita la recopilación, organización y análisis de datos de panel. En este estudio se emplearon las diferentes pruebas estadísticas, como la correlación de Pearson, la regresión de efectos aleatorios, la regresión multinivel, el modelo de regresión de transición suave del panel (PSTR), etc. La correlación de Pearson se utilizó para analizar si existe una relación lineal estadísticamente significativa entre dos variables continuas. . La regresión de efectos aleatorios es una técnica eficiente y proporciona un estimador consistente. Esta técnica disemina componentes de varianza para tiempos y errores, asumiendo las mismas intersecciones y pendientes. La regresión multinivel captura la dependencia dentro del clúster que a menudo muestran las bases de datos de empresas de diferentes países. Brinda la capacidad de estimar coeficientes no sesgados y errores estándar, mejorando así la solidez de los resultados. Además, esta tesis adoptó un modelo PSTR, en el que el efecto de la variable umbral sobre la variable dependiente puede cambiar dependiendo de los regímenes por debajo y por encima del umbral.

En cuanto a los resultados de esta tesis, en primer lugar, en el Capítulo 2, mostramos una relación significativa y positiva entre las políticas ambientales y el alcance de la internacionalización. Confirmamos que, en el contexto internacional, las políticas ambientales adquieren especial relevancia porque aumentan la capacidad de una empresa para superar las barreras verdes de entrada, cumplir con los altos estándares verdes del país anfitrión, acceder a acuerdos y colaboraciones internacionales y reducir la responsabilidad de la extranjería, que son factores que facilitan el proceso de expansión exterior. Así, explicamos que las empresas están desarrollando una actitud más proactiva hacia los temas ambientales, percibiéndolos como una herramienta de legitimidad. Además, esto demuestra que las empresas de países altamente innovadores ya han cumplido con los estándares internacionales desde su creación. Por lo tanto, esta capacidad nacional no sirve como refuerzo en el nexo política ambiental-

internacionalización. Por el contrario, aquellas empresas de países poco innovadores están, por defecto, en una clara desventaja en comparación con sus pares de países innovadores; tal situación de inferioridad refuerza los esfuerzos realizados por las empresas para hacer frente a los estándares internacionales y, a su vez, fortalece la relación entre las políticas ambientales y la internacionalización.

En segundo lugar, en Capítulo 3, nuestro resultado confirma que esta relación va más allá de un efecto positivo o negativo, donde una mayor diversificación internacional en etapas tempranas implica un desempeño ambiental más bajo, pero luego se vuelve positivo ya que las empresas revierten esta situación a partir de la experiencia adquirida y la recombinación. Además, mostramos que las empresas de un país caracterizado por una alta competitividad nacional construyen sus FSA verdes sobre fuertes ventajas de ubicación y acceso a herramientas estratégicas y habilidades avanzadas. A pesar de no encontrar un efecto moderador significativo del perfil medioambiental del país, nuestros resultados muestran que el país de origen de una empresa juega un papel importante para superar antes o después las desventajas de operar en el extranjero con respecto a su estrategia medioambiental.

Finalmente, el Capítulo 4 concluye que en la primera etapa, la digitalización del país de origen tiene un efecto positivo en los resultados ambientales a través de una mayor eficiencia energética y una mejor gestión de los recursos, pero luego, un exceso de digitalización tiene consecuencias negativas en el medio ambiente a través del alto consumo de electricidad, uso de recursos y emisiones. En segundo lugar, nuestros resultados muestran que el marco institucional tiene un efecto sobre esta relación. El modelo PSTR confirma empíricamente que en un régimen alto de marco institucional, el efecto negativo de la digitalización del país de origen lleva mucho tiempo. Por el contrario, en un régimen bajo, el efecto positivo de la digitalización del país de origen se agota antes. Específicamente, nuestros hallazgos contribuyen al cuerpo de conocimiento existente de varias maneras.

Los hallazgos de esta tesis doctoral tienen importantes implicaciones teóricas y prácticas. Las implicaciones prácticas de tesis doctoral son principalmente es en el marco de la teoría institucional. Los hallazgos del Capítulo 2 ofrecen una doble contribución. En primer lugar, estudiamos el nexo entre las políticas ambientales y la internacionalización desde una perspectiva institucional novedosa, la más prevalente para la región de Asia y el Pacífico. La literatura anterior se ha centrado principalmente en la perspectiva del aprendizaje para explicar este nexo. Para reducir la ambigüedad teórica para diferentes contextos, proponemos una perspectiva institucional para explicar cómo las empresas están desarrollando una actitud más proactiva hacia los problemas ambientales, percibiéndolos como oportunidades comerciales en lugar de como cargas. La perspectiva institucional es particularmente adecuada porque la adopción de medidas para combatir los problemas ambientales está directamente condicionada por las presiones institucionales para cumplir con las normas y expectativas de las partes interesadas. Trabajos anteriores ya han discutido esta perspectiva al examinar contextos emergentes, como América Latina (Duque-Grisales et al., 2020). Afirma que las capacidades ambientales sirven como fuente de legitimidad institucional en los mercados externos (Aguilera-Caracuel & Ortiz-de-Mandojana, 2013). En segundo lugar, estudiamos dimensiones moderadoras novedosas distintas a las típicamente estudiadas y reforzamos el vínculo de estudio existente entre los países desarrollados y los emergentes. En particular, desagregamos el constructo de capacidad de innovación. Al hacerlo, agregamos valor a la teoría institucional (Leyva de la Hiz et al., 2019) al mostrar que las empresas de países con un bajo nivel de innovación se ajustan a contextos internacionales institucionalmente exigentes a través de una mayor orientación verde. Por el contrario, las empresas de países con un alto nivel de innovación pueden ajustar su compromiso ambiental a la innovación de su país de origen. Por lo tanto, estas empresas están menos preocupadas por su estrategia de legitimación y reputación verde durante su camino de internacionalización.

En el Capítulo 3, ampliamos la comprensión del nexo internacionalización-entorno del marco FSA-CSA. Este capítulo contribuye al marco CSA/FSA para explicar las estrategias ambientales de las empresas multinacionales en contextos internacionales. Desde una perspectiva global, utilizando un conjunto de datos de panel, contribuimos con la confirmación empírica de que la diversificación internacional aumenta la dificultad para gestionar con éxito el comportamiento ambiental de las empresas debido a un aumento en la complejidad de la transferencia, implementación y explotación de FSA verdes a nuevas ubicaciones. Además, esta investigación contribuye a una perspectiva de recombinación al mostrar que el desempeño ambiental se puede mejorar cuando las empresas combinan FSA verdes con ventajas específicas del país anfitrión. Además, demostramos claramente que los CSA competitivos en el hogar permiten a las empresas obtener un apalancamiento ecológico en contextos internacionales. Además, este artículo va más allá que investigaciones anteriores al enfatizar que la relación entre la diversificación internacional y el desempeño ambiental no debe entenderse como monolítica. Al utilizar un enfoque integrado de ambos argumentos (positivo o negativo), consideramos la naturaleza dinámica de la diversificación internacional que resulta de la combinación cambiante de los inconvenientes y beneficios para el desempeño ambiental de una empresa. Este enfoque no lineal arroja nueva luz al explicar los resultados contradictorios de la literatura previa que explicaba parcialmente este fenómeno.

En el Capítulo 4, nuestro trabajo hace las siguientes contribuciones a la literatura existente. La literatura anterior que informa sobre la relación entre la digitalización y el desempeño ambiental ha propuesto una naturaleza lineal (Benzidia et al., 2021; Rajput & Singh, 2019). En nuestro artículo, enriquecemos estos trabajos de investigación anteriores con un intento novedoso de examinar la relación entre la digitalización y la sostenibilidad ambiental en forma de U invertida. Brindamos una visión integradora y empírica al mostrar que la digitalización puede ser un arma de doble filo. Nuestro estudio también ofrece una

perspectiva internacional y multiindustrial. También contribuimos a la teoría institucional, encontrando que el marco institucional tiene un efecto en esta relación. En nuestra contribución metodológica, utilizando regresión de transición suave de panel (PSTR), encontramos que el efecto de la transformación digital del país de origen en el desempeño ambiental de una empresa cambia entre el régimen bajo y el alto del marco institucional.

La investigación realizada en el Capítulo 3 es relevante e interesante para los gerentes porque nuestros resultados sugieren que deberían considerar la posibilidad de tener desafíos en la gestión ambiental en la etapa inicial de internacionalización de una empresa multinacional. Si bien estos resultados llaman la atención de los gerentes de empresas de países con bajos niveles de competitividad que construyen FSA verdes débiles que no se ajustan a los estándares ambientales globales, nuestros hallazgos alientan a los gerentes a avanzar en su proceso de diversificación internacional, ya que las dificultades relacionadas con la gestión ambiental pueden eventualmente resolverse. superarse aprendiendo de la experiencia internacional. Para los formuladores de políticas, esta investigación proporciona una nueva perspectiva sobre la importancia de considerar el nivel de competitividad de un país. Para mejorar el desempeño ambiental de sus EMN en un contexto internacional, los gobiernos deben tomar en cuenta específicamente políticas que brinden fuertes ventajas de ubicación al país. En consecuencia, los países con un alto nivel de competitividad crean valor para sus empresas y ayudan a construir FSA verdes sólidas.

En cuanto a las implicaciones prácticas, nuestros hallazgos tienen implicaciones considerables para los profesionales y los formuladores de políticas. Desde una perspectiva gerencial, los hallazgos de del Capítulo 2 resaltan la esencia de las políticas ambientales en la expansión internacional de una empresa, ya que las empresas que adoptan una estrategia proactiva tienen más probabilidades de acelerar su proceso de internacionalización. Las empresas que están dispuestas a expandir sus negocios internacionalmente necesitan

establecer estrategias ambientales elementales como una forma de construir una sólida reputación ecológica (Dowell et al., 2000) para integrar los intereses de las partes interesadas internacionales (Christmann, 2000), para disminuir la responsabilidad de la extranjería, y superar a los rivales comerciales en los mercados de los países anfitriones (Chen et al., 2016). Desde la perspectiva de las autoridades gubernamentales, es importante considerar que deben ser capaces de crear programas de incentivos para alentar a las empresas a formular estrategias ambientales responsables que las lleven a expandir sus actividades en los mercados externos. Los gobiernos y las instituciones deben diseñar políticas y programas de innovación alineados para evitar la incompletitud institucional. De esta forma, las empresas del país cuentan con la infraestructura adecuada para adoptar una posición ambiental proactiva que les permita tanto internacionalizarse como recibir a otras empresas extranjeras ambientalmente proactivas (estrategia ganar-ganar).

La investigación realizada en el Capítulo 3 es relevante e interesante para los gerentes porque nuestros resultados sugieren que deberían considerar la posibilidad de tener desafíos en la gestión ambiental en la etapa inicial de internacionalización de una empresa multinacional. Si bien estos resultados llaman la atención de los gerentes de empresas de países con bajos niveles de competitividad que construyen FSA verdes débiles que no se ajustan a los estándares ambientales globales, nuestros hallazgos alientan a los gerentes a avanzar en su proceso de diversificación internacional, ya que las dificultades relacionadas con la gestión ambiental pueden eventualmente resolverse. superarse aprendiendo de la experiencia internacional. Para los formuladores de políticas, esta investigación proporciona una nueva perspectiva sobre la importancia de considerar el nivel de competitividad de un país. Para mejorar el desempeño ambiental de sus EMN en un contexto internacional, los gobiernos deben tomar en cuenta específicamente políticas que brinden fuertes ventajas de

ubicación al país. En consecuencia, los países con un alto nivel de competitividad crean valor para sus empresas y ayudan a construir FSA verdes sólidas.

En el Capítulo 4, desde una perspectiva gerencial, nuestra investigación es relevante para los gerentes porque nuestros resultados sugieren que deberían considerar la posibilidad de encontrar desafíos en el desempeño ambiental en altos niveles de digitalización. Por ejemplo, el trabajo de Chiarini (2021) con fabricantes italianos descubrió que los gerentes siguen sin estar seguros de los resultados finales de la impresión 3D adictiva. Como evidencia anecdótica, uno de los gerentes entrevistados afirmó que, a lo largo de los años, presentamos gradualmente el primer vehículo guiado autónomo y ahora el nuevo robot móvil autónomo. Sin embargo, no hemos ahorrado consumo de forma significativa; por el contrario, hemos aumentado nuestros problemas medioambientales porque ahora tenemos que hacer frente a las baterías y su eliminación al final de su vida útil. Nuestro análisis longitudinal de varios países proporciona evidencia más sólida con respecto a esta preocupación destacada sobre los efectos de rebote de los altos niveles de digitalización. Tal conciencia puede permitir a los gerentes desarrollar mejores conocimientos, políticas y prácticas para prevenir tales resultados negativos.

Chapter 1

Introduction

Introduction

1.1. Background

The scientific and technological discoveries led to rapid industrialization with little or no concern for the environment. An example of this is the addition of tetraethyl lead to petrol, which achieved greater efficiency of engines, harming the environment and endangering public health (United Nations Environment Programme, 2021). Similarly, the chlorofluorocarbons, which at the time were received as an extraordinary achievement to facilitate the life of humans, destroy the earth's protective ozone layer (Molina & Rowland, 1974). Since the Kyoto Protocol and subsequently the adoption of the Paris Agreement and the 2030 Agenda for Sustainable Development in 2015, industrialized countries have taken decisive measures to mitigate the devastating effects of climate change and achieve sustainable development goals across entire counties (Hasan et al., 2020).

The emphasis on environmental sustainability across individual companies, with particular regard to the discussion on the key environmental value creation drivers, has gained more importance, currently positioning itself at the center of strategic business strategies (Aragón-Correa, 1998; Rehman et al., 2020; Sawe et al., 2021). Environmental initiatives have become a key element to guarantee the success and operability of an organization and represent a determining factor for investors seeking long-term profitability (Bueno-García et al., 2022; Epstein & Roy, 2001). As such, firms are under pressure to undertake urgent actions to address the climate and environment emergency (Roxas, 2021) and to go beyond compliance with regulatory policies and standards across different countries (Naidoo & Gasparatos, 2018).

In this context, the adoption of environmental actions based on reducing a firm's impact on the natural environment (Walls et al., 2011) could act as a strategy to outperform

competitors and satisfy stakeholders' needs (Aragón-Correa, 1998; Berrone & Gómez-Mejía, 2009; Uyar et al., 2021). At international scopes, environmental initiatives have been identified as an effective source of increasing a firm's legitimation (Babiak & Trendafilova, 2011; Bansal & Roth, 2000). While we have learned in recent years about how environmental initiatives bring positive corporate outcomes (Bacinello et al., 2021; Dornfeld et al., 2021; Schiessl et al., 2022; Sun et al., 2022), we know little about how country-level antecedents foster or hinder this strategy. The literature shows that firm-level factors do not fully explain company behaviors (Hartmann & Uhlenbruck, 2015). Indeed, firms' performance and strategic decision-making vary depending on their home-country origin because of the particular set of national institutions which differently shape firm's cultural perceptions (Noorderhaven & Harzing, 2003; North, 1990; Wan & Hoskisson, 2003) even more in their environmental culture (Ioannou & Serafeim, 2012). As these institutional practices become embedded in firms' behaviors (e.g., Bansal & Roth, 2000; Paulraj, 2009), the home country profile enables them to develop specific tools to manage their environmental results (Leyva-de la Hiz et al., 2019) that can foster or hinder a competitive advantage in global competition (Cuervo-Cazurra, 2011).

In this regard, the previous literature based on the institutional theory (North, 1990) suggested that the long-term survival of firms operating in an international context requires that they gain legitimacy from international stakeholders (Kostova & Zaheer, 1999). Specifically, institutional theory seeks to explain how each country's specific institutions affect firm structures and activities (North, 1990; Zucker, 1987). Institutions are generally defined as the rules of the game in a country (North, 1990). These rules provide structure and order in a country and guide the behavior and actions of individuals, groups, and firms (North, 1990). Previous literature has argued that national-level institutions affect environmental paths taken by firms (Hartmann & Uhlenbruck, 2015; Ioannou & Serafeim,

2012). This is because firms follow institutional pressures and behave similarly within a given institutional context (Hoffman, 1999).

The institutional theory thus explains why a firm's decision to implement certain practices is not based on rational or economic reasons but is instead due to its adaptations to the rules and norms of the institutional context (Glover et al., 2014; Vasudeva et al., 2013). Firms, therefore, tend to imitate practices implemented by other firms, which subsequently leads to isomorphism and toward the earning of legitimacy. Consequently, different national institutions within the same context differently influence firms (Delmas & Montes-Sancho, 2010; Scott, 1995), which differently determine their environmental results (Ortiz-de-Mandojana et al., 2016). Through the pressures of these institutions, in other words, each institutional dimension embeds a specific environmental response and thus provides firms with a particular range of tools and knowledge different from the others. Thus, this thesis uses the institutional theory as the main theoretical framework to focus on how institutional characteristics shape corporate environmental results.

Based on this theoretical framework, it is required that we determine the way in which this doctoral thesis is carried out. We can distinguish two main factors that can act on the company's environmental performance and that receive the attention of this thesis. On the one side, the role of firm's level factors, on the other side, the country-level factors.

Before analyzing how these factors are connected and can possibly impact the firm's environmental strategies, we first analyze and define this thesis's main construct, which is environmental performance. Environmental performance has a multi-dimension character (Johnstone, 2020; Trumpp et al., 2015), where some scholars used emission reduction (Hartmann & Vachon, 2018; Tawiah et al., 2022), eco-innovation (Nadeem et al., 2021), environmental policies or levels of consumption, and resource efficiency (Kock et al., 2012) as proxies for firm's environmental performance. In line with Trumpp et al. (2015) and

Seifert et al. (2019), we unpack environmental performance into one with two dimensions: environmental management performance (policies, objectives, structures, processes) and operational performance (water consumption, energy usage, emissions).

In Chapter 2, we start by analyzing the effect of environmental management performance, defined as environmental policies. These policies are considered as the initial and essential dimension of environmental strategy. Indeed, environmental policies are considered an initial and crucial step in developing environmental corporative responsibility and improving environmental performance (Haque & Ntim, 2022; Friedman, 1992; Polonsky, Zeffane, & Medley, 1992; Shah et al., 2016; Welford, 2013). It is noteworthy that Welford (2013) points out that "an organization's environmental policy forms the backbone and skeletal framework from which every other environmental component is hung" (p. 90). Besides, through environmental policies, stakeholders can identify the firm's philosophy and the background to all of its activities related to its ecological commitment to nature (Ramus & Montiel, 2005). Furthermore, green policies enable a firm to comply with regulations, build the legitimacy of operations, and achieve green competitive advantages over peers (Abdelzaher & Newburry, 2016). Finally, environmental policy statements can positively affect the public's perceptions of a firm's proactive environmental protection (Henriques & Sadorsky, 1999), resulting in increased market share and improved stakeholder relations (Ramus & Montiel, 2005).

Then, in Chapters 3 and 4, we continue by analyzing environmental operational performance. For this, we opted for The Thomson Reuters Eikon's environmental performance score defined as "a company's impact on living and non-living natural systems, including the air, land and water, as well as complete ecosystems". This index is generated from a weighted score of a company's strengths and weaknesses on indicators related to (1) environmental innovation, (2) emissions, and (3) resource use. The indicators developed by

Thomson Reuters on environmental issues have been widely used in prior studies (Bueno-García et al., 2022; Ellimäki et al., 2021). We employed this index since it covers deeper metrics that record all of different environmental aspects and determine how well a company uses best management practices to avoid environmental risks and capitalize on environmental opportunities in order to generate long term shareholder value. In particular, environmental innovation reflects a company's capacity to reduce the environmental costs and burdens for its customers, thereby creating new market opportunities through new environmental technologies and processes or eco-designed products. Emissions measure a company's commitment and effectiveness towards reducing environmental emissions in the production and operating processes. Resource use reflects a company's performance and capacity to reduce the use of materials, energy, or water, and to find more eco-efficient solutions by improving supply chain management.

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environmental technologies and processes or eco-designed products. Emissions measure a company's commitment and effectiveness towards reducing environmental emissions in the production and operating processes. Resource use reflects a company's performance and capacity to reduce the use of materials, energy, or water, and to find more eco-efficient solutions by improving supply chain management. Once the environmental performance has been defined, we proceed to discuss the role of institutions, which leads us to the study of the specific characteristics of institutions, as a way of impacting on firm's environmental results.

Researchers in environmental management have applied the institutional theory to study the environmental behavior of firms (Bansal, 2005; Delmas & Toffel, 2004; Henriques & Sadorsky, 1999). Based on this institutional perspective, Sangle (2010) demonstrated that institutional pressures are the main driver for implementing proactive environmental strategies in India. Other works indicated that the institutional context of the home-country influences firms to opt for sustainable business practices (Brown & Knudsen, 2012; Ioannou & Serafeim, 2012; Jackson & Apostolakou, 2010). Based on the idea of Moon and Vogel (2008) that the environmental initiatives of firms cannot be viewed in isolation from the national system, we believe that a home country's characteristic has an influence on the environmental initiatives of firms. First, Dimaggio and Powell (1983) demonstrated that firms tend to imitate the successful behavior or practices carried out by their peers. Second, firms are continuously adapting their structures and policies to the institutional context in which they operate (Dimaggio & Powell, 1983; Scott & Meyer, 1994). Similarly, Aguilera et al. (2007) argued that "because business organizations are embedded in different national systems, they will experience divergent degrees of internal and external pressure to engage in social responsibility initiatives" (p. 836). As such, we take into consideration that firms' institutional context enables them to develop specific tools to manage their environmental results (Leyva-de la Hiz et al., 2019). We argue that abundant institutions allow firms to

acquire advanced transfer technology, knowledge, and management practices that benefit their environmental strategy. However, previous studies on institutional characteristics relied primarily on policy and regulation aspects (Brown & Knudsen, 2012; Ioannou & Serafeim, 2012; Jackson & Apostolakou, 2010). In this doctoral thesis, we respond to the need to explore further dimensions of the home country. For this, we investigate different dimensions of home country characteristics and their direct and/or moderating impact on the firm's environmental performance. Chapter 2 examines the moderating effect of the home country's innovation capability between environmental policies and the degree of internationalization. To explore it deeper, we further investigate the specific direct role of home country digitalization on a firm's environmental performance in chapter 4. Apart from innovation and digital dimensions of the home country, we also explore other institutional characteristics such as institutional framework in Chapter 4, home country competitiveness in Chapter 3, and home country environmental performance in Chapter 3.

Once the framework in which the doctoral thesis is developed as well as the object of the investigation has been established, we proceed to present its objectives in order to later develop the studies carried out for it.

