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RESEARCH ARTICLE

Boundary Spanning and Isomorphism Interactions

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ABSTRACT

This study explores the relationship between isomorphism, boundary-spanning, institutional restrictions, and procedural congruence. Using fuzzy (set-theoretic) logic and concepts of causal dependence, we aim to clarify the presence of isomorphism on firms designated as protected origins and boundary-spanning. Employing fuzzy (set-theoretic) logic, we analyse the interactions between isomorphism, institutional restrictions, procedural congruence, and boundary-spanning. By investigating causal dependencies, we uncover the underlying mechanisms shaping firms' interactions within diverse contexts. Our study reveals that isomorphism interactions can be examined through causal (counterfactual) dependence, emphasising their significance. Furthermore, causal dependence can occur without explicit causation, indicating a transitive relationship involving interactions. Isomorphism can serve as a counterexample to causal dependence, maintaining a boundary interaction between contextual factors and institutional constraints. Additionally, causal dependence involving interactions may not necessarily constrain isomorphism, suggesting an intransitive relationship. Isomorphism may also present a facade of conformity when analysed through causal (counterfactual) dependence, highlighting the complexity of these interactions. This research contributes to the literature by examining the relationship between isomorphism and institutional constraints, providing original insights into boundary-spanning and isomorphism. Moreover, our study advances understanding of causal dependence in explaining firm interactions, with implications for international business.

Contribution/Originality: This study makes a significant contribution to the understanding of the intricate relationships between isomorphism, boundary-spanning, institutional restrictions, and procedural congruence. By addressing these interactions, the study delves into the limitations of institutional constraints and their influence on isomorphic behaviours in international business.

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1. Introduction

This study contributes to the boundary-spanning, institutional restrictions and context-bound firms' isomorphism. Firms are a system of interactions relying on institutional restrictions (Gong & Janssen, 2012; Scott, 2014) which after all have an effect on firms interactions (Bromley & Powell, 2012; Greenwood et al., 2011). Yet, restrictions are better understood as an essential notion of firms bound in the context traces the realisation to what we know to apply in one context but not (or differently) in another context is labelled by not a similar pole (Meyer, 2007: 30). Institutional restrictions follow a bipolar interaction with isomorphous rather general processes firms must conform to when context-bound. This standard representation is taking account of the similarity and not the difference one against another. Stated simply, there is no intrinsic irregularity that can be taken as primitive in isomorphism.

In this study, we refer to firms' isomorphism as a causal dependence that closely envelops institutional restrictions, procedural congruence, and context-bound. To distinguish genuine causes from effects, context differences indicate an interaction must be able to relate restrictions shaping their own context and retain their autonomy for independent action (Pfeffer & Salancik, 2003: 261). Between context and restrictions, what sustains an interaction is subject to differences in their own equivalence. Equivalence explain interactions as true (or false) (Andersson et al., 2020). This approach facilitates the development of provable and semantically accurate sets that represent the meaning behind the interaction (Givant & Halmos, 2009; Ragin, 2000). However, interactions may cause a dual effect offering a vague explanation when for instance a procedural congruence is weighty but not intact. To evade vagueness, we think causation based on dependence rather than general similarity (Charlton, 1983; Lewis, 1970).

Causation is explained by statistical correlation (Kenny, 1979) and causal (counterfactual) dependence (Lewis, 1970) among others. Statistical correlation defines significance is an output that accepts truth as input and connects logical operations. Still, it has a very low change in existing if the true effect is of little value to challenge current knowledge (Kenny, 1979). For instance, with statistical correlation, a large sample is preferable to a small sample that performs less desirably, as the latter may contain bias, which can affect inferences in academic research. This conclusion however does not diminish the logical flaws inherent in the small sample data, a proposition can confirm causal (counterfactual) dependence when is taking account the similarity, difference, and balancing off one against another are not separated by a temporal gap, and are therefore simultaneous (Lewis, 1970). To gain such a high degree of precision without statistical correlation, research needs to postulate the algebraic existence of sets that represent causal dependence. In this study, causal dependence enables to treat research (set-theoretic) in a more nuanced way when the State is an advocate for context-bound, an impediment amid institutional restrictions and procedural congruence offers compelling interest in rethinking isomorphism and fuels the need for explaining boundary-spanning. Here, algebraic interactions will offer a plausible examination into whether it applies to a certain locality (span) but not to others.

In this study, we aim to examine the opaque presence of isomorphism. In the academic literature, the centrality of isomorphism is evident, and its merits are conducive to bringing congruence between consensus and conformity (DiMaggio & Powell, 1983; Meyer & Rowan, 1977; Oliver, 1991; Suddaby et al., 2017). Conceptually, causal dependence explains consensus and conformity given the restrictions, for the existence

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of the effect. Restrictions following procedural congruence is not reversible if institutional conditions belong to both given their genuine cause from effect of the fundamental notion of isomorphism remains intact. Our study proposes causal dependence concerning boundary-spanning between restrictions, procedures, and firms' interactions. First, isomorphism interactions can be analysed with causal (counterfactual) dependence. Second, causal dependence occurs without causation (transitive) involving interactions. Third, with causal dependence, isomorphism serves as a counterexample maintaining a boundary interaction. Fourth, with causal dependence (intransitive) involving interactions cannot constrain isomorphism. Fifth, with causal (counterfactual) dependence isomorphism encapsulates a charade of conformity. Our findings validate the boundary span is a definitive element that attenuates isomorphism while increasing the complexity of the interaction.

