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Estimating the Costs of Electronic Retail Payment Networks: A Cross-Country Meta Analysis

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Abstract

As economies across the world continue to digitize, debates around the design and efficiency of national infrastructures for electronic payments have gained added relevance. Central to these debates is the question of how many electronic funds transfer (EFT) systems can viably coexist within a jurisdiction while achieving scale economies to ensure that average cost is minimized, a threshold that largely depends on the shape of the cost function. In this paper, we conduct a cross-country meta-analysis using data from 13 social cost studies across 9 jurisdictions between 2001 and 2016. We quantitatively estimate a cost function relating the total transaction volume to the per-transaction cost and interpret its parameters in terms of fixed and variable costs. We find a rapidly decreasing, convex cost curve that plateaus quickly at around one billion annual transactions. Additionally, we estimate the marginal cost of an EFT to be approximately $0.55 per transaction, expressed in 2025 Canadian dollars, and the total fixed cost to be approximately $83 million per year.

Topics: Payment Clearing and Settlement Systems, Financial Institutions, Financial System Regulation and Policies
JEL codes: E42, E58, H54

Résumé

À mesure que les économies du monde entier continuent de se numériser, les débats sur la conception et l'efficacité des infrastructures nationales de paiement électronique sont de plus en plus pertinents. Au cœur de ces enjeux se trouve la question de savoir combien de systèmes de transfert électronique de fonds (TEF) peuvent coexister de manière viable au sein d'un pays tout en permettant des économies d'échelle pour réduire au minimum le coût moyen, un seuil qui dépend en grande partie de la forme de la fonction de coût. Dans cette étude, nous effectuons une méta-analyse transnationale à l'aide de données provenant de 13 études sur les coûts sociaux menées dans 9 pays entre 2001 et 2016. Nous estimons quantitativement une fonction de coût mettant en corrélation le volume total des transactions et le coût par transaction et interprétons ses paramètres en termes de coûts fixes et variables. Nous constatons que la courbe des coûts est convexe, diminue vite et se stabilise rapidement autour d'un milliard de transactions par an. De plus, nous estimons le coût marginal d'un TEF à environ 0,55 $ par transaction, exprimé en dollars canadiens de 2025, et les coûts fixes totaux à environ 83 millions de dollars par année.

Sujets : Systèmes de compensation et de règlement des paiements; Institutions financières; Réglementation et politiques relatives au système financier
Codes JEL : E42, E58, H54

Introduction

Over the past several years, Canadian payments have rapidly digitized. In 2023, electronic payments accounted for 86% of total payment volume and 75% of total value (Yun et al. 2024). Payment volumes are expected to continue climbing, from new use cases or actors such as machine-to-machine payments driven by artificial intelligence agents. These developments make designing the architecture of a flexible payments ecosystem an important policy question (Morrow 2024; Payments Canada 2017). Having multiple systems in one payments ecosystem can enhance functional specialization and operational resilience, but it also fragments volume and replicates large fixed costs, raising the average cost of transactions. Therefore, it is important to understand the transaction volumes required for each system to reach the economies of scale where the average cost is minimized—a threshold that largely depends on the shape of the cost function. While existing research provides useful insights into the total cost and transaction volumes of various electronic funds transfer (EFT) systems, it largely focuses on country-specific case studies and lacks satisfactory estimates of the cost curve of the average EFT. Accordingly, there is a need for estimates of such a cost curve, and of the rate at which average cost declines with volume. Such analysis will play a role in various cost-benefit analyses, fee setting, benchmarking and justifying investment in new payment systems such as the Real Time Rail (RTR).[1]

In this paper, we estimate the cost function of the average retail EFT using cross-country panel data. The cost function captures the relationship between the total number of transactions (volume) and the per-transaction cost of an EFT, with particular focus on the social cost of payment systems.[2] The parameters of the cost function can be further interpreted as the fixed and variable cost of the EFT. A meta-analysis is well suited to this task for two reasons. First, while individual case studies provide useful country-specific insights, their findings are highly context-dependent and difficult to generalize. By aggregating observations across multiple jurisdictions and years, we can recover more robust structural features of EFT cost behaviour that are not driven by idiosyncratic national conditions. Second, the social cost methodology employed in these studies is broadly comparable, enabling meaningful cross-country comparisons and pooled estimation despite variation in data sources.

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[1] For example, Kronick and Koeppl (2024) conduct a cost-benefit analysis of RTR to the Canadian economy, utilizing cost functions for cash, cheque and credit transfer transactions previously estimated by the Centre for Economics and Business Research Ltd. (2022). In contrast, the cost function estimated in this study focuses specifically on EFTs.

[2] In the literature on payment costs analysis, social costs are defined as the net sum of all private (resource) costs incurred by the payment system.

The dataset we use is compiled from 13 studies examining the social costs of various payment instruments across different countries and years. We narrow our analysis to four distinct classes of payment networks that are equivalent to an EFT: debit cards, domestic payment networks, credit transfers and direct debits. We then take values from those studies for transaction volume, per-transaction cost and total cost; convert them to 2025 Canadian dollars using purchasing power parity (PPP) and Canadian consumer price index (CPI) data; and include year fixed effects to absorb any remaining cross-country and intertemporal differences. While the underlying studies are consistent in their general approach to social cost estimation, the dataset is limited in size, consisting of 26 observations. This restricts the feasible empirical models and warrants cautious interpretation of the resulting estimates.

