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Evaluation of Productivity in the Canadian Copyright-based Industries

By Rashid Nikzad[*]

Copyright industries are an important part of the economy, accounting for five to over ten percent of the GDP of certain economies. Studies suggest that the copyright sector has grown faster than the entire economy in most countries. However, the author's earlier study found that Canada's core copyright-based industries accounted for a smaller share of the economy when compared to those industries in the United States and Europe. This paper examines the factors behind the slower growth of copyright-based industries in Canada. In particular, the paper estimates the growth of the main economic indicators of the core copyright-based industries of Canada and compares them with those of the rest of the economy and with those of the copyright-based industries in the United States. The study also explores the impacts of factors such as exports, foreign direct investment, and information and communication technologies on the productivity of the copyright-based industries. Generalized Method of Moments (GMM) and System GMM methods are used to estimate the models. The study suggests that there is a significant gap between Canada and the United States in terms of value added, employment, investment, and labor productivity growth of core copyright-based industries.

Keywords: *copyright industries, productivity, economic growth, Canada*

Introduction

Copyright is a type of the intellectual property rights. It applies to "every production in the literary, scientific and artistic domain, whatever may be the mode or form of its expression" (WIPO 2015, p. 22). The economic justification for copyright is the possibility of market failure and sub-optimal production of copyrighted goods because these goods are both non-rival and non-excludable. The copyright sector is a growing part of the service sector and accounts for five to over ten percent of the gross domestic product (GDP) of advanced economies (WIPO 2015). There has been significant interest in the economics of copyright in the past few years, driven by factors such as the shift to the service economy; adoption of the internet, digital production and distribution; and better understanding of the value attached to intangible assets (PwC 2010, USPTO 2012; OHIM and EPO 2013, WIPO 2015).

Moreover, while literature suggests that the increase in productivity is the main driver of economic growth in advanced economies (OECD 2019), studies show a significant productivity gap between Canada and the United States (OECD

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2012, Baldwin et al. 2014a). Considering that the service sector, including the copyright-based industries, now accounts for about 70 percent of the GDP of advanced economies, understanding the factors behind productivity, growth, and income distribution of the service sector is of paramount importance. However, despite the importance of the service sector in the economy, most studies on productivity and innovation are focused on the manufacturing sector.

Nikzad and Solomon (2019) estimate the values added and employment of the core copyright-based industries of Canada. This study extends Nikzad and Solomon (2019) on three fronts. First, it estimates the growth of the economic indicators of the core copyright-based industries of Canada for 2006-2019. Second, it compares these indicators with those of the United States. Third, it proposes an empirical model to explain the factors behind the productivity gap between the Canadian copyright-based industries and those of the United States. The study suggests that there is a significant gap between the value added, employment, investment, and labor productivity growth of the core copyright-based industries of Canada and those of the United States.

The structure of the paper is as follows. The next section explains the economic indicators of the core copyright-based industries in Canada. The section also compares Canada's copyright industries with those of the United States. The following Section develops a model that can be used to empirically test the factors that may affect the labor productivity of copyright industries. The last section concludes.

