Why housing and transport costs should always be considered together: A monocentric analysis of prudential measures in housing access

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ABSTRACT

This paper compares the effects of two prudential measures in housing access on the solvency and welfare of households, with specific attention to transport costs and equity issues. A widespread regulation limits the housing burden (defined as the share of income spent on housing), typically at 33% or so. Using the monocentric model, I show that capping the housing burden drives low-income households away from the city center toward suburban areas, where they face high transport costs. This unintended eviction effect lowers the prudential efficiency of this measure. Capping the housing plus transport burden precludes this eviction mechanism and better protects household solvency, including from strong variations in transport costs such as during fuel price spikes. Additionally, by limiting the bidding capacity of households, both prudential measures lead to a decrease in housing prices. This tends to improve the welfare of households, firstly of high-income ones (being less affected by the constraints). The effect is stronger when capping the housing burden, so that households, again firstly high-income ones, are typically better off (in terms of welfare) than when one caps the housing plus transport burden, however. Considering the primary objective of prudential measures – protecting household solvency, firstly of low-income households – these findings call for the inclusion of transport costs within prudential ratios, as well as indicators of housing affordability. This would incidentally raise public awareness with regard to the high costs of private cars, which are often underestimated. A short application to the Paris region corroborates that a policy change from housing only toward comprehensive housing plus transport prudential ratios might significantly improve the situation of low-income households.

1. Introduction

For homebuyer and private renter households, housing usually represents the primary cost item. In 2010, American moderate-income households spent on average 29% of their income on housing for renters, and 43% for homebuyers (Hickey et al., 2012). Accordingly, lenders apply several prudential measures to limit the default risk. A standard underwriting guideline is to cap the monthly installment at a fixed fraction of the household income (typically around one third). In the rental sector likewise, landlords often require from prospective tenants to earn at least three times the rent to ensure that they may sustain such rent over the long term.

These prudential measures, though seemingly sound, are controversial. In tight housing markets, they would incite households to move away from the (expensive) urban center toward more distant (and affordable) neighborhoods to fulfill their housing wishes (homeownership, bigger home…). Suburban lifestyles involve high transportation costs, however, often misestimated by households. These would lead to heavy housing plus transport burdens – ultimately increasing the

default risk – but also raise vulnerability to fuel price spikes. In France, Montagnon and Ringenbach (2013) estimate 60% of households would spend more than 60% of their income on housing and transport were fuel prices to double, against 3% today. Accordingly, several researchers advocate including transport costs within prudential ratios to preclude such unintended consequences (Hare, 1994; Holtzclaw et al., 2002). Empirical evidence on the issue remains mixed, however, and limited by the unavailability of adequate data (Kaza et al., 2016), while theoretical works are seldom, if any (Chatman and Voorhoeve, 2010).

This paper seeks to shed light on this debate by comparing the effects of both prudential measures – capping the housing or housing plus transport budget at a given fraction of the household income – from a theoretical perspective. Two questions are of particular interest: 1) do these regulations improve household solvency as they are intended to and 2) how do they affect household welfare. I use the canonical model of urban economics, the monocentric model. Acknowledging income as a key determinant of housing and transport budgets (Coulombel and Leurent, 2013; Haas et al., 2006), two

household classes are considered in the model: low-income and high-income. The analysis focuses on low-income households, however, as the ones who face the highest housing plus transport burdens and thus the most subject to solvency issues (Kaza et al., 2016; Renne and Sturtevant, 2016).

2. Literature review

When considering household solvency through the prism of housing affordability, two indicators prevail in the literature: the housing burden and the residual income (Revington and Townsend, 2016). The housing burden (also called front-end ratio) measures the share of income spent on housing. Typically, housing is considered unaffordable if the household allows more than 30% of its income to housing expenses (Stone, 2006).[1] This rule-of-thumb actually often serves as a prudential rule as well. In the US, most underwriting guidelines include a PITI (Principal, Interest, Tax and Insurance payment) threshold hovering around 30%. Likewise, a 30% threshold remains the standard in most rental housing programs (Schwarz and Wilson, 2008). In France, a 33% PITI threshold is customarily applied; similarly, most landlords require prospective tenants to earn at least three times the rent (Coulombel, in press). The expense-to-income ratio is straightforwardly computed and easily available, hence its wide use in the academic literature or as a prudential measure.[2] Furthermore, there is large empirical evidence that high front-end ratios increase the risk of mortgage delinquency, supporting current underwriting practices (Kaza et al., 2016). One limitation of expense-to-income indicators is that a same value reflects very contrasted situations depending on the household income, however. A household with above-median income will for instance more easily bear a housing burden of 30% than if below the poverty line.