1.2. Aims of study

The general objective of the doctoral thesis focuses on the analysis of the environmental performance of companies and the institutional aspects of the country of origin. This doctoral thesis has been developed under a common umbrella referring to the study of different dimensions of companies' country of origin from the institutional approach. From this common institutional approach, specific objectives have been formulated. These specific objectives have mainly focused on studying the relationship between environmental performance and internationalization, along with the analysis of the role of home country characteristics. The specific objectives of this thesis are:

- Analyse whether there is a positive relationship between firms' environmental policies and their degree of internationalization.
- Determinate whether national innovation capability moderates the relationship between firms' environmental policies and its degree of internationalization.
- Determinate whether firm's innovation capability moderates the relationship between firms' environmental policies and its degree of internationalization.
- Analyse whether there is a U-shaped curvilinear between international diversification and environmental performance.
- Determinate whether home-country competitiveness level moderates the relationship between international diversification and environmental performance.
- Determinate whether home-country environmental level moderates the relationship between international diversification and environmental performance.
- Analyse whether there is an inverted U shape relationship between home country digitalization and environmental performance.
- Determinate whether the national institutional framework provides a transition effect to an inverted U-shaped relationship between home country digitalization and environmental performance.

1.3. Methodology

In this doctoral thesis, the Thomson Reuters Eikon database was employed to collect information about firms. This data source offers a comprehensive platform for establishing customizable benchmarks for the assessment of firm operating behavior, environmental management, and financial performance (Ellimäki et al., 2021). Thomson Reuters Eikon provides accurate and reliable information (Cheng et al., 2014) and investment analysis tools for professional investors (Gómez-Bolaños et al., 2020). It has been employed by several empirical studies in corporate social responsibility performance (Hartmann & Vachon, 2018;

Hawn & Ioannou, 2016; Ellimäki et al., 2021). On the other hand, different databases containing data series about institutional contexts were employed, such as The World Economic Outlook, Environmental Performance Index, World Competitiveness Yearbook, and Global Competitiveness Report. The World Economic Outlook database contains selected macroeconomic data series from the statistical appendix of the World Economic Outlook report, which presents the IMF's analysis and projections of economic developments at the global level in many individual countries. The Environmental Performance Index identifies targets for several core environmental policy categories by aggregating several environmental items, such as waste of water, energy, etc., and taking into account countries' features as their Gross Domestic Product. World Competitiveness Yearbook and Global Competitiveness Report are databases that measure nations' competitiveness by analyzing how they create a competitive business environment.

Moreover, STATA 15 software was used to carry out the data analysis since this software facilitates the collection, organization, and analysis of panel data. The different statistical tests were employed in this study, such as Pearson correlation, Random effects regression, Multilevel Regression, Panel smooth transition regression model (PSTR), etc. Pearson Correlation was used to analyze whether a statistically significant linear relationship exists between two continuous variables. Random effect regression is an efficient technique and provides a consistent estimator. This technique disseminates variance components for times and error, assuming the same intercepts and slopes. Multilevel Regression captures the within-cluster dependence often shown by databases of firms from different countries. It provides the ability to estimate unbiased coefficients and standard errors, thus enhancing the results' robustness. Moreover, this thesis adopted a PSTR model, in which the effect of the threshold variable on the dependent variable may change depending on the regimes below and above the threshold.

1.4. Structure

This doctoral thesis is structured into five chapters. Chapter 1 includes this introduction, in which we present the framework and objectives of the thesis along with its methodology and structure. In addition to this introductory chapter, three additional chapters correspond to three research works. In the last chapter, the doctoral thesis comprises the conclusions and final comments.

Chapter 2 includes the research work entitled *"Environmental policies and internationalization: The moderating roles of national and firm innovation capabilities in Asia-Pacific firms."* This study analyzes the positive effect of environmental policies on a firm's internationalization degree along with the moderating role of country and firm innovation. A multilevel modeling technique was used to test our hypotheses. Our sample comprises 91 firms from 11 countries in 10 different sectors during the period ranging from 2014 to 2018. This research work analyzes environmental policies as an initial and crucial step in developing environmental corporative responsibility and improving environmental performance (Markusson, 2010; Shah et al., 2016; Welford, 2013). In the international context, environmental policies acquire a particular relevance because they increase a firm's capability to overcome green entry barriers, meet the high green standards of the host country, access international agreements and collaborations, and reduce the liability of foreignness that are factors that facilitate the foreign expansion process. Drawing on institutional theory, we argue that firms from countries with low innovation capability must attenuate their legitimacy deficit as they have a greater need to operate abroad and prove that they meet the environmental standards of developed countries due to having a liability of origin. In this way, they can obtain a "license to operate in foreign markets," reinforcing their international reputation despite being from counties with low national innovation capability. In contrast, firms from countries with a high level of national innovation capability do not

care about obtaining reputation and international legitimacy by already belonging to contexts classified as innovative. We also posit that a firm's innovation activities can be used as a strategical tool to increase their capacity to understand, respond, and predict international stakeholders' demands across different regions, to adapt better to new environmental requirements, to engage more in environmental initiatives, and to have a greater capacity for green signaling.

In Chapter 3, we present research work entitled *"Firm- and country-specific advantages: Towards a better understanding of MNEs' environmental performance in the international arena."* This work is based on an analysis of how the international environment affects the decision processes of multinational enterprises, a scope specifically advocated in the journal description. More particularly, we employ a longitudinal sample to analyze how international diversification affects environmental performance and whether the profile (both competitive and environmental) of the home country may exacerbate such a relationship. This study proposes a U-shaped relationship between firms' international diversification and environmental performance. This analysis has been conducted through a sophisticated empirical method - a generalized linear four-level model including a two-stage Heckman selection procedure and U-tests - allowing us to show the existence of the U-shape relationship as well as significant differences in the inflection point of the U-shaped at varying home country competitiveness levels. Moreover, we examine whether the home country profile (both competitive and environmental) may exacerbate the relationship between international diversification and environmental performance. We show that firms from a country characterized by high national competitiveness build their green FSAs on strong location advantages and access to strategic tools and advanced skills.

Chapter 4 discusses the research work entitled "Too good to be true. The inverted U-shaped relationship between home-country digitalization and environmental performance"

that has been published (Ahmadova et al., 2022). This research was conducted within the international research stay framework in collaboration with Professor Dante I. Leyva-de la Hiz from Montpellier Business School (Montpellier, France). This work is based on analyzing different institutional structures, an aspect specifically advocated in the journal description. We employ a longitudinal international sample to analyze how home-country digitalization impacts environmental proactivity. COVID-19 has urged the need for digitalization; thus, it becomes a must to provide a better understanding of its pros and cons. We propose that initial developments of digitalization bring considerable benefits for improving firms' environmental performance until reaching a tipping point where an excess of digitalization becomes negative for its environmental performance. This analysis has been conducted through a sophisticated empirical method – the panel smooth transition regression (PSTR) model -, hence allowing us to show significant differences in the slopes of the U-shaped relationships at varying institutional framework levels so that countries whose institutions are strong may foster the advantages of digitalization and retard their drawbacks, known in the economics literature as rebound effects.

Finally, Chapter 5 presents the conclusions obtained in this doctoral thesis, the result of the development of the studies presented here. This chapter also includes a review of the limitations of this work as a whole and a description of future lines of research that may derive from this doctoral thesis.

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Chapter 2

Environmental policies and internationalization: The moderating roles of national and firm innovation capabilities in Asia-Pacific firms

Environmental policies and internationalization: The moderating roles of national and firm innovation capabilities in Asia-Pacific firms

Abstract

This research aims to examine whether Asia-Pacific firms use environmental policies as a business strategy to speed up their internationalization process and capture moderating roles of national and firm innovation capabilities. A multilevel modeling technique was used to test our hypotheses. Our sample comprises 91 firms from 11 countries in 10 different sectors during the period ranging from 2014 to 2018. Our results show that firms' environmental policies have a significant positive impact on such firms' scope of internationalization. The results reveal that whereas high national innovation capability has a negative moderating role in the relationship between firms' environmental policies and their scope of internationalization, firm innovation capability does not exhibit a significant scope effect of internationalization.

Keywords: environmental policies; internationalization; institutional theory; national innovation capability; firm innovation capability; Asia-Pacific firms

2.1. Introduction

In recent years, stakeholders' immense pressures have placed environmental actions at the center of business strategies (Rehman et al., 2020). In this context, a growing body of literature based on the Western context has suggested that firms' international experience offers an opportunity to develop a set of best environmental practices (Aguilera-Caracuel et al., 2012; Bansal, 2005; Gómez-Bolaños et al., 2020). The main finding of these research is that firms with a higher degree of internationalization achieve more significant opportunities for progressive assimilation of knowledge and the development of a more advanced environmental approach (Aguilera-Caracuel et al., 2012; Bansal, 2005; Kenelly & Lewis, 2002). Although this assumption may be generally accepted based on a learning perspective, we still know little about how this mechanism works in other regions.

To fill this research gap, we examine the undercurrents of the Asia-Pacific context in depth. Previous research focused on this region has studied how the internationalization of firms is influenced by factors such as ownership structures (Purkayastha et al., 2017), network strategies (Udomkit, 2017), or a linking capacity (Du & Zhou, 2019). However, the environmental proactivity of firms in the Asia-Pacific region has not been sufficiently addressed by scholars (Zhu et al., 2012). The Asia-Pacific region has flourished during the last decade (Legatum Institute, 2018). Moreover, the same region is widely considered a key leader in world economic progress (Lee & Heshmati, 2009). This region's leading economic condition provides a stimulus for export acceleration, consumer incrementation, and powerful economic zones (World Economic Forum (WEF), 2018). The Asia-Pacific region has the most negative ecological footprint globally (Lane, 2014). Also, the Economic and Social Commission for Asia and the Pacific (ESCAP, 2018) demonstrated that "the world average is only 1.2 kg of domestic material consumption per dollar of economic output; this amount is roughly double in the Asia-Pacific region at approximately 2 kg" (p. 3). However, Helble and

Majoe (2017) highlighted that the EU, through environmental regulations for international trade, transformed Asia and the Pacific into "a greener, more competitive, prosperous region" (p. 3). These findings suggest that it is challenging for this region's firms to internationalize, have a good reputation, and compete against foreign rivals without the benefit of highly implemented environmental policies. We contend that the Asia-Pacific region may constitute an interesting analysis context to investigate the connection between environmental policies, internationalization, and innovation capability.

In studying how the environmental behavior of firms affects the internationalization process, we focus on a sample of 91 firms from 11 Asia-Pacific countries distributed across ten different sectors. This context is relevant because, in contrast to Western region firms, the Asia-Pacific companies usually face challenges in their internationalization process due to the strict environmental regulations of host countries (Sandhu et al., 2012; Zhu et al., 2012). A lack of corporate social responsibility (CSR) was a trade barrier for firms from other countries to gain access to Western markets (Breitbarth et al., 2009). Furthermore, attaining customer interest in these markets is one of the biggest challenges that Asian firms face (Srivastava et al., 2015). It seems reasonable to consider that the established theory with a learning perspective cannot work in Asia-Pacific regions.

Our study focuses on environmental policies as a fundamental dimension of environmental proactivity. This is considered a starting point to knowing the mechanisms of environmental proactivity that allow firms to progress in their other environmental dimensions (González-Benito & González-Benito, 2005). We assume that environmental policies enable firms to overcome environmental entry barriers, meet green standards, and reduce the liability of foreignness, which are the factors that can facilitate the foreign expansion process.

Although environmental policies constitute an essential basis for firms to open into foreign markets, we argue that it depends on external and internal conditions that cannot be overlooked. We examine how this relationship is weakened/strengthened by innovation. In this research, we unpack the innovation construction by drawing on its two key components: national innovation capability as an external/macro-component and firm innovation capability as an internal/micro-component. Each component enables firms to access to different features, factors, and tools. National innovation capability refers to configurations of institutions that foster the development of technology and innovation (Nelson & Rosenberg, 1993), whereas firm innovation capability enables them to generate, integrate, and exploit their resources to engage in a new product or service development (Tajvidi & Karami, 2015; Tan & Sousa, 2019).

We examine the impact of these two conditions through their moderating effects. For this, we use an institutional theory as the main theoretical framework. Firms' performance and strategic decision-making vary depending on their home country because of the particular set of national institutions, which shape firms' perceptions (Noorderhaven & Harzing, 2003; Wan & Hoskisson, 2003) even more in their environmental culture (Ioannou & Serafeim, 2012). As these institutional practices become embedded in firms' behaviors (e.g., Bansal & Roth, 2000; Paulraj, 2009), the home country profile enables them to develop specific tools to manage their environmental results (Leyva-de la Hiz et al., 2019) that can foster or hinder a competitive advantage in global competition (Cuervo-Cazurra, 2011). In particular, we know that different institutional pressures (regulatory, mimetic, and normative) exerted by diverse stakeholders motivate firms to implement initiatives oriented to environmental sustainability (Ortiz-de-Mandojana et al., 2016). In this regard, the previous literature based on institutional theory suggested that the long-term survival of firms operating in an international context requires that they gain legitimacy from international stakeholders (Kostova & Zaheer, 1999).

First, we examine the moderating role of home country innovation. The previous literature suggests that environmental initiatives have been identified as an effective source of increasing a firm's legitimation in an international context (Babiak & Trendafilova, 2011; Bansal & Roth, 2000). In contrast, recent studies have found that firms from countries with institutional advantages adopt a lower green orientation level in international contexts (e.g., Ellimäki et al., 2021; Leyva-de la Hiz et al., 2019). As firms enjoy protecting their home country's reputation, they have low incentives to adopt environmental policies as a legitimation strategy that can favor their internationalization process (Babiak & Trendafilova, 2011). This paper seeks to clarify this debate by examining firms from countries with low and high national innovation capabilities. In particular, we argue that whereas a weak innovative home country context reinforces a firm's interest in supporting its legitimacy by increasing its environmental policies, strong innovative countries reduce firms' interest in such sources of legitimation.

Second, we explain the individual behavior of each firm in its innovation capabilities. Previous literature shows that innovative firms tend to adapt better to environmental requirements in new institutional contexts (Cañon-de-Francia et al., 2007). Firms with these advantages are more likely to meet the expectations of institutions and are better able to exploit new market opportunities (Sorensen & Stuart, 2000) to gain international legitimacy and reputation. However, we still do not know how environmental policies interact with firm innovation capability to generate a higher impact on the degree of internationalization. Some nascent literature has attempted to study this impact on financial performance. For instance, Duque-Grisales et al. (2020b) show that the higher the R&D investment is, the stronger the positive impact of green innovation on firm performance. Similarly, Rahman et al. (2020) demonstrate that firm innovativeness strengthens the effect of green performance on market share. Considering that firm innovation capability plays a crucial role in terms of defining

firms' environmental approaches in the different markets where they operate, characterized by having a set of institutional peculiarities/singularities (Duque-Grisales et al., 2020b; Rahman et al., 2020), we argue that a firm's innovation capability will enforce the nexus between its environmental strategies and its scope of internationalization.

To this end, the paper addresses the following research questions:

Q1. What are the effects of firms' environmental policies on internationalization?

Q2. To what extent does the moderating role of innovative capabilities (i.e., national and firm) strengthen/weaken the effects of firms' environmental policies on internationalization?

This research work is divided into six sections. Following the introduction, we review the Asia-Pacific context in the second section. We then present a theoretical review and our hypotheses in the third section. Next, we explain the research methodology in the fourth section. We discuss the results of the empirical analyses in the fifth section. Finally, in the sixth section, we present our conclusions, implications, and limitations of the study and future research lines.

2.2. Theoretical background and hypothesis development

2.2.1. Environmental policies and internationalization

Few studies (see Duque-Grisales et al., 2020a; Martín-Tapia et al., 2008) have analyzed whether firms' environmental strategies influence internationalization. For instance, Martín-Tapia et al. (2010) find that a Spanish firm's strategies for ecological protection enhance its entry into overseas markets. The same result is echoed by Duque-Grisales et al. (2020a), who indicate that Multilatinas' environmental initiatives positively impact their internationalization. These studies have focused on the institutional perspective, suggesting that is committed to environmental protection positively affects a firm's international expansion. Companies perceive environmental initiatives as a business opportunity to gain

institutional legitimacy (Aguilera-Caracuel & Ortiz-de-Mandojana, 2013). To enrich the previous institutional perspective, we present our arguments for a positive relationship between environmental policies and internationalization.

Environmental policies foster a responsible green reputation (Abdelzaher & Newburry, 2016) amongst suppliers and consumers (Martín-Tapia et al., 2008). Obtaining a green reputation boosts a firm's overseas operation and eliminates the need for intensive marketing efforts in an international context (Martín-Tapia et al., 2010). Moreover, firms are induced to adopt environmental management systems to overcome the green trade barriers of global markets (Haider, 2011) by meeting the environmental standard of foreign countries (Dhull & Narwal, 2016). Furthermore, accountable, legitimate, transparent corporate images committed to protecting the environment (Christmann, 2004) facilitate international agreements and collaborations (Duque-Grisales et al., 2020a). Lastly, environmental commitment is considered an efficient tool for overcoming the liability of foreignness in a firm's internationalization process (Liu et al., 2018). Through environmental actions, firms comply with environmental regulations and institutions, are incentivized by the foreign government (Dadush, 2013), and receive less discrimination from the consumers of the host country (Kostova et al., 2008).

Consequently, we assume that environmental policies allow firms to increase their capability to gain institutional legitimacy through overcoming green entry barriers, meeting green standards of the host country, accessing international agreements and collaborations, and reducing the liability of foreignness, which are factors that facilitate the foreign expansion process. Therefore, we propose that firms establish environmental policies as a part of their business strategy to reach greater international expansion, leading us to the following hypothesis:

H1. *A firm's environmental policies positively influence its scope of internationalization*.

2.2.2. The moderating role of national innovation capability

Business scholars (e.g., Leyva-de la Hiz et al., 2019) point to the importance of the home-country innovation profile in explaining the firm's behavior in international contexts. Traditionally, it is expected that home-country innovative activities will generate positive spillover effects on domestic firms, such as experimental knowledge (Birkinshaw & Hood, 2000; Shaver & Flyer, 2000), observational and interactive learning (Vicente & Suire, 2007), along with access to tacit knowledge (Haahti et al., 2005; Sharma & Blomstermo, 2003) and to green technology inventions (Hu et al., 2019) that are critical for the integration and exploitation of environmental knowledge in the foreign expansion process. Nevertheless, recent studies (e.g., Ellimäki et al., 2021) show that firms from countries with institutional voids adopt a higher green orientation level in international contexts. In the same vein, Leyva-de la Hiz et al. (2019) find a negative relationship between the level of development of the home country's innovation profile and green innovation behavior in international contexts. In line with recent studies, based on the institutional theory, we explore the influence of national innovation capability on a firm's environmental policies and its scope of internationalization.

A high level of innovation in the home country enables a firm to be better positioned to signal their environmental progress based on the guaranteed implementation of innovative processes in their home country (Ortiz-de-Mandojana et al., 2011). Thus, firms with strong innovation capability in the home country may enjoy a prior legitimation (Leyva-de la Hiz et al., 2019) and greater credibility regarding environmental responsibility messaging. Firms from highly innovative countries can have low incentives to adopt environmental policies as a legitimation strategy that can favour their internationalization process (Babiak &

Trendafilova, 2011). Given this, we would expect that when the level of the home country's innovativeness is higher, the impact of environmental policies on its scope of internationalization will be weaker.

In contrast, firms from countries characterized by low levels of innovation may face greater scrutiny when operating globally (Fiaschi et al., 2017) due to their liability of origin (Ramachandran & Pant, 2010), defined as "a credibility and legitimacy deficit in the eyes of host country stakeholders who [are] even more circumspect due to inefficient or missing knowledge of foreign emerging market multinational firms, their quality and safety standards, and the like" (Madhok & Kayhani, 2012, p. 31). The literature shows that firms from emerging countries use CSR policies to reduce their liability of origin (Fiaschi et al., 2017; Marano & Kostova, 2016). In this case, firms adjust to a more institutionally demanding international context through a higher green orientation (Leyva-de la Hiz et al., 2019). As evidence shows (e.g., Zyglidopoulos et al., 2016), firms will try to make up environmental initiatives to obtain a "license to operate" in host developed and emerging markets. Although the country-of-origin literature mainly argues that companies invest in CSR activities to internationalize towards a more developed host country (Miller et al., 2008), recent studies argue that it occurs in their internationalization towards both developed and emerging countries (Huang & Chen, 2022; Forcadell & Aracil, 2019). These studies are based on the perspective of corporate social responsibility institutional necessities (CSRINs), which means multinational companies should adopt more proactive strategies to generate mutual benefits and prosperity for both the company and its emerging host country (Forcadell & Aracil, 2019). As these emerging countries have a greater need for CSR, firms take advantage of these needs to engage in CSR activities and gain higher legitimacy from the institutional actors. In the context of Asia-Pacific firms, Child and Tsai (2005) found that companies that

internationalize to China are increasingly expected to demonstrate socially responsible leadership concerning their environmental strategies.

Similarly, a recent study by Huang and Chen (2022) shows that high-tech companies from Taiwan adopt a socially responsible action to engage with emerging markets in China. Through environmental responsibility activities, firms overcome the negative perceptions entailed by the liability of origin (Branco et al., 2019; Ellimäki et al., 2021; Marano & Kostova, 2016). Accordingly, the lower the levels of home country innovativeness are, the stronger the impact of environmental policies on its scope of internationalization will be.

Hence, building on this stream of studies and drawing on institutional theory, firms from countries with low innovation capability must attenuate their legitimacy deficit as they have a greater need to operate abroad and prove that they meet the environmental standards of developed and emerging countries, due to having a liability of origin. In this way, they can obtain a "license to operate in foreign markets", reinforcing their reputation at an international level, despite being from countries with low national innovation capability. In contrast, firms from countries with a high level of national innovation capability do not care so much about obtaining reputation and international legitimacy by already belonging to contexts classified as innovative. For these reasons, we argue that the relationship between a firm's environmental policies and its internationalization is weaker in countries with highly innovative capabilities.

We, therefore, hypothesize the following:

H2. *The national innovation capability negatively moderates the relationship between a firm's environmental policies and its scope of internationalization.*

2.2.3. The moderating role of firms' innovation capability

Having analyzed the moderating role of the country level, now we focus on the firm's innovation capability, which has become one of the essential factors for the survival and

development of organizations in competitive markets (Kwakwa et al., 2018). Highly innovative firms have great flexibility in the ever-changing market and gain and sustain competitive advantages (Li et al., 2019). Drawing on the institutional theory, we present our arguments below.

