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Schumpeterian dynamism, internationalization, and the moderating effect of innovation: A dynamic panel analysis of Canada and the United States

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Abstract

Schumpeterian dynamism offers a useful lens for understanding how regional economies undergo renewal through creative destruction and the interactions within innovation ecosystems. This paper examines whether internationalization strengthens regional business dynamism, and whether innovation capacity, grounded in the idea of absorptive capacity, moderates that relationship. It also tests whether the effect of export intensity is nonlinear, with an optimal level beyond which further global integration yields smaller gains. The analysis uses a dynamic panel of all 50 U.S. states and 10 Canadian provinces from 2007 to 2023. Dynamism is measured by standardized net employment growth, export intensity by exports as a share of GDP, and innovation by business R&D intensity. Fixed effects, difference GMM, and system GMM estimators are compared, with institutional quality treated under alternative instrument assumptions. Exports are positively associated with dynamism in the fixed effects models, but this link is not robust once endogeneity and dynamic adjustment are addressed. Business R&D has no statistically reliable direct effect. The interaction between exports and innovation is positive but close to zero and statistically insignificant, so there is no evidence that innovation moderates the effect of internationalization. The inverted U relationship is also not supported, because the implied turning point falls outside the observed range. Educational attainment and employment are positively associated with dynamism, while population growth is negatively associated. The findings suggest that trade promotion alone is unlikely to maximize regional benefits. Economic development strategies should instead combine international connectivity with investment in human capital, absorptive capacity, and regional innovation systems.

***Keywords*:** Schumpeterian Dynamism, Internationalization, Innovation, Absorptive Capacity, Export Intensity, Regional Development, Dynamic Panel Data, GMM Estimator

JEL Classification: C23, F14, L26

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1. Introduction

Schumpeter (1943/2008) characterizes entrepreneurial dynamism as a process of creative destruction. This concept provides a useful framework for understanding how the longevity of leading firms depends on how rapidly stagnant incumbents are challenged and overtaken by newer, more agile competitors. This proposition has a major implication for regional economic resilience. This paper examines how export intensity drives the persistence of firm dominance. As a key driver of regional dynamism, internationalization expands firms' access to markets, knowledge, technology, talent, and capital. Yet its impact is rarely direct. This raises an important question: under what conditions does trade openness foster business dynamism? From knowledge spillovers and regional learning to international exposure, we examine the role of innovation as a moderating factor in the internationalization-dynamism nexus. Innovation enables firms, especially small and medium-sized enterprises (SMEs), to absorb external knowledge, enhance productivity, and sustain competitive advantage in international markets. However, these opportunities do not automatically translate into regional economic growth and resilience. Firms require a set of organizational routines and strategic processes that allow capabilities, skilled personnel, managerial quality, and complementary innovation assets to systematically drive value creation. This unique ability to identify, assimilate, and exploit international know-how is termed absorptive capacity (Cohen & Levinthal, 1990).

Cohen and Levinthal (1990) posit that although the capabilities that define a firm's absorptive capacity may exhibit similar patterns across different firms, firm-specific variations exist to the extent that the capabilities are derived and deployed. This suggests that in the absence of the appropriate levels of absorptive capacity, or under suboptimal regimes of appropriability, the innovation gains associated with trade openness may not be fully realized. This premise allows us to advance a model outlining the conditions under which the positive moderating effect of innovation can aid a firm's ability to foster Schumpeterian dynamism by maximizing the gains from internationalization.

First, we benchmark dynamism and export intensity across the 50 states and 10 provinces in the United States and Canada, respectively; two advanced economies organized along federal lines. Despite sharing many commonalities at both the cross-country and subnational levels, the two countries, eight regions, and 60 states/provinces exhibit significant differences. Second, in the Canada-U.S. context, and based on the notion of absorptive capacity, situating export intensity as an enabling condition rather than an automatic engine of Schumpeterian dynamism is important. Theoretically, with high levels of absorptive capacity, export intensity fosters international knowledge, which in turn leads to more patents, product innovation, process innovation, and productivity gains. Based on this logic, internationally connected regions with strong R & D capabilities and universities should outperform peer regions that are open but with limited innovation capabilities (Cohen & Levinthal, 1990; Porter, 1998; Florida, 2022). However,

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empirical evidence remains mixed across Canada, the U.S., and other regions, with considerable heterogeneity on whether absorptive capacity strengthens internationalization outcomes (Zahra & George, 2002; Cockburn, MacGarvie & McKeon, 2023). We therefore pose an important question: is the contribution of internationalization to higher net job creation and private-sector employment growth conditional on whether U.S. and Canadian regions can transform global knowledge, competition, investment, and market access into innovation?

Based on a dynamic panel model with Generalized Method of Moments (GMM) estimators, we examine under what conditions innovation moderates the effect of internationalization on regional economic growth and resilience. In the first instance, business dynamism is inherently persistent, as current levels of firm entry, job creation, and employment growth are influenced by past regional economic conditions. Including the lagged dependent variable captures this dynamic persistence while avoiding omitted dynamic effects. Also, the GMM estimator addresses endogeneity arising from reverse causality, simultaneity, and omitted variable bias, while also controlling for unobserved time-invariant regional heterogeneity. The dynamic system GMM framework provides more consistent and efficient estimates of the causal relationships among the variables of interest while accounting for the persistence of business dynamism over time (Arellano & Bond, 1991; Blundell & Bond; 1998; Roodman, 2009). A fixed effects model (FEM) is also estimated to provide a benchmark for comparison where endogeneity is not expected to be a significant concern.

The remainder of the paper is structured as follows. In Section 2, the relevant literature and theoretical underpinnings of Schumpeterian dynamism, internationalization, and innovation are examined. Section 3 discusses variables, data sources, model specification, and empirical strategy. Estimation methods and econometric results are presented in Section 4, while Section 5 concludes with implications for policy, programmatic interventions, and future work in this area.

2. Literature Review and Theoretical Underpinnings

2.1 Regional Dynamism and Internationalization

Much of the conventional literature on the internationalization-dynamism nexus favours a positive correlation, largely because exporting firms are expected to have access to larger markets, leverage economies of scale, and accelerate their learning curve (Jiang & Sekkel, 2024). According to Hsu et al. (2013) and Hill et al., (2021), more internationalized SMEs tend to outperform domestic firms. Similarly, Jong and van Houten (2014) posit that firms involved in international markets perform better than less internationalized firms. While some argue that benefiting from internationalization depends on contextual factors like firm size, industry, and market conditions (de Jong & van Houten, 2014), others note its beneficial effects, with a caveat: internationalization can also introduce new risks and costs, especially for SMEs with limited resources (Hsu et al., 2013). The findings of de Jong and van Houten (2014) highlight that the gains from internationalization may diminish as firms expand beyond their optimal scale of operations,

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resulting in inefficiencies and increased coordination costs. Therefore, a definitive conclusion requires thorough analysis and consideration of firm-and region-specific factors.

Fraser et al. (2026) challenge conventional internationalization models by examining resource-constrained settings through a systematic literature review of 113 studies published between 2005 and 2022. The findings reveal mixed and often contradictory evidence: factors typically conceptualized as antecedents, mediators, and moderators of internationalization do not operate uniformly as facilitators. Instead, they can function as either enablers or inhibitors depending on contextual conditions. Drawing on this paradox, the authors conclude that there is no universal or "one-size-fits-all" approach to managing the complexities of SME internationalization, underscoring the need for context-sensitive strategies.

Qutob and Ye (2024) investigate how SMEs led by native-born Canadians internationalize into distant markets characterized by unfamiliar institutional environments, particularly in the absence of pre-existing ties. Drawing on inductive insights from qualitative interviews, the study examines the internationalization strategies of six Canadian SMEs operating in the United Arab Emirates. Recognizing that institutional conditions are deeply embedded in the business environment, the findings reinforce a key stylized insight: both the early development of networks and the strategic outsourcing of networking activities are critical to achieving success in geographically distant yet commercially attractive markets.

Nevertheless, despite an implicit consensus in the firm internationalization literature that exporters tend to be more innovative, compared to their non-exporting peers, Lileeva and Trefler (2010) offer a somewhat different argument. Lileeva and Trefler's (2010) logic is based on the premise that some exporters may exhibit lower innovation capability than expected, suggesting that due to varying reasons (e.g., market entry costs, learning curves, structural barriers, etc.), SMEs do not always fully capture the innovation gains associated with internationalization. Such mixed evidence warrants further investigation. This study provides insight into this by disentangling the key components of regional dynamism and international integration in a comparative dynamic Canada-US setting.

2.2 The Moderating Effect of Innovation

Baldwin and Hanel (2003) identify two key types of innovation, product and process, both of which play a significant role in enhancing competitiveness, particularly during the internationalization process. These authors further suggest that firms that innovate are better positioned to compete in global markets, as innovation enhances their ability to, among other things, adapt to the diverse needs of international customers and differentiate themselves from competitors.

Internationalization and regional business dynamism are connected through a complex and often non-linear pathway where entrepreneurial orientation (EO) and innovation become the key

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mediating and moderating mechanisms. First conceptualized by Miller (1983), and later refined by Lumpkin and Dess (1996), EO encompasses attributes like proactiveness and risk-taking which can help SMEs to innovate and successfully navigate distant and risky markets. In the same vein, innovation becomes the transmission channel through which internationalization drives Schumpeterian creative destruction. In essence, this implies that the intensity of internationalization is not determined only by the pathway but also the type of innovation.