The Value of the Core Copyright-Based Industries in Canada

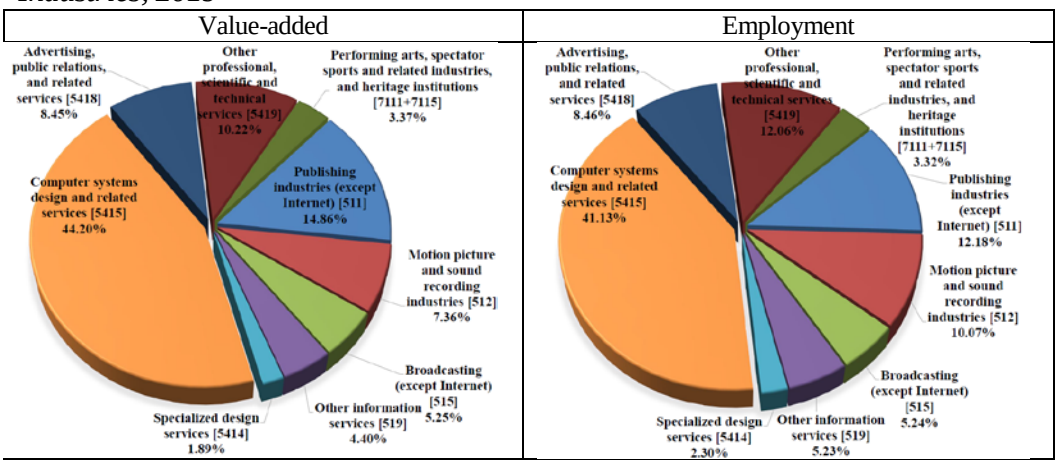
This paper uses the United States Patent and Trademark Office's 2012 study (USPTO 2012) to identify the core copyright-based industries in Canada. USPTO (2012) is a revised version of WIPO (2003), which was published by the World Intellectual Property Office to define the copyright-based industries. To define the "core" copyright-based industries, USPTO (2012) focuses on the subset of copyright-based industries that are primarily responsible for the "creation" or "production" of copyrighted materials. USPTO (2012) was later used by the "Office for Harmonization in the Internal Market" and the "European Patent Office" (OHIM-EPO 2013) and Nikzad and Solomon (2019) to conduct similar studies for Europe and Canada.

USPTO (2012) identifies 13 industries at the 4-digit North American Industry Classification System (NAICS) level as the core copyright-based industries (Table 1). Figure 1 shows the shares of the value-added and employment of these industries in Canada in 2019.

Table 1. *Core Copyright-Based Industries*

No	NAICS	Industry
1	5111	Newspaper, periodical, book, and directory publishers
2	5112	Software publishers
3	5121	Motion picture and video industries
4	5122	Sound recording industries
5	5151	Radio and television broadcasting
6	5152	Cable and other subscription programming
7	5191	Other information services (news syndicates and internet sites)
8	5414	Specialized design services (visual and graphic arts)
9	5415	Computer systems design and related services (software and databases)
10	5418	Advertising, public relations, and related services
11	5419	Other professional, scientific, and technical services (photography and translation)
12	7111	Performing art companies
13	7115	Independent artists, writers, and performers

Figure 1. *Value-Added and Employment Shares of the Core Copyright-based Industries, 2019*



Source: Author's calculation based on Statistics Canada's data.

The variables of interest for this study include value-added, employment, investment, labor productivity, and total factor productivity (TFP). Value-added, employment, and physical investment are extracted from Statistics Canada's CANSIM Table 379-0031, Table 281-0024, and Table 029-0046. The value added is in 2012 chained price. Physical investment is made constant by dividing the investment's current values by the GDP deflator. Labor productivity is calculated by dividing value added by labor. Consistent with Mohnen and Hall (2013) and Baldwin and Gu (2013), the TFP is estimated by dividing value added by the contributions of labor and capital.

Table 2. *Growth of the Economic Indicators of the Copyright-based Industries in Canada from 2006 to 2019*

Growth (%)	Value added	Labor	Physical investment[2]	Labor productivity	TFP[3]
Publishing industries (except Internet) [511]	6.20	-10.75	4.50	18.99	7.14
Motion picture and sound recording industries [512]	40.59	102.20	21.87	-30.47	-19.45
Broadcasting (except Internet) [515]	-6.42	-18.02	-16.42	14.14	18.52
Other information services [519]	81.32	18.28	558.91	53.29	-8.16
Specialized design services [5414]	-38.09	2.41	40.76	-39.55	-53.76
Computer systems design and related services [5415]	78.83	72.77	70.04	3.50	7.39
Advertising and related services [5418]	32.99	28.60	42.45	3.41	-7.76
Other professional, scientific and technical services [5419]	13.95	17.18	92.15	-2.76	-16.44
Performing arts, spectator sports and related industries, and heritage institutions [71A][1]	21.20	31.24	NA[4]	-7.65	NA
Core copyright-based industries[1]	35.63	32.79	NA	2.14	NA
Core copyright-based industries, excluding NAICS 71A[1]	37.35	33.59	39.98	2.81	3.60
All Industries	25.55	18.78	3.79	5.70	6.32

Source: Author's calculation based on Statistics Canada's data.