First, firms with the ability to acquire and assimilate new knowledge such as know-how, core technologies, and operational or market knowledge can rapidly predict and fulfill their national and international requirements (Artz et al., 2010; Jones et al., 2018; Rubera & Kirca, 2012). Firm innovativeness determines how a firm responds to external institutional forces (Cai et al., 2016). Indeed, a high innovation capability enables firms to acquire and integrate valuable knowledge that allows the design of effective environmental policies that have greater acceptance and legitimacy in foreign markets (Aguilera-Caracuel et al., 2012). A high innovation capability facilitates the creation of new knowledge and improves a firm's ability to absorb and exploit existing knowledge. Furthermore, these innovative companies can introduce the accumulated knowledge into their operational development (Su et al., 2013). Put another way, innovation activities have instrumental value in helping firms access various resources and help them utilize resources efficiently. Thus, innovation may lead to new or updated organizational/production processes and products that are able to respond better to external institutions' environmental concerns coupled with financial ones (Ruggiero & Cupertino, 2018), suggesting the ability of a company to convert these initiatives into a tool for internationalization.

Second, high innovation capability generates the availability of greater technical knowledge within a firm. Such knowledge decreases its vulnerability in the face of the demands of new environmental regulations and other institutional requirements beyond regulatory ones (Cañon-de-Francia et al., 2007). As such, innovative firms adapt better to new environmental, institutional requirements than noninnovative firms (Cañon-de-Francia et

al., 2007; Segarra-Oña et al., 2011). These requirements encompass laws, orders, permits, licenses, approvals, authorizations, and other requirements that include sanctions if the minimums are not met. This becomes highly relevant when these innovative companies internationalize since their environmental policies are endowed with trust from international stakeholders.

Similarly, when a firm's environmental policies are supported with innovation capability, a green image would be perceived as authentic since it is more deeply embedded in the firm's resources and capabilities. Thus, firms with strong innovation capability can build a competitive advantage by adopting proactive initiatives and going beyond the standards articulated by institutional forces (Marshall et al., 2015). In contrast, an environmental response from low innovative firms can only be reactive or even passive, serving as greenwashing (Bowen & Aragon-Correa, 2014; Kang & He, 2018).

Last, innovation firms tend to be seen as more proactive in CSR activities (e.g., Shen et al., 2016). This can be explained by the fact that these activities may require R&D efforts by firms, suggesting that innovation initiatives may be driven by sustainability goals (Jain & Krishnapriya, 2020). Indeed, new innovative technologies drive firms to innovate and develop new environmental approaches (Ezzi & Jarboui, 2016). This is possible due to the development of innovative techniques, processes, and products to eliminate or reduce the emission of pollutants and the use of raw materials, natural resources, and energy (Kemp, Miles, & Smith, 1994). In this line, innovation can be considered an effective tool for environmental improvements through product quality developments (Padgett & Leite, 2012), which in turn may signal a firm's capacity to adapt the product to fit local requirements. Thereby, innovation firms can send "a signal to the marketplace pertaining to the firms' commitment towards the fulfillment of relational obligations" (Rahman et al., 2020, p. 2006) in adopting environmental approaches. For innovative firms, environmental policies

significantly impact their degree of internationalization since they obtain resources and capabilities that generate a sustainable competitive advantage that increases customer trust (Olsen et al., 2014).

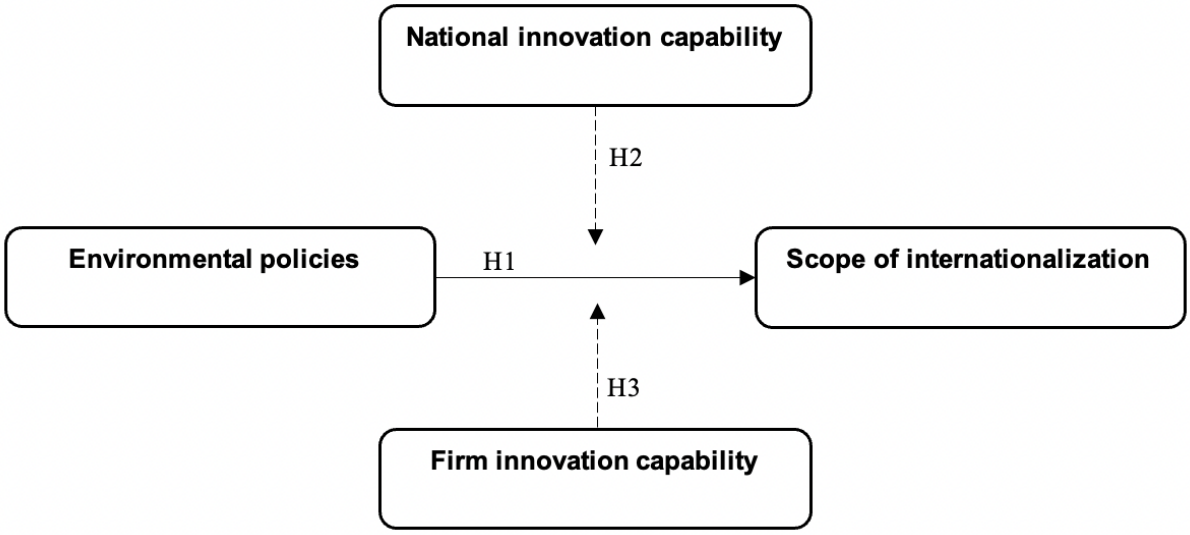
Thus, although increasing levels of environmental policies can be positive for both low and high innovative firms, we expect that adoption of these types of policies will lead to higher internationalization for more innovative firms than noninnovative firms. Certainly, innovation activities can be used as a strategic tool that can make the effect of firms' environmental policies on their scope of internationalization greater. In this study, we assume that firms' innovation activities enable them to increase their capacity to understand, respond to, and predict international stakeholders' demands across different regions, to adapt better to new environmental requirements, engage more in environmental initiatives, and have a greater capacity for green signaling. Moreover, innovative firms tend to be seen as more environmentally friendly. Taken together, these factors make greater the credibility of a firm's green orientation and convert it into a legitimation strategy. As such, the higher innovation the capability, the greater the impact of firm's environmental policies on its degree of internationalization.

Therefore, we posit the following hypothesis:

H3. *The firm innovation capability positively moderates the relationship between a firm's environmental policies and its scope of internationalization.*

The conceptual framework of this study is shown in Figure 2.1.

Figure 2.1. Conceptual framework



2.3. Data and methodology

2.3.1. Sample and data collection

The data were drawn from two different databases. We used the Thomson Reuters Eikon database to collect information relating to environmental policy, internationalization, firm innovation capability, and control variables. This source offers a comprehensive platform for establishing customizable benchmarks for the assessment of firms' operating behavior, environmental management, and financial performance (Ellimäki et al., 2021). It has been employed by several empirical studies in CSR performance (Ellimäki et al., 2021; Hartmann & Vachon, 2018; Hawn & Ioannou, 2016).

Our sample comprises 91 firms during the period ranging from 2014 to 2018. Table 2.1 shows the composition of the sample based on firms' country of origin and their industrial sectors. We included ten different sectors: basic materials, consumer cyclical, consumer non-cyclical, energy, financials, healthcare, industrials, technology, telecommunications service, and utilities. Also, we have 11 countries classified either as developed or developing, according to MSCI market classification followed by Eikon.

Table 2.1. Sample description by country and sector

Country	Basic Materials	Energy	Industrials	Healthcare	Financials	Consumer Non-cyclical	Consumer Cyclical	Technology	Telecommunications Service	Utilities	Total
Australia	5	2	1	0	1	2	1	0	0	0	12
China	1	2	0	0	1	0	1	1	0	0	6
Hong Kong	1	1	2	0	10	0	4	0	1	0	19
Indonesia	0	0	0	0	0	1	0	0	0	0	1
Japan	0	0	2	1	0	1	4	2	1	0	11
Malaysia	0	0	0	0	1	3	1	0	1	1	7
Philippines	0	0	0	0	1	0	0	0	0	0	1
Singapore	0	0	2	0	3	1	0	0	0	1	7
South Korea	2	0	2	0	0	0	1	0	0	0	5
Taiwan	3	0	2	0	0	1	1	10	0	0	17
Thailand	0	1	2	0	0	1	1	0	0	0	5
Total	12	6	13	1	17	10	14	13	3	2	91

2.3.2. Variable measurement

Scope of internationalization. Although it is common to measure internationalization by dividing the ratio of foreign sales by total sales revenue (Attig et al., 2016), we used the entropy index defined by Hitt et al., (1997) since "one simple measure of the scale of internationalization does not provide a fine-grained measure of its scope" (D'Angelo et al., 2016, p. 539). The measurement of internationalization as geographical distribution of sales was proposed by Rugman and Verbeke (2004) since "two firms may show similar export intensities, but one could export to a single neighboring country, while a second had sales to many countries over three continents (D'Angelo et al., 2016, p. 539).

Hence, we divided a firm's revenue from international sales in four big geographical areas (Hitt et al.,1997): the Americas, Europe, Asia and the Pacific, and Africa. Then, following previous empirical research which test international diversification's effects (D'Angelo et al., 2016; Gomez-Mejía et al., 2010), we used the entropy index defined by Hitt et al. (1997) as:

$$Entropy = \sum_{i}^{4} Xi * Ln\,(\frac{1}{Xi})$$

Where Xi represents the percentage of revenue from sales in the region "i". This index accounts for the number of international regions where the firms operate and the sales dimension in each region. Lower values of this index would imply a low level of a firm's international diversification, from 0 for non-internationalized to higher values for more international diversified firms.

Environmental policies. The independent variable in this research is environmental policies, which consists of five items: resource reduction policy, water efficiency policy, energy efficiency policy, emission policy, and waste reduction policy. These dimensions have been employed by several empirical studies in environmental literature (e.g. Duque-Grisales

et al., 2020a; Gómez-Bolaños et al., 2020). Each environmental policy is a dummy variable, representing if a firm has (value 1) or has not (value 0) implemented it. Following previous studies (e.g. Gómez-Bolaños et al., 2020), we compiled an index that represents the percentage of environmental policies that a firm adopts out of the total number of policies considered.

National innovation capability. National innovation capability was drawn from the WEF's Global Competitive Report Database. Khedhaouria and Thurik (2017) highlight that "national innovation capability is an evolutionary learning process that occurs within institutional structures'' (p. 48). Besides, a country's innovation capability is a driver for firms to absorb, adapt, and implement advanced technologies (Nelson & Winter, 1982); it also encourages them to have ''the capacity to turn ideas into new goods and services'' (WEF, 2018, p. 42). A country's innovation capability is an index composed of ten dimensions: diversity of the workforce, state of clusters development, international co-invention, multi-stakeholder collaboration, scientific publications, patent applications, R&D expenditures, research institutions prominence index, buyer sophistication, and trademark applications (WEF, 2018, p. 641). The national innovation capability takes the value on a continuous scale from low to high (0 to 100).

Firm innovation capability. This study draws on previous research (Rahman et al. 2020; Rubera & Kirca, 2012) to measure firm innovation capability as yearly R&D expenditures divided by yearly sales revenue. In environmental literature (Duque-Grisales et al., 2020b; Leyva-de la Hiz et al., 2019), it has been considered that firms' innovation generates strategic value in international contexts.

Control variables. We include some control variables that take into account different factors that can affect firms' internationalization. At the country level, GDP was considered in the analysis because it is related to internationalization (Noailly & Ryfisch, 2015). At a

firm level, we included a firm's relevant features in the internationalization process. In line with previous studies (Aragón-Correa, 1998; Chen et al., 2016) we included firm size as a control variable. This variable was assessed as the natural logarithm of the total revenue of sales. As firm age is considered a relevant factor in the internationalization process (Qian et al., 2013), it was measured as the number of years between the foundation of the firm and the observation year. Several studies (eg. Oesterle et al., 2013) confirm that a firm's ownership influences its internationalization. We measured an ownership type as a dummy, where 1 stand for state-owned enterprise, and 0 otherwise. Additionally, financial slack was included as a control given that (it enables firms to conduct environmental practices in international contexts (Murcia, 2020; Symeou et al., 2019). Low financial stability forces firms to prioritize their operational activities and invest in what they consider to be vital for their financial survival (Aguilera-Caracuel et al., 2015). We measured financial slack as an assets-to-liabilities ratio (Symeou et al., 2019). Furthermore, we control for firm industry in line with previous environmental studies (e.g., Pucheta-Martínez & Gallego-Álvarez, 2019). Finally, the scope of internationalization can be influenced by financial performance (Sun & Lee, 2013), in particular return on equity (ROE) (Nor et al., 2016).

2.3.3. Research methodology

We used STATA 14 software, employing a multilevel modeling technique to test our hypotheses. A multilevel modeling technique presents some advantages over traditional linear regression (Ortas et al., 2019): (1) captures the within-cluster dependence often shown by databases of firms from different countries; (2) provides the ability to estimate unbiased coefficients and standard errors, thus enhancing the results' robustness; (3) manages the variability of firms' internationalization into three levels of analysis (i.e., firms, periods, and countries). Multilevel modeling has received wide acceptance in the literature and has been used in earlier international studies (e.g., Hartmann & Uhlenbruck, 2015; Ortas et al., 2019).

The multilevel model makes it possible to divide the variance of the dependent variable into three variances: (a) firms, (b) years, (c), and (d) countries with a slope of country development: developed or developing. Results were consistent across methods, with similar values obtained using both multilevel modeling techniques and traditional linear regression.

2.4. Results

Table 2.2 shows the descriptive summary and Pearson correlation values for each variable used in this paper.

To assess multicollinearity, the variance inflation factors (VIF) were checked, and the values ranged from 1.07 to 1.92. According to Hair et al. (2009), values below five indicate there are no severe problems with multicollinearity. In Table 2.3, we detail the key findings of our study.

Model 1 shows the control variable results. Our findings show that size and age have a positive and significant impact on a firm's internationalization degree.

Moreover, in Model 2, we test Hypothesis 1 that predicts a positive relationship between a firm's environmental policies and internationalization. Hypothesis 1 is confirmed, as the coefficient is positive and significant. Although the dimensions of environmental policies have been employed by several empirical studies in environmental literature (e.g., Duque-Grisales et al., 2020a; Gómez-Bolaños et al., 2020), we captured the distinct role of different dimensions of a firm's environmental policies by testing the impact of each dimension on the degree of internationalization. The results show that energy efficiency, emission, and waste reduction policies have a significant impact on firms' internationalization. Nevertheless, resource reduction and water efficiency policies have a non-significant influence on firms' internationalization.

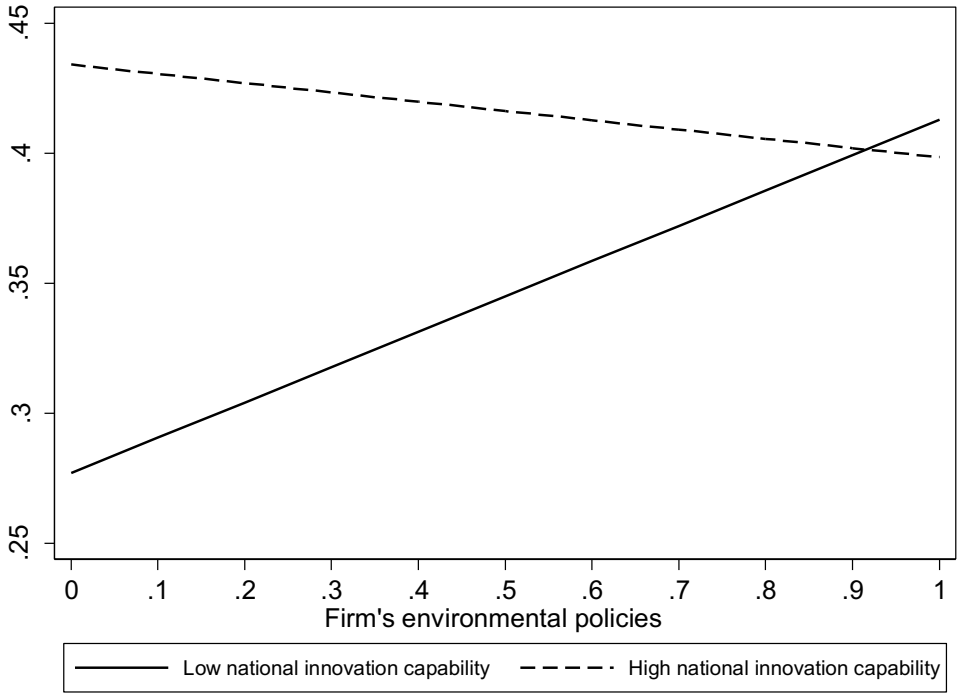
Table 2.2. Descriptive statistics and correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) Internationalization	1.000										
(2) GDP (log)	0.042	1.000									
(3) Age (log)	0.208***	0.027	1.000								
(4) Size (log)	0.366***	-0.144***	0.167***	1.000							
(5) Ownership	0.063	-0.198***	-0.027	0.070	1.000						
(6) Country Development	-0.020	0.801***	0.054	-0.174***	-0.077	1.000					
(7) ROE	-0.047	-0.061	-0.081*	0.106**	-0.168***	-0.143***	1.000				
(8) Slack (log)	-0.014	0.182***	0.052	-0.469***	-0.049	0.118**	-0.092*	1.000			
(9) Environmental Policies	0.267****	0.059	0.091*	0.229***	0.128***	0.138***	-0.052	-0.115**	1.000		
(10) National Innovation Capability	0.286***	0.547***	0.118**	0.067	-0.311***	0.165***	0.073	0.189***	-0.055	1.000	
(11) Firm Innovation Capability	0.090*	0.005	-0.013	-0.046	-0.026	-0.141***	0.024	0.298***	0.017	0.287***	1.000
Mean	0.399	10.189	3.513	21.887	-	-	9.682	0.851	0.777	0.677	0.014
SD	0.305	0.755	0.732	1.494	-	-	8.0041	0.571	0.328	0.094	0.037
Min.	0	7.955	0	16.978	0	0	-34.9	0.05	0	0.371	0
Max.	1.096	10.189	4.89	25.792	1	1	47.8	2.714	1	0.808	0.24

* p < .1; ** p < .05; *** p < .01

Furthermore, Model 3 tests Hypothesis 2 which indicates a negative moderating role of national innovation capability between environmental policies and internationalization. Hypothesis 2 is supported, as the coefficient is negative and significant. Figure 2.2 helps to visually check the effect hypothesized.

Figure 2.2. The moderating effect of national innovation capability



Finally, Model 4 tests Hypothesis 3 that predicts a positive moderating role of firm innovation capability between environmental policies and internationalization. Model 4 revealed that firm innovation capability has a positive but not statistically significant moderating effect on the relationship. Beyond these findings, we confirm that a country's effect is also present, and a firm's scope of internationalization varies across home countries with a slope of country development.

Table 2.3. Multilevel linear regression

	Model 1	Model 2	Model 3	Model 4
Fixed Effects				
GDP	0.043 (0.032)	0.023 (0.033)	0.018 (0.034)	0.023 (0.034)
Firm Age	0.094*** (0.032)	0.032** (0.032)	0.069** (0.033)	0.076** (0.034)
Firm Size	0.032** (0.012)	0.034*** (0.005)	0.032** (0.007)	0.034*** (0.012)
Ownership	0.120 (0.152)	0.099 (0.503)	0.079 (0.150)	0.099 (0.149)
Slack	-0.005 (0.028)	-0.004 (0.028)	-0.001 (0.028)	-0.004 (0.028)
ROE	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)
Environmental Policies		0.074*** (0.027)	0.660*** (0.170)	0.068** (0.029)
National Innovation Capability		0.073 (0.125)	0.828*** (0.250)	0.068 (0.126)
Firm Innovation Capability		-0.321 (0.603)	-0.170 (0.599)	-0.698 (0.911)
Environmental policies X National Innovation Capability			-0.903*** (0.259)	
Environmental policies X Firm Innovation Capability				0.380 (0.577)
Industry Dummies Included	YES	YES	YES	YES
Cons	-1.089** (0.435)	-0.953** (0.432)	-1.336** (0.447)	-0.942** (0.433)
Random effects				
Firm	0.232 (0.018)	0.226 (0.018)	0.227 (0.018)	0.226 (0.018)
Year	0.057 (1.577)	0.055 (0.762)	0.052 (0.792)	0.055 (1.352)
Country (development)	0.074 (0.011)	0.079 (0.010)	0.081 (0.010)	0.079 (0.010)
Residual	0.026 (2.265)	0.028 (0.028)	0.031 (0.973)	0.026 (1.883)
Log Likelihood	244.143	247.863	253.747	248.018
No. Firms	91	91	91	91
No. Observations	441	441	441	441

Significance levels: *p < .1; **p < .05; ***p < .01

2.5. Discussion, limitations and future research

Using institutional theory, this study examines how environmental policies contribute to an increase in the scope of internationalization in Asia-Pacific firms and whether this relationship is moderated by national and firm innovation capability. For this purpose, an empirical study was conducted with a sample of 91 Asia-Pacific firms. Although many studies have been conducted to understand environmental initiatives in international contexts, several gaps remain to be filled. First, the vast majority of previous empirical studies have primarily focused on the Western context. The research works have been limited to the learning perspective, where internationalization offers the opportunity for progressive assimilation of environmental knowledge. In other words, the experience of internationalization allows firms to better understand the host country's institutional requirements and develop a set of best environmental practices (Aguilera-Caracuel et al., 2012; Bansal, 2005; Forslid et al., 2018; Gómez-Bolaños et al., 2020). Although the learning perspective may be generally accepted, a previous work by Duque-Grisales (2020a) challenges this view by showing that the environmental capabilities of Multilatinas serve as a source of institutional legitimacy in foreign markets. Their findings suggest that environmental proactivity is positively associated with international geographic diversification. Our study contributes to this debate by providing evidence of this in the context of Asia-Pacific firms. In addition, we examined different dimensions of a firm's environmental policies by testing the impact of each dimension of the internationalization degree. The results show that energy efficiency, emission, and waste reduction policies have a significant positive impact on firms' internationalization. However, resource reduction and water efficiency policies have a nonsignificant influence on firms' internationalization. Interestingly, this may be because these policies of Asia-Pacific firms do not generate specific real actions on their natural environment. Consequently, firms cannot gain

institutional legitimacy due to a clear gap between intentions and actions (Refinitiv, 2019; 2020). For instance, a recent report by Refinitiv (2020) reveals that slightly more than a third (36%) of Australian firms have a water efficiency policy but only 11% maintain specific targets. Another report by Refinitiv (2019) shows that 62% of the firms in Asia have a water efficiency policy, but only 16% maintain specific water efficiency targets. In the case of Singapore, although 60% of firms have water efficiency policies, only 18% maintain targets (Refinitiv, 2019). Regarding setting targets for a resource reduction policy, 82% of firms in Asia have resource reduction policies, while only a quarter (28%) have actual resource reduction targets (Refinitiv, 2019). These gaps between established actions and generated impact can negatively influence stakeholders' perceptions and cast doubt on the credibility of environmental policies, leading to a nonsignificant influence on firms' internationalization. Thus, future studies can focus on different dimensions of a firm's environmental policies within its scope of internationalization in this context.