Alvarez and Lopez (2005) argue that firms that engage in international activities often experience productivity gains due to efficiency gains that accrue from the competitive pressures in foreign markets. Similarly, Baldwin et al. (2013) suggest that internationalization forces firms to innovate and optimize their operations to compete globally. Sustained competitiveness requires exposure to international best practices, advanced technologies, and innovative business models. Consistent with Cohen and Levinthal's (1990) absorptive capacity proposition, internationalization becomes not just a growth strategy, but a necessity for capability development and long-term survival in a rapidly evolving global market landscape.

2.3 Endogenous Growth Theory

Despite the lack of a unifying framework, much of the theoretical and applied approaches in understanding regional economic performance is based on two major foundations: (1) traditional neoclassical Solow (1956, 2000) growth model anchored largely on labor and capital, and (2) more recent endogenous growth theory which attributes growth more disproportionately to forces like knowledge diffusion and innovation capacity (Romer, 1986; Lucas, 1988). Regional economic development theorizing has increasingly shifted from exogenous factors to the endogenous ramifications. This newer paradigm recognizes that beyond productivity gains in labor or physical capital in the neoclassical tradition, the determinants of long-run economic growth include equally important ingredients like knowledge creation and diffusion, research, innovation capacity, and skills. In this context, internationalization becomes a key driver of dynamism because it expands the regional knowledge base.

2.4 Schumpeterian Creative Destruction Model

The Schumpeterian view of entrepreneurship is grounded in a dynamic process of innovation that generates new products, processes, and business models. Central to this perspective is the concept of creative destruction, through which Schumpeter (1934/2021) argues that economic development thrives through the continual emergence of innovative firms and technologies that displace obsolete products, firms, and production methods. This process of creative destruction underpins business dynamism by fostering firm entry, market renewal, resource reallocation, and sustained productivity growth. Consequently, Schumpeter's creative destruction thesis is an essential part of business dynamism and the renewal process.

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By the same token, Kacher and Weiler (2024) posit that business dynamism is a highly persistent phenomenon because entrepreneurial ecosystems, institutional quality, and local innovation capabilities evolve gradually over time. Based on the logic of historically rooted institutional differences, regions with high rates of venture creation and closure tend to sustain higher levels of entrepreneurship and employment growth, rather than representing isolated episodes of firm turnover.

Viewed against the backdrop of the moderating effect of innovation, export orientation intensifies competitive pressure because SMEs are exposed to foreign competitors, global customers, international standards, and technological leaders. As intense competition forces firms either to innovate or exit, innovation becomes the channel through which internationalization fosters dynamism and renewal, thereby reshaping regional economies. Regions with a high degree of trade openness but limited innovation capacity experience import competition and job losses, while those that pursue internationalization and innovation in parallel create new industries capable of offsetting job losses.

2.5 Krugman's Economic Geography

At its core, the New Economic Geography (NEG) thesis of Krugman (1991) is based on increasing returns to scale, where industries become more efficient as production expands. The model integrates international trade theory, location theory, and economies of scale into a single framework based on the notion that a region is capable of endogenous differentiation into an industrialized "core" and an agricultural "periphery." The NEG theory underscores that regional development and Schumpeterian dynamism are driven not only by natural resources or comparative advantage but also by inherent and self-reinforcing agglomeration forces. The proposition that the core-periphery dichotomy is driven largely by transportation costs and scale economies corroborates why regional inequalities can persist over time despite the presence of economic activity clusters in urban centres and industrial zones. Rather than assuming industries are evenly spread, the model shows how increasing returns to scale, transportation costs, and market size interact to create geographic concentration.

Some of the key takeaways of the Krugman thesis are consistent with other thoughts in urban innovation, which frame business dynamism as a self-reinforcing regional capability generated by innovation, agglomeration, and adaptive renewal. For instance, a 2021 case study of New York's urban reinvention by Ariño Gutiérrez and Olayele (2021) illustrates how the city continually transforms its economic structure by attracting new industries and leveraging diverse knowledge networks. Rather than relying on its single dominant FIRE (finance, insurance, real estate) sector, New York sustains dynamism through innovation, entrepreneurship, and the capacity to adapt to changing technological and global conditions (Ariño Gutiérrez & Olayele, 2021).

Building upon the research summarized above, Florida (2002, 2005) opines that regional competitiveness is largely about attracting the "creative class;" i.e., highly skilled workers engaged

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in knowledge-intensive occupations. These perspectives complement Krugman's NEG model by showing that regional dynamism is not simply about agglomeration economies but the ability to reinvent and continuously renew the sources of competitiveness. From Silicon Valley and the Research Triangle in North Carolina to the Toronto-Waterloo Corridor in Ontario and the Vancouver technology ecosystem in British Columbia, the NEG proposition highlights how high innovation capacity of exporting firms can foster Schumpeterian dynamism.

2.6 Knowledge Spillover Theory

The knowledge spillover theory of entrepreneurship (KSTE) explains how entrepreneurs identify and commercialize unused knowledge based on the spillovers from knowledge created endogenously (Audretsch, 1995; Audretsch & Feldman, 2004; Audretsch & Keilbach, 2007; Acs et al., 2008). This means internationalization substantially paves the way for knowledge spillovers by exposing firms to foreign technologies, multinational corporations, international research collaborations, global supply chains, and international labor mobility.

The KSTE provides an important bridge between Schumpeterian creative destruction, agglomeration theory, creative class theory, and the innovation effect by recalibrating the discussion from innovation as an outcome to innovation as a resource that fosters entrepreneurial vibrancy conditional on the availability of absorptive capacity to translate such opportunities. Essentially, notwithstanding the preposition of the KTSE, spillovers from international knowledge, technologies, and market opportunities do not automatically generate economic growth; it is incumbent on entrepreneurs to leverage existing innovation ecosystems to help them transform such positive externalities into new ventures and spin-offs.

2.7 Regional Innovation Networks

Pioneered and popularized by Cooke (1992) and later refined by other contributors, at its core, the Regional Innovation Systems (RIS) theory argues that innovation depends on regional networks of firms, entrepreneurs, universities, research partnerships, financial institutions, technologies, public institutions, and intermediary organizations that collectively shape a regional economy's capacity to generate, diffuse, and commercialize knowledge (Cooke, 1992; Asheim & Isaksen, 2002). Export intensity creates access to global knowledge and opportunities, but regional innovation systems determine whether those opportunities are converted into entrepreneurial activity, firm renewal, and sustained business dynamism. Regional economies thrive on the interactions among key players in the innovation ecosystem. The RIS thesis explains why regions exposed to the same global opportunities may experience different outcomes because regions with stronger innovation systems possess greater absorptive capacity to transform international knowledge flows into entrepreneurial vibrancy and dynamism.

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2.8 International Business Channels

From location-specific advantages to the VRIO (valuable, rare, difficult to imitate, and effectively organized) proposition, International Business (IB) theory frames how and why firms internationalize in the context of exploiting firm-specific advantages, accessing new markets, and the acquisition of strategic assets that enhance competitiveness (Hymer, 1976; Dunning, 1988; Barney, 1991; Dunning, 1993). International integration creates opportunities for firms and regions by facilitating access to foreign markets, advanced technologies, managerial practices, and knowledge networks. Building on Cohen and Levinthal's (1990) absorptive capacity thesis, the IB model integrates the knowledge transfer role of multinational corporations vis-à-vis technology, organizational routines, production methods, digital capabilities, and managerial expertise. Regional firms learn through supplier relationships, labor mobility, demonstration effects, and collaborative R&D. In the process, and subject to the availability of the appropriate levels and composition of absorptive capacity, innovation converts transferred knowledge into new products, higher productivity, and employment growth. Business dynamism therefore depends upon successful regional learning rather than international exposure alone.

2.9 Implications for Regional Dynamism

The six theories above essentially describe complementary stages of the same process in the regional dynamism discourse. Below, we provide a snapshot of the roles of key variables and the central theories, along with their implications (Tables 1 and 2).

