PERSPECTIVES

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Investigating the determinants of e-commerce driven deliveries

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The Internet has considerably altered the way we shop. With just a few clicks, we can purchase an array of products and services. The impact of this new retail trend has meant an increase in vehicle traffic in residential areas for deliveries. Often referred to as the last-mile issue, it has caused a growing concern in cities. Despite this concern, primary data on home deliveries are scarce due to their private nature. To unravel this issue, two CIRANO studies (Milord, Meloche & Vaillancourt, 2025, Meloche et al., 2025) look at the use of package delivery services by using data from a survey conducted in Montreal census metropolitan area (CMA) in 2024. Their findings suggest that trying to regulate online home delivery is far from straightforward.

The environmental impact of deliveries

The available literature suggests an ambiguity on the environmental impact of e-commerce and deliveries for personal consumption (Pålsson, Pettersson & Winslott Hiselius, 2017 and van Loon et al., 2014). Various forces appear to be at work. E-commerce requires more computers use to search for products, which means an increase in tech and its associated waste. Additionally, prior to purchasing online, some people like to drive around to look for the product, which puts more strain on the environment. If the products are not available at the time of the online search or are in different locations, more people will have to travel and additional parcels will have to be sent, further heightening the environmental impact.

Online sales unequivocally increase product packaging, with the heavier and larger products requiring considerably more packaging. While traditional in-store shopping uses packaging, this effect is limited if policies are put in place to encourage the use of reusable bags or even ban the use of single-use plastics, as is the case in Montreal.

What impact online shopping and deliveries have on the environment and the economy are therefore unclear. If we look solely at online retail activity that replaces in-store visits, there is a reduction in net trips and therefore a reduction in carbon emissions and vehicle traffic. On the other hand, when online shopping is added to in-store consumer activity (complementary effects), the addition of delivery to people's trips does appear to increase pollution and road usage in cities compared with traditional consumer behaviour (Buldeo Rai et al., 2019).

Other issues, such as failures to deliver and returned parcels, although poorly documented, could exacerbate the negative impacts of residential deliveries. When a signature is required on a bill and the person is not at home, additional deliveries or collection from a drop-off point increase the number of trips required.

The amount of product in a store that goes unsold can reach, for certain categories, as high as 35%. Online shopping can reduce that kind of waste and overproduction. The impact depends largely on the proportion of products returned and the way they are returned, with varying return rates on different types of products. Finally, even though warehouses consume less energy than retail outlets, they are increasingly spreading across urban areas, bringing with it increased traffic and higher emissions.

A survey on deliveries for personal consumption

The survey used in both CIRANO studies was designed by the researchers and administered by a polling firm, Leger Marketing, which maintains a representative panel of respondents constituted through a hybrid recruitment approach. The English version of the questionnaire is appended in Milord, Meloche & Vaillancourt (2025). The French version can be found in Meloche et al. (2025). Data collection was carried out online from April 10 to 15, 2024 and generated a sample of 2,006 respondents residing in the Census Metropolitan Area (CMA) of Montreal (Quebec, Canada).

The survey was divided into three parts. The first part gathered socio-demographic information (e.g. sex, gender, education level, household income, health issues related to the ability to travel). The second part asked respondents about the number of packages received during the seven days and the month preceding their answering day. The questionnaire asked respondents about a dozen categories of goods (prepared meals, clothing, newspapers, health products, groceries, housing goods, cultural products, electronic items, animal care, mechanics, furniture and garden products). The third part of the survey asked respondents about their preferences and habits regarding e-commerce deliveries.

More than 900,000 deliveries a day in the Montreal Metropolitan area

Based on the survey, it is estimated that each resident of the Montreal Metropolitan Community received an average of 2.62 parcels per week at the beginning of April 2024 and an average of 4.41 parcels in March of the same year. Taking the average of these two measurements and breaking it down by day, means an average of 0.26 daily parcels.

Our definition of what constitutes delivery is quite broad compared to those of other studies (Buldeo Rai & Dablanc, 2023, Buldeo Rai et al., 2019, Allen et al., 2018). The key difference is that we include food-app deliveries. Delivery of meal packages (that can be for one or more meal) ordered by these apps account for more than 20% of deliveries, according to the survey.

Our definition also includes newspaper, which according to the survey data account for more than 10% of deliveries. Together, prepared meals, clothing and fashion accessories, newspapers, and health, food (other than prepared meals) and household products account for 75% of items delivered in the Montreal metropolitan area.

What also sets our studies apart is that the survey includes parcels that online shoppers choose to have delivered to their place of work rather than their home. These represent around 7.5% of parcels delivered for personal use.

Based on this broader definition of home deliveries, we estimate that more than 900,000 packages were delivered each day, on average, in the Montreal Metropolitan Community in spring 2024.