The remainder of the paper is organised as follows. We present the literature review, followed by the method of investigation. Then, we focus on the discussion, we analyse, conclude, and explain the implications, limitations and direction for future research.

2. Literature Review

2.1. Context-bound firms

This study, utilising a fine-grained method, focuses on the context of protected designation of origin (PDO) institutional restrictions. There are several reasons for this decision. For instance, the context of designation of origin plays a critical role within the global economy owing to the subtle economic contribution under the auspice of intellectual property rights (IPRs) (Mandrinos & Nik Mahdi, 2016). Intellectual property rights secure institutional status by following structural and procedural congruence. The significance of institutional restrictions culminating under the umbrella and hegemony of European Agriculture and Rural Development policy is supranational to maintain context-bound, domestic, regional, and foreign economic growth (Mandrinos & Nik Mahdi, 2016). Moreover, in international business literature, the role of context is instrumental (Maekelburger et al., 2012; Meyer, 2007). Context-bound firms in the fast moving consumer goods industry have been neither clearly nor extensively mapped (Mandrinos et al., 2019; Sakellariou et al., 2014). Context-bound firms preserve the profitability of the agri-food sector, in particular in the vulnerable areas of the same which may account for half or more of a country's total production volume. Consequently, the value of this scheme is dependent on an interplay between the firms and institutions that work together under specific restrictions. Appropriate to the environment, institutional restrictions are vital for firms to prosper (Ashforth et al., 2008; Gunawan & Rose, 2014). However, restrictions and the willingness to (de facto) enforce pressures (Papageorgiadis et al., 2013) may satisfy some, yet may ignore others (Mandrinos & Lim, 2023; Mandrinos et al., 2022; Mandrinos et al., 2019).

2.2. Institutional restrictions

Interaction with institutional restrictions such as IPRs, sets out to specify isomorphism. According to DiMaggio and Powell (1983), there are three mechanisms to explain isomorphism: coercive, mimetic, and normative settings. The normative isomorphism is associated with professional values; the mimetic isomorphism is associated with organisational changes; and the coercive isomorphism is associated with the rule of conformity (DiMaggio & Powell, 1983). This consensual mechanism of isomorphic

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settings includes regulative interactions (laws and rules), normative interactions (values, cultures, and norms), and cultural-cognitive interactions (taken-for-granted cognitive structures). Thus, institutional isomorphic settings are formed through regulative (laws and rules) interactions that give rise to institutional restrictions.

2.2.1. Isomorphism

Intellectual property rights set out to specify restrictions using the designation of origin (PDO) to protect the determined production areas' resources. Article 13.1 of Regulation 510/2006 specifies institutional restrictions' structural and procedural congruence. Structural because of specific guidelines imposed to adopt specific structures, and procedural because of the processes to follow against the complexity of misuse, imitation, or evocation of the PDO (European Commission, 2006). Structures and processes engage firms constructively across the boundaries of institutional restrictions to carry out a public service that could not otherwise be accomplished. Simply put, institutional restrictions determine what is legal and legitimate to provide procedural congruence by becoming isomorphic to secure institutional status (DiMaggio & Powell, 1983; Keupp et al., 2010; Meyer & Rowan, 1977; Scott, 1995) which leads to structural equivalence for instance with resource absorption (Meyer & Rowan, 1977; Oxley, 1999; Pfeffer & Salancik, 1978).

The use of designation of origin isomorphism enables interactions to be implemented. This institutional logic directs attention to specific conformity criteria by providing guidelines – similar in any detail – for determining specific relationships (Greenwood et al., 2011; Heese et al., 2016; Raynard, 2016; Thornton, 2002). Consequently, with isomorphism, the resulting allocation of one or several restrictions determines a relation's structural and procedural congruence, despite the fact that it evolves from different sets of interests and still needs to consent to the same set-ups limited by the institutional restrictions. However, with isomorphism, an exchange is exposed to a logic applied to a set of elements, showing the result can be either true or false to explain institutional restrictions. Thus, research struggles to describe a relationship that is assumed to be true because the development of embedded criteria (elements) is not always clearly specified (Piekkari et al., 2009) and may fall short of providing clarity (Doz, 2011; Welch & Piekkari, 2017) causing institutional restrictions and context-bound firm dependence to omit true meaning and stressing the need for a rigorous approach to explaining interactions.