Table 1. Key variables and their effects on Schumpeterian dynamism

Theory	Role of Internationalization	Role of Innovation	Effect on Business Dynamism
Endogenous growth theory	Expands knowledge and human capital	Converts knowledge into productivity gains	Sustained employment and firm growth
Schumpeterian creative destruction	Increases competitive pressure	Drives creative destruction and industrial renewal	Firm entry, exit, and net job creation
Krugman's NEG	Connects regions to global markets	Strengthens clusters and agglomeration	Concentration of innovative firms and jobs
Knowledge spillover thesis	Generates international knowledge spillovers	Commercializes knowledge through entrepreneurship	New firms and high-growth businesses
Regional innovation systems	Links local and global innovation actors	Coordinates knowledge creation and diffusion	Faster commercialization and regional competitiveness
International business theory	Transfers knowledge and technology across borders	Absorptive capacity enables learning and adaptation	Productivity, expansion, and employment growth

Source: Authors

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Table 2. Theoretical architecture and key takeaways

Theory	Main question answered	Key takeaway and implication for this study
International Business Theory (Hymer, 1976; Dunning, 1988)	Why do firms internationalize?	Explains how global integration provides access to foreign markets, technologies, knowledge, strategic assets, and competitive pressures.
New Economic Geography (Krugman, 1991)	Why do economic activities and innovation cluster in particular places?	Explains how agglomeration economies, market access, increasing returns, knowledge spillovers, and spatial concentration create regional advantages. Internationalization can reinforce these dynamics by connecting regions to global markets and knowledge networks.
Endogenous Growth Theory (Romer, 1986; Lucas, 1988)	Why do some economies achieve sustained growth?	Explains how endogenous factors—innovation, R&D, human capital, and knowledge accumulation—drive long-term productivity growth and economic renewal rather than relying solely on external shocks.
Resource-Based View / VRIO (Barney, 1991)	Why do some firms benefit more from internationalization than others?	Explains how valuable, rare, difficult-to-imitate, and well-organized capabilities allow firms to transform international opportunities into sustained competitive advantages.
Absorptive Capacity Theory (Cohen & Levinthal, 1990)	How do firms convert external knowledge into innovation?	Explains why regions and firms with stronger R&D, skills, and organizational capabilities are better able to exploit international knowledge flows.
Regional Innovation Systems (Cooke, 1992; Asheim & Isaksen, 2002)	Why do regions differ in innovation capacity?	Explains how interactions among firms, universities, governments, and intermediary institutions create regional capabilities for innovation and commercialization.

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Theory	Main question answered	Key takeaway and implication for this study
Knowledge Spillover Theory of Entrepreneurship (Audretsch & Keilbach, 2007)	How does knowledge become entrepreneurial activity?	Explains how unused or underexploited knowledge generates new ventures, entrepreneurship, and business renewal when regional conditions support commercialization.
Schumpeterian Entrepreneurship (Schumpeter, 1934/2021, 1943/2008)	How does innovation generate economic renewal?	Explains creative destruction, firm entry and exit, technological change, and the continuous replacement of outdated economic activities.
Creative Class Theory (Florida, 2002, 2005)	Why do some regions attract innovation capabilities?	Highlights the role of talent, diversity, openness, and urban amenities in attracting knowledge workers who support innovation and entrepreneurship.
Urban Innovation and Reinvention (Ariño Gutiérrez & Olayele)	How do global cities reinvent themselves to sustain competitiveness?	Shows how cities continuously adapt by leveraging global networks, innovation ecosystems, talent, and economic diversification.
Regional Business Dynamism Persistence (Kacher & Weiler, 2024)	Why does business dynamism persist in some regions?	Explains how entrepreneurial ecosystems, institutions, and accumulated capabilities create path-dependent patterns of firm creation, renewal, and employment growth.

Source: Authors' compilation

From knowledge spillovers and regional learning to international exposure, the preceding section provides a detailed synthesis of theoretical and empirical perspectives the role of innovation as a moderator in the analysis of trade openness and Schumpeterian dynamism.

3. Data, Empirical Strategy, and Model Specification

3.1 Business Dynamism

Our major object of interest is business dynamism, based on the notion of Schumpeterian creative destruction. To be able to gather and analyze comparable subnational U.S. and Canadian data, we

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define business dynamism as the extent to which firms in a regional economy create jobs, expand, enter and exit markets, reallocate resources, adapt to new technologies, and respond to related competitive pressures from globalization (Schumpeter, 1943; Foster et al., 2001; Decker et al., 2014; Haltiwanger, 2015). Due to a lack of unified U.S. and Canadian data collection framework, two similar, comparable, but distinct measures of net job creation rate are used: U.S net employment growth (from U.S. Census Bureau) and Canadian private-sector net employment growth (Statistics Canada). This approach warrants two important methodological notes. First, business dynamism is broader than employment growth alone, and could also capture other indicators like net job creation, firm birth rate, establishment entry rate, establishment exit rate, high-growth firm share, business survival rate, etc. Second, while the U.S. Census Bureau's net job creation rate measures births, deaths, expansions, and contractions based on longitudinal establishment data, Statistics Canada's private-sector employment growth generally measures net changes in private employment and may not explicitly decompose employment changes into the same components. Both metrics capture the ability of firms to generate employment through expansion and new business activity and as such constitute one of the primary manifestations of business dynamism. Since both are state- and province-level annual indicators of employment dynamics, the datasets are standardized for pooled panel estimation. The z-score for each is computed as follows:

U.S. states:

$$Z_{it}^{US} = \frac{NJCR_{it} - \bar{NJCR}_{US}}{\sigma_{US}}$$

Canadian provinces:

$$Z_{it}^{CAN} = \frac{PNEG_{it} - \bar{PNEG}_{CAN}}{\sigma_{CAN}}$$

where:

- $NJCR$= Net job creation rate
- $PNEG$= Private-sector net employment growth rate

The standardized values are pooled into a single dependent variable. We also include a country dummy (U.S. = 1, Canada = 0). This approach preserves within-country variation while placing both series on a comparable scale. Overall, this standardized treatment helps preserve the validity of the study's causal interpretations and ensures that its broader research objectives are maintained.

3.2 Export Intensity

Exports offer a valuable performance measure for internationalized firms, as exporting not only reflects demand for a firm's products abroad but also acts as an indicator of the firm's adaptability

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and innovation capacity (Melitz & Trefler, 2012). Research shows that firms which succeed in foreign markets tend to be more innovative, as operating abroad often means overcoming the initial fixed costs associated with exporting and adapting products or processes to suit international demands (Lileeva & Trefler, 2010). We use exports as a percentage of GDP as a measure of internationalization; the equivalent exports per capita measure is included for robustness check. State and provincial exports data are collected from the U.S. Census Bureau and Statistics Canada, respectively.

3.3 Innovation Spending

Following the endogenous growth thesis, innovation expenditure serves as a valuable proxy for innovation performance, as investment on innovation correlates with the development of new products, processes, and technologies that drive firm efficiency (Alvarez & López, 2005). Research indicates that firms allocating resources to innovation, such as R&D or digital transformation, often experience enhanced competitive capabilities (Baldwin et al, 2013; Crespi et al., 2008). Business R & D innovation expenditure as a share of GDP is taken as a measure of innovation, with state and provincial data collected from the U.S. Bureau of Economic Analysis and Statistics Canada, respectively.

3.4 Descriptive Analytics

The relevant descriptive statistics for dynamism, export intensity, and innovation spending across all eight U.S. and Canadian regions are presented below (Table 3 and Figures 1 to 4).

Table 3. Descriptive statistics for all eight U.S. and Canadian regions

Region	Variable	N	Mean	Median	Std. Dev.	Minimum	Maximum
Atlantic	EXP (% of GDP)	40	27.1%	26.6%	11.7%	12.0%	49.4%
Atlantic	INNV (% of GDP)	40	0.4%	0.4%	0.1%	0.2%	0.7%
Atlantic	DYN (z-score)	68	-6.3%	-19.7%	107.0%	-304.3%	308.1%
Central	EXP (% of GDP)	20	22.6%	22.9%	2.3%	18.8%	26.8%
Central	INNV (% of GDP)	20	1.4%	1.3%	0.3%	1.0%	1.9%
Central	DYN (z-score)	34	0.0%	15.9%	90.5%	-283.9%	165.8%
Pacific	EXP (% of GDP)	10	15.4%	14.9%	2.0%	13.4%	19.8%
Pacific	INNV (% of GDP)	10	1.1%	1.0%	0.3%	0.7%	1.6%
Pacific	DYN (z-score)	17	19.4%	36.2%	104.3%	-283.9%	178.5%
Prairie	EXP (% of GDP)	30	34.3%	34.2%	12.2%	19.5%	63.0%
Prairie	INNV (% of GDP)	30	0.5%	0.4%	0.1%	0.3%	0.8%
Prairie	DYN (z-score)	51	1.9%	15.9%	96.9%	-319.5%	148.1%
Midwest	EXP (% of GDP)	204	7.2%	7.0%	2.3%	2.3%	14.0%
Midwest	INNV (% of GDP)	201	1.6%	1.5%	0.9%	0.2%	4.8%
Midwest	DYN (z-score)	204	-2.7%	16.5%	84.8%	-296.9%	240.3%
Northeast	EXP (% of GDP)	170	5.9%	5.5%	1.9%	2.7%	14.2%
Northeast	INNV (% of GDP)	168	2.3%	2.2%	1.5%	0.4%	8.5%
Northeast	DYN (z-score)	170	-9.2%	9.9%	100.9%	-361.3%	228.8%
South	EXP (% of GDP)	255	9.2%	7.5%	6.5%	2.3%	50.9%
South	INNV (% of GDP)	255	0.8%	0.7%	0.5%	0.1%	2.9%
South	DYN (z-score)	255	0.0%	24.7%	89.3%	-288.0%	204.2%
West	EXP (% of GDP)	221	6.2%	5.8%	3.8%	0.4%	19.9%
West	INNV (% of GDP)	221	1.8%	1.5%	1.8%	0.0%	8.9%
West	DYN (z-score)	221	9.6%	38.0%	121.5%	-587.0%	348.2%