Our findings show that the cost function decreases and is convex with respect to total transaction volume, intuitively highlighting the economies of scale in payment systems. We observe a steep initial decline in per-transaction cost as transaction volume increases, suggesting that scale efficiencies emerge rapidly even at relatively low levels of usage. The estimated total fixed cost is approximately $82 million per year, expressed in 2025 Canadian dollars, while the per-transaction cost is estimated at $0.55. This result is consistent with evidence that electronic payment instruments (e.g., information technology systems and card/point-of-sale terminals) have high fixed costs but comparatively low variable costs (Junius et al. 2022). Overall, the results point to declining average costs as volume increases.

Background

An EFT is a computer-based payment instrument that enables the transfer of funds between bank accounts, either within one institution or across institutions. The most prominent examples of such instruments are direct deposits, direct debits and credit transfers. EFT systems are networks that facilitate these transfers.

Payments ecosystems are complex and interconnected patchworks of EFT systems. This complexity somewhat blurs the conceptual boundary between different payment instruments or forms. For instance, two payments initiated through distinct instruments, such as a credit transfer and a card payment, may ultimately be cleared and settled on the same underlying system, such as a deferred net settlement system, real-time gross settlement system or fast payment system.

The question of how many payment systems a jurisdiction should operate is a recurring and important policy and design consideration. In Canada, this issue was a central focus of the payments modernization initiative launched in 2016

(Payments Canada 2017) and remains relevant today as the country prepares to introduce its fast payment system, the RTR.

Looking ahead, as new private payment rails—infrastructures that move funds between parties—such as stablecoins and other blockchain-based infrastructures begin to interact with existing systems, the question of the adequate number and type of systems in an ecosystem will remain relevant. Kosse, Lu and Xerri (2020) show that adding new payment rails would shift volumes away from existing systems, with the magnitude of this substitution being highly sensitive to certain policy levers such as value caps and participation rules. Further, evidence from Canada's transition from the Large Value Transfer System to Lynx shows that consolidating wholesale processing into a single liquidity-saving stream pools liquidity and improves efficiency, underscoring the potential cost of fragmenting flows across multiple systems (Desai et al. 2023). This insight remains relevant today, as the emergence of new private or blockchain-based payment rails raises similar questions about the appropriate degree of integration within national and global payment architectures. Taken together, this research implies a trade-off. While introducing a new payment system can deliver benefits, such as meeting distinct use-case needs across batch retail, real-time retail, wholesale and emerging digital-asset payments, it will also spread transaction volumes across more rails. This fragmentation can be costly if it prevents systems from operating at efficient scale since fixed infrastructure expenses must be covered multiple times (Bulusu and Xie forthcoming).

Assessing such trade-offs requires reliable estimates of the cost structure of the average EFT. Two estimates are needed in particular: estimates of the curvature/shape of the cost function of the average EFT to indicate how quickly economies of scale are realized, and of the marginal cost to inform fee-setting and cost recovery. Importantly, these estimates must be of social costs: the real resources consumed by society in providing and using the EFT system. This distinction ensures such estimates capture the real economic benefits of EFT systems, rather than private redistributions such as fees or transfers of resources between system participants. However, existing research remains largely descriptive, consisting mostly of country-level case studies of individual EFT instruments, rather than systematic estimates of the cost structure of the average EFT. To move beyond descriptive case studies, we draw on cross-country data and specify an empirical model of the social costs of the average EFT.

The social cost of an EFT System

In the payments literature, the term "social costs" is used somewhat differently than in economics more broadly. In general economics, social costs are defined as the sum of private costs and external costs (for example, the environmental costs of pollution). By contrast, in the payments literature, social costs refer to the total resource costs to society of producing payment services. They represent the pure production costs incurred by all stakeholders in the payment chain, but exclude transfer payments such as fees, tariffs or charges made between participants (Kosse et al. 2017). Importantly, these exclude the costs associated with building the payment instruments. Rather, they are the costs of operating the system in the steady state.

In recent decades, several country-level case studies have attempted to measure the social cost of various EFT instruments (see **Table 1**). These studies typically adopt a resource-costing approach, in which researchers collect detailed data from the main stakeholders in the payment chain (i.e., banks and other financial institutions, merchants, central banks, and in some cases households). The goal is to quantify the real resources used to produce and accept payments: operating expenditures, staff time, capital costs of infrastructure and equipment, and sometimes the time spent by consumers in making payments. A key feature of this methodology is that it excludes financial transfers such as interchange fees, tariffs or bank charges, since these represent redistribution between participants rather than a net resource cost to society. Instead, what is reported is the sum of the resource costs across all actors, often expressed both as a per-transaction average and as a share of gross domestic product.

While the broad approach is consistent across this literature, there are some notable differences in scope. Early research such as Gresvik and Øwre (2002) and Guibourg and Segendorf (2004) focuses primarily on the banking sector, meaning that they capture private production costs but not the full social cost. Later studies, such as Segendorf and Jansson (2012) in Sweden, Danmarks Nationalbank (2012) and Banco de Portugal (2016), broaden their scope to include merchants and households, valuing consumer time as part of the resource cost. A few studies also produce counterfactual simulations—for example, Turján et al. (2011) in Hungary examine how social costs would change under different adoption scenarios for electronic payments.

