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Regulatory Accumulation, Business Dynamism and Economic Growth in Canada

by Wulong Gu

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Abstract

Despite their good intent, regulations and their accumulation over time impose real costs to businesses and may have a negative impact on economic growth and competitiveness. Accurately measuring these costs and benefits is important for understanding if regulations are achieving their desired results. This paper uses a new, modelled, measure of regulatory burden developed by KPMG and Transport Canada to inform about the possible overall impact of the changing number of regulations faced by firms on Canadian economic activity.

Measuring regulatory burden is complex, and there is not a consensus on the best approach. The novel Transport Canada – KPMG measure is based on counting the number of regulatory provisions in Federal legislation and is one of several aggregate measures of regulatory burden available. It shows that regulatory requirements in Canada rose 2.1% per year from 2006 to 2021. A measure from the US based Mercatus Center that is not as broadly defined showed an increase in the number of provisions rising 1.1% per year over the same period while the OECD measure of product market regulation (PMR) that tracks the stringency, rather than the number, of regulations declined.

Using the newly developed Transport Canada – KPMG measure, regression estimates show that regulatory accumulation from 2006 to 2021 is associated with a decline in gross domestic product (GDP) growth by 1.7 percentage points and reduced employment growth by 1.3 percentage points in the business sector. A smaller decline on labour productivity of 0.4 percentage points was also estimated. The business sector investment growth was lowered by an estimated 9.0% (with the effect being bigger for small firms than for large firms) for the period 2006 to 2021 and that regulatory accumulation is associated with lower business entry and exit rates.

Understanding economy wide costs and benefits from regulations is challenging. The results of the study provide a first indication for Canada of the estimated impacts of the changing number of regulations over time on businesses. While the results of the study point to potentially important costs for the economy, it is not meant to reflect a full economic assessment of the benefits of regulations nor economic impacts associated with not introducing regulations.

1 Introduction

Regulations are intended to correct market failures; ensure the good functioning of markets; and protect the public interest, such as safety, health and the environment. Despite their good intent, regulations and their accumulation over time impose real costs to businesses and may have a negative impact on economic growth and competitiveness.

This paper examines the effect of regulatory accumulation on aggregate economic growth. This represents one aspect of the costs and benefits associated with regulation. Regulations also have social, health and environmental effects that are not captured in their effects on economic performance. Those non-economic effects must be included when examining the costs and benefits and the overall impact of regulations.

Aggregate economic growth arises from growth occurring at individual firms and firm turnover through firm entry and firm exit. Therefore, the paper will examine the effect of regulatory accumulation on those two main drivers of aggregate economic growth separately: firm growth and business dynamism. Because an increase in regulatory requirements may disproportionately burden small businesses compared with large businesses, the paper will also examine whether the economic effect of regulations differs between small and large firms.

The accumulation of an increasingly complex set of regulatory constraints is the most striking characteristic in the history of regulations (Dawson and Seater, 2013; Coffey, McLaughlin and Peretto, 2020). Dawson and Seater (2013) constructed a measure of regulatory accumulation using the page counts of regulatory text and found that the measure rose by 3.5% per year from 1949 to 2005 in the United States. A more sophisticated measure of regulatory accumulation based on the number of restrictive provisions was constructed by the Mercatus Center located at George Mason University (Al-Ubaydli and McLaughlin, 2015; McLaughlin and Sherouse, 2019). According to that measure, the total number of restrictive provisions rose 1.9% per year in the United States from 1970 to 2021.

A comprehensive examination of the effect of introducing new regulations on economic performance must consider two factors. First, a regulation is examined on its own for its effect on economic performance. Second, the introduction of new regulations adds to the stock of regulations already in place and increases the overall burden of regulations. A single regulation may appear to have a net beneficial impact on economies when examined on its own—such as a pro-competitive regulation and a reduction in entry barriers—but may still have a net negative effect on economic growth when it is added to other regulations (Dawson and Seater, 2013; Coffey, McLaughlin and Peretto, 2020).

Many of the previous studies focused on the effect of regulations on economic growth on its own and developed regulation measures that target specific economic activities, such as pro-competitive measures (reduction in entry barriers, privatization of public-owned enterprises, and reduction in trade barriers and environmental regulation) (Cette, Lopez and Mairesse, 2014; Gu and LaFrance, 2008; Parker and Kirkpatrick, 2012, for a review of the literature). These measures are then used to examine the effects of regulation on firm and industry performance and economic growth. The Organisation for Economic Co-operation and Development (OECD) measure of product market competition is one of the most notable such initiatives (Conway and Nicoletti, 2006).

The OECD indicator of product market regulation (PMR) measures the restrictiveness of regulations to market competition or the extent to which regulations create barriers to entrepreneurship and restrict competition in domestic markets where technology and demand conditions make competition viable. The indicator of PMR was developed for several non-manufacturing sectors, initially including energy, transport and communication, which were then

extended to include retail distribution and professional services in 30 OECD countries (Conway and Nicoletti, 2006).

The other notable measure of regulation is the World Bank's Ease of Doing Business Index, which is also used in empirical studies to examine the relationship between regulations and economic performance.

This paper differs from the previous studies that focused on specific areas of regulations. Rather, it centres on the accumulation of regulations over time and examines the effect of regulatory accumulation on economic performance and economic growth. The work became feasible after an experimental measure on the accumulation of regulatory provisions was developed for Canada by KPMG, in collaboration with Transport Canada (Transport Canada and KPMG, 2021). The measure by KPMG and Transport Canada (which will hereafter be referred to as the KPMG measure) is conceptually similar to the one (called RegData) developed by the Mercatus Center for the United States, which was further expanded to include Canada and several other countries (Al-Ubaydli and McLaughlin, 2015; McLaughlin and Sherouse, 2019). This paper uses the KPMG measure.

To the author's knowledge, this is the first paper to examine the effect of regulatory accumulation on firm performance and business dynamism, as well as the differential effect of regulatory accumulation between small and large firms. The previous studies focused on the aggregate effect of regulatory accumulation on industry-level or economy-level performance (Dawson and Seater, 2013; Coffey, McLaughlin and Peretto, 2020).

The rest of the paper is organized as follows. Section 2 presents the novel KPMG measure of regulatory accumulation for Canada and compares it with the regulation measure from the Mercatus Center (RegData) and the OECD PMR measure for Canada. Section 3 shows the empirical results on the relationship between regulation and firm performance and firm dynamics. Section 4 concludes.