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Figure 1. Exports as a % of GDP (Canada, USA, All Regions)

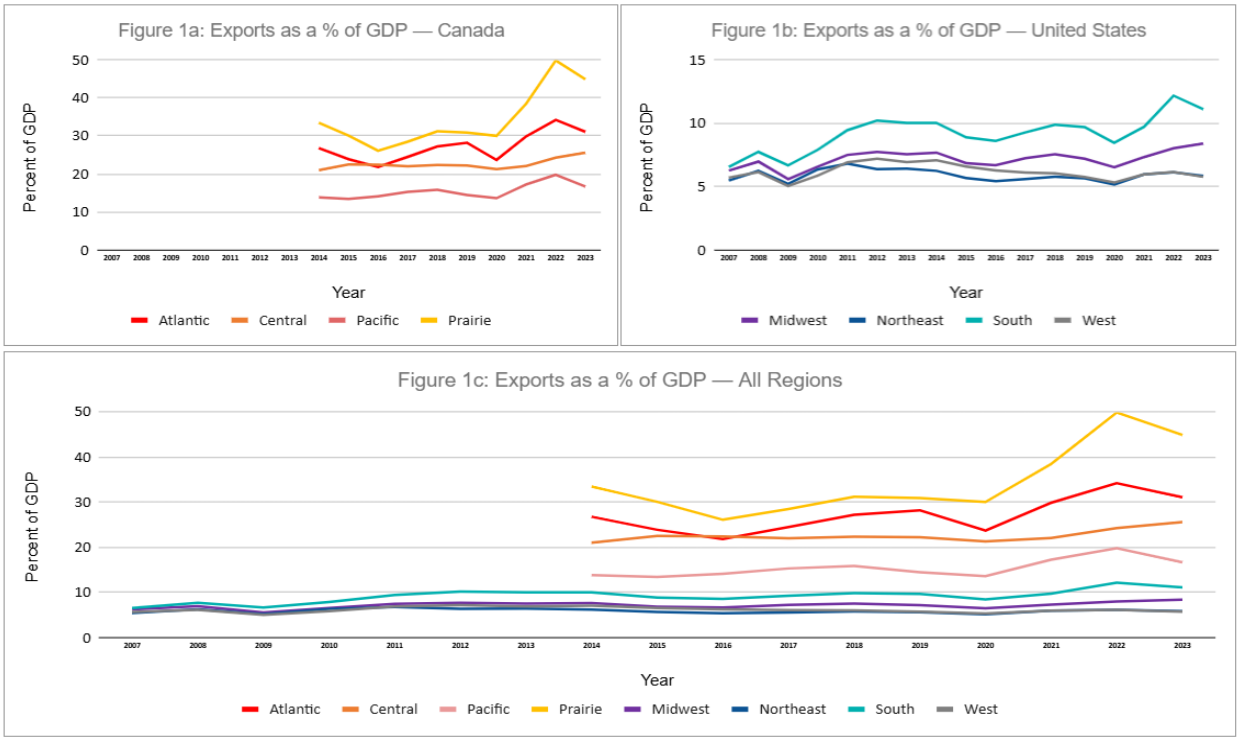

Figure 2. Business R&D Expenditure as a % of GDP (Canada, USA, All Regions)

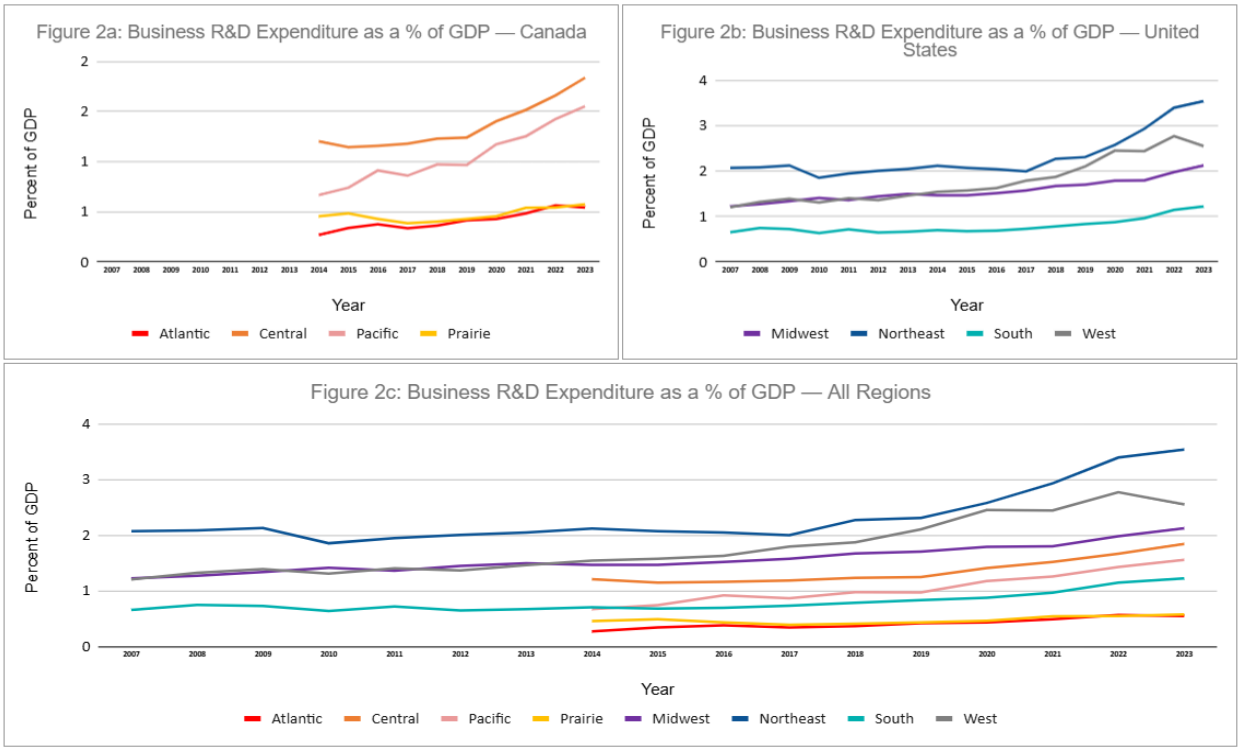

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Figure 3. Private Sector Job Growth Rate (Canada, USA)

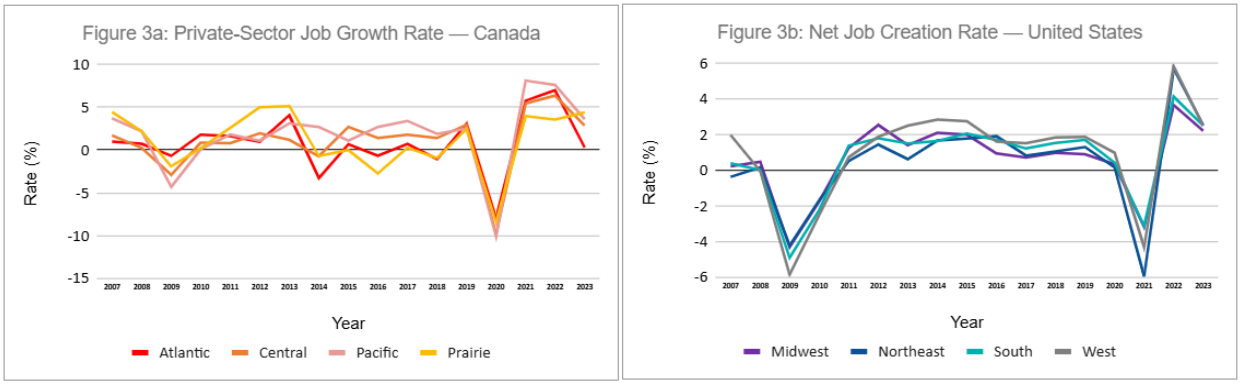
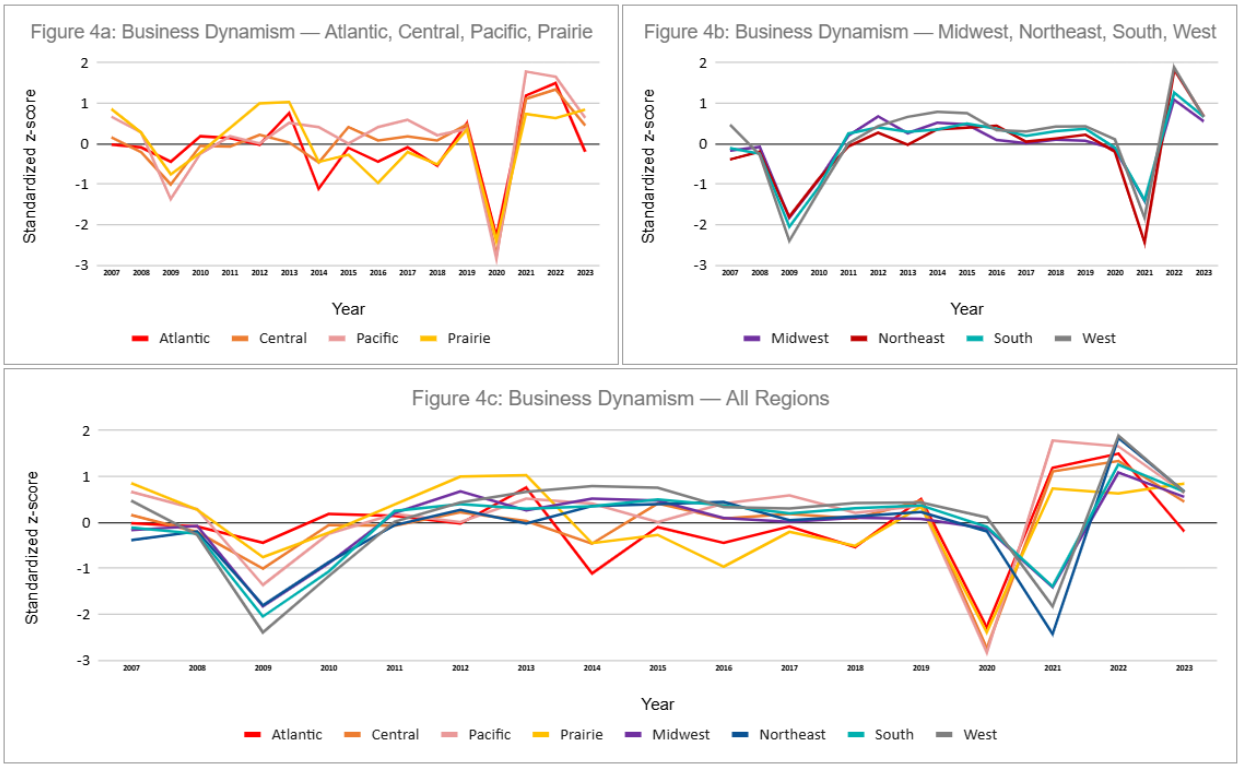