Overall, however, the common thread in this literature is the measurement of the real resources required to produce payment services, aggregated across stakeholders, with slight methodological differences arising mainly from the set of stakeholders included and whether household time is valued.

Data

Our dataset gathers the findings of 13 separate studies analyzing the social costs of various payment instruments in specific countries and years. These studies, conducted between 2001 and 2016, span seven European countries as well as Australia and Canada. **Table 1** provides a brief description of this literature.

Table 1: Literature on the social costs of payment systems

Year	Author	Payment types considered	Country
2001	Gresvick and Øwre	Direct debit, domestic payment network	Norway
2002	Brits and Winder	Debit cards, domestic payment network	Netherlands
2002	Bergman, Guibourg and Segendorf	Debit cards	Sweden
2003	National Bank of Belgium	Debit cards, domestic payment network	Belgium
2005	Banco de Portugal	Debit cards, direct debit, credit transfers	Portugal
2006	Schwartz et al.	Domestic payment network	Australia
2007	Gresvik and Haare	Domestic payment network, debit and credit cards	Norway
2009	Segendorf and Jansson	Direct debit, credit transfers, debit cards	Sweden
2009	Turján et al.	Credit transfers, direct debit, debit cards	Hungary
2009	Danmarks Nationalbank	Debit cards, domestic payment network	Denmark
2012	Jonker	Debit cards	Netherlands
2013	Stewart et al.	Domestic payment network, debit cards	Australia
2014	Kosse et al.	Debit cards	Canada

Note: Table 1 summarizes the literature sources from which our dataset is derived. Each entry corresponds to a study estimating the costs of operating a payment network in a specific country for a given year. The table reports the year in which each analysis was conducted—not the year of publication—along with the authors, the payment network types investigated and the country.
Sources: Banco de Portugal 2007; Bergman, Guibourg and Segendorf 2004; Brits and Winder 2005; Danmarks Nationalbank 2011; Gresvik and Haare 2009; Gresvik and Øwre 2002; Jonker 2013; Kosse et al. 2017; National Bank of Belgium 2006; Schwartz et al. 2007; Segendorf and Jansson 2012; Stewart et al. 2014; Turján et al. 2011

We focus on electronic payments. Specifically, our analysis is based on the following four payment instruments:

- **Debit cards**—This category includes all card instruments that transfer funds directly from a consumer's account to a merchant's account. For studies that do not differentiate between credit and debit cards, we categorize the transactions as "debit and credit cards."

- **Domestic payment instruments—**This group includes all electronic payment instruments that facilitate transactions within a specific economy. In our dataset, this includes eftpos in Australia and Norway, Giro in Norway, Dankort in Denmark, and national electronic purses in Belgium and the Netherlands.
- **Credit transfers**—This category includes all instruments that allow a payment service provider to transfer funds to a payee's account based on a payer's order.
- **Direct debits**—This group includes all instruments that enable pre-authorized withdrawals from a payer's bank account.

We extract values for transaction volume, transaction value, per-transaction cost and total cost of a payment instrument in a given country for a given year.[3] For each of our observations in year t, we:

1. convert the reported denomination from local currency units into international dollars using the World Bank's PPP conversion factor dataset (World Bank 2025),
2. convert this international dollar figure to the Canadian dollar (CAD) in year t using Canada's PPP
3. restate the value in 2025 CAD using CPI data (Bank of Canada 2025).

The results of this calculation are presented in **Table 4** in the Appendix. Our final working dataset consists of 26 observations and 7 variables: year, country, class, payment instrument, transaction volume, per-transaction cost (CAD) and total cost (CAD).

Table 2 and **Chart 1** provide the summary statistics of the data. Debit cards are by far the most popular payment class with the highest transaction volume. Meanwhile, direct debits are the least popular payment class, yet are on average the least costly among all payment classes. **Chart 1**, panel c shows a nonparametric regression. The regression line shows a negative relationship between transaction volume and per-transaction cost, indicating economies of scale. Furthermore, this relationship appears to be convex, with per-transaction costs declining rapidly at lower transaction volumes and leveling off as the volume increases.

[3] In several cases, the source literature provides estimates for only two or three of these variables. This was the case for the Netherlands in 2012, Denmark in 2009, Hungary in 2009, Sweden in 2009, Portugal in 2005 and Belgium in 2003. To fill in these gaps, we infer the missing values algebraically using the basic relationships shown below.

$$(i)\quad \boldsymbol{Per\ Trans.Cost} = \frac{\boldsymbol{Total\ Cost}}{\boldsymbol{Trans.Volume}} \qquad (ii)\quad \boldsymbol{Total\ Cost} = \boldsymbol{Trans.Volume} \times \boldsymbol{Trans.Value}$$