	Total per day	Percentage share	Average per person		
			Weekly	Monthly	Daily
Prepared meals	187,367	20.7	0.49	1.14	0.05
Clothing and fashion accessories	123,743	13.7	0.38	0.52	0.04
Newspapers	105,004	11.6	0.26	0.70	0.03
Health products	95,554	10.6	0.29	0.41	0.03
Food items	88,504	9.8	0.26	0.42	0.03
Housing goods	77,904	8.6	0.24	0.32	0.02
Cultural products	65,752	7.3	0.20	0.30	0.02
Electronic items	56,903	6.3	0.17	0.24	0.02
Pet food	29,109	3.2	0.09	0.12	0.01
Parts - mechanical and repair	23,851	2.6	0.08	0.08	0.01
Furniture and household appliances	17,256	1.9	0.06	0.05	0.00
Garden products	10,893	1.2	0.04	0.04	0.00
Others	23,166	2.6	0.07	0.08	0.01
Total	**905,007**	**100**	**2.62**	**4.41**	**0.26**

Total number of parcels received per day, percentage share and averages per person, March and April 2024
Source: Meloche et al. (2025).

Online retailing will likely continue to gain market share

Milord, Meloche & Vaillancourt (2025) report both descriptive statistics and multivariate analysis results of the probability of using delivery services, the number of packages delivered and the probability of subscription to a delivery service.

Their findings suggest that larger households (people living with a spouse, roommate or children) in the Montreal metropolitan area have a higher probability of receiving deliveries and subscribing to a delivery service than individuals that live alone. They also receive more packages.

Contrary to the results found by most other studies, household income does not play a significant role in e-commerce usage in Montreal metropolitan area. Education has also only a minor effect when other socio-demographic variables are taken into consideration. Health issues affecting mobility, on the other hand, significantly increases the use of delivery services, particularly for groceries.

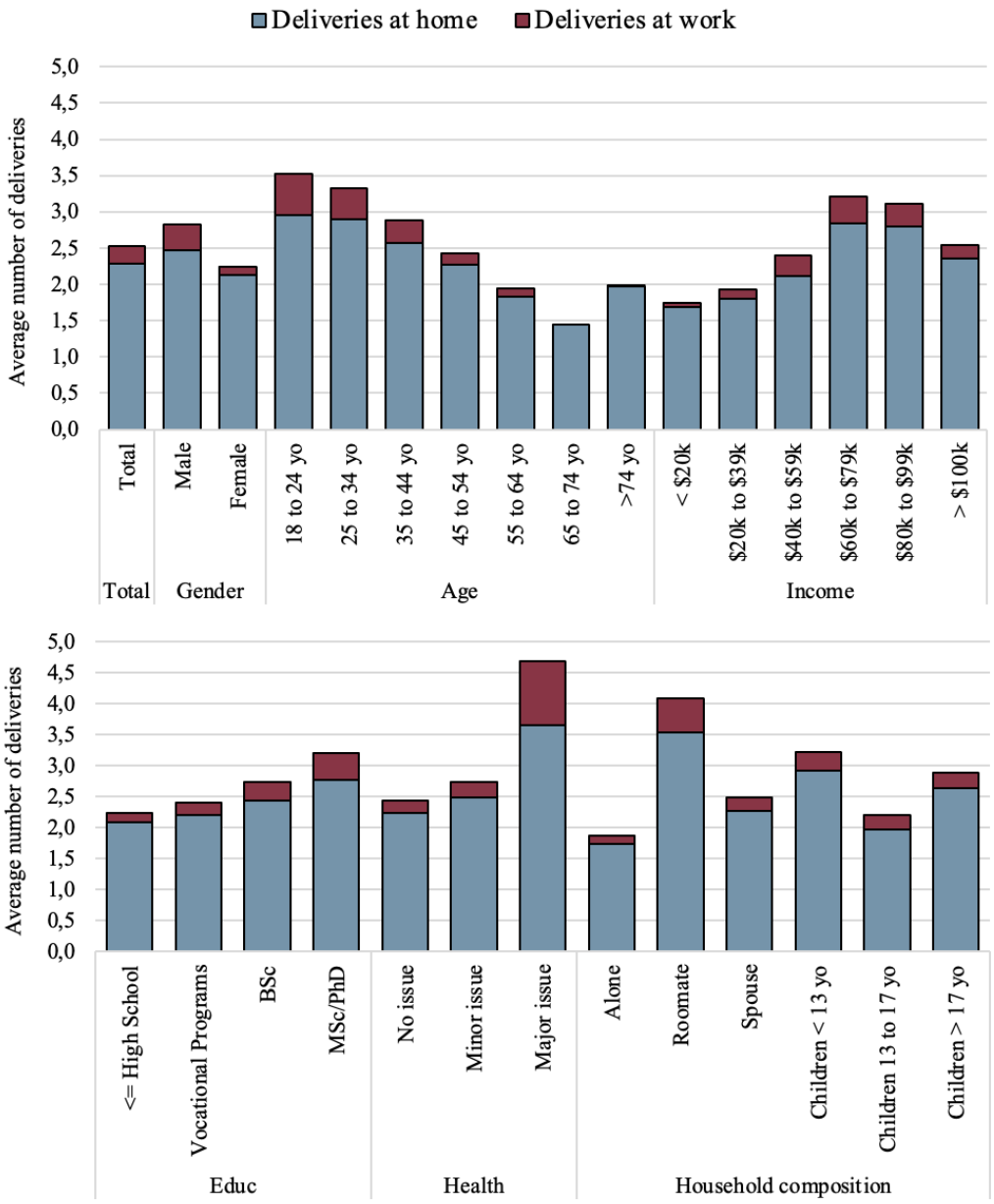
Regarding psychometric variables, there are both aficionados of online shopping/delivery services (order more, use priority deliveries) and refractory individuals that still enjoy examining products before purchasing them. Individuals that usually pay for faster delivery have a higher probability of subscribing to a delivery service and receiving more deliveries.