2 Measuring regulation: A comparison of various measures

This section presents a brief discussion of the newly developed KPMG measure that will be used for this study. A more detailed discussion of that measure was prepared by Transport Canada and KPMG (2021), and it summarizes the main difference between the KPMG measure and other measures that focus on specific areas of regulations. As the main interest in the present paper is the effect of regulation on economic performance and industry competitiveness, the main comparison will be with the OECD PMR measure, which focuses on the restrictiveness or “tightness” of regulations for competition. This comparison will help to better understand the aspects of regulations that the KPMG measure captures.

The measure will also be compared with RegData from the Mercatus Center, which also developed a measure of regulatory accumulation for Canada. Conceptually, both measures are similar and represent a count of regulatory provisions. But there are some distinctions in the implementation, discussed below, that give rise to differences between the two measures.

KPMG created a regulation measure using a similar approach to the Mercatus Center RegData—by quantifying the overall burden of regulation. It derived a measure of regulation burden by counting the number of regulatory requirements and then using an artificial intelligence routine to assign them to particular industries.

Regulations are scanned to be placed into 1 of 10 categories: prohibitive provisions, restrictive provisions, permissive permissions, operational requirements, administrative requirements, ministerial compliance costs, ministerial enforcement costs, ministerial administrative costs, no requirements or unclassified. The first five categories (prohibitive provisions, restrictive provisions, permissive permissions, operational requirements and administrative requirements) impose burdens on industry participants. The next three categories (ministerial compliance costs, ministerial enforcement costs and ministerial administrative costs) impose burdens on the regulators. The final two (no requirements and unclassified) are residual categories.

It should be mentioned that the collaboration between KPMG and Transport Canada is much more than the development of a measure of regulatory accumulation used to examine the effect of regulations on economic performance in this paper. The main purpose of that collaboration is to create an inventory of regulations or a regulatory platform that can be accessed by businesses for their own economic activities, such as starting a new business.

The OECD PMR measure focuses on regulations that restrict competition in product markets. Regulations covered in the OECD PMR measure vary by industry. They include barriers to entry (available for all industries), public ownership (all industries except road freight), vertical integration (only for gas, electricity and railways), market structure (only for gas, telecommunications and railways) and price controls (only for road freight).

The OECD time series measure of PMR was developed for seven non-manufacturing industries: gas, electricity, post, telecommunications, passenger air transport, railways and road freight. These are the network or infrastructure industries that supply inputs to other downstream industries, and the performance of the network industries affects the overall performance of the entire economy. By contrast, the KPMG measure in this paper includes every regulation issued by the federal government and covers all industries. It counts the number of regulatory provisions over time to measure the overall burden of regulatory accumulation on industries, including prohibitions, restrictions, permissions and administrative reporting. It also measures enforcement costs.

The OECD measure essentially captures the tightness or restrictiveness of regulations and the extent that regulations influence market competition. Consider the airline industry in Canada, for instance. Various regulations on safety and customer relations have been imposed on airlines.

The number of such regulations has increased over the years. But the industry has gone from one that was protected against entry to one where entry by domestic carriers is now allowed, and therefore the intensity of the entry barriers has declined. Therefore, the OECD measure of PMR shows regulations for air transportation becoming less restrictive over time and more friendly to competition. By contrast, the KPMG regulatory accumulation measure shows that regulations increased over time as new regulations are added to existing ones.

The KPMG and OECD measures serve different purposes in empirical studies on regulation and economic performance. To examine the economic effect of regulations related to competition, the OECD measure on PMR and other measures that focus on specific types of regulations, such as the World Bank’s Ease of Doing Business Index, are preferred. If, instead, the goal is to examine the cumulative effect and overall burden of regulations, then the regulation measure from KPMG is preferred.

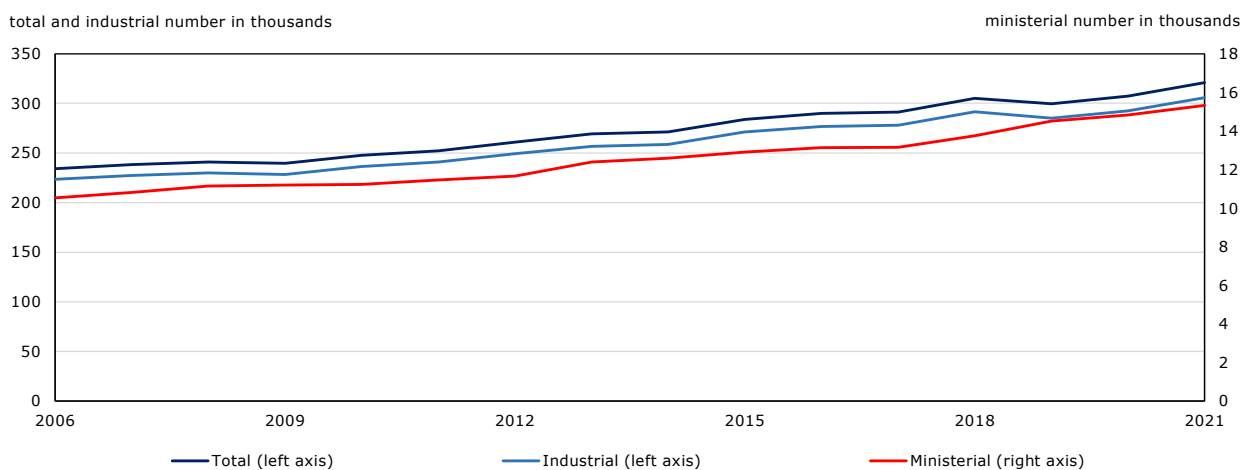
These two regulation measures (from the OECD and KPMG) are useful for evaluating regulatory impact on economic performance and for designing regulations. When considering the introduction of new regulations, it is necessary to examine both aspects—one in isolation and the other in relation to other regulations—for the overall cumulative burden of regulations.

As of now, the KPMG measure includes only regulations at the federal level. Regulations at the provincial and municipal levels will be included in the future.

2.1 Trend in regulatory requirements

Chart 1 presents the number of regulatory requirements, along with their two main components: industrial regulatory requirements and ministerial regulatory requirements. The number of total regulatory requirements increased by 2.1% per year from 2006 to 2021. The number of total regulatory requirements in 2021 was about 37.0% higher than that in 2006. Most regulatory requirements were imposed on industries (95.2% in 2019), while a very small share of the regulatory burden was placed on departments and other government organizations responsible for administering these regulations (4.8% in 2019).

Chart 1
Total number of regulatory requirements in Canada, 2006 to 2021



Source: Author’s tabulation from the KPMG and Transport Canada database on regulatory requirements.