Moreover, the novelty of our study is that we unpack the innovation construct by drawing on its two key components: firm innovation capability as an internal component and national innovation capability as an external component. Previous studies have primarily focused on the regulatory aspects of the home country (Estrin et al., 2016; Rugman & Verbeke, 1998). There are few studies that have studied the innovative environment of the home country (see Leyva-de la Hiz et al., 2019). Since the innovation construct as a moderator has not been directly explored in the context of Asia-Pacific firms, our findings fill an important gap in the field. Furthermore, the results of this study go against the traditional assumption of positive spillover effects of institutional strengths. Thus, this study represents an important advance in institutional theory by showing a negative moderating role of national innovation capability. Furthermore, with regard to firm innovation capability, although our results also show its positive moderating effect as hypothesized, these findings

are not statistically significant; hence, future studies should entail a detailed examination of the effects of firm innovation capability. The nonsignificant result may be because the majority of the Asia-Pacific region has a low level of R&D expenses, which reflects the low levels of firm innovation. As such, firms do not have the capacity to respond better to external forces. Consequently, a firm's innovation capability does not strengthen the impact of environmental policies on its scope of internationalization. Thus, support from governments and institutions is strongly recommended to increase the investment level in R&D.

We are aware that our research may have some limitations that serve as a base for further studies on international business. First, we have examined a single dimension of environmental performance. A further line of continuation of our work is to realize an in-depth analysis of the core motives of Asia-Pacific firms in terms of environmental transformation to complete a picture of the environmental behavior and its influence on internationalization. Future researchers can focus on how managers from these firms perceive the importance of environmental proactivity, the implementation of environmental standards such as ISO 14001, and the environmental decision-making process of managers and their attitudes towards commitment to nature. In addition, scholars can investigate the main drivers of internationalization for these firms and their relationship with their stakeholders in international business. Second, for the moderating effect, we focused on the home country's role in the relationship between environmental policies and internationalization. It would be highly significant for future research to explore whether the host country's innovation capability matters when firms decide to expand into international markets. Additionally, our counterintuitive finding of a negative moderating effect of home-country innovation capability in the Asia-Pacific region can encourage researchers to investigate the sign of the effect of this home-country aspect in other contexts. Also, further research can focus on other

home/host country aspects as a moderating effect, such as the macroeconomic environment, market size, infrastructure, and environmental or economic performance. Moreover, one limitation of our study is the possibility of reverse causality. To minimize the effect of possible reverse causality on our results, we additionally conducted the dynamic regression model with a lagged dependent variable (Blundell & Bond, 1998). The results suggested a marginally significant relationship with a p-value of 0.056 for the relationship between environmental policies and internationalization. Therefore, we strongly recommend future studies to assess the potential causality using different statistical analyses.

Eventually, it is important to highlight that a fast-growing economy and a high level of industrialization can lead the Asia-Pacific region to ignore its commitment to nature. However, our results suggest that these firms are in their first steps of environmental transformation. We believe that these firms are using this transformation to obtain greater legitimacy in international markets, leading them to accept and adapt their actions following their environmental plans. Even though implementing highly environmentally friendly policies may not guarantee that these firms will take proper action to face ecological challenges, it is an optimal way to gain access to new demanding markets by opting for going green. Second, as expected, initiating considerable actions on environmental issues can take a long time. Stakeholders can interpret environmental policies as a corporate greenwash (Meng et al., 2019) if firms do not change in future years their ways of producing, working, and operating. In our view, our results are useful and can awaken environmental awareness among Asia-Pacific firms. We hope that our findings will encourage researchers to analyze firm environmental behavior and internationalization in the context of this promising region. These companies can show their environmental commitment by incorporating the Sustainable Developmental Goals approved by the UN into their business strategy and governance and

sustainable system. In the current pandemic situation, now more than ever, green recovery is offered as a solution to build a more inclusive economy (OECD, 2021).

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Chapter 3

Firm- and country-specific advantages: Towards a better understanding of MNEs' environmental performance in the international arena

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Firm- and country-specific advantages: Towards a better understanding of MNEs' environmental performance in the international arena

Abstract

International diversification is predominantly assumed to have a mixed (either positive or negative) linear relationship with environmental performance in multinational enterprises (MNEs). Departing from this assumption, we use firm-specific advantages (FSA) theory to hypothesise that international diversification, due to recombination barriers, has a curvilinear U-shaped relationship with MNEs' environmental performance. Because of their key roles as boosters of country-specific advantages (CSA), we also examine whether home-country competitiveness and environmental levels moderate the proposed curvilinear relationship. Results from panel data of 298 MNEs between 2006 and 2017 from 21 different countries in 11 sectors provide support for the main curvilinear relationship and the moderating influence of home-country competitiveness. Our study contributes to the international business literature by casting doubt on the widely held assumption that international diversification always carries either positive or negative effects on environmental records.

Keywords: environmental performance; international management; longitudinal analysis; regression analysis, competitive advantage, and environmental strategy.

3.1. Introduction

In recent years, the relationship between a firm's internationalization and its environmental performance has generated considerable interest in academia and business management (Aragón-Correa et al., 2016; Chen et al., 2016; Gómez-Bolaños et al., 2020). Environmental performance is based on reducing firms' impact on the natural environment (Walls et al., 2011), which works as a strategy to outperform competitors (Aragón-Correa, 1998; Bansal & Roth, 2000; Berrone & Gómez-Mejía, 2009). At an international level, such a strategy acquires a special relevance because the multinational enterprises' (MNEs') behaviour attracts special attention from several local agents (Aragón-Correa et al., 2016; Berrone et al., 2013; Delgado-Márquez et al., 2015) and so, in the extent to which the complexity in successfully managing all operations will be higher for internationally diversified firms (Doh & Guay, 2006; Fifka, 2013; Gallego-Álvarez et al., 2018; Lenz & Viola, 2017). In this sense, international diversification is understood as 'a strategy through which a firm expands the sales of its goods or services across the borders of global regions and countries into different geographic locations or markets' (Hitt et al., 2009, p. 231). Given this, in this research, by the term 'internationally diversified firms', we refer to a firm that operates in multiple and diverse markets abroad.

After several decades of research, the literature on international business (IB) has reached mixed findings regarding the influence of MNEs' internationalization on its environmental performance. Broadly, two main approaches can be distinguished. Previously, a growing body of literature has shown that such a relationship has a positive nature (e.g. Aguilera-Caracuel et al., 2012; Bansal, 2005; Gómez-Bolaños et al., 2020; Forslid et al., 2018; Symeou et al., 2018). The main argument of these studies is that firms operating in more international locations exhibit better environmental performance because they achieve greater opportunities for progressive assimilation of knowledge and development of a more

advanced environmental approach (Aguilera-Caracuel et al. 2012; Bansal, 2005). This is because internationalization allows firms to achieve economic of scales, which facilitate the adoption of cleaner technology and investment in abatement, and, in turn, lead to lower environmental emissions (Forslid et al., 2018). Hence, firms operating with more international scope are more able to improve their environmental results, as they have more resources and tools.

However, a few other studies have resulted in contrary findings, suggesting that an international scope does not guarantee high environmental performance (Aragón-Correa et al., 2016; King & Shaver, 2001; Levy, 1995). For example, Aragón-Correa et al. (2016) found that the largest MNEs present weaker environmental performance despite making more effort to disclose more detailed information about such environmental results. This can be explained by the difficulty in managing the increased complexity that involves having geographically dispersed subsidiaries (Kostova & Roth, 2003). In conditions of such increased international diversification, "MNEs may act irresponsibly not out of malice or ill-will, but because they have to stretch their resources and capabilities in order to coordinate and monitor subsidiaries" (Strike et al., 2006, p. A3). Indeed, studies show that more international firms may generate higher waste due to their relative lack of experience with local conditions and difficulty in finding and negotiating with buyers for waste materials (e.g. King & Shaver, 2001; Levy, 1995). Thus, in this view, some MNEs are not able to implement better green practices abroad due to a lack of integrated knowledge and/or expertise to face greater difficulties derived from operating in diverse international contexts.

There is no clarity as yet on the sign of the relationship between international diversification and firms' environmental performance as well as on how the orchestration of such a relationship actually develops. Recent literature has shown the need to provide further evidence about the environmental impacts of international firms (Aray et al., 2021; Burritt et

al., 2020). We contend that this phenomenon entails a higher complexity that goes beyond a linear path and instead complements prior findings by proposing a U-shaped curvilinear focus at the international diversification and environmental performance nexus. To that, we rely on the firm-specific advantages (FSA) theory proposed by Rugman and Verbeke (1998a, 1998b). Particularly, Rugman and Verbeke (1998a, p.7) defined green FSAs as 'FSAs that are developed in response to challenges posed by the natural environment to enhance both environmental and economic performance and capabilities in the environmental area that allow firms to outperform their competitors and enhance industrial performance'. According to Singh et al. (2014, p.7), green FSAs are 'a bundle of strategic assets that constitute green capabilities and resources, deployed to implement environmental management practices'. Thus, we argue that firms face difficulties to diffuse, deploy and exploit their green FSAs to production operations dispersed across several countries during their initial stage of internationalization. However, by accumulating international experience, recombining their green FSAs with the host country environment, MNEs are able to reverse this situation and improve their environmental performance to later present good environmental results.

In addition, we investigate the moderating role of the home-country profile because firms' behaviour and strategic decision-making vary depending on their home country-specific advantages (CSAs) (Narula &Verbeke, 2015; Noorderhaven & Harzing, 2003; Rugman et al., 2012; Wan & Hoskisson, 2003). Specifically, we draw on two key aspects of the home-country profile: home-country competitiveness and environmental performance. These two dimensions of the home country are relevant to determine a firm's strategy (Carney et al., 2017; Leyva-de la Hiz et al., 2019; Stavropoulos et al., 2018). Each dimension provides access to different features, factors and/or tools that enable firms to build strong green FSAs. The highly competitive countries are characterised by an efficient government, financial resources, sophisticated market, educational system, labour market, and other

resources (Delgado, Ketels, Porter, & Stern, 2012; Fainshmidt et al., 2016). Scholars have found that these competitive location advantages will lead firms to build strong green FSAs, such as investment in green production processes (Berrone et al., 2013; Ortas et al., 2019) and environmental practices (Ioannou & Serafeim, 2012). In regard to home-country's green location advantages, we highlight the firm's exposure to higher environmental standards (Porter & van der Linde, 1995), strict environmental regulations (Rugman & Verbeke, 1998a), in particular, the banning of toxic substances, the requirement for cleaner production technologies and the establishment of bounds on pollution levels (Wang et al., 2018). Together these green location advantages drive firms to opt for advanced green FSAs (Porter & van der Linde, 1995).

The remainder of this chapter is organised as follows. The next section revises a theoretical background to develop our research hypotheses regarding the U-shaped relationship between international diversification and a firm's environmental performance and the moderating role of competitiveness and the environmental home-country profile. In third section, we present an explanation of the research methodology, including details from our sample, variables' measures, and statistical technique. Then, we discuss the results obtained in fourth section. Finally, we conclude the paper with a discussion of our findings, along with future research lines.

3.2. Theoretical background and hypothesis development

3.2.1 The influence of international diversification on MNEs' environmental performance

Although high potential for transferability of green FSAs to international contexts can be expected, the pressure for national responsiveness exerted by governments, consumers and other stakeholders may stimulate MNEs to develop location-bound green FSAs that are specific to individual countries and non-transferable (Kolk & Pinkse, 2008; Rugman &

Verbeke, 1998a). In the same line, Aguilera-Caracuel et al. (2013) highlight that foreign firms tend to adapt their green FSAs according to each country's legal requirements. Moreover, due to the fact that environmental challenges can differ across countries (Gasbarro et al., 2017), the transfer of green FSAs to relatively 'distant' countries (Ghemawat, 2001) in terms of dissimilarity of environmental regulations can be complicated. This will result in higher adaptation costs for MNEs (Kolk & Pinkse, 2008; King & Shaver, 2001; Rugman & Verbeke, 2005) within the initial countries where MNEs start to operate at early stages of international diversification. Also, firms possess location-specific assets that are potentially available in a specific location (Collinson & Narula, 2014). For instance, some specific technologies related to renewable energy, such as hydroelectric and wind power, require mountainous areas and sufficient wind speed, respectively (Kolk & Pinkse, 2008; Russo, 2003). Thus, implementing and deploying such advanced environmental technologies in another location can be very costly at first, owing to a lack of adequate infrastructure (Kolk & Pinkse, 2008). Finally, even for MNEs seeking global green FSAs that can be transferred and deployed globally (Patchell & Hayter, 2021), implementation throughout global operations takes time, typically dependent on new investments, and disparities in environmental performance occur (Christmann, 2004; Christmann & Taylor, 2006; Morano & Kostova, 2016; Perkins & Neumayer, 2010; Vogel, 2010).

With increased international experience in more foreign markets, however, firms will be able to overcome the challenges of environmental management that were faced in their initial stages of international diversification. Thus, the increase in the number and diversity of operations in more regions allow firms to better manage overseas operations (Hitt et al., 1997) and recombine their green FSAs and location-specific advantages in the host country (Coviello et al., 2017; Grøgaard et al., 2019; Verbeke, 2009). Recombination capability is the MNE's highest-order FSA (Bohnsack et al., 2020; Narula et al., 2019; Scott-Kennel &

Giroud, 2015), by which a firm creates new knowledge, integrates it with the existing knowledge base and exploits the resulting new knowledge bundles across geographic space (Grøgaard et al., 2019; Rugman et al., 2011; Verbeke, 2009). The recombination process can be developed inside (intra-firm), outside the firm (extra-firm), or both (network combination) through learning and experience (Lee et al., 2021). Thus, with increased international diversification, firms are able to recombine their green FSAs and diverse host countries' specific advantages, which consequently lead to an improvement in their environmental performance.

Moreover, a firm's international diversification in different external institutional environments promotes the generation of other organisational capabilities useful for the recombination process of green FSAs, such as flexibility or stakeholder management (Starik et al., 2000). Higher interaction and collaboration with international external partners that own or control key location-specific advantages (Collinson & Narula, 2014; Narula & Verbeke, 2015; Verbeke & Kano, 2016), which are important for developing advanced environmental initiatives. Thus, firms create a value network of suppliers and partners (Zott & Amit, 2010) in a host location, which is at the basis of the FSAs' recombination (Bohnsack et al., 2020). Furthermore, it is important to note that with a greater level of internationalization, costs of environmental standards implementation diminish due to the fact that MNEs take advantage of global standards to reduce their air emissions, solid waste and energy usage (Aguilera-Caracuel et al., 2012).

Consequently, after passing through the adaptation period through recombination with host countries' location-specific assets (Bohnsack et al., 2020) and beginning to take advantage of internationalization, firms are able to revert their poor environmental behaviour to a positive environmental performance from the increased experience of more international diversification. Hence, 'the cross-border activities enable firms to further strengthen their

position and to expand the assets available' (Freiling & Laudien, 2012, p.6) at later stages of international diversification. For these reasons, firms will exhibit higher environmental performance in more international diversified steps once they recombine their green FSAs in accordance with the host-country environment.

In sum, at early stages of international diversification, MNEs face difficulties in transferring and exploiting their green FSAs; however, with increased international diversification, MNEs are able to recombine their green FSAs from higher experience abroad and thus will present a better environmental performance.

We, therefore, hypothesise the following:

H1. *The relationship between international diversification and environmental performance is U-shaped curvilinear, with environmental performance decreasing up to a certain point but later increasing with higher levels of international diversification*.

3.2.2 The moderating role of an MNE's home-country profile

Along with FSAs, CSAs as a country dimension influence a firm's behaviour during its internationalization process (e.g. Bhaumik et al., 2016; Rugman, 1981; Yaprak et al., 2018). CSAs refer to location advantages specific to the country in which the unit of the MNE is located (Rugman & Nguyen, 2014). In particular, home CSAs play a critical role in the development of strong FSAs (Dunning & Lundan, 2008; Rugman et al., 2011) because different CSAs provide firms with specific previous tools and knowledge to manage their potential behaviour and outcomes on an international scope in terms of their environmental performance.

For this reason, scholars used to study which dimensions of home CSAs are indeed differential with respect to shaping firm's environmental behaviour in international contexts (e.g. Berrone et al., 2013; Delmas & Montes-Sancho, 2010). These dimensions arise from the

different national institutions within the same context, which differently influence firms (Berrone et al., 2013; Delmas & Montes-Sancho, 2010; Hitt et al., 2006; Scott, 1995) and which differently determine their environmental results. Through the pressures of these institutions in other words, each dimension will embed a specific cultural response and thus provide firms with a specific range of tools and knowledge different from the others. Consequently, we argue that strong home CSAs (Rugman et al., 2011) derived from different home-country dimensions will lead firms to develop best green FSAs that will not suffer from challenges in their international expansion.

In particular, we contend that two home CSAs provide differential influences on a firm's environmental performance in their internationalization process (Carney et al., 2017; Leyva-de la Hiz et al., 2019; Stavropoulos et al., 2018): home-country competitiveness and home-country environmental profile. These two dimensions of the home country have a special relevance to determine firms' environmental behaviour in global markets due to a great complementary influence of the whole home-country location advantages (Leyva-de la Hiz et al., 2019; Kolk & Fortanier, 2013) since they include both kinds of normative and regulatory institutions and pressures (e.g. Aragón-Correa et al., 2020; Ortiz-de-Mandojana et al., 2016) and so they represent the entire dimensions of a firm's home country.

Home-country competitiveness profile. The home-country competitiveness level has a relevant and particular impact on the relationship between MNEs' international diversification and environmental performance. Competitiveness refers to the home country's institutional profile based on the 'ability of a nation to achieve long-term value for its enterprises and more prosperity for its people' (IMD World Competitiveness Center, 2020). The importance of country competitiveness to firms is described in Porter's (1990) diamond model, suggesting that country-specific conditions derived from competitiveness, such as factor endowments, demanding consumers, and clusters of supporting industries, interact

with firm strategies and structure to determine a firm's competitive advantage and therefore its strategy formulation (Carney et al. 2017; Rugman et al., 2012). Hence, this fact arises as an essential factor in shaping the firm's internationalization process for its environmental performance.

In particular, a country's high competitiveness entails important advantages for firms, such as access to financial markets, the educational system and labour market as well as other resources (Delgado et al., 2012). For instance, firms within developed credit and equity markets will face fewer capital constraints (Hall & Soskice, 2001), which enhances their ability to invest in green production process (Berrone et al., 2013; Ortas et al., 2019). In addition to this, highly efficient and less corrupt counties provide incentives, such as tax exemptions for responsible firms, leading firms to engage in environmental practices (Ioannou & Serafeim, 2012). Firms will be considered as having a higher degree of these tools and advantages to better translate their FSAs if they come from countries with a higher level of competitiveness.

On the one hand, MNEs from highly competitive countries build their green FSAs on strong home-country location advantages, which are not difficult to transfer internationally. These greater location advantages are due to abundant home-country institutions allowing firms to acquire advanced skills and transaction efficiency that benefit their geographic diversification (Wan & Hoskisson, 2003). Thus, institutions related to home CSAs have a strong impact in terms of how FSAs are managed, developed, transferred across borders, and recombined with new resources in host countries (Ferraris, 2014; Rugman et al., 2011). Indeed, high home-country competitiveness predicts the creation of non-location-bound FSAs (easily transferable internationally) (Ferraris, 2014; Porter, 1990). For this reason, MNEs from competitive countries may get over the barriers derived from international

diversification earlier since the learning and acquiring tools process is less dilated as they already enjoy a previously competitive background (Ellimäki et al., 2021).

On the other hand, firms from lowly competitive countries face difficulties in transferring and deploying their green FSAs when going global. In this sense, MNEs from lowly competitive countries have to make an extra effort to adopt environmental management practices in their host-country subsidiaries (Tatoglu et al., 2014) to mitigate the drawback of their origin (Amankwah-Amoah & Debrah, 2017; Asmussen, 2009; Ellimäki et al., 2021). Hence, these firms will later recombine their green capabilities and resources with the home-country environment due having less previous knowledge and tools provided by their home country's competitive profile. Even, with strong corporate sustainable background in their home country, emerging MNEs are "susceptible to decoupling or misfit in the transfer of corporate sustainability from parent companies to foreign subsidiaries" (Park, 2018, p.1517).

In sum, the U-shaped relationship between international diversification and environmental performance is conditioned by the home-country competitiveness level. MNEs from highly competitive countries will earlier make this relationship positive, whereas MNEs from the lowly competitive countries will do so later because the former are more prepared to transfer their green FSAs due to the great range of tools previously derived from their higher competitiveness level, such as access to fewer capital constraints (Hall & Soskice, 2001), advanced financial markets, the educational system, labour market (Delgado et al., 2012) and even incentives, such as tax exemptions for socially responsible firms, leading firms to opt for green practices (Ioannou & Serafeim, 2012).

Therefore, we posit the following hypothesis:

H2a. *The greater the home-country competitiveness level, the earlier the international diversification impact on environmental performance becomes positive.*

Home-country environmental profile. Furthermore, the home-country environmental level has a special influence on the relationship between MNEs' international diversification and environmental performance (Leyva-de la Hiz et al., 2019; Zeng & Eastin, 2012). The home-country environmental level reflects how well environmental issues, such as resource conservation, pollution abatement, and eco-efficiency, are addressed in a country (Siche et al., 2008; Xiao et al., 2018) as well as differences in economic and environmental priorities (Christmann & Taylor, 2006). The literature evidences that if an MNE perceives environmental challenges such as climate change as a global issue, decision-making power on this issue will be at the level of its headquarters (Kolk & Pinkse, 2008). Thus, environmental profile is an essential aspect of home CSAs that can shape a firm's environmental performance in their international diversification process.

In particular, the country's high environmental profile adds a layer of environmental compliance pressure, leading firms to feel pressed to increasingly engage in green practices (Delmas & Toffel, 2011). The firms usually behave in accordance with laws and regulations that are promulgated by the government (Liao, 2018). Governments from countries with a strong environmental profile impose regulative pressures often by banning toxic substances, requiring cleaner production technologies and establishing bounds on pollution levels (Wang et al., 2018). Such pressures create strong green location advantages, as for instance, firms from countries that support global climate policy may be able to profit from easier access to supranational stakeholders and global norms (Kolk & Ciulli, 2021). Thus, the level of home-country environmental profile will provide these specific tools for firms to translate their FSAs.

In this sense, MNEs from countries with strict environmental regulations (Stavropoulos et al., 2018) will develop best green practices and deal better with environmental challenges at their first stage of internationalization. Indeed, MNEs benefit

from higher environmental standards in their home market because such standards induce them to develop superior green FSAs (Kolk & Pinkse, 2008; Porter & van der Linde, 1995). Thus, MNEs from countries with a strong environmental profile can easily transfer technology, knowledge and management practices developed at home to host-country subsidiaries (Blomstrom & Kokko, 1998; Branstetter, 2006) since their green FSAs stick to strict global environmental standards.