Figure 4. Business Dynamism (Atlantic, Central, Pacific, Prairie, Midwest, Noreast, South, West, All Regions)



Notes: Regional lines are unweighted averages across states/provinces with available data. Canadian exports and business R&D observations begin later; missing years are shown as gaps rather than imputed.

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Table 3 and Figures 1–4 reveal substantial regional differences in dynamism, exports, and innovation intensity both between and within both countries. The U.S. Northeast and Central Canada are relatively urban, diversified, and

knowledge-intensive, characterized by research universities, advanced services, manufacturing clusters, and well-developed innovation ecosystems. Both exhibit comparatively high and generally rising business R&D intensity, although the Northeast maintains a clearer lead. Their export patterns differ, however. Central Canada records a higher export-to-GDP ratio because of its concentration of export-oriented manufacturing, whereas the Northeast combines a large domestic market with a substantial service economy, implying that similar innovation capacity does not necessarily produce comparable export intensity.

The U.S. South and Atlantic Canada present a contrasting pattern. Both contain rural jurisdictions and economies in which natural resources, traditional industries, and smaller population centres remain important. Atlantic Canada nevertheless records relatively high export intensity because of its fisheries, energy, forestry, and other externally oriented industries, while its business R&D intensity remains below that of Central Canada and the leading U.S. regions. The U.S. South is more heterogeneous, as large and rapidly growing states coexist with less diversified rural economies, generating wider variation in business dynamism.

The Prairie and Pacific regions further demonstrate the importance of disentangling the direct and indirect effects of innovation intensity on Schumpeterian dynamism. The Prairies exhibit the highest and most volatile export share, consistent with their exposure to commodity price volatility and energy and agricultural cycles. Pacific Canada and the U.S. West benefit from trade gateways and technology-oriented metropolitan clusters, although their trajectories are not uniform. Most regions also experienced sharp disruptions around 2020, followed by recoveries of varying magnitude.

Overall, consistent with much of the literature and theoretical synthesis in Section 2 (see Tables 1 and 2), the regional patterns corroborate the notion that industrial composition, urbanization, core-periphery architecture, and innovation capacity influence how international exposure impacts regional dynamism. However, since these patterns are descriptive, and do not establish causality, we cannot infer whether innovation acts as a moderating condition or not. This is examined subsequently using dynamic panel estimators.

3.5 Control Variables

Based on the augmented Solow growth framework, we include controls for per capita income, human capital, physical capital accumulation, population, institutional quality, and employment. Human capital is measured by educational attainment. For U.S. states, this is defined as the proportion of the adult population aged 25 years and older holding at least a bachelor's degree, based on the American Community Survey (ACS). For Canadian provinces, the comparable

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measure is the proportion of the population aged 25–64 with tertiary education, obtained from Statistics Canada.

Physical capital accumulation is measured using gross fixed capital formation. Provincial data are obtained from Statistics Canada, while comparable state-level capital stock data are drawn from Yamarik and El-Shagi's dataset, building on the methodology of Yamarik (2011) and Hall and Jones (1999). Institutional quality is proxied by the overall Economic Freedom Index published by the Fraser Institute (Gwartney et al., 2025). This index captures several dimensions of the institutional environment, including the size of government, legal systems and property rights, sound money, freedom to trade internationally, and regulatory efficiency.

Population is included to control for market size and demographic dynamics, and data are obtained from the U.S. Census Bureau and Statistics Canada. Employment and per capita income data are obtained from the U.S. Bureau of Economic Analysis (Regional Economic Accounts) and Statistics Canada (Provincial and Territorial Economic Accounts). The resulting dataset covers all 50 U.S. states and 10 Canadian provinces over the 2007–2023 period, producing a balanced panel of 60 jurisdictions and 1,020 jurisdiction-year observations before the removal of years with missing data, and 945 jurisdiction-year observations after. After the lagged dependent variable and additional lag requirements are introduced, the final GMM estimation sample consists of 820 jurisdiction-year observations.

3.6 Hypothesis and Underlying Model

As already established, existing theoretical and empirical research largely supports the notion that firm internationalization plays a critical role in driving regional dynamism, while evidence on the moderating effect of innovation remains mixed. Also, this study focuses on moderation, where innovation does not transmit the effect of export intensity, but instead changes the strength of that effect. Based on the collective insights drawn so far, here is the central question we pose: Under what conditions does internationalization translate into sustained regional dynamism?

We hope to answer this question based on the following four underlying hypotheses:

H1: Internationalization positively influences regional dynamism.

H2: Innovation capacity positively influences regional dynamism.

H3: Innovation capacity positively moderates the relationship between internationalization and regional dynamism.

H4: The relationship between internationalization and regional dynamism is nonlinear and follows an inverted U-shaped pattern.

To the extent that innovation is a boundary condition, not a causal pathway, H3 remains our principal hypothesis. Innovation is conceptualized as a conditioning capability that alters the

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strength of the relationship between internationalization and dynamism, which is tested through interaction effects in a dynamic panel framework.

3.7 Model Specification

Since regional dynamism is persistent over time, internationalization and innovation may be endogenous, and reverse causality is plausible, our analysis is well suited for the GMM model.

3.7.1 Baseline Model

$$\boldsymbol{Dynamism_{it} = \alpha Dynamism_{it-1} + \beta_1 Internationalization_{it} + \beta_2 Innovation_{it} + \beta_3 Controls_{it} + \mu_i + \lambda_t + \varepsilon_{it}}$$

where

- $\boldsymbol{i}$= state/province
- $\boldsymbol{t}$= year.

3.7.2 Innovation as a Moderator

To examine whether innovation moderates the impact of internationalization on dynamism, the baseline model is extended by including an interaction term:

$$\boldsymbol{Dynamism_{it} = \alpha Dynamism_{it-1} + \beta_1 Internationalization_{it} + \beta_2 Innovation_{it} + \beta_3 (Internationalization \times Innovation) + \beta_4 Controls_{it} + \mu_i + \lambda_t + \varepsilon_{it}}$$

The coefficient of interest is $\boldsymbol{\beta_3}$.

Interpretation:

- $\boldsymbol{\beta_3 > 0}$: innovation strengthens the positive impact of internationalization.
- $\boldsymbol{\beta_3 < 0}$: innovation weakens the effect.

The marginal effect becomes:

$$\boldsymbol{\frac{\partial Dynamism}{\partial Internationalization} = \beta_1 + \beta_3 Innovation.}$$

Our goal is to test whether innovation changes the strength of the internationalization effect. From an econometric perspective, an interaction term tests moderation, not mediation, since mediation requires estimating the indirect pathway based on sequential regressions.

3.7.3 Nonlinear Internationalization

To examine whether internationalization effects vary depending on the existing level of trade openness, the nonlinear specification is estimated as:

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$$Dynamism_{it} = \alpha Dynamism_{it-1} + \beta_1 Internationalization_{it} + \beta_2 Internationalization_{it}^2 + \beta_3 Innovation_{it} + \beta_4 (Internationalization \times Innovation) + \beta_5 Controls_{it} + \mu_i + \lambda_t + \varepsilon_{it}$$

where $Internationalization_{it}^2$ captures diminishing or increasing returns, and:

- $\beta_2 < 0$indicates an inverted-U relationship.
- $\beta_2 > 0$indicates a U-shaped relationship.

This specification identifies whether there is an optimal level of export intensity (i.e., a turning point) beyond which additional global integration produces smaller benefits for regional dynamism. The turning point is captured by a unique threshold of internationalization:

$$Internationalization^* = -\frac{\beta_1}{2\beta_2}.$$

Together, these specifications provide an integrated framework for evaluating if, and under what conditions, innovation and internationalization foster regional dynamism.

