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CONTENTS

STRATEGIC DECISION MAKING FOR ORGANIZATIONAL SUSTAINABILITY: THE IMPLICATIONS OF SERVANT LEADERSHIP AND SUSTAINABLE LEADERSHIP APPROACHES

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ABSTRACT: *This conceptual paper explores the implications of servant leadership and sustainable leadership for strategic decision making by the top management of an organization. It is argued that a different type of leadership is required if effective strategic decisions are to be made in organizations striving to become more sustainable and that servant leadership and sustainable leadership approaches provide a sound basis to inform these decisions. The contributions of these two leadership approaches are explored, before considering the implications for leadership development. Particularly, the inclusion in leadership development programmes of values based leadership, and the development of integrative thinking, is discussed.*

Keywords: *servant leadership, sustainable leadership, strategic decision making*
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1. INTRODUCTION

This conceptual paper explores the implications of servant leadership and sustainable leadership for strategic decision making by the top management of an organization. Historically, strategic decision making has focused on optimising the competitiveness of organizations, primarily in the service of the interests of shareholders. Now, it is increasingly recognised that business organizations have a broader set of responsibilities. Organizations have an obligation to a range of stakeholders and as such are to serve the greater good of society, rather than merely the interests of their shareholders (Mirvis & Googins, 2006). With the growing acknowledgement of the role of business in society as extending beyond narrow economic interests of a few, the stakeholder view of organizations has emerged (Freeman, 1984; 2010), recognising that social and environmental interests also need to be advanced by organizations as they act responsibly. Organizational responsibility can be defined as "*context specific organizational actions and policies that take into account stakeholders*" expectations and the triple bottom line of economic, social, and environmental performance" (Arguinis, 2011, p. 855).

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A contemporary leadership paradigm therefore needs to include the engagement of leaders with various groups of enlightened stakeholders (Sanford, 2011), and not only focus on the interaction of leaders with followers. Leadership needs to be exercised with at least five other stakeholder groups: Firstly, there are consumers who are integrators of products into their personal and professional life. Secondly there are co-creators who are involved in innovating the fulfilling solutions for clients. Thirdly, planet Earth and its ecosystem that is the first supplier and final recipient of all that is created by human beings is increasingly viewed as a stakeholder. The inclusion of planet Earth as a stakeholder is gaining ground, particularly when ethics, inclusiveness, fairness and strategic perspectives are being integrated (e.g. Haigh & Griffiths, 2009; Inhabitat, 2012; Laine, 2010, Phillips & Reichart, 2000). Fourthly, the community is a stakeholder in that it offers a social context within which the organization function is upgraded, with educational collaboration and decision-making amongst different stakeholders, including combining the efforts of government, profit and non-profit organizations. Finally, responsible and well informed investors are stakeholders, and who as a part of contextualised decision-making are appreciative of ecological and social impacts.

As will be demonstrated in this paper, servant and sustainable leadership approaches have a unique contribution to make to enlightened strategic decision making in this expanded context of responsible leadership that other leadership theories cannot make. This is because of (1) their orientation to serve and contribute to the well-being of others and the natural environment ahead of self-interest; (2) their focus on the long term interests of multiple organizational stakeholders, rather than a few internal ones (or a narrow focus on the leader-follower interaction); and (3) their recognition of the duty of leadership as stewards of organizational and natural resources to serve the common good. It is therefore argued here, that servant leadership and sustainable leadership can inform strategic leaders as to how they should be exercising strategic decision making within this context of multiple demands from multiple enlightened stakeholders. The paper therefore aims to contribute to leadership theory literature by presenting propositions that deal with servant and sustainable leadership approaches' characteristics. We propose that sustainable organizations in the contemporary business environment need new decision making frameworks, which servant and sustainable leadership approaches can provide.

2. STRATEGIC DECISION MAKING AND LEADERSHIP

While the number of decisions that strategic-level leaders have to make varies widely, based on the environment they operate in, it is evident that strategic decision-making is an important aspect of their job (Hambrick, Finkelstein & Mooney, 2005) and would set the tone (Treviño, Brown & Hartman, 2003) for decision making throughout the organization. According to Eisenhardt (1989) strategic decisions are major decisions characterised by strategic positioning, high stakes, and the involvement of several of an organization's functions. They tend to be infrequent, but "*critically affect organizational health and survival*" (Eisenhardt & Zbaracki, 1992, p. 17). Contemporary leaders are typically confronted with non-programmed decisions, which are made in response to a unique

situation that is poorly defined and largely unstructured, and have important long-term consequences for the organization (Daft & Marcic, 2011).

McCauley, Van Velsor and Ruderman (2010) note a paradigm shift from leadership that is primarily the achievement of one leader, to leadership, which is the achievement of a collective. Consequently, there may be some debate about when the CEO makes a decision versus the top management team (Olie, van Iterson & Simsek, 2012-13), but to a greater or lesser extent, strategic actions, such as strategic decision making, are seen to be a reflection of its top management team (Hambrick & Mason, 1984). Given that these decisions are partly based on the personal interpretations, experiences and preferences of the leaders (Hambrick et al., 2005, Finkelstein & Mooney, 2005), they are sometimes flawed in either the process followed in reaching a decision, or in the decision, itself (Hambrick et al., 2005, Finkelstein & Mooney, 2005; Nutt, 2004). Safi and Burrell (2007) argue that, given the far reaching impacts of decisions made by leaders, combined with the complexities of reaching a decision, critical decision-making skills are required. For example, Shimizu and Hitt (2004) argue that leaders need strategic flexibility, being able to reverse ineffective strategic decisions if need be. They caution that this flexibility is adversely influenced, inter alia, by insensitivity, self-serving interpretation, and inaction. Furthermore, in comparison to the traditional managerial decision-making process (see for example Daft & Marcic, 2011) the decision-making process of strategic leaders mainly stems from their value system. Given the personal dimension of the complexity of strategic decision making it is argued that the leadership approach of the leader can hold sway in decision making, particularly when considering approaches to leadership that are values based. In a context when there is increased appreciation of the social and ecological impacts of decisions, Vithessonthi (2009) recognises the influence of the attitudes of leaders towards sustainable development, on decisions made. As will be demonstrated later, in contrast to many other leadership approaches, sustainable leadership and servant leadership are highly appreciative of the social and ecological dimensions of their leadership.

Proposition 1: Leaders whose approach to leadership is informed by both sustainable and servant leadership are more inclined to make strategic decisions that take into account the economic, social and ecological dimensions of such decisions, as expressed by various stakeholders.

3. SUSTAINABLE ORGANIZATIONS

A growing realisation of the unsustainability of human activity has brought about an increased scrutiny of the sustainability of organizational practices. For example, in the ecological sphere, the core technologies of the industrial age, combined with a profligate use of resources, threaten the viability of life on planet Earth. To illustrate, between 1900 and 2000 the world population increased four-fold; the urban population increased 13-fold, energy use per capita increased six-fold; industrial output increased 40-fold, and the number of marine fish caught increased 35-fold (McNeill in Dunphy, 2003). The evolution of the term sustainable development (Hardy, Beeton & Pearson, 2002) is most commonly

cited as being prompted by an increase in an environmental awareness in the 1960s and 1970s (Dovers & Handmer, 1993; Wilbanks, 1994). However, it can be argued that the concept of sustainable development originated many years before: 1) as a conservation vision; 2) as a community vision; and 3) as an economic theory. The emergence of the sustainable development concept marked a convergence between economic development and environmentalism that was officially presented at the Stockholm Conference on Humans and the Environment in 1972. This conference strengthened the concept of eco-development whereby cultural, social and ecological goals were integrated with development (Hardy et al., 2002, Beeton & Pearson, 2002). In 1972 the Club of Rome released a report entitled *The Limits to Growth,* which challenged the traditional decision making of the leaders of that time and their assumption that the natural environment provided an unlimited resource base for population and economic growth and could cope with the increasing amounts of waste and pollution caused by industrial society (Harding, 1998). Consequently, in 1973 *Ecological Principles for Economic Development* linked the environment with economic development and the World Conservation Strategy (IUCN, 1980). This document was followed up by *Caring for the Earth* (International Union for the Conservation of Nature, United Nations Environment Programme, World Wide Fund for Nature, 1991).

The Brundtland Commission report (1987, p. 15) defined sustainable development as "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*". The journey towards sustainability is a long process that can be evident in the dedication of several international institutions, such as Global Reporting Initiative - GRI (2015) and the European Sustainable Development Network – ESDN (2015). At the global level, the Institute for Sustainable Leadership - ISL (2015) is a specialized community of scholars and practitioners who research and develop the concept of sustainable leadership in business and educational setting.

The concept of sustainable development has developed in two main directions since it was first introduced (Hardy et al., 2002, Beeton & Pearson, 2002). Firstly, there has been support for the concept at a local, national and international level (such as UN's Earth Summit and regional strategies for sustainable development); and secondly, work on the details of how sustainable development can be implemented, including both its conceptualization and the indicators needed to operationalize it. Looking at business entities in particular, organizational sustainability addresses the dynamic interactions among the economic, environmental, and social impacts through ethical, transparent, responsible, and accountable operations, the institutional framework and strategies, company culture, decision-making, and voluntary practices. It deals with incorporating sustainability into the strategic management, systems, and culture (Organizational sustainability, 2015). Organizational sustainability (Chartered Quality Institute, 2015) is defined as the enduring challenge to achieve long-term success while having a positive impact on the society and the environment in which the organization lives and works.

Literature on organizational sustainability is pioneered by Dunphy (2000) and has been advanced by, amongst others, Collins and Porras (2000), Drucker (2001), Collins (2001), Royal, Daneshgar and O'Donnell (2003) and Senge, Smith, Kruschwitz, Laur and Schley

(2008). Despite the vast interest in sustainability, a fundamental theory of sustainability still has to emerge (Cabezas & Faith, 2002). Several frameworks have been developed that identify key characteristics of sustainable organizations and how they are led. Examples include the European Corporate Sustainability Framework (van Marrewijk, 2003), the Lowell Center's Principles of Sustainable Production (Veleva & Ellenbecker, 2001), the Sustainability Balanced Scorecard (Figge, Hahn, Schaltegger & Wagner, 2002), The Corporate Sustainability Model (Epstein, 2009) and the Sustainable Leadership Pyramid (Avery & Bergsteiner, 2011a; b). By taking a cognitive mapping approach, a multidimensional space of sustainability can be deduced (Kiewiet & Vos, 2007). Dunphy, Griffiths and Benn (2003) use qualitative analysis of companies to argue for indices of financial, environmental and human sustainability. They provide a case for the adoption of organizational sustainability principles in every aspect of the organizational life. Dunphy et. al. (2003, p. 12) establish that "*an organisation is sustainable (when) its stakeholders continue to support it*".

Sustainability is a long-term journey, a direction that requires sustainable leadership, responsible decision making, and understanding of sustainability principles and commitments. Mirvis and Googins (2006) describe this journey in corporate citizenship in five stages. Firstly, the Elementary stage is characterised by a lack of awareness and indifference. With society beginning to expect more of corporates, they are challenged to gain credibility and move to Stage 2: Engaged, where there is a growing realisation of the company's role in society and that mere compliance is not enough. Companies react to this with various policy changes and then come to the realisation that they face a capacity challenge. This marks the move to Stage 3: Innovative. Mirvis and Googins (2006) observe that in this stage companies begin to truly grasp a stakeholder viewpoint, adopt numerous initiatives, and begin to monitor their activities, but grapple with the "*business case*" for corporate citizenship. This challenge of coherence leads to Stage 4: Integrated. It is during this stage that companies begin to integrate the economic, social and environmental dimensions of their strategic decision making, activity and reporting. The final challenge to deepen commitment would move the company to the final stage of Transforming, where under the guidance of visionary leaders, new market opportunities are developed from combining the company's citizenship agenda with its business agenda.

3.1 Implications for strategic decision making

It is evident from this discussion of organizations as good corporate citizens who are embarking on a sustainability journey that critical strategic decisions need to be made by leaders (Giampetro-Meyer, Brown, Browne & Kubasek, 1998), as well as adopting operational decisions and frameworks to put these strategic decisions into effect. The journey towards sustainability requires strategic decision making that integrates four main organizational areas (FML, 2015), namely: (1) strategic sustainability (i.e. a realistic vision and goals); (2) product and programme sustainability (i.e. high-quality products, services and programmes); (3) personnel sustainability (i.e. effective and reliable performance of workers); and (4) financial sustainability (i.e. conducting financial reserve and contingency

planning). Making sustainability operational within organizational practice demands answering interrelated questions (FML, 2015): A "*What?*" question, an "*attribute-question*" and a "*Who?*" question" that provide a tailor-made interpretation of sustainability. That is, leaders need to ask themselves and their stakeholders what systemic changes they are aiming to implement and with what attributes that would characterize sustainability. Also, it must be clear who have they identified in their environment that can help them carry out sound decisions. This kind of framework stems from the notion that stakeholders as a collective need to make sense of sustainability.

There are a number of implications that emerge when considering the strategic decision making of strategic leadership in organizations that are on a journey to becoming more sustainable. Two of these are discussed here. Firstly, the values and priorities of leaders need to be aligned with organizational sustainability considerations. It is argued that sustainable leadership and servant leadership approaches offer perspectives for leadership with respect to their strategic decision making, which facilitate alignment with organizational sustainability considerations. This argument is developed in ensuing sections and is essentially a justification of Proposition 1 that was proposed earlier. Secondly, economic considerations in decisions may not be aligned with what is best from a social, ethical or environmental perspective, thereby creating a paradox for leadership decision making. It will be argued that integrative thinking is required in decision making, for leaders to be able to resolve these paradoxes. This point is developed further when considering the leadership development implications of strategic decision making for organizational sustainability later on in the paper.

4. LEADERSHIP APPROACHES IN SUPPORT OF RESPONSIBLE STRATEGIC DECISION MAKING IN SUSTAINABLE ORGANIZATIONS

Whilst in the past the study of leadership was oriented towards behaviour, interactions, attributes, competencies (Hollenbeck, McCall & Silzer, 2006; Voskuijl & Evers, 2008) and styles; contemporary leadership researchers have, inter alia, been developing values-oriented leadership theories (Chen & Li, 2013). Unlike traditional leadership models that study the leader-follower relationship as a mutual exchange in the form of transactional leadership, contemporary models of leadership are derived from transformational views of leadership, which emphasize the symbolic behaviour of leaders, such as setting a vision, giving inspirational messages, giving individual attention and providing intellectual stimulation (Avolio, Walumbwa and Weber in Chen & Li, 2013). Here, leadership is perceived as a product of subtle inner feelings, thoughts and intuition (Badaracco in Fry & Kriger, 2009). Fry and Kriger (2009) have also highlight the inadequacy of traditional understandings of leadership and instead proposed a leadership process that is focused on "*being*" to complement leadership theories which emphasize "*having*" or "*working*" (e.g. researching whether an individual possesses certain competencies or responds appropriately in certain situations). This paper examines two contemporary values-oriented approaches to leadership that emphasize leadership as "*being*", namely sustainable leadership and servant leadership. As stated earlier, servant and sustainable leadership approaches

have a unique contribution to make to enlightened strategic decision making that other leadership theories cannot make, because of (1) their orientation to serve and contribute to the well-being of others and the natural environment ahead of self-interest; (2) their focus on the long term interests of multiple organizational stakeholders, rather than a few internal ones (or a narrow focus on the leader-follower interaction); and (3) their recognition of the duty of leadership as stewards of organizational and natural resources to serve the common good. This is illustrated by referring to some of the key characteristics of each of these leadership approaches.

4.1 Sustainable leadership

Sustainable leadership is still not at the level of a mature theoretical concept and is according to Reichers and Scheider's (in Gurr, 2007) analysis, at the first phase of being introduced on the scale of introduction-evaluation-consolidation of the concept, into a big theory. As a point of departure, it is therefore useful to selectively compare sustainable leadership to other leadership theories and approaches. Sustainable leadership has several attributes that overlap with other theories of leadership, but also has its own distinctive elements.

Transformational and sustainable leadership are similar in the following ways: (1) their dedication to understanding the whole, because creating a sense of meaning facilitates the commitment of stakeholders; (2) intellectual stimulation of stakeholders; (3) motivation by inspiring action and (4) individualized treatment of stakeholders (Avolio, Bass, & Jung, 1999; Bass, Avolio, Jung, & Berson, 2003). Whereas transformational leadership is focused more on personal charisma or idealized influence in influencing current followers (House, Spangler & Woycke, 1991), sustainable leadership is focused on nurturing future generations' potential for a dignified existence.

Like servant leadership, sustainable leadership (Avery & Bergsteiner, 2011a), focuses more on the needs of others than on the leader's needs. However, sustainable leadership (Avery & Bergsteiner, 2011c) is distinctive from servant leadership in the sense that it is focused on the future needs of many stakeholders, and not only the present needs of current followers.

Sustainable leadership is based upon the notion of ethical leadership (Brown & Treviño, 2006), but extends its area of application by claiming that it is ethical that we take into consideration the needs of a wider range of stakeholders', including future generations and the natural environment. Olivier (2012) exposed a number of critical leadership challenges, and described sustainability as one of the main contemporary social, economic and ecological challenges of the type of ethical leader that Aristotle called the "*good man*", who seeks the welfare of his subjects because he is burdened with the pursuit of justice, in order to protect the common well-being of the community. In essence, in comparison to other leadership theories that stem from the transformational leadership approach, sustainable

leadership is distinguished by pursuing the value of sustainability at the individual, organizational, social and ecological level for both current and future generations.

Having contrasted sustainable leadership to other leadership approaches, it can now be defined more precisely and its defining characteristics highlighted. The Institute for Sustainable Leadership (2015) defines sustainable leadership in a business environment as those behaviours, practices and systems that create enduring value for all stakeholders of organizations, including investors, the environment, other species, future generations and the community (Edge equilibrium, 2015). Hargreaves (2007, p. 224) proposed a definition of sustainable leadership in an educational setting as leadership that develops in-depth learning in a way that does not harm and generates positive effects for all stakeholders, present and future. In combination, these definitions emphasize that sustainable leadership is (1) exercised in relation to a wide range of stakeholders; (2) transcends a preoccupation with the current state of affairs by adopting a long term view; (3) exercises leadership not only through behaviour but also through other organizational systemic components; and (4) defines value in terms of a greater common good.

When considering the approach to strategic decision making that is advocated by sustainable leadership, this is firstly characterised as a comprehensive systemic approach. Davies (in Gurr, 2007) notes that it is focused on several competing key factors that enable long-term development. Sustainable leadership takes into consideration a wide range of complex interrelations among individuals, the business community, global markets and the ecosystem, with the key aim that an organization achieves welfare by respecting social values, achieving long-term success by value-based strategic decision-making and protecting the natural environment, of which we all form an integral part. Secondly, in strategic decision making, sustainable leadership acts responsibly. Avery and Bergsteiner (2011c) claim that sustainable leadership builds communities, fosters collaboration among stakeholders and promotes long term value. The relevance of sustainable leadership for responsible strategic decision making in sustainable organizations is evident in the way it directs the attention of sustainable leaders towards four areas of consideration when making decisions. It demands that top management adopts a macro view of the organization (Avery & Bergsteiner, 2011c) because sustainability relates to various aspects of performance and development (Casserley & Critchley, 2010): (1) on a personal level: maintaining personal psychological and physical health; (2) at the organizational level: maintaining a work environment that allows employees to develop multiple intelligences with the aim of achieving the organization's objectives, which are aligned with the objectives of stakeholders; (3) at the social level: socially-responsible action in the wider community; and (4) on the ecological level: conservation and sustainable environmental change.

Based on this discussion of sustainable leadership, two propositions are derived:

Proposition 2: A sustainable leadership approach contributes to comprehensiveness in strategic decision making, by ensuring that the long term effects of decisions on a range of stakeholders are taken into consideration.

Proposition 3: A sustainable leadership approach in strategic decision making prioritizes the responsible, proactive care of the natural environment, alongside personal, organizational and societal considerations.

4.2 Servant leadership

Like sustainable leadership, servant leadership is still developing as a theoretical concept (Parris & Peachey, 2013). While it has recently received more scrutiny regarding its construction, it still has to consolidate (Reichers and Scheider's in Gurr, 2007). Despite the intuitive linkage between the concepts, relatively little is known about the influence of a servant leadership approach to the strategic leadership of organizations, and whether or not such an approach creates more sustainable organizations (Joseph & Winston, 2005). This situation has risen partly because of the dominance of popular anecdotal writings on the topic of servant leadership and that only more recently has there been much interest in conducting scholarly research on servant leadership (Jackson, Farndale & Kakabadse, 2003; Laub, 2004; Russel & Stone, 2002; van Dierendonck, 2011).

Greenleaf (1977) is regarded as the founder of the modern day conceptualization of servant leadership. In describing servant leadership, Greenleaf (1977, p. 27) notes:

"*It begins with the natural feeling that one wants to serve, to serve first. Then conscious choice brings one to aspire to lead. That person is sharply different from the one who is leader first, perhaps because of the need to assuage an unusual power drive or to acquire material possessions. For such it will be a later choice to serve – after leadership is established. The leader – first and the servant – first are two extreme types … The difference manifests itself in the care taken by the servant, first to make sure that other people's highest priority needs are being served.*"

While originally written about as a philosophical approach to leadership, subsequent research on servant leadership (Liden, Wayne, Liao & Meuser, 2014) has tried to isolate, define and measure the characteristics of servant leaders (see for example Barbuto & Wheeler, 2006; Laub, 2004; Liden, Wayne, Zhao & Henderson, 2008; Patterson, 2003; Russel & Stone, 2002; Sendjaya & Sarros, 2002, Sendjaya, Sarros & Santora, 2008; Spears, 1995; van Dierendonck, 2011). When considering the potential contribution of servant leadership to strategic decision making in sustainable organizations, the following three characteristics of servant leadership are worth noting as they emphasize the restorative and service elements of leadership that is exercised in a multiple stakeholder context for the long-term common good: foresight, stewardship and healing.

Firstly, servant leadership is characterised by foresight. According to Spears and Lawrence (2002) foresight is about being able to foresee the future implications of past and current trends. Consequently, leaders with foresight realize the continuity of things and adopt a longer term strategic view, consistent with a sustainability and stewardship perspective that recognises obligations to future generations. Van Dierendonck (2011) notes that serv-

ant leaders provide direction to others in a way that ensures accountability, and relies on values (Russell, 2001) and convictions rather than advancing self-interest. Leaders achieve stakeholders' membership through sharing the vision, expressing concern for the values of others and orienting themselves towards achieving the vision.

Secondly, servant leadership is characterised by stewardship, which is also central to the concept of sustainable development. Block (1993, p. 34) defines a steward as "*a leader who is holding something in trust for another*". This notion of stewardship is aligned with the Brundtland Commission report's (1987) definition of sustainable development. By implication, the strategic decision making of leadership takes on a long term perspective when stewardship is upheld, also recognising that the organization exists first and foremost for the good of society rather than shareholders, and therefore there needs to be mutual accountability to all for decisions made (Spears, 1995; Russel & Stone, 2002). These leaders also influence the decision making of others. As van Dierendonck (2011) notes, through stewardship, leaders influence others to act in the common interest. That is, they act in partnership with others, including followers who are also empowered to be stewards (Russel & Stone, 2002).

Thirdly, Greenleaf (1977) was the first to espouse the view that the servant leader brought healing. That is, they served others in a manner that dealt with personal pain, rejection and brokenness, in pursuit of wholeness. Servant leadership operates from the premise that work exists for the development of the worker as much as the worker exists to do the work. As such, servant leaders devote themselves to others and to the organization's mission (Daft & Marcic, 2001). Since servant leadership is a form of values based leadership, in their role of strategic decision makers, the primary purpose of the servant leader (Fry & Kriger, 2009) is to create a positive impact on employees and interested stakeholders. Such an orientation in the leaders, would be motivated by what Patterson (2003) – writing from a Christian perspective on servant leadership - would refer to as agape love, or unconditional love. Senander (2013) draws on Ignatian philosophy to argue that love should be a foundation for leadership, not only in the church, but in business as well. In holding to this characteristic of healing, the servant leader becomes conscious of the social dimension of the business and its responsibility towards both employees and the broader society. Another characteristic of servant leaders that is supportive of healing, is that servant leaders are concerned with building community at the local level (Spears, 2005). Typically this occurs through altruistic giving and service. In their research, Taylor, Pearse, and Louw (2013) discovered that having the opportunity to engage in community service was instrumental to the formation of a philosophy and practice of servant leadership in a group of young men, and that this leadership was epitomised by advancing the interests of others and improving their lot in life, rather than serving their own selfish interests.

It is evident that the adoption of servant leadership in general, and its characteristics of foresight, stewardship and healing in particular, has the potential of aligning the values of leadership with the long term interests of the organization for the common good. In so doing, organizational leaders, whose approach to leadership is based upon servant leadership would be more inclined to take strategic decisions that advance sustainability.

Proposition 4: The service and restorative elements of servant leadership contribute to more comprehensive strategic decision making by ensuring that the long term social and ecological effects are also taken into account, as well as addressing the legacies of poor decision making in the past, in the interest of the greater good.

5. IMPLICATIONS FOR LEADERSHIP DEVELOPMENT

This paper has argued that a different type of leadership is required if effective strategic decisions are to be made in organizations striving to become more sustainable. In this section, the development of such leadership is considered. Effective leadership development recognises the importance of designing a comprehensive set of interventions that are holistic, extend beyond the classroom or training room and ensure coherence among these programme components (Day & Harrison, 2007). In designing such programmes, two key implications for leadership development are discussed, namely the inclusion of values based leadership in development programmes and the development of integrative thinking.

5.1 Values based leadership in development

It has been argued here that values based approaches to leadership - and particularly sustainable leadership and servant leadership specifically in combination - will facilitate the strategic decision making process in organizations that are trying to embrace sustainability. In particular, there are synergies that are realised when sustainable leadership and servant leadership approaches are combined to integrate social and environmental interests with economic ones in decision making. This values based orientation to leadership is required in sustainable organizations, since values based leaders actively incorporate stakeholder and organizational values into organizational thinking (Viinamäki, 2009, 2012). This implies that organizations need to reconsider how they go about selecting and developing leaders. Firstly, sustainable organizations should select their leaders based on the fit between the personal values of applicant leaders and those of the organization (Brown & Treviño, 2006). A selected decision informed by such considerations creates alignment, where pro-natural and pro-social ideas can be expressed in the organization, appropriate strategic decisions made by leaders and then implemented with the support of the organization. Secondly, organizations should adopt processes that develop values based leadership throughout the organization. This includes role modelling, training, participatory communication and reflection (Brown & Treviño, 2006; Viinamäki, 2009).

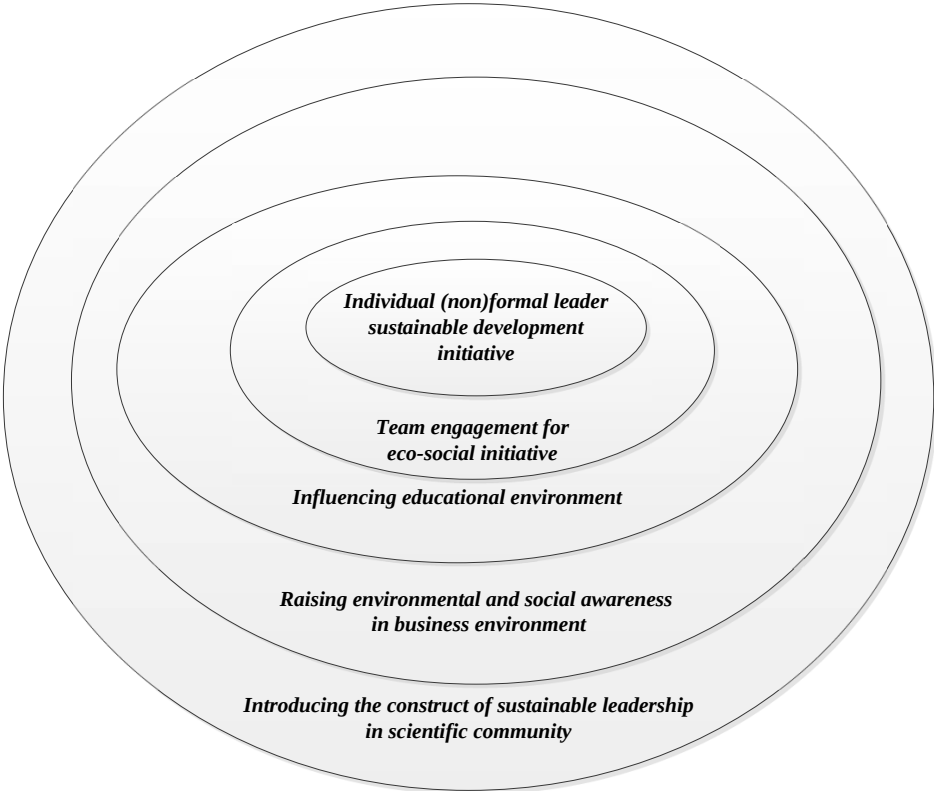
Finally, attention should be paid to the organizational culture, both in leadership training programmes, and in how leaders influence it. That is, the shared values of the organization are embedded in the culture of the organization (e.g. Cha & Edmondson, 2006; Graber & Kilpatrick 2008; Schein, 2010; Viinamäki, 2009). Therefore, leaders need to be able to decipher the organizational culture so as to understand its impact on decision making, as well as to shape the culture of the organization so that it is supportive of strategic decision making that advances sustainability. In doing so, they need to appreciate the tensions that exist

among the values, interests, and power of various stakeholders (Prilleltensky, 2000) and that there will be competing, conflicting and shifting values (Graber & Kilpatrick, 2008).

5.2 Development of integrative thinking

Sustainable and servant leadership approaches build on the notion that change evolves in concentric circles of integrative thinking within a leadership network (See Figure 1), where the initiator of activity engages others in the process of community building and sustainable development. This holistic component of sustainable leadership implies that leaders see other human beings and society as parts of a much bigger whole – an ecosystem that is interconnected and needs to be synchronized (Maak & Pless, 2006).

Figure 1: *Integrative thinking within sustainable leadership*



However, this process of synchronising does not imply that all of the elements of the ecosystem are aligned. To the contrary, there are often paradoxes present. Smith and Lewis (2011, p. 382) define a paradox as "*contradictory yet interrelated elements that exist simultaneously and persist over time*". These paradoxes will be encountered during strategic

decision making. Leaders need to both correctly perceive the paradoxes and resolve them effectively if effective decisions are to be made.

Smith and Lewis (2011, p. 388) identify four types of paradoxes or tensions that occur when deciding "*what they are going to do, how they are going to do it, who is going to do it, and in what time horizon.*" These are performing, organizing, belonging, and learning tensions and offer a point of departure for leaders to recognise the existence of a paradox and how to deal with it in strategic decision making. Performance paradoxes derive from the tensions between internal and external stakeholders and their performance expectations (Smith & Lewis, 2011). Adopting an organizational sustainability paradigm with a stakeholder perspective signifies a fundamental change in the way in which the organization is viewed as a system and what its priorities are. A normative view of stakeholder theory makes the assumption that the interests of all stakeholders are of intrinsic value (Donaldson & Preston, 1995) and therefore need to at least be acknowledged by the organization. However, when engaging stakeholders who have competing interests, Mitchell, Agle and Wood (1997) argue that stakeholders differ in their power, legitimacy and urgency. This characteristics of stakeholders, as well as their position on particular issues, will affect strategic decision making.

Organizing paradoxes (Smith & Lewis, 2011) arise when systems require simultaneous paradoxical structural arrangements, such as control and flexibility, or centralisation and decentralisation. Historically, financial controls have dominated organizations, but sustainability demands that this economic concern now has to be balanced by also taking into account social and environmental impacts when making strategic decisions. Leaders have to decide how best to reach these decisions, as well as how to structure the organization to ensure that these decisions are acted upon.

Learning paradoxes emerge when systems change, and organizations have to either innovate new systems or abandon old systems. The journey to organizational sustainability is in essence a learning journey. This journey requires leaders to redefine the organization and their role in it, while simultaneously maintaining the core competitive advantage and short term survival (Rowe, 2001). As illustrated above, servant leadership and sustainable leadership approaches can assist in this process.

Belonging paradoxes derive from deciding who is going to do what, as this can create tensions around "*conflicting identities, roles, and values*" of leaders (Smith & Lewis, 2011, p. 388). As stated earlier, decisions are partly based on the personal interpretations, experiences and preferences of the leader (Hambrick et al., 2005, Finkelstein & Mooney, 2005), and they may be flawed in either the process followed in reaching a decision, or in the decision, itself (Hambrick et al., 2005, Finkelstein & Mooney, 2005). This point highlights the additional demands being placed on leaders when engaged in strategic decision making for sustainability. Martin (2007) notes that leaders require integrative thinking to be able to resolve these paradoxes as they move through the four stages of decision making which he refers to as determining salience, analysing causality, envisioning the decision architecture and achieving resolution.

In essence, integrative thinking provides a learning and development mechanism for leaders to identify, articulate and resolve the paradoxes that arise in strategic decision making when multiple stakeholders make multiple and competing demands, and decisions need to integrate economic, social and ecological implications.

6. CONCLUSION

Contemporary leaders are met with numerous and complex global challenges that are affecting their strategic decision making. The development of leaders from a servant and sustainable leadership perspective aims at spreading the leader's influence beyond the confines of everyday organizational needs and looking outside the organization, as well as into the future needs of generations to come. Leaders whose approach to leadership is informed by both sustainable and servant leadership are more inclined to make strategic decisions that take into account the economic, social and ecological dimensions of such decisions, as expressed by various stakeholders. Not only does this constitute prosocial behaviour, but it is also a pro-natural perspective, which offers a new research avenue to scholars who are researching decision making within the contemporary leadership paradigm.