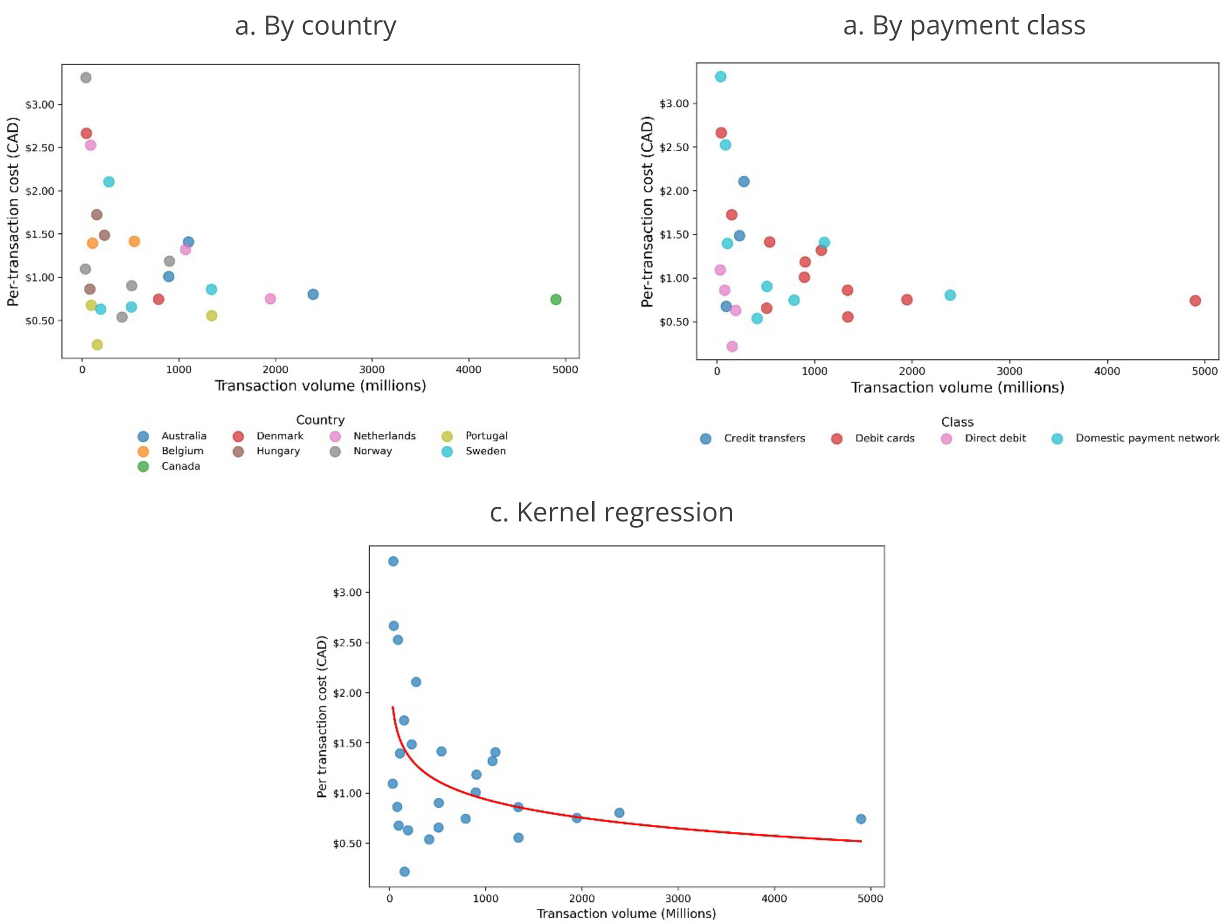
Table 2: Summary statistics

		Mean	Std. dev.	# Obs.
Debit cards	**Transaction volume (in billions)**	1.2	1.33	11
	Per-transaction cost (CAD)	1.17	0.61	11
Domestic payment networks	**Transaction volume (in billions)**	0.68	7.8	8
	Per-transaction cost (CAD)	1.45	0.98	8
Credit transfers	**Transaction volume (in billions)**	0.2	9.4	3
	Per-transaction cost (CAD)	1.42	0.72	3
Direct debits	**Transaction volume (in billions)**	0.11	7.17	4
	Per-transaction cost (CAD)	0.70	0.37	4

Note: Table 2 presents summary statistics for transaction volumes per year and per-transaction costs across the four payment classes. For each class, the table reports the mean, standard deviation and number of observations, facilitating a comparative analysis of these variables. These data are derived from the literature described in Table I.

Sources: Banco de Portugal 2007; Bergman, Guibourg and Segendorf 2004; Brits and Winder 2005; Danmarks Nationalbank 2011; Gresvik and Haare 2009; Gresvik and Øwre 2002; Jonker 2013; Kosse et al. 2017; National Bank of Belgium 2006; Schwartz et al. 2007; Segendorf and Jansson 2012; Stewart et al. 2014; Turján et al. 2011

Chart 1: Volumeper transaction cost



Note: Panel a displays a scatterplot of the data with observations colour-coded by country, while panel b presents the same scatterplot with observations colour-coded by payment class. Panel c displays a kernel regression of per-transaction cost on log-transformed transaction volume using a Gaussian kernel with a bandwidth chosen by least-squares cross-validation. Predictions are plotted on the original cost scale against transaction volume. The fitted curve is downward-sloping and concave-up, indicating that cost falls at a diminishing rate as volume increases. Taken together, panels a–c imply the presence of economies of scale in payment networks.

