Housing, Price, (un)Affordability. Using Transactions Data to Analyze Neighborhood-based Dynamics of Affordability (Paris, Lyon, Avignon, France)

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Urban Affairs Association | 50th Annual Conference | April 12-14, 2022 | Washington, DC

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4/7/2022

Conference paper. Draft, April, 13th 2022. The conference paper is released on an open archive institutional repository as a research note. 1996-2018 time series animated maps available online : https://rysebaert.gitpages.huma-num.fr/wisdhom-maps/price.html

Abstract

The context of the study stems from 3 decades of housing price increase, faster than the income of buyers, becoming an important driver of social polarization and household vulnerability. The novelty of the approach is to observe neighborhood change, comparing trajectories in 3 urban areas (Paris, Lyon and Avignon), by means of large datasets of individual transactions in Paris, Lyon and Avignon urban areas, to develop a spatial analysis of housing-based inequality in France.

Research question: The contribution draws on a research agenda on French housing markets since the end of the 1990s, that explores the linkages of inflation with the 'house price-credit feedback cycle,' a price regime that emerged with a shift towards asset-based welfare, the goal being to provide an empirically-grounded theorization of the socio-spatial inequalities that determine neighborhood choice and residential strategies.

Methods: The paper highlights some of the challenges in the analysis of datasets that differ substantially in their structure, exhaustiveness and content, with price references that do not always compare. Bridging heterogeneous data, the approach requires modeling and interpolation of highly disaggregated data (down to the address, and latitude-longitude coordinates), time series data (1996 – 2018 for transaction data), census and households INSEE data, and income data derived from tax rolls.

Anticipated outcomes: The outputs of the study highlight the geographical structure of affordability, with spatio-temporal price to income ratios, debt-to-price analysis, and indicators on sellers and buyers, to analyze the local accumulation of wealth (and multi-ownership) as well as the spatial structure of affordability.

1. Introduction

Since the mid-1990s, housing prices have increased faster than the income of buyers, digging the gap between those who can afford to buy and capitalize on housing wealth, and the others.

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This affordability crisis is situated in a shift towards an asset-based welfare model (H. Schwartz 2012; Vergriete 2013) : theories link the high proportion of capital investment that housing represents for households and the ways welfare states have been reformed (Kemeny 2001), through the pursuit of owner-occupancy being viewed as a superior form of tenure, while also privatizing social housing (Van Gent 2010). Our main hypothesis is that local property markets restratification is an important driver of social polarization and household vulnerability, and a main driver also for neighborhood change, in a homeowner society, like France has now become. The contribution draws on a research agenda on French housing markets since the end of the 1990s, that explores the linkages of inflation with the 'house price-credit feedback cycle,' a price regime that emerged with a shift towards asset-based welfare, the goal being to provide an empirically-grounded theorization of the socio-spatial inequalities that determine neighborhood choice and residential strategies (Le Goix, Casanova Enault, et al. 2021). Our objective is to integrate housing affordability and conditions for ownership back into the broader debate of neighborhood and local dynamics, as a means to synthesize the mechanisms through which the housing market shapes inequality in cities. To do so, We explicitly link price dynamics inequality, asset capitalization and vulnerability, in a spatial analysis effort, using the opportunity of real-estate markets microdata availability in France.

The remainder of the contribution is structured in five sections. Section 2 covers the backgrounds of the study, establishing explicit linkages between the affordability crisis, and the ways the French home property market has been reformed and predicatd upon asset-based welfare regime. Section 3 covers the methodology: we aim at observing neighborhood change, and comparing trajectories in 3 urban areas (Paris, Lyon and Avignon), by means of large datasets of individual transactions in Paris, Lyon and Avignon urban areas. The overarching goal of the study is to develop a spatial analysis of housing-based inequality in France. This conference paper is however very much a work in progress. Section 4 will present and discuss some of the main results. The conclusion (section 5) elaborates on our data-driven approach, to explain the ways that asset-accumulation and household vulnerability is embedded in each spatial contexts.