Due to the fact that both leadership approaches presented here have an ethical component, it is proposed that the leader of the future will need to support and not exploit his or her followers, and facilitate their development and decision making in a way that promotes the common good. Servant and sustainable leadership have incorporated social and environmental responsibilities (Bowen, 1953; Margolis & Walsh, 2001) and offer a framework for further research of sustainable leadership development. Further research needs to be focused on managing the relationships with a multiplicity of stakeholders and making effective and ethical decisions. In addition, research is needed into the design of effective leadership development programmes that will enhance strategic decision making through inculcating values based leadership and developing integrative thinking.

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INSTITUTIONAL CHANGE AS A RESULT OF INTERNATIONAL ACCREDITATION: BUSINESS SCHOOLS OF LITHUANIA AFTER THE IRON CURTAIN

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ABSTRACT: *This paper studies the effects of gaining international accreditation in business schools (B-schools) in Lithuania. As in other CEE countries, in Lithuania international accreditation has recently become one of the key solutions to achieving legitimacy for B-schools. Due to the lack of research in this area, the aim of this paper is to explore and unveil the reasons for, and the consequences of the accreditation using an institutional theory framework. A multiple case study methodology is used to answer the research questions. The findings reveal that accreditation effects represent a case of institutional isomorphism, because B-schools seek accreditation to achieve legitimacy rather than improved performance. B-schools decide for accreditation and implement it mainly because of bandwagon effects and the reduction of information asymmetry – reasons which are accompanied by all three types of isomorphic change (coercive, mimetic, and normative). Based on the findings, the study concludes by suggesting propositions to be tested in future studies to further investigate this under-researched topic, especially in the CEE region.*

Keywords: *institutional change, isomorphism, business schools, international accreditation, case studies*
JEL Classification: B15, I23, M16
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1. INTRODUCTION

Since the 1990s, Central and Eastern Europe (CEE) has become the region of experiments to test the applicability of existing theories in management studies (Meyer & Peng, 2005). According to Koźmiński (2008, p. 8-9), CEE markets were integrating, competition was becoming global, and "*corpocrats*" were substituted by entrepreneurs. Among the countries of the CEE, Lithuania has experienced a growth in tertiary education since the 1990s (Robert & Saar, 2012). It faced a shift from public to private higher education, with questions about the legitimacy of this process (Suspitsin, 2007). International accreditation became a key solution toward the legitimacy of business schools (B-schools). However, as its effects on B-schools have been under-researched, we study this in our paper using the case of Lithuanian B-schools.

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Deans of B-schools ranked accreditation as the second most important event in the world for the last 20 years after the issue of globalisation (Thomas H. Thomas, L. & Wilson, 2013). In the quest for legitimacy, accreditation practices started spreading throughout CEE countries during the first decade of the new century, with a growing number of discussions about accreditation influence on B-schools in CEE. Global distribution of accredited schools shows that the CEE region is still behind many other regions in terms of accredited schools (Bruner & Iannarelli, 2011). In the absence of adequate research in CEE, this practice has been both criticised and praised. It also raised related questions: Do international accreditation bodies from the West change the B-schools in the East through their accreditation standards? Does the "quality label" which comes from the West have any value for B-schools in the East? What impact does it have on business education, and, therefore, on the transformation of the whole generation of future managers?

International accreditation of business education is available from various organisations (AACSB, EFMD, AMBA, CEEMAN, etc.). Each agency is perceived by B-schools as a certain quality differentiator because of their individual standards. The strongest CEE B-schools usually seek to gain a Western-European "quality label" from the EFMD (European Foundation for Management Development) with its institutional EQUIS or programme EPAS accreditation. The leading European B-schools are engaged in promoting EQUIS as a means for providing a better comparison, and to defend European values by having a consistent system (Wedlin, 2010; Hedmo et al. 2006). The institutional accreditation of the Central and East European Management Development Association (CEEMAN) has become popular among the B-schools of CIS and Baltic countries. On one hand, CEEMAN recognises the different starting points of B-schools in transition economies; but on the other hand, this accreditation is based on the EQUIS scheme with funding through the EU (PHARE, TACIS) programmes (Lock, 1999). As Hommel (2009a) summarises, CEE B-schools have created a platform with CEEMAN to foster networking as an intermediate step toward AACSB and EQUIS accreditation.

The purpose of our paper is to present and discuss findings from B-schools on their experience of international accreditation in Lithuania based on the institutional theory framework. We conduct our study using a multiple case study methodology exploring the effects of EPAS, EQUIS, and CEEMAN accreditations. We argue that the benefits of using multiple cases are in enabling a broader exploration of research questions and theoretical elaboration, where cases are used to create propositions to be tested in future studies (Eisenhardt & Graebner, 2007). On a theoretical level, this study integrates the current knowledge of accreditation of how it is introduced and perceived with its specifics in CEE, and discusses the relationship between coercive, normative, and mimetic isomorphic forces within the institutional theory's framework. On an empirical level, the study shows accreditation effects on changes in B-schools, drawing on the evidence from field studies with an analysis based on the triangulation of methods (interviews, questionnaire, and archival data). We found that accreditation effects represent a case of institutional isomorphism because B-schools seek accreditation to achieve legitimacy rather than improved performance. B-schools decide for accreditation and implement it mainly because of bandwagon effects and also a reduction of information asymmetry reasons which are accompanied by all three types of isomorphic change (coercive, mimetic, and normative). Our results might help B-school Deans, top-

managers, and policy makers to enhance the legitimacy through accreditation of different quality differentiators. Moreover, providing a framework for research on accreditation, this paper contributes a template for studying accreditation effects in other regions of CEE by suggesting propositions to be tested in future studies.

The remainder of the paper is structured as follows. A literature review with research questions is presented in the next section. Section 3 describes the research methodology. Section 4 shows and discusses the findings, indicating propositions for future research. The paper concludes with further research implications of our study.

2. LITERATURE REVIEW

The focus of our paper is on the legitimacy of accreditation practices in CEE B-schools using an institutional theory framework to explore the changes surrounding accreditation implementation. We start from the point that there is a visible absence of research on CEE B-school changes as a result of external accreditation. The pilot study research by Istileulova and Peljhan (2013) shows how the process of business accreditation is gradually spreading in Commonwealth of Independent States (CIS) countries with certain preferences. The Graduate School of Management SPbU (St. Petersburg University) is the only school with EQUIS accreditation for all of Russia and the CIS, which had a resident population of 276 million people in 2014. Due to the missing academic studies in this field, many authors urge for more research. For example, Suspitsin (2007) recommends more comparative research on private education in post-Soviet countries. Hodge (2010) proposed replicating case study analysis on international accreditation using the institutional theory. Baker (2011) advocates study of other schools which "*provide a more holistic understanding of how educators perceive accreditation*." Williams (2011) recommends undertaking "*a research opportunity that studies the perceptions*" of accreditation in Higher Education Institutions (HEIs). Beard (2006) and Cooper et al. (2014) suggest exploring accreditation's related changes with qualitative methodologies, especially case studies.

Spinoza (1883) gave a classical definition of knowledge stating that we can say we know something when we understand it through its causes: what causes it, why and how they came to be. Bearing that in mind, the main focus of our study is drawn from the following research questions:

- Why do B-schools introduce international accreditation?
- What are the changes taking place in B-schools as a result of accreditation processes?
- How do B-schools perceive accreditation in terms of benefits versus costs?

In the paper, we use the institutional theory framework to explore the forces that influence B-schools to enhance their legitimacy by accreditation. Institutional theorists suggest that organisations (i.e. formal social units, in our case B-schools[3]) become more similar over

3 From here on the word 'organisation' (B-school) refers to organisation as a formal social unit (FSU), i.e. an economic organisation, a firm. When we are talking about organisational changes that happen in processes and structures we are in fact addressing the internal organisation of a B-school. For more on the distinction between FSU and its internal organisation see Mihelčič (2012).

time because of a normative process that rewards similarity (Newman, 2000). Organisations that adapt to institutional pressures are more likely to obtain scarce resources and have higher survival chances by gaining legitimacy (DiMaggio & Powell, 1991; Newman, 2000). Institutional theorists view change as a continuous process in which the drivers of change are strong extra organisational norms (such as accreditation standards) about what constitutes appropriate organisational goals and structures (Newman, 2000). Here the objective of change is greater legitimacy (B-schools seeks approval from others), not a better performance (Ashworth et al. 2009). There are two types of changes, organisational and institutional (Newman, 2000). In this context, institutional change has a broader meaning: it transcends organisational change to focus on entire classes of organisations serving different societal functions (business, education, government) (Halal, 2005). In order to understand institutional change in B-schools with ongoing accreditation in Lithuania, we have to study organisational changes on the level of each B-school. Organisational changes refer to the changes of processes and structures that happen because of accreditation 'pressure.' Arroyo (2012) argues that practice is considered as institutionalised at: (1) the organisational level (the level of each B-school), when the new practice is taken-for-granted; and (2) the field level (the level of all accredited B-schools), when diffused by other organisations or highly accepted with a normative quality.

DiMaggio and Powell (1983) address three isomorphic forces driving institutional change: (1) coercive isomorphism as a result of political influence and the need for legitimacy; (2) mimetic isomorphism as a standard response to uncertainty by imitation; and (3) normative isomorphism as a result of professionalisation. While the three isomorphic effects can be distinguished conceptually, in reality they are difficult to untangle (Guler et al. 2002). We describe isomorphic forces as follows.

First, 'coercion' means that organisations adjust their structures and procedures to organisations on which they are dependent (Dobbins & Knill, 2009). In the HEIs, coercive mechanisms include the influence of accreditation agencies, legislation, and the influence of research funds or partners (Decramer et al. 2012). In other words, coercive isomorphism is the result of formal and informal pressures exerted on B-schools by accrediting agencies, and in B-schools substantial legitimacy is achieved through 'triple accreditation' (Wilson & McKiernan, 2011). Some governments in CEE (the Czech Republic, Serbia, Macedonia) have linked school rankings with accreditation, to decide whether a particular HEI should be formally recognised (Hazelkorn, 2014).

Second, the concept of mimetic isomorphism means that organisations copy others that seem to be successful (McGurk, 2012). Mimetic isomorphism refers to the imitation of structures and practices of other organisations to manage uncertainty (Jen-Jen & Ping-Hung, 2011). Mimetic change means that schools are becoming similar because of the content, frequency, and depth of assessments by accreditation agencies (Wilson & Thomas, 2012). Mimetic isomorphism is very close to bandwagon effects – when B-schools seek accreditation because of the social and economic pressures, not because of its efficiency (Hodge, 2010). Bandwagon theories are grounded in institutional theory, managerial process, and agency theory, where they argue that firms tend to imitate their rivals regardless

of value-enhancing (Pangarkar, 2000). The bandwagon gets rolling due to the number of other organisations (e.g. B-schools) that are doing the same thing. Abrahamson and Rosenkopf (1993) differentiate between "*institutional bandwagon*," when non-adopters fear appearing different from many adopters and "*competitive bandwagon*," when non-adopters fear below-average performance if many competitors profit from adopting.

Third, the force of normative isomorphism considers the influence of the state, regulatory bodies, or professional organisations on B-schools via expectations or standards, admission requirements, programme contents, international orientation, and when organisations (B-schools) in CEE use similar logics with "*guidelines provided by professional organisations*" (Bandelj & Purg, 2005, p. 6; Wilson & McKiernan, 2011). As Suspitsin (2007, p. 23) suggests, accreditation "*may be considered a normative mechanism*" because it is not defined by laws. A normative mechanism's function is a filter of the certified personnel: professionalisation and socialisation effects are significant (Horii, 2012). It is derived from shared obligations and codes of conduct (Jen-Jen & Ping-Hung, 2011).

In addition, there is an issue of asymmetric information: the relationship between the future student and the school (where accreditation is a signal for students to "buy" the degree) and between the B-school and employee (with incomplete information and merits for each) (Hodge, 2010). In this case, accreditation reduces information asymmetry to attract more local and international students (Ba & Pavlou, 2002).

In our paper, we investigate the changes that occur as a result of accreditation processes in B-schools. As changes are compliant with isomorphic pressures (Ashworth et al. 2009), we assume that B-schools are implementing changes as a result of accreditation processes. For example, EQUIS accreditation is often seen as an instrument of organisational strategic development and the way to force schools to change and improve. Although DiMaggio and Powell (1991) emphasise the explanatory potential of institutional theory in its "silent area" of organisational change's analysis, little attention has been paid to the details of organisational change when it happens in response to isomorphic pressures (Ashworth et al. 2009). In Table 1, we present some views on changes as a result of accreditation.

Table 1. *Literature review on changes as a result of accreditation based on institutional theory*

Author(s) / Study/ country	**Type of change**	**Results**
1. Ashworth et al. 2009. Conceptual & empirical paper, UK	MI forces: copy activities, structures. CO forces: political influence on changes. NO norms describe effect of standards.	A. impact is visible in structures, culture, strategy, content. There is evidence of convergence due to isomorphic forces. The biggest effect on strategy, culture.
2. Ba & Pavlou, 2002. Research, U.S.A.	IA with a trust-building mechanism	A. reduces IA, costly policy brings higher prices

3. Barman & MacIndoe, 2012. Empirical paper, U.S.A.	NO: adoption of measurement is influenced by networks, accreditation. CO by resource provider: the greater change, the more organisations are salient to its adoption.	CO: organisations in a field share characteristics over time.
4. Casile & Davis-Blake, 2002. Empirical paper, U.S.A.	The impact of NO change has generally not been studied. Private schools are more sensitive than public schools due to dependency on students' revenues.	Institutional factors had a greater effect on public organisations; technical factors (economic gains from A.) had a greater effect on the private organisations' responsiveness.
5. Cret, 2011. Three cases of English, French B-schools: UK, France	Strategic changes; change of academicians; Quality assurance has to be considered within the institutional frame of CO, MI, NO pressures.	There is a link b/n A. and organisational change in B-schools. A. is as a case of institutional isomorphism, and a delegation of power.
6. Fernández-Alles & Llamas-Sánchez, 2008. Theoretical paper, Spain	Jump on the BAs of innovation that have been implemented in other countries – the direct motivation for reforms. NO: change as a result of professional associations'standards.	BA takes advantage of reform models previously legitimised in other services, countries. NO attempts to protect members' interests.
7. Horii, 2012. Refugee Survey, The European Union	NO force has effects of socialisation, professionalisation, where professional community creates a mechanism of A.	Socialisation is associated with networking. Creation of A. is a normative support.
8. Cooper et al. 2014. Illustrative case study, UK	A. is identified as a key NO mechanism (formal education, professionalisation) to initiate change. The move to internationalisation is MI pressure.	Changes are the result of exogenous institutional pressures from A. There is a need for case studies.

9. Masrani, Williams, & McKiernan, 2011. The case study, UK	CO and NO strategies work to reinforce impact, legitimacy. It is established with CO lobbying, turns to professionalisation in a NO fashion.	Isomorphic convergence to homogeneity is evident through MI, NO, and CO (social obligation).
10. McKee et al. 2005. AACSB. Theoretical paper, Canada	Uncertainty creates climate for MI. NO forces is important for faculty, deans. Substantive change involves CO, PE role.	Key staff hiring from a defined population leads to NO. CO alters resource dependencies and social practice.
11. Paccioni et al. 2008. A multiple-case longitudinal study with mixed approach, Canada	Changing mission is a way to change the culture. A. is conceptualized as an ideological control more than CO. The effects of A. on quality, has little impact on employees not involved in process.	The A. dynamic is limited to the administrators, while professionals, showed a mixed perception in terms of quality.
12. Teodoro & Hughes, 2012. Models, descriptive statistics paper, U.S.A.	Professionalising an agency requires "deep change," with new ways of thinking in mission. Advocates of A. claim that the process improves performance (PE).	A. may affect organisational culture by socialising employees, by signalling them priorities.

Abbreviations used: A – accreditation, NO – normative isomorphism, CO – coercive isomorphism, MI – mimetic isomorphism, BA– Bandwagon, IA – information asymmetry, PE – performance related issues (reasons, changes).

The proponents of accreditation explain that, it is "*a formal authorising power*" (Lejeune, 2011). B-school leaders must decide which accreditation provides value to the school in terms of context, mission, student body, and its aspirations (Trapnell, 2007). EQUIS, for example, focuses on strategic and accountability considerations (Lejeune & Vas, 2009), input factors (infrastructure and qualifications of staff/students, etc.) connected to "quality," activities (R&D, executive education), and outcomes (contribution to the community, personal development) (Lejeune, 2011). Benefits promised by accreditation are the following: (1) differentiation from the competition; (2) criteria for self-assessment, peer review; (3) the ripple effect, where school competitors seek to improve themselves through accreditation (Cornuel & Urgel, 2009; Urgel, 2007). Benefits of accreditation are understood "*in the context of the pressures of institutional isomorphism and contingent strategies*" (McKee et al. 2005). In Table 2, we present advantages and disadvantages of accreditations that are present in the studied Lithuanian B-schools.

Table 2. *Perceptions of B-schools about EQUIS, CEEMAN, and EPAS accreditation value (as discussed by the referred authors)*

Accreditation	**Body**	**Advantages**	**Disadvantages**
Institutional	EQUIS	Capabilities: strategizing, changing, branding; quality assessment, contribution to improvement, and brand recognition (Urgel, 2007). Quality of the faculty, community interaction, programmes development, social openness, and ability to acquire resources (Lejeune & Vas, 2009).	Quality does not always lead to effectiveness gains, but to legitimacy (Lejeune & Vas, 2009). The cost of accreditation is high (Helmig et al. 2010)
	CEEMAN	It has development programmes, adapts international standards to each school's mission, environment; it is less costly than EQUIS or AACSB (Mirvis, 2014). It explains how quality can be improved (Myasoedov, 2013). It is interested in schools with the learning process (Abell, 2012).	There are no requirements on activity results (like KPIs) and personnel satisfaction (like "research on satisfaction of personnel needs" required by EFQM or ISO 9001 (Serafinas & Alber, 2007).

Programme	EPAS	Help for EQUIS, student recruitment, and international mix (Rees, 2009). Catalyst for institutional change, benchmark, internationalisation, networking, and reputation effects (Hommel, 2009a). Change: curricular design & delivery; obligatory semester abroad; programme internationalisation, corporate interactions (Katkalo, 2009; Hommel, 2009a; Rees, 2009); brand (Hommel, 2009b); quality; and peer-review (Greensted, 2009).	EPAS is "*a chicken and egg situation*": it will promote an internationalisation of the programme, but to be accredited it has to have already an international perspective (Greensted, 2009). *If EPAS is seen as a distraction from normal activities, EQUIS is a complete takeover* (Rees, 2009).

To explore our research questions, we conducted a multiple case study on the top-three Lithuanian B-schools in the process of gaining international accreditation. The methodology is presented as follows.

3. METHODOLOGY

Our study is based on the analysis of three cases of private Lithuanian B-schools with three different international accreditation practices, the recent phenomena in CEE. Actually, we cover the whole population of B-schools with international accreditation in Lithuania. Lithuania is the largest country of the three Baltic States with an estimated population of 3 million, the first of the iron-curtain states to declare independence in 1990. In Lithuania, there were a lot of changes in higher education after Lithuania's independence from USSR in 1990. There were 63,000 students in 13 HEIs in 1990/91, and this number dropped to 54,000 students in 1995/96 (Mockienė, 2004). In the late 1990, Lithuania was the country that had been viewed as lagging behind the other Baltic countries (Jongsma, 2002). The private higher education sector emerged more slowly than in the rest of the CEE region: the first two private institutions were established in 1999, and the higher education system was diversified with 19 university-type (academies, colleges, seminaries, universities) and 24 non-university-type' colleges (kolegijos) in 2002 (Mockienė, 2004). Lithuania has moved to a mass higher education with 14 state and 9 private universities over the last 15 years (Mitchel, 2013).

The top B-schools were founded 15-25 years ago, right after the "Iron Curtain," the symbolic, ideological, and physical boundary dividing Europe into two different areas from the end of World War II. Three cases of B-schools are summarised in Table 3.

Table 3. *Three cases of B-schools in Lithuania*

B-SCHOOLS	**BMI (BALTIC MANAGEMENT INSTITUTE)**	**ISM UNIVERSITY OF MANAGEMENT AND ECONOMICS**	**IBS (INTERNATIONAL BUSINESS SCHOOL AT VILNIUS UNIVERSITY)**
YEAR OF FOUNDATION	1999	1999	1989
OWNERSHIP	PRIVATE	PRIVATE	PRIVATE
EDUNIVERSAL RANKING	3 PALMS	4 PALMS	3 PALMS
ACCREDITATION PROCESS	EPAS (2006/2010/2015)	EQUIS (IN PROCESS), IQA GRANTED BY CEEMAN (2006/2013)	CEEMAN (IN PROCESS)
CASE OF	PROGRAMME EPAS	INSTITUTIONAL EQUIS (IN PROCESS)	**INSTITUTIONAL CEEMAN (IN PROCESS)**
PARTICIPANTS OF INTERVIEWS	**3 PARTICIPANTS: DIRECTOR GENERAL, COMMUNICATION DIRECTOR, PROGRAMME DIRECTOR**	**1 PARTICIPANT: SENIOR QUALITY MANAGER DATA FROM INTERVIEWS WITH RECTOR AND QUALITY DIRECTOR (SOURCE: BMDA)**	**2 PARTICIPANTS: DEPUTY DIRECTOR FOR ACCREDITATION, QUALITY REPRESENTATIVE**

In our study, we apply an exploratory multiple-case study methodology. Research questions "how" and "why" favour the use of case studies (Yin, 2003, p. 3), with the substantial benefits from using multiple-case studies. The purpose of case study research in business and management is to use empirical evidence from real people in real organisations (i.e. formal social units) to make an original contribution to knowledge (Myers, 2013). We argue that the benefits of using multiple cases in our study are in enabling a broader exploration of research questions and theoretical elaboration, where cases are used to create propositions to be tested in future studies (Eisenhardt & Graebner, 2007, p. 27; Tellis, 1997). The units of our analysis are represented by the private business schools that go through the processes of international accreditation.

Our case study is characterised by the triangulation of multiple data sources, consisting of different data collections techniques (Farquhar, 2012). It is based on the semi-structured interviews, the questionnaire[4], and study of the archival data (external documents and articles

4 Interview protocol and questionnaire can be provided upon request. The questionnaire was pre-tested earlier on the B-schools with international accreditation in CEE countries.

from the B-schools' web sites). Interviews with B-school representatives were conducted by Istileulova in Lithuania after her participation in the Tempus conference "Putting Bucharest's Conclusions on Track: An Experts' Role" in June 2012 in Vilnius. The meetings were preliminarily set up and conducted with the participation of the representatives from six B-schools (see Table 3) at their locations. An initial interview protocol was developed to ensure that evidence would be collected on participants' views related to their experiences and opinions on the accreditation effects. The semi-structured interviews lasted 50 minutes and were recorded and transcribed to ensure accuracy. In addition to interviews, we used the questionnaire to get the standardised data. The questionnaire was distributed and filled in after these interviews. Its purpose was to gather the general data about each school, their familiarity with different types of accreditation, who decided for the accreditation, reasons for its adoption, advantages and disadvantages, the effects of accreditation (on programmes, faculty, strategy), and ongoing changes. We see the value added of this process in gathering complementary information to make our analysis more comprehensive. Eisenhardt (1989) also argues that structured questionnaires and semi-structured interviews are often used together in case studies, where different data collection methods are combined (such as archives, interviews, questionnaires, and observations).

Once the data had been collected, collated, and transcribed, interview and questionnaire responses were (manually) coded using the key theoretical constructs, patterns, and exceptions in the coded data were identified (Miles & Huberman, 1994; Ahrens & Dent, 1998). Patterns that emerged from the data were then compared to the institutional theory framework of our study. The results were documented once this process was complete. A similar process of pattern identification was undertaken for questionnaire and archival data.

The quality of our research is established using construct validity, external validity, and reliability (Kidder & Judd, 1986).[5] Construct validity refers to establishing correct operational measures for the concepts being studied. The major threats to construct validity are those created by bias either through the process of observing itself or bias introduced by the observation method. The questionnaire used and the semi-structured interviews were carefully constructed and contained questions to elicit information required to investigate research questions and as such, it is assumed that the construct validity is high. When undertaking our multiple case studies, multiple sources of evidence were used, establishing a chain of evidence. Also, the draft case study report was reviewed by key informants to increase the construct validity (Yin, 2003). The use of multiple sources enabled verification through triangulation, the strength of case research (Noda & Bower, 1996). An interview protocol ensured that the same themes were covered. Interview data were continually cross-checked with other data sources to enhance the reliability of the case study material. The notion of external validity for case methodology relates to the generalisability of the results to the underlying theory. Therefore, this paper's goal is to expand and generalise theories (i.e. analytical generalization) and not to enumerate frequencies (i.e. statistical generalisation). The generalisation in this study is to the underlying institutional theory. External validity is addressed by using replication logic in multiple case studies (Yin, 2003). Reliability of this study is ensured by using a case study protocol and

5 Internal validity is a concern for explanatory case studies, and is not applied to exploratory case studies such as ours (Baškarada, 2014; Yin, 2003).

by carefully documenting the procedures (Yin, 2003). This implies that the data collection procedures can be repeated with the same results.

4. RESULTS AND DISCUSSION

The results of our study are organised around our three research questions: "Why do B-schools introduce international accreditation?"; "What are the changes taking place in B-schools as a result of accreditation processes?"; and "How do B-schools perceive accreditation in terms of benefits versus costs?" We provide the answers from interviews that were conducted with each school's representatives. Moreover, as we also have the standardised answers from the questionnaire, we are summarising all sources of our results in Table 4. This allows us to comprehensively analyse how the three isomorphic forces (i.e. coercive, mimetic, and normative) combined with bandwagon, information asymmetry, and performance implications act in particular cases. After discussing the findings related to a particular research question, we propose propositions that we believe can be a good starting point for future studies that are going to be performed in other CEE countries.

4.1 Reasons for introducing international accreditation

We investigated what were the reasons for introducing international accreditation and who made the decision about it.

In Case 1 (BMI), there were two main reasons for gaining EPAS accreditation. The Director General explained that the first reason was to focus on the international students and programmes: "*Since B- schools have been globalised, we are trying to fight for the international students*." The other reason was that the school became "*the academic institution, being in a consortium of the leading European partners-schools: Copenhagen Business School, HEC School of Management, the Norwegian School of Economics, and Business Administration Louvain School of Management. Because of that we also try to attract international faculty . . . The market is international, prestigious, and we need to have some knowledge and standard of accreditation. The decision has been made by our partners – the presidents of partners' schools and the local partners.*"

In Case 2, the ISM Rector says: "*The EQUIS accreditation is our strategic goal; it is the highest quality label for business schools, a demonstration of international recognition. The path to the accreditation is long and will require continuous effort and much investment*" (Source: BMDA). According to ISM Quality Director, universities are refocusing their programmes on the competences' development, integrating the results into quality which is "*impossible without a quality-driven culture fostering the University's values, and the ability to change and excel*" (Source: BMDA).
At ISM, the detailed interview was provided by the Senior Quality Manager who explained how the decision was made: "*According to our strategic plan we had to change our mission by 2015, but it has already been reviewed. The decision about accreditation came from our institutional strategic document, from the top management, by the Board of Directors, and the*

Rectorate. Those who were initiating this process had a very strong strategic view. It will raise our possibilities to attract more students. It is also a sign that the institution is trying to reach the international level, showing that we can also be more flexible."

In Case 3 (IBS), when asked why his B-school decided to follow with the institutional CEEMAN accreditation, the Deputy Director for Accreditation answered: "*The decision at school about international accreditation was made in the strategic plan for 2006-2013 years. CEEMAN was not even mentioned in that time. In fact, the B-school had proposals to start from AACSB, not from CEEMAN. We checked ISO 9001 requirements with the Bologna process, CEEMAN, and EFMD. The reason we decided to start from CEEMAN is because IBS did not have any active research activities for the last two years. For EFMD and AACSB, the B-school should be much more active in research activities. Top management with lecturers made this decision. We had only part-time lecturers, and this is quite different from other schools. The lecturers are motivated with rewards for every activity – lectures, publications, presentations for TV programme, and we have a very good result.*" The reasons to get accreditation were commented: "*If you want to have a good partnership, you should be accredited for the big partnership. Now it is created according to the requirements. The students do not understand the idea of accreditation. The main purpose was to cooperate with the good international partners and improve the reputation on the local and international markets.*"

From the results (see above and Table 4) we can see that the prevailing effects for introducing accreditation stem from bandwagon effects, coercive isomorphic forces, and reduction of information asymmetry (to attract more local and international students). This proves Hodge's (2010) view that B-schools seek accreditation because of the social and economic pressures, not because of its efficiency. We can confirm Ashworth et al. (2009), Masrani et al. (2011) and Decramer et al. (2012) findings, that coercive mechanisms include the political influence of accreditation agencies and the influence of B-schools' partners. We found out that decisions about accreditation were made at the level of partners (Case 1) and by the top-management (Cases 2 and 3), while the majority of reasons for introducing the accreditation stem from the bandwagon effects (e.g. peer and partner pressure). We can also support Cret's (2011) idea that accreditation is a case of institutional isomorphism, because B-schools seek accreditation to achieve legitimacy rather than improved performance. The only type of isomorphism lacking in the Lithuanian case is normative isomorphism (based on professionalisation). However, that doesn't necessary mean that it is not present in any other school from CEE. Therefore, we can translate the discussion on "why do B-schools seek international accreditation" in the institutional theory framework as the following propositions for further research, especially in CEE countries:

Proposition 1: B-schools seek accreditation to achieve legitimacy rather than performance, efficiency, or quality benefits.

Proposition 2: B-schools seek "quality labels" to achieve organisational legitimacy as a result of bandwagon effects.

Proposition 3: B-schools seek accreditation in order to achieve legitimacy to reduce information asymmetry.

4.2 Changes resulting from the accreditation

We examined what changes are taking place in B-schools as a result of accreditation processes.

In terms of the main results of accreditation the BMI (Case 1) wanted to achieve, the Director General said: "*It is both external value we want to generate and a quality. We are now in compliance with the best programmes that have been accredited. The brand has a certain value itself. Of course, it is a brand that affects the value, and accreditation means that we are one of the accredited schools.*"

The Communication Director (BMI) answered: "*One of the expectations was to improve the marketing of our programmes, and EPAS also has facilitated the relations with other institutions.*

The Programme Director (BMI) added: "*Our partners had already been accredited with EFMD, AACSB, and we have to compile this standard as well. The fully international content of programmes offered has more focus on the international market. The majority of our students are coming from the local market, because we are a national school. At the same time, now we are focusing more on the international market.*"

Regarding the changes that a school had to implement to gain accreditation, there was a comment of the Director General BMI): "*We did not have anybody who would be responsible for academic staff and academic affairs, and we had to formalise it.*" The Programme Director added: "*We didn't need to change many things. We did not change our mission, we had to comply with our partners. We had to introduce only two changes: to create the position "Academic Affairs" and formalise our quality. We were a newcomer on the market and exceeded expectations.*"

In Case 2 (ISM), EQUIS accreditation has been perceived as a tool (Senior Quality manager): "*The tool such as accreditation is a methodology how to organise your structure. It offers good possibilities to structure your institution and to review/study a process. First, we need to deconstruct, and then to organise the logical process. We have discussed which processes create values, which processes supply the value added, and how to manage it. The results are that by having EQUIS we sent a message outside to the international business community on marketing issues, quality, and trademark. We are also moving from national to the international space: students from post-soviet countries, Asia, and from European countries are coming to our programmes.*"

Regarding the changes that ISM had to implement to gain accreditation the Senior Quality Manager commented: "*A systematic process is a pretty new thing, and some programmes should be added, created. In general, we would like to have more students, but… the country is quite small, and the region has to face this problem. We have national indicators to make an improvement and connection with business community, networks, and international networks. We are the school that wants to differentiate marketing issues, quality, trademarks, and to send a message outside to the business community and universities.*"

About the changes that IBS (Case 3) implemented, the Deputy Director for Accreditation commented: "*We did a lot of changes in terms of the strategic process: now it is more*

documented and formalised. We are working based on this scheme: every process is described – how the decision will be monitored, and which impact it makes for the society. The lecturers started to work in the groups. We plan to invite the international lecturers, and the business community should be involved into our research, in the study programmes, during the students' defences, and to evaluate students. According to the Lithuanian system of higher education, we do not have MBA/EMBA programme, – it is not approved by the Ministry, and legally we do not have a degree programme. If we want to have a programme, we have to register this programme at the level of Ministry as a Master's degree programme."

Data on changes were gathered also via the questionnaire. The summarised results are in Table 4. A school with the programme accreditation (Case 1) experienced less isomorphic changes compared to schools with institutional accreditation (Cases 2 and 3), where changes were broader in scale and scope. In the case of programme accreditation (Case 1) it was a minimum change, because the B-school was already in the consortium of Western schools, and coercive forces dominated from the very beginning. In the case of institutional accreditation (Cases 2 and 3) we found a greater change, with a range of all isomorphic forces. For institutional accreditations (EQUIS, CEEMAN), performance-related issues are also noticeable (more obvious in EQUIS case). The actual ongoing changes for B-schools resulting from each accreditation are different in scope and isomorphic forces, depending on the quality differentiator. In the programme accreditation, bandwagon forces are dominant, followed by coercive and mimetic isomorphic changes, and information asymmetry reduction influence. In the cases of institutional accreditation, the total results show that information asymmetry effects are prevailing, followed by normative isomorphic changes. There are more normative and coercive influences in the CEEMAN case. All cases demonstrate that B-schools expect that accreditation reduces the information asymmetry both on the local market and for their international partners to attract international students.