Sources: Banco de Portugal 2007; Bergman, Guibourg and Segendorf 2004; Brits and Winder 2005; Danmarks Nationalbank 2011; Gresvik and Haare 2009; Gresvik and Øwre 2002; Jonker 2013; Kosse et al. 2017; National Bank of Belgium 2006; Schwartz et al. 2007; Segendorf and Jansson 2012; Stewart et al. 2014; Turján et al. 2011

Regression analysis

We conduct a regression analysis based on the assumption that the underlying infrastructure of each network in our dataset was operated with comparable resources. However, recognizing the potential heterogeneity across countries and time periods, we further include country fixed effects, year fixed effects and payment class fixed effects in the regression to improve the robustness of our analysis. The model is as follows:

$$Per\ trans. cost\ (CAD) = \beta_0 + \beta_1 \frac{1}{Volume} + Country\ FE + Year\ FE + Class\ FE + \epsilon. \quad (1)$$

The advantage of using a parametric regression model, i.e., Equation (1), rather than a nonparametric regression analysis as in Chart 1, panel c, is that the parametric model has a natural economic interpretation: the total cost of a payment system can be divided into fixed and variable components. If we assume that the marginal variable cost is constant, the variable component is the product between the marginal cost and total number of transactions. A constant marginal variable cost is reasonable because each electronic payment usually has variable costs not affected by volume and value of transactions (Centre for Economics and Business Research Ltd. 2022). The fixed component is invariant to the transaction volume. Based on the assumption on the total cost of an EFT, we can derive the cost function as follows:

$$\begin{aligned} Per\ trans. cost &= \frac{Total\ cost}{Volume} \\ &= \frac{Marginal\ cost * Volume + Fixed\ cost}{Volume} \\ &= Marginal\ \ cost + \frac{Fixed\ cost}{Volume}. \end{aligned} \quad (2)$$

Equation (2) indicates that β_0 from equation (1) can be interpreted as the marginal cost, and β_1 can be interpreted as the fixed cost. A crucial assumption is that the marginal cost remains constant regardless of the transaction size. This assumption can be justified by the automated nature of the EFT.

The results of our regression model are shown in **Table 3**. Specification 1 in the table presents the results of a standard ordinary least squares (OLS) regression without fixed effects. It estimates the variable cost $\hat{\beta}_0$ to be \$0.90 per transaction, and the fixed cost $\hat{\beta}_1$ to be \$48.57 million. Specification 2 presents the results of a standard OLS regression with country and year fixed effects. It estimates the variable cost to be \$0.68 per transaction, and the fixed cost to be \$55.32 million. Finally, specification 3 presents the results of a standard OLS regression with fixed effects for country, year and payment class. It estimates the variable cost to be \$0.55 per transaction, and the fixed costs to be \$82.83 million.

The discrepancy between these three specifications highlights the expected heterogeneity across the observations in our sample. We first express all costs in 2025 Canadian dollars using PPP and Canadian CPI, which puts observations on a common cross-country and intertemporal footing. Specification 3 then adds fixed effects for country, year and payment class to absorb the remaining structural differences such as country-specific input costs, global shocks and systematic cost differences across network types. Given this broader control for residual heterogeneity, we take specification 3 as our preferred model. Robustness checks with alternative treatments of the data, reported in the Appendix, yield estimates that are statistically indistinguishable from those in specification 3.

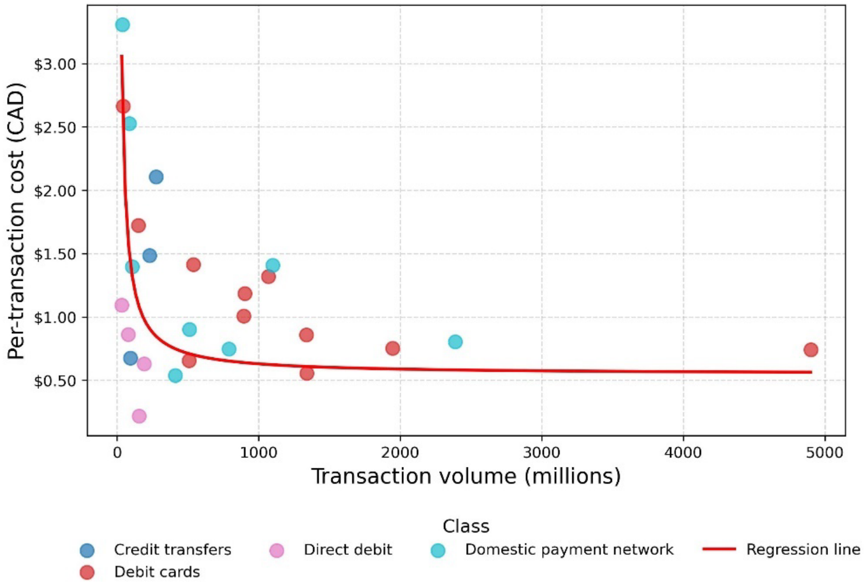
Chart 2 plots the estimated cost function based on the preferred regression model (specification 3). As expected from the assumed functional form, the curve is downward sloping and convex. However, the function also reveals an interesting feature: a steep decline in cost per transaction as volume increases from 0 to 1,000 million. This sharp drop, which is driven by the data rather than the functional form, indicates that economies of scale emerge rapidly. This finding is particularly relevant for countries with annual transaction volumes exceeding 1,000 million, such as Canada, because it suggests that an EFT system can quickly reach a steady and cost-efficient state given sufficient market demand. Indeed, with approximately 14 million households in Canada, one billion transactions per year corresponds to approximately 70 transactions annually per household, a level that is readily attainable with current levels of digital payment use.

