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The good impacts of biking for goods: Lessons from Paris city

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ABSTRACT

This paper seeks to assess the growing usage of bicycles and tricycles for commercial goods movement in Paris city and the resulting transport externality savings between 2001 and 2014. Results from an original survey of nine couriers and delivery companies are presented to quantify new commercial goods movements via human-powered or electrically-assisted bicycles or cargo cycles. After identifying growth in cycle freight volumes and the modes by which these trips previously moved, congestion, CO_2, local pollutant, and noise savings are estimated and valued.

1. Introduction

In recent years, major cities throughout the world have sought to reduce transportation externalities through implementation of policies aimed to increase non-motorized transport use. Researchers, including Pucher and Buehler (2008) and Pucher et al. (2011) have found these policies to be largely successful internationally in their intended aim to increase bicycle commuter mode shares. Socioeconomic assessments have also been conducted to measure social impacts such as environmental, congestion and health savings from investments in non-motorized infrastructure and related mode shifts; these have produced mixed results. Sælensminde (2004) found high benefit-cost ratios for new walking and cycling track networks in three Norwegian cities. Koning and Kopp (2014) found recent "pro-bikes" policies in Paris to be slightly beneficial to society, with benefits to cyclists almost offset by driver losses and high costs for public finances. Focusing only on CO_2 savings, Brand et al.'s (2014) UK study did not identify major CO_2 savings from new walking and cycling infrastructure. However, in examining health and emissions costs in New Zealand, Lindsay et al. (2011) determined that a 5% mode shift from car to bicycle would produce considerable benefits. Inconsistencies in these conclusions likely result from the specific costs and benefits considered; Litman (2015) provides a comprehensive discussion of impacts to consider in benefit-cost evaluation of non-motorized transportation.

In the above referenced studies, little attention has been given in the evaluation of "pro-bikes" policies to the area of urban goods movement. This study aims to address this gap by quantifying the growing usage of human-powered and electrically assisted bicycles and tricycles for local delivery in Paris city and valuing the related externality savings, including CO_2 emissions, local pollutants, noise, and road congestion, between 2001 and 2014. In recent years, human-powered cycles have gained prominence as a sustainable mode for local goods movement in a number of European and North American cities. In addition to their use for local business-to-business (B2C) and business-to-customer (B2C) movements of food, pharmaceuticals, documents, and other small consumer products, cycles are also employed by major freight integrators as a last-mile solution for parcel delivery in heavily congested urban centers. A number of recent studies have examined the use of human-powered cycles for urban freight operations; these have primarily focused either on the broad potential for goods delivery via bicycle or tricycle or on carrier costs and operations. Studies by Transport for London (TFL, 2009), Barber and Wood (2013), and Gruber et al. (2014) have sought to evaluate the broad potential for use of bicycles and tricycles for goods delivery in various business sectors in European cities; the latter estimated that 42% of courier delivery tours currently completed by car could feasibly be completed by electric cargo cycles. Dablanc (2011), Browne et al. (2011), and Kok et al. (2012) detail the cost tradeoffs and environmental impacts for individual

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cargo cycle operators replacing motorized delivery operations in Paris, London, and Brussels. Recent US studies examine the cost (Tipagornwong and Figliozzi, 2013) and traffic performance (Conway et al., 2014) competitiveness between freight tricycles and motorized delivery vehicles. In general, these studies have found that while cargo cycles are less expensive to purchase, maintain, and power and may provide better reliability and more parking flexibility for short trips in urban areas compared to motorized vehicles, their limited capacities and service ranges necessitate expensive space for transloading in densely developed areas and more vehicles and drivers than comparable services employing motorized vehicles. High costs for labor and space and lower economies of scale frequently limit the cost-competitiveness of cargo cycles.

Through micro-level analysis, the same studies have identified net benefits in terms of CO_2 and local pollutant emissions and reduced congestion impacts for the surrounding cities (Dablanc, 2011; Browne et al., 2011; Kok et al., 2012; Conway et al., 2014). However, no known study has yet sought to undertake a city-wide socioeconomic assessment of modal shifts towards non-motorized bicycles and tricycles for goods movement. This study aims to produce such an assessment. The total value of these externalities no longer emitted in Paris city due to the increased usage of bikes and cargo bikes are translated into a common – monetized – metric. Because we are not able to properly isolate the effects induced by recent Parisian transport policies, this exercise cannot be viewed as a "pure" costs-benefits analysis; however, the influence of recent policy changes on bicycle use for goods movement can be examined by studying changes in commercial operator mode choice since 2001. The results of this analysis provide interesting insights on recent trends in goods movements in Paris city and can be seen as a first step towards a more comprehensive policy analysis.