Changing the mission is the way to change the culture (Paccioni et al. 2008). This feature is observable for institutional accreditation in both cases with the difference that in Case 2 it had already been implemented, and in Case 3 – B-school still needs to do this. We assume that in Case 1, the culture was already in place due to its formation by the founders, the listed foreign partners located in Western Europe. This fact also explains the minimum changes implemented due to the programme EPAS accreditation and time for accreditation implementation (one year). B-schools expect the accreditation to improve internationalisation process, branding, quality, and reputation, thus confirming findings of other authors (Katkalo, 2009; Hommel, 2009a, 2009b; Lejeune & Vas, 2009; Masrani et al. 2011).

As Masrani et al. (2011) suggest, accreditation comes with coercive lobbying, but turns to professionalisation, thus increasing legitimacy with an overall institutional change in the Lithuanian market. We expect competitive B-schools to copy the practices of peer within their 'industry,' causing a visible institutional change because of bandwagon effects. Thus, changes from accreditation pressures (normative, coercive, and mimetic) lead B-schools, as well as their environment, to change confirming Arroyo's (2012) findings. Therefore, we propose the following for further research:

Proposition 4: The effects from accreditation pressures (coercive, mimetic, normative) lead B-schools to institutional change.

4.3 Perception of accreditation in terms of benefits versus cost

We explored how B-schools perceive accreditation in terms of benefits versus costs. Data on advantages and disadvantages regarding a particular accreditation were gathered mainly via the questionnaire. The results are presented in Table 4. However, in Case 1 and Case 2, the school's representatives added their own comments when conducting interviews.

Director General (BMI - Case 1) discussed the pros and cons of EPAS accreditation as follows: "*One of the values and advantages is that standards we deliver are in compliance with the international standards. Second, it is a marketing potential and also a market reputation. EPAS brand itself is acknowledged by the clients, the business executives. For the programme being differentiated, the client should understand that BMI with the EPAS accreditation is what others do not have. To promote a brand is a specific requirement of our clients. The disadvantages are a huge cost, a large amount of work, preparation for the meetings, and you do not have any idea about the process. It took our school one year since the time of application to gain this accreditation.*"

In Case 2 (ISM), two disadvantages have been marked in the Questionnaire: (1) The process requires considerable human resources to be involved, and (2) The process is long, and the outcome is uncertain. The Senior Quality Manager added: "*In terms of disadvantages, it takes a lot of time: attendance of high-level top-management, by academia – they have to spend some extra time. We started it at the beginning of 2011. We identified our bottlenecks very clearly: the process was organised in the project way. The most difficult in EQUIS accreditation is to follow the guidelines. From one side, you need to act in a flexible way, from the other side, you should follow your strategy, and you cannot take it according to different methodologies. All methodologies might be good as a checklist, and we need to understand which point we are in. It is the guidance, and a tool to measure your situation, your achievements. By the nature, we have to put a lot of effort into the connection with the business community.*"

Table 4: *Summary table from interviews and questionnaire with the codes of isomorphic forces*

Questions on	**BMI: EFMD (EPAS)**	**ISM: EFMD (EQUIS)**	**IBS: CEEMAN (IQA)**
REASONS (Why?)	-in compliance with partners of consortium (CO) because they are accredited (MI); partners have AACSB, EQUIS, we have to compile with it (a peer pressure) (BA), other schools do not have it (innovation) – BA; to attract international students (IA); to generate external value (BA); to facilitate relations with others (BA)	- highest quality label, awareness of the value (BA) - international recognition (IA); - to attract international students (IA) - Quality driven culture (PE), - ability to change (PE)	- this particular accreditation was not in strategy of 2006-13, there was another one (BA) - we could not apply for EFMD (CO), because we do not have research activity (but want to obtain accreditation) (BA) - resources (part-time lecturers) (PE)

DECISION (How?)	By partners (international and local) (CO)	Top-management, Board of Directors (CO)	Top-management (CO) with Faculty
FORCES Reason+ Decision	BA – 4; CO – 2; IA – 1, MI-1	IA – 2; PE – 2; CO – 1; BA - 1	BA – 2; CO – 2; PE - 1
Expected Results	-to improve marketing of the programmes (IA); -EPAS facilitates relations with partners (CO); - being "one of " accredited (NO) - newcomer on the market (IA), others do not have it (this innovation) (BA)	- marketing (IA) - quality-driven culture (PE) - trademark (BA)	-expectation for partnership (NO) -improved reputation (NO) - international market (IA)
CHANGES (What are the changes?)	- create academic unit to meet formal requirements (MI); - formalised quality in control of processes, policies, procedures (MI) MI - 2	- systematic process (NO); - new academic programmes to be created/added (MI); - connections with business community, networks, international partners (NO); - increase in the quality of publications (PE); -message outside on quality (BA) - increase in full time employees (NO); - internationalisation of students (IA); - internationalisation of faculty body (IA); - strengthening resources (financial) (PE) - increase in number of students (IA) IA – 3; NO – 3; PE-2; MI-1; BA - 1	- to improve reputation on local market (NO); - a lot of changes in strategic process (CO); - involve faculty, business community in research (NO); - more formalised (MI); - to review mission (CO); - improve connections with the business community (IA); - increase in the quality of publications (PE); - internationalisation of students (IA); - internationalisation of faculty body (IA) IA – 3; NO-2; CO-2; PE-1, MI-1,
TOTAL RESULTS	**BA – 5; CO – 3; MI -3, IA – 3; NO – 2;**	**IA- 5; PE – 5; NO-3; BA – 3; MI -1; CO -1.**	**IA – 4; NO – 4; CO – 4; BA – 3; MI – 1; PE - 2**
Advantage (Pros)	- standards are in compliance with international standards (MI) - marketing reputation (NO); - promotion of brand on international market (IA)	- a move from national to international space (IA); - a methodology how to organise your own structure (MI);	-to structure institution (MI) -to review process from the value-added point (BA) - improved reputation (NO)

Disadvantage (Cons)	- high cost; - a lot of work; - we have no idea whether we will gain A. or not	- considerable human resources; a lot of time - difficult to follow the guidelines; - long process, uncertain results	- the preparation stage slows down the pursuit of other schools' goals
Benefits	MI+NO+IA	MI+IA	MI+BA+NO

Abbreviations: The same as used in Table 1.

We found out that the perception of accreditation benefits to enhance legitimacy from "quality labels" is higher than the perception of accreditation cost. The perception of accreditation value is mainly associated with the mimetic benefits listed in all three cases, confirming Dobbins and Knill's (2009) finding that organisations adjust their structures and procedures to organisations on which they are dependent. The perceived benefits of mimetic isomorphic change in the B-school's structure are accompanied with the reduction of information asymmetry (in the cases of EFMD differentiator) and normative isomorphism (improved reputation), confirming Hommel (2009a) arguments. Based on our results, we propose the following proposition to be tested in future studies:

Proposition 5: Perception of accreditation benefits to enhance the legitimacy from "quality labels" is higher than the perception of the accreditation cost.

5. CONCLUSION

This paper explores the effects of implementing international accreditations in B-schools in Lithuania using the institutional theory framework and multiple case study methodology. Our findings reveal that B-schools decide for accreditation and implement it mainly because of bandwagon effects and reduction of information asymmetry reasons – which are accompanied by all three types of isomorphic change (coercive, mimetic, and normative). The total effects from isomorphic pressures observed in the market are the following: in programme accreditation bandwagon forces are dominant, followed by coercive and mimetic isomorphic changes, and also an information asymmetry reduction influence. In the cases of institutional accreditation, the total results show that information asymmetry effects are prevailing, followed by normative isomorphic changes. The only case where performance-related issues are observed equally with information asymmetry is the case of EQUIS accreditation. In the case of CEEMAN, there are more normative and coercive influences present. All cases demonstrate that B-schools expect that the acquired accreditation reduces the information asymmetry. They want to reduce it both on the local market and for their international partners to attract international students. As regards the effects of accreditation on the institutional environment, we argue that competing B-schools follow the behaviour of the closest rivals: if a B-school has already gained accreditation, its closest rival will follow the same pattern. We expect rival B-schools to copy the practices of peer within their 'industry,' causing a visible institutional change because of bandwagon effects. Moreover, accreditation is a tool for decreasing information asymmetry – which is proved by our findings.

The findings from this study with the specifics of the CEE region fit well into the framework of institutional theory. While the international accreditation shows the trend of creating isomorphic pressures on B-schools in practice, the cases also illustrate differences within the field. B-schools with institutional accreditation follow the path of changes that is much broader compared to programme accreditation. At the same time, the influence of EFMD is higher compared to CEEMAN.

There are three contributions of our study. First, the analysis was implemented in B-schools for three quality differentiators (EPAS, EQUIS, CEEMAN) accreditations, which was not the case in previous studies (Bandelj and Purg, 2005; Beard, 2006; Baker, 2011; Bruner and Iannarelli, 2011; Cornuel and Urgel, 2009; Greensted, 2009; Hedmo et al. 2006; Lejeune and Vas, 2009; Lejeune, 2011). Second, the criteria of institutional theory were applied for international accreditation practices of B-schools, providing a framework for future research (Ashworth et al. 2009; Ba and Pavlou, 2002; Casile and Davis-Blake, 2002; Cooper et al. 2014; Cret, 2011; Decramer et al. 2012; DiMaggio and Powell, 1983; 1991; Dobbins and Knill, 2009; Fernández-Alles and Llamas-Sánchez, 2008; Hodge, 2010; Newman, 2000; Paccioni et al. 2008). By suggesting propositions, we set the bases especially for further research in CEE countries, where accreditation practices have just recently appeared in discussion, but lack comprehensive academic analyses (Abell, 2012; Hommel, 2009a, 2009b; Katkalo, 2009; Lock, 1999; Myasoedov, 2013). As this field is still in early stages of research and there is relatively small number of accredited B-schools in CEE, we suggest future studies to start with a qualitative methodology. This will enable more comparative multiple case analysis to further improve the suggested propositions. Third, with the suggested propositions, future studies can focus broader and also study the effects of accreditation in business firms' related practices as well as further differentiate and untangle the isomorphic effects in practice (Guler et al. 2002).

Our study is subject to the following limitations. First, we involved only top-management teams working on accreditation, and omitted other groups. Therefore, we suggest that in further studies on international accreditation, authors include various groups of stakeholders to get more balanced analysis. Second, it is not always clear how to separate (and if this is even necessary) accreditation effects with regard to isomorphic pressures on one hand, and bandwagon and information asymmetry effects on the other. Third, we didn't cover AMBA and AACSB accreditations, as they haven't been introduced to Lithuanian B-schools yet. Fourth, we compared B-schools with different types of accreditations (from different accreditation bodies, institutional and programme). Hence, we suggest that further studies focus on comparison among B-schools with the same type of accreditation. Fifth, we interviewed the informers about the events and intentions in the past. Therefore, we have to mention the possibility of a retrospective bias as a limitation.

The main conclusion is that institutional theory is an appropriate framework for studying the effects of accreditation on B-school's institutional change in various regions of CEE. Therefore, we suggest that further case studies are performed exploring and explaining the institutional change of CEE B-schools with different accreditation quality differentiators based on institutional theory.

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EFFECTIVENESS OF FINANCIAL AND FISCAL INSTRUMENTS FOR PROMOTING SUSTAINABLE RENEWABLE ENERGY TECHNOLOGIES

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ABSTRACT: *The new EU target of achieving 80-95% emission reductions by 2050 calls for novel energy policy solutions. Previous research has failed to evaluate the influence of all relevant elements of energy policy on technology-specific sustainable renewable energy diffusion. This paper adds to existing research by studying the effectiveness of financial and fiscal instruments on diffusion, additionally controlling for potential political, economic, social, and environmental drivers. These drivers are analysed for 26 EU countries over the period 1990-2011. The main results show that feed-in tariffs, quotas, and tenders effectively promote wind technologies. Other explanatory variables have technology- and model-dependent impacts.*

Keywords: *urenewable energy technology, sustainability, financial instrument, fiscal instrument, effectiveness*
JEL Classification: Q01; Q43
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1. INTRODUCTION

Sustainable renewable energy (SRE) technologies play a critical role in powering national economies, satisfying increasing energy needs, and reducing harmful emissions. Identifying potential strategies for accelerating the process of SRE technology diffusion is a crucial policy topic. Policymakers must choose the financial and fiscal instruments that are most effective at encouraging installation of renewable technologies and related electricity generation. The ultimate goal is to achieve the European Union's key "20-20-20", "2030", and "2050" targets. The "20-20-20" targets include reducing greenhouse gas (GHG) emissions, increasing energy consumption from renewables, and reducing primary energy use by 20% compared to 1990 levels. The "2030" targets imply that GHG emissions should be reduced by at least 40%, the share of energy consumption from SRE sources should increase by at least 27%, and energy efficiency should increase by 30% until 2030, compared to 1990 levels. The "2050" target requires reducing GHG emissions by 80-90% of 1990 levels by 2050 (European Commission, 2009; 2011; 2014). As argued by Sawin (2004) and Ragwitz et al. (2006) and later empirically confirmed by Dong (2012), effective SRE policies exist only in a limited set of countries. However, there is clear disagreement in the literature about the most effective policies to drive diffusion of SRE technologies.

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As such, the aim of this paper is to bring clarity to the mixed findings in the literature by examining the effectiveness of the whole spectrum of source-specific financial and fiscal, political, socioeconomic, and environmental elements at promoting SRE technology diffusion. Determining the effectiveness of these elements will provide additional support for countries in their design of renewable energy policies. In this paper, the term "most effective" refers to the policy instruments that achieve SRE policy objectives to the greatest extent. The source-specific financial and fiscal support instruments examined include technology-specific feed-in tariffs (FITs), renewable portfolio standards (RPSs) or quotas, caps, tenders, tax incentives, and investment grants. Political elements examined include corruption and energy import dependence. Socioeconomic elements examined include GDP; prices of coal, natural gas, and oil; electricity production from coal, oil, natural gas, and nuclear sources; energy consumption per capita, and technology-specific patents. The environmental element included is carbon intensity. Recent research (e.g., Johnstone, Haščič & Popp, 2010) that focuses on patenting activity (the innovation phase) to study development of renewables[2] finds that the effect of SRE policies depends highly on the type of renewable energy source. To validate this finding, this paper's analysis of technological diffusion differentiates between four different renewable energy sources: wind, solar, biomass, and geothermal.

The impact of the SRE policy elements on technological diffusion is studied by using panel data for 26 EU countries during the period from 1990 to 2011. Two different measures of SRE technology diffusion—installed capacity of renewable sources and related actual electricity generation—are used to verify the robustness of the results. The results confirm that the impact of policy elements on technological diffusion varies across different renewable energy sources.

This paper contributes to existing research in several ways. First, it expands the literature by providing a comprehensive and up-to-date review of relevant empirical studies, focusing on their methodological aspects. Second, it considers the impact of financial and fiscal, political, economic, environmental, and social elements on countries' source-specific SRE installed capacity and electricity generation. These elements have not yet been systematically addressed in the literature. Third, the analysis controls for the effects of the political environment, as measured by perceived corruption, and the socioeconomic environment, as measured by technology-specific patents. Fourth, it uses the latest International Energy Agency (IEA) data to test the impact of prices of non-renewable sources on the diffusion of renewables. Finally, it examines a longer time period, which allows for improving the precision of the estimates. The novel results, based on empirical research, aim to inform (perhaps even alarm) European Union (EU) policymakers that rapid reorganization of the existing SRE-supporting policy instrument mix is needed. Only by doing so can the EU climate change mitigation targets be met.

The paper is organized as follows. Section 2 provides a current overview of the literature on effectiveness of renewable policy instruments in terms of reaching the EU's "20-20-20"

2 According to the European Environment Agency (EEA, 2011), development of renewables (i.e., the eco--innovation process) encompasses three stages: invention, innovation, and diffusion of technology. However, researchers usually differentiante only between innovation and diffusion.

and "2050" renewable energy targets. Section 3 describes the paper's empirical approach and econometric strategy. Section 4 describes the data and offers descriptive statistics. Section 5 presents results on the impact of policy elements on technology diffusion. Section 6 discusses results and concludes, considering further research avenues.

2. LITERATURE REVIEW

This section includes a survey of the relevant literature (summarised in Appendix 1). Most papers dealing with renewable energy issues have taken an informative and qualitative approach (see Marques & Fuinhas (2011) for an overview). Ragwitz et al. (2006), Klessmann et al. (2011), and Winkel et al. (2011) provide comprehensive and informative country-, policy-, source-, technology-, and instrument-specific analyses for the EU countries, forming an excellent foundation for conducting further empirical investigations of SRE. Additionally, case studies (Lipp, 2007; Mabee, Mannion & Carpenter, 2012) and other qualitatively oriented investigations have demonstrated that SRE-supporting policies are important drivers of SRE technologies. However, econometric examinations of the impact of public policy instruments on the implementation of SRE technologies are rare, although they have increased in the last two years.

A few empirical studies have evaluated the effectiveness of the FITs and RPSs that are widely used to support renewable energy (see Dong (2012) for a review). However, these studies have failed to consider other support instruments, such as cap and trade schemes, tenders, tax incentives, and investment grants, which are included in this analysis. Most empirical papers dealing with renewable electricity technologies focus on the United States, mainly examining RPS (Huang et al., 2007; Carley, 2009; Yin & Powers, 2010; Shrimali & Kniefel, 2011). Another group of papers has focused mostly on total renewable sources, not any particular type of SRE technology or support instrument (e.g., Marques, Fuinhas & Manso, 2010; Marques & Fuinhas, 2011, 2012; Marques, Fuinhas & Manso, 2011; Salim & Rafiq, 2012). If researchers differentiate between renewable energy sources, they usually do not address all relevant sources (i.e., wind, solar, biomass, and geothermal). Wind is considered most frequently since data on wind technology installation is more comprehensive than that for other SRE sources (e.g., Bird et al., 2005; Menz & Vachon, 2006; Dong, 2012). Moreover, wind technologies have the greatest installed base among SRE technologies (WWEA, 2010). The following sections review each of these literatures in turn. In addition, I review studies that focus on SRE innovations (Popp, Haščič & Medhi, 2011; Bayer, Dolan & Urpelainen, 2013) because they cover some variables (e.g., corruption) that should be included in the diffusion framework.

Among studies focused on US states and RPS, Carley (2009) applies a fixed effects vector decomposition (FEVD) model to panel data from 50 US states, 1998-2006. She finds that RPS has no significant impact on SRE electricity generation across states. Shrimali & Kniefel (2011), using panel data for the 50 states from 1991-2007, employ a state fixed effect model with state-specific time trends to estimate the impact of state policies on the diffusion of SRE sources. They find that RPS with capacity/sales requirements has a sig-

nificant positive impact on geothermal and solar capacities. However, it has a significant negative impact on diffusion of wind and biomass SRE. Voluntary RPSs are found to be ineffective in supporting any type of renewable capacity.

Considering studies examining total renewables, Marques, Fuinhas & Manso (2010) conduct the first econometric analysis of SRE technologies using EU countries' data. Marques & Fuinhas (2011) were first to apply the quintile regression approach to studying SRE, observing the 21 EU countries during two time spans: 1990 to 1998 and 1999 to 2006. They find that energy efficiency measures effectively promote renewables during the second period. However, these measures are not statistically significant in explaining SRE use in the first period. Salim & Rafiq (2012) use panel data and time series analysis to examine the determinants of SRE consumption in six major emerging economies: Brazil, China, India, Indonesia, the Philippines, and Turkey. Their results show that income and carbon emissions have been significant long-term drivers of SRE consumption in four countries; in the Philippines and Turkey, income is the main determinant of SRE consumption. Aguirre & Ibikunle (2014) apply FEVD and panel corrected standard errors (PCSE) estimators to panel data from the EU, OECD, and BRICS countries. They observe period from 1990 until 2010 to examine elements that could influence macro level SRE growth. Aguirre & Ibikunle (2014) find, amongst other, that some SRE policies (i.e. financial and fiscal; voluntary agreements) slow down SRE investments, what implies failures in their design.

Among studies that focus on source-specific technology, Dong (2012) uses panel data for 53 countries, covering five years starting from 2005. He finds that FITs promote total wind capacity better than RPS. For annual wind capacity installations, however, there is no significant difference between the two policies. His research also showed that wind energy development responds to high electricity demand and high oil dependence. Dong's paper has two main limitations: longer time series are needed to confirm that there is no multicollinearity when lags are included, and, with a larger sample size, the different policy designs should be tested for all included countries. Gan & Smith (2011) conduct one of the few empirical studies focused on bioenergy. The authors find that GDP, SRE, and bioenergy market-deployment policies significantly and positively affected the supply of SRE and bioenergy in OECD countries between 1994 and 2003; R&D expenditures, energy prices, CO_2 emissions, and other energy policies do not have significant impacts. The authors note that the magnitudes of these non-statistically significant variables were too small to significantly influence energy supply in the period observed, but longer series should be used to re-examine their impact before making final conclusions or policy recommendations.

Among studies that focus on technological innovations, Popp, Haščič & Medhi (2011) assess the impact of technological change on technology-specific SRE capacity investments in 26 OECD countries from 1991 to 2004. The authors find that technological advances lead to increased investments, although the effect is small. Bayer, Dolan & Urpelainen (2013) study the economic and political determinants of energy innovation in 74 countries from 1990 to 2009. Testing the impact of corruption within the technological innovation framework, they find that it does not have large effects on a country's production of

international SRE patents. However, their results also suggest that democratic institutions contribute to innovation.

Taking a broader view than these studies, three recent analyses empirically examined the effect of multiple policy instruments in promoting SRE technologies (Yin & Powers, 2010; Groba, Indvik & Jenner, 2011; Jenner, 2012). By introducing a new quantitative measure for RPS stringency that accounts for differences in RPS policy design among countries, Yin & Powers (2010) make a significant contribution to the SRE field. Focusing on US states and applying fixed effects estimation techniques, the authors find that RPS policies significantly and positively affect total in-state SRE development—a finding opposite that of Carley (2009). Moreover, the authors verify that this result is masked when RPS design characteristics are not taken into account. Groba, Indvik & Jenner (2011) use panel data for 26 EU countries for the period from 1992 to 2008 and find that FIT policies are drivers of solar photovoltaic (PV) and onshore wind capacity development in the EU. They develop a new indicator for FIT strength to estimate the resulting return on investment, taking into account variability in tariff size, contract duration, digression rate, price of electricity, and electricity generation cost. Jenner (2012) develops an investment decision model to explain how diverse FIT policy designs affect the incentive to invest in SRE technologies. To analyse this relationship between policy support instruments and SRE technologies, the author applies the PCSE approach. The analysis, including 26 EU countries from 1990 to 2010, reveals that FITs effectively support geothermal, solar PV, and biomass electricity generation. No such link is found in the case of onshore wind, however. When using binary variables to test the impact of FITs on SRE generation, a significant positive impact is found only in the case of SRE generation from solar PV technologies; replacing these binary variables with the tariff amount produces similar results. In addition, Jenner (2012) finds that biomass energy is not affected by a quota system, whereas energy from solar PV, geothermal, and onshore wind sources decreases significantly with a tighter quota. Yin & Powers (2010) and Jenner (2012) argue that design of RPS and FIT policies might affect results but do not control for the design of other supporting policy instruments. However, they do draw conclusions about the instruments' effectiveness.

Considering the gaps in the literature and the different conclusions obtained thus far, this research thus intends to provide a more comprehensive analysis in order to provide reliable guidance to policymakers to help them to revise SRE policies and programs. In particular, this paper aims to analyze the impact of financial and fiscal, political, economic, social and environmental elements on technology specific diffusion. The next section details the empirical approach used to do so.

3. EMPIRICAL APPROACH AND ECONOMETRIC ISSUES

The analysis examines the effectiveness of 26 EU countries' energy policy instruments. Different modelling scenarios are used to test the impact of financial and fiscal instruments on the diffusion of technology-specific renewable energy sources. I also control for political, socioeconomic, and environmental factors that could affect diffusion of SRE

capacity. To make the results more robust, I employ two different measures of SRE diffusion, namely annual installation of renewable capacity and related annual electricity generation. Following Dong's (2012) approach, I consider the added technology-specific capacities and related electricity generation to be the appropriate proxies for the instruments' effectiveness. The model is estimated using a larger panel of data (from 1990 to 2011) than used in most previous studies. This helps improve the precision of the estimates, generate more reliable standard errors, and control for unobserved heterogeneity across states and years.

(1)

$$\Delta X_{ijt} = \alpha_0 + \beta_1 FFIT_{ijt-1} + \beta_2 PFIT_{ijt-1} + \beta_3 RPS_{it-1} + \beta_4 CAP_{it-1} + \beta_5 TENDER_{it-1} + \beta_6 TIIG_{it-1} + \beta_n lnN_{it-1} + \delta T + u_{it} + \varepsilon_{it}$$

where *i* denotes a country, *j* denotes a particular SRE source, and *t* is time in years. ΔX_{ijt}, defined as $\Delta X_{ijt} = X_{ijt} - X_{ijt-1}$, indicates two different sets of dependent variables: installed source-specific SRE capacity and source-specific SRE generation. Financial and fiscal variables $FFIT_{ijt}$, $PFIT_{ijt}$, RPS_{it}, CAP_{it}, $TENDER_{it}$, and $TIIG_{it}$ denote fixed feed-in tariffs, premium feed-in tariffs, renewable portfolio standards, cap and trade schemes, tendering schemes, and fiscal incentives (tax incentives or grants), respectively. N_{it} is a vector of socioeconomic, political, and environmental control variables. Socioeconomic variables included are as follows: GDP; oil, coal, and natural gas prices; electricity production from oil, coal, natural gas, and nuclear sources; energy consumption per capita; and technology-specific patents. Political variables include corruption perception and energy import dependence. The environmental variable included is carbon intensity. δT denotes time dummies, u_{it} is a fixed effects term, and ε_{it} is the usual standard error. In order to reduce variability, all variables are expressed in natural logarithms. In the models considering the annual change in the dependent variable, all explanatory variables are time-lagged by *s* years (*s*=1).

Primarily, I test the adequacy of the use of the panel data structure by employing the Breusch and Pagan Lagrangian multiplier test.

I then perform estimations using the most common panel data techniques: ordinary least squares (OLS), random effects, and fixed effects. Next, I run the Hausman test (1978) to examine if, given the nature of the data, the fixed effects model is superior to the random effects one. Furthermore, macro panels with long time series (longer than 20 years) usually face problems of heteroscedasticity, contemporaneous correlation (or cross-sectional correlation), and serial correlation (or first-order autocorrelation). To examine these issues, I employ the modified Wald test for groupwise heteroscedasticity, the Pesaran cross-sectional dependence test, and the Wooldridge test for autocorrelation in panel data.

The link between capacity installations/related electricity generation and policy, as determined by simple OLS regression, cannot be interpreted as causal due to the potential

bias of omitted variables, such as country-specific characteristics. Moreover, basic OLS does not correctly estimate the standard errors in the presence of panel heteroscedasticity, cross-sectional correlation, or serial correlation of the errors, as present in this dataset. Therefore, the main model is estimated using fixed effects with year dummies included to control for unobserved, time-invariant state-level characteristics. These characteristics, such as source-specific potential and pre-existing renewable capacity, could impact countries' energy policies and their subsequent development of SRE technologies. The use of the common fixed effects and random effects models with robust standard errors that control for heteroskedasticity but not for contemporaneous or serial correlation could lead to biased estimated standard errors. In order to solve this problem, Parks (1967) suggests using an Feasible Generalized Least Squares (FGLS) estimator. However, FGLS tends to provide inaccurate standard errors estimates. Moreover, FGLS can be used when T is greater than N (Beck & Katz, 1995). Beck & Katz (1995) develop the PCSE, an estimator that is alternative to FGLS. Compared to FGLS, it provides more accurate standard error estimates with no or little efficiency loss. Therefore, following Shrimali & Kniefel (2011), Jenner (2012), and Marques & Fuinhas (2012), I use the panel-corrected standard errors estimator to correct for heteroscedasticity and serial and contemporaneous correlation.

In order to further verify the robustness of the results, I follow Marques, Fuinhas & Manso (2010) and include a control variable for EU Directive 2001/77 (European Commission, 2001), which requires EU countries to implement policies supporting SRE development. This binary variable indicates the ratification year of the directive and applies to countries that were EU member states at that time. This variable should control for changes in the process of SRE development after the directive was implemented, as its implementation should motivate installation of SRE capacity and greater generation of related electricity. Moreover, I re-estimate the main model after excluding three countries that, according to their high environmental achievements, might be driving the results. These countries are Italy, Germany, and Spain. The third robustness check includes annual growth rate of GDP and yearly dummies for the economic crisis.

4. DATA AND DESCRIPTIVE STATISTICS

The analysis is conducted using panel data for 26 EU countries and considering two time spans. One EU country, Malta, is excluded due to incomplete data. Data on wind, solar, geothermal, and biomass electricity generation covers a period of 22 years, from 1990 to 2011. 1990 is chosen as the starting year because most of the relevant policy instruments were adopted in the late 1990s. In addition, data by Johnstone, Haščič & Popp (2010) reveals that growth in wind and solar energy patenting activity was especially fast from the mid-1990s. Data on installed capacity is available from 1991 to 2009 and is provided only for wind, solar, and geothermal technologies. Data is derived from the relevant statistical sources: the Energy Information Administration (EIA), EUROSTAT, IEA, Res-legal, REN21, the United Nations Environment Programme (UNEP), the World Bank's World Development Indicators, Transparency International, and PATSTAT. Data is then merged to form a balanced panel. Table 3 provides summary statistics.

Table 3: *Descriptive statistics*

Variable	Obs	Mean	Std. Dev.	Min	Max
Added geothermal capacity installed	468	0.2906077	7.62399	-91	93
Added solar, tide & wave capacity installed	468	34.81411	266.9627	-39	4467
Added wind capacity installed	468	157.6774	444.7475	-352	3247
Added wind electricity generation	546	0.3170644	0.9908431	-1.935001	9.003002
Added solar electricity generation	546	0.0840221	0.5935326	-0.029	8.823999
Added biomass and waste electricity generation	546	0.2404192	0.6965191	-1.618	7.739
Added geothermal electricity generation	546	0.0048497	0.0476912	-0.25	0.6789999
Fixed feed in tariff for wind	572	0.3496503	0.4772769	0	1
Premium feed in tariff for wind	572	0.0734266	0.2610637	0	1
Fixed feed in tariff for solar	572	0.3496503	0.4772769	0	1
Premium feed in tariff for solar	572	0.0611888	0.2398861	0	1
Fixed feed in tariff for biomass	572	0.3006993	0.4589635	0	1
Premium feed in tariff for biomass	572	0.0769231	0.2667026	0	1
Fixed feed in tariff for geothermal	572	0.2534965	0.4353934	0	1
Premium feed in tariff for geothermal	572	0.0157343	0.1245545	0	1
First cap introduced	572	0.0681818	0.2522783	0	1
Renewable portfolio standard / quota obligation	572	0.1031469	0.3044168	0	1
Tendering scheme	572	0.1118881	0.3155047	0	1
Tax incentive / investment grant	572	0.1346154	0.341611	0	1
GDP	572	4.59E+11	6.53E+11	7.29E+09	2.83E+12
Annual growth rate of GDP	571	.0041247	.3904943	-4.112694	2.707832
Coal prices	572	93.65844	24.765	46.19342	192.573
Oil prices	572	88.47796	15.30759	27.62831	139.2245

Natural gas prices	572	93.89317	24.31737	37.62953	211.6287
Electricity production from coal, %	572	32.39609	27.37131	1.00E-05	97.49284
Electricity production from natural gas, %	572	17.44163	19.16968	1.00E-05	93.90462
Electricity production from nuclear, %	572	21.63645	24.49528	1.00E-05	87.98622
Electricity production from oil, %	572	9.655245	19.97473	1.00E-05	100
Energy consumption per capita	572	157.4077	68.82126	61.82684	439.5631
Wind patents	572	2.015712	9.37446	1.00E-05	131
Solar patents	572	1.252487	5.234898	1.00E-05	64
Geothermal patents	572	0.176033	0.7436238	1.00E-05	8
Biomass patents	572	3.327464	8.532733	1.00E-05	82
Corruption perception index	572	6.201066	2.086322	2.15	10
Energy import dependence	572	53.87881	28.64878	-50.92	103.63
Carbon intensity	572	0.6405603	0.5655682	0.12837	3.44926

The two types of dependent variables used indicate promotion of SRE technologies, namely in terms of added geothermal, wind, and solar installed capacity and added geothermal, wind, solar, and biomass electricity generation. Added installed capacity is defined as the difference between cumulative SRE capacities in adjacent years. I choose installed capacity to capture the maximum potential effect of investment on a particular SRE technology under the different support schemes. Examining electricity generation allows for testing the investments' real effects. By using capacity added in a given year, I am able to separate out the effect of the overall trend in total capacity installation.

The explanatory variables included in the analysis are factors that might influence country-specific SRE policies and, consequently, achievements in installed capacity and SRE electricity generation. The explanatory variables are grouped into four categories: financial and fiscal, socioeconomic, environmental, and political. The respective data sources and measurement units for the variables are given in Table 1.