4. Analysis and Results

4.1 Instrument Strategy

As indicated under the literature section, since Schumpeterian dynamism is persistent, exports may respond to regional performance, while innovation may be jointly determined with dynamism. This justifies the use of GMM estimators since equations in first differences and levels are combined using internal instruments. Table 4 below provides a summary of the instruments and the rationale for classification as endogenous, predetermined, or strictly exogenous.

Table 4. Variables and Instrument Strategy

Variable	Classification	Reason
$Dynamism_{t-1}$	Endogenous	Dynamic panel bias
Internationalization	Endogenous	Export intensity may respond to regional performance
Innovation	Endogenous	Simultaneous relationship with business dynamism

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Variable	Classification	Reason
Interaction ($INT \times INN$)	Endogenous	Product of endogenous regressors
Quadratic term (INT^2)	Endogenous	Nonlinear transformation of an endogenous regressor
Per capita income	Predetermined	Current shocks may affect future income but not contemporaneously
Educational attainment	Predetermined	Adjusts slowly over time
Capital stock	Predetermined	Investment decisions exhibit persistence
Population	Strictly exogenous	Slow-moving demographic variable
Institutional quality	Strictly exogenous (or predetermined if justified)	Often determined by long-run institutional processes rather than short-run shocks
Employment	Predetermined	Labor market conditions evolve gradually and may react with a lag to shocks
Year dummies	Strictly exogenous	Capture common macroeconomic shocks

Source: Authors

Consistent with Table 4 above, the dynamic base case, innovation as a moderator, and the nonlinear internationalization scenario are modeled across three estimators: FEM, two-step difference GMM (DGMM), and two-step system GMM (SGMM). Based on the instrument strategy in Table 4, institutional quality is used as the principal benchmark for assessing model performance across alternative specifications. For instance, as advanced economies and federal jurisdictions, the observed regions share many institutional characteristics, while several remain highly differentiated across industrial policy, fiscal policy, innovation support programs, international trade promotion strategies, labor regulations, etc. Institutional quality therefore captures important structural heterogeneity that may not be fully absorbed by country or year fixed effects. Table 5 below summarizes the classification of variables as endogenous, predetermined, or strictly exogenous across both the baseline and alternative scenario for the DGMM and SGMM estimators.

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Table 5. Institutional quality benchmark for alternative specifications

Variable	DGMM1 (S1)	DGMM2 (S1)	SGMM1 (S1)	SGMM2 (S1)	DGMM1 (S2)	DGMM2 (S2)	SGMM1 (S2)	SGMM2 (S2)
Dynamism$_{t-1}$	EG	EG	EG	EG	EG	EG	EG	EG
Internationalization	EG	EG	EG	EG	EG	EG	EG	EG
Innovation	EG	EG	EG	EG	EG	EG	EG	EG
Interaction (INT x INN)	EG	EG	EG	EG	EG	EG	EG	EG
Quadratic term (INT^2)	EG	EG	EG	EG	EG	EG	EG	EG
Per capita income	PD	PD	PD	PD	PD	PD	PD	PD
Educational attainment	SE	SE	SE	SE	SE	SE	SE	SE
Capital stock	PD	PD	PD	PD	PD	PD	PD	PD
Employment	SE	PD	SE	PD	PD	PD	PD	PD
Population	SE	SE	SE	SE	SE	SE	SE	SE
Year dummies	SE	SE	SE	SE	SE	SE	SE	SE
Institutional quality	N/A	N/A	N/A	N/A	N/A	PD	N/A	PD

Source: Author

Notes: S1 = scenario 1; S2 = scenario 2; DGMM1 = DGMM under scenario 1; DGMM2 = DGMM under scenario 2; SGMM1 = SGMM under scenario 1; SGMM2 = SGMM under scenario 2; EG = endogenous; PD = predetermined; SE = strictly exogenous; N/A = not applicable.

Table 6 below treats institutional quality as a predetermined variable. Based on the same logic, results in Table 7 assume that institutional quality is strictly exogenous.

Table 6. Estimation results (with institutional quality as a predetermined variable)

	FE1	FE2		DGMM3	DGMM4	SGMM5	SGMM6
Lagged DYN	−0.070**	n/a		−0.251**	−0.236**	0.254	0.028
	(0.034)			(0.098)	(0.107)	(0.244)	(0.175)
EXPG	0.014***	0.013***		0.001	−0.000	0.000	0.003
	(0.003)	(0.003)		(0.004)	(0.004)	(0.002)	(0.002)
EXPG2	−0.000***	−0.000***		−0.000	−0.000	0.000	−0.000
	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)
INNV	−0.002	−0.003		−0.002	−0.002	0.003	−0.006
	(0.005)	(0.005)		(0.010)	(0.009)	(0.009)	(0.005)
EXPG_INNV	0.000	0.000		0.000	0.000	−0.000	0.000
	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)
GDPPC	−1.784	−1.321		−19.696	−21.742	−11.707	−8.645
	(3.556)	(3.395)		(20.414)	(18.429)	(8.237)	(6.039)
CAP	−0.000***	−0.000***		−0.000*	−0.000*	0.000	0.000
	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)
EMP	36.800***	33.062***		95.407***	102.219***	14.613	28.933***
	(4.843)	(3.876)		(18.998)	(34.101)	(9.115)	(7.820)
EDU	−0.086	−0.019		0.905***	0.883***	0.134*	0.141**
	(0.075)	(0.066)		(0.181)	(0.175)	(0.078)	(0.061)
POP	−24.096***	−23.859***		−79.822***	−83.247***	−14.800	−29.008***
	(8.468)	(6.933)		(16.806)	(23.448)	(9.260)	(7.698)
EFI	n/a	n/a		n/a	n/a	n/a	n/a
Groups	60	60	Groups	60	60	60	60
Observations	881	945	Observations	820	820	881	881
Within R²	0.2543	0.2315	Number of instruments	32	33	40	42
Between R²	0.0387	0.1352	Number of lags used	2 to 3	2 to 3	2 to 3	2 to 3
Overall R²	0.0091	0.0170	Sargan Test (p value)	0.916	0.933	0.009	0.196
Prob > F	0.0000	0.0000	Hansen Test (p value)	0.730	0.824	0.108	0.247
Rho	0.9700	0.9432	AB AR(1) (p-value)	0.002	0.001	0.005	0.003
Corr(u_i, Xb)	-0.9935	-0.9890	AB AR(2) (p-value)	0.955	0.881	0.073	0.157

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Notes: Figures in parentheses are robust standard errors. * significant at 10%; **significant at 5%; ***significant at 1%. All estimations based on the Windmeijer's (2005) finite sample correction to the standard errors. FE1 indicates that the lagged dependent variable is included; it is omitted in FE2.

Table 7. Estimation results (with institutional quality as a strictly exogenous variable)

	FE1	FE2		DGMM3	DGMM4	SGMM5	SGMM6
Lagged DYN	−0.072**	n/a		−0.288***	−0.187*	0.277	0.119
	(0.032)			(0.104)	(0.112)	(0.273)	(0.160)
EXPG	0.014***	0.013***		0.001	0.001	0.000	0.002
	(0.003)	(0.003)		(0.005)	(0.005)	(0.002)	(0.002)
EXPG2	−0.000***	−0.000***		−0.000	−0.000	−0.000	−0.000
	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)
INNV	−0.002	−0.003		−0.000	−0.009	−0.002	−0.005
	(0.005)	(0.005)		(0.008)	(0.010)	(0.008)	(0.005)
EXPG_INNV	0.000	0.000		0.000	0.000	−0.000	0.000
	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)
GDPPC	−1.954	−1.321		−19.926	−17.631	−7.559	−7.303
	(3.618)	(3.395)		(19.438)	(17.743)	(8.284)	(5.628)
CAP	−0.000***	−0.000***		−0.000*	−0.000**	0.000	0.000
	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)
EMP	36.228***	33.062***		94.413***	89.051**	14.759	25.057***
	(5.298)	(3.876)		(34.517)	(35.609)	(13.073)	(7.247)
EDU	−0.090	−0.019		0.828***	0.904***	0.113	0.123**
	(0.081)	(0.066)		(0.166)	(0.191)	(0.089)	(0.060)
POP	−23.722***	−23.859***		−74.776***	−83.389***	−14.736	−25.076***
	(8.777)	(6.933)		(22.928)	(26.661)	(12.867)	(6.941)
EFI	0.168	n/a		n/a	n/a	n/a	n/a
	(0.352)						
Groups	60	60	Groups	60	60	60	60
Observations	881	945	Observations	820	820	881	881
Within R^2	0.2546	0.2315	Number of instruments	34	35	43	45
Between R^2	0.0388	0.1352	Number of lags used	2 to 3	2 to 3	2 to 3	2 to 3
Overall R^2	0.0093	0.0170	Sargan Test (p value)	0.880	0.733	0.016	0.236
Prob > F	0.0000	0.0000	Hansen Test (p value)	0.801	0.473	0.090	0.274
Rho	0.9694	0.9432	AB AR(1) (p-value)	0.001	0.000	0.011	0.001
Corr(u_i, Xb)	-0.9934	-0.9890	AB AR(2) (p-value)	0.733	0.499	0.100	0.048

Notes: Figures in parentheses are robust standard errors. * significant at 10%; **significant at 5%; ***significant at 1%. All estimations based on the Windmeijer's (2005) finite sample correction to the standard errors. FE1 indicates that the lagged dependent variable is included; it is omitted in FE2.