2. Background

Affordability crisis and homeownership in European cities and in France

Housing is a major policy issue regarding urban well-being, cohesion and sustainability in Europe. This affordability crisis impacts the well-being of residents in European cities, and has been well analyzed at macro-economic levels. As soon as the early 1990s, housing finance (access to credit, mortgage and fiscal incentives for investors) has increased dramatically in the Global North, yielding a continuous inflow of buyers on markets, and a volatile inflation of price: residential mortgage outstanding debt has reached as soon as 2006 an all-time high levels: 35% (France), 50% (Sweden, Spain, Germany), 80% (US) and 100% (Netherlands, Denmark) of the GDP, according to H. M. Schwartz and Seabrooke (2009). A 2012 IMF report analyzed the change in household debt-to-income ratio between 2002 and 2010: +100% in Ireland and the Netherlands, +45% in Spain, +50% in Norway and in the UK, for instance. Also, since the early 2000s, the gap between households' income and real estate prices has widened. For owner-occupied households, in Britain, Ireland, the average price to income ratio of 3:1 in 1996 has reached values between 4:1 and 5:1 in 2007 (H. M. Schwartz and Seabrooke 2009). A study in 17 countries (14 in Europe, and the USA, Canada, Japan) showed that the homeownership rates ranges between 50 to 83% in 2010. In many countries, homeownership has skyrocketed until the 1990s then stabilized. There are evidences that housing markets have since switched to a more debt-driven inflation dynamic : data show a growth of mortgage debt without growth of ownership "in [a] majority of countries, recent decades, particularly in the 2000s, were marked by a growth of mortgages per GDP not paralleled by a growth of homeownership, which either grew much less than before or even declined" (Kohl 2018, 185). In parallel, entire segments of the markets have shifted to private rental, with a massive transfer of housing debt dedicated to investments in private rental, a sector that has been framed by national policy regimes (Wijburg 2019; Byrne 2020; Hochstenbach and Ronald 2020).

This results in an unprecedented inflation in OECD countries: in 1985-2010 price-to-income ratio has increased from + 13% up to +28% in France, 44% in the UK, except in Germany and Japan (M. Aalbers 2016). In

France, affordability of homeownership, i.e. real estate purchase power, calculated by dividing housing prices by level of wealth (income generally) has dropped at its lowest historical level (Friggit 2021), because of a +70% increase of the actual cost of real estate since 2000, while households benefited from lower interest rates and longer credit range to offset this price inflation and maintain purchase power.

Asset-based welfare, housing regimes and inequalities

Given the effects of price inflation or price-to-income gap in European cities, it is crucial to contextualize the issue within the different market regimes between European cities, as a large part of the literature considers a global shift in market regimes have occurred (Fernandez and Aalbers 2016). Affordability of housing has become, in this context more and more socially and politically embedded in welfare.

This situation in European countries is linked with financial and macroeconomic parameters like monetary policies, credit affordability and fiscal policies targeting investment (national policies): 25 States in the OECD promote homeownership by means of subsidies and fiscal incentives to first-time property owners and/or fiscal incentives to offset the cost for individual buyers (André and Chalaux 2018). This shows how advanced economies have shifted toward an asset-based welfare model, yielding a regime linking an ideology of ownership, credit affordability and house price often subsidized by the State and local governments (Ronald 2008; Rolnik 2013). Topalov (1987) has well established how homeownership regimes shifted from a rentier-system to a credit-based massive homeownership system. Such a shift has been regulated by converging public policies (to increase household solvency and provide incentives to homeownership), banking industry, market players' strategies (among which developers have been preeminent), and preservation of assets strategies by households. Some scholars describe a path dependency-shift in almost every nation-state influenced by global World Bank policies (Rolnik 2013; Theurillat, Rérat, and Crevoisier 2015). Other studies suggest that housing regimes have also recently shifted towards a retargeting of investment, from owner-occupied housing to private lenders: recent studies showed that private sector rental has been preeminent in the restructuring of credit markets since the GCF (Byrne 2020). Trajectories are therefore highly dependent upon national frameworks, and the state enables households to act as investors, engaging through markets with prospects of future gains, while exposed to greater risks (volatility of price, loss of property values, risks of bankruptcy and foreclosures, etc.), raising questions of individual and systemic risks, and therefore vulnerabilities of households (H. Schwartz 2012).