Table 1: *Variables description*

Variables of interest	Description of the variable	Unit of measurement	Data source	Period
GEO I.	Added geothermal electricity installed capacity	Thousand Kilowatts	UNEP/EIA	1991-2009
SOL I.	Added solar, tide & wave electricity installed capacity	Thousand Kilowatts	UNEP/EIA	1991-2009
WIN I.	Added wind electricity installed capacity	Thousand Kilowatts	UNEP/EIA	1991-2009
GEO G.	Added geothermal electricity net generation	Billion Kilowatthours	EIA	1990-2011
WIN G.	Added wind electricity net generation	Billion Kilowatthours	EIA	1990-2011
SOL G.	Added solar, tide & wave electricity net generation	Billion Kilowatthours	EIA	1990-2011
BIO G.	Added biomass and waste electricity net generation	Billion Kilowatthours	EIA	1990-2011
FIT	Feed In Tariff - prefix 'f' indicates fixed, and 'p' premium tariff - suffix w, s, b and g denotes wind, solar, tide & wave, biomass & waste, and geothermal, respectively	Binary	IEA/IRENA, Res-legal, REN21, Haas et al. (2011)	1990-2011
CAP	CAP	Binary	IEA/IRENA, Res-legal, REN21, Haas et al. (2011)	1990-2011
RPS	Renewable portfolio standard or quota obligation	Binary	IEA/IRENA, Res-legal, REN21, Haas et al. (2011)	1990-2011
TENDER	Tendering scheme	Binary	IEA/IRENA, Res-legal, REN21, Haas et al. (2011)	1990-2011
TI/IG	Tax incentives / investment grants	Binary	IEA/IRENA, Res-legal, REN21, Haas et al. (2011)	1990-2011

Variables of interest	Description of the variable	Unit of measurement	Data source	Period
GDP	GDP based on purchasing power parity (PPP)	Constant 2005 int. dollars	World Bank	1990-2011
COALNEW	Coal prices	Indices of Energy End-Use Prices	Energy Prices and Taxes - IEA	1990-2011
OILNEW	Oil prices	Indices of Energy End-Use Prices	Energy Prices and Taxes - IEA	1990-2011
NGNEW	Natural gas prices	Indices of Energy End-Use Prices	Energy Prices and Taxes - IEA	1990-2011
EPCP	Electricity production from coal	% of total	The World bank	1990-2011
EPNGP	Electricity production from natural gas	% of total	The World bank	1990-2011
EPNUP	Electricity production from nuclear	% of total	The World bank	1990-2011
EPOP	Electricity production from oil	% of total	The World bank	1990-2011
ECpc	Energy consumption per capita	million BTU per person	EIA	1990-2011
SOLPAT	Solar patents	Integer	PATSTAT	1990-2011
WINPAT	Wind patents	Integer	PATSTAT	1990-2011
GEOPAT	Geothermal patents	Integer	PATSTAT	1990-2011
BIOPAT	Biomass & waste patents	Integer	PATSTAT	1990-2011
CPI	Corruption perception index	Score 0 (highly corrupt) – 100 (very clean)	Transparency International	1990-2011
EID	Energy import dependence	% of total	Eurostat	1990-2011
CI	Carbon intensity	Metric Tons of Carbon Dioxide per Thousand Year 2005 U.S. Dollars	EIA	1990-2011

The main variables of interest are dichotomous variables accounting for the impact of **financial and fiscal SRE policy instruments** (technology-specific fixed and premium FIT, RPS, cap, tender, and tax incentive or investment grant) on dependent variables. Each dummy variable equals 1 if the given policy instrument is in place and 0 otherwise; they are time variant, indicating the year the given policy instrument was adopted. The analysis accounts for different FITs for four SRE technologies: geothermal, wind, solar, and biomass.

FIT is a long-term fixed or premium financial support provided for SRE electricity producers. RPS or quota requires a certain amount of electricity to be produced from SRE sources. The cap and trade scheme denotes a limit on CO_2 emissions. Firms that are below the limit could sell their unused emission allowances to higher emitters. Tender can be investment or generation based. The investment based tender works in such a way that a fixed number of technologies that should be installed is announced, and the firm with the most competitive tender receives the investment support. The generation based tender works in a similar way, however, by providing a bid price subsidy for generated SRE electricity. The tax incentive or investment grant denotes various types of incentives for SRET implementation and use that is in force in a particular EU country (e.g. electricity tax exemption, other tax reductions or exemptions).

Following the logic behind the support instruments, the estimated coefficients on these dummy variables should be positive and significant. However, taking into account the less positive and also non-unique findings of some relevant empirical studies (e.g., Carley, 2009; Marques, Fuinhas & Manso, 2010; Groba, Indvik & Jenner, 2011), we might expect different instruments to have different impacts on different SRE technologies. Moreover, other relevant SRE policy elements might impact the significance of the effect of financial and fiscal support for deployment of renewables. This more comprehensive approach should thus help clarify previous results.

The **socioeconomic elements** considered are as follows: GDP; prices of coal, natural gas, and oil; electricity production from coal, oil, natural gas, and nuclear sources; energy consumption per capita; and technology-specific patents. As established in the literature (e.g., Carley, 2009; Groba, Indvik & Jenner, 2011), countries with higher **GDPs** should be more easily able to afford the costs of the SRE technological diffusion process. On the other hand, as explained by Marques & Fuinhas (2011), higher GDP might be associated with considerable existing infrastructure for traditional energy sources. Transitioning this to renewable infrastructure is expensive; therefore, a negative effect could also be expected. In line with the literature (Bird et al., 2005; Van Ruijven & van Vuuen, 2009; Marques, Fuinhas & Manso, 2010; Marques & Fuinhas, 2011), I include **prices of coal, natural gas, and oil**[3] in the regressions. In countries without strong environmental policies, higher prices could lead consumers to decide to further rely on conventional sources. On the other hand, higher prices for electricity generated from non-SRE sources could make SRE more economically feasible and competitive. Insignificant results could also be seen, potentially because small price increases are insufficient to encourage a shift towards re-

3 For non-OECD countries, indexes for OECD Total serve as a proxy.

newables. Energy price movements (1990-2011) reveal price increases for the majority of countries in the sample during the last decade.

Following Huang et al. (2007), Marques, Fuinhas & Manso (2010), and Groba, Indvik & Jenner (2011), I include **electricity production from coal, oil, natural gas, and nuclear sources** in the regressions. The traditional energy industry lobbies are expected to be barriers to SRE capacity diffusion. Carley (2009), Marques & Fuinhas (2011), and Marques, Fuinhas & Manso (2010, 2011) suggest using **energy consumption per capita** as a development indicator and a proxy for a country's energy needs; it is also used as an energy efficiency indicator (e.g., Toklu el al., 2010; Marques & Fuinhas, 2011). The effect of this variable on SRE capacity could be positive if SRE sources meet additional energy needs or negative if conventional technologies dominate in doing so. I also include cumulative counts of **renewable energy patent applications** filed through the European Patent Office (EPO)[4]. The patent search is conducted using the appropriate International Patent Classification (IPC) codes, as determined by Popp, Haščič & Medhi (2011). These codes relate directly to SRE in the areas of wind, solar PV, geothermal, and biomass and waste.

Ideally, increased patenting activity should have a positive and significant impact on SRE technology development. However, as noted by Popp, Haščič & Medhi (2011), policy-induced substitution might overwhelm this induced technological change.

Following basic logic, also supported by the literature (e.g., Van Ruijven & van Vuuen, 2009), higher **CO_2 intensity** should prompt investments in SRE technologies. However, the effect might be different if countries show less environmental concern and consequently continue using fossil fuels.

Under **political elements,** I emphasize the potential impacts of perceived corruption and energy import dependence on the promotion of renewables. To the best of my knowledge, testing the effect of **perceived corruption** on technology-specific renewables deployment, together with other drivers of SRE diffusion, is a new contribution to the literature. As indicated by Bayer, Dolan & Urpelainen (2013), corruption could negatively impact the process of transitioning to renewables if SRE technology opponents, such as power plant owners, bribe officials to raise barriers to SRE innovations. The same problem could occur in the case of technological diffusion. Following Marques, Fuinhas & Manso (2010), I focus on **import dependency in energy** as a proxy for energy security; higher reliance on foreign energy is expected to motivate domestic SRE development.

The Variance Inflation Factor (VIF) test indicates that multicollinearity is not a concern, as the highest mean VIF among all models is 3.

4 EPO filings mainly include valuable innovations with high commercial value. I take counts based on the inventor country, looking at the priority date, which denotes the date of the first application in any country worldwide. These criteria are chosen because, for measuring a country's innovation performance, a count of resident inventors is more meaningful then a count of applicants. In addition, the only clearly meaningful date from a technological or economic point of view is the priority date, which is closest to the date of invention (OECD, 2001). In order to avoid double counting I use fractional counting if multiple inventors or IPC classes are provided.

5. RESULTS

The results of this analysis contribute to the current debate on the effectiveness of renewable energy policies by identifying the most effective instruments (financial and fiscal, socioeconomic, political, and environmental).

The analysis starts with the Breusch and Pagan Lagrangian multiplier test that rejects the null hypothesis, confirming that there is a significant difference across entities, i.e. panel effect. Then, the Hausman test rejects the null hypothesis that the unique errors are not correlated with the regressors; this validates the use of fixed effects to remove the time-invariant biases from the error term. Furthermore, the modified Wald test for groupwise heteroscedasticity confirms the presence of heteroscedasticity. The Pesaran cross-sectional dependence test confirms that the residuals are correlated among entities. The Wooldridge test for autocorrelation in panel data confirms that the data is characterized by first-order autocorrelation[5]. Therefore, in line with Shrimali & Kniefel (2011), Jenner (2012), and Marques & Fuinhas (2012), PCSE estimator is employed to correct for heteroscedasticity, serial and contemporaneous correlation.

In interpreting the regression results, the instruments with the largest estimated coefficients are the most effective at achieving policy objectives with respect to SRE diffusion. All tables show regression results with different variable specifications. Table 5 presents the results of models in which the dependent variables are added wind, solar, and geothermal installed capacity. Table 6 shows the results when the dependent variables are added wind, solar, geothermal, and biomass renewable electricity generation. In both tables, OLS results are presented next to fixed effect results with year dummies (equivalent to pooled OLS with country and year dummies) and PCSE included for each dependent variable. To additionally demonstrate the robustness of findings, the results with the control variable for EU Directive 2001/77 are presented in Appendix 2. Moreover, the results obtained after excluding Italy, Germany, and Spain are presented in the Appendix 3. The results obtained after including the annual growth rate of GDP and yearly dummies for the economic crisis are presented in the Appendix 4.

Table 5: *Impact of policy elements on added renewable installed capacity (1991-2009) in 26 EU countries*

Estimation technique	**OLS**	**FE**	**OLS**	**FE**	**OLS**	**FE**
DEPENDENT VARIABLE Ln (added wind, solar, geothermal installed capacity)	**WIN I.**	**WIN I.**	**SOL I.**	**SOL I.**	**GEO I.**	**GEO I.**
Fixed feed in tariff *t*-1	**3.404*** **	**3.520*** **	**2.435*** **	**0.164**	**-1.687*** **	**-0.271**
	[4.93]	**[4.19]**	**[3.79]**	**[0.22]**	**[-4.67]**	**[-0.49]**
Premium feed in tariff *t*-1	**4.669*** **	**3.851** **	**1.916**	**0.537**	**1.345**	**0.423**
	[3.84]	**[2.46]**	**[1.55]**	**[0.35]**	**[1.25]**	**[0.65]**

5 Results for all tests are available from the author on request.

Cap *t*-1	**-0.515**	**-1.037**	**-1.063**	**-2.140***	**-0.965**	**-1.069**
	[-0.36]	**[-0.93]**	**[-0.80]**	**[-1.86]**	**[-1.33]**	**[-1.32]**
Quota *t*-1	**3.047*****	**2.399****	**1.445**	**1.173**	**-0.622**	**-0.745**
	[3.18]	**[1.98]**	**[1.60]**	**[1.07]**	**[-1.28]**	**[-1.29]**
Tender *t*-1	**1.839****	**1.575**	**-0.984**	**-0.500**	**-1.510*****	**0.026**
	[2.00]	**[1.27]**	**[-1.12]**	**[-0.31]**	**[-3.37]**	**[0.02]**
Tax incentive/investment grant *t*-1	**2.608*****	**-1.633**	**-0.323**	**0.763**	**-0.855****	**-0.456**
	[3.24]	**[-1.35]**	**[-0.42]**	**[0.69]**	**[-2.16]**	**[-1.32]**
Ln GDP *t*-1	**1.936*****	**-2.398**	**1.918*****	**-6.045****	**0.846*****	**-3.216****
	[6.60]	**[-0.49]**	**[6.65]**	**[-2.13]**	**[6.00]**	**[-2.19]**
Ln oil prices *t*-1	**-4.735****	**-5.310**	**3.451***	**-0.106**	**-0.116**	**2.087****
	[-2.32]	**[-1.50]**	**[1.81]**	**[-0.05]**	**[-0.11]**	**[2.08]**
Ln coal prices *t*-1	**-0.127**	**-0.288**	**2.184**	**-1.424**	**-2.140****	**-2.157**
	[-0.07]	**[-0.10]**	**[1.36]**	**[-0.53]**	**[-2.48]**	**[-1.24]**
Ln natural gas prices *t*-1	**3.917****	**4.788***	**-2.615**	**-1.809**	**3.412*****	**3.771*****
	[2.27]	**[1.82]**	**[-1.58]**	**[-0.77]**	**[4.00]**	**[2.60]**
Electricity production from oil *t*-1	**-0.062*****	**0.081**	**-0.012**	**0.023**	**0.011**	**0.085**
	[-3.73]	**[0.99]**	**[-0.77]**	**[0.27]**	**[1.31]**	**[1.12]**
Electricity production from coal *t*-1	**0.014**	**0.071**	**-0.038****	**0.035**	**-0.003**	**-0.011**
	[0.72]	**[0.96]**	**[-2.13]**	**[0.51]**	**[-0.32]**	**[-0.30]**
Electricity production from natural gas *t*-1	**0.013**	**0.087**	**-0.012**	**0.123***	**-0.000**	**-0.009**
	[0.62]	**[1.23]**	**[-0.59]**	**[1.79]**	**[-0.03]**	**[-0.23]**
Electricity production from nuclear *t*-1	**-0.039****	**0.061**	**-0.024**	**0.087**	**-0.022****	**-0.027**
	[-2.29]	**[0.61]**	**[-1.53]**	**[1.06]**	**[-2.56]**	**[-0.66]**
Energy consumption pc *t*-1	**-0.023*****	**-0.018**	**-0.000**	**-0.019**	**-0.004**	**0.012**
	[-4.07]	**[-0.49]**	**[-0.01]**	**[-0.68]**	**[-1.43]**	**[1.13]**
Ln patents *t*-1	**0.045**	**-0.041**	**0.268*****	**0.033**	**0.114*****	**0.050**
	[0.82]	**[-0.88]**	**[4.83]**	**[0.46]**	**[2.99]**	**[1.15]**
Ln corruption perception index *t*-1	**5.541*****	**-2.067**	**5.349*****	**4.273***	**-0.851**	**0.203**
	[3.86]	**[-0.98]**	**[3.97]**	**[1.95]**	**[-1.20]**	**[0.19]**
Energy import dependence *t*-1	**0.027****	**0.046**	**0.022***	**0.080****	**0.019*****	**0.011**
	[2.22]	**[1.51]**	**[1.85]**	**[1.97]**	**[3.23]**	**[1.11]**
Ln carbon intensity *t*-1	**-1.541***	**-3.131**	**1.674***	**5.799****	**-0.496**	**-1.528**
	[-1.69]	**[-0.88]**	**[1.95]**	**[2.27]**	**[-1.14]**	**[-0.97]**
Constant	**-57.708*****	**64.728**	**-76.008*****	**161.132****	**-34.821*****	**52.579***
	[-4.42]	**[0.54]**	**[-6.20]**	**[2.23]**	**[-5.42]**	**[1.43]**
Observations	**457**	**457**	**462**	**462**	**460**	**460**
R-squared	**0.637**	**0.619**	**0.528**	**0.534**	**0.275**	**0.472**

Notes: The dependent variable is added wind / solar / geothermal installed capacity. The dependent variable is defined as a rate of change. OLS results are presented before fixed effects (FE) results for each dependent variable. FE regressions control for time fixed effects. Panel corrected standard errors are in brackets. ***, **, *, denote significance at 1%, 5% and 10% significance levels, respectively. Ln represents logarithm, and *t*-1 indicates the one-year lag.

Table 6: *Impact of policy elements on added renewable electricity generation (1990-2011) in 26 EU countries*

Estimation echnique	**OLS**	**FE**	**OLS**	**FE**	**OLS**	**FE**	**OLS**	**FE**
DEPENDENT VARIABLE Ln (added wind, solar, geothermal, biomass electricity generation)	WIN G.	WIN G.	SOL G.	SOL G.	GEO G.	GEO G.	BIO G.	BIO G.
Fixed feed in tariff *t*-1	2.322***	1.174***	1.622***	0.389	-1.022***	-0.054	0.057	0.310
	[7.02]	[3.06]	[5.49]	[1.07]	[-4.39]	[-0.36]	[0.17]	[0.65]
Premium feed in tariff *t*-1	3.398***	0.707	1.052*	0.369	1.358**	0.145	0.031	0.046
	[5.91]	[1.06]	[1.87]	[0.58]	[2.01]	[0.51]	[0.06]	[0.07]
Cap *t*-1	-0.352	-0.389	0.704	-0.595	-0.378	-0.258	0.699	0.531
	[-0.57]	[-0.86]	[1.40]	[-1.08]	[-0.95]	[-0.82]	[1.29]	[0.51]
Quota *t*-1	1.476***	0.872*	0.535	0.648	-0.182	-0.370***	0.555	-0.454
	[3.28]	[1.90]	[1.33]	[1.14]	[-0.59]	[-3.25]	[1.23]	[-1.40]
Tender *t*-1	1.036**	1.394***	-0.483	-0.288	-0.633**	0.641	-1.026**	0.018
	[2.40]	[3.07]	[-1.17]	[-0.44]	[-2.22]	[1.38]	[-2.53]	[0.05]
Tax incentive/ investment grant *t*-1	1.713***	-0.914*	-0.853**	0.247	-0.688***	-0.187	0.845**	-0.114
	[4.28]	[-1.95]	[-2.45]	[0.51]	[-2.69]	[-1.34]	[2.25]	[-0.17]
Ln GDP *t*-1	0.992***	2.245	1.210***	-1.720*	0.723***	-0.568	1.299***	2.700
	[6.93]	[1.17]	[8.95]	[-1.79]	[7.95]	[-1.28]	[8.78]	[1.26]
Ln oil prices *t*-1	-2.042**	-2.060*	1.621*	-0.879	0.266	0.662*	2.322**	0.610
	[-2.16]	[-1.71]	[1.87]	[-1.13]	[0.41]	[1.92]	[2.46]	[0.37]
Ln coal prices *t*-1	0.985	0.650	2.702***	-0.265	-0.173	-0.618	0.047	0.623
	[1.33]	[0.95]	[4.05]	[-0.28]	[-0.34]	[-0.92]	[0.06]	[0.92]
Ln natural gas prices *t*-1	2.360***	2.466***	0.787	-1.438	1.067**	0.387	0.949	-0.910
	[3.06]	[2.62]	[1.11]	[-1.47]	[2.10]	[0.85]	[1.27]	[-1.32]
Electricity production from oil *t*-1	-0.034***	0.013	-0.001	-0.017	0.003	-0.016	-0.030***	-0.032**
	[-4.13]	[0.45]	[-0.08]	[-0.65]	[0.59]	[-0.60]	[-3.84]	[-2.08]
Electricity production from coal *t*-1	0.010	0.027	-0.031***	-0.046*	-0.009	-0.013	0.011	0.060***
	[1.07]	[1.15]	[-3.77]	[-1.80]	[-1.52]	[-0.89]	[1.21]	[2.82]
Electricity production from natural gas *t*-1	0.023**	0.027	-0.032***	-0.026	-0.009	-0.019	-0.011	0.010
	[2.16]	[1.24]	[-3.46]	[-1.07]	[-1.35]	[-1.23]	[-1.08]	[0.56]
Electricity production from nuclear *t*-1	-0.015*	0.055	-0.017**	-0.010	-0.025***	-0.018	-0.008	-0.023
	[-1.82]	[1.55]	[-2.20]	[-0.46]	[-4.44]	[-1.25]	[-1.01]	[-1.06]
Energy consumption pc *t*-1	-0.013***	0.009	0.005**	-0.005	-0.002	-0.005	0.004	0.003
	[-4.79]	[0.82]	[2.12]	[-0.39]	[-1.06]	[-1.56]	[1.47]	[0.23]

Ln patents *t*-1	0.064**	0.011	0.142***	-0.019	0.057**	0.008	0.013	0.048**
	[2.45]	[0.66]	[5.50]	[-0.75]	[2.32]	[0.81]	[0.53]	[2.32]
Ln corruption perception index *t*-1	3.441***	-1.338*	0.936	-0.107	-0.982**	-0.238	2.010***	1.970*
	[5.03]	[-1.75]	[1.49]	[-0.14]	[-2.12]	[-0.98]	[3.01]	[1.78]
Energy import dependence *t*-1	0.016***	0.027**	0.012**	0.019	0.019***	0.000	-0.002	-0.004
	[2.66]	[2.55]	[2.24]	[1.43]	[5.16]	[0.09]	[-0.33]	[-0.36]
Ln carbon intensity *t*-1	-0.967**	-1.856	1.036***	3.495***	-0.318	1.145**	-0.789*	-2.921**
	[-2.22]	[-1.26]	[2.60]	[2.63]	[-1.12]	[2.13]	[-1.85]	[-2.31]
Constant	-43.543***	-75.738*	-63.168***	51.757**	-32.107***	-84.941*	-56.696***	-84.197
	[-6.93]	[-1.57]	[-11.20]	[2.13]	[-7.88]	[-1.60]	[-9.52]	[-1.58]
Observations	502	502	526	526	527	527	442	442
R-squared	0.741	0.787	0.603	0.643	0.341	0.775	0.701	0.751

Notes: The dependent variable is added wind / solar / geothermal / biomass electricity generation. The dependent variable is defined as a rate of change. OLS results are presented before FE results for each dependent variable. FE regressions control for time fixed effects. Panel corrected standard errors are in brackets. ***, **, *, denote significance at 1%, 5% and 10% significance levels, respectively. Ln represents logarithm, and *t*-1 indicates the one-year lag.

The results will be discussed for each of the four relevant variable categories: financial and fiscal, socioeconomic, political, and environmental.

To begin with the effectiveness of financial and fiscal instruments in promoting installation of SRE capacity (Table 5), fixed FITs, premium FITs, and quotas have positive and significant impacts on installed wind capacity. In particular, implementing a fixed FIT would stimulate installation of around 3,520 thousand kilowatts of additional wind capacity. Implementing a premium FIT would support an additional 3,851 thousand kilowatts of wind installations, and implementing quotas would support an additional 2,399 kilowatts of wind installations (after controlling for other factors in all cases). Tendering schemes also positively affect installed wind capacity, although this impact is not significant. Considering solar capacity, fixed and premium FITs, quotas, tax incentives, and investment grants all have positive but insignificant impacts on the implementation of solar technology. The models with added geothermal capacity as the dependent variable also identify positive but insignificant effects of premium FITs and tendering schemes. From Table 6, which displays the set of regressions with added electricity generation as the dependent variable, it is clear that FITs, quotas, and tenders effectively promote wind electricity production. When the dependent variables are added solar, geothermal, and biomass electricity generation, there are predominantly positive, although insignificant, links between financial and fiscal instruments and SRE electricity generation.

Next, we consider the effectiveness of socioeconomic elements in promoting renewables. As presented in Tables 5 and 6, there is a significant negative impact of GDP on solar and geothermal SRE installation and related electricity generation. An increase in oil prices leads to a significant increase in geothermal capacity installations and use, whereas an in-

crease in natural gas prices contributes significantly to greater achievements in wind and geothermal capacity and electricity generation. The signs and significances of the impacts of electricity production from oil, coal, natural gas, and nuclear depend on the source, but the effect of energy consumption per capita on SRE capacity and electricity generation is insignificant. Finally there is a positive and significant impact of biomass innovations on electricity generation from biomass technologies.

Turning to the effectiveness of political elements in promoting SRE sources, the results presented in Tables 5 and 6 reveal a significant positive relationship between perceived corruption and both solar capacity installations and biomass electricity generation. However, there is a significant negative relationship between perceived corruption and electricity production from wind technologies. Moreover, higher energy import dependence significantly stimulates installation of solar technologies and generation of electricity from wind technologies.

Considering the environmental factor examined, the results presented in Tables 5 and 6 show that increased carbon intensity motivates installation of solar capacity and related electricity generation. It has a negative impact, however, on installed capacity and energy generation using biomass.
The results of models that include the additional control variable (EU 2001/77 Directive), presented in Appendix 2, strongly support the robustness of the main results. Implementation of the directive significantly contributes to increases in installed capacity and electricity generation using solar technology. On the other hand, it has significant negative impact on installed wind capacity and biomass electricity generation. Moreover, significance, as well as the signs of variables, predominantly remain the same after excluding Italy, Germany, and Spain form the sample, which is an additional confirmation of the robustness of the results (Appendix 3). The results of models that include the annual growth rate of GDP and yearly dummies for the economic crisis, presented in Appendix 4, remain predominantly the same as the main results. Results show that annual change in GDP does not have a significant impact on SRET diffusion. Moreover, results reveal a predominantly positive impact of the crisis on SRET diffusion.

6. DISCUSSION, CONCLUSIONS AND POLICY IMPLICATIONS

In this paper, I have compared the effectiveness of policy elements aiming at supporting renewables as applied within EU countries. By comparing regressions with different dependent variables, I was able to confirm the importance of particular policy elements in the process of SRE diffusion. With a longer data series, this paper has avoided the small sample sizes and omitted variable biases that constrained previous studies (e.g., Menz & Vachon, 2006). Therefore, its findings can be generalized across the sample of countries considered, excepting those without (or with low) technology-specific SRE potential.

The Renewable Energy Directive 2009/28/EC that amended and repealed the Directive 2001/77/EC sets individual SRE targets for EU member countries (European Commis-

sion, 2009). These national targets are consistent with the EU overall SRE targets (20-20-20, 2030, and 2050). EUFORES's (2014) study shows that nine EU countries (Austria, Bulgaria, Cyprus, Denmark, Estonia, Italy, Latvia, Romania, Sweden) are progressing well towards the 2020 targets achievements. However, it is questionable whether four EU countries (Finland, Germany, Ireland, Slovakia) will reach their national SRE targets with current support instruments in force. The remaining fourteen EU countries are not progressing well towards 2020 targets, which indicates that their current SRE policies should be reconsidered. If policy measures would be revised on national level, all EU countries would have a potential to achieve or even exceed their national 2020 SRE targets (EUFORES, 2014).

Considering the effectiveness of financial and fiscal instruments in promoting renewables, this paper's results are consistent with research noting that financial and fiscal support instruments drive diffusion of SRE technologies. This is especially true for fixed and premium FITs, quotas, and tendering schemes in the case of wind technology installations and electricity generation. The impacts of financial and fiscal instruments on solar, geothermal, and biomass installations and electricity generation are also predominantly positive, although not significant. The absence of a significant positive relationship between e.g. FIT and geothermal resources could be caused by two potential reasons: first, only a few EU countries use geothermal resources and second, the FIT design in terms of the tariff amount and contract duration is not (sufficiently) efficient. Therefore, if a particular EU country has better preconditions for the diffusion of other types of SRET, these technologies should receive a higher support. Consequently, conventional technologies could be replaced to a greater extent. These results are consistent with previous studies (e.g., Groba, Indvik & Jenner, 2011), which have confirmed that FITs have driven the development of wind energy. Employing an indicator for RPS strength, those authors also identify a positive and significant impact of RPS on added installed capacity for both solar and wind technologies. However, Dong (2012), applying a fixed effects model including time-variant policy variables, shows a positive but insignificant link between FITs and installed wind capacity. On the other hand, Jenner (2012) finds that FITs, measured in nominal units or indicated as a binary variable, only effectively promote solar technologies. The author also demonstrates a negative significant impact of RPS on electricity generation from all SRE sources. However, Jenner's (2012) finding of a positive impact of tax incentives on solar electricity generation supports this paper's results.

Furthermore, the coefficients on certain support instruments are positive but not statistically significant in certain models. For example, more mature technologies are associated with lower electricity generation costs than are newer clean technology alternatives. Investors could be motivated to install such technologies by receiving a return on their investments or via climate change awareness campaigns, even though their investments would not be (completely) supported by financial instruments. However, in this case, it is not possible to conclude that SRET would diffuse completely without being supported by policy instruments. When the coefficients are negative, however, implementing the relevant instrument(s) would be less effective than having no instrument(s) in force. Johnstone et al. (2010) and Aguirre & Ibikunle (2014) further explain that the negative impact

of financial and fiscal instruments on SRET diffusion could be a consequence of lack of investors' confidence in often changing level of instruments' support. When deciding on the policy support instruments, countries that are progressing slower than planned could look into the experience of leading countries in technology specific diffusion. According to the EIA (EIA, 2015) data, among EU countries, Germany generated the highest amount of electricity from biomass sources in 2012 (followed by UK, Italy, Sweden, Finland and Poland). Germany was the leading EU country in solar electricity generation in 2012 (followed by Italy, Spain, France, Czech Republic and Belgium). The highest amount of electricity from wind sources in the EU was also produced by Germany in 2012 (followed by Spain, UK, France, Italy, and Denmark). Italy, one of the few EU countries that generate electricity from geothermal sources, is also the most successful at doing so (followed by Portugal, Germany, France, UK and Austria).

Turning to the socioeconomic elements, the results show that GDP has a negative impact on solar and geothermal installations and electricity production. This negative effect of GDP on these newer and more expensive technologies suggests that these countries might have considerable traditional energy infrastructure. Therefore, they might be more reluctant to assume the high costs of investment in renewables. In line with these findings, Groba, Indvik & Jenner (2011) determine that GDP per capita has a significant negative impact on solar installations when a binary variable is used to indicate a FIT. The results for fossil fuel prices show that an increase in oil prices leads to an increase in installation and use of geothermal capacity. An increase in natural gas prices, in contrast, contributes to greater achievements in installing wind and geothermal capacity and using it for electricity generation. These positive impacts arise because increases in the prices of non-renewables raise investors' interest in SRE capacity. Marques & Fuinhas (2011) do not find significant effects of prices on the contribution of renewables to the energy supply, perhaps because their analysis ends in 2006 and does not reflect recent oil price rises, especially those in 2008. It also does not control for continuously rising environmental awareness, the increased stringency of countries' SRE policies (aiming to achieve faster SRE development), or the financial crisis, which also affected the SRE sector. This paper, in contrast, does control for price effects, including a longer time span and employing the newest IEA data, and finds that electricity production from natural gas has positive impact on solar capacity installations. This is partially consistent with Groba, Indvik & Jenner (2011) finding that the natural gas share has a positive and significant impact on cumulative installed capacity for all SRE sources. The rationale behind this is that, due to its environmental and logistical benefits, natural gas is a potential complement to SRE electricity generation. Producing electricity from natural gas causes less harmful emissions than when it is produced using other fossil fuels. The results also show that innovation efforts in biomass technologies lead to an increase in the level of electricity later produced from biomass renewables.

Considering the political elements, the results show a significant positive relationship between perceived corruption and both installed solar capacity and electricity generation from biomass. It is surprising that countries with higher levels of perceived corruption tend to be more oriented toward SRE and suggests that there is a greater amount of cor-

ruption in the SRE infrastructure construction industry. The results also reveal a significant negative relationship between perceived corruption and electricity production from wind technology. This negative relationship confirms that corrupt energy lobbies prevent the development of wind resources. Bayer, Dolan & Urpelainen (2013) do not find a significant impact of corruption on SRE innovations. However, this paper is the first to test the impact of corruption on SRE diffusion and related electricity generation within this framework. Corruption coefficients are relatively high and significant, but, with exception of the wind, are not very robust. Therefore, the results for other SRE sources should be taken with caution. The model should be re-estimated with longer time series and with newly collected data on corruption (perception) within the SRET specific sector.

As expected, the results also show that higher energy import dependence stimulates the installation of solar and wind capacity and related electricity generation. This indicates that higher reliance on foreign oil motivates domestic technological development. Marques, Fuinhas & Manso (2010) also identify a positive impact of energy import dependence on the contribution of renewables to the total energy supply. The same effect is identified by Groba, Indvik & Jenner (2011) for added wind capacity and by Jenner (2012) for solar and geothermal electricity generation.

As expected, higher carbon intensity supports the installation of solar capacities and related electricity generation. However, it has a negative impact on biomass installations and electricity generation, which is consistent with the results of Marques, Fuinhas & Manso (2010) and Romano & Scandurra (2011). This suggests that increased pollution is not necessarily a sufficiently strong motivator for investment in SRE technologies. Moreover, these results could reinforce the conclusion that the majority of countries decide to pay penalties for emitting CO_2 instead of investing in SRE technologies. The interests of energy lobbies prevail in these countries, making it challenging to achieve environmental quality improvements.

Considering EU Directive 2001/77, the results confirm that the implementation of the directive significantly contributed to increased solar energy capacity and electricity generation. However, in line with the findings of Marques, Fuinhas & Manso (2010), the directive has not stimulated wind capacity installations or biomass electricity generation; this suggests that, in the case of larger required capacities, the directive's requirements alone are insufficient to instigate a switch to wind and biomass technologies. Moreover, results show a predominantly positive impact of the economic crisis on SRET diffusion. This is in line with Geels' (2013) findings regarding the positive influence of the crisis on sustainability transition in its early period (2008-2010). The crisis started to impede SRET diffusion after 2010-2011 (Geels, 2013). Therefore, its impact on SRET diffusion in the later period should be further verified when more data becomes available.