2.3. Fuzzy logic

Comparing interactions, qualitative comparative analysis (QCA) represents fuzzy logic an essential addition to research proposing Boolean algebra simplifications pointing to interactions (Ragin, 1987, 2000; 2008: 183). Ragin's research in the field of sociology to identify complex sets depending on binary data, explains why set theory provides meaning to algebraic operations (Caramani, 2009; Ragin, 2000; Wagemann et al., 2015). Analysing the ways of putting elements together resembles a form of logic for getting thoughtful insights with an algebraic structure of null (0) as false and one (1) as true. To an extent, representative logic has a good effect on solving problems regarding causation and connection of events. However, exposure to different elements (criteria) can be unhelpful in getting the true logic, for many key concepts can be disguised in logical clothing (Halmos & Givant, 1998; Hilbert, 1902; Ragin, 1987, 2008). Because the concept of truth become elusive, to overcome the problem of making it difficult to discern,

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research follows the disclosure of a set with many inference forms. In this case, logic can be possibly true (fuzzy) stated by a proposition when it forms Boolean algebra and not as a numeric interval of 0 to 1 (Boole, 1854; Givant & Halmos, 2009; Halmos & Givant, 1998; Pierce, 1881). Fuzziness is an important part of set-theoretic logic when interactions cause vague effects to emerge, such as boundaries, an opaque area over which spanning occurs. In this case Boolean axiomatic operations (mathematical conditions) assist in developing and understanding a proposition before developing and deductively testing a hypothesis with statistical correlation, an expected practice in academic research.

2.3.1. Set theory

The theory of Boolean algebra offers a logical treatment to simplify a procedure for different problems. Boolean algebra became a modern mathematical discipline with connections to logic and set theory (category theory, group theory). Set as a theory in its aspect of organising and suggesting manipulation in abstract algebra has found applications in scientific and non-scientific areas (Ragin, 2000; Steingart, 2023). Logic can be measured with relations (unary, binary, …) that separate into sets and subsets being expressed and proved by the theory. A set (X) together with the two binary ($\vee$, $\wedge$) and the unary ($'$) operations, and the two distinguished elements (0, 1) satisfying axioms (see Table 1) that generate new logic out of old and put elements together with an algebraic structure to get thoughtful insights (Givant & Halmos, 2009; Halmos & Givant, 1998, p. 20).

Table 1: Axioms of set theory foundational principles

Axioms		Information
$\mathbf{0}' = \mathbf{1},\ \ \mathbf{1}' = \mathbf{0}$	Complement law	this Boolean equation forms the complement of 0 and 1
$\boldsymbol{P} \wedge \mathbf{1} = \boldsymbol{P},\quad \boldsymbol{P} \vee \mathbf{0} = \boldsymbol{P}$	Identity law	this Boolean equation shows 'P' is identical with itself
$\boldsymbol{P} \wedge \boldsymbol{P}' = \mathbf{0},\quad \boldsymbol{P} \vee \boldsymbol{P}' = \mathbf{1}$	Complement law	this Boolean equation is a dual that results from interchanging 0 and 1 and at the same time interchanging $\wedge$ and $\vee$
$(\boldsymbol{P}')' = \boldsymbol{P}$	Double complement	this Boolean equation has a 'not' within a 'not' cancelling each other out
$(\boldsymbol{P}\,\boldsymbol{R}) \vee (\boldsymbol{P}'\,\boldsymbol{F}) \vee (\boldsymbol{R}\,\boldsymbol{F}) = (\boldsymbol{P}\,\boldsymbol{R}) \vee (\boldsymbol{P}'\boldsymbol{F})$	Consensus law	this Boolean equation reduces complexity in the procedure

When the binary operations are interchanged to get thoughtful insights with 0 as false and 1 as true at the same time this fact is referred to as dichotomy (duality) which is often vague in applications and can lead to surprising relationships (Ragin, 2000, 2008). Often, relations can be complex and not clear of duality, but they can be represented when an explanation of a proposition might be true. Fuzziness can describe complexity beyond dichotomous interactions. It offers a comprehensive analysis and provides a balanced perspective on pursuing a set-theoretic logic. In this study, research attains fuzzy interactions with set and element logic when we define the sets based on *union, intersection, complement,* and *join, meet, and complement,* respectively. When two

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elements join, this is known as a union, whereas when two elements meet, this is an intersection of what they have in common. In short, the join operation unites sets together, and the meet operation is where sets intersect. We define relations with set substitutions

$$R = institutional\ restrictions; P = procedural\ congruence;\ F = context\ bound\ firms$$

via a list of set-theoretic operations to satisfy a list of axiomatic conditions (see Table 1)

- join is 'one the other or both' (∨),
- meet is 'both or neither of' (∧),
- complement is 'opposite/contradiction of a given statement' (′).

The set X is the whole space from all sets (F, R, P) which are considered to be subsets of the set we call $I(X)$ since I demonstrates isomorphism (IPRs) between institutional restrictions and context-bound firms under the tightly bound inability, vulnerability, and uncertainty to continue functioning in the absence of structural and procedural congruence (PDO). Through this lens, we evade the problem of semantics with fuzzy sets, ensuring that the sets represent the meaning attached to them. Thus, our fuzzy logic stands out as a catalyst for specific interactions and underscores reliability by knowing the relevant sets.