For the empirical analysis on the effect of regulations on firm performance, industrial regulatory requirements will be used. They impose real compliance and administrative costs on firms. By contrast, ministerial regulatory requirements impose costs on the ministers who administer these regulations. From 2006 to 2021, the number of industrial regulatory requirements increased by 2.1% per year, while the number of ministerial regulatory requirements rose by 2.5% per year.

Table 1 presents annual growth in the number of total, industrial and ministerial regulatory requirements from 2006 to 2021 by major sector of the Canadian economy. The largest increase in the number of industrial regulatory requirements was in the e-communications sector, followed by media, financial services and electricity. For the agriculture and forestry sector and the fisheries sector, the number of regulatory requirements declined over this period.

Table 1
Annual growth in the number of regulatory requirements by major sector, 2006 to 2021

Sector	Total	Industrial requirements	Ministerial requirements	Share of industrial requirements
E-communications	5.54	5.53	6.74	98.20
Media	5.01	4.86	0.49	96.98
Financial services	2.80	2.86	1.92	93.94
Electricity	2.58	2.54	3.64	97.01
Transport	2.42	2.40	2.99	96.50
Distribution	2.30	2.24	3.33	95.31
Manufacturing	2.27	2.24	2.85	94.97
Construction	1.67	1.65	2.67	97.03
Mining and quarrying (including oil extraction)	1.37	1.34	2.14	96.94
Business services	1.13	1.11	1.52	95.88
Hotels and restaurants	0.67	0.68	0.00	98.16
Fisheries	-0.51	-0.57	1.53	97.19
Agriculture and forestry	-0.88	-0.75	-2.56	92.90
Grand total	2.10	2.08	2.50	95.47

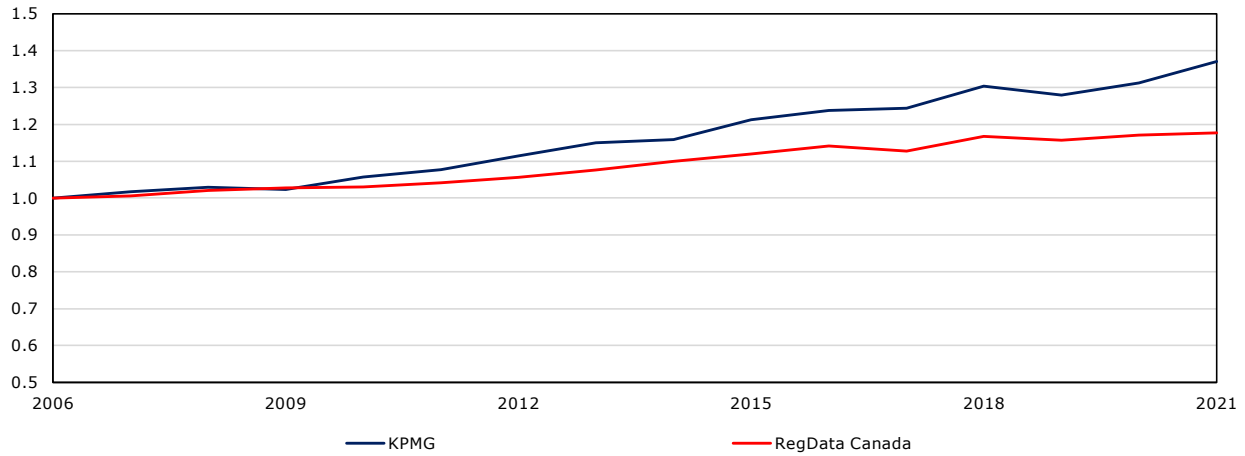
Source: Author's tabulation from the KPMG and Transport Canada database on regulatory requirements.

2.2 A comparison of alternative regulation measures

The concept of regulatory requirements from KPMG is similar to that of RegData developed by the Mercatus Center. As shown in Chart 2, both measures show similar increasing trends in regulatory requirements. The KPMG measure rose at a faster rate than that of RegData. The KPMG measure increased 2.1% per year for Canada from 2006 to 2021, while the RegData measure rose 1.1% per year for Canada over the same period. The level of regulatory requirements also differs between the KPMG measure and the RegData measure. The number of requirements in the KPMG measure is higher than that in the RegData measure, as RegData has about 30% of the restrictions for Canada found in the KPMG measure. This suggests that the concept of restrictions and regulatory requirements is broader for KPMG than for RegData.

Chart 2
Total number of regulation requirements, KPMG versus RegData Canada

number of regulatory requirements (2006=1)

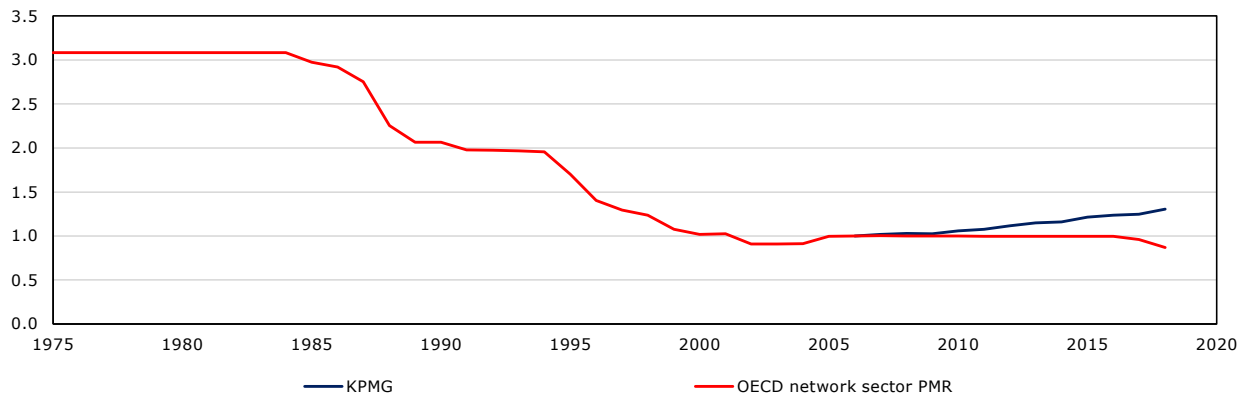


Source: Author's tabulation from the KPMG and Transport Canada database on regulatory requirements and the Mercatus Center RegData Canada.

Chart 3 presents the OECD measure of PMR and the KPMG measure of regulatory accumulation for the network sectors (energy, transport and telecommunication). The OECD measure shows a long-term decline in the restrictiveness of product market competition in the network sectors since 1975, while the KPMG measure shows a trend in regulatory accumulation in these sectors over the last 20 years. While regulatory requirements increased in the network sectors after 2006 according to the KPMG measure, the regulations in these sectors became less restrictive as a result of deregulation in certain industries, such as the telecommunication and air transport sectors.