To summarize, this paper's results confirm the equivalent importance of all segments of SRE-supporting policies, be they financial, fiscal, economic, social, environmental, or political. The results should prove instructive for political decision-makers when reconsidering the implementation or removal of policy instruments for promoting specific SRE sources. However, implemented instrument's design or re-design (in terms of e.g. tariff

amount or support duration) should always be country specific, technology specific, and considered within the existing country's policy design.

Building on the work of Jenner (2012), future research should aim to develop more sophisticated indicators that would incorporate all design elements of a particular policy support mechanism. The research could also be extended to cover developing countries. In addition, researchers have typically focused only on the positive characteristics of SRE sources; additional research could further examine the negative aspects.

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APPENDICES

Appendix 1: *Overview of the relevant up-to date studies on policy instruments aimed at supporting the SRET diffusion*

STUDY	TIME PERIOD	SAMPLE	TECHNO-LOGIES	DEPENDENT VARIABLE/S	INDEPENDENT VARIABLES	ECONOME-TRIC APPROACH
Aguirre & Ibikunle (2014)	1990 - 2010	EU countries, remaining OECD countries, and BRICS	Biomass, solar, wind energy potential; not technology specific	Contribution of renewable energy (RE) to energy supply	- CO_2 emissions; net energy imports; energy use; population growth; GDP per capita (pc); year of full deregulation of electricity (el.) market (dummy); continuous commitment to RE (dummy); ratification of the Kyoto (dummy); el. production from coal, gas, nuclear, and oil; coal, natural gas, crude oil prices and el. rates for industry; biomass, solar, wind potential; total number of direct investment, FIT, fiscal & financial support, grants & subsidies, green certificates, information and education, loans, market based instruments, negotiated agreements, RD&D, regulatory instruments, policy support, voluntary instruments)	FEDV and PCSE
Bayer et al. (2013)	1990-2009	74 countries across the world	Wind, solar, hydro	Renewable patent counts	INDEPENDENT VARIABLES: oil prices; installed RE el. capacity; democratic institutions; corruption; CONTROLS (lagged by one year): ln GDP; net inflows of FDI as % of GDP; sum of imports and exports as % of GDP; urban population; OECD membership; ROBUSTNESS: capital account openness; KOF globalization index; ln total expenditures on education; the share of the employees with tertiary education; total count of CDM projects	FE negative binomial models

STUDY	TIME PERIOD	SAMPLE	TECHNO-LOGIES	DEPENDENT VARIABLE/S	INDEPENDENT VARIABLES	ECONOME-TRIC APPROACH
Carley (2009)	1998-2006	48 US States	Not technology specific	- RE share - RE total	- RPS, binary; a state's legislative commitment toward environmental policy; pc natural resource employees; petrol / coal manufacturing gross state product (GSP); annual GSP pc; growth rate of population; the amount of total el. generated pc; deregulation; el. price; wind, biomass and solar potential; tax index; subsidy index; % of regional states that have PRS policy, lagged by one year	- FE - FEVD
Dong (2012)	2005-2009	53 countries	Wind	Cumulative and annual wind capacity installed	- FIT and RPS + their interaction terms; GDP pc; el. net consumption; net oil imports; wind resources; CO_2 intensity; other promotion policies in each country	OLS, FE
Gan & Smith (2011)	1994-2003	26 OECD / IEA countries	Renewable energy in general and bioenergy	Supply of renewable energy or bioenergy pc	- Energy price; natural resources endowments, land area pc, and forest land area pc; GDP pc; government R&D on RE and bioenergy; CO_2 emissions, t CO_2 pc; policies: research and innovation policies, market deployment policies, market-based energy policies, number	- One way (country) FE model - GLS
Groba et al. (2011)	1992-2008	26 EU countries	Solar PV and onshore wind	- Total capacity - Annual added capacity	- Indicator ROI, nominal units; indicator for RPS strength; FIT, binary; tax or grant, binary; tender, binary; GDP pc; land area; net import ratio, % – ln of net el. imported to total el. produced; energy consumption pc; nuclear, oil, natural gas, coal share; EU 2001/EC/77 Directive, binary	Pooled OLS, FE

STUDY	TIME PERIOD	SAMPLE	TECHNO-LOGIES	DEPENDENT VARIABLE/S	INDEPENDENT VARIABLES	ECONOME-TRIC APPROACH
Jenner (2012)	1990-2010	26 EU countries	Biomass, geothermal, solar PV, wind	Biomass, geothermal, solar PV, onshore wind el. generation	- Biomass, geothermal, solar PV, onshore wind FIT: binary, tariff amount-eurocents, SFIT - %; ISI, %; tax break or investment grant, binary; tendering scheme, binary; nuclear, oil, natural gas, coal share; GDP pc; net import ratio of el.; energy consumption pc	OLS, FE, PCSE
Marques & Fuinhas (2011)	1990-1998; 1999-2006	21 EU country	Not diversified	- Contribution of RE to total energy supply	- Total number of energy efficiency policies and measures; CO_2 pc (kg/cap); pc energy; GDP – Real; import dependency on energy; importance of coal, oil, gas, nuclear to el. generation; coal price; natural gas price; oil price	Quantile regression technique
Marques & Fuinhas (2012)	1990-2007	23 EU countries	- Not diversified	- Contribution of RE to energy supply	- CO_2 pc; pc energy; import dependency of energy; importance of coal, oil, gas, nuclear to electricity generation; dummy = 1 if CRES higher or equal 10; accumulated number of RE policies and measures	- PCSE - Random effects, FE
Marques et al. (2010)	1990-2006	European Union countries	Not diversified	- Contribution of RE to total energy supply	- Member of the EU in 2001; import dependency on energy; prices of oil, natural gas and coal; CO_2 pc emissions; contribution of coal, oil, natural gas and nuclear to el. generation; energy consumption pc; income; geographic area; continuous commitment on RE	OLS, random effects, FE, FEVD
Popp et al. (2011)	1991-2004	26 OECD countries	Wind, solar photovoltaic, geothermal, biomass and waste	- RE capacity pc, - Technology specific investment pc, - % of RE el. capacity	- The global knowledge stock for technology; GDP pc; % growth of el. consumption (t-1); % of el. production from nuclear and from hydro (t-1); production of coal, natural gas, oil per capita; % of energy imported (t-1); ratification of the Kyoto; REC - % of RE power required by any REC program in the country; FIT – continuous; other policies - dummy	Regression with technology specific dummies, year and country FE

STUDY	TIME PERIOD	SAMPLE	TECHNO-LOGIES	DEPENDENT VARIABLE/S	INDEPENDENT VARIABLES	ECONOME-TRIC APPROACH
Romano & Scandurra (2011)	1980-2008	29 countries	Not technology specific	- Ratio: total RE el. net generation / total net el. generation-net el. imports (shREN)	- shREN$_{-1}$; ln GDP; ln energy intensity; ln CO_2 emissions; ratio: nuclear el. net consumption/total net electricity generation-net el. imports	Dynamic panel analysis
Salim & Rafiq (2012)	1980-2006	Brazil, China, India, Indonesia, Philippines and Turkey	Not technology specific	RE consumption	- real GDP; Carbon emission; oil prices	- FMOLS, DOLS - ARDL - Granger causality test
Shrimali & Kniefel (2011)	1991-2007	50 US States	Wind, biomass, geothermal and solar photovoltaic	- ratio: total non-hydro and technology specific RE capacity / total net el. generation	RPS with a capacity requirement; RPS with a sales requirement; RPS with a sales goal; State Government Green Power Purchasing; required green power options; clean energy fund; all BINARIES**;** el. prices**;** natural gas prices, the data is deflated using the CPI; GDP pc**;** coal capacity; LCV rating	- pooled OLS - a state and time FE with state-specific time-trends
Yin & Powers (2010)	1993-2006	50 US States	Not technology specific	- % of generating capacity in a state that is non-hydro RE	- Incremental % requirement (RPS); RPS binary; RPS trend; RPS nominal; mandatory green power option, binary; public benefits fund, binary; net metering, binary; interconnections standards, binary; electricity price; state income; league of conservation voters scores; import ratio (el.); REC free trade; neighbour; penalty cap	FE

Source: Own compilation according to the studies cited.

Appendix 2: *Robustness check 1. Impact of policy elements on added renewable installed capacity / electricity generation (1990-2011) in 26 EU countries*

Estimation technique	**FE**	**FE**	**FE**	**FE**	**FE**	**FE**	**FE**
DEPENDENT VARIABLE Ln (added wind, solar, geothermal installed capacity)/ Ln (added wind, solar, geothermal, biomass electricity generation)	WIN I.	SOL I.	GEO I.	WIN G.	SOL G.	GEO G.	BIO G.
EU Directive 2001/77 *t*-1	-2.357**	1.766*	0.321	-0.940	0.529	0.347***	-2.574***
	[-2.15]	[1.83]	[0.95]	[-1.36]	[1.22]	[3.07]	[-5.91]
Fixed feed in tariff *t*-1	3.360***	0.345	-0.264	1.153***	0.434	-0.038	0.115
	[4.04]	[0.44]	[-0.48]	[3.15]	[1.20]	[-0.25]	[0.27]
Premium feed in tariff *t*-1	3.643**	0.884	0.459	0.691	0.470	0.190	-0.415
	[2.39]	[0.58]	[0.71]	[1.05]	[0.73]	[0.69]	[-0.52]
Cap *t*-1	-0.855	-2.264**	-1.103	-0.362	-0.618	-0.276	0.860
	[-0.75]	[-2.01]	[-1.34]	[-0.80]	[-1.14]	[-0.91]	[0.89]
Quota *t*-1	2.735**	0.936	-0.793	1.034**	0.580	-0.432***	0.028
	[2.23]	[0.86]	[-1.31]	[2.32]	[0.98]	[-3.60]	[0.09]
Tender *t*-1	2.084*	-0.829	-0.019	1.590***	-0.347	0.597	0.438
	[1.71]	[-0.51]	[-0.01]	[3.35]	[-0.52]	[1.29]	[1.23]
Tax incentive/ investment grant *t*-1	-1.764	0.802	-0.431	-0.988**	0.273	-0.164	-0.275
	[-1.45]	[0.75]	[-1.27]	[-2.17]	[0.57]	[-1.16]	[-0.40]
Ln GDP *t*-1	-3.162	-5.603**	-3.099**	1.945	-1.656*	-0.495	2.094
	[-0.67]	[-2.04]	[-2.10]	[1.04]	[-1.76]	[-1.19]	[0.96]
Ln oil prices *t*-1	-5.523	0.090	2.083**	-2.037*	-0.884	0.668*	0.614
	[-1.61]	[0.04]	[2.06]	[-1.76]	[-1.15]	[1.96]	[0.36]
Ln coal prices *t*-1	0.304	-1.764	-2.236	0.847	-0.335	-0.688	1.284*
	[0.11]	[-0.66]	[-1.27]	[1.27]	[-0.35]	[-1.03]	[1.95]
Ln natural gas prices *t*-1	4.718*	-1.732	3.824***	2.435***	-1.390	0.439	-1.175*
	[1.81]	[-0.75]	[2.61]	[2.68]	[-1.42]	[0.98]	[-1.77]
Electricity production from oil *t*-1	0.083	0.020	0.084	0.012	-0.018	-0.016	-0.031*

	[1.03]	[0.24]	[1.10]	[0.44]	[-0.66]	[-0.62]	[-1.91]
Electricity production from coal *t*-1	0.055	0.046	-0.009	0.020	-0.042*	-0.010	0.039*
	[0.75]	[0.66]	[-0.25]	[0.86]	[-1.65]	[-0.71]	[1.67]
Electricity production from natural gas *t*-1	0.093	0.117*	-0.010	0.029	-0.027	-0.019	0.014
	[1.32]	[1.72]	[-0.25]	[1.34]	[-1.10]	[-1.27]	[0.78]
Electricity production from nuclear *t*-1	0.038	0.106	-0.023	0.046	-0.009	-0.017	-0.048**
	[0.38]	[1.27]	[-0.57]	[1.29]	[-0.40]	[-1.20]	[-2.29]
Energy consumption pc *t*-1	-0.018	-0.019	0.012	0.009	-0.004	-0.005	0.002
	[-0.50]	[-0.66]	[1.13]	[0.80]	[-0.33]	[-1.47]	[0.13]
Ln patents *t*-1	-0.013	0.030	0.049	0.020	-0.020	0.008	0.038*
	[-0.27]	[0.41]	[1.13]	[1.18]	[-0.79]	[0.78]	[1.85]
Ln corruption perception index *t*-1	-2.890	4.852**	0.302	-1.643**	0.085	-0.102	0.952
	[-1.33]	[2.26]	[0.29]	[-2.02]	[0.11]	[-0.39]	[0.97]
Energy import dependence *t*-1	0.043	0.086**	0.011	0.026**	0.021	0.001	-0.010
	[1.45]	[2.13]	[1.12]	[2.54]	[1.53]	[0.35]	[-0.88]
Ln carbon intensity *t*-1	-1.413	4.195	-1.783	-1.199	3.023**	0.835	-0.568
	[-0.39]	[1.54]	[-1.09]	[-0.82]	[2.09]	[1.53]	[-0.47]
Constant	90.255	151.264**	52.579*	-75.783*	51.757**	3.156	-84.941*
	[0.76]	[2.15]	[1.43]	[-1.57]	[2.13]	[0.29]	[-1.60]
Observations	457	462	460	502	526	527	442
R-squared	0.631	0.552	0.470	0.795	0.647	0.778	0.768

Notes: The dependent variable is added wind / solar / geothermal installed capacity and added wind / solar / geothermal / biomass electricity generation, respectively. The dependent variable is defined as a rate of change. FE regressions control for time fixed effects. Panel corrected standard errors are in brackets. ***, **, *, denote significance at 1%, 5% and 10% significance levels, respectively. Ln represents logarithm, and *t*-1 indicates the one-year lag.

Appendix 3: *Robustness check 2. Impact of policy elements on added renewable installed capacity / electricity generation (1990-2011) in 23 EU countries*

Estimation technique	FE	FE	FE	FE	FE	FE	FE
DEPENDENT VARIABLE Ln (added wind, solar, geothermal installed capacity)/ Ln (added wind, solar, geothermal, biomass electricity generation)	WIN I.	SOL I.	GEO I.	WIN G.	SOL G.	GEO G.	BIO G.
Fixed feed in tariff *t*-1	2.900***	0.073	-0.163	1.231***	0.753*	0.161	0.055
	[2.87]	[0.08]	[-0.38]	[2.75]	[1.85]	[1.04]	[0.10]
Premium feed in tariff *t*-1	3.743**	0.899	0.613	0.769	0.497	0.255	0.056
	[2.29]	[0.56]	[0.90]	[1.11]	[0.72]	[1.05]	[0.09]
Cap *t*-1	-1.339	-2.346*	-0.959	-0.441	-0.598	-0.238	0.536
	[-1.02]	[-1.83]	[-1.25]	[-0.86]	[-0.99]	[-0.71]	[0.50]
Quota *t*-1	2.183*	1.435	-0.357*	1.103**	1.131*	0.008	-0.174
	[1.65]	[1.03]	[-1.67]	[2.16]	[1.82]	[0.08]	[-0.43]
Tender *t*-1	1.613	-0.317	-0.487	1.572***	-0.119	0.617	0.016
	[1.32]	[-0.18]	[-0.47]	[2.93]	[-0.18]	[1.44]	[0.04]
Tax incentive/ investment grant *t*-1	-1.815	0.973	-0.210	-0.748	0.448	-0.001	0.037
	[-1.45]	[0.83]	[-0.69]	[-1.55]	[0.85]	[-0.01]	[0.05]
Ln GDP *t*-1	-3.233	-5.880**	-1.807	1.779	-1.410	-0.144	2.644
	[-0.64]	[-1.99]	[-1.36]	[0.95]	[-1.56]	[-0.37]	[1.27]
Ln oil prices *t*-1	-4.890	-0.668	1.362*	-2.499**	-1.157	0.078	-0.274
	[-1.28]	[-0.32]	[1.72]	[-2.13]	[-1.34]	[0.23]	[-0.15]
Ln coal prices *t*-1	-0.951	-0.595	-1.105	0.527	-0.222	-0.585	0.698
	[-0.31]	[-0.23]	[-0.95]	[0.71]	[-0.22]	[-0.96]	[0.85]
Ln natural gas prices *t*-1	5.248*	-2.042	2.120*	2.688***	-1.667	0.018	-1.278*
	[1.82]	[-0.77]	[1.83]	[2.73]	[-1.60]	[0.04]	[-1.73]
Electricity production from oil *t*-1	0.071	-0.005	0.033	0.019	-0.015	-0.032	-0.065***
	[0.71]	[-0.05]	[0.47]	[0.48]	[-0.43]	[-0.92]	[-3.27]
Electricity production from coal *t*-1	0.060	0.058	0.013	0.028	-0.039	-0.005	0.065***
	[0.78]	[0.81]	[0.46]	[1.02]	[-1.33]	[-0.32]	[2.66]

Electricity production from natural gas *t*-1	0.075	0.137*	0.015	0.030	-0.019	-0.009	0.016
	[1.00]	[1.94]	[0.47]	[1.18]	[-0.71]	[-0.54]	[0.76]
Electricity production from nuclear *t*-1	0.042	0.160*	0.008	0.049	-0.006	-0.011	-0.014
	[0.37]	[1.93]	[0.25]	[1.24]	[-0.26]	[-0.75]	[-0.54]
Energy consumption pc *t*-1	-0.018	-0.018	-0.000	0.013	0.001	-0.004	-0.002
	[-0.47]	[-0.60]	[-0.02]	[1.17]	[0.08]	[-1.22]	[-0.16]
Ln patents *t*-1	-0.045	0.053	0.048	0.009	-0.010	0.004	0.036
	[-0.84]	[0.65]	[1.63]	[0.40]	[-0.37]	[0.37]	[1.36]
Ln corruption perception index *t*-1	-1.781	1.979	0.752	-1.459	-0.128	0.182	2.492*
	[-0.68]	[0.85]	[1.29]	[-1.54]	[-0.15]	[0.70]	[1.86]
Energy import dependence *t*-1	0.052	0.070	0.004	0.019*	0.014	-0.003	-0.006
	[1.53]	[1.63]	[0.60]	[1.66]	[1.00]	[-1.58]	[-0.50]
Ln carbon intensity *t*-1	-2.811	4.467	0.002	-2.385	2.678*	1.149*	-2.360*
	[-0.75]	[1.52]	[0.00]	[-1.60]	[1.91]	[1.70]	[-1.88]
Constant	81.211	160.65**	24.504	-62.245	51.188**	-2.935	-76.580
	[0.66]	[2.17]	[0.69]	[-1.33]	[2.12]	[-0.27]	[-1.50]
Observations	403	408	411	443	467	471	386
R-squared	0.571	0.411	0.233	0.767	0.558	0.683	0.734

Notes. The dependent variable is added wind / solar / geothermal installed capacity and added wind / solar / geothermal / biomass electricity generation, respectively. The dependent variable is defined as a rate of change. FE regressions control for time fixed effects. Panel corrected standard errors are in brackets. ***, **, *, denote significance at 1%, 5% and 10% significance levels, respectively. Ln represents logarithm, and *t*-1 indicates the one-year lag.

Appendix 4: *Robustness check 3. Impact of economic crisis on added renewable installed capacity / electricity generation (1990-2011) in 26 EU countries*

Estimation technique	**FE**	**FE**	**FE**	**FE**	**FE**	**FE**	**FE**
DEPENDENT VARIABLE Ln (added wind, solar, geothermal installed capacity)/ Ln (added wind, solar, geothermal, biomass electricity generation)	WIN I.	SOL I.	GEO I.	WIN G.	SOL G.	GEO G.	BIO G.
Economic crisis dummy	0.488	21.800	0.228**	0.537	17.951**	-8.030**	0.548
	[1.28]	[1.27]	[2.13]	[1.21]	[2.53]	[-2.56]	[0.99]
Fixed feed in tariff *t*-1	3.517***	0.171	-0.208	1.171***	0.394	-0.040	0.356
	[4.19]	[0.22]	[-0.39]	[2.99]	[1.08]	[-0.26]	[0.72]
Premium feed in tariff *t*-1	3.527**	-0.003	-0.019	0.966	0.105	0.046	0.671
	[2.30]	[-0.00]	[-0.03]	[1.60]	[0.16]	[0.17]	[1.01]
Cap *t*-1	-1.022	-2.248**	-1.062	-0.401	-0.618	-0.270	0.489
	[-0.93]	[-1.99]	[-1.29]	[-0.86]	[-1.13]	[-0.87]	[0.45]
Quota *t*-1	2.461**	1.302	-0.644	0.805*	0.654	-0.357***	-0.458*
	[2.03]	[1.12]	[-1.18]	[1.78]	[1.12]	[-3.22]	[-1.74]
Tender *t*-1	1.485	-0.790	-0.168	1.495***	-0.301	0.619	0.113
	[1.22]	[-0.47]	[-0.14]	[3.35]	[-0.45]	[1.35]	[0.27]
Tax incentive/investment grant *t*-1	-1.737	0.561	-0.654*	-0.803*	0.186	-0.224*	-0.002
	[-1.49]	[0.48]	[-1.92]	[-1.72]	[0.39]	[-1.70]	[-0.00]
Annual growth rate of GDP	0.064	1.240	0.663	-2.278	-2.000	0.115	4.061
	[0.01]	[0.38]	[0.51]	[-0.79]	[-0.98]	[0.18]	[1.12]
Ln oil prices *t*-1	-5.201	0.083	2.344**	-2.124*	-0.955	0.679*	0.693
	[-1.48]	[0.04]	[2.24]	[-1.74]	[-1.25]	[1.93]	[0.38]
Ln coal prices *t*-1	-0.223	-1.326	-2.050	0.654	-0.217	-0.601	0.495
	[-0.08]	[-0.48]	[-1.19]	[0.96]	[-0.23]	[-0.90]	[0.63]
Ln natural gas prices *t*-1	4.805*	-1.708	3.728**	2.491***	-1.425	0.384	-0.844
	[1.81]	[-0.70]	[2.58]	[2.63]	[-1.46]	[0.84]	[-1.16]
Electricity production from oil *t*-1	0.073	0.008	0.078	0.018	-0.023	-0.017	-0.025
	[0.90]	[0.10]	[1.05]	[0.67]	[-0.86]	[-0.65]	[-1.46]
Electricity production from coal *t*-1	0.067	0.031	-0.014	0.030	-0.047*	-0.013	0.062***
	[0.92]	[0.45]	[-0.37]	[1.32]	[-1.84]	[-0.90]	[2.64]

Electricity production from natural gas *t*-1	0.081	0.111	-0.017	0.033	-0.032	-0.020	0.020
	[1.16]	[1.62]	[-0.41]	[1.58]	[-1.28]	[-1.30]	[1.01]
Electricity production from nuclear *t*-1	0.069	0.114	-0.016	0.048	-0.011	-0.017	-0.034
	[0.70]	[1.39]	[-0.41]	[1.34]	[-0.54]	[-1.23]	[-1.34]
Energy consumption pc *t*-1	-0.027	-0.042*	-0.000	0.017	-0.014	-0.007**	0.018*
	[-0.88]	[-1.83]	[-0.04]	[1.59]	[-1.20]	[-2.15]	[1.80]
Ln patents *t*-1	-0.040	0.039	0.053	0.011	-0.019	0.009	0.048**
	[-0.85]	[0.55]	[1.22]	[0.65]	[-0.78]	[0.84]	[2.20]
Ln corruption perception index *t*-1	-2.180	3.955*	0.043	-1.203	0.029	-0.238	1.707
	[-1.02]	[1.78]	[0.04]	[-1.56]	[0.04]	[-0.96]	[1.48]
Energy import dependence *t*-1	0.040	0.065	0.005	0.032***	0.014	-0.001	0.004
	[1.42]	[1.56]	[0.54]	[3.03]	[1.08]	[-0.44]	[0.41]
Ln carbon intensity *t*-1	-1.720	9.410***	0.286	-3.045***	4.431***	1.424***	-4.514***
	[-0.67]	[5.55]	[0.28]	[-2.58]	[3.51]	[2.95]	[-6.96]
Constant	5.348	12.227	-28.704***	-16.437**	9.741	-9.065	-18.124**
	[0.22]	[0.77]	[-3.36]	[-2.12]	[1.57]	[-3.21]	[-1.99]
Observations	457	462	460	502	526	527	442
R-squared	0.620	0.513	0.476	0.786	0.641	0.776	0.749

Notes. The dependent variable is added wind / solar / geothermal installed capacity and added wind / solar / geothermal / biomass electricity generation, respectively. The dependent variable is defined as a rate of change. FE regressions control for time fixed effects. Panel corrected standard errors are in brackets. ***, **, *, denote significance at 1%, 5% and 10% significance levels, respectively. Ln represents logarithm, and *t*-1 indicates the one-year lag.

HOW TRADING FIRMS UPGRADE SKILLS AND TECHNOLOGY: THEORETICAL MODEL

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ABSTRACT: *This paper studies the mechanisms of skill upgrading in trading firms by developing a theoretical model that relates the individual's incentives for acquiring higher skills to the profit-maximizing behaviour of trading firms. The model shows that only the high ability individuals have incentives for acquiring higher skills, as long as they are compensated with higher wages after entering employment. Furthermore, high-productive firms have incentives for investing in higher technology, to employ high-skilled labour, and to engage in international trade. The decisions for technology dress-up and skill upgrading coincide with firm's decisions to start importing and exporting as the latter requires higher technology and high-skilled labour. Contributions of the paper are twofold: gaining new insights by combining fragments of models on individual's and firm's behaviours, and broadening the content of the Melitz (2003) model by introducing importers and controlling for skilled and unskilled labour.*

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1. INTRODUCTION

The liberalisation of international trade increases firm's productivity for two reasons; one is due to easier access to a better selection of advanced technologies and another is due to a better allocation of production factors. The latter channel was among others emphasized in the Melitz (2003) model, while the former was for example stressed in Bustos (2011b). The Melitz (2003) model explores the effects of trade on intra-industry reallocations and aggregate industry productivity by taking into account heterogeneous firms that differ regarding their level of productivity. The model concludes that only the most productive firms engage in exporting activities. The Melitz (2003) model represents groundwork in the recent trade literature and was used as a basis also in the Bustos (2011b) model, which explores the effects of trade liberalisation on skill upgrading in exporting firms, where the model also differentiates between high- and low-technology firms.

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This paper aims to fill the void in the international trade theory by broadening the theoretical models of Melitz (2003) and Bustos (2011b), and correspondingly including imports to the model. By doing this, the model also explains recent empirical findings on the importance of importing as one of the drivers of firm's productivity gains. Evaluating trade liberalisation after China's entry to the World Trade Organization, Bloom, Draca and Van Reenen (2011) find that the increased Chinese import competition increased the innovations and adoption of new technologies, which in turn increased the productivity within firms, while between firms it transferred employment toward innovative and technologically advanced firms. The positive impact of importing on the firm's productivity was confirmed also by Halpern, Koren and Szeidl (2011), studying the Hungarian data, Kasahara and Rodrigue (2008), studying the Chilean data, and Amiti and Konings (2007), studying the Indonesian data. The latter study points out that these productivity increases are a consequence of importing high-quality intermediates, the enhanced diversification of inputs, and higher learning opportunities (Amiti, & Konings, 2007). Taking into account importers and exporters, Smeets and Warzynski (2010) confirm that both, exporting and importing, increase the firm's productivity, while firms with the highest level of productivity are engaged in both trading activities. In relation to these findings, empirical papers also certify the positive impact of importing on exporting. Bas and Strauss-Kahn (2014) emphasize three channels through which importing affects exporting positively. First is the indirect productivity channel of increased productivity after importing, which can in turn have a positive effect on overcoming export costs. Second is a direct cost channel due to changing the input structure towards more cost-effective importing intermediates. Finally, through the quality/technology transfer, imported intermediate inputs can enable exporting products to be of such quality and technology levels, as desired in the export markets. Positive effects of importing on exporting were for example confirmed also by Feng, Li and Swenson (2012), studying the Chinese data.

In addition, since the individual's decisions for acquiring higher skills later have an important impact on the behaviour of profit-maximizing firms, another motivation for writing this paper was to combine specific individual's and firm's decisions. Since the existing trade models are based on broader, firm-level decisions, the impetus of the present paper is to explore more in depth also the behaviour of individuals and their decision for skill upgrading, as these decisions have in turn the effect on skill upgrading within a firm.

The model in this paper bases its framework on the models of Bustos (2011a, 2011b) and Melitz (2003), and on the work of Stark and others (see for example Stark, & Wang, 2001; Stark, Helmenstein, & Prskawetz, 1998; Stark, & Chau, 1998; and Stark, Helmenstein, & Prskawetz, 1997 for reference), who developed models on human capital formation. The model first explores the behaviour of individuals, who decide whether to invest in acquiring higher skills or not. In this part, the model differentiates between high ability and low ability individuals, where the individual's ability level defines the cost level for acquiring skills. Upon the level of these costs, individuals decide whether to invest in obtaining the skills or not, where this decision relies also on their future wage level. Results suggest that only high ability individuals find it profitable to invest in acquiring additional skills, while they in turn demand higher wages after entering employment. These findings are then incorporated in

the second part of the model, which focuses on exploring the behaviour of heterogeneous firms that decide on when to start investing in higher technology, and when to start engaging in trading activities. In this part of the model, profit-maximizing firms differ upon their level of labour productivity, where the proxy for higher labour productivity are higher labour costs, indicating a higher employment level of skilled employees. The latter judgement is backed up by the results from the first part of the model. Investing in higher technology and starting to import and export brings higher fixed costs, but decreases the level of firm's marginal costs, and/or increases the employment of skilled workers, and/or increases revenues. Findings from the second part suggest that the technologically advanced firms employ a higher number of skilled workers and that only the most productive firms find it profitable to start trading, investing in higher technology and skill upgrading.

This paper contributes to the literature in two ways. Firstly, since the mentioned empirical papers emphasized the importance of differentiating between importing and exporting, this model accounts for both. Therefore, the model broadens the content of the papers of Bustos (2011a, 2011b) and Melitz (2003), who take into account only exporters. Secondly, while other theoretical trade models only analysed decisions from a firm's point of view, this paper's contribution is to combine behaviour of individuals and firms in one model of trade. The model therefore broadens the existing trade models by analysing the behaviour of individuals and their decision for skill upgrading. This is later incorporated in the firm-level decisions, by taking into account the firm's labour demand and productivity.

The remainder of the paper is organised in the following manner: the next section presents a brief introduction of the theoretical background, which is further on used as a reference point to the theoretical model, included in the third section. The last section summarises the main findings and includes a conclusion.

2. LITERATURE REVIEW

Melitz (2003) developed an important theoretical model, which explores the effects of trade on intra-industry reallocations and aggregate industry productivity. The model uses heterogeneous firms that differ regarding the level of productivity, where firms with higher levels of productivity produce the same amount of products at lower marginal costs. After observing their level of productivity, firms decide to exit or enter the market, where new entrants have a lower level of productivity and a higher probability to exit than firms that are already on the market. When exploring the effects of trade, the author only focuses on exports. After firms start exporting, they are faced with higher costs for two reasons; one reason is higher per-unit trade costs, and the other reason are higher fixed costs. The latter can be explained as a consequence of establishing new networks, adapting the product to the new market, setting up new distribution channels, etc. After introducing the possibility to export to the model, firms again observe their level of productivity. Once more, the least productive firms decide to exit the market, the firms with medium-level of productivity decide to serve the domestic market, while the most productive firms serve the domestic market and export (Melitz, 2003).

The Melitz (2003) model presents the groundwork for many subsequent theoretical models on trade. Bustos upgraded the Melitz (2003) model by including technology upgrading (Bustos, 2011a) and skill upgrading (Bustos, 2011b) into the model. In the first model, Bustos (2011a) takes into account profit maximizing firms which decide whether to start exporting and whether to invest in higher technology. By adopting higher technology, firms pay higher fixed production costs, while their marginal costs are reduced. After proving that using high technology and serving the domestic market is always dominated by some other choice, firms form four different groups: the least productive firms exit, the low productive firms use low technology and serve the domestic market, the medium productive firms still use low technology but also export, while only the most productive firms upgrade their technology level and export (Bustos, 2011a).

The gains of different production factors, labour and capital to be precise, were included already in the Heckscher-Ohlin model (the H-O model), which predicts that countries adjust their production and trading on behalf of their factor endowments. The Stolper-Samuelson theorem in the H-O model indicates that the real returns of the factor-abundant owners increase, and the real returns of the owners of the other factor decrease as a consequence of trade (Krugman, Obstfeld, & Melitz, 2012). Relating to the conclusions of the H-O model, the relative demand for skilled workers – a scarce factor in developing countries – should decrease after trade liberalisation. However, the empirical findings show the opposite (see for example Goldberg, & Pavcnik, 2007). Bustos (2011b) has filled the gap in trade literature, by exploring the effects of trade liberalisation on skill upgrading in exporting firms. The model accounts for two categories of workers, skilled and unskilled. As in the previous model (Bustos, 2011a), firms form four different groups before trade liberalisation, whereas after liberalisation, they form six groups in total. The least productive firms exit. Among the firms that did not export before trade liberalisation, a fraction of these firms continue serving the domestic market, use low technology and downgrade skills; another fraction of these firms still uses low technology, but they start exporting and downgrade skills, while the most productive of these firms start to export, upgrade their technology and skills. Firms that were already exporting before trade liberalisation and used low technology continue to export, switch to high technology and upgrade skills. Finally, the most productive firms that were exporting and using high technology before trade liberalisation continue exporting and using high technology, but they downgrade skills. The conclusions of the theoretical model were later tested also with the empirical model, which studies the effect of Brazil's tariff reduction on Argentinian firms. The model's predictions that low-technology firms downgrade skills and that firms in the upper-middle range of productivity distribution upgrade skills after trade liberalisation are consistent with the empirical findings. On the other hand, the prediction that the most productive high-technology firms downgrade skills after trade liberalisation is not consistent with the empirical findings (Bustos, 2011b).