Three operations on $I(X)$ set are the union, intersection and complement. Using a set builder notation, we write the definition of the union as

$$F \cup R = f : f \in F\ or\ f \in R$$

that is, the union $F \cup R$ is the set of all context-bound firm f elements such that a context-bound firm f is an element of the context-bound firms' subset F *or* the context-bound firm f is an element of institutional restrictions subset R. In a similar manner, using the set builder notation, we write the definition of an intersection as

$$F \cap R = f : f \in R\ and\ f \in R$$

that is, the intersection $F \cap R$ is the set of all context-bound firm f elements such that context-bound firm f is an element of context-bound firms' subset F *and* the context-bound firm f is an element of institutional restrictions subset R. The complements F', R', P' and I' are the subset of elements that is *not* in F, R, P and I respectively. There is also the empty set ∅ which has *no* elements.

In the $I(X)$ set, the institutional restrictions R, procedural congruence P, and context bound firms F subsets are under examination. The 2-valued subsets transformation can be used when R contains r_0, P contains p_0 and F contains f_0, take the value 0 or 1. The elements of the subsets are different with 1 as true, and 0 as false. The value 1 shows there is an isomorphism between the context-bound firm, institutional restrictions and procedural congruence whereas when the isomorphism is false, the value is 0.

3. Methodology

This research is based on case study data. According to academic research, a case study is an appropriate method for exploring small sample data. A case is a common form of

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research that usually examines a single country over a period of time, often for the purpose of explaining some outcome at the end or showing the effects of some change that occurred during the time examined (Geddes, 2003: 117). Its representativeness can be found within the collection of selected elements (Tsai, 2007). This paper follows interviews and the language of the interview quotes is used to explain the data, suggesting clarity of the case study evidence is attained. Data is coming from empirical PhD research conducted to shed light on an archetypal industry (Mandrinos, 2014). Six pilot interviews were conducted in addition to the twenty-five main interviews in Greece. The pilot study embraces six firms involved in the approved production establishments of milk and dairy products (Feta) according to Regulation 853/2004 (European Commission, 2004). The main study is based on nine firms, the largest exporters in the world where a PDO certification provides the only IPRs allowing exporters to become lawful players, expanding their global footprint.

For pilot research, we decided to contact two types of firms, three medium and three small, because the large majority of European Union designation of origin organisations are SMEs. The unit of analysis is the key representative in selecting and making export decisions (Hackett & Dilts, 2008; Yin, 2009). We interviewed two owners, two export managers one export agent and one sales director. Yet, we decided not to use small firms for our core investigation, first because small firms became secretive and reluctant due to fear of leaking their own information and second because they did not have an export department, and thus were not directly engaged with exporting, in sharp contrast to medium and larger firms in the field. Because the main objective of this research is to opt for data-rich cases (Gerring & Seawright, 2008) our sampling of small and medium units changed into medium and large units of analysis.

Using the Hellenic Milk Organisation database, thirteen firms showed interest in participating, yet only nine decided on the list of respondents (see Table 2), and thus, the selection of managers is purposeful (Patton, 1990). Interviews are conducted with one owner, three general managers (USA-Bulgaria-Romania), eleven export managers/directors, six export area managers, three export assistants and one marketing manager. In order to reduce bias and ensure a rich multiplicity of our responses, interviews are not just limited to upper-echelon management but also equally conducted with the staff at headquarters and experts in the field (Regnér & Edman, 2014). Interviews ranged from 40 to 80 minutes (Bernard, 2000) and were conducted in the local language (Greek) to avoid language barriers (Krave & Brinkmann, 2008). Confidentiality and anonymity are also protected from any intentional or negligent disclosure of information to other respondents or third parties in the same industry. All interviews inductively derived from the field were recorded, transcribed verbatim, translated, and analysed.

Table 2: Profile of focal firms that participated in empirical PhD research on an archetypal industry

Firm	Age (Years)	Size	Status	Participant	Location
α1	30+	Medium	Family Business	Owner	Head Office
α2	30+	Medium	Family Business	Export Manager	Head Office
β1	60+	Large	Corporation	Export Manager	Remotely
β2	60+	Large	Corporation	Export Economic Director	Head Office
γ1	30+	Medium	Corporation	Export Manager	Head Office