In contrast, MNEs from countries with a weak environmental profile will have to face greater difficulties since the "country-of-origin" effect suggests if MNEs arise from poorly regulated environments and on average convey poor environmental practices in their international operations (Zeng & Eastin, 2012). Hence, MNEs from low environmental countries will have to experience a greater process to adopt better green practices (Gardberg & Schepers, 2008; Leyva-de la Hiz et al., 2019), and thus they will later overcome the challenges related to international environmental management.

In conclusion, on the one hand, MNEs from countries with a high environmental profile present an ability to transfer technology, knowledge, and management practices developed at home to host-country subsidiaries. On the other hand, MNEs from countries with a low environmental profile may have a poor environmental process in their early international diversification process due to fewer previous tools to implement in this international experience and thus enhance their environmental performance. Thus, MNEs benefit from a home-country's strong environmental profile, such as high environmental standards (Porter & van der Linde, 1995), strict environmental regulations (Rugman & Verbeke, 1998a; Wang et al., 2018), easier access to supranational stakeholders and global norms (Kolk & Ciulli, 2021). These green location advantages drive MNEs to develop superior green FSAs (Porter & van der Linde, 1995) and maintain their competitiveness once environmental regulations are raised in foreign countries (Aguilera-Caracuel et al., 2011).

We thus post that the effect of our U-shaped relationship is moderated as follows:

H2b. *The greater the home-country environmental level, the earlier the international diversification impact on environmental performance becomes positive.*

3.3. Data and method

3.1.1. Sample and data collection

Our sample comprises companies in the MSCI World Index, an index which contains 1,626 MNEs from 21 different countries and encompasses a reliable data source for this study. These MNEs operate in 11 different industries, and we have information for the period from 2006 to 2017 (i.e., 12 years). From this dataset, the highest percentages of MNEs come from the United States, Japan, Canada and Australia, but there are also MNEs from other Asian and European countries (see Table 3.1).

To build our international diversification data, we restricted our analysis to MNEs that report at least 95 percent of their total sales disaggregated by foreign regions: this is the key reason for missing data in our MNEs listed in the MSCI World Index, providing a final sample of 2,875 observations from 298 different MNEs. We consider that this restriction is essential to robustly examine the real effect of our international diversification variable, since firms with poor reports on their regional sales abroad may not provide an accurate idea of their international diversification in global markets.

Finally, it is important to highlight that each observation includes information about environmental results, international sales and financial results of an MNE for each year. We collected the information from the Thompson Reuters Eikon database, from the *Environmental*, *Social* and *Governance section* (*ESG*) and the international segments for each MNE.

Table 3.1. Home country of sampled MNEs

Home Country	Number of Companies	Percentage of the Sample
United States	85	28.52
Japan	50	16.78
Canada	35	11.74
United Kingdom	18	6.04
Australia	17	5.70
Germany	17	5.70
France	15	5.03
Sweden	9	3.02
Switzerland	7	2.35
China	6	2.01
Netherlands	6	2.01
Norway	6	2.01
Singapore	6	2.01
Finland	5	1.68
Belgium	3	1.01
Denmark	3	1.01
Ireland	2	0.67
New Zealand	2	0.67
Italy	2	0.67
Portugal	2	0.67
Spain	2	0.67
Total	298	100%

3.3.2. Variable measurement

Environmental performance. Measuring environmental performance has a multidimensional character (Johnstone & Hallberg, 2020), where some scholars use the reduction of emissions (Hartmann & Vachon, 2018) or levels of resource efficiency and/or consumption (Kock et al., 2012) as proxies for MNEs' environmental performance. However, further measures which record all of these aspects were demanded, so past management literature offers different indices and scores for better proxies of this category (e.g. Aragón-Correa et al., 2016; Berrone et al., 2010; Walls et al., 2012). Therefore, like previous environmental studies (e.g. Gómez-Bolaños et al., 2020), we selected the environmental score

from Thompson Reuters Environmental, Social and Governance Eikon (TRESG) (Thomson Reuters, 2019). The TRESG emission score measures "a company's commitment and effectiveness towards reducing environmental emissions in the production and operational processes". This index includes measures such as NO_x, CO_2, and SO_x emissions or green expenditures, among others, so we find that this measure is in line with recent metrics as a proxy for environmental performance. The index values range between 0 and 100, with higher values meaning greater environmental performance.

International diversification. It is common to measure the degree of diversification by dividing the ratio of foreign sales by total sales revenue (Attig et al., 2016; Tihanyi et al., 2005). However 'one simple measure of the scale of internationalization does not provide a fine-grained measure of its scope' since 'two firms may show similar export intensities, but one could export to a single neighboring country, while a second had sales to many countries over three continents' (D'Angelo et al., 2016, p. 539). Therefore, the measurement of internationalization needs a geographical distribution of sales beyond simply considering the level of internationalization (Rugman & Verbeke, 2008), as an MNE operating in more international areas will be more diversified.

Hence, we first downloaded the MNEs' revenue from sales in each of the four big areas, considering the four global markets (Hitt et al., 1997): the Americas, Europe, Asia and the Pacific and Africa. Then, following previous empirical researches which tested the effects of international diversification (D'Angelo et al., 2016; Gomez-Mejía et al., 2010; Qian et al., 2010), we used the entropy index defined by Hitt et al. (1997):

$$\text{Entropy} = \sum_i^4 X_i \, Ln \left(\frac{1}{X_i}\right) \quad (1)$$

where X_i represents the percentage of revenue from sales in the region i. This index thus accounts for the number of international regions in which the MNE operates and the

sales dimension in each region, so this measurement presents the advantage of including a level of MNEs' internationalization as well as the variety of international areas. Lower values for this index imply a low level of MNEs' international diversification, from 0 for a non-internationalised and non-diversified company to higher values for more internationally diversified MNEs, the maximum possible value being 1.386 for a company with 25 percent foreign revenue in each region.

Home country. We delved into the home country literature to extract an accurate measure of both our moderating variables and thus get a score for each MNE's home country for our sample period 2006–2017. On the one hand, following previous studies which measure home-country competitiveness (Andreeva et al., 2018; Hervas-Oliver et al., 2011; Stahle & Bounfour, 2008; Stoian & Mohr, 2016), we used the IMD Competitiveness Online database. According to IMD methodology, a country's global competitiveness is based on economic performance, business efficiency, government efficiency and infrastructure. A country's competitiveness takes a value on a continuous scale from 0 (low) to 100 (high).

On the other hand, we used the Environmental Performance Index (EPI) to measure home-country environmental performance in a similar way to other studies (e.g., Leyva-de la Hiz et al., 2019). EPI is elaborated by Yale University (Wendling et al., 2018), and it comprises a variety of items from environmental results in the country, such as waste of water, energy, etc., but also including macro-economic indicators, such as the gross domestic product. This index also ranges between 0 and 100, where higher values represent the better environmental performance of the specific country.

Controls. We included the most typical effects in international and environmental literature to account for different firm features. Previous studies (Aragón-Correa et al., 2016; Gómez-Bolaños et al., 2020) have pointed out that a firm's size affects its environmental activity, so we included firm size, measured as the natural logarithm of total assets. To

control for the financial situation, we used firm leverage as firm performance measured by the ratio of total debt to total equity, in line with previous studies (Cormier & Magnan, 2015; Walls et al., 2012). We also controlled for the firm's value, by using the natural logarithm of the market capitalisation for the firms per year (e.g. Calza et al., 2016). Moreover, since environmental performance may differ in firms with different levels of investment in green improvements (e.g. Radu & Francoeur, 2017; Walls et al., 2012), we control for firms' green innovation through an Environmental Innovation Index from the Thomson Reuters Eikon database, defined as 'a company's capacity to reduce the environmental costs and burdens for its customers, thereby creating new market opportunities through new environmental technologies and processes or eco-designed products' (Thomson Reuters, 2019). This index also ranges from 0 to 100, and higher values also represent better green innovation for a firm. Finally, we control for firm industry with economic sectors from Thomson Reuters Eikon used in previous environmental studies (e.g., Pucheta-Martínez & Gallego-Álvarez, 2018) categorising different industries: industrial, communication services, consumer discretionary, consumer staples, financial, energy, health care, information technology, materials, real estate and utilities.

3.3.3. Research methodology

Model specification and estimation method. A multilevel generalised linear model was run to estimate the environmental performance based on the reports from firms pooled together in the MSCI World Index. This data set covers approximately 85 percent of the free float-adjusted market capitalisation in each country in the period 2006–2017. Each year observed in the sample was selected as a stratified sample of firms by industry, country and size. The panel element in a sample was treated using a multilevel estimation approach.

In a multilevel analysis—sometimes also called a hierarchical, random coefficient, or mixed-effects model—the data structure in the population is hierarchical and data are viewed

as a multistage sample from this hierarchical population (Goldstein, 2003). Consequently, firms are hierarchically nested in a four-level model that relates the dependent variable to predictor variables at more than one level (Luke, 2004). Firstly, the macro level contains the twelve available years of the MSCI data set; there are 21 different countries and 11 different economic sectors at the meso-level. Finally, there are 1,637 firms assumed to be randomly sampled (micro level).

Formally, a generalised linear four-level model was estimated with the environmental performance dependent variable y_{ijkt} and the independent variable x_{ijkt} such that:

$$g\left[E\left(y_{ijkt}\right)\right] = \beta_0 + \beta_1 x_{ijkt} + v_{ijkt} \quad (2)$$

where i is the firm (level 1), j is the economic sector (level 2), k is the country (level 3) and t serves to index the year (level 4). The dependent variable y_{ijkt} gathers environmental performance. The explanatory variables, which were previously described, are presented by x_{ijkt}. Finally, ε_{ijkt} is an error term that, in the hierarchical model, consists of four components:

$$\varepsilon_{ijkt} = \gamma_{i\cdots} + \mu_{ij\cdot\cdot} + \upsilon_{ijk\cdot} + \nu_{ijkt} \quad (3)$$

where $\gamma_{i\cdots}$ represents the omitted variables that vary across firms but not over sector, country, and year; $\mu_{ij\cdot\cdot}$ denotes the omitted variables that vary over firms and sectors; $\upsilon_{ijk\cdot}$ denotes the omitted variables that vary over year and country but are constant across sector and firms; and ν_{ijkt} is the usual error term. As noted by Srholec (2010), the presence of more than one residual term makes a standard multivariate model such as fixed-effects specification inapplicable; therefore, a generalised linear mixed-effects model procedure should be used to estimate equation.

Additionally, a multilevel model specification controls for the assumption of independence of the observations in grouped data; the context may not be independent for firms because of such influences as peer effects and country characteristics. The covariation

between firms' environmental performance sharing the same country externalities can be expressed by intra-class correlation (Hox, 2010). With this, between-countries variance contributes to firms' environmental performance in addition to the variance between firms.

Furthermore, when estimating equation (2), it was necessary to control for sample selection bias by carrying out a two-stage Heckman approach similar to that described by Delgado-Márquez et al. (2018). In the first stage of the analysis (selection equation), a mixed-effect probit selection model was run. This selection step consisted of identifying, through a probit regression on the total number of observations, those firms that implement an international diversification strategy, understood as the increase of sales across the borders of global regions and countries into different geographic markets.

Thus, observations on environmental performance can be affected by those observations that, independent of the adoption of diversification strategies, have higher environmental performance.

Selection step: $Pr(D = 1 \,|z_{ijkt}) \; = \Phi \, (\, \alpha' \, z \,)$ (4)

where D indicates that the firm adopts international diversification strategies ($D = 1$ if y_{ijkt} if $y_{ijkt} > 0$ and $D = 0$ otherwise), α is a vector of unknown parameters, and Φ is the cumulative distribution function of the standard normal distribution. Finally, z is a vector containing the explanatory variables that affect the decision to carry out an international diversification strategy. In the second stage (outcome equation), from selection equation (4), we followed the generalised Heckman approach as developed by Greene (2002) to compute the inverse Mill's ratio (λ_{ijk}); the selection bias was corrected by including this Mill's ratio when equation (2) was estimated. Finally, to allow the regression to have a U shape, the standard approach (Lind & Mehlum, 2010) is to include a quadratic term in the regression model. Thus, the conditional expectations of environmental performance, which consider international diversification strategies, can be written as follows:

$$g\left[E\left(y_{ijkt}\right)|x_{ijkt}, D=1\right] = \beta_0 + \beta_1 x_{ijkt} + \beta_2 f(x_{ijkt}) + \rho\sigma_\varepsilon \lambda_{ijkt} + (\gamma_{i\cdots} + \mu_{ij\cdot\cdot} + \upsilon_{ijk\cdot} + \nu_{ijkt}) \quad (5)$$

where ρ is the correlation between the unobserved determinants of a propensity to apply an international diversification strategy and the observed error term ε_{ijkt}, and σ_ε is the standard deviation of ε_{ijkt}. The presence and direction of a selection bias was inferred from the statistical significance and sign of the Mill's ratio coefficient in equation (5). Here, the known function f gives a curvature and, depending on the estimated parameters β_1 and β_2, equation (5) may be U-shaped or not. We assume that f is chosen so that the relationship has at most one extreme point. In that case, the relationship is U-shaped curvilinear, or monotone.

3.4. Results

Table 3.2 reports the summary statistics and a correlation matrix.

Table 3.2. Descriptive statistics and correlation matrix

		1	2	3	4	5	6	7	8
1	Environmental Performance	1							
2	Diversification	0.13	1						
3	Home-Country Competitiveness	-0.07	-0.08	1					
4	Home-Country Environmental Performance	0.16	0.09	-0.19	1				
5	Firm Size (log)	0.25	0.04	-0.36	0.11	1			
6	Performance (log)	0.15	-0.07	0.02	0.05	0.03	1		
7	Firm Value (log)	0.20	0.10	-0.33	0.09	0.86	-0.18	1	
8	Green Innovation (log)	0.26	0.05	-0.07	0.11	0.14	0.13	0.07	1
	Mean	4.056	0.588	0.467	0.477	24.181	3.648	23.905	3.925
	SD	0.648	0.285	0.499	0.500	2.041	2.295	1.805	0.668
	Min	-0.495	0.026	0.000	0.000	18.607	-7.706	19.209	-0.842
	Max	4.604	1.348	1.000	1.000	31.389	9.814	29.336	4.602

Note: Bivariate correlations and descriptive statistics, diversification active firms (N = 298) are shown.

Correlations are within standard levels obtained in other studies analysing internationalization and environmental categories (e.g., Leyva-de la Hiz et al., 2019).

Table 3.3. Multilevel generalised linear mixed-effects model with Heckman's two-step corrections

	Base Model		Full Model		Interaction Model			
					Home-Country Competitiveness		Home-Country Environmental Performance	
	i		*ii*		*iii*		*iv*	
	Coef.	**SE**	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**
Diversification			-0.543	0.237**	-0.883	0.269***	-0.522	0.267*
Quadratic term			0.544	0.194***	0.780	0.214***	0.596	0.219***
Home-Country Competitiveness			0.060	0.027**	-0.161	0.090*	0.062	0.027**
HCC interaction term with Diversification					0.848	0.319***		
Quadratic term with interaction					-0.622	0.244**		
Home-Country Environmental Performance			0.009	0.018	0.010	0.018	0.009	0.018
HCEP interaction term with Diversification							-0.143	0.244
Quadratic term interaction							-0.012	0.191
Control Variables								
Firm size (log)	0.138	0.020***	0.140	0.020***	0.140	0.020***	0.139	0.020***
Performance (log)	0.026	0.006***	0.026	0.006***	0.026	0.006***	0.026	0.006***
Firm Value (log)	0.039	0.018**	0.034	0.018*	0.036	0.018**	0.033	0.018*
Green Innovation (log)	0.076	0.015***	0.074	0.015***	0.076	0.015***	0.074	0.015***
Mill's ratio								
Diversification selection	-0.025	0.011**	-0.021	0.011*	-0.020	0.011*	-0.021	0.011*
Sample	2006-2017		2006-2017		2006-2017		2006-2017	
Observations	2875		2875		2875		2875	
Groups country	21		21		21		21	
Groups sectors	11		11		11		11	
Groups company	298		298		298		298	
Log likelihood	-1721.1		-1713.5		-1709.9		-1727.2	
Chi-squared	1806.9		1758.6		1760.4		1724.8	
Prob > chi2	0.000		0.000		0.000		0.000	
Interaction terms joint test [a]								
Chi-squared	n/a		n/a		6.910		0.060	
Prob > chi2					0.009		0.804	

Note: ***, ** and * significance at the 1%, 5% and 10% levels, respectively.

Values shown are coefficient estimates and standard errors (SE) from maximum likelihood regressions using a.

Besides, we observed that variance inflation factors were adequately ranged between 1.02 and 4.37 and had a mean of 1.98, which suggests that the variables' correlation does not imply relevant multicollinearity biases in this study (Hair et al., 1998). Table 3.3 presents the results of the multilevel generalised linear mixed-effects model and the second stage of the Heckman procedure after adjusting for the endogeneity of international diversification strategy. Table 3.4 reports the first stage of the two-step Heckman approach based on the estimation of the same sample of 13,024 observations.

Table 3.4. Random-effects probit estimates

Two-step Heckman approach	*Diversification (D =1)*		
	Coef.	SE	
Firm age (logs)	0.505	0.180	***
Quadratic term	-0.184	0.040	***
Firm size (logs)	0.212	0.041	***
Internationalization (logs)	0.126	0.088	
Year dummies	Yes		
Sectoral dummies	Yes		
Constant	-12.781	1.118	***
sigma u	6.774	0.248	
rho	0.979	0.002	
Sample	2006−2017		
Observations	13024		
Groups	1101		
Likelihood-ratio test			
Wald chi2	5709.56		
Prob > chi2	0.000		

Note:
***, ** and * significance at the 1%, 5% and 10% levels, respectively.

Model 1 reports the baseline results, which include firm size, firm performance, firm value and firm's green innovation variables. The coefficients and the *p* values are fairly stable across specifications in both magnitude and significance. Model 2 serves to test our Hypothesis 1 regarding the curvilinear U-shaped influence of international diversification on environmental performance, and model 3 and 4 contrast Hypotheses 2a and 2b, respectively, about the moderating effect of MNEs' home-country profiles on this relationship. As can be seen in model 2 (Table 3.3), the U-shaped relationship between international diversification and environmental performance is measured by introducing the linear specifications for international diversification ($p = 0.022$) and its squared term ($p = 0.005$).

These results provide clear strong support for Hypothesis 1, since it predicts a curvilinear relationship between international diversification and environmental performance, with environmental performance decreasing up to a certain point at which it becomes positive and continues to increase with a higher level of international diversification. As illustrated in Figure 3.1a, the relationship between international diversification and environmental performance shows the U-shaped effect. Hence, in the first steps of international diversification, MNEs display a worse level of environmental performance. However, at a certain level of international diversification, the worsening stops, and the relationship between international diversification and environmental performance becomes positive. This is the point from which MNEs continued to improve their environmental results in relation to the extent to which they increase their international diversification level.

Despite the statistical significance of the estimates related with international diversification and the graphical representations shown in Figure 3.1a, to correctly verify the existence of hump-shaped relationships, the test for U-shaped relationships proposed by Lind and Mehlum (2010) was run (see Table 3.5).

Table 3.5. Test for hump-shaped relationships

Model	Full Model		Home-Country Competitiveness				Home-Country Environmental Performance			
	ii		*iii*				*iv*			
Bounds	**Lower**	**Upper**	**Low**		**High**		**Low**		**High**	
			Lower	**Upper**	**Lower**	**Upper**	**Lower**	**Upper**	**Lower**	**Upper**
Interval	0.026	1.348	0.026	1.348	0.026	1.348	0.026	1.348	0.026	1.348
Slope	-0.514	0.924	-0.842	1.220	-0.027	0.392	-0.490	1.084	-0.634	0.909
t-value	-2.270	3.030	-3.270	3.710	-0.090	1.020	-1.920	3.160	-2.480	2.740
P > t	0.023	0.002	0.001	0.000	0.926	0.307	0.055	0.002	0.013	0.006
Extremum point:	0.499		0.566		0.112		0.438		0.569	
95% conf. Interval	[0.362,	0.636]	[0.467,	0.664]	[-1.440,	1.665]	[0.276,	0.600]	[0.444,	0.695]
Overall test of:	U-shape		U-shape		U-shape		U-shape		U-shape	
Prob > chi2	7.84		5.35		0.41		7.43		7.38	
P > t	0.005		0.021		0.523		0.006		0.007	

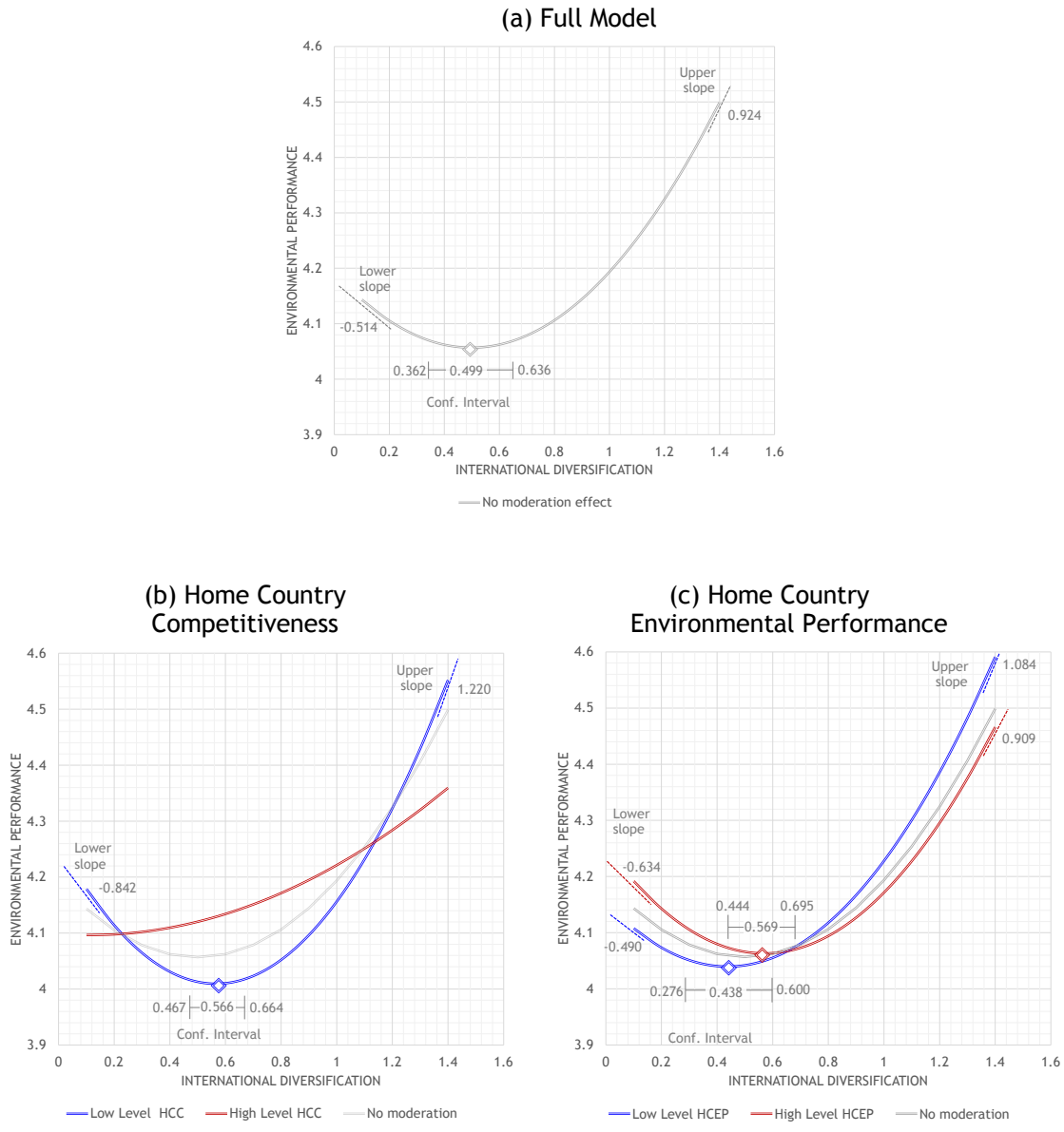
Note: Dependent variable: Environmental performance. The low p-values in the overall test reject the null hypothesis (monotone) in favour of a U-shape.