Finally, as presented in the introduction, it is important to control for the imports in trade models, as imports usually serve as a prerequisite to exporting activities (see for example empirical studies of Damijan, & Kostevc, 2015; and Altomonte, & Békés, 2010). To be precise, by studying the connections between importing, exporting and innovation in

Spanish firms, Damijan and Kostevc (2015) find that importing enables firms to first start with process and product innovation, and later also with exporting. In addition, exporting stimulates further innovation. Although empirical studies show the importance of importing, the latter is infrequently included in the theoretical models of trade. One of the models that does account for importing is the theoretical model by Amiti and Davis (2011), who base their theoretical model on the Melitz (2003) model and control for imports, by including additional costs of importing in the model.

The theoretical model in this paper combines different aspects of the models, presented in the literature review and adds also a thorough analysis of individual's behaviour and their decision for skill upgrading. It is necessary to study these decisions, as they later have an important impact on the firm's productivity level, labour demand and labour costs. For this purpose, several papers of Stark and others were taken into account (see for example Stark, & Wang, 2001; Stark, Helmenstein, & Prskawetz, 1998; Stark, & Chau, 1998; and Stark, Helmenstein, & Prskawetz, 1997 for reference). The primary focus is on the paper by Stark and Wang (2001), who developed a model of human capital formation in an environment with and without migration. I bring the model into use as a benchmark and use it for explaining the individual's choice for skill upgrading.

3. THE MODEL

This section presents a simple theoretical model, the first part of which studies the decision of individuals to invest in acquiring additional skills. The findings of the first part of the model are later incorporated in the second part, which analyses the decision of heterogeneous firms to start trading and investing in higher technology.

3.1 Setup of the Model

The model takes into account the country, endowed with heterogeneous workforce and heterogeneous firms. Firms differ according to the different productivity levels, which are the end result of different technologies used, and in regards to firms being included in international trade. Concerning the latter, the model differentiates between importing and exporting firms, whereas concerning the former, it differentiates between high-technology and low-technology firms.

3.2 Individuals

This part of the theoretical model follows the work of Stark and others (see for example Stark, & Wang, 2001; Stark, Helmenstein, & Prskawetz, 1998; Stark, & Chau, 1998; and Stark, Helmenstein, & Prskawetz, 1997 for reference). Each individual in the economy is endowed with a certain amount of efficiency units (θ), which represents the ability of a worker. If the average ability of workers in the economy is $\underline{\theta}$, and the abilities of high

ability and low ability workers are θ_S and θ_U, respectively, the following applies: $\theta_U < \underline{\theta} < \theta_S$. For brevity, the model denotes all individuals with above-average abilities by θ_S, and individuals with below-average abilities by θ_U. Derivations of the model therefore assume two ability levels.

After individuals evaluate their level of ability, they decide whether to invest in acquiring higher skills or not. It is assumed that the costs for acquiring higher skill levels are different for individuals with different abilities. To be precise, costs for acquiring human capital for high ability individuals (k_S) are lower than the costs of low ability individuals (k_U); i.e. $k_U > k_S > 1$. All individuals have an opportunity to achieve higher levels of education and become skilled. However, since the costs for acquiring the highest levels of human capital are too high for low ability individuals, they will be able to obtain the human capital only up to a certain level and will not be able to achieve above-average skill levels.

Individuals with higher abilities will have incentives for acquiring above-average levels of human capital, if their costs for acquiring high skill levels will be later compensated with higher gross earnings when they are employed. In order to emphasise the period after individuals acquire skills, the model denotes high ability, high skilled individuals with Θ_S and low ability, low skilled individuals with Θ_U. The gross earnings of high ability, high skilled workers (w_S) should therefore be higher than the gross earnings of low ability, low skilled workers (w_U); i.e. $0 < w_U < w_S$. Thus, each individual initially bears the costs of acquiring human capital. However, the costs are later transmitted onto firms in the form of higher expected gross earnings of high ability, high skilled individuals.

The function of gross earnings for unskilled workers is the following:

$$w_U(\Theta_U) = \lambda[\ln(\Theta_U + 1)] - k_U\Theta_U, \qquad (1)$$

where the first term on the right hand side ($\lambda[\ln(\Theta_U + 1)]$) represents personal returns to human capital, and the last term represents costs of acquiring human capital. The parameter λ is assumed to be positive. Furthermore, for convenience, the following is assumed as well: $\lambda > k_U > k_S > 1$.

Similarly, the function of gross earnings of skilled workers can be written as:

$$w_S(\Theta_S) = \lambda\,[\ln(\Theta_S + 1)] - k_S\Theta_S. \qquad (2)$$

The succeeding claim proves that the optimal skill level of workers with low ability and low skills is lower than the optimal skill level of workers with high ability and high skills. It is important to prove that in order to make further inferences on the wage level of skilled workers.

Claim 1: The optimal skill level of individuals with low ability is lower than the optimal skill level of individuals with high ability.

Proof: To get the optimal skill level of high and low ability individuals, first order conditions of gross earnings for each level of skills are derived.

$$\frac{\partial w_U(\Theta_U)}{\partial \Theta_U} = \frac{\lambda}{\Theta_U + 1} - k_U$$

$$\frac{\partial w_S(\Theta_S)}{\partial \Theta_S} = \frac{\lambda}{\Theta_S + 1} - k_S$$

When checking the maxima, the following optimal skill levels of workers are calculated. Optimal skill level of the low ability workers (Θ_U^*) is:

$$\Theta_U^* = \lambda(k_U)^{-1} - 1. \quad (3)$$

Optimal skill level of the high ability workers (Θ_S^*) is:

$$\Theta_S^* = \lambda(k_S)^{-1} - 1. \quad (4)$$

When comparing both optimal levels and taking into account that $k_S < k_U$, it is confirmed that $\Theta_U^* < \Theta_S^*$. ▪

Although the previous claim confirms that the high ability workers will have higher optimal skill levels than the low ability workers, it also has to be proven that the high ability workers will have incentives to invest in their educational attainment and make the best of their potential. As mentioned before, high ability workers will have incentives to invest in their educational attainment and become skilled, if their future income would increase because of that investment. By inserting optimal skill levels of high ability and low ability individuals (expressions (3) and (4)) in the functions of gross earnings (expressions (1) and (2)), the following can be derived:

$$w_U(\Theta_U^*) < w_S(\Theta_S^*)$$
$$\lambda[\ln(\lambda / k_U)] - k_U\,[(\lambda / k_U) - 1] < \lambda[\ln(\lambda / k_S)] - k_S\,[(\lambda / k_S) - 1].$$

Taking into account the assumption $\lambda > k_U > k_S > 1$, it can be confirmed that the gross earnings of workers with low optimal ability ($w_U(\Theta_U^*)$) are lower, compared to the gross earnings of workers with high optimal ability ($w_S(\Theta_S^*)$).

For consistency purposes it was also confirmed that $w_U(\Theta_U^*) > 0$. The proof for this claim can be found in Appendix A.

As only the high ability individuals have incentives to invest in acquiring higher skills, total workforce (L) in the country comprises high ability, high skilled workers (L_S) and low ability, low skilled workers (L_U). Workforce in the country as a whole is therefore the following: $L = L_S + L_U$.

3.3 Firms

This part of the model takes into account heterogeneous profit-maximizing firms that differ in their level of labour productivity and decide whether to adopt a skill-intensive technology, and whether to start exporting and importing. The previous part of the model concluded that skilled workers have a higher level of ability and can hence be employed in a more productive way. This finding will be accounted for in the current part of the model, when taking into account the level of firm's labour productivity. This part of the theoretical model follows the work of Melitz and Redding (2014), Amiti and Davis (2011), Bustos (2011a and 2011b), and Melitz (2003).

3.3.1 Preferences

Following Melitz and Redding (2014), and Bustos (2011a, 2011b), this part considers two symmetric countries that engage in bilateral trade after trade liberalisation. Consumer preferences are described by a continuum of horizontally-differentiated varieties and are assumed to take the Constant Elasticity of Substitution (CES) form:

$$Q = \left[\int_0^M q(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right]^{\frac{\sigma}{\sigma-1}},$$

where ω defines a particular variety of a product, M is the number of existing varieties, and σ is a constant elasticity of substitution. The following applies: $\sigma = 1/(1-\rho)$, where ρ is a parameter which determines the constant elasticity of substitution, so that $\sigma > 1$ applies. These preferences define the following demand function for each variety ω: $q(\omega) = XP^{\sigma-1} p(\omega)^{-\sigma}$. Here, X represents the aggregate spending level of consumers, $p(\omega)$ the price of each variety, and P the price index, equal to:

$$P = \left[\int_0^M p(\omega)^{1-\sigma} d\omega \right]^{\frac{1}{1-\sigma}}.$$

3.3.2 Firm entry and exit

Following Melitz and Redding (2014), and Bustos (2011b), firms pay a sunk fixed entry cost f_X to enter an industry. After that, firms draw the level of their productivity φ from a cumulative distribution $G(\varphi)$ and with regard to this level they decide whether to exit the market or to produce.

3.3.3 Technology and factor heterogeneity

Products are produced by using a composite factor of production, L, which is composed of skilled labour (L_S) and unskilled labour (L_U). From the previous subchapter, it follows that skilled workers have a higher level of ability, which is reflected in their higher wage level $w_U < w_S$. Furthermore, following Melitz and Redding (2014), and Bustos (2011b), by paying an additional fixed cost, firms can upgrade to a high-technology level h, which is also more skill-intensive and reduces the firm's marginal costs of production. On the other hand, the low-technology level l is less skill-intensive and demands lower fixed costs for producing goods.

Total costs for low-technology firms are as follows:

$$TC_l = \left[f + \frac{q}{\phi} \right] w_S^{\beta} w_U^{1-\beta}, \tag{5}$$

where f denotes fixed costs, w_S and w_U are wages of skilled and unskilled workers, respectively, q is the level of firm's output, φ is productivity level, and $\beta \in (0,1)$ denotes skill intensity.

On the other hand, firms can invest in higher skill-intensive technology. Total costs for the latter can be defined by:

$$TC_h = \left[f\eta + \frac{q}{\gamma\phi} \right] w_S^{\alpha} w_U^{1-\alpha}, \tag{6}$$

where $\eta > 1$, $\gamma > 1$, $\alpha \in (0,1)$, and $\alpha > ß$. The model assumes that due to a smaller relative share of skilled employees in low-technology firms, who use low-technology equipment, the labour productivity in low-technology firms is lower than the labour productivity in high-technology firms. On the other hand, as a result of investing in skill-intensive technology, high-technology firms change their skill structure by employing a higher number of high ability, high skilled employees. Accordingly, the model assumes that skill-intensive technology is brought into use more productively when employing relatively more skilled individuals with high abilities. Relating to the findings from the first part, which studied the incentives for individual's skill upgrading, the model also assumes that firms with higher labour productivity have higher labour costs, as a consequence of a higher employment of skilled workers, who earn higher wages; $w_S > w_U$. Higher labour costs can therefore be considered as a proxy for higher employment of skilled workers. These assumptions are consistent with the findings of empirical studies, which confirm that bigger firms use more technology-advanced equipment, pay higher wages and employ more productive workers (Idson, & Oi, 1999). Similar characteristics have also been confirmed in trading firms, which are larger in size and more productive (Altomonte, & Békés, 2010). These conclusions are reflected in the assumption that $\alpha > ß$ (expressions (5) and (6)), when defining the total costs of low- and high-technology firms.

3.3.4 International activities of firms

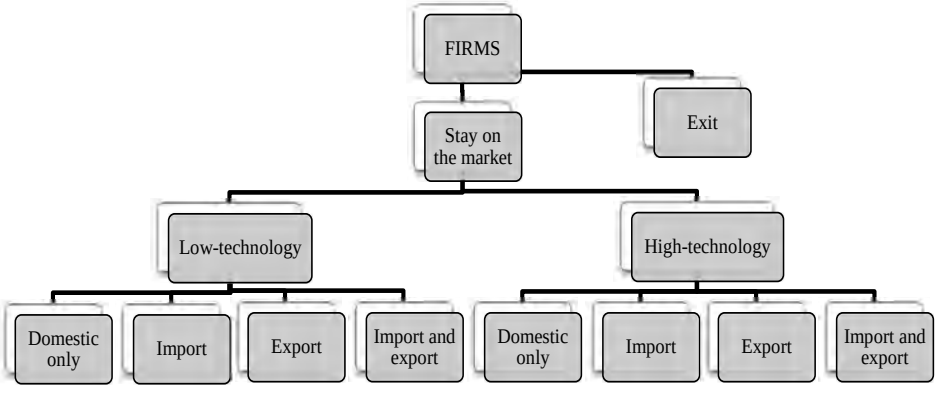
The model is built as a 2-stage model, where costs of trade decrease significantly only in the second stage, as a consequence of trade liberalisation. In the first stage, firms decide whether to invest in skill-intensive high-technology, whereas in the second stage, firms decide whether to engage in trading activities. Similarly as in Melitz and Redding (2014), and Bustos (2011b), firms decide to start exporting after realising their level of productivity, φ, and taking into account the higher costs of exporting. On the one hand, additional fixed costs of exporting, f_E, arise from establishing new sales channels, advertising, adapting to new laws and rules, etc., while on the other, firms also have to pay additional iceberg variable trade costs τ, meaning that τ number of units have to be shipped abroad in order for one unit to arrive, where $\tau > 1$ (Melitz, & Redding, 2014). For very similar reasons as in the case of exports, importing also entails higher fixed costs, denoted by f_I (Amiti, & Davis, 2011). Additional costs of exporting and importing make an assortment of the most productive firms that can afford to endure higher costs.

3.3.5 Firm behaviour

Some additional assumptions concerning costs and the change in productivity levels are made below. As introduced earlier, this model is of a two-stage type, where in the first stage, firms decide whether to invest in high-technology or not and in the second stage, after trade liberalisation, firms decide whether to engage in international activities or not. When firms start importing, they have access to cheaper technology and/or access to cheaper intermediates. It is therefore anticipated that importing increases the productivity of firms for two different reasons. First, importing intermediates allows other factors of production to be used more productively. Second, importing more affordable technology equipment in turn increases the firm's productivity. Accordingly, the level of labour productivity in firms increases after importing. The model also assumes the fixed costs of acquiring high-technology are higher than the fixed costs of importing; i.e. $f_I < f\eta$. The reason behind this assumption is that when comparing the technology level of importing low-technology firms and high-technology firms, which invest in technology within their own R&D departments, it is assumed that the increase in the productivity level will not be as big in low-technology firms that start importing, compared to the productivity increase in firms that start investing in high-technology. Although low-technology firms still have a more affordable option for increasing their level of productivity through importing, the benefits are not as high, compared to investing into developing custom-made high-technology equipment within firms. Finally, due to exporting, firms sell their products to a higher number of customers and therefore reach higher revenues.

The following paragraphs describe a two-stage model, where in each of the steps, firms decide between several options and choose the most profitable one. It is assumed that in the first stage (before trade liberalisation) importing and exporting is beyond the reach due to high costs, so firms can only choose whether to invest in higher technology or not. In the second step, after trade liberalisation, firms have an option to start importing, exporting or both. The following diagram summarises the steps of the model.

Figure 1: *The flow-chart of events in the two-stage model*



In the listed steps, firms compare several different profit options, which are described next. Following Melitz and Redding (2014), and Bustos (2011b), the market structure is of monopolistic competition type, where each firm chooses its price in order to maximise its profits. The profit maximising price is a constant mark-up over marginal costs. In the first stage, low-technology firms charge the price

$$p_l = \frac{\sigma}{\sigma - 1} \frac{w_S^{\beta} w_U^{1-\beta}}{\phi},$$

while high-technology firms charge the price

$$p_h = \frac{\sigma}{\sigma - 1} \frac{w_S^{\alpha} w_U^{1-\alpha}}{\gamma\phi}.$$

Firms compare the following two options:
a) No trade, use low technology:

$$\pi_l(\phi) = \frac{r_l(\phi)}{\sigma} - f w_S^{\beta} w_U^{1-\beta},$$

where $\pi_l(\varphi)$ are the total profits of firms with low-technology levels, φ is the level of labour productivity, and $r_l(\varphi)$ are revenues, with $r_l(\phi) = XP^{\sigma-1}\left(\frac{\sigma}{\sigma-1}\frac{w_S^{\beta} w_U^{1-\beta}}{\phi}\right)^{1-\sigma}$.

b) No trade, use high technology:

$$\pi_h(\phi) = \frac{r_h(\phi)}{\sigma} - f\eta w_S^{\alpha} w_U^{1-\alpha},$$

where $\pi_h(\varphi)$ are the total profits of firms with high-technology levels, and $r_h(\varphi)$ are the revenues, with $r_h(\phi) = XP^{\sigma-1}\left(\frac{\sigma}{\sigma-1}\frac{w_S^{\alpha} w_U^{1-\alpha}}{\gamma\phi}\right)^{1-\sigma}$.

According to Melitz and Redding (2014), firms first assess their level of productivity and upon that decide whether to stay and produce or whether to exit the market. If they stay, they maximise the level of their profits with regard to the level of their productivity. This generates a survival bound productivity φ^*, returning zero profits: $\pi(\varphi^*) = 0$.

When comparing zero-profit bounds of low- and high-technology firms in the first stage of the model; i.e.

$$\pi_l(\phi) = \pi_h(\phi) \Leftrightarrow \frac{r_l(\phi)}{\sigma} - fW_l = \frac{r_h(\phi)}{\sigma} - f\eta W_h,$$

it follows that due to the higher fixed costs of adopting new technology, only the most productive firms will be able to afford investing in high-technology. For convenience, W_l is denoted as total labour costs in low-technology firms ($W_l = w_S^{\beta} w_U^{1-\beta}$), and W_h as total labour costs in high-technology firms ($W_h = w_S^{\alpha} w_U^{1-\alpha}$). Least productive firms will therefore use low-technology. Furthermore, the exit bound productivity, φ^*, is defined by:

$$\pi_l(\phi^*) = 0 \Leftrightarrow \phi^* = Af^{\frac{1}{\sigma-1}} W_l^{\frac{\sigma}{\sigma-1}},$$

where $A = \left(\frac{\sigma}{X}\right)^{\frac{1}{\sigma-1}} \frac{1}{P\rho}$.

To get the level of productivity, above which a firm finds it profitable to invest in high-technology, φ_h, the subsequent two expressions are compared: $\pi_l(\phi_h) = \pi_h(\phi_h)$, yielding the following:

$$\phi_h = A\left[f(\eta W_h - W_l)\right]^{\frac{1}{\sigma-1}} \left(\frac{W_h}{\gamma} - W_l\right).$$

Now, it must apply that $\phi^* < \phi_h$, which is true as long as $(W_l)^{\frac{\sigma}{\sigma-1}} < (\eta W_h - W_l)^{\frac{1}{\sigma-1}} \left(\frac{W_h}{\gamma} - W_l\right)$.

The latter expression stands when the wages in high-technology firms (W_h) are significantly higher than the wages in low-technology firms (W_l). This is consistent with the findings from the first part of the paper, which concludes that higher wages signal a higher employment of skilled workers. I believe this assumption is valid as it confirms previous empirical findings that firms, which use more technology-advanced equipment, also pay higher wages, and employ more productive workers (see for example Idson, & Oi, 1999). Therefore, only the most productive firms use skill-intensive technology and upgrade skills. In addition, taking into account the last term in the upper expression $\left(\frac{W_h}{\gamma} - W_l\right)$, the relative increase in wages due to investing in higher technology has to be higher than the relative decrease in marginal costs; i.e. $\frac{W_h}{W_l} > \gamma$, which additionally emphasises the importance of higher employment of skilled workers in high-technology firms.

After trade liberalisation in the second stage, low-technology firms compare the following four options:

a) No trade, use low technology:

$$\pi_l(\phi) = \frac{r_l(\phi)}{\sigma} - f w_S^{\beta} w_U^{1-\beta},$$

where $\pi_l(\varphi)$ are the total profits of firms with low-technology levels, φ is the level of labour productivity, and $r_l(\varphi)$ are the revenues, with $r_l(\phi) = XP^{\sigma-1}(\frac{\sigma}{\sigma-1}\frac{w_S^{\beta} w_U^{1-\beta}}{\phi})^{1-\sigma}$.

b) Start importing, use low technology:

When low-technology firms start importing, their costs and productivity level increase and add up to: $TC_l^I = \left[f + f_I + \frac{q}{\gamma_l^I \phi} \right] w_S^{\beta^I} w_U^{1-\beta^I}$, where $\beta < \beta^I < \alpha$, and $1 < \gamma_l^I < \gamma$.

Introducing the factors β^I and γ_l^I enables controlling for the decrease in marginal costs and the changes of the skill structure in favour of the skilled employees after low-technology firms start importing. However, as explained above, the increase in the productivity level is not as big as it would be if the firms invested in developing the custom-made technology within their own R&D departments. Firms charge the price: $p_l^I = \frac{\sigma}{\sigma-1}\frac{w_S^{\beta^I} w_U^{1-\beta^I}}{\gamma_l^I \phi}$. Taking these facts into account, profit is as follows:

$$\pi_l^I(\phi) = \frac{r_l^I(\phi)}{\sigma} - (f + f_I) w_S^{\beta^I} w_U^{1-\beta^I},$$

where $\pi_l^I(\phi)$ are the total profits of low-technology firms that start importing, and $r_l^I(\phi)$ are the revenues, with $r_l^I(\phi) = XP^{\sigma-1}(\frac{\sigma}{\sigma-1}\frac{w_S^{\beta^I} w_U^{1-\beta^I}}{\gamma_l^I \phi})^{1-\sigma}$.

c) Start exporting, use low technology:

When low-technology firms start exporting, their costs add up to: $TC_l^E = \left[f + f_E + \frac{\tau q}{\phi} \right] w_S^{\beta} w_U^{1-\beta}$.

Consequently, firms charge the price: $p_l^E = \frac{\sigma}{\sigma-1}\frac{\tau w_S^{\beta} w_U^{1-\beta}}{\phi}$.

Taking these facts into account, the profit is:

$$\pi_l^E(\phi) = \frac{r_l^E(\phi)}{\sigma} - (f + f_E) w_S^{\beta} w_U^{1-\beta},$$

where $\pi_l^E(\phi)$ are the total profits of low-technology firms that start exporting, and $r_l^E(\phi)$ are the revenues, with $r_l^E(\phi) = XP^{\sigma-1}(\frac{\sigma}{\sigma-1}\frac{\tau w_S^{\beta} w_U^{1-\beta}}{\phi})^{1-\sigma}$.

d) Start importing and exporting, use low technology:

When low-technology firms start importing and exporting, their costs add up to: $TC_l^{IE} = \left[f + f_I + f_E + \frac{\tau q}{\gamma_l^I \phi} \right] w_S^{\beta^I} w_U^{1-\beta^I}$.

Consequently, firms charge the price: $p_l^{IE} = \frac{\sigma}{\sigma - 1} \frac{\tau w_S^{\beta^I} w_U^{1-\beta^I}}{\gamma_l^I \phi}$.

Taking these facts into account, the profit is:

$$\pi_l^{IE}(\phi) = \frac{r_l^{IE}(\phi)}{\sigma} - (f + f_I + f_E) w_S^{\beta^I} w_U^{1-\beta^I},$$

where $\pi_l^{IE}(\phi)$ are the total profits of low-technology firms that start importing and exporting, and $r_l^{IE}(\phi)$ are the revenues, with $r_l^{IE}(\phi) = XP^{\sigma-1} \left(\frac{\sigma}{\sigma - 1} \frac{\tau w_S^{\beta^I} w_U^{1-\beta^I}}{\gamma_l^I \phi} \right)^{1-\sigma}$.

When comparing the zero-profit bounds in this stage of the model, the assumption of identical countries is considered (Bustos, 2011a), from which it follows that the price index (P) and the expenditure level (X) are the same at home and abroad. First, the zero-profit bounds of low-technology firms that do not engage in international activities are compared to the bounds of those which start importing in the second stage of the model:

$$\pi_l(\phi) = \pi_l^I(\phi) \Leftrightarrow \frac{r_l(\phi)}{\sigma} - fW_l = \frac{r_l^I(\phi)}{\sigma} - (f + f_I) W_l^I.$$

For convenience, I again used the abbreviation for the total labour costs in low-technology firms (W_l) and denoted the total labour costs of importing low-technology firms by $W_l^I = w_S^{\beta^I} w_U^{1-\beta^I}$. It follows that only the most productive low-technology firms will be able to afford paying higher fixed costs of importing, while the least productive low-technology firms will continue serving the domestic market. To get the level of productivity, above which a low-technology firm finds it profitable to start importing, ϕ_l^I, one compares the subsequent two expressions: $\pi_l(\phi_l^I) = \pi_l^I(\phi_l^I)$, and gets the following:

$$\phi_l^I = A \left[f (W_l^I - W_l) + f_I W_l^I \right]^{\frac{1}{\sigma-1}} \left(\frac{W_l^I}{\gamma_l^I} - W_l \right).$$

The expression $\phi^* < \phi_l^I$ applies, as long as $f^{\frac{1}{\sigma-1}} (W_l)^{\frac{\sigma}{\sigma-1}} < \left[f (W_l^I - W_l) + f_I W_l^I \right]^{\frac{1}{\sigma-1}} \left(\frac{W_l^I}{\gamma_l^I} - W_l \right)$.

This is true when the wages in importing low-technology firms (W_l^I) are significantly higher than the wages in low-technology firms (W_l), which again signals a higher employment level of skilled workers, as follows from the first part of the model. This assumption is also valid, since the empirical data confirms that importing firms are on average larger and pay higher wages (see for example Altomonte, & Békés, 2010). In addition, taking into account the last term in the upper expression $\left(\frac{W_l^I}{\gamma_l^I} - W_l \right)$, the relative increase in wages due

to importing has to be higher than the relative decrease in marginal costs after the start of importing; i.e. $\frac{W_l^I}{W_l} > \gamma_l^I$. This statement corresponds to the initial assumption that the decrease in marginal costs due to imports is lower than it would be, should the firms invest in developing custom-made technology within their own R&D departments.

Furthermore, when comparing the zero-profit bounds of low-technology firms that do not engage in international activities and of those which start exporting in the second stage of the model:

$$\pi_l(\phi) = \pi_l^E(\phi) \Leftrightarrow \frac{r_l(\phi)}{\sigma} - fW_l = \frac{r_l^E(\phi)}{\sigma} - (f + f_E)W_l,$$

it follows that exporting low-technology firms do not invest in upgrading their skill structure nor do they invest in acquiring lower marginal costs. Therefore, since the productivity level of low-productive firms stays the same after they start exporting, low-technology firms will export only if the costs of exporting are lower than the increase in revenues after the start of exporting. However, following Melitz and Redding (2014), it is assumed that the fixed costs of exporting are too high for low-technology firms and therefore present a selection, so that only the most productive firms start exporting. As a result, firms that do not invest in acquiring a higher level of productivity – either through importing or through investing in higher technology – cannot start exporting since their productivity level is too low.

In addition, the zero-profit bounds of low-technology firms which do not engage in international activities and of those that start importing and exporting in the second stage of the model, are compared with the following expressions:

$$\pi_l(\phi) = \pi_l^{IE}(\phi) \Leftrightarrow \frac{r_l(\phi)}{\sigma} - fW_l = \frac{r_l^{IE}(\phi)}{\sigma} - (f + f_I + f_E)W_l^I.$$

In relation to the upper comparison, low-technology firms will find engaging in importing and exporting activities profitable only if the increase in revenues and productivity level is bigger than the increase in costs of exporting and importing. To get the level of productivity, above which a low-technology firm finds it profitable to start importing and exporting, ϕ_l^{IE}, the subsequent two expressions are compared: $\pi_l(\phi_l^{IE}) = \pi_l^{IE}(\phi_l^{IE})$, yielding the following:

$$\phi_l^{IE} = A\left[f(W_l^I - W_l) + (f_I + f_E)W_l^I \right]^{\frac{1}{\sigma-1}} \left(\frac{\tau}{\gamma_l^I} W_l^I - W_l\right).$$

This allows us to check when the productivity level of low-technology firms that import (ϕ_l^I) is lower than the productivity level of low-technology firms that export and import (ϕ_l^{IE}):

$$\phi_l^I < \phi_l^{IE} \Leftrightarrow \left[f(W_l^I - W_l) + f_I W_l^I \right]^{\frac{1}{\sigma-1}} \left(\frac{1}{\gamma_l^I} W_l^I - W_l\right) < \left[f(W_l^I - W_l) + (f_I + f_E)W_l^I \right]^{\frac{1}{\sigma-1}} \left(\frac{\tau}{\gamma_l^I} W_l^I - W_l\right).$$

Since $f_E > 0$ and $\tau > 1$, it follows that $\phi_l^I < \phi_l^{IE}$, when the wages in importing low-technology firms (W_l^I) are significantly higher than the wages in low-technology firms (W_l), which was already assumed. Therefore, only the most productive low-technology firms that will be able to compensate for higher exporting costs will start exporting and importing.

To sum up, after trade liberalisation in the second stage of the model, only the most productive low-technology firms choose to upgrade skills and to start exporting and importing, less productive low-technology firms only import, and the least productive low-technology firms continue serving the domestic market. On the other hand, low-technology firms will not decide to engage in exporting activities without increasing their level of productivity by importing, as their productivity level would be too low to bear exporting costs.

The model now focuses on evaluating the following four options of high-technology firms after trade liberalisation in the second stage:

a)No trade, use high technology:

$$\pi_h(\phi) = \frac{r_h(\phi)}{\sigma} - f\eta w_S^{\alpha} w_U^{1-\alpha},$$

where $\pi_h(\varphi)$ are the total profits of firms with high-technology levels, and $r_h(\varphi)$ are the revenues, with $r_h(\phi) = XP^{\sigma-1}\left(\frac{\sigma}{\sigma-1}\frac{w_S^{\alpha} w_U^{1-\alpha}}{\gamma\phi}\right)^{1-\sigma}$.

b) Start importing, use high technology:
When high-technology firms start importing, their costs and productivity level increase and add up to: $TC_h^I = \left[f\eta + f_I + \frac{q}{\gamma_h^I \phi} \right] w_S^{\alpha^I} w_U^{1-\alpha^I}$, where $\beta < \beta^I < \alpha < \alpha^I < 1$, and $\gamma_l^I < \gamma < \gamma_h^I$. Introducing factors α^I and γ_h^I enables controlling for the increase in productivity level and the changes in skill structure in favour of the skilled employees after high-technology firms start importing. In addition, firms charge the price: $p_h^I = \frac{\sigma}{\sigma-1}\frac{w_S^{\alpha^I} w_U^{1-\alpha^I}}{\gamma_h^I \phi}$. Taking these facts into account, the profit is:

$$\pi_h^I(\phi) = \frac{r_h^I(\phi)}{\sigma} - (f\eta + f_I) w_S^{\alpha^I} w_U^{1-\alpha^I},$$

where $\pi_h^I(\phi)$ are the total profits of high-technology firms that start importing, and $r_h^I(\phi)$ are the revenues, with $r_h^I(\phi) = XP^{\sigma-1}\left(\frac{\sigma}{\sigma-1}\frac{w_S^{\alpha^I} w_U^{1-\alpha^I}}{\gamma_h^I \phi}\right)^{1-\sigma}$.

c)Start exporting, use high technology:
When high-technology firms start exporting, their costs add up to: $TC_h^E = \left[f\eta + f_E + \frac{\tau q}{\gamma\phi} \right] w_S^{\alpha} w_U^{1-\alpha}$.
Consequently, firms charge the price: $p_h^E = \frac{\sigma}{\sigma-1}\frac{\tau w_S^{\alpha} w_U^{1-\alpha}}{\gamma\phi}$.

Taking these facts into account, profit is as follows:

$$\pi_h^E(\phi) = \frac{r_h^E(\phi)}{\sigma} - (f\eta + f_E) w_S^{\alpha} w_U^{1-\alpha},$$

where $\pi_h^E(\phi)$ are the total profits of high-technology firms that start exporting, and $r_h^E(\phi)$ are the revenues, with $r_h^E(\phi) = XP^{\sigma-1}\left(\frac{\sigma}{\sigma-1}\frac{\tau w_S^{\alpha} w_U^{1-\alpha}}{\gamma\phi}\right)^{1-\sigma}$.

d) Start importing and exporting, use high technology:

When high-technology firms start importing and exporting, their costs add up to: $TC_h^{IE} = \left[f\eta + f_I + f_E + \frac{\tau q}{\gamma_h^I \phi} \right] w_S^{\alpha^I} w_U^{1-\alpha^I}$.

Consequently, firms charge the price: $p_h^{IE} = \frac{\sigma}{\sigma-1}\frac{\tau w_S^{\alpha^I} w_U^{1-\alpha^I}}{\gamma_h^I \phi}$.

Taking these facts into account, the profit is:

$$\pi_l^E(\phi) = \frac{r_l^E(\phi)}{\sigma} - (f + f_E) w_S^{\beta} w_U^{1-\beta},$$

where $\pi_h^{IE}(\phi)$ are the total profits of high-technology firms that start importing and exporting, and $r_h^{IE}(\phi)$ are the revenues, with $r_h^{IE}(\phi) = XP^{\sigma-1}\left(\frac{\sigma}{\sigma-1}\frac{\tau w_S^{\alpha^I} w_U^{1-\alpha^I}}{\gamma_h^I \phi}\right)^{1-\sigma}$.