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γ2	30+	Medium	Corporation	Export Sales Director	Head Office/ Remotely
δ1	50+	Large	Family Business	Export Director	Head Office
δ2	50+	Large	Family Business	Export Department	Head Office
ε1	50+	Large	Corporation	Export Manager	Head Office/ Remotely
ε2	50+	Large	Corporation	Export Area Manager	Head Office
ε3	50+	Large	Corporation	Export Area Manager	Head Office
ζ1	90+	Medium	Corporation	Export Director (IBDM)	Remotely
ζ2	90+	Medium	Corporation	Export Area Manager	Head Office/ Remotely
η1	60+	Large	Corporation	Marketing Manager	Head Office
η2	60+	Large	Corporation	Export Area Manager	Head Office
η3	60+	Large	Corporation	Bulgaria Market Director	Remotely
η4	60+	Large	Corporation	USA Market Director	Remotely
θ1	30+	Medium	Family Business	Export Manager	Head Office
θ2	30+	Medium	Family Business	Export Area Manager	Head Office
θ3	30+	Medium	Family Business	Export Department	Head Office
ι1	30+	Large	Corporation	General Director / Consultant	Head Office
ι2	30+	Large	Corporation	Romania Market Director	Remotely
ι3	30+	Large	Corporation	Export Manager	Remotely
ι4	30+	Large	Corporation	Export Area Manager	Head Office
ι5	30+	Large	Corporation	Export Department	Head Office
P1	20+	Medium	Family Business	Export Manager	Remotely
P2	45+	Medium	Family Business	Sales Director	Remotely
P3	65+	Medium	Family Business	Chief Executive Officer	Remotely
P4	85+	Medium	Family Business	Export Trade Consultant	Remotely
P5	55+	Medium	Family Business	Owner	Head Office
P6	65+	Medium	Family Business	Owner	Remotely

Different measurements are established to further evaluate the accuracy of the responses (Cuervo-Cazurra et al., 2020). The context-dependency validity has improved the accuracy of the data as the researcher had prior experience working in the field's national and international environments (Welch & Piekkari, 2017). The contextual understanding preserved the authenticity of participants' responses to the analysis of the data based on an in-depth understanding of the field setting (Caprar, 2011). Reliability was established by developing the case-study protocol and the case-study database. The case study protocol (entrant cases, interviewee selection, interview guide) and case study database were carried out according to the principles of good practice to minimise error and bias in a study. The 'table shells' layout was utilised in the case-study protocol to record data (Miles & Huberman, 1994). We analyse data using cross-case comparison to improve generalisability and trustworthiness were established and validated by using triangulated cross-case analysis (Eisenhardt, 1989; Yin, 1984) as new layers of explanation entail better reasoning (causal understanding) and therefore increase the matching ability to generalise (Locke, 2007). Thus, construct validity was established by using multiple sources of evidence, the creation of a chain of evidence, and the key informant responses of the case-study report. In the same vein, we condensed the relevant data according to precision and distinctiveness. We built the summary-tables for every element to display

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data for further comparison (Sobh & Perry, 2006). This method helped us organise and categorise the data to develop internal validity through data triangulation (interviews, secondary data, and the data analysis process). Triangulation validates responses when interviews are triangulated with other documents such as press releases, published newspaper articles, annual reports and direct observations which are crucial, vital, and imperative for the case study. This method is important in determining the time of the different events recounted in the interviews along with field responses which ultimately point to the evidence for the study. Finally, external validity has increased via the informative logic of the case-study approach (Patton, 2002; Yin, 2009). In analytics, the 'matrix' technique was utilised as a pattern role, with transcription, data cleaning, and computer-assisted qualitative data analysis software (CAQDAS) being utilised for coding. The matrix technique unearths specific responses from interview transcripts to emphasise the figurative meanings and help explain the flow and connection of data (Miles & Huberman, 1994). This careful development anchoring the case-study in a 'logical sequence' (Yin, 2003, p. 20) favours a pattern to match salient responses and better understand the logic of a developing proposition.

4. Findings

From a multilevel perspective, our data underlines key quotes as causal dependence interactions between context-bound firms and the parent legislation are vital for *"[…] there are rules all dairy producers have to conform equally" (ι2).* Isomorphism is an inclusive standard caused by structural guidelines against the effect of misuse or evocation of the PDO because *"[…] the government plays a significant role for the PDO has to do with the control the State maintains over the producers to ensure PDO" (β1).* In this situation, it is assumed to perform legislative and executive functions, institutional guidelines control any inclination to maximise interests will symmetrically lock firms into a procedural congruence that adopts regulative restrictions. The State is engaging the PDO industry in the provision of policies with public services offered as a justification for their adoption when *"[…] the Greek government and the State's services support PDO" (ε2)*. Connecting isomorphous tendencies to agriculture and rural development policy that focus on maintaining and expanding the domestic and foreign competitiveness, the State's public services justify policy transfer, with structures and procedures serving as an effective means for stabilising PDO output. Offering an integrated set of processes in relation to institutional restrictions, public service is integral to the State and can lead context-bound firms to growth in differential advantage over time.

When distinctive features are protected under regulative restrictions, structural and procedural congruence enables context-bound firms to provide a PDO output that differs from competition. Therefore, it affects isomorphism when *"[…] the absence of a national strategy intensifies competition […] competition is Greek competition, and this is initiated because there isn't an institutionalised framework to ensure how a national product such as feta should be sold abroad" (θ1).* Similarly, an alarming variation of *"[…] the last 18 years I am here I have not seen any intervention, something to facilitate the process. Any intervention rather creates problems" (δ1)*. Procedures are not incorporated meaningfully based on authority of the officials when *"[…] we want to penetrate new foreign markets to unlock new markets, we contact the Ministry or relevant Ministries, repeatedly, but the same officials of the Ministries do not even know what procedures, firms need to follow" (θ2).* This quote focusing on essential procedural issue does not deny the clarity of some jurisdiction but the interaction appeared to be a vexing problem when *"[…] the State looks after all these years how to impede and put obstacles in our efforts; thus, I say we are in a difficult*