Chart 3
KPMG regulatory requirements versus Organisation for Economic Co-operation and Development network sector product market regulation, Canada

index of regulations (2006=1)



Notes: OECD = Organisation for Economic Co-operation and Development; PMR = product market regulation.

Source: Author's tabulation from the KPMG and Transport Canada database on regulatory requirements and the Organisation for Economic Co-operation and Development network sector product market regulation database.

The KPMG measure as a count of regulatory requirements gives equal weight to regulations that may be pro-competition and those that may be less so. The OECD measure shows that competition-related regulations became friendlier toward competition. By contrast, the KPMG measure demonstrates that the number of regulatory requirements increased in the network sectors as new regulations were added to existing ones.

3 Measuring the economic impact of regulation

Growth at the industry and total economy levels arises from growth at the firm level and from firm turnover (the entry and exit of firms). To examine the economic impact of regulations, this paper will focus on the source of economic growth at the firm level and, in particular, examine the effect of regulations on firm growth and firm turnover.

This section will first present a theoretical framework and regression model that will be used to examine the effect of regulatory accumulation on firm performance and firm dynamics, from the entry and exit of firms. It will then discuss the firm-level data used for the empirical analysis and present regression results.

3.1 The effect of regulatory accumulation on firm performance and firm turnover

This subsection presents a theoretical framework about how regulatory accumulation affects firm performance and firm turnover. The discussion is mostly informal, but a more rigorous and formal presentation of the models can be found in the work of Coffey, McLaughlin and Peretto (2020) and the Swedish Agency for Growth Analysis (2010).

Regulatory accumulation imposes costs and burdens on firms. Perhaps the most direct and obvious cost of regulation is compliance costs—the costs that businesses must incur to fulfill regulatory obligations. The costs may include filling out paperwork, navigating the set of rules for starting up a new business, and purchasing new equipment to meet mandated standards such as safety and environmental standards.

The direct compliance costs of regulation are expected to further affect firm investment, firm growth and firm dynamics, and ultimately aggregate output and productivity growth. These indirect costs for economies are found to be much higher than the direct compliance costs (Swedish Agency for Growth Analysis, 2010).

The first component of the indirect costs of regulatory accumulation is its effect on firm investment and firm growth. The compliance costs of regulation increase the costs of production, reduce the demand for products and therefore lower returns to business investment, leading to less firm investment and innovation activity. As investment is a major contributor to firm growth in output and productivity, a decline in investment activities resulting from regulatory accumulation leads to a decline in output growth and productivity growth.

The effect on firm employment is ambiguous and is a result of two main factors. On the one hand, the increase in compliance costs of regulatory accumulation leads to the hiring of additional staff for regulatory compliance. On the other hand, the reduced production from regulatory accumulation leads to a decline in employment. The overall impact of the regulatory burden is a net effect of these two offsetting factors. If the decline in employment from reduced sales is larger than the increase in employment from compliance, overall employment will decline. If the increase from compliance is larger than the decline from reduced sales, overall employment will increase.

Second, regulatory accumulation is also expected to have a negative effect on firm turnover and business dynamism. Regulation is expected to reduce business start-ups as additional costs from regulatory compliance reduce the value of potential entry, and firms will be less likely to enter an industry. The decline in business entry from regulatory accumulation is expected to further lead to an overall decline in business dynamism, the process of creative destruction and firm exit.

As firm entry and exit and creative destruction are major sources of innovation and economic growth (Schumpeter, 1942), the decline in business dynamism from regulatory accumulation will reduce innovation activities and economic growth. Empirical studies for Canada and other

countries show that a significant portion of productivity growth is from entry and exit. For example, the contribution of entry and exit to labour productivity growth was found to be about 20% over a 10-year period in the manufacturing sector (Baldwin and Gu, 2006; Bartelsman et al., 2009). The contribution of entry and exit to labour productivity growth is even larger in service sectors where entry and exit are more frequent, such as the retail sector (Baldwin and Gu, 2011).

The increase in regulatory requirements may disproportionately burden small businesses compared with large businesses. Larger firms have more capacity to comply with additional regulatory requirements, because they are likely to have lawyers and dedicated staff on payroll or to contract out regulatory compliance. By contrast, small businesses may have limited resources and expertise for regulatory compliance. The costs of regulatory compliance can be seen as fixed costs that lead to economies of scale. As a result of economies of scale for regulatory compliance, large firms will have lower unit costs related to compliance, because they can spread fixed compliance costs over larger production output than small firms. For example, Tu (2020) found that in Canada, the direct compliance costs related to the costs for filling forms to meet regulatory requirements, as a share of total revenue, are negatively related to firm size.

Conversely, large businesses are more complex and often involve more lines of business than their smaller counterparts. Large businesses must navigate a more complex set of regulations compared with small businesses. Therefore, economies of scale in regulatory compliance may be limited for large firms. Regulatory accumulation may have a greater effect on firm growth among large firms, especially when indirect costs of regulatory accumulation are included.

The discussions above give rise to four sets of equations on the economic effect of regulations that will be estimated in this paper. Regression analysis will be used to estimate these equations. Essentially, the performance of firms with different exposure to cumulative regulation burdens will be compared to get an estimate of the effect of regulation on firm performance after controlling for other factors that may affect performance.

First, the regression equation for firm growth in output, employment and productivity will be estimated:

$$YChg_{ijt} = \alpha_1 Reg_{jt} + \alpha_2 Small_{it} + Cyclical_t + \gamma_i + \varepsilon_{ijt}, \quad (1)$$

where $YChg_{ijt}$ is firm growth in employment, value-added output and labour productivity over a period in year t for firm i that is assigned industry j ; reg_{jt} is the number of regulatory requirements in industry j in year t ; $Small_{it}$ is the dummy variable for small firms, defined as firms with fewer than 100 employees; $Cyclical_t$ is the cyclical variable that controls for cyclical changes in the dependent variable over time; γ_i is the set of firm fixed effects; and ε_{ijt} is the error term for the regression.¹ The cyclical variable is measured by capacity utilization in all industries.

The set of firm fixed effects is included to account for firm-specific factors that affect growth, such as business management skills, technical prowess, specific human capital and other firm-specific intangibles that affect growth.

In the empirical estimation, firm growth, $YChg_{ijt}$, in year t is defined as the growth of output, employment and labour productivity over three years for firm i from year t to year $t+3$. The empirical specification in equation (1) is based on the hypothesis that regulatory requirements in

1. The growth in gross output is also used as a measure of firm performance. The regression results are similar to the results for the growth in value added.

a year will have an effect on firm growth in the future. For robustness, firm growth over a period of one or two years is used in the regression. The results are similar.