[1]Note that Statistics Canada does not publish the value added and investment of NAICS 7111 and 7115. Instead, it publishes NAICS 71A, which includes both copyright industries (NAICS 7111 and 7115) and non-copyright industries (NAICS 711 and 712). This paper uses NAICS 71A as a proxy for NAICS 7111 and 7115. The estimates for the core copyright-based industries are reported with and without NAICS 71A.

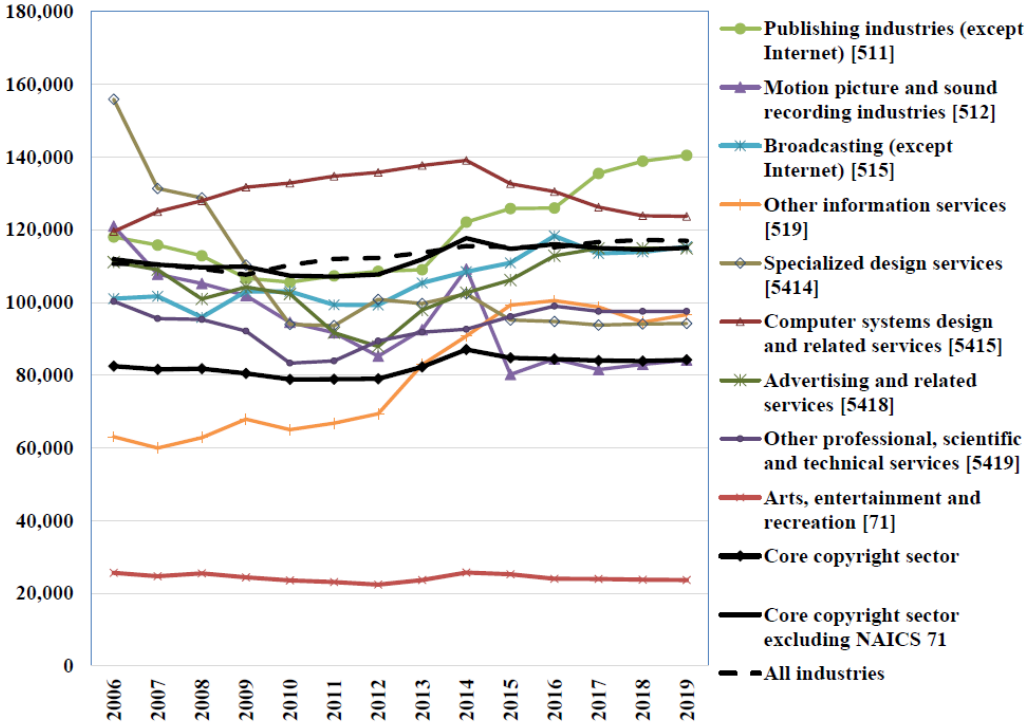
[2]Physical investment is probably not a good measure for investment and assets in the copyright sector. The reason is that intangible assets and investment in intangible asset constitute an important part of assets in the copyright sector. These assets are not captured by physical investment.

[3]TFP is defined as TFP = Value Added/Labour^0.7 * Capital^0.3, assuming constant shares of labour and capital equal to 70% and 30%. Besides this strong assumption, the lack of data about the intangible assets in the copyright sector makes the calculated TFP less reliable.

[4]NA: Data not publicly available.

Table 2 presents the growth of the economic indicators of the copyright-based industries from 2006 to 2019. Some industries are combined due to data limitation. Table 2 suggests that "Computer systems design and related services" (NAICS 5415), "Other information services" (NAICS 519), and "Motion picture and sound recording industries" (NAICS 512) had the highest economic growth measured by value added and labor in 2006-2019. However, with the exception of the labor productivity of "Other information services" (NAICS 519), the productivity measures of the other industries did not grow much or declined. "Specialized design services" (NAICS 5414) shows a significant drop in value added, labor productivity and TFP in this period. Table 2 also shows that while value added, labor, and physical investment of the entire core copyright-based industries grew faster than those of the entire economy in 2006-2019, its productivity indicators grew more slowly.