The following two expressions are considered when comparing the zero-profit bounds of high-technology firms that do not engage in international activities and of those which start importing in the second stage of the model:

$$\pi_h(\phi) = \pi_h^I(\phi) \Leftrightarrow \frac{r_h(\phi)}{\sigma} - f\eta W_h = \frac{r_h^I(\phi)}{\sigma} - (f\eta + f_I) W_h^I.$$

For convenience, the abbreviation for the total labour costs in high-technology firms (W_h) is applied, while total labour costs of importing high-technology firms are denoted by $W_h^I = w_S^{\alpha^I} w_U^{1-\alpha^I}$. To calculate the level of productivity in importing high-technology firms, ϕ_h^I, the subsequent two expressions are compared: $\pi_h(\phi_h^I) = \pi_h^I(\phi_h^I)$, yielding the following:

$$\phi_h^I = A\left[f\eta(W_h^I - W_h) + f_I W_h^I \right]^{\frac{1}{\sigma-1}} \frac{\gamma W_h^I - \gamma_h^I W_h}{\gamma_h^I \gamma}.$$

In order for this expression to be positive, $\phi_h^I > 0$, γ_h^I and γ must not be too far apart. This means that the marginal cost reduction of high-technology firms that do not engage in international activities and of those which start importing in the second stage of the model, should not differ substantially. This coincides with the assumption from the previous part of the paper, stating that importing brings lower marginal cost reduction, compared to the marginal cost reduction due to investment into high-technology. In addition, the level of

productivity of high-technology domestic firms, ϕ_h, and the level of productivity of high-technology importing firms, ϕ_h^I, is compared as well. The expression $\phi_h < \phi_h^I$ applies, as long as $\left[f(\eta W_h - W_l) \right]^{\frac{1}{\sigma-1}} (\frac{W_h}{\gamma} - W_l) < \left[f\eta(W_h^I - W_h) + f_I W_h^I \right]^{\frac{1}{\sigma-1}} (\frac{\gamma W_h^I - \gamma_h^I W_h}{\gamma_h^I \gamma})$.

The latter expression is valid when the wages in high-technology firms (W_h) are significantly higher than the wages in low-technology firms (W_l). Also, the wage level in high-technology firms should increase substantially as a consequence of importing (W_h^I). Again, following the conclusions made when studying the skill upgrading at the level of individuals, both presumptions signal a higher employment level of skilled workers and were already assumed in the previous part of the paper.

Next, the following two expressions are considered when comparing the zero-profit bounds of high-technology firms that do not engage in international activities and of those which start exporting in the second stage of the model:

$$\pi_h(\phi) = \pi_h^E(\phi) \Leftrightarrow \frac{r_h(\phi)}{\sigma} - f\eta W_h = \frac{r_h^E(\phi)}{\sigma} - (f\eta + f_E) W_h .$$

To get the level of productivity, above which a high-technology firm finds it profitable to start exporting, ϕ_h^E, the subsequent two expressions are compared: $\pi_h(\phi_h^E) = \pi_h^E(\phi_h^E)$, yielding the following:

$$\phi_h^E = A\left[f_E W_h \right]^{\frac{1}{\sigma-1}} \frac{\tau W_h}{\gamma} (1 - \frac{1}{\tau}) .$$

Since it was already assumed that $\tau > 1$, the productivity level of high-technology exporting firms will be positive; $\phi_h^E > 0$. In addition, the level of productivity of high-technology domestic firms, ϕ_h, and the level of productivity of high-technology exporting firms, ϕ_h^E, is compared as well. The expression $\phi_h < \phi_h^E$ applies, as long as $\left[f(\eta W_h - W_l) \right]^{\frac{1}{\sigma-1}} (\frac{W_h}{\gamma} - W_l) < \left[f_E W_h \right]^{\frac{1}{\sigma-1}} \frac{\tau W_h}{\gamma} (1 - \frac{1}{\tau})$. The latter expression confirms that only the most productive high-technology firms, which will be able to compensate for higher exporting costs, start exporting.

By confirming that the most productive high-technology firms engage in trading activities after trade liberalisation in the second stage due to their initial higher level of productivity, it is possible to compare the zero-profit bounds of high-technology firms that start importing and of those which start exporting in the second stage of the model:

$$\pi_h^I(\phi) = \pi_h^E(\phi) \Leftrightarrow \frac{r_h^I(\phi)}{\sigma} - (f\eta + f_I) W_h^I = \frac{r_h^E(\phi)}{\sigma} - (f\eta + f_E) W_h .$$

High-technology firms choose between the start of importing and exporting on behalf of their productivity level; high-technology firms decide to import if their productivity level is not yet high enough to start exporting, whereas more productive

high-technology firms start exporting in order to increase their revenues. This makes it possible to compare the productivity levels of high-technology firms that start importing (ϕ_h^I) and high-technology firms that start exporting (ϕ_h^E) and see that high-technology firms start importing, when the level of bound productivity is higher; i.e.

$$\phi_h^E < \phi_h^I \Leftrightarrow \left[f_E W_h \right]^{\frac{1}{\sigma-1}} \tau W_h (1-\frac{1}{\tau}) < \left[f\eta (W_h^I - W_h) + f_I W_h^I \right]^{\frac{1}{\sigma-1}} (\frac{\gamma}{\gamma_h^I} W_h^I - W_h).$$

The latter expression applies if the wage level in high-technology firms (W_h) is significantly lower than the wage level in high-technology importing firms (W_h^I): $W_h < W_h^I$, which is again a sign of a higher employment level of skilled workers. Moreover, the decision between the start of importing and exporting will depend on external factors; i.e. the cost level of importing and exporting. If the costs of importing are significantly higher than the costs of exporting, only the most productive high-technology firms will be able to afford importing. In contrast, when the opposite holds, only the most productive high-technology firms will be able to afford exporting.

The next step compares the zero-profit bounds of importing high-technology firms and of high-technology firms that start importing and exporting in the second stage of the model:

$$\pi_h^I(\phi) = \pi_h^{IE}(\phi) \Leftrightarrow \frac{r_h^I(\phi)}{\sigma} - (f\eta + f_I) W_h^I = \frac{r_h^{IE}(\phi)}{\sigma} - (f\eta + f_I + f_E) W_h^I .$$

It follows that high-technology firms will find exporting and importing profitable only if the increase in revenues will be bigger than the increase in costs of exporting. To get the level of productivity, above which a high-technology firm finds the start of importing and exporting profitable, ϕ_h^{IE}, the subsequent two expressions are compared: $\pi_h^I(\phi_h^{IE}) = \pi_h^{IE}(\phi_h^{IE})$, obtaining the following:

$$\phi_h^{IE} = A \left[f_E W_h^I \right]^{\frac{1}{\sigma-1}} \frac{\tau W_h^I}{\gamma_h^I} (1-\frac{1}{\tau}).$$

This shows when the productivity level of high-technology firms that import (ϕ_h^I) is lower than the productivity level of high-technology firms that export and import (ϕ_h^{IE}):

$$\phi_h^I < \phi_h^{IE} \Leftrightarrow \left[f\eta (W_h^I - W_h) + f_I W_h^I \right]^{\frac{1}{\sigma-1}} (W_h^I - \frac{\gamma_h^I}{\gamma} W_h) < \left[f_E W_h^I \right]^{\frac{1}{\sigma-1}} \tau W_h^I (1-\frac{1}{\tau}).$$

Again, the latter expression applies if the wage level in high-technology firms (W_h) is significantly lower than the wage level in high-technology importing firms (W_h^I); $W_h < W_h^I$. Findings from the part of the model, studying the skill upgrading at the level of individuals, again indicate higher wages being a signal of a higher employment level of skilled workers. In addition, if the costs of importing are significantly higher, compared to the costs of exporting, only the most productive firms will be able to afford the start of importing.

Finally, since the decision of high-technology firms on when to start exporting and importing depends also on external factors; i.e. the cost level of exporting and importing, the analysis from the previous paragraph has to be repeated for high-technology firms that decide between starting to export, and starting to export and import. Therefore, the zero-profit bounds of exporting high-technology firms and of high-technology firms that start importing and exporting in the second stage of the model are compared with the following expressions:

$$\pi_h^E(\phi) = \pi_h^{IE}(\phi) \Leftrightarrow \frac{r_h^E(\phi)}{\sigma} - (f\eta + f_E)W_h = \frac{r_h^{IE}(\phi)}{\sigma} - (f\eta + f_I + f_E)W_h^I .$$

From this it follows that high-technology firms find exporting and importing profitable only if the increase in the level of productivity is bigger than the increase in costs of importing. To get the level of productivity, above which a high-technology firm finds it profitable to start importing and exporting, ϕ_h^{IE}, the subsequent two expressions are compared: $\pi_h^E(\phi_h^{IE}) = \pi_h^{IE}(\phi_h^{IE})$, yielding the following:

$$\phi_h^{IE} = A\left[(f\eta + f_E)(W_h^I - W_h) + f_I W_h^I\right]^{\frac{1}{\sigma-1}} \frac{\tau}{\gamma\gamma_h^I}(\gamma W_h^I - \gamma_h^I W_h).$$

One can now check when the productivity level of high-technology firms that export (ϕ_h^E) is lower than the level of high-technology firms that export and import (ϕ_h^{IE}):

$$\phi_h^E < \phi_h^{IE} \Leftrightarrow \left[f_E W_h\right]^{\frac{1}{\sigma-1}} \tau W_h(1-\frac{1}{\tau}) < \left[(f\eta + f_E)(W_h^I - W_h) + f_I W_h^I)\right]^{\frac{1}{\sigma-1}} \tau(\frac{\gamma}{\gamma_h^I}W_h^I - W_h).$$

The latter expression applies if the wage level in high-technology firms (W_h) is significantly lower than the wage level in high-technology importing firms (W_h^I), which again signals a higher employment level of skilled workers after importing. Concerning external factors, if the costs of importing are significantly high, only the most productive high-technology firms will be able to engage in both, exporting and importing.

To sum up, after trade liberalisation in the second stage of the model, only the least productive high-technology firms serve only the domestic market, where the decision on whether to start importing, exporting or both depends on the level of wages before and after importing, on the firm's productivity level and on external factors; i.e. the level of export and import costs. Interestingly, when high-technology firms decide whether to start exporting or not, the final decision is not based on the wage level of high-technology non-trading firms and high-technology exporting firms. Making inferences from the first part of the paper which studied the skill upgrading at the level of individuals, this would be a sign of a higher employment level of skilled employees. Therefore, skill upgrading occurs only in firms that import or firms that engage in both; importing and exporting.

4. CONCLUSION

The theoretical models of trade have been evolving through history in a desire of a thorough interpretation of international flows. Recent theoretical trade models account for

firm heterogeneity, and also for technology and skill upgrading. Guided by these theories, I developed a theoretical model, which explores the individual's decisions for investing in skill upgrading and the firm's decisions to start technology upgrading and trading.

The model in this paper is divided in two parts. First part explores the behaviour of individuals and their decisions on whether to invest in acquiring higher skill levels. The findings suggest that since the education costs of low ability workers for acquiring higher skills are excessive, only high ability workers achieve higher skill levels. In addition, in order to have incentives for acquiring higher skills, high ability, high skilled workers demand higher wages after entering employment. The latter conclusion is then brought into use in the second part of the model, which takes into account the firm's decisions on whether to invest in higher technology and whether to engage in international activities. The model suggests that before trade liberalisation, only the most productive firms invest in acquiring higher technology levels, where higher labour costs of these firms signal a higher employment level of skilled workers. After trade liberalisation, costs of importing and exporting diminish and firms have an option to start engaging in international activities. Taking into account low-technology firms first, the most productive low-technology firms choose to skill upgrade and to start exporting and importing, less productive low-technology firms also upgrade skills but start only importing, and the least productive low-technology firms continue serving only the domestic market. Low-technology firms therefore use importing as means of increasing their productivity level before the start of exporting. This finding on learning-by-importing was confirmed also in empirical studies (see for example Damijan, & Kostevc, 2015; and Altomonte, & Békés, 2010). On the other hand, low-technology firms do not engage exclusively in exporting, as their productivity level is too low to cover exporting costs. With regards to high-technology firms, only the least productive high-technology firms do not start importing and/or exporting after trade liberalisation, where the decision on whether to import, export, or both, depends on the firm's productivity level, the skill upgrading before and after importing, and on external factors; the level of export and import costs. Skill upgrading in high-technology firms after trade liberalisation takes place only in firms that start importing, or that start engaging in both, importing and exporting.

The model highlights several facts, which would be noteworthy of further empirical testing. One could empirically analyse the following findings of the theoretical model: (i) firms with better skill structure also start importing; (ii) importing firms have a better skill structure than non-importing firms; and (iii) by having an access to cheaper technology and/or to cheaper intermediates, imports serve for increasing the technology level before the start of exporting.

The key contributions of this model are a differentiation between importers and exporters and a thorough analysis of the behaviour of individuals and firms, where the connection between the two has been made by linking fragments of models on the individual's and the firm's behaviour. The possible limitations of the model present additional assumptions, which had to be made when developing the model; e.g. the increase in the wage level of skilled workers after investing in high technology ($\frac{W_h}{W_l} > \gamma$), and after the start

of importing ($\frac{W_I^I}{W_I} > \gamma_I^I$), compared to the decrease in the marginal costs in these firms. Furthermore, the model also assumes that the productivity level increase after importing is lower compared to the productivity level increase after investing in high-technology. These additional assumptions to some extent limit the value of the model, as it would be hard to test them empirically. In addition, although the model considers three dynamic phase shifts; i.e. the individual's decision to acquire skills, the firm's decision to opt for high technology, and the firm's decision to start importing and/or exporting, it is limited in discussing only two firm's decisions simultaneously (e.g. high-technology vs. low-technology, no trade vs. importing, etc.). Since nowadays firms face the changing environment which demands complex decision-making on a daily basis, this structure of the model would be limited to transform in everyday environment. Although losing a more static structure of the model would greatly increase its complexity, this limitation would be useful to be taken into account in further studies. Nevertheless, despite the aforementioned shortcomings, I believe the model's conclusions bring contributions to the field of knowledge, since the conclusions are also consistent with previous empirical findings and open several possibilities for further empirical analyses.

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APPENDICES

Appendix A

Claim 2: The gross earnings of rational individuals with the low ability are positive (i.e. $w_U(\Theta_U^*) > 0$).

Proof: Consider rational workers, who maximize their gross earnings and therefore achieve the optimal level of ability:

$$w_U(\Theta_U^*) = \lambda[\ln(\lambda / k_U)] - k_U\,[(\lambda / k_U) - 1].$$

After simple calculation, one gets the following:

$$w_U(\Theta_U^*) = \lambda[\ln(\lambda) - \ln(k_U) - 1] + k_U.$$

Knowing the following inequality holds: $\lambda > k_U > k_S > 1$, it follows that $w_U(\Theta_U^*) > 0$. ▪

CAN OVERSIGHT MITIGATE AUDITOR'S MOTIVATED REASONING? AN EXPERIMENTAL STUDY*

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ABSTRACT: *Evidence of auditors' failure to provide an independent opinion has reopened debates on measures to ensure auditor independence. We examine the effectiveness of oversight on two prominent determinants of auditor's biased opinion – financial incentives and a personal relationship with the client. We conduct a between-subject experiment involving an accounting choice task. We find a significant effect of a personal relationship on the auditor's choice after controlling for financial incentives. Oversight has a significant negative effect on auditor's choice arising from financial incentives, whereas a personal relationship significantly reduces the effectiveness of oversight. Our results show that, in addition to oversight, other solutions that break up personal ties are needed to ensure auditor independence.*

Keywords: *auditing, bias, financial incentives, motivated reasoning, oversight, personal relationship*
JEL Classification: M48, M42
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1. INTRODUCTION

The recent global financial crisis has shaken users' confidence in financial statements (Sikka, 2009; Richard, 2008). Sikka (2009) reports that many distressed financial institutions in different countries received unqualified audit opinions on their financial statements just prior to publicly declaring financial distress. Prior to the financial crisis, the accounting profession underwent a profound regulatory reform in the U.S. (Sarbanes-Oxley Act of 2002) as well as in the EU (Directive 2006/43/EC). One of the most radical measures of the reforms was the introduction of public oversight. It was expected that effective public oversight would mitigate the negative effects of auditor dependence. Recent evidence shows that the quality of auditing and the quality of financial reporting have improved

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since the Sarbanes-Oxley Act was passed (DeFond & Lennox, 2011; Carcello et al., 2011; Chambers & Payne, 2011).

In spite of these positive developments, new regulatory debates have been initiated due to a continuing concern that the last regulatory changes did not succeed in effectively enforcing auditor independence and mitigating the vital drivers of an auditor's conflict of interest. The issue of audit tenure was revisited by the European Commission Green Paper (2010: 11), where the Commission recognised that "*situations where a company has appointed the same audit firm for decades seem incompatible with desirable standards of independence*".

The reason that audit firm rotation debates have regained relevance lies in the essence of the threat to auditor's independence. Although several studies provide evidence of a positive relationship between audit firm tenure and audit quality (Myers et al., 2003; Johnson et al., 2002; Geiger & Raghunandan, 2002; Carcello & Nagy, 2004; Ruiz-Barbadillo et al., 2009), explaining it with the learning process, a number of other studies point out that auditors are inclined to serve their client's interests, in particular in long-lasting relationships with ambiguous accounting choices (Hackenbrack & Nelson 1996; Kadous et al., 2003; Shafer et al., 2004; Blay, 2005; Kadous et al., 2008; Moore et al., 2010, Chu et al., 2011). As argued by Callao and Jarne (2010), the scope for ambiguity has increased with the adoption of IFRS in Europe. A biased judgment arises from an interpersonal auditor-client relationship which makes an auditor hesitant to act with professional rigor in order not to impair the relationship with the client (Johnstone et al., 2001). Some scholars believe that in order to restore the integrity of the audit function audit firms (not just lead auditors) should work on a contract for a fixed number of years (Bazerman & Moore 2011: 310)[4].

The aim of our study is to shed more light on the intentionality of auditor bias. Financial incentives and a personal relationship create so-called directional goals that elicit motivated reasoning (Kunda, 1990). These goals drive individuals to process information in a biased manner, seemingly achieving objective support for the desired goal (Kunda, 1990; Blay, 2005). One of the controversies of motivated reasoning lies in the question of whether it occurs intentionally (consciously) or unintentionally (i.e. without awareness). As stressed by Bazerman et al. (2006), the distinction of the intentionality of the bias is key to regulatory intervention not only because such a distinction offers an insight into the effectiveness of various prevention measures, but also because it is only intentionality that gives grounds for legal charges.

While Kunda (1990) and Nelson (2005) propose that people are not aware that their information processing is biased by their goals, empirical evidence in accounting settings suggests that professionals are sensitive to high practice risks (Farmer et al., 1987; Lord, 1992; Blay, 2005; Kadous et al., 2008). Such sensitivity implies that this bias is, at least to some extent, deliberate. As biases are hard to observe with standard research methodology, the studies do

4 In April 2014, after four years of discussions, the EU adopted mandatory audit firm rotation for public-interest entities. This calls for a mandatory audit firm rotation after 10 years of audit firm engagement with an option of prolongation for another 10 years when specific criteria are met (Regulation 537/2014 of the European Parliament and of the Council on specific requirements regarding statutory audit of public-interest entities).

not distinguish which of the two conditions – financial incentives or personal relationship – accounts for each type of bias. Most studies investigate either financial incentives (Farmer et al., 1987; Lord, 1992) or personal relationships (Blay, 2005; Bamber & Iyer, 2007), whereby the motives arising from a personal relationship may also be trimmed down to financial dependence. Although biases arising from a personal relationship have been investigated in (social) psychology (Milgram, 1974; Neuberg & Fiske, 1987; Kunda, 1990), corporate governance (Morck, 2008) and auditing (Bamber & Iyer, 2007; Moore et al., 2010), they are much less understood. To the best of our knowledge, the only study to simultaneously analyse the effects of financial incentives and a personal relationship on auditor choice is by Moore et al. (2010). The authors suggest that a personal relationship elicits non-conscious bias. Although the results of their experimental study do not confirm such a hypothesis, they show that auditors are inclined to serve their client and that they cannot entirely de-bias their actions.

Without neurological analysis it is difficult to discern conscious bias from non-conscious bias. To some extent, however, their presence may be observed behaviourally by varying the auditor's practice risk. The auditor's tendency to serve the client's preferences decreases with increasing practice risk such as a loss of reputation, litigation costs or licence withdrawal (Bauwhede & Willekens, 2004; Hope & Langli, 2010). The absence of practice risk is a limitation of the Moore et al. (2010) study. Our study advances their analysis by proxying for practice risk in the form of public oversight. Assuming that individuals are not aware of non-conscious bias, public oversight is expected to only mitigate conscious bias, while non-conscious bias should remain largely unaffected. Our results largely confirm our hypotheses. We find that a personal relationship affects the subject's actions beyond financial incentives. The relevance of a personal relationship becomes evident in the interaction with the exposure of subjects to the oversight. A personal relationship significantly offsets the mitigating effect of oversight on auditor's support for a client's preference.

The paper provides the following contributions to the literature. First, it adds to the theory of motivated reasoning and the relatively scarce empirical evidence of bias that arises in a personal relationship after controlling for financial incentives. Second, by studying the simultaneous effects of financial incentives, a personal relationship and the oversight risk, it advances previous findings and allows for a differentiation between biases that can or cannot be mitigated by the introduction of oversight. Finally, the finding that a personal relationship significantly diminishes the effect of oversight may hold important implications for the debate on audit firm rotation, as well as corporate governance in general. Despite the fact that after four years of debates the EU regulation (Regulation 537/2014) has not introduced any form of effective audit firm rotation, our findings suggest that mechanisms to counter familiarity remain important. Their enforcement continues to lie in the hands of the decision-makers involved in the auditor appointment process (audit committees and boards of directors).

2. THEORETICAL BACKGROUND AND HYPOTHESES DEVELOPMENT

Auditor independence is considered a vital determinant of the integrity of financial reporting (Spira, 1999). Lee and Gu (1998: 534) define it as "*the absence of collusion between*

the auditor and the manager of the client firm". Although the auditors are expected to subordinate their self-interest in favour of the public interest, different threats to auditor independence and their impact on earnings management have been thoroughly investigated in the accounting and auditing literature. While agency theory stresses intentional distortions, behavioural literature points out that auditor bias arises from the cognitive limitations of individuals (Blay, 2005; Kadous et al., 2008).

Kadous et al. (2003) explain the mechanisms of auditor decision-making with emotion-based motivated reasoning. When a person perceives that his or her outcome depends in some way on the actions taken by another person, such outcome dependency creates a directional goal. A directional goal, in turn, influences the cognitive process of reasoning by affecting the type of information that someone will consider, its evaluation and interpretation. As Kunda, the author of the motivated reasoning account, explains, the confusing fact is that a person is able to provide evidence to support his or her (biased) decision without realising the bias: "*The objectivity of this justification construction process is illusory because people do not realize that the process is biased by their goals, ... they might even be capable of justifying opposite conclusions on different occasions*" (Kunda, 1990: 486). In the audit setting, the more auditors aspire to benefit from their support for their client's preferences, the more likely it is that they will find sufficient evidence and interpret it in a way that is aligned with the client's preferences.

A necessary condition for motivated reasoning is the ambiguity of the choice. If the preferred choice cannot be seemingly objectively justified, individuals will not take it, regardless of their commitment to a directional goal (Kunda, 1990).

Two major conditions that create directional goals in auditing are contingent financial incentives and a personal relationship with the client (Nelson, 2005, 2006; Blay, 2005; Moore et al., 2010). The client's ability to influence auditor reporting decisions is stronger if the incumbent auditor perceives the client as a source of perpetual annuity (Gul, 1991; Seabright et al.,1992; Acemoglu & Gietzmann, 1997; Ruiz-Barbadillo et al., 2009).

To promote independence and disconnect auditors from the interests of the management, auditors receive a fixed fee for their services. Nevertheless, their financial incentive is implicitly variable. The nature of the auditor-client relationship creates a variable fee structure in the sense that a long audit tenure increases labour productivity as the auditor is increasingly more familiar with the client's business and lower audit engagement is needed to perform an audit.

Overall, the stronger the auditor's support for the client's preferences, the more likely is the extension of the contract to future years. Johnstone et al. (2001) suggest that contingent fees (i.e. an implicit promise of future rents dependent on the auditor's support for the client) directly threaten auditor's independence. Hence, we propose the following hypothesis:

H1: Financial incentives increase the probability of the auditor's support for the client's preferences.

An alternative and/or complementary venue that affects biased decision-making is the nature of the relationship between the auditor and the client. Existing literature suggests different

drivers of a personal relationship on decision choice. Rennie et al. (2010) indicate that continuity of the auditor–client relationship results in a closeness between auditors and their clients and that it is positively related to the auditor's trust in a client. Bamber and Iyer (2007) report that auditors who identify more closely with a client are more likely to consent to the client-preferred position. Similarly, Nelson (2009) and Johnstone et al. (2001) report that identification with a client leads to a low professional scepticism Neuberg and Fiske (1987) report that outcome dependency enhances the probability of a target person (i.e. a client) being liked. Liking somebody introduces emotions into the decision-making process that is no longer based purely on rational behaviour.

An alternative explanation of the influence of a personal relationship on choice can be drawn from the field of social psychology, in particular from the work of Milgram (1974). He argues that humans have an instinctive predisposition for loyalty, an impulse to obey authority. Building on the work of Milgram (1974), Morck (2008) points out the predisposition of individuals for excessive loyalty (obedience) to the principal in the field of corporate governance. Excessive loyalty depends on the nature of the personal relationship between the agent and the principal. Applied to the lasting relationship between non-executive directors and executive managers, Morck (2008) spotlights the phenomenon of a so-called agentic shift according to which non-executive directors become excessively subservient to executive managers due to a different effective distribution of power than what is formally defined. Parallels can be drawn to the relationship between the auditor and executive manager who may be seen by an auditor as a principal (authority). Shafer et al. (2004), for example, provide evidence that auditors consider it perfectly appropriate to align their judgment regarding choices of accounting principles with that of their clients.

Related to the effects of a personal relationship on a subject's choice, we hypothesise that:

H2: A personal relationship increases the probability of the auditor's support for the client's preferences.

The two drivers inducing auditor bias are, however, essentially different. The preferences influence decision-making in various ways, some of which the decision-maker (auditor) may have some insight into, but for many he does not. A cue to bias awareness may be obtained by varying auditor practice risk and by simultaneously estimating how it interacts with both drivers of bias. A regulatory measure in the form of public oversight of auditors is supposed to represent such a practice risk. The oversight may result in litigation costs, licence withdrawal and negative reputation effects (all leading to the loss of future business). Prior experimental studies unanimously show that, while serving their clients, auditors and tax advisors are sensitive to the variation of risks that might threaten their own interests (Farmer et al., 1987; Lord, 1992; Hackenbrack & Nelson, 1996; Cloyd & Spilker, 1999; Kadous et al., 2003; Shafer et al., 2004; Blay, 2005; Kadous et al., 2008). However, the susceptibility of auditors to different drivers of bias is not explicitly addressed. This distinction is important as the oversight is more likely to reduce the bias that an individual is aware of, but less likely to mitigate the bias of which an individual is unaware of.

A closer examination of manipulation conditions in previous research shows that a personal relationship only captures the financial incentive dimension, rather than the affec-

tive processes innate in long-lasting relationships. None of the studies has attempted to separate the financial and affective underpinnings of a personal relationship. Consequently, the finding that an auditor's support for a client's preferences could be effectively mitigated by introducing high practice risk may be attributable to the fact that the bias arose from financial incentives alone. However, the affective component of bias that arises from a personal relationship may be more resistant to oversight. We propose that oversight has a weaker impact on bias arising from a personal relationship (after controlling for financial incentive) because the auditor is not completely aware of that bias.

In sum, based on prior findings we conjecture that oversight has a significant mitigating effect on choices arising from financial incentives. We suggest that this effect occurs because financial incentives are predominantly conscious. In line with the literature on personal relationships, developing affection for a person may be largely non-conscious. We therefore predict that bias arising from a personal relationship is less effectively mitigated by oversight. In other words, it reduces the effectiveness of oversight.

Hence, we propose the following hypothesis:

H3: The mitigating effect of oversight on auditor's choice is more pronounced when that choice is motivated by financial incentives and less pronounced when the choice is affected by a personal relationship.

3. EXPERIMENTAL SETTING

Participants. We analysed the hypotheses experimentally with a two-by-two-by-two, between-subjects design that involved a choice task. For this purpose, we recruited 312 students of the Faculty of Economics, University of Ljubljana. Subjects assumed the roles of auditors (217 students) or clients, i.e. Chief Financial Officers (95 students). Subjects playing the role of clients were used to create the atmosphere of auditor-client familiarity. To motivate the participants, we set up a compensation scheme in which they could earn between EUR 0 to EUR 6. Their expected compensation was EUR 3 for half an hour of activity, which roughly represents the average hourly rate for student work. We recruited senior undergraduate (90%) and graduate (10%) accounting and finance students in order to assure that they were familiar with the task. Nevertheless, we had to exclude 12 subjects in the role of auditors from our final sample due to their answers provided in the manipulation checks. The final number of subjects in the role of auditors was 205 (44% female, average work experience 2.8 years).

Procedure. The subjects in the role of auditors were either seated alone or matched in pairs with the subjects who assumed the role of the CEO of the client. The auditors were presented with the task of making a decision regarding the value of an asset on the company's balance sheet. They could either approve the high valuation of the asset, as proposed by the client, or choose an alternative (lower) valuation, which was not in their client's interest. Clients were given the same scenario with the task to persuade the auditor to approve the valuation in their interest. Two alternative values of the investment were measured with a valuation model. In the first model, a more realistic assumption about the growth of cash flows was used, which

produced a lower value of the investment. In the second model, a very aggressive assumption about the future growth of cash flows was incorporated, yielding a higher value of the asset in favour of the client. In the first five minutes of the experiment, the auditor-client pairs were instructed to discuss personal matters in order to create an atmosphere of familiarity. They then read the case and learned their task. In the next ten minutes they were asked to discuss the valuation and the auditor's decision. After the discussions the auditors indicated their decision. The client's reward was calculated on the basis of the auditor's response. In the subgroup without the presence of the client the auditors took their decisions without any client interaction. Finally, following the experimental task, the participants completed an exit questionnaire with manipulation checks and demographic questions.

As a robustness check, we measured the difference in decision-making with a question in which the task was repeated, but where the role of the participants was changed from auditors to investment advisors (adopted from Moore et al., 2010). According to Lord et al. (1984), subjects are unable to de-bias their choice even if they are told to be objective. A person can effectively undo the bias only if asked to consider the choice from another perspective or another personal role.

Design. The experiment had a two (personal relationship: anonymous vs. personal) by two (financial incentive: fixed fee vs. 'variable' fee) by two (oversight: 50% probability of oversight, no probability of oversight) between-subjects factorial design. Subjects in the role of auditors were randomly assigned to eight groups. We manipulated the experimental conditions in following ways. In the condition of an anonymous client, auditors received instructions and completed their decision individually in the absence of any interaction with other participants. In the condition of a personal relationship with the client, we set out to match auditors and clients. We asked participants to pair with those people they know best.

In the fixed fee condition, the auditors were paid a fixed fee of EUR 2 regardless of their decision. In the 'variable' fee condition, the auditors received a EUR 2 fixed fee if they supported the valuation which was not in the interest of their client, but based on more realistic assumptions. In addition, they could earn another euro as the present value of future business with the company if they supported the valuation the client preferred. In total, they could receive EUR 3 for this decision. Clients received EUR 2 in compensation if the auditor disagreed with their valuation and EUR 3 if the auditor agreed to the valuation based on the aggressive assumption of growth. The extra compensation for the clients was based on the bonus they were set to receive if the profits of their company were above a certain threshold. In order to achieve that, an auditor had to agree to the higher valuation of the asset on the audited company's balance sheet. The compensation scheme for clients was therefore designed to correspond to the compensation scheme for auditors and to make them eager to convince agents to support the valuation in their interest.

Oversight was manipulated in the following way: subjects in the no-oversight condition were assured that no oversight would take place. Those in the oversight condition were told that it was possible that their audit would be subject to regulatory oversight. The probability that the oversight would take place was 50%. If they had approved the lower value of the asset, the oversight authority would not have opposed their opinion. If they had approved the higher

value of the investment, it is certain that the oversight authority would have disagreed with their decision and the penalty would have been applied.

The financial incentives in the future business condition and the oversight condition were composed of a EUR 2 fixed fee and an additional EUR 4 if approving the higher value of the investment. Under both incentive schemes – fixed fee and future business – the compensation would be zero if the auditor supported the client's choice and the oversight took place. In the future business condition, the expected value of the total compensation in the oversight condition was kept equal to the expected value of the compensation in the no-oversight condition.

As soon as the auditors made a choice in the oversight condition, a random number drawn by a computer mimicked whether the oversight had taken place or not. This determined the value of the auditor's compensation given their valuation choice. Clients were paid based on the valuation choice and were not penalised if the oversight had disapproved of the auditor's decision. The auditor payoffs under the different schemes are presented in Table 1.

Table 1: *Auditor payoff under all schemes*

Variable No oversight	Fixed No oversight	Variable Oversight	Fixed Oversight
2+1	2	2+4 (50%), 0 (50%)	2 (50%), 0 (50%)

4. RESULTS

We first analysed the mean values of the choices made by the subjects across subgroups by computing the predicted means. In Table 2 we present the proportions of decisions for a high valuation under the different incentive, relationship and oversight conditions.