To include firm growth for entry and exit over these three years, a generalized form of firm growth is used:

$$YChg_{ijt} = (Y_{ijt+3} - Y_{ijt}) / \left(\frac{Y_{ijt} + Y_{ijt+3}}{2} \right). \quad (2)$$

For this definition, firm growth for entry will be 2, while firm growth for exit will be -2. For a robustness check, firm growth calculated among continuers will also be used as the dependent variable in the regression.

The main interest of this paper is the coefficient estimate α_1 , which is expected to be negative for growth in output and labour productivity. For employment growth, it could be either positive or negative.

The second set of regressions relates to firm entry and exit rates:

$$Rate_{jt} = \alpha_1 Reg_{jt} + \alpha_2 Cyclical_{jt} + \beta_t + \gamma_j + \varepsilon_{jt}, \quad (3)$$

where $Rate_{jt}$ is entry or exit rates for industry j in year t , reg_{jt} is the number of regulatory requirements in industry j in year t , β_t is the set of year dummies, γ_j is the set of industry dummies and ε_{jt} is the error term for the regression.

The entry rate for year t is calculated as the share of new firms from year t to year $t+1$ in the number of firms in year t . The exit rate is calculated as the share of firms that exited from year t to $t+1$ in the number of firms in year $t+1$. These represent annual entry and exit rates. Entry and exit rates over a longer period, such as three years, will also be estimated and be regressed upon to test the robustness of the results. The empirical specification in equation (3) is based on the hypothesis that regulatory requirements in year t will have an effect on firm dynamics in the future.

The entry and exit rates are also calculated using the share of total revenue to account for the fact that average entry and exits are smaller than average incumbents.

The main interest is the coefficient estimate α_1 , which is expected to be negative for both entry and exit rates. That is, regulatory accumulation has a negative effect on firm entry and exit or business dynamism.

The third set of regressions being estimated is used to examine the difference in the effect of regulatory accumulation between small firms and large firms. For that purpose, the interaction term of regulatory accumulation and firm size is included in regression (1):

$$YChg_{ijt} = \alpha_1 Reg_{jt} + \alpha_2 Small_{it} + \alpha_3 Reg_{jt} * Small_{it} + Cyclical_{it} + \gamma_i + \varepsilon_{ijt}. \quad (4)$$

If regulatory accumulation disproportionately affects small firms, the coefficient estimate α_3 will be negative.

The fourth set of regressions is for investment in tangible assets such as machinery and equipment (M&E) and non-residential construction:

$$I_{ijt} = \alpha_1 Reg_{jt} + \alpha_2 Small_{it} + \alpha_3 OutputChg_{it} + Cyclical_t + \gamma_i + \varepsilon_{ijt}. \quad (5)$$

The dependent variable I is either the incidence of investment or investment intensity defined as real investment per unit of employment in logarithm. The incidence of investment is a binary variable that is 1 if the investment in tangible assets is positive and 0 if there is no investment in tangible assets. $OutputChg_{it}$ is the growth in real gross output for a firm in a previous period from year $t-1$ to t . When equations for the incidence of investment are estimated, the sample of firms includes all those with or without positive investment. When equations for investment intensity are estimated, the sample of firms used for estimation is restricted to those with positive investment. All regressions control for firm fixed effects, γ_i .

Ordinary least squares is used to estimate all four equations, including incidence of firm investment. For the regressions at the firm level (equations [1], [4] and [5]), cluster robust standard errors are reported to take into account the possible correlation of firms belonging to the same industry at the North American Industry Classification System (NAICS) four-digit level of industry aggregation (Moulton, 1990).

3.2 Empirical results

The main data used for estimating firm performance are the National Accounts Longitudinal Microdata File (NALMF), which is available for the years after 2000. The NALMF was developed by combining several data sources, including administrative tax records (T2 Corporation Income Tax Return and T4 Statement of Remuneration Paid). The database covers both incorporated and unincorporated firms. The file provides information from the income statement, balance sheets for each incorporated firm that files a T2 and T4 employment data for those firms. The firms in the file are assigned NAICS four-digit codes, which are linked to KPMG regulation data available at the NAICS four-digit level of industry aggregation.

Output and investment from the database are nominal values that are deflated by output and investment deflators at the industry level to derive output and investment at constant prices.

The period of the study is from 2006 to 2019, as regulation measures from KPMG cover only a period starting in 2006. The data from 2020 to 2021 during the COVID-19 pandemic are excluded, because the effect of regulations may be compounded by the effects of the pandemic. The sample of firms is further restricted to all incorporated firms in the business sector that have at least one employee.

The main variable of interest is the number of industrial regulatory requirements. Regulatory requirements borne by industries impose burdens and costs on them, which affect firm performance. Ministerial requirements for departments and other government organizations, which account for a small fraction (5%) of the total number of regulatory requirements, represent costs for these organizations that administer the regulations. Therefore, ministerial requirements will not be included in the regression when examining the effects of regulation on business performance.

Table 2 presents summary statistics of the main variables used for regression. Mean value-added growth in a three-year period is 0.011, or 1.1%. Mean employment growth in a three-year period is 0.9%, while mean labour productivity growth in a three-year period is 0.1%. The mean entry and exit rates in a year as a share of firm counts are both 0.09, or 9%. Mean entry and exit rates as a share of revenue are 3% for entry rates and 4% for exit rates, which are lower than their share in firm counts, as entrants and exiters tend to be smaller than incumbents. The incidence of investment is 0.41. That is, about 41% of firms in the sample invested in tangible assets. Mean investment per worker in log among firms with positive investment is 6.31, which represents \$550 per worker in 2012 prices.

Table 2**Summary statistics of the variables for regression in the sample**

Variables	Number of observations	Mean	Standard deviation
Output growth	4,225,264	0.011	0.573
Employment growth	4,767,204	0.009	0.524
Labour productivity growth	4,225,264	0.001	0.484
Entry rate as share of firm counts	2,418	0.088	0.045
Exit rate as share of firm counts	2,416	0.086	0.036
Entry rate as share of revenue	2,418	0.032	0.064
Exit rate as share of revenue	2,416	0.038	0.068
Regulation in log	7,018,037	6.724	1.643
Incidence of investment	7,672,440	0.412	0.492
Investment per worker in log	2,415,917	6.331	2.165
Cyclical indicator	7,672,440	81.020	2.527

Notes: The number of observations represents firm-year pairs for all variables, except for entry and exit rates, for which the number of observations represents industry-year pairs. The growth in output, employment and labour productivity in a year is calculated for the next three years, and, therefore, the growth variable is not available for all firm-year pairs.