This paper proceeds as follows. First, Section 2 describes recent transportation policies implemented in Paris, with a specific focus on bicycle and freight interventions. Fig. 1 illustrates the four following phases of this analysis. Section 3 describes an original survey conducted during Spring 2014 as part of this study to characterize and estimate goods movements by bike in Paris City in 2014 and 2001. Using this empirical material, Section 4 quantifies cargo bike freight activity in Paris in both years and identifies the origin mode by which freight trips made by non-motorized cycles in 2014 would have moved in 2001. Emissions factors and monetary valuations for various transport externalities (congestion, CO_2, local pollutants and noise) due to freight activities are presented in Section 5. Section 6 provides benchmark estimates of external savings due to increasing goods movement by bikes and cargo-bikes in Paris. As the estimation methods are subject to many uncertainties, sensitivity analyses are also performed in Section 6. Section 7 summarizes the conclusions of this study and next steps for future research.

2. Recent Paris transport policy

As one of the most densely populated cities in the world, Paris generates a tremendous volume of travel. In 2001, the city faced severe congestion problems, with Parisians making about 6.3 million daily person trips to, from, or within the city using motorized modes and bicycles, and generating 300,000 daily freight shipments and deliveries (City of Paris, 2013b). With 35% of these passenger trips made by car and 90% of freight movements made by van or truck, a new municipal team elected in 2001 sought to address the city's heavy motor vehicle reliance by actively promoting passenger commuter switches to public transportation and non-motorized modes.

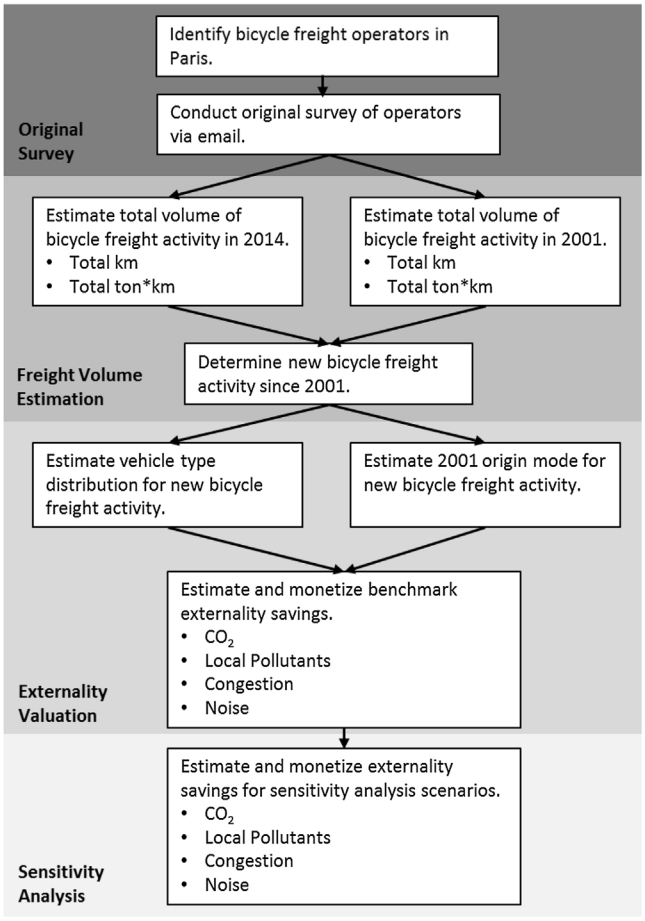

Fig. 1. Method of analysis.

2.1. "Pro-bikes" policies

Beginning in 2001, the local government implemented "quantity regulation," narrowing urban space dedicated to cars by approximately a third (Prud'homme and Kopp, 2008). Resulting free space was redistributed to cleaner transport modes. An enhanced network of dedicated bus lanes was installed rapidly, and streetcars were reintroduced in 2006. In addition to lane reductions, authorized traffic speeds were reduced to 30 km/h in many neighborhoods.

As shown in Table 1, the bicycle network was extensively developed, with an increase of 355 lane-kilometers between 2003 and 2012.[1] Bicycle parking also expanded, with more than 20,000 additional spaces provided for private bikes between 2003 and 2012. As can also be seen in Table 1, space for this new parking supply for bikes came mainly from a reduced parking supply for cars. The Paris municipality also introduced a bikeshare service (Vélib) in July 2007, signing a 10-year Public-Private Partnership with JC Decaux, a major international provider of urban equipment (public benches, bus stations) and advertising. The private company agreed to bear the initial cost of the 20,000 bikes parked

[1] This mileage includes both dedicated and shared facilities; nearly 60% of the growth corresponds to the 2009 opening of many roads to contra-flow bicycle traffic, and another 11% to new shared bus lanes (in which bicycles have been permitted to operate since 2001). Most of the remaining growth is in protected bicycle lanes.

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