There are many differences between France and more archetypal models of financialization observed in the USA and UK, e.g. mortgage securitization. In France, loans are mostly backed by mutual insurance companies and are granted on the basis of household income rather than the assessed property value. Synthetic securitization is rare, which may explain why French real-estate markets better resisted the external shocks of the Global Financial Crisis (Tutin 2013). There are, however, convergences with other countries. First, the regulation of mortgage lending has shifted from a state-administered financing system to a system organized by private banks. The injection of capital into the housing sector was made possible by household debt incurred through private bank loans. Household indebtedness increased from 30% of the total annual household income in 2000 to almost 100% in 2017, of which housing debt represented 85% (France 2019). New loan origination mainly involves international circuits of interbank and financial networks through which refinancing vehicles are traded. Second, while deregulating loans, public policies have maintained instruments that increase the solvency of borrowers (Le Corre 2019) and promote lower-income ownership (Lambert 2015). Third, tax incentives have been instrumental in encouraging wealthier households to invest in the private rental sector formerly dominated by the state (Vergriete 2013; Pollard 2018).

Our main hypothesis stems from the social embeddedness of housing finance regimes within local residential markets. The flow of investment capital into and out of local housing markets is influenced by the financial stratification of urban inequalities. We assume that stratification operates through the assemblage of different housing and financial policies, market devices, and technologies (M. B. Aalbers 2005; Fourcade and Healy 2017) that recursively perpetuate the geographical variegation of urban inequality and vulnerability (Migozzi 2019).For owners, real estate has become a major component of household wealth. But local markets are also volatile. Housing prices are therefore unstable and contingent upon the market's continuous restratification within and across neighborhoods. Real estate influences the local conditions through which household wealth

is accumulated or lost (Le Goix, Casanova Enault, et al. 2021). This stratification is therefore shaped *at least* two factors: (i) residential access and affordability for buyers (price and price-to-income ratio), and (ii) the trajectories of accumulated wealth (local housing price growth), as well as the positive or negative equity associated with residential real estate (debt-to-value ratio).

Current researches on housing affordability in a context of housing wealth accumulation

Some research agendas recently published on property markets engage with a series of approaches on the issues of affordability and access to ownership. For instance, Walks (2019) discusses how inequalities stems from a context of pro-ownership policies and housing bubble. Wijburg (2020) analyzes the local contestations of financial-led accumulation, and alternative approach to ownership. In a recent paper by our research team, prepared with preliminary data, we demonstrated that inflation and local instability can accommodate investment accumulation in residential real estate, while also increasing the vulnerability of property owners (Le Goix, Casanova Enault, et al. 2021).These are counter-arguments to prevailing assumptions regarding asset-based welfare, which views real-estate investment as the primary way to secure a household's economic well-being. In fact, market dynamics have enabled some households in more affordable neighborhoods to benefit from housing price inflation, but only in highly localized and specific circumstances. These variegated, uneven, and disjointed movements reflect the complexity of the ways that housing-finance regimes are enacted and maintained through diverse systemic and individual factors we have sought to frame for further analysis.

In this research context, this paper aims at analyzing how the constellation of asset-based welfare policies in France, residential market volatility and stratified accumulation and vulnerability impinge upon the geography of housing-based inequality today. The novelty of the approach is to observe neighborhood change, comparing trajectories in 3 urban areas (Paris, Lyon and Avignon), by means of large datasets of individual transactions in Paris, Lyon and Avignon urban areas, to develop a spatial analysis of housing-based inequality in France.

Comparing housing market data between and within neighborhoods

There are plenty of institutional (census records), private (real-estate agents and websites) and national or local datasets (cadastral records, tax rolls). However, few methods have been developed to harmonize this spatial data with as a means to study housing market trends (Julliard and Gusarova 2019). While OECD (2018) data allows for comparison between countries (André and Chalaux 2018), it characterizes affordability at national aggregates only. This is one reason why current research often focuses on national aggregates to interpret the effects of homeownership on social inequality (Kohl 2018; Walks 2019; Arundel and Ronald 2020).