Table 2: *Decision by two-by-two-by-two groups. Numbers represent proportion of high valuations.*
Difference represents t-test of proportion differences. n=205

		No oversight		**Oversight**		**Difference**	
Incentive	**Relation**	**Anonymous**	**Personal**	**Anonymous**	**Personal**		
		1	2	3	4	3-1	4-2
Fixed	mean	35.5%	55.0%	11.1%	48.3%	-24.4% **	-6.7%
	std. dev.	48.6%	51.0%	32.0%	50.9%		
	n	31	20	27	29		
Variable	mean	64.0%	72.2%	18.5%	71.4%	-45.5% ***	-0.8%
	std. dev.	49.0%	46.1%	39.6%	46.0%		
	n	25	18	27	28		

*** denotes significance at the level below 0.01, ** denotes significance at the level below 0.05

We first look at the results without the presence of oversight (columns 1 and 2 in Table 2). The results show that 35.5% of the subjects in the fixed fee condition and an anonymous relationship decided to approve the valuation in favour of the client, whereas in the variable fee condition and an anonymous relationship this proportion increased to 64.0%. Further, 55.0% of the subjects chose the valuation in favour of the client in the personal relationship and fixed fee condition, while the percentage rose to 72.2% in the combined condition of a personal relationship and variable fee. The results show that the effect of the type of relationship on the decision is stronger in the absence of contingent compensation – i.e. in the condition of fixed pay. The proportion of decisions favourable to the client increases by roughly 20 percentage points (55.0%–35.5%) in the case of fixed pay compared to an increase of around 8 percentage points in the case of variable pay (72.2%–64.0%).

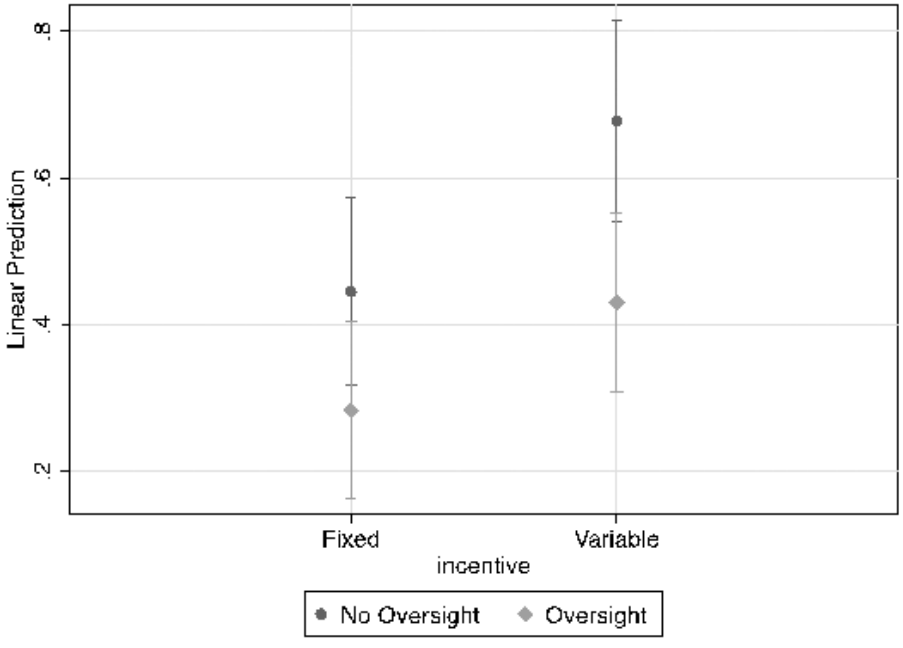
Next, we look at the results in the presence of oversight (columns 3 and 4 in Table 2). The share of subjects who chose the valuation in favour of the client in the fixed fee condition without oversight amounted to 35.5%, whereas in the oversight condition it was just 11.1%. The difference of 24.4 percentage points is statistically significant. In the variable fee condition without oversight, 64.0% of subjects chose the higher valuation, while in the same condition with the presence of oversight the proportion dropped to 18.5%. Again, the difference of 45.5 percentage points is statistically significant.

Contrary to these results, the effect of oversight is much less pronounced in the case of a personal relationship. The share of subjects who selected the valuation in favour of the client was somewhat smaller in the fixed pay and personal relationship conditions in the presence of oversight, but the difference of 6.7 percentage points is not statistically significant. Interestingly, oversight had no effect in the condition of a personal relationship and variable pay.

The results clearly show that the oversight affects the decisions made by the subjects. However, the effect of the oversight has only a significant impact on the decision in the anonymous relationship condition, which leads us to believe that the oversight is able to mitigate the effect of financial incentives, but has little or no effect when it comes to a personal relationship.

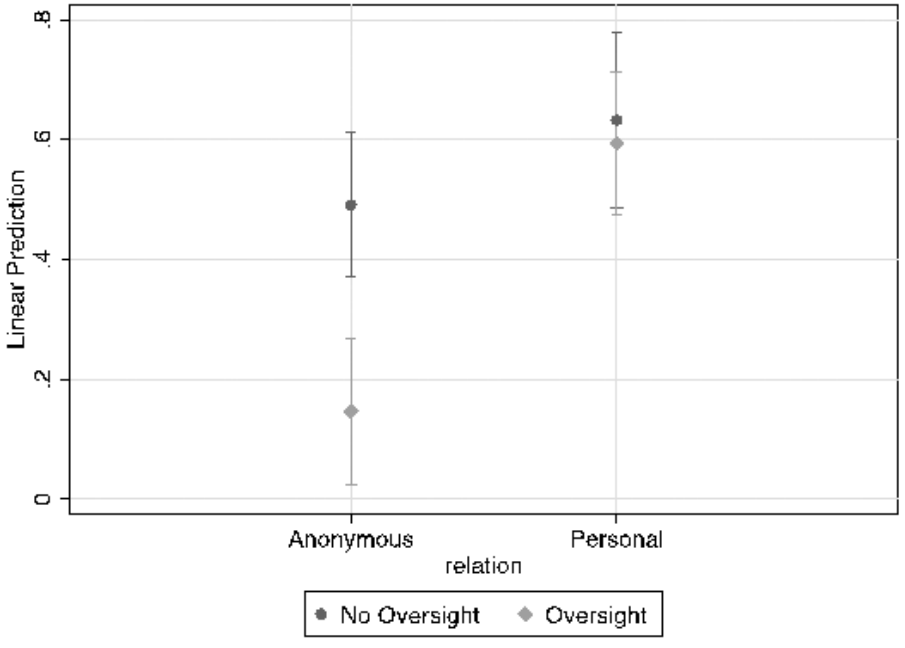
In Figures 1 and 2 we illustrate the effect of oversight on decisions made by the subjects in the financial and relationship conditions by estimating marginal effects of the introduction of the oversight. By doing so, we further investigate the channel through which the effect of oversight takes place.

Figure 1: *Financial Incentive by Oversight plot for Decision (High Valuation=1) with and without Oversight.*



The oversight should have a minimum effect in the fixed fee condition as this condition does not give any incentive to support the client's preferences. However, the results presented in Figure 1 surprisingly demonstrate a large impact of the oversight in both financial conditions: with the fixed fee the share of subjects choosing the higher valuation amounts to 44.5% in the no-oversight condition compared to 28.3% in the oversight condition. With the variable fee in the no-oversight condition, this share amounts to 67.8% compared to 43.0% in the oversight condition. In the figure we also show 95% confidence interval of the linear prediction and, as observed, albeit the mentioned difference seems large, it is not statistically significant. Note that the effect of joint conditions when estimating predictive margins or marginal effects (fixed and variable) in the personal relationship is presented such that the reported means are not directly comparable to those shown in Table 2. The results suggest that subjects who supported the client preference did so not only due to the financial incentives but also due to incentives arising from the personal relationship.

Figure 2: *Personal Relationship by Oversight plot for Decision (High Valuation=1) with and without Oversight.*



In Figure 2 we present the effect of the oversight on decision incentives arising from a personal relationship. Like before, we observe a large difference in the percentage of subjects choosing the higher valuation in the condition of an anonymous relationship: the share of higher valuation choices amounts to 49.1% in the no-oversight condition and 14.7% in the oversight condition (note that here the difference is also statistically significant). In the personal relationship condition, the presence of oversight makes almost no difference: the share of auditors choosing the higher valuation is 63.2% in the no-oversight condition compared to 59.3% in the oversight condition.

In line with the predictions in Hypothesis 3, oversight seems to influence the subjects' decision mostly through its effect on financial incentives, while its effect seems to be much weaker in the personal relationship condition.

To confirm the bivariate results we perform logistic regressions where a dependent variable is a decision. The results are presented in Table 3.

Table 3: *Logistic Regression. Dependent Variable: Decision (High Valuation=1). n=205*

Dependent Variable Decision	**Coef.**	**Mfx**	**SE**	**Sig.**		**Coef.**	**Mfx**	**SE**	**Sig.**	
incentive	0.898	0.219	0.313	0.004	***	1.010	0.244	0.438	0.021	**
relation	1.429	0.341	0.322	0.000	***	0.620	0.151	0.447	0.165	
oversight	-0.981	-0.239	0.324	0.002	***	-1.718	-0.401	0.607	0.005	***
*incentive*oversight*						-0.152	-0.037	0.637	0.811	
*relation*oversight*						1.610	0.382	0.663	0.015	***
intercept	-0.778	N/A	0.296	0.009	***	-0.525	N/A	0.337	0.120	

*** denotes significance at the level below 0.01, ** denotes significance at the level below 0.05; Mfx stands for marginal effects and SE for robust standard errors.

The financial incentive condition takes the value of 0 for a fixed fee and the value of 1 for a variable fee. The personal relationship condition takes the value of 0 for an anonymous relationship and the value of 1 for a personal relationship. Similarly, oversight takes the value of 0 in the no-oversight condition and the value of 1 in the oversight condition. We present two separate specifications. In the first specification, we do not include interaction terms between the main conditions and the oversight, while in the second specification we add the two interaction terms.

The results of the basic model are in line with our expectations in Hypotheses 1 and 2. Financial incentive significantly positively affects the probability of choosing the higher valuation (i.e. the one in the client's interest) (a coefficient of 0.898 and marginal effect of 0.219[5]). Personal relationship also has a significant positive effect on the probability of choosing the higher valuation (coefficient of 1.429 and marginal effect of 0.341). Oversight has a significant negative effect on the probability of choosing the higher valuation (coefficient of -0.981 and marginal effect of -0.239).

However, as implied by the bivariate results, oversight seems to have a differential impact on the two drivers that we regard as proxies for conscious and non-conscious bias. To analyse its impact (Hypothesis 3), we add two interaction terms (incentive*oversight and relation*oversight) to the basic specification. The results of the extended model show that the significant positive effect of the financial incentive on the probability of choosing the higher valuation persists (a coefficient of 1.010 and a marginal effect of 0.244). The same holds for the negative effect of the oversight – i.e. a reduced probability of choosing the higher valuation (a coefficient of -1.718 and a marginal effect of -0.401). However, we now find no significant effect of a personal relationship on the decision. Moreover, the interaction term between a relationship and the oversight has a significant positive effect (a coefficient of 1.610 and marginal effect of 0.382) that almost entirely offsets the negative effect

5 Marginal effect is the change in probability of choosing a high valuation as opposed to a low valuation when the value of a binomial independent variable (incentive, relation and/or oversight, as well as interaction terms) changes from 0 to 1.

of the oversight on a stand-alone basis. This result corroborates our previous findings that the oversight impedes the financial incentive channel, but has very little if no effect on the relationship channel. We interpret this finding as providing evidence to support our third hypothesis about the stronger effect of oversight on financial incentives than on a personal relationship.

As a robustness test, we investigate the decisions taken by the subjects when playing a different role in the experiment. In one of the exit questions the subjects were asked to indicate the value of the investment if they were in the role of experts advising an investor. In other words, they were asked what they really thought the true value of the asset was.

Table 4: *Difference in the decision taken in the role of auditor and expert with and without presence of the oversight (n=203, two missing values)*

	Number	**Percent**	**Number**	**Percent**
	No oversight		***With oversight***	
		No Bias		
As auditor "60", as expert "60"	33	35.5%	39	35.5%
As auditor "60", as expert "50"	10	10.8%	22	20.0%
		Conscious Bias		
As auditor "80", as expert "50"	17	18.3%	15	13.6%
As auditor "80", as expert "60"	23	24.7%	12	10.9%
		Non-conscious Bias		
As auditor "80", as expert "80"	10	10.8%	14	12.7%
		Other		
As auditor "60", as expert "80"	0	0.0%	8	7.3%
Total	93	100.0%	110	100.0%

Note: 50, 60 and 80 refer to low or high valuation of the company in the scenario.

In Table 4 we compare the responses given in the role of experts to the responses given in the role of auditors in both the conditions with and without the oversight. We denote the responses where the subjects as experts chose a lower value than they actually chose as auditors as 'conscious bias'. This indicates that the subjects were aware of a different value of the asset that they provided in a different role. We observe that 43% of the subjects provided a higher value as auditors in the no-oversight condition than they did as experts and only 24.5% of subjects did so in the oversight condition. In addition, we observe that 46.3% of the subjects do not seem to exhibit any bias in the no-oversight condition, while the percentage of no bias is 55.5% in the oversight condition. Finally, we characterise 10.8% of the subjects as exhibiting 'non-conscious bias' in the no-oversight condition – these are the ones who chose the more aggressive valuation of the asset in both roles. This share amounts to 12.7% in the oversight condition.

We define a new multiple response variable related to 'bias'. The variable "bias" takes the value of 1 for "conscious bias" (subjects who chose the higher valuation, but believed that the true value of the asset is lower and 0 otherwise), and the value of 2 for "non-conscious bias" (subjects who chose the higher valuation in which they truly believed). Note that we exclude eight subjects who selected higher values as experts compared to the decision they made in the role of auditors. These subjects were excluded since on one hand they cannot be regarded as 'unbiased' and, on the other hand, they do not exhibit any of the two 'biases' in which we are interested. This leaves us with 195 responses for which we performed a multinomial probit analysis to investigate the factors affecting the biases.

Table 5: *Multinomial Probit Regression. Dependent Variable: No Bias=0, Conscious Bias=1, Non-conscious Bias=2 (n=195; excluded 8 observations that do not fit into these categories)*

Dependent Variable Bias	Conscious				Non-conscious			
	Coef.	Robust SE	Sig.		Coef.	Robust SE	Sig.	
incentive	0.697	0.384	0.069	*	1.133	0.557	0.042	**
relation	0.199	0.395	0.613		1.403	0.574	0.014	**
oversight	-1.890	0.542	0.000	***	0.409	0.773	0.597	
*incentive*oversight*	0.237	0.577	0.681		-1.297	0.726	0.074	*
*relation*oversight*	1.793	0.592	0.002	***	0.268	0.751	0.722	
intercept	-0.438	0.291	0.133		-2.387	0.625	0.000	***

*** denotes significance at the level below 0.01, **denotes significance at the level below 0.05, * denotes significance at the level below 0.1

The results shown in Table 5 demonstrate that financial incentives affect both conscious and non-conscious bias (coefficients of 0.697 and 1.133, respectively). Oversight is only effective in the case of conscious bias (a significantly negative coefficient of -1.890). However, in the personal relationship condition oversight fails to deliver (a significantly positive coefficient of the interaction effect between a relationship and oversight of 1.793 which almost entirely compensates for the negative stand-alone effect of oversight). Next to financial incentives, a personal relationship is a significant explanatory variable for non-conscious bias (a positive coefficient of 1.403), while oversight does not have any effect on a stand-alone basis. It can offset the effect of financial incentives (a significantly negative coefficient of -1.297), but it is not effective in mitigating the effect of a personal relationship.

Overall, our results confirm the first and second hypotheses about the main effect of financial incentives and a personal relationship, as well as the third hypothesis that the mitigating effect of oversight is stronger in the financial incentive condition than in the personal relationship condition. Oversight can only effectively unravel the effect of financial incentives. We conjecture that the ineffectiveness of oversight in a personal relationship is an indication of the presence of emotion-based decision-making that people are not entirely aware of.

5. DISCUSSION

Being provoked by high-impact audit failures during the recent global financial crisis, the aim of this study is to provide new evidence regarding the intentionality of auditor biases and add to the debates on how to resolve auditor conflicts of interest. As argued in moral seduction theory by Moore et al. (2006), the understanding of perceptual biases importantly indicates the effectiveness of regulatory measures. In particular, the study intends to contribute to the debates on whether oversight can effectively mitigate auditors' biases and which alternative measures (if any) are additionally required. This might be particularly important to audit committees in the auditor appointment process.

To analyse these questions, we looked separately at personal relationships and financial incentives that create directional goals according to theory of motivated reasoning. Regarding financial incentives, our results corroborate prior evidence that financial incentives adversely influence auditor's independence. Although audit fees are fixed in practice, the notion of variable financial incentives is based on the premise that the probability of auditor reappointment increases if an auditor delivers an affirmative audit opinion. Despite the evidence that the introduction of audit committees had a mitigating effect on earnings manipulation (Bedard et al., 2004; Baxter & Cotter, 2009) by interfering between auditor's opinion and managers' selection of the auditor, it would be naïve to expect that audit committees are perfectly informed about the negotiations that take place between managers and auditors (Gibbins et al., 2007). Their analysis of survey responses by CFOs shows that less than one-fifth of the solutions are adopted as originally proposed by the auditor; others are either adopted as proposed by the client or negotiated among them. This indicates that managers are able to exercise a subtle influence in the process of auditor reappointments.

Regarding a personal relationship we found that it significantly affects the choice of the auditor. The subjects who were in the personal relationship condition were more inclined to accept the less realistic assumptions put forward by clients. Further, our more detailed analysis suggests that a personal relationship significantly offsets the otherwise mitigating effect of oversight.

We find that oversight effectively reduces the overall bias and its magnitude. Interestingly, oversight decreases the bias related to the financial incentive condition of both those with a fixed fee and those with a variable fee. This suggests that the subjects with a fixed fee schedule also had intentional bias. Such bias could only arise from the personal relationship which half the subjects were exposed to in the fixed fee condition. But we also show that a personal relationship significantly offsets the mitigating effect of oversight. We interpret this finding as evidence of non-conscious, unintentional bias in a personal relationship.

Based on our analyses and results, we argue that a combination of several measures is needed to efficiently address the issues of auditor bias. While oversight is efficient for mitigating conscious bias, our findings imply that only the termination of a personal rela-

tionship would help eliminate biases arising from auditors' allegiances. Although debates on mandatory audit firm rotation are currently off the regulatory agenda due to the adoption of the new EU regulation (Regulation 537/2014), this mechanism should be considered as an important complementary control mechanism. As reported by Wang and Tuttle (2009), auditors report fewer cooperative negotiation strategies with their clients in the case of mandatory auditor rotation. Milgram (1974) demonstrated that excessive loyalty can be substantially reduced by introducing a so-called 'dissenting peer'. Having the auditor action challenged or reviewed by a different auditor would create such an effect. The public oversight that was introduced following the recent auditing regulatory reform to scrutinise audit quality beyond professional self-regulation can be regarded as an effective measure to improve audit quality. The only question is how far-reaching it is given that the public oversight authority cannot examine the entire market frequently enough. On the other hand, peer oversight – the crucial element of audit firm rotation – can extend to all market participants and could represent an effective complementary mechanism for mitigating auditor biases.

6. LIMITATIONS AND FUTURE RESEARCH

The validity of our results is to be weighed up against the limitations of the study. Probably the greatest limitation is the fact that the experimental subjects were students. To some extent, we attempted to control for this limitation by inviting only senior accounting and finance students to participate. These students were most familiar with the auditing profession and regulation. Moreover, they had on average 2.8 years of work experience and many of them have worked as audit assistants in audit firms. An important argument in favour of the use of students is that when sensitive issues such as professional ethics are being investigated auditors relatively easily recognise politically appropriate answers to which students may be less susceptible (Randall & Fernandes, 1991).

In some well-cited studies that use students to proxy auditors (i.e. Moore et al., 2010 Curtis, 2006) a clear case is made that students are expected to behave in a similar way as auditors when it comes to making a choice in an experimental task on the condition that the experiment adequately addresses the auditor's decision problem. Our experiment is essentially a game in which the financial rewards are explicit, while the relationship is implicit. Accordingly, in our experimental conditions the students were better aware of the financial incentives than they were of the personal relationship and this may have driven the result whereby they reacted more to oversight under a financial incentive manipulation. Our focus was, however, not on financial incentives as this effect has been robustly proven in a number of previous experimental studies which used practising auditors as experimental subjects. The contribution of this study lies in highlighting the role of a personal relationship that may create unintentional bias after controlling for the strong effect of financial incentives and in the additional robustness analysis.

In the robustness test a limitation may stem from our assumption (like in Moore et al., 2010) that the subjects would be able to de-bias their choice when they changed their role.

Some subjects might have been unaware that they were giving a biased answer when they made their initial judgments. Later, when asked to take on the role of an expert, they realised that they had failed to consider the alternative point of view previously, and responded differently. However, this limitation in our approach does not inflate non-conscious bias, but rather underestimates it.

Although the only possible examination of non-conscious or conscious decision-making would entail the emerging neuroscientific methods, we believe we managed to shed some light on the cognitive effect of a personal relationship on non-conscious bias, which was (to the best of our knowledge) previously neglected in the literature.

Overall, we consider the experiment a sufficiently powerful tool to reveal the effects of the studied variables. We believe that the question of conscious and non-conscious biases in auditors' decision-making is worth pursuing further. Future research could complement our findings by refining the measurement methods of non-conscious bias and directly addressing the effectiveness of various measures when it comes to mitigating both types of bias.

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RESEARCH EXPERIMENT

Background

You work as an auditor for an established audit firm. Currently, you are auditing financial statements of a major public company A. As it seems, the company will report a modest operating profit of 30 million EUR. Some years ago Company A bought shares of Company B, which operates in the food industry. At the time Company A paid 100 million EUR for this significant stake in Company B that provided Company A with the significant influence over Company B. Due to the financial crisis and the fact that cash flows of Company B are not meeting the expectations, Company A is faced with the issue of investment impairment due to the decrease in the fair value of its stake in Company B. The current market value of the mentioned financial investment is 50 million EUR. The Chief Financial Officer (CFO) of Company A believes that it is inappropriate to value their investments in Company B by using the market value, because of the extremely low liquidity in the market. Therefore, he proposed to value the investment with a valuation model. As the auditor you are currently reviewing the valuation model the CFO has proposed. In the model the CFO assumed a 5% growth of cash flows without any apparent capital expenditure to support this growth. The valuation based on this assumption gives the value of the investment into Company B of 80 million EUR.

Historical patterns show that the growth in demand for products of Company B is closely related to the growth of the purchasing power of population. Generally, the purchasing power is reflected in the growth of the gross domestic product. According to forecasts GDP is expected to grow in the next years by 1% only. At the assumption of a 1% growth rate in the valuation model, the estimated value of the investment is 60 million EUR.

If the investment value proposed by the CFO will be used in the financial statements, an impairment of 20 million EUR will have to be accounted for. If, on the other hand, the lower investment value will be recognized, an impairment of 40 million EUR will be needed. In this latter case the valuation of the investment will cause a net loss of Company A, while the valuation according to the assumption proposed by the CFO, would not.

SUMMARY

Purchase price of the investment in Company B: 100 million, projected growth of GDP: 1%.

Valuation model	Mark-to-model value	Assumption regarding growth of cash flows	Impairment of the investment	Operating profit of Company A	Net profit / loss of Company A after impairment
CFO's	80 million	5%	20 million	30 million	10 million
Alternative	60 million	1%	40 million	30 million	-10 million

As the auditor you are aware of the importance of your professional reputation and the fact that the auditor is primarily committed to serve public interest - namely, that the creditors, shareholders and other users of financial information get the reliable information about fair presentation of the financial position and financial performance of Company A.

FINANCIAL INCENTIVE CONDITION

Either:
FIXED CONDITION: Your payment for auditing services is fixed, regardless which of the two valuation models you confirm. Your payment is EUR 2.

Or:
FUTURE BUSINESS CONDITION: Your payment for auditing service is fixed and amounts to 2 EUR. If you require the recognition of the lower value of the investment, next year you will no longer be hired by Company A. If you approve the higher value of the investment, your contract with the Company A will be renewed in the next years. Present value of future business with Company A amounts to 1 EUR. Your total compensation will hence amount to 3 EUR (2 EUR of fixed fee + 1 EUR of future business).

OVERSIGHT CONDITION

Either: NO OVERSIGHT: Your audit firm was inspected by the Agency for public oversight just last year. Therefore, no oversight will take place in your audit firm.

Or:
OVERSIGHT: There is a 50 % probability that your audit firm will be subject to public oversight this year.

FINANCIAL INCENTIVE UNDER THE OVERSIGHT CONDITION

Either:
FIXED CONDITION: Your payment for auditing services is fixed, regardless which of the two valuation models you confirm. Your payment is EUR 2.

Or:
FUTURE BUSINESS CONDITION: Your payment for auditing service is fixed and amounts to 2 EUR. Your payment for auditing service is fixed and amounts to 2 EUR. If you require the recognition of the lower value of the investment, next year you will no longer be hired by Company A. If you approve the higher value of the investment, your contract with the Company A will be renewed in the next years. Present value of future business with Company A amounts to 4 EUR. Your total compensation will hence amount to 6 EUR (2 EUR of fixed fee + 4 EUR value of future business).

If you approve the valuation model with a lower growth rate, the oversight will not disapprove of your audit.

If you approve the valuation model with a higher growth rate, oversight will disagree with your decision. You will get fined and reprimanded. In this case your payment will be 0 EUR.

Your decision

Please specify which valuation model you will approve in the financial statements audit (tick the box).

- **the valuation model that takes into account the lower growth rate:** You request that the value of the investment is set at **60 million EUR** and that the impairment of the investment amounts to 40 million EUR.

- **the valuation model that takes into account the higher growth rate:** You approve the model that was prepared by the CFO with the value of the investment at **80 million EUR**. You agree that the impairment of the financial investment amounts to 20 million EUR.

E/B/R

POVZETKI V SLOVENSKEM JEZIKU

STRATEGIC DECISION MAKING FOR ORGANIZATIONAL SUSTAINABILITY: THE IMPLICATIONS OF SERVANT LEADERSHIP AND SUSTAINABLE LEADERSHIP APPROACHES

STRATEŠKO ODLOČANJA ZA ORGANIZACIJSKO TRAJNOST: VKLJUČITEV USLUŽNEGA VODENJA IN PRISTOPI K TRAJNOSTNEMU VODENJU

JUDITA PETERLIN, NOEL J. PEARSE, VLADO DIMOVSKI

POVZETEK: *Konceptualni prispevek raziskuje vključitev uslužnega vodenja in trajnostnega vodenja za strateško odločanje najvišjega managementa organizacije. Dokazano je, da je potreben drugačen stil vodenja, da bodo narejene učinkovite strateške odločitve v organizacijah, ki si prizadevajo, da postanejo bolj trajnostne ter da uslužnostno vodenje in trajnostni vodstveni pristopi zagotavljajo trdno podlago za ozaveščanje o teh odločitev. Učinki teh dveh vodstvenih pristopov morajo biti raziskani pred odločitvijo o vključitvi v razvoj vodenja. Še posebno se razpravlja o vključitvi v programe razvoja vodstvenih vrednot in razvoj integrativnega mišljenja.*

Ključne besede: *uslužno vodenje, trajnostno vodenje, strateško odločanje*

INSTITUTIONAL CHANGE AS A RESULT OF INTERNATIONAL ACCREDITATION: BUSINESS SCHOOLS OF LITHUANIA AFTER THE IRON CURTAIN

INSTITUCIONALNA SPREMEMBA KOT POSLEDICA MEDNARODNE AKREDITACIJE: POSLOVNE ŠOLE V LITVI PO ŽELEZNI ZAVESI

YELENA ISTILEULOVA, DARJA PELJHAN

POVZETEK: *Članek preučuje vplive pridobivanja mednarodne akreditacije v poslovnih šolah (p-šole) v Litvi. Tako kot v drugih državah Srednje in Vzhodne Evrope, je tudi v Litvi mednarodna akreditacija postala v zadnjem času ena izmed ključnih rešitev za doseganje*

legitimnosti p-šol. Zaradi pomanjkanja raziskav na tem področju, je cilj članka je, da razišče in predstavi razloge za in posledice akreditacij z uporabo okvirja institucionalne teorije. Odgovori na raziskovalna vprašanja so pridobljeni z večkratno študijo primera. Ugotovitve kažejo, da akreditacijski učinki predstavljajo primer institucionalnega izomorfizma, ker p-šole zaprosijo za akreditacijo za doseganje legitimnosti namesto boljšega delovanje. P-šole se odločajo za akreditacijo in jo v glavnem izvajajo zaradi učinkov »približevanja večini« in zmanjšanju asimetrije informacij; razlogov, ki so pospremljeni z vsemi tremi tipi izomorfnih sprememb (prisila, mimetika in normativ). Na podlagi ugotovitev študija zaključuje s podanimi predlogi, ki jih je potrebno upoštevati v prihodnjih raziskavah te premalo raziskane teme, še posebej v regijah Srednje in Vzhodne Evrope.

Kjučne besede: *institucionalna sprememba, izomorfizem, poslovne šole, mednarodna akreditacija, študije primerov*

EFFECTIVENESS OF FINANCIAL AND FISCAL INSTRUMENTS FOR PROMOTING SUSTAINABLE RENEWABLE ENERGY TECHNOLOGIES

UČINKOVITOST FINANČNIH IN FISKALNIH INSTRUMENTOV ZA SPODBUJANJE TRAJNOSTNIH TEHNOLOGIJ OBNOVLJIVE ENERGIJE

RENATA DOMBROVSKI

POVZETEK: *Novi cilj EU za dosego 80-95% zmanjšanja emisij do leta 2050 kliče po novih rešitvah energetske politike. Predhodne raziskave niso ovrednotile vplivov vseh ustreznih elementov energetske politike tehnološko specifične trajnostni difuzije obnovljivih virov energije. Članek dopolnjuje obstoječe raziskave s študijo učinkovitosti finančnih in fiskalnih instrumentov na difuzijo z dodatnim nadziranjem potencialnih političnih, gospodarskih, socialnih in okoljskih deležnikov. Ti deležniki so analizirali iz 26 držav članic EU v obdobju 1990-2011. Glavni rezultati kažejo, da posamične tarife, kvote in ponudbe učinkovito promovirajo tehnologijo izrabe vetra. Ostale pojasnjevalne spremenljivke imajo tehnološko in modelno odvisnost od učinkov.*

Ključne besede: *obnovljivi viri energije, tehnologija, trajnostni razvoj, finančni instrumenti, fiskalni instrumenti, učinkovitost*

HOW TRADING FIRMS UPGRADE SKILLS AND TECHNOLOGY: THEORETICAL MODEL

KAKO TRGOVSKA PODJETJA NADGRADIJO SPRETNOSTI IN TEHNOLOGIJO: TEORETIČNI MODEL

MOJCA LINDIČ

POVZETEK: *Članek preučuje mehanizme nadgradnje spretnosti v trgovskih podjetjih z razvojem teoretičnega modela, ki se nanaša na spodbude posameznika za pridobitev večjih spretnosti za vedenje najvišje profitabilnosti trgovskih podjetij. Model kaže, da imajo le visoko sposobni posamezniki spodbude za pridobitev višjih spretnosti , dokler se kompenzirajo z višjimi plačami po zaposlitvi. Poleg tega imajo visoko produktivne družbe spodbude za vlaganje v visoko tehnologijo, za zaposlovanje visoko kvalificirane delovne sile in vključevanje v mednarodno trgovino. Odločitve za tehnološko preobleko in spretnost nadgradnje sovpada z odločitvami podjetja za začetek uvoza in izvoza, kar slednje zahteva višjo tehnologijo in visoko kvalificirano delovno silo. Prispevek članka je dvojni: pridobivanje novih spoznanj s kombiniranjem fragmentov modelov vedenja posameznikov in podjetja in razširitev vsebine Melitzovega modela (2003) z uvedbo uvoznikov in nadzorom nad kvalificirano in nekvalificirano delovno silo.*

Ključne besede: *nadgradnja spetnosti, nadgradnja tehnologije, trgovska podjetja*

CAN OVERSIGHT MITIGATE AUDITOR'S MOTIVATED REASONING? AN EXPERIMENTAL STUDY

ALI LAHKO NADZOR UBLAŽI REVIZORJEVO MOTIVIRANO SKLEPANJE? EKSPERIMENTALNA ŠTUDIJA

MAJA ZAMAN GROFF, SERGEJA SLAPNIČAR, IGOR LONČARSKI

POVZETEK: *Dokaz neuspeha revizorjev, da zagotovi neodvisno mnenje, so ponovno odprte razprave o ukrepih za zagotovitev neodvisnosti revizorjev. Preučili smo učinkovitost nadzora dveh pomembnih dejavnikov revizorjevega pristranska mnenja;*

finančne spodbude in osebni odnos s stranko. Med temi vodimo eksperiment, ki vključuje naloge računovodstva. Najdemo pomemben vpliv osebnega odnosa na revizorjevo izbiro po nadzorovanju finančne spodbude. Nadzor ima pomemben negativen vpliv na revizorjevo izbiro, ki izhaja iz finančnih spodbud, ker osebni odnos bistveno zmanjša učinkovitost nadzora. Naši rezultati kažejo, da so poleg nadzora potrebne druge rešitve, ki omejijo osebne vezi za zagotovitev neodvisnosti revizorjev.

Ključne besede: *revizija, pristranskost, finančne spodbude, motivirano sklepanje, nadzor, osebni odnos*