Figure 2. *Trend of Labor Productivity in the Canadian Copyright-based Industries from 2006 to 2019*



Source: Author's calculation based on Statistics Canada's data.

Also, as Figure 2 shows, the labor productivity of the core copyright-based industries is below that of the entire economy. This difference becomes negligible if NAICS 71A is excluded from the core copyright-based industries. Note that Nikzad and Solomon (2019) had found that the value added of the core-copyright based industries grew more slowly (30%) than the entire economy (31%) in 2001-2015. An explanation for that finding of Nikzad and Solomon (2019) was that the core-copyright based industries were more susceptible to the impact of the 2008 economic recession than the entire economy.

Moreover, Nikzad and Solomon (2019) show that while the core copyright-based industries employed a similar share of employees in Canada, the United States and the European Union in 2010, these industries had a relatively smaller contribution to Canada's GDP (Table 3). This result implies a lower labor productivity of the core copyright-based industries of Canada than those of the United States and Europe. This study expands on this finding by comparing the economic indicators of Canada's core copyright-based industries with those of the United States.

Table 3. *Shares of the Core Copyright-Based Industries, 2010*

	Share of GDP	Share of Employment
Canada	3.0%	3.4%
United States	4.4%	3.5%
European Union	4.2%	3.2%

Table 4 presents the growth of the economic indicators of U.S. copyright-based industries from 2006 to 2019. Unlike Canada, all core copyright-based industries of the United States for which data is available show a significant increase in value added and labor productivity. Also, the growth of the labor productivity of the core copyright-based industries of the United States in 2006-2019 is higher than that of the United States' economy and those of Canada.

Table 4. *Growth of Economic Indicators of Copyright-based Industries in the United States from 2006 to 2019*

Growth (%)	**Value added**	**Labor**	**Physical investment[1]**	**Labor productivity**
Publishing industries (except Internet) [511]	91.44	-15.25	94.83	125.88
Motion picture and sound recording industries [512]	44.47	16.53	38.39	23.98
Broadcasting (except Internet) [515]	66.23	-18.70	45.55	104.47
Other information services [519]	483.18	178.81	593.72	109.17
Specialized design services [5414]	NA[3]	4.22	NA	NA
Computer systems design and related services [5415]	200.89	70.02	62.60	76.98
Advertising and related services [5418]	18.43	6.35	NA	11.36
Other professional, scientific and technical services [5419]	NA	37.17	NA	NA
Performing arts, spectator sports, museums, and related activities [711AS][2]	42.96	30.21	25.46	9.79
Core copyright-based industries (available industries)	108.44	29.41	69.35	61.07
Core copyright-based industries (available industries), excluding NAICS 711AS	118.88	29.34	73.23	69.23
All industries	24.47	10.61	20.19	12.54

Source: Author's calculation based on data from U.S. Bureau of Economic Analysis and Bureau of Labor Statistics.

[1]Physical investment growth is proxied by changes in the net stock of private fixed assets. Due to the lack of data for this variable, "Broadcasting (except Internet) [515]" and "Other information services [519]" are proxied by "broadcasting and telecommunications [515, 517]" and "information and data processing services [518, 519]".

[2]The closest data publicly available to represent the economic variables related to the copyright industries NAICS 7111 and 7115 is NAICS 711AS. However, the scope of this industry is not the same across all variables.

[3]NA: Data not publicly available.

[4]TFP was not calculated because most industries do not have publicly available data for physical capital.