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position" (η4) in addition to *"[...] the obstacles we encounter are not foreign but domestic obstacles [...] outside we face no difficulty, we find our way, yet, in Greece is the difficulty" (θ1).*

In the provision of public services, a core impediment is the export value-added tax (VAT). Export VAT does not describe specific IPRs regulative restrictions, yet it does endorse procedural congruence, such as how to benefit from an unfair advantage in foreign trade when firms do not receive a complete refund they have paid on their inputs, when "*[...] financial capital is withheld by the Greek government, this is a very important parameter inhibiting PDO exports. For instance, the VAT must be compensated on time within 20 days. In Greece, VAT is withheld for 5-6 months and rebate is completed after great effort and numerous checks by the internal revenue office" (ι2).* There is no immediately obvious homogeneity for institutional restrictions cannot constrain IPRs procedural congruence via VAT however VAT represents procedural congruence that can be perturbed by restrictions showing the reverse interaction can be validated. Aware of impending danger, an attempt to mitigate the negative repercussions of the international crisis when the State and institutions need to adapt to what appears to be a new era of uncertainty, a divergent relationship contradicting the integrated set of processes of IPRs (European Commission, 2012) reduces the export reliance on the PDO industry and places undue economic burden on context-bound firms. Concerning PDO policy, joint institutional processes and the traditional representative public services combine several strands to encounter the logic of procedural congruence. This analogy covers institutional restrictions within the same PDO system with vague interactions in a nexus that encloses firms, institutions and isomorphism to secure institutional status. From this view, isomorphism is considered not false depending on procedural congruence that describes interactions is weighty but not intact.

5. Discussion

The set $I(X)$ demonstrates isomorphism under the tightly bound inability to continue functioning in the presence of structural and procedural congruence. The extent to which institutional restrictions and procedural congruence secure isomorphism, is explained according to the union and intersection operations. For instance, with union, the set of procedural congruence and institutional restriction elements are either in P *or* in R, and when their elements join, they belong to $P \cup R$ union, it involves R closure (R^{-}) found in the intersection $P \cap R$ of the initial relation. In this regard, procedural congruence belongs to every closed set that involves R preserves the inclusion of P as a subset of institutional restrictions $(P \subseteq R)$. The union of procedural congruence closure and institutional restrictions closure $(P^{-} \cup R^{-})$ shows both are included in the union $P \cup R$ preserves the inclusion of isomorphism for both are subsets of I, that is, $P \cup R \subseteq I$. The union is the largest, and its closure is the smallest set in the isomorphism showing that the context-bound firm set F is dense. Dense means the set R and P contains F when the closure of context-bound firms (F^{-}) include every other subset such that the firm f has a join and meet operation with institutional restriction r, and procedural congruence p elements.

Institutional restrictions R are part of the European Agriculture and Rural Development policy. The policy is to maintain in different States both the domestic and foreign competitiveness of context-bound firms. In other words, isomorphism institutionalises specific criteria underpinning the taken-for-granted sense of restrictions. There is a dependence between the State's quest for conformity aligned with institutional

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restrictions R for this logic directs attention to specific criteria by providing guidelines – similar in any detail – for determining specific relationships (Greenwood et al., 2011; Heese et al., 2016; Raynard, 2016; Thornton, 2002). Consequently, with isomorphism, the institutional restrictions R determine the structural and procedural congruence of the interaction between context-bound firms and State's institutions. The State despite the fact that it evolves from different sets of interests still needs to consent to the same set of restrictions limited by the PDO. We draw on this premise where procedural congruence signals a divergent relation perplexing the exchange with P and its complement P' are subsets of isomorphism I. We form the set A_P generated by procedural congruence P is a subset of isomorphism I that is $A_P: P \subseteq I$. We explain that the set A_P such that P is a subset of R and P, that is

$$A_P: P \subseteq R \text{ and } P$$

with the two values of $X(0,1)$. Consequently, because a procedural congruence p is an element of P subset ($p \in P$) likewise, its complement p' is an element of P subset ($p' \in P$) encounters a typical join operation. Since the join operation ($\vee$) may be written with the first and the second complement laws (see Table 1).

$$1 = p \vee p' \in P \text{ with } 0 = 1' \in P$$

explains that the State's procedural congruence cannot secure institutional status when p' (false) is in P. This dual condition prescribes the logic of union when A_P emphasises the subset P is open or closed. When the set P is open, it contains the union, intersection, empty set, and whole space but not its complement. When is closed it explains the complement of the procedural congruence closure (P'^{-}) is a subset of the procedural congruence complement (P') such that $P'^{-} \subseteq P'$ exhibiting the intersection of the procedural congruence closure (P^{-}) and the complement of the procedural congruence closure (P'^{-}) subsets, is the procedural congruence closure subset such that $P^{-} \cap P'^{-} = P^{-}$. This shows that governing the allocation of the State's procedural congruence is joining in differing and synergistic ways. The State impedes procedures that do not pertain to structural guidelines imposed to adopt to the set of institutional restrictions to ensure isomorphism. By maintaining a consensus, the State causes public services to secure institutional status which precludes the possibility of isomorphism. Therefore, isomorphism is not an inclusive standard. Subject to procedural differences, an isomorphism is a counterexample often used in scientific fields to prove the boundary of a true equivalence (Givant & Halmos, 2009).