4.2 Fixed Effects Results

The FEM examines the within-region relationship between business dynamism, internationalization, and innovation while controlling for all time-invariant jurisdictional characteristics. With 60 Canadian and U.S. jurisdictions over 16 years (i.e., 945 observations after deleting years with missing data) and standard errors clustered at the regional level, the within R-squared value of 0.2315 for FE1 is reasonable, to the extent that our primary goal is to leverage unbiased coefficients for causal inference rather than maximizing predictive fit. The within R-squared is 0.2543 for FE2 when the lagged dependent variable is included. The roughly 23% of the variation in regional dynamism within U.S. states and Canadian provinces over time suggests that a meaningful share of temporal changes in dynamism is captured by the model while leaving

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scope for other time-varying factors not explicitly modeled. The fixed effects estimation relies on changes within each region rather than differences across regions, so the within R-squared metric is a reliable measure for fixed effects. Overall, the estimated FEM performs well both when the lagged dependent variable is omitted and included.

4.3 GMM Estimators

For the DGMM and SGMM estimators, the diagnostics show mixed evidence. Following Roodman (2009), the lagged dependent variable is instrumented using lags 2–3 in both GMM estimators, with the instrument matrix collapsed to limit instrument proliferation. The AR(1) result is as expected and does not indicate a problem. However, while the AR(2) test for the DGMM performs well with p-values of 0.955 and 0.881 across both specifications (DGMM1 and DGMM2), SGMM1 is disappointing. Furthermore, the reported p-values for the Sargan and Hansen tests validate the reasonableness of the instrument strategy for DGMM1 and DGMM2 (less so for SGMM1). The diagnostic tests provide mixed support for the validity of SGMM1, establish the robustness of the DGMM estimator, and to a reasonable degree, SGMM2. The lagged dependent variable under SGMM1 and SGMM2 is not statistically significant, while it is highly significant (at 5%) for DGMM1 and DGMM2.

In summary, the diagnostic and lagged dependent variable results indicate that the outcome deserves careful interpretation rather than assuming one estimator is right and the others are wrong. Under the alternative scenarios where institutional quality is treated as strictly exogenous (Table 7), similar to the results in Table 6, the FEM results are strong. By the same token, for the GMM estimators, the lagged dependent variable is statistically significant under both DGMM1 and DGMM2 but not for SGMM1 and SGMM2. The diagnostic tests also show patterns like Table 6, thereby validating DGMM1, DGMM2, and SGMM1. From an econometric standpoint, these results suggest that the estimators identify the dynamic effect differently. Based on the reviewed literature, it is plausible that key explanatory variables like exports, innovation spending, per capital income, and the interaction and quadratic terms may absorb much of the trend in persistence.

As such, lagged dynamism is unable to contribute additional explanatory power in the presence of these variables. This becomes apparent given that the lagged dependent variable is highly significant in the FE1, FE2, and DGMM models, while losing statistical significance only in the full SGMM specification. One final point on this is the classic "small T, large N" context under which SGMM is expected to thrive. In our case, with T=17 and N=60, Nickell bias is relatively negligible, and the FEM is expected to be reliable.

Therefore, since endogeneity of exports and innovation is the main concern, SGMM2 in Table 6 and SGMM1 in Table 7 are appropriate for causal interpretations because they explicitly fix this problem. Even though the lagged dependent variable is statistically significant under FE1, FE2, DGMM1, and DGMM2, and statistically insignificant under the SGMM specification, since the

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latter model satisfies the AR (1) and AR (2) serial correlation tests and the Hansen and Sargan tests of instrument validity, the insignificant coefficient does not imply model misspecification. Rather, it can be interpreted as evidence that after controlling for internationalization, innovation, and other regional nuances, business dynamism shows limited persistence. The diagnostic tests validate the reliability of SGMM2 in Table 6 and SGMM 1 under Table 7 as the preferred estimators.

4.4 Sensitivity Analysis

Alternative proxies of selected variables are examined to evaluate the robustness of the estimated relationships. For instance, since exports as a share of GDP measures trade openness, but it is influenced by the size of the regional economy, exports per capita are used in place of exports as a share of GDP as an alternative proxy for internationalization. Beyond the two instrument-strategy scenarios reported for institutional quality, several alternative specifications are examined, including different variable operationalizations and estimation choices, to evaluate the robustness of the results. The results under sensitivity analysis do not produce substantially different outcomes.

4.5 Estimation Results

Consistent with the underlying hypotheses, we affirm the FEM as the baseline, DGMM as a robustness check, and the SGMM as the standard estimator that fixes the issue of endogeneity. The results in Table 7 establish that for SGMM2 (S1), SGMM1 (S2), DGMM2 (S1), and DGMM1 (S2), institutional quality exhibits insufficient variation to warrant a separate coefficient being estimated (refer to Table 5 for the definitions of the acronyms). Therefore, institutional quality is absorbed by the combination of year fixed effects and the first-difference transformation. In the FE1 model where it is estimated, the coefficient is statistically insignificant. This offers useful insights because given our subnational Canadian and U.S. samples, this outcome supports the view that not only do within-state/province institutional dynamics change slowly over the 2007-2023 period examined but there is also insufficient statistical evidence that changes in institutional quality drive changes in regional dynamism over the same period. This may imply many things.

First, perhaps institutional nuances influence Schumpeterian dynamism through some of the other drivers (e.g., trade openness and innovation spending). Also, if they are construed as enablers rather than direct employment generators, institutions may exert their influence by facilitating innovation and exporting rather than through direct channels. The coefficient of lagged dynamism is negative and statistically significant across several estimators and scenarios: FE1 (S1) and FE2 (S2) at 5%; DGMM1 (S1) and DGMM2 (S1) at 5%; DGMM1 (S2) at 1%; and DGMM2 (S2) at 10%. The negative range of -0.187 to -0.288 suggests that after controlling for export intensity, innovation, and other factors, a unit increase in dynamism in the previous period is associated with about 0.187-0.288 decrease in current dynamism. A negative coefficient is rather unusual, but it is valid and remains economically sensible. Overall, this could signify mean reversion or adjustment

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dynamics instead of persistence. In the U.S.-Canada subnational setting, this can be explained in several ways. A business cycle adjustment, which returns slower growth due to labor market tightening after witnessing strong employment growth during an economic expansion, is plausible.

Also, as observed across several states and provinces in the immediate aftermath of the COVID-19 pandemic, high business dynamism can lead to labor shortages and higher wages which, in turn, can dampen growth in the subsequent period. In the U.S., Canada, and many OECD countries after the pandemic, several government stimulus and support programs for small businesses which generated temporary job growth were shut down, leading to mean reversion. Across the specifications, the coefficient of internationalization is positive and statistically significant for the FEM, but largely insignificant when estimated with both GMM estimators. This pattern shows that the fixed effects results are not robust after endogeneity and dynamic adjustment are accounted for. The fixed effects finding is consistent with much of the predictions in the theoretical and applied literature on regional development and internationalization insofar as international integration is a key driver of market access and firm entry, and these latter variables are, themselves, drivers of employment growth. Nonetheless, its statistical insignificance in the GMM estimators is also plausible.

Overall, based on both the fixed effects and GMM methods, we can affirm that although exporting is associated with dynamism, we don't have enough evidence to infer causality between internationalization and dynamism after controlling for endogeneity in a dynamic sense. A negative and statistically insignificant coefficient on innovation spending across all estimators and scenarios confirm there is no statistically reliable evidence that changes in business R&D intensity directly affect business dynamism across U.S. states and Canadian provinces over the 2007-2023 period. Again, this should be analyzed in a nuanced context. First, since it takes many years before research commercialization and business R&D spending activities translate into tangible economic benefits, the contemporaneous annual R&D expenditure included in our panel analysis may not immediately translate into observable employment growth. By the same token, it could be that business R&D spending improves the qualitative aspect of a business by focusing on process innovation, rather than job creation. As seen in the increased adoption of AI across several industries in the last five years, adopting a more capital-intensive process may reduce the demand for labor in the medium term, while improving other aspects of the business in terms of productivity and competitiveness. As explained under our empirical strategy, the coefficient of the interaction between export intensity and innovation, β_3, explains the moderating effect of innovation on internationalization.

Across all specifications and estimators, the coefficient is positive, close to zero, but statistically insignificant. Given the centrality of the moderation hypothesis (H3) to this study, we affirm that innovation does not moderate the relationship between exports and Schumpeterian dynamism.

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Since the effect of exporting on business dynamism is not influenced by innovation, the marginal effect ($\frac{\partial Dynamism}{\partial Internationalization} = \beta_1 + \beta_3 Innovation$) is effectively the same as β_1, the coefficient of internationalization.