Possible explanations for the lower growth of the core copyright-based industries of Canada compared to those of the United States are as follows. First, various studies suggest that Canadian labour productivity and TFP lag those of the United States (McFetridge 2008, Council of Canadian Academies 2009, Lynch and Sheikh 2011, OECD 2012, Science, Technology and Innovation Council 2015). Copyright based industries may suffer from the same issue as the rest of the economy. Also, it is possible that industries that are classified under the same NAICS in Canada and the United Stated include different activities with different

capital and labor intensities. For example, the difference between Canada and the United Sates in the labor productivity growth of an industry like "Motion picture and sound recording industries" may be attributed to different types of activities that are classified under the same NAICS 512, while the activities in Canada are more labor intensive and the activities in the United States are more Capital intensive.

Second, some studies suggest that Canadian businesses spend less on the information and communication technology (ICT) than US businesses, and that when they spend on the ICT, the quality of their ICT investment is lower than that of US businesses. There are also studies that suggest that this ICT gap is one of the factors behind the Canada-US productivity gap (Gera and Gu 2004, Acharya 2014, Baldwin et al. 2014b). ICT could be an important contributor to the success of the copyright sector. Third, it could be possible that the investment in and value added of the copyright sector are not fully captured in statistics. It should be noted that an important part of investment and output of this sector is intangible. Fourth, the productivity gap could be the result of different copyright policies in the two countries that affect the investment and growth of the copyright sector.

The next section develops an empirical model to examine some of the factors behind the difference in the labor productivity of the copyright-based industries of the two countries.

Analysis of Labor Productivity

The Model

The paper assumes that the production (value added, *Y*) of the core copyright-based industries is a function of labor (*L*), capital (*K*), exports (*Exp*), foreign direct investment (*FDI*), and ICT expenditures (*ICT*). All of these variables are expected to have a positive effect on production:

$$Y = L^{\alpha} K^{\beta} Exp^{\mu} FDI^{\gamma} ICT^{\eta} \quad \text{(Equation 1)}$$

At the next step, labor productivity (*LP*) is defined by dividing production on labor:

$$LP = {}^{Y}/_{L} = L^{\alpha-1} K^{\beta} Exp^{\alpha} FDI^{\gamma} ICT^{\eta} \quad \text{(Equation 2)}$$

After taking the logarithm, Equation 2 is transformed to the following model to estimate the effect of the variables of interest on the labor productivity of the core copyright-based industries:

$$logLP_{i,t}^{CA} = \theta_i + \theta_t + \lambda logL_{i,t}^{CA} + \beta logK_{i,t}^{CA} + \mu logExp_{i,t}^{CA} + \gamma logFDI_{i,t}^{CA} + \eta logICT_{i,t}^{CA} + \varepsilon_{i,t} \quad \text{(Equation 3)}$$

where *i* and *t* stand for industry and year, *CA* stands for Canada, θ_i and θ_t indicate industry and time dummies, λ equals α-1, and ε is the error term. Equation 3 is the first model to estimate. Literature also suggests that research and development (R&D) expenditures is an indicator of knowledge accumulation that can increase productivity. However, this variable is not considered in the model for two reasons. First, there are not much disaggregated data about the R&D expenditures of the copyright sector. Second, it is not clear in literature what constitutes R&D expenditures in the copyright sector and its relationship with output.

The second model examines whether the difference between the labor productivity of Canada and that of the United Stated can be explained by the differences in labor, capital, exports, FDI, and ICT expenditures of the two countries. Starting with Equation 2, the difference between the labor productivity of the two countries can be modeled as follows where *US* stands for the United States:

$$\frac{LP^{CA}}{LP^{US}} = \frac{(L^{CA})^{\alpha-1}}{(L^{US})^{\alpha-1}}\frac{(K^{CA})^{\beta}}{(K^{US})^{\beta}}\frac{(Exp^{CA})^{\mu}}{(Exp^{US})^{\mu}}\frac{(FDI^{CA})^{\gamma}}{(FDI^{US})^{\gamma}}\frac{(ICT^{CA})^{\eta}}{(ICT^{US})^{\eta}}$$

(Equation 4)