In this sense, results related to model 2 indicate significant differences in sign in the slope at both ends. The slope of the lower bound is -0.514 (p = 0.023), while the slope of the upper bound is 0.924 (p = 0.002), resulting significant the presence of a U-shaped relationship between international diversification and environmental performance (p = 0.005). Furthermore, the results suggest a plausible interval range from 0.362 to 0.636, with an extreme point of 0.499, which is close to the turning point shown in Figure 3.1a. Moreover, model 3 (Table 3.3) tests Hypothesis 2a, which predicts that the home-country competitiveness level moderates the U-shaped relationship between international diversification and environmental performance, where MNEs from more competitive countries will reach the point where the relationship becomes positive earlier. In this model, we included both iteration terms to test this moderating effect, so we added the linear diversification term multiplied by the home-country competitiveness (p = 0.008) and the squared diversification term multiplied by the home-country competitiveness (p = 0.011).

The joint results (p = 0.009) provide statistical support for Hypothesis 2a. Similarly, Figure 3.1b helps checking the effect hypothesised. For MNEs based in countries with a low level of competitiveness (blue line), we observe how the inflection point for the U-shaped relationship is shifted to the right, so firms achieve positive environmental results at a later level of international diversification. Interestingly, MNEs from lowly competitive countries achieve better environmental performance over time despite improving later. In contrast, MNEs from highly competitive countries (red line) do not face a fall in environmental performance when they diversify internationally. The results of the U-test shown in Figure 3.1b related to model 3 corroborate these findings (see Table 3.3). On the one hand, the results for MNEs from low competitive home countries indicate that the slope of the lower bound reaches -0.842 (p = 0.001), while the slope of the upper bound gets 1.220 (p = 0.000), resulting in a significant test (p = 0.021) and strong evidence of a U-shaped relationship. Additionally, the test suggested a plausible interval range from 0.467 to 0.664, with an extreme point of 0.566, which is close to the turning point shown in Figure 3.1b. On the other hand, high p-values for the lower and upper bounds of the U-test for MNEs from highly competitive countries lead us to conclude that a U-shaped effect is not found (p = 0.523). Finally, Model 4 tests Hypothesis 2b, which predicts that home-country environmental performance level moderates the U-shaped relationship between international diversification and environmental performance, where MNEs from more environmentally sustainable countries will reach the point where the relationship becomes positive earlier. In this model, we also introduce both iteration terms, adding the linear diversification term multiplied by the home-country environmental performance (p = 0.155) and the squared diversification term multiplied by the home-country environmental performance (p = 0.951). Here, the p-values observed for both iteration terms are not significant, showing that MNEs' home-country environmental performance does not have an effect on the U-shaped relationship between

international diversification and environmental performance. The third graph in Figure 3.1 suggests that the moderating effect of the home-country environmental profile and the main effect had similar behavior.

Figure 3.1. International diversification and moderation effects



Moreover, the U-test results in Table 3.5 give us enough evidence to state that the home-country environmental profile does not moderate the relationship between international diversification and environmental performance. The values of the slopes and the turning point

are quite similar to those in the full model, suggesting that there is no moderating effect of the home-country environmental profile. To sum up, these results yield the necessary and sufficient conditions to reject Hypothesis 2b.

3.5. Discussion, limitations and future research

The presented research provides several theoretical and practical contributions to the literature. First, the previous literature has shown that the relationship between international diversification and environmental performance has a linear nature (e.g., Andonova, 2003; Aragón-Correa et al., 2016; Chen et al., 2016). In our paper, we enrich these prior research works by a novel attempt to examine this relationship in a more complex way. Our evidence shows that at low levels of the international diversification process, environmental performance deteriorates due to an increase in the complexity of transfer, deployment and exploitation of green FSAs in new locations. However, from a certain point, MNEs are able to improve their environmental performance by recombining their green FSAs and location-specific advantages in the host country. With that, we rely to the triple recombination proposed by Lee et al. (2021).

Second, we provide key theoretical implications for the existing FSA/CSA framework (Rugman, 1981; Rugman & Verbeke, 1992, 1998a) by integrating FSAs and CSAs in the environmental management literature. Our research points out the importance of distinguishing MNEs from countries with high and low competitiveness levels as a key previous background for firms. In particular, we argue that firms from highly competitive countries build their green FSAs on strong home CSAs due to their access to strategic tools and advanced skills. Thus, these firms succeed in overcoming challenges related to environmental management at an earlier point of their international expansion. However, MNEs from lowly competitive countries have to overcome stronger environmental

management challenges due to having fewer previous tools, and thus they have to make an extra effort. That is, they experience a deeper learning process since they have to acquire more tools and knowledge during their internationalization process, and thus they have a bigger background to further improve their environmental results at later stages of international diversification levels.

This study has several limitations. As for the dependent variable, Thomson Reuters Emission Score as a proxy for environmental performance presents a potential limitation because it is not possible to customise its components (Gómez-Bolaños et al., 2020). Hence, it would be useful for future research to propose additional proxies of environmental performance that might provide a different perspective. For moderating effect, we focused on the home CSAs' role in the relationship between international diversification and environmental performance. It would be highly significant for future research to explore whether the host geographical region's CSAs matter when firms decide to diverse their international business. Furthermore, for home CSAs, we have only studied the national competitiveness level. Future studies can examine the moderating role of other home CSAs on the relationship between international diversification and environmental performance.

In conclusion, this study sheds light by joining both approaches regarding the relationship between firm's international diversification and environmental performance—those which posit a negative effect with those which proposed a positive one. In particular, the green FSA perspective is crucial to integrate them and thus confirm the existence of a U-shaped relationship. Firms start to suffer difficulties within their early internationalization process, but they manage to reverse the situation, even more so if they can use the previous experience that their home CSAs provide them. Understanding a firm's internationalization process and

home CSA background is essential to overcome challenges related to environmental actions in international contexts.

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Chapter 4

Too good to be true: The inverted U-shaped relationship between home-country digitalization and environmental performance

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Too good to be true: The inverted U-shaped relationship between home-country digitalization and environmental performance

Abstract

Digitalization has been seen in the past as a panacea as it has been argued that higher digitalization will translate into better environmental performance. As the process of digitalization has advanced, however, some environmental drawbacks have been encountered and need to be addressed. We thus explore the inverted U-shaped relationship between home country digitalization and environmental performance. We hypothesize that in the first stage, home country digitalization has a positive impact on environmental performance (e.g., enhanced energy efficiency and resource management), but then it reaches a tipping point at which an *excessive* level of digitalization causes a "rebound effect," hence increasing the use of resources and resulting in higher pollution. Our panel data of 5,015 firms from 47 countries in 10 sectors for the period 2014–2019 confirms our predictions. The panel smooth transition regression model (PSTR) confirms the moderating effect of the level of a country's institutional framework on this relationship between digital transformation and environmental performance. More particularly, our results show that countries with stronger institutional frameworks flatten the inverted U-shaped curve.

Keywords: digitalization; environmental performance; inverted U-shaped relationship; institutional framework; longitudinal analysis; home country; innovation; resource use; emissions.

4.1. Introduction

While digital transformation has been on the political and organisational agendas for some years, the current pandemic situation has placed it on the frontline (Muzio & Doh, 2021), and a better understanding is thus now more urgent than ever. The Institute for Management Development (IMD, 2020) has noted the importance of this topic at the governmental level, and at the same time, a recent study made by the Boston Consulting Group (BCG) revealed that over 80% of high-level executives believe the digital transformation to be a top priority (BCG, 2020). A digital strategy is thus no longer an option, nor something that is "nice-to-have" for firms: it is a must (Forbes, 2020). Digital transformation is not only a synonym of technology, however, but also involves new ways of working, innovating, decision-making and the transformation of organisational strategies and cultures (PwC & Microsoft, 2017). Advocators of digital transformation go beyond the benefits it provides for operational and financial performance and establish a positive link with a firm's environmental results (Ford & Despeisse, 2016; Ghobakhloo, 2020).

In order to test this alleged relationship, an incipient number of works have begun analysing the effect of digital transformation on emissions, energy consumption, and resource and energy efficiency (GeSI & Deloitte, 2019; Lange et al., 2020; Lange & Santarius, 2020; World Bank, 2020). Such interest has yielded important, but mixed, findings. The mainstream line largely supports the positive effect of digitalization on a firm's environmental performance (Rajput & Singh, 2019; Queiroz & Wamba, 2019). These studies indicate that digitalization brings benefits such as lower emissions, higher resource efficiency, improvements in supply chain management, flexibility of production, lifecycle management, and reduction of waste (Ford & Despeisse, 2016; Rajput & Singh, 2019; Queiroz & Wamba, 2019; GeSI & Deloitte, 2019). For instance, the use of *recyclebots*, an open-source hardware device for converting waste plastic into 3-D printing filament, resulted

in a decrease of recycling-related energy consumption of up to 70% (Kreiger et al., 2014). The positive benefits can thus be explained by the fact that technologies include energy management systems, advanced analytics, optimisation, and smart grids (Bengtsson & Ågerfalk, 2011; Watson et al., 2011).

Nevertheless, digital economy may be a double-edged sword that has been overlooked in the literature (Verbeke & Hutzschenreuter, 2021). While the positive effect of digitalization for a firm's environmental performance is relatively well known, digital transformation poses some drawbacks that need to be addressed. For example, Lange and Santarius (2020) point out that, although the energy intensity of processing units (CPUs) halves every 1.5 years, Moore's Law predicts that the capacity of CPUs also doubles every 1.5 years, thus outbalancing the energy savings. This is due to the fact that digitalization is "energy-hungry" and resource-intensive (Coroamă & Mattern, 2019; Lange et al., 2020; Lange & Santarius, 2020). Findings show that digitalization can increase energy consumption, exhaust scarce resources, and increase environmental pollution resulting from waste output and recycling challenges (Kunkel & Matthess, 2020). For instance, Honée et al.'s (2012) analysis of Swedish insurance administration showed that more than half its carbon footprint is due to the PC equipment, given the "relative short economic lifetime of the IT hardware" (p. 1).

In the energy economics literature, these undesirable counter effects are known as *rebound effects* (Belaïd et al., 2020; Khazzoom, 1980; Lange et al., 2020). A central argument is that rebound effects occur when initial positive effects make a product or service more attractive, which in turn, increases its use (Galvin, 2015; Lange et al., 2020). The positive effect of the technology can be "eaten up" by the increased demand for energy (Santarius et al., 2020). For instance, digitalization has fostered video conference systems such as Zoom and Microsoft Teams, but this technology has replaced many traditional calls,

which are less energy intensive. Another example is the appearance of online platforms such as Netflix as a replacement for DVD rentals. While this initially reduced energy consumption, the greater (and unlimited) access to this platform has meant that users have significantly increased their hours of video consumption (Cisco, 2019), resulting again in a rebound effect. More digitalization therefore stimulates more energy and resources, consequently leading to more pollution, and decreasing the initial positive effect or, in the worst cases, even outweighing it (Coroamă & Mattern, 2019).

These mixed results challenge our understanding of digital transformation and its implications for a firm's environmental performance and suggest that the relationship between the two variables is more complex than a linear nature. We consider a curvilinear model where the positive or negative effects of digital transformation on environmental performance are not unlimited. The use of nonlinear models for analysing complex phenomena is somewhat present in the context of energy economics (Liu et al., 2020; Grossman & Krueger, 1991; Merlevede et al., 2006; Solarin & Lean, 2016). In particular, the Environmental Kuznets Curve (EKC) hypothesis introduced by Grossman and Krueger (1991) represents a remarkable advance in explaining complex relationships like this one. This EKC examines the interaction between economic growth and environmental degradation, and how pollution levels increase up to a certain point as economic development goes up; and after that decrease (Blampied, 2021).

Studies have also established a link between digitalization and environmental results at both the firm(micro)-level or country(macro)-level (Benzidia et al., 2021; Chiarini, 2021; ElMassah & Mohieldin, 2020; Lange, Pohl, & Santarius, 2020). Less is known about the country (macro) – firm (micro) level relationship, as country level factors affect the technological paths taken by firms (Casper & Whitley, 2004; Leyva de la Hiz, 2019), suggesting that country-level inclination towards digitalization spurs corporate behaviour in

that direction. Indeed, the literature shows that firm-level factors alone do not fully explain firm behaviour relative to corporate environmental performance (Hartmann & Uhlenbruck, 2015). From this perspective, we study the effect of home country digitalization on firm environmental performance, since country level factors allow us to analyse a more complex picture of "how institutions affect firms and how this plays out in different countries" (Hartmann & Uhlenbruck, 2015, p. 729).

It thus becomes more meaningful to go beyond the traditional views that primarily focus on either the positive or negative effects of digital transformation on a firm's environmental performance, and explore the dynamic performance resulting from the changing combination of the benefits and drawbacks of digital transformation that arise in practice. This paper extends previous work (Lange et al., 2020) that has emphasised the double-edged sword of digitalization, as its rebound effects may lead it to backfire. We also examine the effect that the home-country institutional framework has on the nonlinear relationship between home-country digital transformation and environmental performance. Home-country institutions are a relevant setting because a number of studies have shown that firms into different institutional environments differ in their resource profiles and willingness to make strategic decisions (Hitt et al., 2021). For instance, disparities in information-processing-related policies between a firm's home country and foreign partners may present a critical challenge in digital innovation projects (Luo, 2021). In other words, a firm's performance and strategic decision-making vary depending on their home country, because of the particular set of national institutions (Cuervo-Cazurra, 2011; Donbesuur et al., 2020; Kolk & Fortanier, 2013; Levänen et al., 2018; North, 1990). In the context of digital transformation, we believe that supporting institutions will extend the advantages of digitalization over environmental performance and reduce its negative effects, but the latter will not completely disappear.

The remainder of the article is organised as follows. The next section reviews the theoretical background, and extends previous findings of institutional theory, to develop our research hypotheses regarding an inverted U-shaped relationship between a home country's digital transformation and a firm's environmental performance, and the transition effect of the institutional framework. In the third section, we explain the research methodology, including details from our sample, variable measures, and statistical methods. We performed the estimation of the PSTR models in order to check our hypotheses, which provides a complementary vision to previous studies. We discuss the results in the fourth section. Finally, we conclude the paper with a discussion of our findings, along with future research lines and limitations.

4.2. Theoretical background and hypothesis development

Sustainability is a global issue, and, in the same way that firms are increasingly globalising, the effect of institutions on a firm's environmental approach is increasing (Aragón-Correa et al., 2020; Hartmann & Uhlenbruck, 2015). Despite this, there are notable differences in the level of institutional development among countries. Scholars have taken a keen interest in studying how institutions affect a firm's environmental outcomes (Hartmann & Uhlenbruck, 2015; Iannou & Serafeim, 2012). For example, strong legal and general institutional frameworks improve a firm's engagement in generating environmental innovations (Aragon-Correa et al., 2020). Some authors (Haxhi & Van Ees, 2010; Ho et al., 2012) have found that a firm's environmental behaviour is driven by cultural context. Graafland and Noorderhaven (2020) argued that the cultural trait of long-term orientation in combination with economic freedom improve a firm's engagement in CSR practices.

4.2.1. Home country digitalization and environmental performance

Despite the existing institutional differences among countries, concerns about both the environment and digitalization appear at the top of the political and business agenda

worldwide (Council of the EU, 2020; DigitalES, 2020; IMD, 2020; BCG, 2020). Digitalization and environmental sustainability have largely been addressed separately, so that studying their relationship is becoming a cutting-edge research topic (Coroamă & Mattern, 2019; Ghobakhloo, & Fathi, 2021; Lange, et al., 2020; Rajput & Singh, 2019; Queiroz & Wamba, 2019). The findings of these studies have resulted in two seemingly competing perspectives (positive and negative) that co-exist to explain how digitalization shapes environmental performance (Lange et al., 2020). In other words, digitalization is a double-edged sword capable of both improving and damaging environmental quality.

On the one hand, digitalization offers great benefits for addressing environmental issues such as energy consumption (Ghobakhloo & Fathi, 2021), CO2 emissions (Schulte et al., 2016), waste reduction (Kiel et al., 2020), and others (GeSI & Deloitte, 2019; Mickoleit, 2010). A first interesting research line argues that digitalization is a potential tool for reducing energy consumption. For instance, Ghobakhloo and Fathi (2021) found that digital industrial transformation contributes to energy efficiency through more intelligent energy production and distribution equipment. Similarly, the digitalization of manufacturing enables the advanced tracking of resource and energy utilisation (Bai et al., 2020).

Schulte et al. (2016) found evidence that digitalization can be a potential solution for reducing CO2 emissions. This might be because digital technologies enable the tracking of air pollution and facilitate the capture and storage of carbon emissions (IEA, 2017a, 2017b).

The literature has supported the idea that technological intensity drives firms to be engaged in environmental innovation (Doran & Ryan, 2012; Horbach, 2008; Leyva-de la Hiz et al., 2019; Rehfeld et al., 2007). Leyva et al.'s (2019) analysis of 80 international firms showed that higher levels of technological intensity led firms to generate green innovations. Similar findings were reported by Doran and Ryan (2012) in the context of European firms.

Nascent technologies such as big data analytics and artificial intelligence (BDA-AI) drive the green supply chain (Kshetri, 2018; Queiroz & Wamba, 2019). The literature reports that such technological infrastructure improves the coordination and standardisation of supply chain processes, since it allows complex information from diverse sources to be interpreted and combined (Benzidia et al., 2021; Wang et al., 2016). In a sample of 168 French hospitals, Benzidia et al. (2021) found that the use of BDA-AI technologies has a significant effect on environmental process integration and green supply chain collaboration. Similarly, the World Bank's report (2020) on the port and maritime sector shows that the use of smart technology-based methods improves environmental performance.

Despite these studies showing a positive impact of digitalization over sustainability, a number of scholars have also found a negative relationship between these phenomena (Collard et al., 2005; Chiarini, 2021; Kamble et al., 2018; Zhou et al., 2018). Studies reveal that digitalization may lead to higher energy demand (Faucheux & Nicolaï, 2011; Wang et al., 2015), resource use (Waibel et al., 2017), CO2 emissions (Honée et al., 2012), and other severe environmental impacts. For instance, a report by the Öko-Institut for the European Commission (2019) noted that the use of digital technologies has a negative effect on resource consumption (abiotic and biotic), water consumption, land use and biodiversity. Similarly, Jungmichel et al.'s (2017) analysis of the German electronics industry showed that, for each EUR of turnover obtained, companies used three litres of water during their production system. This research shows that some 15% of water consumption is attributed to regions with high water stress, such as Asia and Africa, where raw materials are extracted to produce the hardware that will enable digital technologies.

In the same vein, Collard et al.'s (2005) analysis of the tertiary sector in France showed that the consumption of ICT commodities led to a loss of energy use efficiency. Kamble et al. (2018) also showed that the extensive use of sensors and smart equipment

resulted in higher energy use. Recently, Chiarini (2021), in a study of Italian manufacturing firms, found that some smart technologies, such as automated mobile robots, additive manufacturing, collaborative robots, traditional robots and autonomous guided vehicles had a negative effect on a firm's environmental performance. An analysis of the Swedish insurance administration showed that more than half its carbon footprint is due to the relatively short economic lifetime of the IT hardware (Honée et al., 2012). Other studies (Waibel et al., 2017; Wang et al., 2015; Wang et al., 2016) have argued that smart factories employing massive electronic equipment will consume more energy and resources than traditional ones. These undesirable adverse effects are known as the "rebound effect" (Belaïd et al., 2020; Khazzoom, 1980; Lange et al., 2020). In other words, technological progress not only brings improvements in resource use, but it also decreases the cost of use, what may result in a disproportionate increase in consumption (Li & Wang, 2017; Herring & Roy, 2007).

From this review, it is clear that the relationship between digital transformation and environmental performance is more complex than a simple, linear one. Since both views have support from the empirical evidence to some extent, we have taken both views into consideration by proposing a curvilinear relationship, where the positive or negative effects of digital transformation on environmental performance are not unlimited: digitalization in a business context can become a double-edged sword. We propose that the initial developments of digitalization bring considerable benefits in improving a firm's environmental performance until it reaches a tipping point where an *excess* of digitalization becomes disadvantageous for environmental performance. Consequently, we propose the following:

H1. *There is an inverted U shape relationship between home country digitalization and environmental performance.*

4.2.2. The effect of institutional framework on the relationship between digitalization and environmental performance

Once we have established our baseline hypothesis, the U shape relationship between digitalization and environmental importance, we consider whether the relationship between these elements is even more complex than "just" a nonlinear one. In order to gain a better understanding of the relationship between digitalization and environmental performance we also have to bring the institutional context into the equation. Although we are witnessing a worldwide increase in digitalization, notable differences remain at the institutional level (Godil et al., 2021; Hoffman, 1999; Leyva-de la Hiz, 2019). Institutions are generally defined as the rules of the game in a country (North, 1990). These rules provide structure and order in a country, and guide the behaviour and actions of individuals, groups, and firms (North, 1990). The previous literature argues that national-level institutions affect the technological path taken by firms (Casper & Whitley, 2004; Leyva de la His, 2019). This is because firms follow institutional pressures and behave similarly within a given institutional context (Hoffman, 1999). Institutional theory thus explains why a firm's decisions to implement certain practices does not have rational or economic reasons, but are instead due to its adaptations to the rules and norms of institutional context (Glover et al., 2014; Vasudeva et al., 2013). Firms therefore tend to imitate practices implemented by other firms, which subsequently leads to isomorphism and towards earning legitimacy.