Source: Author's tabulation from the National Accounts longitudinal microdata file.

3.2.1 Effect of regulatory accumulation on firm performance

Table 3 presents regression results for firm growth in output, employment and labour productivity. Growth is expressed as three-year cumulative growth in these variables. Firm fixed effects are included in all these regressions, and cluster robust standard errors are reported in parentheses.

Table 3**Regression results for firm performance, three-year difference**

Variables	Output growth	Employment growth	Labour productivity growth
Regulation	-0.131 **	-0.110 ***	-0.019 *
Small firms	0.406 ***	0.472 ***	-0.055 ***
Cyclical indicator	0.001	0.006 ***	-0.004 ***
Constant	0.380	-0.212	0.543 ***
R-squared	0.367	0.334	0.276

* significantly different from reference category ($p < 0.05$)

** significantly different from reference category ($p < 0.01$)

*** significantly different from reference category ($p < 0.001$)

Note: All regressions control for firm fixed effects.

Source: Author's estimation from the National Accounts longitudinal microdata file.

Regulatory requirements are negatively correlated with growth in output, employment and labour productivity. All these coefficients are statistically significant at the 5% level.

The coefficient estimate on the novel KPMG regulatory burden measure suggests that a 1% increase in regulatory accumulation reduces output growth by 0.131 percentage points in three-year cumulative growth, or 0.044 percentage points in annual growth. Meanwhile, a 1% rise in regulatory accumulation decreases employment growth by 0.110 percentage points in three-year cumulative growth, or 0.036 percentage points in annual growth. The effect of regulatory accumulation on growth in firm labour productivity is smaller. A 1% increase in regulatory accumulation reduces labour productivity growth by 0.019 percentage points in three-year cumulative growth, or 0.006 percentage points in annual growth.

To estimate the effect of regulatory accumulation on GDP growth for all firms in the sample from 2006 to 2021, the estimated coefficient derived from the sample of firms over the 2006-to-2019

period is multiplied by the growth in industrial regulatory requirements in a NAICS four-digit industry from 2006 to 2021 to derive the effect on value-added growth in that industry. These industry effects are then aggregated across industries to derive the effect of regulatory accumulation on aggregate value-added growth using value added as weight. As the firms in the data include all those in the business sector, the aggregate effect estimated represents the effect of regulations in the business sector.

This procedure for calculating the effect of regulatory accumulation on value-added growth in the business sector is the same as an alternative procedure. In this alternative procedure, industrial regulatory requirements at the NAICS four-digit level are aggregated to derive an aggregate index of industrial regulatory requirements using value added as weight. The growth in these value-added weighted industrial regulatory requirements is then multiplied by the estimated coefficient on regulatory requirements to derive the effect of regulatory requirements on aggregate value-added growth in the business sector. This alternative procedure will be used to estimate the effect of regulations on GDP growth.

Log growth in this aggregate weighted index of industry regulatory requirements is 38.8% for the 2006-to-2021 period. Growth in this aggregate weighted index is higher than growth in a simple sum of industrial regulatory requirements, whose log growth is 31.2%. This is because growth in industrial regulatory requirements is higher for large industries with relatively high value added.

This 38.8% log growth in weighted regulatory requirements is estimated to have reduced real GDP growth by a cumulative 1.7 percentage points,² or 0.1 percentage points per year, over the 2006-to-2021 period.

The effect of regulatory accumulation on employment growth can be estimated similarly. Aggregate employment-weighted industrial regulatory requirements increased by 0.35 log points. The effect of the accumulation of industrial regulatory requirements on employment growth from 2006 to 2021 is estimated to be 1.3 percentage points over that period, or 0.1 percentage points per year.

The effect of regulatory requirements on growth in labour productivity is much smaller. Regulatory requirements reduced labour productivity growth by a cumulative 0.4 percentage points for the 2006-to-2021 period.

The coefficient on the dummy variable for small firms is positive and statistically significant at the 1% level for employment and output growth. It is negative and statistically significant at the 1% level for labour productivity growth. That is, small firms have higher growth in value added and employment than large firms, but lower growth in labour productivity. Small firms in Canada are scaling up and catching up to large firms in employment and output. However, small firms are not improving their relative labour productivity compared with large firms.

The coefficient estimate on the dummy variable for small firms suggests that three-year growth in value added is 0.41 log points higher for small firms than large firms, which is about 14% per year in annual growth in value added among small firms.³

Three-year growth in employment is 0.47 log points higher among small firms compared with large firms, while annual employment growth is 16% higher per year among small firms.

Small firms tend to have lower labour productivity growth; three-year growth in labour productivity among small firms is about 6% lower than that among large firms.

2. This is equal to 38.8% log growth in industrial requirements times the estimated coefficient on industrial requirements, 0.044.

3. The growth rate over the three-year period is calculated for all firms, including entrants and exiters. The estimated growth rates range from -200% for exiters to +200% for entrants.

The cyclical variable is positively related to employment and output growth and negatively related to labour productivity growth. This is consistent with the view that employment and output are procyclical, while labour productivity is countercyclical (Fernald and Wang, 2016).

Table 3 shows the regression results when the dependent variable for firm growth is estimated over a three-year period. As a robustness check, the regression equation is estimated with firm growth over a two-year period. These results are presented in Table A.1 in the appendix. The estimated effects of regulations on growth in output, employment and labour productivity are slightly larger when calculated over a two-year period. For example, a 1% increase in regulatory accumulation reduces output growth by 0.121 percentage points in two-year cumulative growth, or 0.061 percentage points in annual growth. By contrast, when the three-year growth in firm output is used for regression, a 1% increase in regulatory accumulation is estimated to reduce output growth by 0.044 percentage points per year.

As another robustness check, the regression equation is estimated with firm growth over a three-year period among continuers. The results are presented in Table A.2 in the appendix. The estimated effects of regulations on growth in output, employment and labour productivity are very similar to those reported in Table 3, where a generalized form of growth is calculated for all firms, including entrants, exiters and continuers.

To sum up, changes in the novel KPMG measure of regulatory accumulation from 2006 to 2021 are estimated to have reduced output growth by 1.7 percentage points and employment growth by 1.3 percentage points. The effect on labour productivity growth is small; regulatory accumulation reduced labour productivity growth by 0.4 percentage points.

3.2.2 Effect of regulatory accumulation on business dynamism

Table 4 presents the regression results for entry and exit rates.