Subscribing to a delivery service in Montreal is also correlated with a higher probability to shop online and receive deliveries. The causality of this correlation remains however unclear. Heavy users of deliveries may receive more deliveries because they have a subscription, but they also have a higher probably to pay for subscription if they expect to become heavy users of e-commerce.

One important finding is that the younger generation (less than 45) shows a greater likelihood of using delivery and also of using it in greater quantities than older individuals, particularly for prepared meals. This suggests that generational and life cycle trends are at play. Having children and suffering from mobility problems are also associated with one's life cycle.

Combining these results, we would argue that a new generation with a higher tendency to shop online and use deliveries will eventually age into life cycle events like having family or will become elders with mobility limitations. Since these events will increase their use of e-commerce as their generation already order more online, all this points toward an increase in market share of e-commerce and in the absolute number of deliveries in the future.

The figure on next page shows some descriptive statistics from the survey. It illustrates the main findings of Milord, Meloche & Vaillancourt (2025). It also indicates that deliveries at the workplace remain less frequent than home deliveries for all sociodemographic groups. The highest volumes of workplace delivery are observed in young individuals and those suffering from major health issues that affect their mobility.



Deliveries by location, type of good and sociodemographic characteristics, Montreal CMA, April 2024
Source: Milord, Meloche & Vaillancourt (2025).

Regulating traffic and developing urban infrastructure are solutions to be considered

Economic solutions to regulate deliveries, like delivery charges, are difficult to put in place. Delivery companies in the Montreal region revealed during workshop that they did not trust local governments to manage this type of measure (Meloche et al., 2025).

Even if delivery companies leave a considerable footprint on the environment and on the use of roads, these impacts are not necessarily greater than those resulting from the movement of people to traditional stores. If the aim is to minimize the overall impact of motorized travel and road use, it would be more effective to target the entire transport sector and not just parcel deliveries. Solutions such as kilometer-based pricing for all vehicles, as proposed by Meloche, Robert-Anger & Godbout (2025), would more broadly tackle consumer-related travel and avoid some undesirable substitution effects. This solution, which seems fairer and is clearer in its objectives, could help to allay the fears of delivery companies.

However, a kilometer-based tax requires significant investment and commitment from all levels of government. It may take a long time before such a tool can be implemented in the Montreal Metropolitan Community. In the meantime, a registration or permit system, giving an operator the right to deliver within the area, would be an interesting and simpler alternative to a fee based on the number of parcels or a kilometer-based tax.

A charge based on the number of parcels has the advantage of gathering statistical information needed to measure the impact of parcel deliveries on the territory and to help design public policies. To achieve the same objective with delivery permits, data relating to the number and type of vehicles on the roads, the number of deliveries made per geographical area and the kilometers traveled would need to be shared.

Investment in logistics infrastructure could also offer interesting benefits, particularly when individuals access it by active modes of transport. In fact, these infrastructures are more consensual among delivery operators. There have been several experiments with collection and drop-off points in Montreal, including the Purolator project in collaboration with the STM (Normandin 2019), the Colibri project (Ville de Montréal 2022) and the Envoi Montréal project (CQCD 2022). This type of intervention facilitates the deployment of sustainable delivery activities in the areas where they are set up. This approach is of interest where land use is becoming denser or as part of pedestrianization projects. The comments that we gathered from Montreal-area delivery companies as part of our study show that local players are very supportive of this type of intervention. These experiments are still recent or at the pilot-project stage in Quebec. The data needed to assess all the impacts are not available, but the idea is based on solutions that have been studied elsewhere in the world. These solutions should continue to be evaluated, as they offer good potential for supporting the transition of delivery practices in Montreal towards more sustainable solutions.

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