Table 3: Regression model results

	Specification 1	Specification 2	Specification 3
Intercept ($CAD)	0.90 (0.16)	0.68 (0.21)	0.55 (0.40)
Transaction volume inverse ($CAD millions)	48.57 (14.99)	55.32 (23.95)	82.83 (19.47)
Country j fixed effects	No	Yes	Yes
Year fixed effects	No	Yes	Yes
Class fixed effects	No	No	Yes
N	26	26	26
R-squared	0.30	0.56	0.83

Note: Table 3 reports the results of the regression $\boldsymbol{Per\ trans.cost\ (CAD)} = \boldsymbol{\beta_0} + \boldsymbol{\beta_1}\frac{\mathbf{1}}{\boldsymbol{Volume}} + \boldsymbol{Country\ FE} + \boldsymbol{Year\ FE}$, where the "Intercept" row values correspond to $\widehat{\boldsymbol{\beta}}_{\mathbf{0}}$, the "Transaction volume inverse" row values correspond to $\widehat{\boldsymbol{\beta}}_{\mathbf{1}}$, and $\boldsymbol{Per\ trans.cost\ (CAD)}$ is the dependent variable. $\widehat{\boldsymbol{\beta}}_{\mathbf{0}}$ can be interpreted as the variable cost component of a network's cost function, while $\widehat{\boldsymbol{\beta}}_{\mathbf{1}}$ can be interpreted as the fixed cost component. All values are denominated in 2025 Canadian dollars.

Chart 2: Estimated volume cost, by transaction



Note: Chart 2 depicts the fitted values from Specification 3 (which incorporates country, year and payment class fixed effects) plotted against the observed data. The downward-sloping regression line suggests that as transaction volumes increase, per-transaction costs decrease, highlighting the presence of economies of scale in payment networks.

Sources: Banco de Portugal 2007; Bergman, Guibourg and Segendorf 2004; Brits and Winder 2005; Danmarks Nationalbank 2011; Gresvik and Haare 2009; Gresvik and Øwre 2002; Jonker 2013; Kosse et al. 2017; National Bank of Belgium 2006; Schwartz et al. 2007; Segendorf and Jansson 2012; Stewart et al. 2014; Turján et al. 2011

Discussion

Ideally, each EFT system in an ecosystem should operate at efficient scale, with volumes high enough that their average cost lies very close to their respective marginal cost. The central policy question, therefore, is what happens to the ecosystem if a new EFT system is introduced. A major concern is that introducing a new system would pull transaction volumes from existing rails and push each rail down its average-cost curve, raising the average cost. If fees must rise to cover these higher unit costs, the effective price of payments across systems could be driven above the socially efficient level. In that case, the result would be a reduction in transaction volume relative to the optimum and the creation of a deadweight loss. This concern is especially acute given the imminent launch of the RTR, which is expected to draw a substantial share of Interac e-Transfer® volumes that currently clear through the Automated Clearing Settlement System (ACSS) (Kosse, Lu and Xerri 2020).

Our analysis shows there is little evidence that fragmentation will undermine scale economies in Canada. Canadian EFT systems already process high transaction volumes, positioning them well within the flat part of the average-cost curve. This implies that even if volumes were split across an additional system, each rail would likely remain close to efficient scale, with the average cost only slightly above the marginal cost. Put differently, Canada's payments market is large enough that the "lost scale penalty" from spreading transactions across an additional system is relatively modest. This suggests that, if current transaction volumes were evenly distributed across all systems, Canada's payments ecosystem could support several additional systems operating at efficient scale. It is important to emphasize that this conclusion pertains strictly to cost efficiency. Our analysis does not account for potential benefits of introducing new systems, such as enhanced functionality, resilience or competition. Rather, it indicates that, from a cost perspective, Canada's payments market is sufficiently large to sustain multiple payment systems operating at efficient scale.

To see this, consider the following. According to Payments Canada, in 2024 the ACSS cleared approximately 10 billion EFT transactions (Payments Canada 2025). Inserting this figure into our estimated cost curve gives an average cost of about $0.558 per transaction, essentially at marginal cost. In the same year, Interac reported approximately 1.4 billion e-Transfer transactions (Interac Corporation 2024), the vast majority of which clear through the ACSS. Suppose, hypothetically, that the RTR captured all e-Transfer volumes. In that case, the ACSS would continue to process roughly 8.5 billion transactions, nominally moving it down its average cost curve, but in practice leaving its average cost virtually unchanged. Additionally, the RTR would launch with a volume base of approximately 1.4 billion that, when inserted into our estimated cost curve, yields an average cost of $0.61 per transaction, which is also very near marginal cost. The implication here is that, even under large migration scenarios, the Canadian payments ecosystem would continue to operate rails at or close to their efficient scale, minimizing the risk of higher average costs or inefficient pricing.