Table 4
Regression results for entry and exit rates

Variables	Entry rate as share of firm counts	Exit rate as share of firm counts	Entry rate as share of revenue	Exit rate as share of revenue
Regulation	-0.018 ***	-0.007 **	-0.105 ***	-0.017 **
Cyclical indicator	0.001 **	0.001 **	0.001 **	0.002 ***
Constant	0.150 ***	0.080 ***	0.002	0.001
R-squared	0.732	0.606	0.237	0.212

** significantly different from reference category ($p < 0.01$)

*** significantly different from reference category ($p < 0.001$)

Note: All regressions control for industry fixed effects at the North American Industry Classification System four-digit level of aggregation.

Source: Author's estimation from the National Accounts longitudinal microdata file.

The coefficient estimates on regulatory requirements are negative and statistically significant at the 5% or 1% level. This suggests that the accumulation of regulatory requirements reduces business dynamism. A 1% increase in regulatory requirements is related to a 0.02 percentage point decline in the entry rate, measured as the share of entrants in the number of firms or in total revenue. For the exit rate, a 1% increase in regulatory requirements is associated with a 0.01 percentage point decline in the share of exits in the number of firms or a 0.02 percentage point decrease in the share of exits in total revenue.

To estimate the overall impact of regulatory accumulation on the entry and exit rates, firm counts are the correct weights to aggregate industrial regulatory requirements. The aggregate index of regulatory requirements weighted by firm counts across industries rose by 0.33 log points over the 2006-to-2021 period. The increase in regulatory requirements over this period reduced the

entry rate in firm counts by 0.01 ($= 0.33 \times 0.02$), or 1 percentage point. Meanwhile, the increase in regulatory requirements during this period reduced the exit rate by 0.003 ($= 0.33 \times 0.01$), or 0.3 percentage points.

The annual entry and exit rates in the sample are about 8% (Table 2). This estimated reduction in the entry and exit rates from the accumulation of regulations over the period represents about a 10% reduction in the entry rate and a 5% reduction in the exit rate. If the total number of regulatory requirements had remained at the 2006 level, the entry rate would have been 1 percentage point, or about 10%, higher in 2021, and the exit rate would have been 0.5 percentage points, or about 5%, higher.

The coefficient estimates on the cyclical variable are positive and statistically significant for the entry and exit rates. In the regressions, the entry and exit rates in a year are defined in a future period from the current year to the next year. These forward-looking entry and exit rates are found to be procyclical. This differs from the well-documented evidence that the current-year entry rate is procyclical and the exit rate is countercyclical when the entry and exit rates are defined for the current year.⁴

3.2.3 Difference in the effect of regulatory requirements on firm performance by firm size

To examine whether regulatory requirements have a disproportionately large effect on small firms, the interaction term of regulatory requirements and the dummy variable for small firms is included in the regression for firm performance. The results are presented in Table 5. The regression in Table 5 includes firm fixed effects.

Table 5
Regression results for differential effects of regulations on firm performance

Variables	Output growth	Employment growth	Labour productivity growth
Regulation	-0.157 ***	-0.130 ***	-0.027 *
Small firms	0.228 ***	0.332 ***	-0.104 ***
Regulation X small firms	0.027 **	0.021 *	0.007 *
Cyclical indicator	0.001	0.006 ***	-0.004 ***
Constant	0.554	-0.074	0.591 ***
R-squared	0.367	0.334	0.276

* significantly different from reference category ($p < 0.05$)

** significantly different from reference category ($p < 0.01$)

*** significantly different from reference category ($p < 0.001$)

Note: All regressions control for firm fixed effects.

Source: Author's estimation from the National Accounts longitudinal microdata file.

In the regressions with the interaction of regulations and the small-firm indicator, the coefficient estimate on regulations is the effect of regulations for large firms. The coefficients on regulations are negative for all regressions, suggesting that regulatory accumulation has a negative effect on output growth, employment growth and labour productivity growth for large firms.

The coefficient estimates on the interaction term of small firms and regulatory requirements measure the difference in the effect of regulations between small and large firms. The estimated effect of regulations on small firms is the sum of the coefficients on regulations and their interaction with small firms. The sums of these two coefficients measuring the effect of regulations on small firms are all negative for output growth, employment growth and labour productivity

4. When the entry and exit rates in year t are defined as the rates for the period from year $t-1$ to year t , the entry rate is positively correlated with the cyclical variable, while the exit rate is negatively correlated.

growth. This suggests that regulatory accumulation also reduced output growth, employment growth and labour productivity growth for small firms.

The estimated coefficients on the interaction term of regulations and the small firm indicator are positive and statistically significant for all regressions. Therefore, the negative effect of regulations on firm growth in output, employment and labour productivity is smaller for small firms compared with large firms.

The coefficient estimate on regulations suggests that, for large firms, a 1% increase in regulatory accumulation reduces output growth by 0.052 percentage points per year and employment growth by 0.043 percentage points per year. For small firms, a 1% increase in regulatory accumulation reduces output growth by 0.043 percentage points per year and employment growth by 0.036 percentage points per year. The effect of regulations on output and employment growth was about 20% lower for small firms compared with large firms.

Once again, the negative effect of regulations on labour productivity growth was lower for small firms. The negative effect of regulations on labour productivity growth was about 25% lower for small firms than for large firms.⁵

Overall, regulation accumulation reduced firm growth in output, employment and labour productivity for small and large firms. The effect was lower for small firms compared with large firms.

3.2.4 Effect of regulatory accumulation on investment

Table 6 presents the regression results for investment in tangible assets, including M&E and construction. The first two columns are for the regressions on the incidence of investment in tangible assets, while the last two columns are for regression results for investment per unit of employment in logarithm. All regressions control for firm fixed effects. The growth in real output in the past year is also included to examine the effect of demand growth on investment, which is expected to be positive.

Table 6
Regression results for firm investment in tangible assets

Variables	Indicator for investment	Indicator for investment	Investment per worker	Investment per worker
Regulation	-0.056 **	-0.057 **	-0.269 ***	-0.230 **
Small firms	-0.043 ***	-0.051 **	0.106 ***	0.374 **
Output growth	-0.001	-0.001	0.324 ***	0.325 ***
Cyclical indicator	0.001 ***	0.001 ***	0.029 ***	0.029 ***
Regulation x small firms	...	0.001	...	-0.040 *
Constant	0.739 ***	0.746 ***	5.694 ***	5.437 ***
R-squared	0.561	0.561	0.655	0.655

... not applicable

* significantly different from reference category ($p < 0.05$)

** significantly different from reference category ($p < 0.01$)

*** significantly different from reference category ($p < 0.001$)

Note: All regressions control for firm fixed effects.