While there are many plausible interpretations, two key premises are appropriate in our U.S-Canada state/provincial context. First, if innovation and exporting activities operate independent of each other, they may affect entrepreneurial dynamism in the regional ecosystem through separate conduits. Second, to the extent that complementarity is a key driver of productivity growth, if firm international activities only marginally benefit from business R&D spending across states and provinces, then other components of innovation such as research commercialization or product innovation may have greater impact on internationalization than R&D spending.

For the nonlinear internationalization thesis (H4), the FEM returns a negative and statistically significant quadratic coefficient, indicating an inverted U-shaped relationship between export intensity and business dynamism, while the GMM models generate statistically insignificant coefficients. Even so, the estimated coefficient for the FEM is extremely small and close to zero in magnitude, which shows that the nonlinear marginal effect is negligible notwithstanding its statistical significance. Since the quadratic internationalization effect in the FEM is not robust after addressing endogeneity and dynamic adjustment, we do not have enough evidence to affirm that internationalization exerts a nonlinear effect on entrepreneurial dynamism across Canadian and U.S. jurisdictions over the period observed in our study.

With $\beta_2$effectively equal to zero under the FEMs, the threshold of internationalization (i.e., a turning point) beyond which additional export intensity generates smaller benefits for regional dynamism ($Internationalization^* = -\frac{\beta_1}{2\beta_2}$) is extremely small. In our case, with a coefficient of 0.014 for internationalization and -0.000002 for the corresponding quadratic term, the implied turning point for the estimated coefficients is 0.14/-0.000002 = -7,000.

Judging from the descriptive statistics in Table 3, this turning point lies outside the observed range of values reported under exports as a percentage of GDP. This shows that the coefficient of the quadratic term in the FEM, while statistically significant, has little or no practical interpretation in our sample. As such, it does not offer any useful guide for policy or programmatic intervention. We conclude that beyond its mathematical elegance and convenience, the turning point (or inverted U-shape) does not have any implications for the diminishing returns thesis contemplated under H4.

Given the importance of addressing endogeneity, we interpret the coefficients of the control variables strictly based on the SGMM estimator. The control variables seem to be key drivers of the main variation observed in Schumpeterian dynamism, since the four key explanatory variables (internationalization, innovation, interaction term, and the quadratic term) are not statistically significant after endogeneity is addressed.

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Population shows a negative and statistically significant coefficient. Since the estimator here is the dynamic SGMM, this indicates that negative net employment growth is associated with growth in state or provincial population after controlling for export intensity, innovation, and the other factors. This means unless it is matched by investment and innovation activities, population growth alone is not a sole driver of regional business dynamism. The positive and statistically significant coefficient affirm that higher educational attainment fosters business dynamism. As established under the literature review section, this is consistent with the endogenous growth model which underscores the importance of skills and innovation for regional economic dynamism and resilience. Higher educational attainment gives firms access to talent pool and enhances entrepreneurial capabilities.

Employment has a positive and significant coefficient, indicating that increases in employment are conducive for higher entrepreneurial dynamism. For context, our dependent variable is a standardized score based on net employment growth rate and private-sector net employment growth rate, so this is economically plausible. Higher employment may trigger a virtuous circle where increased local demand drives stronger labor market outcomes, which in turn foster business dynamism and firm expansion. It is reasonable for states and provinces with strong labor markets to witness greater business dynamism. Nonetheless, we expect the close relationship between employment and business dynamism to limit the extent of any causal inference from this result. Given that the SGMM is the estimator in question, any concerns around endogeneity are effectively taken care of. Capital stock shows a negligible and statistically insignificant coefficient, meaning any changes in physical capital accumulation do not have any material independent effect on business dynamism. This is inconsistent with the predictions of the augmented Solow growth model and there are many plausible reasons. Perhaps because it takes decades for capital accumulation to occur, our annual data may not significantly capture tangible dynamics here. It could also be because we are analyzing two advanced economies, incremental additions to capital stock may not have noticeable effect on job growth.

4.5 Implications and Key Takeaways

Taken together, these results have major implications for economic development policy and programmatic interventions.

First, the findings underscore that education and labor market dynamics are more important determinants of regional entrepreneurial dynamism than capital accumulation, export intensity, or innovation once endogeneity is addressed. The key implication here is that trade openness alone is insufficient to generate sustained regional dynamism. Internationalization and innovation must be seen as complementary rather than independent development strategies. Regional, state, and provincial economic development agencies should complement export promotion and foreign investment attraction with programs and policies that foster regional innovation ecosystems,

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including R&D, technology adoption, commercialization, and entrepreneurship support. Consistent with the predictions of the endogenous growth model, human capital is a strong positive determinant of regional dynamism, highlighting the importance of skills for business dynamism. In the same vein, this underscores the critical nature of absorptive capacity. If innovation is expected to moderate the benefits of internationalization, the absorptive capacity of firms should be strengthened through investments in business R&D, skills, digital capabilities, and other ingredients discussed under theoretical underpinnings. Export-oriented firms that lack these capabilities may struggle to translate international exposure into productivity gains, and centering industrial policy measures around this will generate suboptimal outcomes.

Second, as established under the RIS and Krugman NEG propositions, regional differences remain important in fostering entrepreneurial vibrancy. For instance, the Atlantic region in Canada shows that while scale and demographic factors constitute major limitations, smaller regions can improve business dynamism by integrating into global markets through industries where they are truly competitive and can strategically deploy differentiated capabilities (e.g., ocean industries, cybersecurity, life sciences, and renewable energy). The recent surge in population growth across major cities in the region has significantly increased demand across several sectors, including manufacturing, utilities, and retail (McMillan, 2023). For a regional economy historically dominated by oligopolistic firms and well-established incumbents, this demographic shift presents both challenges and opportunities for firms operating in the ecosystem. For SMEs seeking to capture greater market share and remain competitive, one critical lever for achieving this may be internationalization. Uniform national policies are unlikely to produce comparable outcomes across regions. Programs and policy should therefore identify regional strengths, develop industry clusters, support sector-specific innovation, and leverage local comparative advantages.

In the U.S, manufacturing-oriented midwestern states like Michigan and Ohio are proof that internationalization can support dynamism when investments in advanced manufacturing and continuous innovation complement existing platforms rather than on mature production alone. By the same token, as seen in smaller and rural states like Vermon and Maine, even with smaller domestic markets, targeted exporting in agri-food innovation and digital industries can foster business dynamism under an appropriate regional innovation ecosystem. Canada's Global Innovation Clusters program offers a classic example of this. The results also support the view that job growth and a thriving labor market both foster business expansion and are more important for regional dynamism than internationalization. This is instructive and has a major implication. Internationalization should be contextualized beyond exporting. If international integration is designed as a playbook for participation in global value chains, research and innovation networks, and continuous learning rather than simply increasing export flows, integrated policy and programs are likely to yield stronger outcomes.

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Finally, two key and interrelated findings are worth highlighting. As reported above, population growth is desirable, but demographic expansion without critical enablers does not guarantee regional dynamism. Also, capital stock does not have an independent effect on dynamism after controlling for other key factors. As witnessed in Canada over the 2021-2025 period, rapid population growth put pressure on infrastructure, housing, and labor markets (Bank of Canada, 2024). This shows that when rapid population growth outpaces housing, infrastructure, and productivity-enhancing investment, it can strain markets and contribute to weaker productivity growth and slower business investment. According to the OECD (2025), rapid population growth has supported labor input and aggregate GDP in Canada, but it has also strained productivity and housing.

These findings suggest that policies aimed solely at increasing trade openness are unlikely to maximize regional economic benefits in the absence of complementary innovation capabilities, and more importantly, absorptive capacity. A more effective economic development strategy is one that integrates internationalization with investments in regional innovation systems, entrepreneurial ecosystems, and human capital. Such an approach enables regions not only to participate in the global economy but also to absorb external knowledge, commercialize innovation, and sustain entrepreneurial dynamism over the long term.

5. Conclusions and Lessons for Policy

This study demonstrates that internationalization alone is unlikely to generate sustained regional dynamism. Among other contributions, our work extends the IB theory to the regional economic development literature and integrates the notion of absorptive capacity, Schumpeterian creative destruction thesis, the RIS model, KSTE, Krugman's NEG thesis, VRIO proposition, and the endogenous growth theory into one framework. Using dynamic panel methods under an integrated U.S.-Canada regional framework, we offer new insights and demonstrate that innovation is better contextualized as a boundary condition, than merely a transmission mechanism. While the results are very sensitive to the estimation methods and various functional specifications and the instruments used, we underscore an important policy lesson: rather than focusing solely on increasing exports, international integration should focus on broader objectives that strengthen innovation ecosystems in order to allow firms and regions maximize the benefits of global integration.

In the context of future work in this area, examining sectoral heterogeneity and distinguishing between goods and services exports would offer additional insights. Also, insofar as the drivers and constraints of Schumpeterian dynamism differ substantially across places, comparing urban and rural states/provinces is likely to improve regional programmatic interventions. This could provide a stronger basis for place-based policy interventions.

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Data availability statement

The data that support the findings of this study are available at the U.S. Census Bureau and Statistics Canada.

Disclosure statement

The authors report there are no competing interests to declare.

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Declaration of generative AI use

The authors report generative AI was not used in their research or preparation of this manuscript.

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