Conclusion

As economies become increasingly digitized, possibly including agentic transactions, we can expect payment transaction volumes to increase sharply. Payment instruments might become more diverse, highlighting the question of the appropriate architecture (number and type) of systems in a national payments ecosystem. This paper advances this discussion by estimating the average EFT cost function and quantifying its fixed and marginal components. Based on our preferred regression specification, we estimate the total fixed cost to be approximately $83 million per year and the per-transaction cost to be approximately $0.55 in 2025 CAD. Moreover, the estimated cost function is convex and declines rapidly, plateauing around 1 billion annual transactions, which implies that scale economies are realized at relatively modest volumes.

Our analysis implies that multiple payment systems can coexist inside a jurisdiction, but that the efficiency of this coexistence hinges on whether each can attain volumes near their respective efficient-scale regions. Below this threshold, the average cost remains significantly higher, meaning that fragmenting demand across parallel rails increases the risk that no system reaches scale. In the Canadian context, this provides a benchmark for evaluating the RTR. If projected usage exceeds the one-billion threshold, steady-state average costs should be close to the plateau by our estimates.

This study has several limitations, which suggest five caveats for interpreting the results. First, the analysis relies on cross-country data and does not account for country-specific characteristics, such as the Canadian context, which may influence the costs of EFTs. Second, while the study incorporates the costs of various implied EFT systems (e.g., debit cards, direct debits), it does not differentiate the unique features and cost structures of each payment method. Third, the estimations are derived from a relatively small dataset, which may result in substantial estimation variance. Nonetheless, the robustness checks conducted indicate consistent findings across different model specifications. Fourth, introducing new payment systems may entail broader social costs that are not always captured in standard estimates. These include one-time set-up and migration expenses, the opportunity cost of collateral held for liquidity purposes, and other resource commitments associated with maintaining system interoperability and resilience. Incorporating these factors could change the overall assessment of Canada's ability to accommodate additional payment systems. Fifth, the cost structure of modern payment systems may differ materially from that observed in the underlying studies. Recent infrastructures face higher expenditures on cybersecurity, compliance and resilience, while benefiting from cheaper computing, cloud-based deployment and more efficient architectures. As a result, historical cost data may not fully represent the balance of fixed and variable costs faced by contemporary or future systems.

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Appendix

We conduct three robustness checks on our analysis. First, to provide a simple market–exchange-rate benchmark against which to compare our other results, we restate all cost figures using the January 2025 exchange rate between CAD and each country's currency. We then re-estimate specification 3 on these data, the results of which are shown in column 1 of **Table 5** and are plotted in panel a of **Chart 3**.

Second, given the unbalanced nature of our data, there may be concerns about potential bias from uneven country-year coverage. To address this, we reconstruct the dataset by selecting the most recent observations for each country and payment class. This modification results in a final dataset consisting of 21 observations. We then fit specification 3 to these data, the results of which are shown in column 2 of **Table 5** and are plotted in panel b of **Chart 3**.

Third, valuing all observations at the 2025 exchange rate may cause some concern about distorting cross-country comparisons. To address this, we obtain data (OFX 2025) on exchange rates for the period 1995–2015, covering the conversion rates between the Canadian dollar (CAD) and the other currencies in our dataset, and compute the average exchange rate over this interval. The results of this calculation are presented in **Table 4**. We then fit specification 3 to these data, the numerical results of which are shown in column 3 of **Table 5** and are plotted in panel c of **Chart 3**.

Table 4: Exchange rates used

Country	Year	Currency	2025 ex. rate	Avg. ex. rate	LCU–CAD 2025
Norway	2001	NOK	0.13	0.19	0.13
Netherlands	2002	EUR	1.49	1.46	1.66
Sweden	2002	SEK	0.13	0.17	0.13
Belgium	2003	EUR	1.49	1.46	1.61
Portugal	2005	EUR	1.49	1.46	1.58
Australia	2006	AUD	0.92	0.94	0.86
Norway	2007	NOK	0.13	0.19	0.14
Sweden	2009	SEK	0.13	0.17	0.13
Hungary	2009	EUR	1.49	1.46	1.67
Denmark	2009	DKK	0.2	0.20	0.16
Netherlands	2012	EUR	1.49	1.46	1.76
Australia	2013	AUD	0.92	0.94	0.85

Note: Table 4 reports the three conversion measures used in this paper. "2025 ex. Rate" is the January 2025 market exchange rate used in our first robustness check. "Avg. ex. rate" is the 1995–2015 average rate used in robustness check (3). "LCU–CAD 2025" is the purchasing power parity and consumer price index factor used in the main analysis.

Sources: OFX Group Limited (2025), Bank of Canada (2025) Currency Converter, World Bank (2025), Bank of Canada (2025).