This leads us to suggest that the effects of digitalization on environmental performance, both positive and negative, are not homogeneous among countries (Lange et al., 2020). For instance, a World Bank report (2020) states that "while the technology forms the backbone of a digital platform, the institutional framework and available human capital are crucial to ensuring its success" (p.108). Similarly, the EU Council (2020) noted that digitalization is an excellent tool to accelerate the transition towards decarbonisation, however, at the same time, an appropriate policy framework is stressed as essential to avoid the adverse effects of digitalization on the natural environment. Scholars have argued that

governments need to act in order to foster an efficient transition toward a digital economy (Weber et al., 2019). These researchers found that institutional quality has a positive effect on environmental performance (Ali et al., 2019; Majeed, 2018; Sun et al., 2019). For instance, Ali et al. (2019) and Panayotou (1997) show that CO2 emissions can be potentially reduced by higher institutional quality at national level. Salman et al. (2019) found that well-organised and unbiased national institutions play a very significant part in decreasing C02 emissions. Jones and Manuelli (2001) argue that strong policies and regulation flatten the EKC and reduce environmental degradation, along with achieving higher economic growth.

Al-Mulali et al.'s (2015) analysis of institutions in developed vs developing countries, showed that internet use decreases carbon emissions in developed countries, but they did not find any significant relationship in developing countries. In a similar vein, Majeed (2018) empirically showed that digitalization has a positive impact on CO2 emissions in developed countries; but this effect was the opposite in emerging countries. Since developed countries tend to possess stronger institutions (e.g., Vasudeva et al., 2013), we believe that such a stronger institutional framework will favour the advantages of digitalization, and help reduce their disadvantages.

Put differently, we argue that in countries with a weak institutional framework, home country digitalization worsens a firm's environmental results at an earlier stage compared to countries with stronger institutional frameworks, and vice versa. In other words, although the overall relationship between digitalization and environmental performance has a U inverted shape (as argued in H1), this shape is different for home countries with higher and lower institutional levels. More specifically, high institutional frameworks *flatten* the curve between digitalization and environmental performance. Consequently, we propose the following:

H2. *The national institutional framework provides a transition effect to an inverted U shape relationship between home country digitalization and environmental*

performance, such that stronger institutions broaden the positive effects of digitalization on environmental performance, whereas weaker institutions curtail these positive effects.

4.3. Data and method

4.3.1. Sample and data collection

We selected a sample of firms from Thomson Reuters Eikon, from different countries around the world (the USA, UK, Australia, Canada, etc.) and diverse sectors of activity (energy, basic materials, technology, telecommunications, and industrials, among others).

Table 4.1. Number of firms by country

Country	Firms	Share (%)	Country	Firms	Share (%)
Argentina	10	0.20	Malaysia	51	1.02
Australia	248	4.95	Mexico	39	0.78
Austria	28	0.56	Netherlands	57	1.14
Belgium	44	0.88	New Zealand	41	0.82
Brazil	87	1.73	Norway	46	0.92
Canada	235	4.69	Peru	13	0.26
Chile	27	0.54	Philippines	21	0.42
China	473	9.43	Poland	30	0.60
Colombia	16	0.32	Portugal	13	0.26
Czech Republic	3	0.06	Qatar	2	0.04
Denmark	39	0.78	Russia	40	0.80
Finland	34	0.68	Singapore	39	0.78
France	138	2.75	South Africa	78	1.56
Germany	158	3.15	Spain	65	1.30
Greece	17	0.34	Sweden	118	2.35
Hungary	4	0.08	Switzerland	107	2.13
India	90	1.79	Taiwan	122	2.43
Indonesia	31	0.62	Thailand	37	0.74
Ireland	31	0.62	Turkey	24	0.48
Israel	12	0.24	Ukraine	1	0.02
Italy	77	1.54	United Arab Emirates	5	0.10
Japan	357	7.12	United Kingdom	362	7.22
Kazakhstan	2	0.04	United States of America	1517	30.25
Luxembourg	26	0.52			
			Total	5015	100.00

The Thomson Reuters database offers a comprehensive platform for establishing customisable benchmarks for the assessment of a firm's operating behaviour, environmental management and financial performance (Ellimäki et al., 2021). Our analysis uses an unbalanced panel dataset including 16,893 observations from 5015 different firms for the period between 2014 and 2019. Following previous environmental studies (e.g. Leyva-de la Hiz et al., 2019), our sample included firms with a minimum net sales revenue of US$ 1 million.

Table 4.1 shows the variety of 47 different countries in the analysis, the higher percentages being from the United States of America, China, the United Kingdom, Japan and Australia.

The economic activity of most of the firms in Table 4.2 pertains to the industrial, consumer cyclical, financial and basic materials sectors.

Table 4.2. Number of firms by industry

Country	Firms	Share (%)
Basic materials	577	11.51
Consumer Cyclical	781	15.57
Consumer Non-Cyclical	387	7.72
Energy	374	7.46
Financial	793	15.81
Health Care	341	6.80
Industrial	946	18.86
Technology	462	9.21
Telecommunication services	118	2.35
Utilities	236	4.71
Total	5015	100.00

4.3.2. Variable measurement

Dependent variables. This study uses the environmental performance scores of ESG criteria retrieved from Thomson Reuters' Asset4 database as dependent variables. Measuring environmental performance is multi-dimension in character, and some scholars have used

emissions reduction (Hartmann & Vachon, 2018), or levels of consumption and resource efficiency (Kock et al., 2012) as proxies for the firm's environmental performance. Following previous studies (e.g. Qureshi et al., 2019), we opted for the Thomson Reuters Eikon's environmental performance score, defined as "a company's impact on living and non-living natural systems, including the air, land and water, as well as complete ecosystems". This index is generated from the weighted score of a company's strengths and weaknesses on indicators related to: (1) environmental innovation, (2) emissions, and (3) resource use. We employed this index since it includes deeper metrics that record different environmental aspects and determines how well a company uses best management practices to avoid environmental risks and capitalise on environmental opportunities in order to generate long term shareholder value. The values range between 0 and 100, where higher values represent better environmental performance. This paper also separately analyses the three components of environmental performance.

1) Environmental Innovation. This category score reflects a company's capacity to reduce the environmental costs and burdens for its customers, thereby creating new market opportunities through new environmental technologies and processes or eco-designed products.

2) Emissions. This category measures a company's commitment and effectiveness in reducing environmental emissions in the production and operating processes.

3) Resource Use. This category reflects a company's performance and capacity to reduce the use of materials, energy or water, and to find more eco-efficient solutions by improving supply chain management.

Independent variable. The IMD World Digital Competitiveness (WDC) database was used to determine home country digitalization. The WDC analyses and ranks the extent to which countries adopt and explore digital technologies leading to transformation in

government practices, business models and society in general. Home country digitalization takes a value on a continuous scale from "low" to "high" (0 to 100). The methodology of WDC ranking defines three main dimensions of country digitalization: knowledge, technology and future readiness..The knowledge dimension captures the intangible infrastructure necessary to discover, understand, and build new technologies. The technology dimension quantifies the overall context that enables the development of digital technologies. The dimension of future readiness examines the level of an economy's preparedness to assume and exploit its digital transformation.

Transition variable. The institutional framework of home country was selected as a transition variable. This variable was extracted from the IMD World Competitiveness (WCC) database. The institutional framework is elaborated by aggregating several country-specific items such as legal and regulatory framework, adaptability of government policy, government decisions, cost of capital, central bank policy, and country credit ranking. This variable also ranges between 0 and 100, where higher values represent the strong institutional framework of the specific country.

Control variables. We include some firm-level control variables that take into account different factors that can affect a firm's environmental performance. In line with previous studies (Aragón-Correa, 1998; Chen et al., 2016; Christmann, 2004) about the environmental behaviour of firms, we included firm size as a control variable. This variable was assessed as the natural logarithm of the total revenue. Following previous studies (e.g. García-Martín & Herrero, 2019), we considered firm indebtedness as having an impact on environmental performance. This variable was measured as firm total debt by total assets. Finally, we control for *firm industry* with economic sectors from Thomson Reuters Eikon, as used in previous environmental studies (e.g., Purcheta-Martínez & Gallego-Álvarez, 2018), which categorises different industries: industrial, communication services, consumer discretionary,

consumer staples, financial, energy, health care, information technology, materials, real estate, and utilities.

At the country level, GDP was considered in the analysis to measure the economic development of the home country (Alam et al., 2019). In order to measure the home country's environmental culture, we selected the Environmental Performance Index (EPI), as used in other studies (e.g., Leyva-de la His et al., 2019). The EPI is produced by Yale University (e.g., Wendling et al., 2018) by aggregating several environmental items, such as water waste, energy, and other factors. It can be assumed that countries which rank highly on the EPI tend to invest more in environmental protection (Singh et al., 2016). This index ranges between 0 for the worst–environmental value and 100 for the maximum environmental performance for a country.

4.3.3. Research methodology

Base models. Inverted U-shaped relationships can be found in a growing body of business management literature, in different themes, such as corporate innovation (Delgado-Márquez et al., 2017; Ma et al., 2021), green investment (Huang, & Lei, 2021), a firm's financial performance (Boakye et al., 2021) and so on. In this study, we propose four potential inverse-U shaped relationships as base models according to the following expression:

$$FEP_{i,t} = \mu_i + \beta_1 HCD_{i,t} + \beta_2 HCD^2{}_{i,t} + \lambda' Z_{it} + \nu_i + \tau_t + \varepsilon_{i,t} \quad (1)$$

where $i = 1, \ldots, N$, and $t = 1, \ldots, T$. N is the number of firms, and T is the number of years. $FEP_{i,t}$ represents a firm's environmental performance and the three components of the index (environmental innovation, emissions and resource use). $HCD_{i,t}$ represents home country digitalization, and we add the square term ($HCD_{i,t}^2$) to verify the possible nonlinear relationship between environmental performance and home country digitalization. $Z_{i,t}$

contains control variables that may affect FEP, including home country environmental performance (EPI), home country economic profile (GDP), firm's revenue (REV), and firm's indebtedness ($INDEB$). Parameters ν_i and τ_t are dummy variables to account for a firm's potential industry effect and year effect, respectively and ε_{it} is the error term.

Panel smooth transition regression (PSTR). In line with previous environmental studies (Aydin, Esen, & Aydin, 2019; He, & Lin, 2019; Lahouel et al., 2020; Wang et al., 2019), we adopt a panel smooth transition regression (PSTR) model: an extension of panel threshold regressions (Hansen, 1999). This model was first applied by González et al. (2005) to examine the effect of capital market imperfections on investment. A PSTR framework has two main advantages (Cheikh et al., 2021). First, as Lahouel et al. (2020) note, "the threshold value of the transition variable in not given a priori but is generated by the PSTR model" (p. 4). Second, the transition across the identified regimes is relatively smooth and gradual (Cheikh et al., 2021).

In a PSTR model, the effect of the threshold variable on the dependent variable may change depending on the regimes below and above the threshold (Inglesi-Lotz et al., 2020). The coefficient that shows the effect of the threshold variable on the dependent variable is thus different depending on the regimes (Lahouel et al., 2020; Wang et al., 2017). Theoretically, the PSTR is given by Equation (2):

$$y_{i,t} = \mu_i + \beta_0' x_{i,t} + \beta_1' x_{i,t} \mathrm{g}(q_{i,t,}\ y, c) + \varepsilon_{i,t,} \qquad (2)$$

In this model, the dependent variable is $y_{i,t}$. μ_i indicates the vector of the individual fixed effects. The PSTR model is based on a continuous function of transition $\mathrm{g}(q_{i,t,}\ y, c)$, usually bounded between 0 and 1. $x_{i,t}$= $(x_{i,t}^1, .., x_{i,t}^k)$ is a vector of k explanatory variables. β_0 and β_1 indicate the parameter vector of the linear model and the nonlinear model, respectively. ε_{it} is an independent and identically distributed (i.i.d.) error term.

The given logistic transition function $g(q_{i,t,}\ y, c)$ is formulated as follows:

$$g(q_{it}; \gamma, c) = \{1 + exp[-\gamma(q_{it} - c)/\hat{\sigma}_q]\}^{-1}, \quad \gamma > 0 \qquad (3)$$

where parameter c indicates the threshold parameter (location) between one regime and another and γ denotes the smoothness of transition (Duarte et al., 2013). On one hand, when γ tends to infinity, the transition function g is sharp and PSTR is transformed to a panel threshold model developed by Hansen (1999). On the other hand, when γ tends to 0, the transition function g is constant, and the model degenerates to the standard linear model with fixed effects.

The basic idea is that when some threshold is exceeded, the relationship between home country digitalization and a firm's environmental performance becomes different between low and high regime. In our study, we examine the transition effect of the institutional framework on the relationship between home country digitalization and a firm's environmental performance. We use the following econometric model, and the transition function is given in Equation (4):

$$FEP_{i,t} = \mu_{i,t} + \beta_1 HCD_{i,t} + \beta_2 HCD^2{}_{i,t} + \left[\beta_3 HCD_{i,t} + \beta_4 HCD_{i,t}^2\right] g\left(IF_{i,t}; y, c\right) + \lambda' Z_{it} + \nu_i + \tau_t + \varepsilon_{i,t} \qquad (4)$$

In this model, the institutional framework ($IF_{i,t}$) acts as transition variable in the transition function g(·). As before, a firm's environmental performance (FEP) is the dependent variable, HCD is home country digitalization, and HCD^2 is the quadratic term of home country digitalization. $Z_{i,t}$ contains control variables, parameter ν_i and τ_t control by industry-year effects, and ε_{it} is the error term.

Test of linearity. Before estimating the PSTR, it is essential to test whether the regime-switching effect is statistically significant using linearity. The linearity versus non-

linearity test is the first step prior to the specification and estimation of the non-linear model. H_0 is the linear model and is suitable, while H_1 is PSTR with two regime or one transition is suitable. First, following Fracasso and Marzetti (2014), the Fisher LM test (LMF)[1] was conducted, which can be represented as follows:

Fischer LM test: $LM_f = \left(\frac{\mathrm{SSR_0 - SSR_1}}{\mathrm{K}}\right) / \left(\frac{\mathrm{SSR_0}}{\mathrm{N\Gamma - N - K}}\right)$

(5)

Although, in the null hypothesis (H_0), the addition of squared residuals is illustrated by $\mathrm{SSR_0}$,in alternative hypothesis (H_1), the addition of squared residual is illustrated by $\mathrm{SSR_1}$. In $F(K, NT - N - K)$ distribution, K is the number of explanatory variables, the time length of the panel and the number of cross sectional units are denoted by T and N, respectively. As in previous studies (Fracasso & Marzetti, 2014), a third-order Taylor approximation was applied. If the null hypothesis of linear relationship is rejected, it thus means that the connection between the variables is non-linear and can be apprehended by the PSTR with at least two regimes.

Second, we employ the approach suggested by Hansen (1999, 2000) for threshold regression models. The null hypothesis of this model suggests that there is no threshold effect and it is defined by the linear constraint: $H_0: \beta_1 = \beta_2$. Following Hansen (1999, 2000), this null hypothesis is tested using likelihood ratio test (LR) having a non-standard distribution, that is defined as follows:

$$LR_F = (SSR_0 - SSR_1(\gamma, \mathrm{c}))/\hat{\sigma}^2 \quad (6)$$

As indicated by Hansen (1996), a bootstrap is implemented to obtain first-order asymptotic distribution. The p-values of this test are thus constructed from the bootstrap procedure that is asymptotically valid.

[1] Likelihood ratio tests (LRT) and Wald LM test (LMw) were also checked but are not reported here. They are available upon request.

Estimation of the PSTR specification

Once linearity is checked, the final stage of the PSTR analysis is the estimation stage (Aydin, Esen, & Aydin, 2019). The PSTR model's parameters γ and c are estimated using nonlinear

least squares (NLS) (González et al., 2005). Following previous studies (Duarte et al. 2013), the minimum residual sum of squares is used to estimate the corresponding β' coefficient vector of Equation (4):

$$SSR = \underset{\gamma>0\,,\ c\in\Gamma_n}{argmin}\, S_1(\gamma, c) \tag{7}$$

where $S_1(\gamma, c)$ is the sum of squared residuals for a fixed value γ and c and such that $\Gamma_n = \Gamma \cap \{q_1, \dots, q_n\}$. To obtain the slope coefficient γ and the threshold parameter c values, a grid search was applied. Given this, the values of γ and c that allow $S_1(\gamma, c)$ to be minimised could be selected as good starting values.

4.4. Results

Table 4.3 shows the Pearson correlation coefficients for all variables included in the models. The mean, standard deviation, and minimum and maximum values for all variables are also reported.

Our starting point is to test our base models with random effect regression. Table 4.4. shows the results of this analysis for a firm's overall environmental performance and each of its components.

Table 4.3. Descriptive statistics and correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1)Environmental Performance	1.000									
(2) Environmental Innovation	0.647***	1.000								
(3) Emissions	0.847***	0.289***	1.000							
(4) Resource Use	0.848***	0.307***	0.721***	1.000						
(5) Home country digitalization	-0.082***	-0.010	-0.095***	-0.017**	1.000					
(6) Institutional framework	0.013*	0.012	-0.009	0.021***	0.661***	1.000				
(7) EPI	0.090***	0.083***	0.094***	0.122***	0.629***	0.313***	1.000			
(8) Firm size (log)	0.474***	0.208***	0.429***	0.425***	0.082***	0.055***	0.066***	1.000		
(9) Firm indebtedness (log)	0.053***	0.052***	0.023***	0.029***	-0.011***	-0.036***	-0.027***	0.060***	1.000	
(10) GDP (log)	0.098***	-0.069***	-0.102***	-0.090***	-0.465***	-0.331***	-0.631***	-0.056***	0.021***	1.000
Mean	39.56	50.17	49.52	49.90	75.89	49.98	66.36	18.60	2.68	0.77
SD	26.62	25.27	28.94	29.08	18.56	9.48	15.41	2.20	1.54	0.88
Min.	0.02	0.18	0.13	0.14	23.46	10.94	29.09	13.82	-15.67	-4.34
Max.	98.53	99.82	99.88	99.86	100	80.38	90.68	26.97	9.43	3.17

Specific p-values are in parenthesis.
*p < 0.10; **p < 0.05; ***p < 0.01

Model 1 takes overall environmental performance as a dependent variable and tests the existence of an inverted U-shaped relationship between home country digitalization and a firm's environmental performance. A firm's environmental performance is based on three dimensions: environmental innovation, emissions and resource use. Each dimension represents the different characteristics of environmental outcomes. For this reason, it is important to examine the relationship between digitalization and the environmental performance dimensions. For model 1A, Model 1B, and Model 1C, we thus used a firm's environmental innovation, emissions and resources, respectively, as dependent variables.

Table 4.4. Random effect model results

Independent variables:	Dependent variables: Environmental performance			
	Total	Environmental Innovation	Emissions	Resource Use
	Model 1	Model 1a	Model 1b	Model 1c
Home country digitalization	1.112*** (0.000)	1.060*** (0.000)	1.206*** (0.000)	0.718*** (0.000)
Home country digitalization (Squared)	-0.008*** (0.000)	-0.007*** (0.000)	-0.009*** (0.000)	-0.005*** (0.000)
EPI	0.132*** (0.000)	0.047 (0.163)	0.196*** (0.000)	0.241 (0.000)
Firm size (log)	6.940*** (0.000)	3.149*** (0.000)	7.759*** (0.000)	7.595 (0.000)
Firm indebtedness (log)	0.157 (0.193)	0.371 (0.084)	-0.051 (0.752)	-0.044 (0.782)
GDP (log)	-0.192 (0.197)	-0.288 (0.229)	-0.464** (0.019)	0.020 (0.918)
Sector effect	Yes	Yes	Yes	Yes
Year effect	Yes	Yes	Yes	Yes
Constant	-163.261*** (0.000)	-65.842 (0.000)	-176.816 (0.000)	-163.655 (0.000)
R2	0.249	0.049	0.225	0.205
Number of firms	5,015	2,747	4,594	4,516
Number of observations	16,893	8,930	15,219	15,068

Standard errors are in parenthesis.
*p < 0.10; **p < 0.05; ***p < 0.01

We introduced the linear variable for home country digitalization and also the squared term for this variable, for each model. Respectively, in each model, we see a positive and

significant coefficient for the linear term of home country digitalization, and a negative and significant coefficient for the squared home country digitalization term. These results provide a clear strong support for our hypotheses, confirming the existence of an inverted U-shaped relationship between proposed relationships.

Figure 4.1. Home country digitalization and a firm's environmental performance

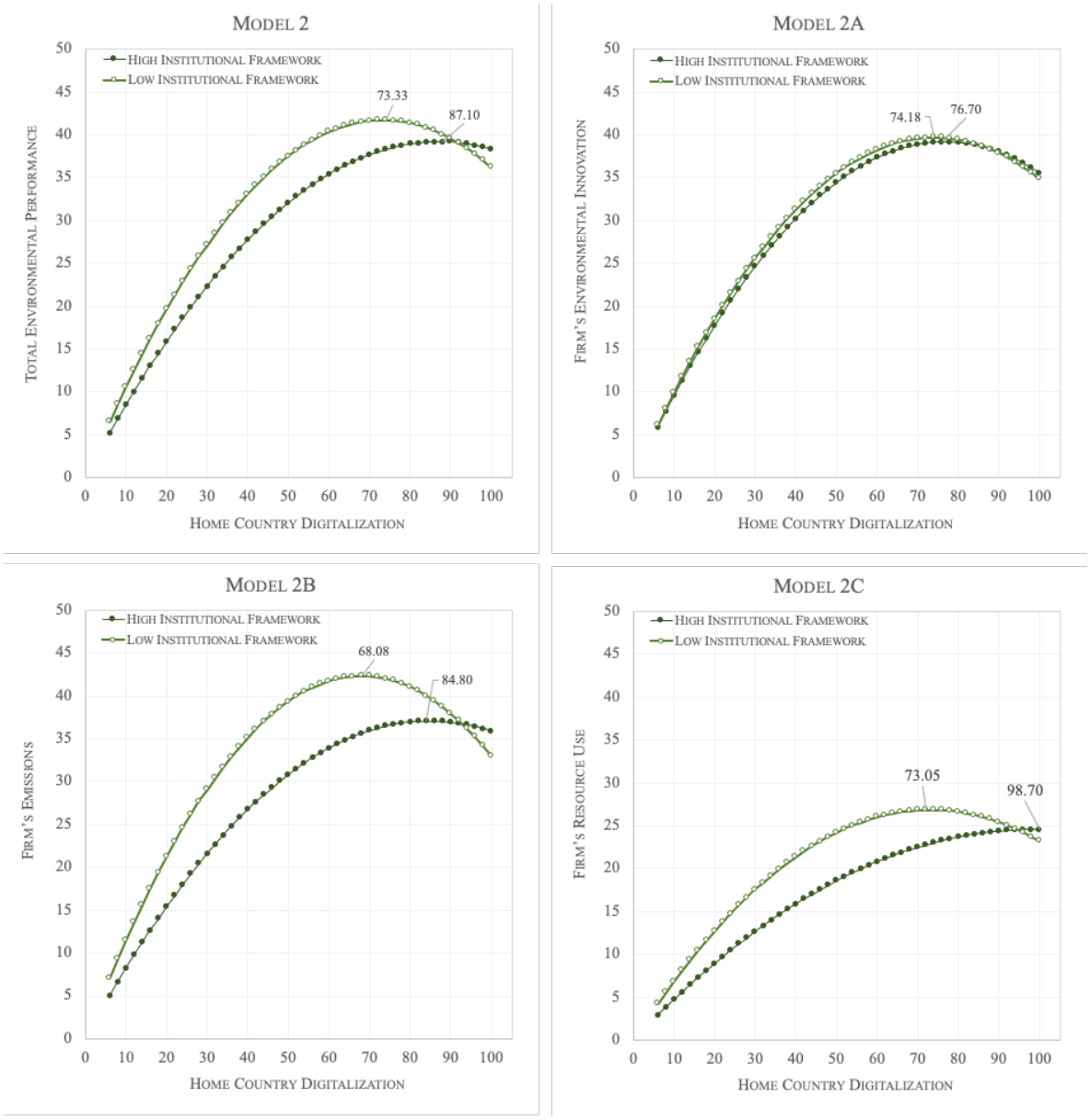


Figure 4.1 depicts this effect graphically for better understanding. In the first steps of home country digitalization, firms thus obtain high environmental results, both in overall performance, and in each category (innovation, emissions, and resource use), however, at a

certain level, the positive contribution of home country digitalization becomes negative, consequently leading to the deterioration of the firm's environmental results.