We can now explain, first, the boundary-spanning using the consensus law (see Table 1).

$$(P\ R) \vee (P'\ F) \vee (R\ F) = (P\ R) \vee (P'\ F)$$

demonstrating that when a context-bound firm conforms on institutional restrictions matches a procedural congruence. Second, with the truth table as a systematic way to analyse and visualise the values of logical expressions (see Table 3), we test the set-theoretic logic to determine if the three sets can be replaced consistently by the true and false distinguished elements in such a manner the operation proves causal dependence. This method as Ragin (1987) notes, in all elements of interest is explained by another circumstance, which is common among all elements. Ragin (1987) has made this logic (combinatorial) the distinctive feature of the comparative method (Ragin, 1987, p. 15). Third, with the true table, we explain that when

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- all elements are *false*, a consensus is *false*, and with all elements *true*; a consensus is *true*, as is expected for causation
- procedural congruence and institutional restriction are *false* but context-bound firm interaction is *true* showing a consensus is *true,* for causal dependence can be a counterfactual dependence
- procedural congruence and context-bound firm interaction are *false* but institutional restrictions is *true*; a consensus is *false*, for causal dependence implies causation is transitive [1] whereas causal dependence is not, explains causation without causal dependence
- procedural congruence is *false* while institutional restrictions and context-bound firm interaction are *true*; a consensus is *true,* for causal dependence of the procedural congruence complement is in the closure of institutional restrictions. The closure is the intersection of all closed sets and this is the smallest closed set is a counterexample maintaining a boundary interaction
- procedural congruence is *true* and institutional restrictions and context-bound firm interaction is *false*; a consensus is *false,* for causal dependence is intransitive [2] when procedural congruence occurs without institutional restrictions
- procedural congruence and context-bound firm interaction are *true* but institutional restrictions is *false*; a consensus is *false* as it is expected for causation and causal dependence
- procedural congruence and institutional restrictions are *true*, but the context-bound firm interaction is *false*; a consensus is *true* maintains a causal (counterfactual) dependence by adhering to a charade of conformity to the institutional restrictions

Table 3: Truth table of logical expressions

$P\ \binom{procedural}{congruence}$	$R\ \binom{institutional}{restriction}$	$F\ \binom{context}{bound\ firm}$	$(P\ R) \vee (P'F) \vee (R\ F)$	$(P\ R) \vee (P'\ F)$
0	0	0	0	0
0	0	1	1	1
0	1	0	0	0
0	1	1	1	1
1	0	0	0	0
1	0	1	0	0
1	1	0	1	1
1	1	1	1	1

It is proposed hereby that boundary-spanning highlights the tense relationship among institutional restrictions, procedural congruence, and context-bound firm interaction. Based on our Boolean discussion, the causation transform is very practical to explain. First, procedural congruence depends causally on institutional restrictions if and only if the former occurs if the latter has occurred. However, when procedural congruence and institutional restrictions are false can be analysed as counterfactual dependence because its antecedent and consequence are true. Second, causal dependence implies causation; the latter is a cause of the former, but the reverse interaction between institutional restrictions and procedural congruence is not true. Causation is transitive, whereas causal dependence may not; thus, there is causation without causal dependence. Third, subject to causal dependence, isomorphism is not an inclusive standard but serves as a

[1] Transitive relation occurs when P is related to R, and R is related to F, then P is related to F.
[2] Intransitive relation occurs when P is related to R, and R is related to F, then P is not related to R yet relates to F.

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counterexample that differs from complement. While a complement is a contradictory statement, a counterexample refutes procedural congruence when consensus is reached, finely adjust a boundary interaction. Fourth, as far as causal dependence goes, when procedural congruence depends on regulative (VAT) interactions that cannot constrain IPRs isomorphism but represent procedural congruence being perturbed by restrictions, the causal dependence is intransitive. Specifically, VAT restrictions cause procedural congruence, even though procedural congruence is true without institutional restrictions. Finally, a causal (counterfactual) dependence encapsulates a charade of conformity when consensus is reached, the closure of the context-bound firm is dense, includes institutional restrictions and procedural congruence.

6. Contribution and Implications

In a nutshell, this paper contributes to boundary-spanning, and isomorphism interactions. Boundaries are central in providing meaning, establishing certain institutional restrictions that may hamper exchange. This duality is significant for research because defined boundaries are meaningful for causing interactions in any combination. Boundary transforms a context-bound isomorphism into an interaction that becomes critical to understanding procedural congruence signifies institutional restrictions. We focus predominantly on the role of causal dependence that must be considered in isomorphism interactions to produce concrete results.