Our reasearch uses fine-grained data (individual transactions) to harmonize temporal and spatial affordability trends. Transactions data are collected by the Chamber of Notaries, and stored on the BIEN and PERVAL databases, as well as by the French Department of Public Finance which provides open-source cadastral and property tax data (DVF dataset, see Figure 1). A key issue with these datasets is that they differ substantially in their structure, exhaustiveness and content, with variables that do not always compare (Casanova et al. 2017; Boulay et al. 2020). Combining these different elements nevertheless allows us to control for inconsistencies across transaction data, while also enhancing our ability to analyze new relationships between disaggregated data (between sellers and buyers, for instance). In particular, our focus centers on the local geographies of the market (200 m grid, 1k grid and municipalities) to insure the robustness of our aggregation techniques, and to draw conclusions about spatial stratification at a finer scale of analysis (Le Goix, Ysebaert, et al. 2021).

3. Methodology : bridging datasets that are usually used separately

Our research covers 3 metropolitan areas: Paris, Lyon and Avignon. With this selection, we investigate three distinctive levels of the French urban hierarchy, a capital city, a regional center and a medium size city : that covers a very diverse range of 2400 municipalities, among central, inner and outer-suburban places.

To proceed further, we propose a fine grain local approach, going down to at least municipalities and when possible to census tracts – IRIS in French definition and grid data at the 1 km and 200 m neighborhood level. We do so by bridging different spatial datasets that have so far been employed separately. Analysis have been conducted on datasets that cover transactions, parcel and building valuation for local property taxation, as well as census income data derived from tax rolls. The goal is to incorporate into the research data that has not been originally designed or structured to do so. Such massive datasets allow to broaden the analysis's scope to include entire metropolitan systems (Hochstenbach and Musterd 2021), while maintaining a high spatial and time resolution.

Coverage	Description of the dataset	Provider	Open public data
Paris	BIEN. A fully disaggregated database of transactions (address and parcel identifier) Current access is 1996-2018. Access to information on sellers and buyers, and credit/mortgage data	Chamber of the Notaries Ile-de-France	No (statistical secrecy applies)
Avignon & Lyon	PERVAL. A fully disaggregated database of transactions (address and parcel identifier). Access to information on sellers and buyers, and credit/mortgage data	Chamber of the Notaries	No (statistical secrecy applies)
Paris / Lyon / Avignon	DVF (Demandes de Valeurs Foncières), fully disaggregated database of transactions (last 5 years only). Parcel data (land registry and built structures)	DGFIP	Yes
Paris / Lyon / Avignon	MAJIC / Fichiers fonciers – Property tax rolls. A fully disaggregated database describing owners and parcel data for tax assessment. + DV3F, a geo-referenced derivative of DVF and Fichiers fonciers	DGFIP and DGALN (via CEREMA)	No

Figure 1: General description of transactions, parcel data and property tax rolls used.

Bridging datasets... with heterogeneous spatial coverage and geographies

However, it should also be mentionned that using massive unconventional datasets comes at a greater methodological cost.

The transaction time series we have acquired for a fee cover the 1996 – 2018 period, with an unequal availability of data. We could not afford to buy a complete sample for each year. We then made assumptions regarding the trajectories, and we paid (literally) a special attention to get enough data for years 2007 – 2010 because of the global financial crisis. Compared with opensource data other projects might use, transactions data include information on credit and socio-professional categories of buyers. Second, the sample for each city varies according to the size of the markets. This yields a sample gap between Paris, up to 100,000 transactions a year, Lyon averaging 15n000 transactions a year, and Avignon, a much smaller market (Figure 2).