It is worth mentioning that the inverted U-shaped relationship is more pronounced for a firm's emissions. To ensure the correct interpretation of our findings, we ran a U-test developed by Lind and Mehlum (2010). This test allows the statistical verification of the existence of hump-shaped relationships.

The results of this test are shown in Table 4.5. This test was applied for the four potential inverse U-shaped relationships proposed in this study. The findings of this test collaborate our hypotheses. The test also indicates the extremum point of each hump-shaped relationship, which coincides with the turning point shown in Figure 4.1.

Table 4.5. Test for Hump-shaped relationships

	Dependent variables: Environmental performance							
	Total		Environmental Innovation		Emissions		Resource Use	
	Model 1		Model 1a		Model 1b		Model 1c	
Bounds	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper
Interval	23.463	100	23.463	100	23.463	100	23.463	100
Slope	0.758	-0.399	0.725	-0.369	0.792	-0.559	0.489	-0.256
t-value	12.499	-10.463	6.742	-5.940	9.835	-11.550	6.157	-5.221
P>t	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Extremum point:	73.593		74.164		68.316		73.712	
Overall test of:	U-shape		U-shape		U-shape		U-shape	
T value	10.46		5.94		9.83		5.22	
P>t	0.000		0.000		0.000		0.000	

Second, we adopt a PSTR model to examine the threshold effect of institutional framework on the relationship between home country digitalization and a firm's environmental results. As we said earlier, before estimating the PSTR model, we conducted a Fischer LM test. The results of this test are presented in Table 4.6. As shown, the results reject the null hypothesis and accept the existence of non-linearity by taking institutional

framework as the transition variable for environmental performance, emissions, and resource use. However, it can be seen that the linear model is suitable for environmental innovation. We checked the existence of a threshold effect using LR_F. The results of this test, shown in Table 6, suggest that the null hypothesis is rejected for the proposed variables, with the exception of environmental innovation. Consequently, the threshold effect is confirmed for environmental performance, emissions, and resource use.

Table 4.6. Test results for model's non-linearity

	Dependent variables: Environmental performance			
	Total	Environmental Innovation	Emissions	Resource use
	Model 2	Model 2a	Model 2b	Model 2c
Threshold variable:	Institutional framework			
Fisher Tests (LMF)	7.902 (0.000)	0.574 (0.933)	6.563 (0.000)	6.141 (0.000)
LRF	9.216 (0.010)	0.282 (0.868)	12.971 (0.002)	6.656 (0.036)

Specific p-values are in parenthesis.

As we stated earlier, the lower and higher levels of a home country's institutional framework can have different effects on the relationship between home country digitalization and a firm's environmental results. To check these hypotheses, we performed an estimation of the PSTR models. The results of the models are reported in Table 4.7.

Table 4.7. Estimation results of the PSTR model

Independent variables:	Dependent variables: Environmental performance			
	Total	Environmental Innovation	Emissions	Resource Use
	Model 2	Model 2a	Model 2b	Model 2c
Low Regime:	Low Institutional framework			
Home country digitalization	1.138*** (0.000)	1.070*** (0.000)	1.244*** (0.000)	0.735*** (0.000)
Home country digitalization (Squared)	-0.008*** (0.000)	-0.007*** (0.000)	-0.009*** (0.000)	-0.005*** (0.000)
Extremum point	73.331	74.176	68.081	73.051
High Regime:	High Institutional framework			

Home country digitalization	0.900*** (0.000)	1.022*** (0.000)	0.875*** (0.000)	0.498*** (0.000)
Home country digitalization (Squared)	-0.005*** (0.000)	-0.007*** (0.000)	-0.005*** (0.000)	-0.003* (0.053)
Extremum point	87.103	76.704	84.798	98.702
Controls:				
EPI	0.134**** (0.000)	0.046 (0.174)	0.200*** (0.000)	0.245*** (0.000)
Firm size (log)	6.942*** (0.000)	3.153*** (0.000)	7.757*** (0.000)	7.588*** (0.000)
Firm indebtedness (log)	0.152 (0.207)	0.371 (-0.283)	-0.057 (0.745)	-0.049 (0.760)
GDP (log)	-0.284* (0.071)	-0.283 (0.257)	-0.633** (0.002)	-0.129 (0.534)
Sector effect	Yes	Yes	Yes	Yes
Year effect	Yes	Yes	Yes	Yes
Constant	-164.083*** (0.000)	-66.239*** (0.000)	-177.899 (0.000)***	-164.010*** (0.000)
Threshold	62.756	62.756	62.756	62.756
Number of firms	5,015	2,747	4,594	4,516
Number of observations	16,893	8,930	15,219	15,068

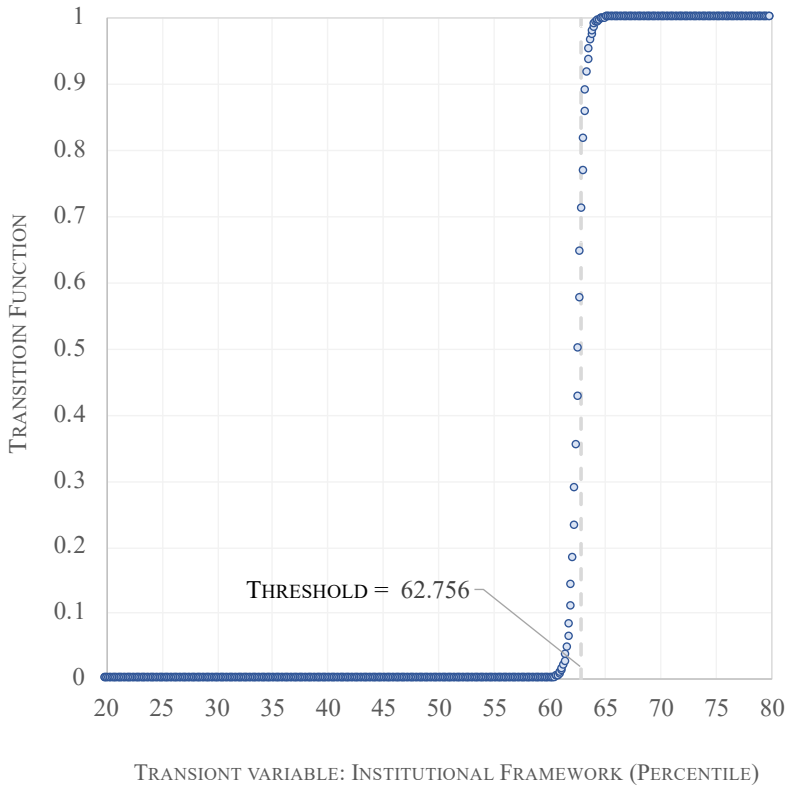
Standard errors are in parenthesis.

*p < 0.10; **p < 0.05; ***p < 0.01

Figure 4.2 illustrates the transition function of the institutional framework for all four proposed relationships. Two regimes were found regarding the variable of institutional framework, namely low and high regimes.

The results of Table 4.7 show that the variable of home country digitalization also has two regimes. In regard to Model 1, where environmental performance is a dependent variable, the results suggest that the effect of home country digitalization varies from a low regime to a high regime. In the low-level regime, the positive effect of home country digitalization on a firm's environmental performance becomes exhausted earlier (with an extremum point of 73.331), while it seems to be prolonged in the high-level regime (with an extremum point of 87.103).

Figure 4.2. Estimated transition function of the PSTR model



Regarding the variable of a firm's environmental innovation in Model 1a as a dependent variable, we observe from Table 4.7 that a home country's digitalization does not vary from a low regime to a high regime, with an extremum point of 74.176 and 76.704, respectively. We also consider a firm's emission and resource use in Models 1b and 1c as dependent variables, respectively. We obtain a similar transition effect of institutional framework for these models, which is significantly different between the low and high regimes. In the low regime, the home country digitalization worsens a firm's environmental results at an earlier stage, while its positive contribution does not become exhausted in the high regime. In Model 1c, it is worth mentioning that the extremum point of the curve is 98.702. This implies that home country digitalization allows firms to decrease the use of resources in countries with a strong institutional framework. In summary, these results suggest that institutional framework plays an important role in shaping the impact of home country digitalization on a firm's environmental results. The effect of digitalization on a

firm's environmental results is thus harmful for countries with weak institutions. Conversely, a country's strong institutions can affect a firm's environmental results through high digitalization.

4.5. Discussion, limitations and future research

This research makes several contributions to the literature. First, we bring the non-linear relationship into debate, as we argue (and empirically show) that further digitalization can be a double-edged sword: digitalization is no longer an activity that needs to be maximised by any means (Verbeke & Hutzschenreuter, 2021). It is a pioneering study of the relationship between home country digitalization and a firm's environmental performance along its three dimensions (environmental innovation, emissions, and resource use). The findings of our study also provide an international and multi-industrial perspective. Our results can therefore be generalised to other geographic areas and across multiple industries. Second, the importance of our work lies in its contribution to the environmental proactivity literature. We challenge articles that treat digitalization in a naive way as regards the subject of the natural environment. Our paper demonstrates that digitalization is not a panacea for the environment. Finally, this research contributes to institutional theory, by showing that institutional framework can flatten the suggested U-shaped curved in the countries with strong institutions.

Our work has some limitations that present new research lines for future study. We analysed home country digitalization since there was no data available at the firm level regarding the degree of digitalization. Future works can thus explore whether these findings are confirmed with firm level data. Second, we obtain environmental scores from secondary data that is provided by Thomson Reuters Eikon. It would be useful for future research to propose additional proxies of environmental performance that can be obtained through surveys. Third, we focused on the home-country's institutional framework in the relationship

between digitalization and firm's environmental performance. It would be important to explore other home country dimensions that can alter this relationship. Future research can also provide more empirical evidence, for example, conducting a comparison study between levels of economic development of countries.

Our study serves as empirical evidence for global discussion on the link between digitalization and the environment. We confirm that digitalization itself is not a panacea for the natural environment. Developing an appropriate institutional framework from long-term perspective can avoid the negative environmental impacts of digitalization. Our analysis of the different home country institutional levels has clear policy implications. Our work shows that government should not take a *laissez faire* policy regarding the digitalization of companies because, although digital transformation is a global trend, governments still play a key role in fostering (or hindering) the advantages of this technological change. This remaining importance of policymakers has been recently echoed by the European Commission (2020), as an appropriate policy framework allows the adverse effects of digitalization on the environment to be avoided. For instance, Sanna Marin, Prime Minister of Finland (World Economic Forum, 2021) has indicated that technology alone cannot solve climate change issues, suggesting that national states need to create policy frameworks that enable the transition toward a green economy.

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Chapter 5

Conclusions

Conclusions

5.1. Introduction

This last chapter of the thesis is dedicated to summarizing the main conclusions and contributions of the works that are part of this thesis. We begin by exposing the main findings obtained from the thesis in general, and the investigations carried out throughout the three previous chapters specifically. Next, we highlight the implications that this work can have for academia, for business managers, and for public regulators. Finally, we mention the limitations encountered during the work of the thesis, and future lines of research are provided.

5.2. Concluding remarks

In this section, we highlight the most relevant conclusions of this work. In general, we make a contribution to studies on environmental sustainability and home country literature, using the institutional perspective, where the home country and country-specific advantages theory stand out. Our results show that different factors such as, such as internationalization and home country digitalization have important consequences on the adoption of environmental sustainability. In addition, we see how the differences between the home country's institutional framework, competitiveness and innovation level moderate the relations explained above.

Specifically, in chapter 2, we show a significant and positive relationship between environmental policies and the scope of internationalization. We confirm that in the international context, environmental policies acquire special relevance because they increase a firm's capability to overcome green entry barriers, meet the high green standards of the host country, access international agreements and collaborations, and to reduce the liability of foreignness, which are factors that facilitate the foreign expansion process. Thus, we explain that companies are developing a more proactive attitude towards environmental issues,

perceiving them as a legitimacy tool. Moreover, this shows that firms from highly innovative countries have already met international standards since their creation. Thus, this national capability does not serve as a booster in the environmental policy–internationalization nexus. In contrast, those firms from low innovative countries are, by default, at a clear disadvantage compared to their peers from innovative countries; such an inferiority situation enforces the efforts carried out by firms to cope with international standards and, in turn fortifies the relationship between environmental policies and internationalization.

In Chapter 3, our result confirms that this relationship goes beyond a negative or positive effect, where more international diversification at early stages implies lower environmental performance but later becomes positive since firms reverse this situation from acquired experience and recombination. Moreover, we show that firms from a country characterized by high national competitiveness build their green FSAs on strong location advantages and access to strategic tools and advanced skills. Despite not finding a significant moderating effect of the environmental country profile, our results show that a firm's home country plays an important role to overcome earlier or later the disadvantages of operating abroad with respect to their environmental strategy.

Finally, Chapter 4 concludes that in the first stage, home country digitalization has a positive effect on environmental results through enhanced energy efficiency and better resource management, but later, an excess of digitalization has negative consequences on the environment via high electricity consumption, resource use, and emissions. Second, our results show that institutional framework has an effect on this relationship. The PSTR model empirically confirms that in a high regime of institutional framework, the negative effect of home country digitalization takes a long time. Conversely, in a low regime, the positive effect of home country digitalization depletes earlier. Specifically, our findings contribute to the existing body of knowledge in various ways.

5.3. Implications

This research has considerable theoretical and practical implications.

5.3.1. Theoretical implications

The findings of Chapter 2 offer a twofold contribution. First, we study the environment policies–internationalization nexus from a novel institutional perspective, the most prevalent for the Asia-Pacific region. The previous literature has mainly focused on the learning perspective to explain this nexus. To reduce theoretical ambiguity for different contexts, we propose an institutional perspective to explain how companies are developing a more proactive attitude towards environmental issues, perceiving them as business opportunities rather than as burdens. The institutional perspective is particularly suitable because adopting measures to combat environmental problems is directly conditioned by institutional pressures to comply with stakeholders' regulations and expectations. Previous work has already discussed this perspective by examining emerging contexts, such as Latin America (Duque-Grisales et al., 2020). It states that environmental capabilities serve as a source of institutional legitimacy in foreign markets (Aguilera-Caracuel & Ortiz-de-Mandojana, 2013). Second, we study novel moderating dimensions distinct to the ones typically studied and reinforcing the existing study link between developed and emerging countries. In particular, we disaggregate the innovation capability construct. By doing so, we add value to the institutional theory (Leyva de la Hiz et al., 2019) by showing that firms from countries with a low level of innovations adjust to institutionally demanding international contexts through a higher green orientation. In contrast, firms from countries with high-level innovation may adjust their environmental commitment to their home country's innovativeness. Thereby, these firms are less concerned about their legitimation strategy and green reputation during their internationalization path.

In Chapter 3, we extend the understanding the internationalization-environment nexus from the FSA-CSA framework. This chapter contributes to the CSA/FSA framework to explain MNEs' environmental strategies in international contexts. From a global perspective, using a panel data set, we contribute empirical confirmation that international diversification increases the difficulty in successfully managing firms' environmental behaviour due to an increase in the complexity of transfer, deployment and exploitation of green FSAs to new locations. Moreover, this research contributes to a recombination perspective by showing that environmental performance can be improved when firms recombine green FSAs with host-country-specific advantages. Additionally, we clearly demonstrate that home competitive CSAs enable firms to gain green leverage in international contexts. Besides, this paper goes further than previous research by emphasising that the relationship between international diversification and environmental performance should not be understood as monolithic. By using an integrated approach of both arguments (positive or negative), we consider the dynamic nature of international diversification that results from the changing combination of the drawbacks and benefits for a firm's environmental performance. This non-linear approach sheds new light by explaining the contradictory results of previous literature that partially explained this phenomenon.

In Chapter 4, our work makes the following contributions to the existing literature. Previous literature reporting on the relationship between digitalization and environmental performance has proposed a linear nature (Benzidia et al., 2021; Rajput & Singh, 2019). In our paper, we enrich these prior research works with a novel attempt to examine the relationship between digitalization and environmental sustainability in inverted-U shaped form. We provide an integrative and empirical view by showing that digitalization can be a double-edged sword. Our study also offers an international and multi-industrial perspective. We also contribute to institutional theory, finding that institutional framework has an effect

on this relationship. In our methodological contribution, using panel smooth transition regression (PSTR), we find that the effect of the home country digital transformation on a firm's environmental performance changes between the low and the high regime of institutional framework.

5.3.2. Practical implications

Our findings of Chapter 2 have considerable implications for practitioners and policymakers. From a managerial perspective, this study's findings highlight the essence of environmental policies on a firm's international expansion since firms that adopt a proactive strategy are more likely to accelerate their internationalization process. Firms that are willing to expand their businesses internationally need to establish elementary environmental strategies as a way to build a solid green reputation (Dowell et al., 2000) to integrate international stakeholder interests (Christmann, 2000), to diminish the liability of foreignness, and to rise above business rivals in host country markets (Chen et al., 2016). From the perspective of governmental authorities, it is important to consider that they should be able to create incentive programs to encourage firms to formulate responsible environmental strategies that can lead them to expand their activities in foreign markets. Governments and institutions must design aligned innovation policies and programs to avoid institutional incompleteness. In this way, the country's firms have the correct infrastructure to adopt a proactive environmental position that allows them to internationalize as well as receive other foreign companies that are environmentally proactive (win-win strategy).

The research conducted in Chapter 3 is relevant and interesting for managers because our results suggest that they should consider the possibility of having challenges in environmental management at an MNE's early stage of internationalization. Although these results draw the attention of the managers of firms from countries with low competitiveness

levels who build weak green FSAs that do not conform to global environmental standards, our findings encourage managers to advance their international diversification process since difficulties related to environmental management can eventually be overcome by learning from international experience. For policymakers, this research provides new insight into the importance of considering a country's competitiveness level. To improve the environmental performance of their MNEs in an international context, governments must specifically take into consideration policies that bring strong location advantages to country. Consequently, countries with a high competitiveness level create value for their firms and help to build strong green FSAs.

In Chapter 4, from a managerial perspective, our research is relevant for managers because our results suggest that they should consider the possibility of encountering challenges in environmental performance at high levels of digitalization. For instance, Chiarini's work (2021) with Italian manufacturers found that managers remain unsure about the final results of 3D addictive printing. As anecdotal evidence, one of the managers interviewed stated that "[o]ver the years, we gradually introduced first autonomous guided vehicle and now the new autonomous mobile robot. However, we have not saved consumption significantly; on the contrary, we have increased our environmental problems because we now have to cope with batteries and their end-of-life disposal." Our longitudinal, multi-country analysis provides more robust evidence regarding this salient concern about the rebound effects of high levels of digitalization. Such awareness can allow managers to develop better knowledge, politics and practices to prevent such negative outcomes.

5.4. Limitations and future research lines

The results and conclusions obtained in the present doctoral thesis are not exempt from limitations and possible aspects to improve, aspects that lay the foundations for future research work, which we will develop in this section.

First, the general limitation of this thesis is that environmental scores from secondary data that was provided by Thomson Reuters Eikon. This database is considered a reliable source of information (Cheng et al., 2014), but it only includes the information that firms are willing to disclose (Gómez-Bolaños et al., 2020). On one hand, even if our longitudinal samples cover diverse industries and countries, it may imply some potential methodological concerns such as heterogeneous distribution. This limitation emerges from the lack of ESG data for the corporates. The database reports that this data is only available for more than 6,000 global companies worldwide (Pérez-Cornejo et al., 2019). Due to this, we urge further studies to increase the sample size to test the replicability of these results. On another hand, future studies could complement secondary data with additional proxies for environmental performance that could be obtained through surveys. Although some scholars have remarked upon the advantages of using secondary data instead of questionnaires, as the latter may be biased toward providing a desired image (Berrone et al., 2013).

Second, the general limitation is that have explored some characteristics of home country (innovative, competitive, environmental and digital profile) that impact firm's environmental performance. Further research can focus on other home country aspects, such as the macroeconomic environment, market size, infrastructure, or economic performance. Future research can also provide more empirical evidence by, for example, conducting a comparative study of the levels of economic development among countries. Similarly, it would be highly significant for future research to explore whether the host country's characteristics matters in the firm's environmental performance.

Third, the specific limitation of this thesis is linked to the Chapter 2 is its focus on the Asia-Pacific context. Thus, our findings cannot be generalized to firms in other geographical regions. As such, we encourage further studies to explore the institutional perspective of the environmental–internationalization nexus in other developed and/or developing regions.

Finally, another specific limitation can be found in Chapter 2 and Chapter 3 related to the measurement of the international diversification since we group countries into four global markets (Hitt et al., 1997): the Americas, Europe, Asia and Pacific and Africa. This approach can be debatable because the countries of each region can be heterogeneous in terms of their cultures, consumer tastes, political system, market environment and administrative mechanisms (Chang & Wang, 2007; Gomes & Ramaswamy, 1999). Hence, future works could improve diversification measures if more disaggregated geographical regions were used. In addition, it might be interesting to measure international diversification on country-level data.

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