Source: Author's estimation from the National Accounts longitudinal microdata file.

5. Robustness checks were done by running regressions in which firm growth was defined over a two-year period and in which firm growth was calculated only for continuers. The results are similar.

Regulatory accumulation is negatively related to both the incidence of investment and investment intensity. A 1% increase in regulatory accumulation reduces the incidence of investment by 0.06 percentage points.⁶ The aggregate index of regulatory requirements weighted by firm counts across industries rose by 0.33 log points for the 2006-to-2021 period. The increase in regulatory requirements over this period reduced the investment incidence by 0.02, or 2 percentage points. The average incidence of investment was about 41% in the sample (Table 2). The effect on investment incidence is small.

Regulatory accumulation also reduces investment intensity, as indicated by the negative coefficient on regulations in the last two columns. A 1% increase in regulations reduces investment intensity by 0.269% (column 3). The aggregate index of regulatory requirements weighted by employment for firms with positive investment across industries rose by 0.33 log points from 2006 to 2021. The increase in regulatory requirements over this period reduced investment intensity by 0.09 log points, or about 9.0%. If the total number of regulatory requirements had remained at the 2006 level, business sector investment would have been 9.0% higher in 2021.

The negative effect of regulatory accumulation on investment incidence is similar for large and small firms, because the estimated coefficient on the interaction term of regulations and the small firm indicator is not statistically significant. Regulatory accumulation has a bigger negative effect on investment intensity for small firms than for large firms, as the coefficient on the interaction term of regulations and small firms is negative and statistically significant. For large firms, a 1% increase in regulatory accumulation reduces investment intensity by 0.23 log points. For small firms, the effect of a 1% increase in regulatory accumulation is to reduce investment intensity by 0.27 log points. That is, the negative effect on investment intensity is about 20% higher for small firms than for large firms.

The other noteworthy finding is that small firms have a lower incidence of investment but higher investment intensity among those with positive investments. Growth in demand is positively related to investment intensity but not investment incidence.

In sum, the effect of regulations on investment is on intensive margins, not on extensive margins. Regulatory accumulation reduced business investment by 9% in 2021 through its effect on intensive margins.

6. To estimate the overall impact of regulations on investment incidence, firm counts are the correct weights to aggregate industrial regulatory requirements. To estimate the overall impact of regulations on investment intensity (investment per worker), employment is the correct weight to aggregate industrial regulatory requirements.

4 Conclusions

In Canada, the newly developed Transport Canada – KPMG measure for regulatory burden rose by 2.1% per year, or by a total of 37%, from 2006 to 2021. This increase in the number of regulatory requirements was found to have a negative effect on growth in firm output, employment and labour productivity.

The estimates show that regulatory accumulation over the 2006-to-2021 period reduced gross domestic product (GDP) growth by 1.7 percentage points in the business sector. It also reduced employment growth in this sector by a cumulative 1.3 percentage points. The effect on labour productivity growth was small, at 0.4 percentage points.

The results point to costs associated with increasing numbers of regulatory provisions. However, understanding economy wide costs and benefits from regulations is challenging. The results of the study provide a first indication for Canada of the estimated impacts of the changing number of regulations over time on businesses. While the results of the study point to potentially important costs for the economy, it is not meant to reflect a full economic assessment of the benefits of regulations and costs associated with not introducing regulations.

The estimated effect of regulatory accumulation on GDP is much smaller than the effect estimated by Coffey et al. (2020). They found that had regulation been held constant at levels observed in 1980, GDP would have been nearly 25% higher by 2012 in the United States. The estimates in the present paper are derived from a large sample of firms and control for individual firm-level effects such as skills, technical innovation and organizational innovation that affect growth. By contrast, Coffey et al. (2020) derived their estimates from aggregate industry data and did not include a large number of firm-level fixed effects on firm growth, as in this paper.

Regulatory accumulation reduced growth in output, employment, and labour productivity for small and large firms, but the effect was lower for small firms. The negative effect of regulations was about 20% lower among small firms than among large firms for output growth and employment growth, while it was about 25% lower for labour productivity growth. Large businesses must navigate a detailed set of regulations compared with small businesses, because large businesses are more complex and often involve more lines of businesses. As a result, regulatory accumulation reduced firm growth more for large firms than for small firms.

Regulatory accumulation over the 2006-to-2021 period was also found to reduce business sector investment by 9.0%. If the total number of regulatory requirements had remained at the 2006 level, business sector investment would have been 9.0% higher in 2021. This negative effect is bigger for small firms than for large firms. The effect of regulations on investment is on intensive margins rather than extensive margins.

Finally, regulatory accumulation reduced business start-ups and business dynamism. If the total number of regulatory requirements had remained at the 2006 level, the entry rate would have been 1 percentage point, or about 10%, higher in 2021, and the exit rate would have been 0.5 percentage points, or about 5%, higher.

Developing a regulatory accumulation measure and studying its effect on economic performance should be seen to complement existing economic impact studies on specific regulations, such as pro-competition regulations and environmental regulations. To evaluate the impact of implementing regulations, it is necessary to focus on both the specific effect of a regulation and the overall effect of regulatory accumulation on economic performance.

Appendix

Table A.1

Regression results for firm performance, two-year difference

Variables	Output growth	Employment growth	Labour productivity growth
Regulation	-0.121 **	-0.105 ***	-0.013 *
Small firms	0.320 ***	0.375 ***	-0.043 ***
Cyclical indicator	0.001	0.005 ***	-0.004 ***
Constant	0.394	-0.077	0.422 ***
R-squared	0.284	0.260	0.207

* significantly different from reference category ($p < 0.05$)

** significantly different from reference category ($p < 0.01$)

*** significantly different from reference category ($p < 0.001$)

Note: All regressions control for firm fixed effects.

Source: Author's estimation from the National Accounts longitudinal microdata file.

Table A.2

Regression results for firm performance, three-year log growth among continuers

Variables	Output growth	Employment growth	Labour productivity growth
Regulation	-0.162 **	-0.138 **	-0.023 *
Small firms	0.502 ***	0.620 ***	-0.088 ***
Cyclical indicator	0.002	0.008 ***	-0.005 ***
Constant	0.396	-0.312	0.636 ***
R-squared	0.372	0.340	0.291

* significantly different from reference category ($p < 0.05$)

** significantly different from reference category ($p < 0.01$)

*** significantly different from reference category ($p < 0.001$)

Note: All regressions control for firm fixed effects.

Source: Author's estimation from the National Accounts longitudinal microdata file.

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