To overcome this difficulty, the residual income approach considers the income left after subtracting one or several predefined expense items, and evaluates whether this amount is sufficient to meet the household's (remaining) basic needs. While first works only subtracted housing costs (Kutty, 2005; Stone, 2006), there is growing consensus that measures of housing affordability should include both housing and transport costs (Fisher et al., 2009; Renne and Sturtevant, 2016). Indeed, transport costs strongly vary within metropolitan areas, typically rising with distance to the city center.[3] As conversely housing burdens are generally fairly stable, several works report housing plus transport (H+T) burdens increasing with distance to the city center (Coulombel, 2010; Hickey et al., 2012).[4] Arguing that high H+T burdens are likely to increase the risk of insolvency, the same works advocate including transport costs within prudential ratios.[5]

Henceforward, prudential measures limiting the housing burden are referred to as CH policies (for Capped Housing burden), and those limiting the H+T burden as CHT policies. Whether the latter are indeed preferable remains controversial, in particular considering the paucity of scholarly works (Chatman and Voorhoeve, 2010). A first strand of the literature examines the hypothesis underlying CHT policies that

high transport costs increase the risk of mortgage delinquency (like housing costs do). Although recent works corroborate this point to a smaller or greater extent (Kaza et al., 2016; Pivo, 2014; Rauterkus et al., 2010), empirical evidence remains somewhat inconclusive and a few works find no influence of location accessibility on the default risk (e.g. Blackman and Krupnick, 2001). Moreover, all works are limited by the unavailability of households' transportation budgets in home loan datasets, so that some accessibility measure (walk score, gravity index, number of vehicles…) is used as a proxy instead. Another strand of the literature investigates the effect of borrowing constraints - including the CH constraint – on tenure choice and housing demand. However, this literature seldom considers location choices and the role of transport costs, as well as effects on housing supply and prices.

This work analyses CH and CHT policies using the monocentric model. The monocentric model – first formulated by Alonso (1964) – considers location choices and housing price formation within a metropolitan area, putting emphasis on households' trade-offs between housing and transport costs. It allows capturing the effects of CH and CHT policies on location choices and housing prices, two points rarely addressed in the literature. To the best of my knowledge, this paper is also the first to compare CH and CHT policies systematically and within a same analytical framework.

3. The monocentric model

3.1. Overview

In the monocentric model, all jobs are located in a single point, the Central Business District (CBD). Households commute to the CBD for work, and earn an income Y. The commuting cost, noted $T(r)$, strictly increases with distance r to the CBD. There are three goods in the economy: transport, land, and a composite good standing for all other goods, taken as the *numéraire*. The household utility maximization problem writes:

$$\max_{z,s,r} U(z, s) \qquad s.\,t. \qquad R(r)s + z + T(r) = Y, \tag{1}$$

where z and s are the quantities of composite good and land consumed, and $R(r)$ the unit land rent. When choosing its location r, the household faces a trade-off between transportation costs $T(r)$ and housing prices $R(r)$.[6] Housing prices are determined endogenously through a bid-auction mechanism. At equilibrium, they reflect the locational comparative advantage in terms of accessibility, travel cost savings associated to CBD proximity being capitalized in land rents.

Land supply available at distance r is noted $L(r)$. Landlords can rent to either the agricultural sector or households, who compete for land. The former are represented by a constant bid-rent $R_A \geq O$, while the household bid-rent function is:

$$\Psi(r, u) = \max_{z,s} \left\{ \frac{Y - T(r) - z}{s} \, U(z, s) = u \right\}. \tag{2}$$

$\Psi(r, u)$ is the maximum bid price (per surface unit) a household can offer at location r and still achieve utility u. Landlords rent to the highest bidder:

$$R(r) = \max(\Psi(r, u), \quad R_A). \tag{3}$$

I consider the standard case of a closed-city with fixed population N and absentee landlords (meaning land rents exit the economy). At equilibrium, all households have the same utility level u_e, with the following conditions regarding u_e and city size r_f:

$$\Psi(r_f, u_e) = R_A, \tag{4}$$

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[1] The scope of housing costs typically includes: rents (for tenants), loan payments (for homebuyers), insurance, and taxes. Utilities and home maintenance are sometimes included.

[2] It is also used to study (domestic) fuel poverty or transport vulnerability (Berry et al., 2016).

[3] For instance, in Philadelphia the mean transport burden of a moderate-income household remained in 2010 below 20% close to the city center, but exceeded 30% in the most remote parts of the metropolitan area (Hickey et al., 2012).

[4] In the Paris region for instance, the average H+T burden of median-income households ranged in 2001 from 32% in inner Paris to 50% in rural areas (Coulombel, 2010).

[5] Current underwriting guidelines already consider transport costs to some (limited) extent, as car loan payments enter the overall debt-to-income ratio. Notwithstanding, the threshold for the debt-to-income ratio is typically higher than for the front-end ratio, and loan payments are but a part of the auto full cost. In the rental market, landlords seldom if at all consider transport costs to screen tenants.

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[6] In the standard monocentric model land equals housing; land rents and housing prices are thus confounded.