As a topic generating new insights, a contradiction, and a confirmation of isomorphism, we explain that when the procedural congruence is *false* (counterexample) and *true* (counterfactual), it maintains boundary-spanning interaction. Hence, the role of institutional practice is questioned by the requirements of the relevant specification and the appropriate policy. Policy and practice are two fundamental concepts for understanding interactions that often develop to be merely ceremonial and thus without substantive implementation (Boxenbaum & Jonsson, 2008; Lim & Mandrinos, 2020; Mandrinos & Nik Mahdi, 2016; Meyer & Rowan, 1977). From an institutional standpoint, our study contributes to greater visibility of the need for governments to revisit institutional isomorphism in structures and procedures affecting context-bound firms' interactions. The tensions that arise from institutional restrictions can lead to an opaque exchange that may limit the potential and returns of international business. Procedural congruence can be detrimental to context-bound firms regardless of conformity, which may manifest in institutional restrictions.

Theoretical concepts such as the structural and procedural congruence of institutional restrictions have been introduced to sustain isomorphism which differs from institutional voids, and allows for decoupling from conformity (Gurr, 1998; Tashman et al., 2018). In this study, the procedural congruence excludes the degree of public processes following the complexity of misuse of the PDO. Between isomorphism and procedural congruence, context-bound firm growth depends on institutional restrictions. Restrictions commit to defining the reporting structures so isomorphism becomes part of the causal procedures when division and distance from isomorphism are especially acute. Isomorphism plays a vital role in the supranational environment conforming to institutional restrictions results in governmental support needed to ensure growth (DiMaggio & Powell, 1983; Meyer & Rowan, 1977). Hence, our study is critical for policymakers to gain a better theoretical and practical understanding of the effects of causal dependence on isomorphism, including the issue of procedural congruence.

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Another central conjecture underpinning this investigation is that our study contributes to qualitative and quantitative research to discern the boundary span. Findings are valuable for practicing researchers and industry practitioners who want to learn more about the effects of fuzzy logic and set theory (Boolean) considering the institutional restrictions on the behaviour of context-bound firms with IPRs. Fuzzy (set-theoretic) logic explains the true equivalence of a proposition resulting from set substitutions. In our study, interview-based relations connected with set-theoretic logic produce provable responses, words and sentences. A typical example of algebraic logic using sentences as mathematical applications might seem less constructive than deductively enumerating (Steingart, 2023). Yet, algebraic operations can be helpful to get causal dependence and add to description and exploration suited to contextualised research. Thus, fuzzy (algebraic) logic allows inductive theory building to combine contextual and explanatory rigour especially in areas where evolving logic makes it difficult to discern the boundary span. Inductive theory building is an important addition to the language of interview quotes in combination with causal dependence to explain the true equivalence of the developing proposition.

7. Limitations and Future Directions

Our investigation has limitations regarding utilising theoretical and empirical lenses that allow the fundamental relationship to be shown. Although we claim that fuzzy (set-theoretic) results are robust, some unobserved elements may be omitted. Hence, a possible deficiency could intrigue future researchers to extend our findings from perspectives that might account for any elements missing from our consideration. For instance, causation and causal dependence can be explained by continuity of change (Charlton, 1983). With procedural congruence, it is regular to cause continuation, and what causes a change relates to the past; yet, what causes a change may not be followed by change or may be followed by change but not produce one; then there must be other elements that cause continuity that presumably occur simultaneously (Charlton, 1983: 152). Equally, our investigation has limitations relating to the sample, which only includes firms from a single country. This is no minor inconsistency; for all other things being equal, a large sample size is more conclusive than a small sample and valid on hypothesis merits. This leads us to ask whether the outcomes of the study can apply to other geographical and IPR contexts. Despite our research maps out the conceptual landscape of boundary-spanning and isomorphism interactions by comparing how underlying elements are related, why, and under what circumstances they show a particular relationship, still, it is reasonable to ask whether our study can apply to other IPR contexts. Further investigation must be conducted to corroborate if a single country's findings can help explore in greater detail other possible, more complicated IPR context interactions in a union of countries or supranational institutions (i.e., the EU). The context examined within this paper demonstrates a firm regulatory heterogeneity amid EU and non-EU markets, and, therefore, any cross-country investigation to consider the flaws or strengths of our presented sets (firms or institutions) should be confirmed or refuted through a more detailed examination to avoid simplification of findings. The experience in similar markets is particularly relevant to understanding the transferability to other markets and IPR contexts. Suppose our rationalisation and industry relevance is confirmed within different contextual settings. In that case, this may allow us to assimilate and outpace flows in scholarly studies and provide more supplementary insights.

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Ethics Approval and Consent to Participate

The researchers used the research ethics provided by the Research Ethics Committee of University of Essex, UK. All procedures performed in this study involving human participants were conducted in accordance with the ethical standards of the institutional research committee. Informed consent was obtained from all participants according to the Declaration of Helsinki.

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Conflict of Interest

The authors declare no conflict of Interest.

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