After taking the logarithm, Equation 4 is transformed to the following model (Equation 5). Industry and time dummies are added as in Equation 3:

$$\begin{aligned}\Delta\text{logLP} = {} & \log\left(LP_{i,t}^{CA}\right) - \log\left(LP_{i,t}^{US}\right) \\ & = \theta_i + \theta_t + \lambda\left(logL_{i,t}^{CA} - logL_{i,t}^{US}\right) + \beta\left(logK_{i,t}^{CA} - logK_{i,t}^{US}\right) \\ & \quad + \mu\left(logExp_{i,t}^{CA} - logExp_{i,t}^{US}\right) \\ & \quad + \gamma\left(logFDI_{i,t}^{CA} - logFDI_{i,t}^{US}\right) \\ & \quad + \eta\left(logICT_{i,t}^{CA} - logICT_{i,t}^{US}\right) + \varepsilon_{i,t}\end{aligned}$$

(Equation 5)

Equation 5 is the second model to estimate. The advantage of this model is that it controls for unobserved factors that can affect the productivity of the copyright-based industries. It should be noted that Equations 4 and 5 assume that the copyright industries of Canada and the United States can be modeled by the same production function. Under this assumption, the difference in the labor productivity of the two countries is attributed to the differences in labor, capital, exports, FDI, and ICT expenditures of the copyright sector of the two countries.

Empirical Results

Equations 3 and 5 are the main equations to estimate. There are significant data issues with both models. First, exports, FDI, and ICT expenditures of the core copyright-based industries are not publicly available at the 3 and 4 digit-level NAICS for Canada. To run Equation 3, the logarithms of exports and FDI of the core copyright-based industries are proxied by the exports and FDI intensities of the industries represented by NAICS 51 and 54 for their respective sub-industries.

More specifically, the exports are proxied by the intensity of the receipts of copyrights and related rights of "Information, culture and arts" (NAICS 51 and 71) and "Professional, scientific and technical services" (NAICS 54) (Statistics Canada's CANSIM Table 376-0109). The logarithm of the ICT expenditures is proxied by the ICT production intensity of the service sector. Intensity is defined by the share of the variable in GDP. It should be noted that while these variables are the closest publicly available data to the core copyright-based industries, they may not reflect the behavior of the copyright industries correctly.

Second, this study uses physical investment to calculate capital. There is a large body of literature that shows companies invest in intangible assets as much as in tangible and physical assets, and that investment in intangible assets may not be captured correctly by statistical agencies. This problem is probably more profound in the copyright sector that relies significantly on intangible assets.

Table 5 presents the econometric results of Equation 3. The estimations include a panel (longitudinal data) of eight copyright-based industries from 2007 to 2017. The generalized method of moments (GMM) and system GMM are used to estimate the model. Both methods are designed for situations with few time periods and many individuals, independent variables that are not strictly exogenous and may be correlated with past and current error terms, fixed effects, and heteroskedasticity and autocorrelation within individuals. The GMM, also called difference GMM, attempts to remove the potential source of omitted variable bias in estimation by first-differencing the equation. System GMM is an augmented version of GMM that includes both the levels and the first difference equations to improve the use of lagged and differenced variables as instruments. The advantage of using the GMM estimator is that it addresses the endogeneity problem of the variables and the possible unit roots issue. Roodman (2009) explains the applications and differences between these two estimators.

Table 5. *Determinants of the Labor Productivity of the Copyright-based Industries, Canada*

Labor productivity (log)	**GMM**	**System GMM**
Labor (log)	-0.366[d]	-0.354[d]
	(0.226)	(0.226)
Capital (log)	0.192[a]	0.194[a]
	(0.062)	(0.061)
Exports intensity	509.882[c]	510.861[c]
	(300.243)	(297.968)
FDI intensity	-12.150	-12.237
	(12.305)	(12.256)
ICT intensity	-14.908	-18.175
	(24.251)	(20.809)
Constant		12.266[a]
		(1.872)
Observations	80	88

Eight copyright-based industries from 2007 to 2017 (NAICS 71A excluded). Standard errors in parentheses. a: $p<0.01$, b: $p<0.05$, c: $p<0.1$, d: $p<0.15$. The estimations assume labor, value added, trade, FDI and ICT expenditures are endogenous.