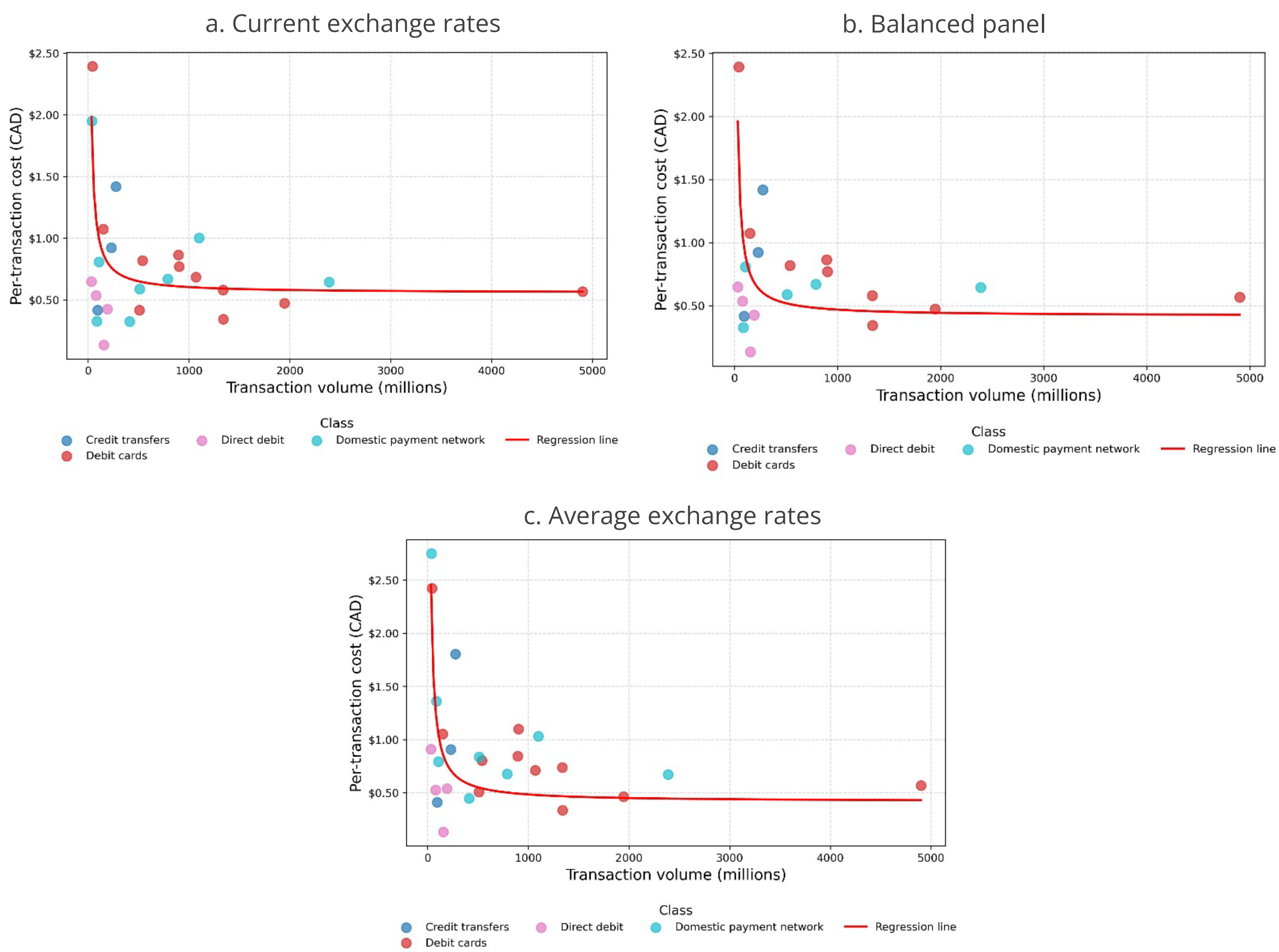
Table 5: Robustness checks

	(1)	(2)	(3)
Intercept ($CAD)	0.56 (0.29)	0.42 (0.25)	0.42 (0.35)
Transaction volume inverse ($CAD	47.14 (14.07)	50.94 (16.90)	67.78 (17.13)

millions)			
Country *j* fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Class fixed effects	Yes	Yes	Yes
N	26	21	26
R-squared	0.80	0.89	0.81

Note: Table 5 presents the results from our robustness checks. Column (1) reports estimates using costs converted to CAD with the January 2025 market exchange rate. Column (2) reports estimates using the subsample comprising only the most recent observation for each country–payment class. Column (3) reports estimates using costs converted to CAD with the 1995–2015 average exchange rate.

Chart 3: Robustness checks



Note: Panel a plots each observation's per-transaction cost against the transaction volume, with costs converted to January 2025 Canadian dollars using contemporaneous market exchange rates. Panel b presents a scatterplot

of the most recent observation for each country-year-payment class, with the fitted curve based on column (2) in Table 5. Panel c presents a scatterplot of the original dataset with the transaction value recalculated via the average exchange rate, along with the fitted curve based on column (3) in Table 5.
Sources: Banco de Portugal 2007; Bergman, Guibourg and Segendorf 2004; Brits and Winder 2005; Danmarks Nationalbank 2011; Gresvik and Haare 2009; Gresvik and Øwre 2002; Jonker 2013; Kosse et al. 2017; National Bank of Belgium 2006; Schwartz et al. 2007; Segendorf and Jansson 2012; Stewart et al. 2014; Turján et al. 2011