In this study, estimations are done using the xtabond2 command of Stata. It should be noted that since the time dimension is small (trade date are available only from 2007 to 2017), the system GMM results are more reliable. The coefficients of labor and capital in Table 5 are consistent with the literature, but slightly lower for capital. According to this results, exports intensity of copyright-based industries had a positive and statistically significant impact on the labor productivity of the copyright sector.

Table 6 presents the econometric results of Equation 5. The estimations are based on a panel of eight copyright-based industries from 2008 to 2017. Besides the data issues that explained above, Equation 5 suffers from an additional issue: the investments of many of the core copyright-based industries of the United States are not publicly available. As indicated in Table 4, the closest available data was used to for the physical capital of the industries. For this reason, the estimations are presented with and without capital. Exports and FDI of the copyright-based industries of the United States are proxied by the exports and FDI of "information" (NAICS 51) and "professional, scientific, and technical services" (NAICS 54) industries for their respective sub-industries.

Table 6 suggests that the difference in capital and FDI intensity, and to some extent in labor, exports intensity, and ICT intensity, could explain the difference in the labor productivity of the core copyright-based industries of Canada and the Unites States.

Table 6. *Determinants of the Difference between the Labor Productivity of Copyright Industries between Canada and the United States*

Difference in labor productivity	**GMM 1**	**GMM 2**	**System GMM 1**	**System GMM 2**
Difference in labor	-0.100	-0.240[b]	-0.152	-0.164
	(0.079)	(0.113)	(0.114)	(0.111)
Difference in capital	0.169[a]		0.134[b]	
	(0.049)		(0.062)	
Difference in exports intensity	-0.003	0.124	0.053[b]	-0.043
	(0.057)	(0.105)	(0.022)	(0.070)
Difference in FDI intensity	0.162[b]	-0.015	0.072[c]	0.159[b]
	(0.067)	(0.125)	(0.042)	(0.077)
Difference in ICT intensity	0.351	1.184[c]	0.258	0.350
	(0.371)	(0.714)	(0.616)	(0.565)
Constant			0.570	-0.222
			(1.710)	(1.841)
Observations	39	42	46	52

Copyright-based industries from 2008 to 2017 when data available, excluding NAICS 711AS. Standard errors in parentheses. a: p<0.01, b: p<0.05, c: p<0.1, d: p<0.15. The estimations assume labor, value added, trade, FDI and ICT expenditures are endogenous.

Conclusion

The objective of the paper was to compare the economic variables of the core copyright-based industries of Canada with those of the United States and develop a model to explain the factors behind the productivity gap between Canada and the United States in these industries. This question deserves attention considering that the service sector is by far the largest sector of the economy and that the copyright sector is a fast-growing sector of the service sector in many countries (WIPO 2015, Nikzad and Solomon 2019).

The paper suggests that there is a significant gap between the value added, employment, and labor productivity growth of the core copyright-based industries of Canada and those of the Unites States. The study proposes an empirical framework to better understand the factors behind this gap. The empirical findings suggest that the exports intensity of the copyrighted products has a positive impact on the labor productivity of the copyright-based industries, and that the differences in the exports, ICT, and FDI intensities of the copyright-based industries of Canada and the United States could explain their gap in labor productivity. However, the results of the empirical models should be interpreted with caution due to data issues.

In particular, there are two data specific issues. First, disaggregated industry data at the 4-digit NAICS are not publicly available for some Canadian copyright-based industries and for many U.S. copyright-based industries. This issue can be resolved by accessing available, but non-public disaggregated data. Second, the study used physical investment to measure investment and capital in the copyright-based industries. However, a large part of investment in copyright-based industries probably consists of intangible assets, and that it is possible that intangible assets and value-added are not reflected correctly in industry statistics. This issue can be resolved in the future as statistical agencies try to better capture the value of intangible assets.

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