Bridging datasets... with heterogeneous spatial coverage

Among the 3 cities we investigated, Avignon, in South-East France is a good example of the issues at stake. (Figure 3) shows the distribution of income, as delivered as grid data. The distribution of population on

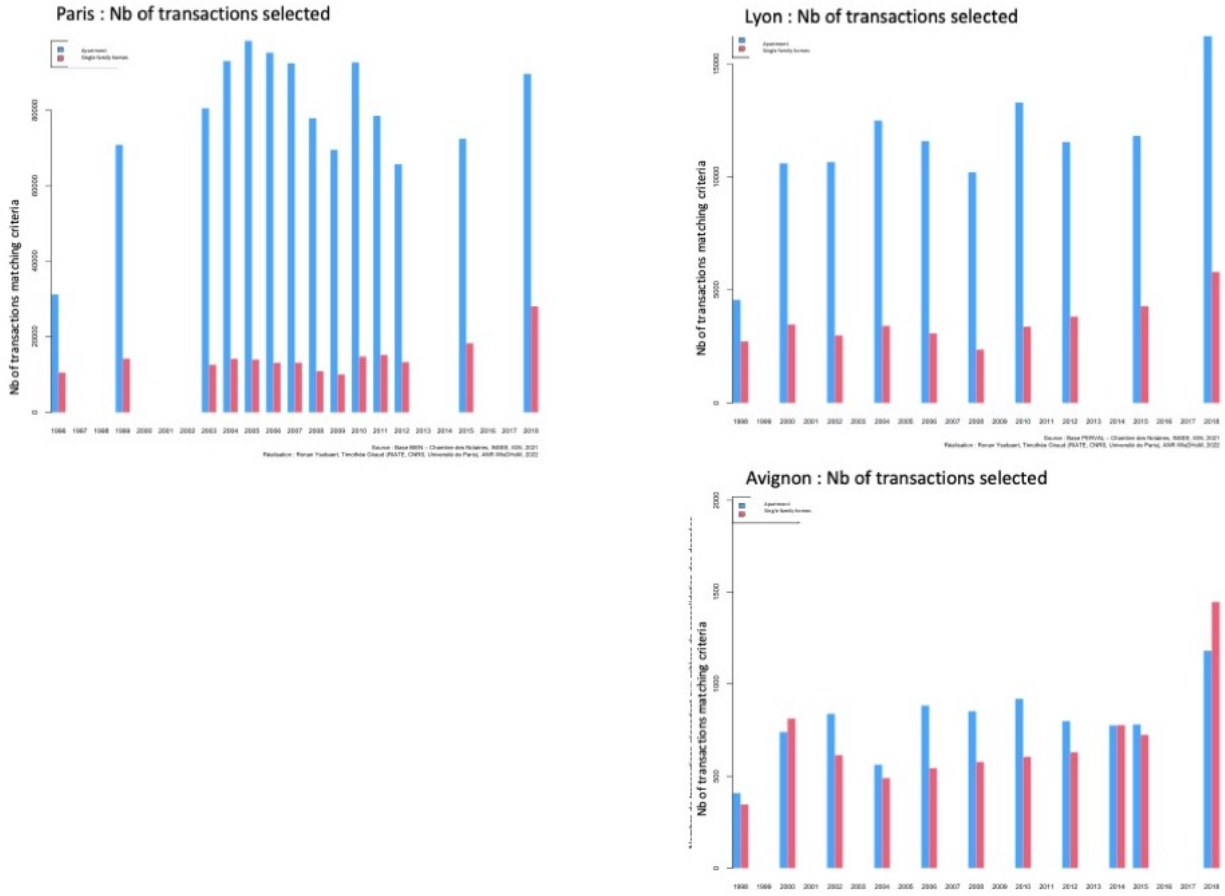

Figure 2: Samples available in Paris, Lyon and Avignon, per year.

fine grained data is uneven, with a lot of gaps (there are forests, fields, etc.). In such a situation usual interpolation methods are challenging as we cannot input income where no one lives . The map to the right shows the distribution of transactions. On the other hand, the sample of transaction is also scarce: in Avignon, roughly 1500 transactions only are available for single family homes in 2018 (and 1000 apartments). Year 2018 is however the best case situation. Bridging income and property price requires to find the best level of aggregation possible, between the obvious easy solution of adopting municipal boundaries, and the solution that requires interpolation, at the 200 m grid level, to analyze property transactions in there very local context.

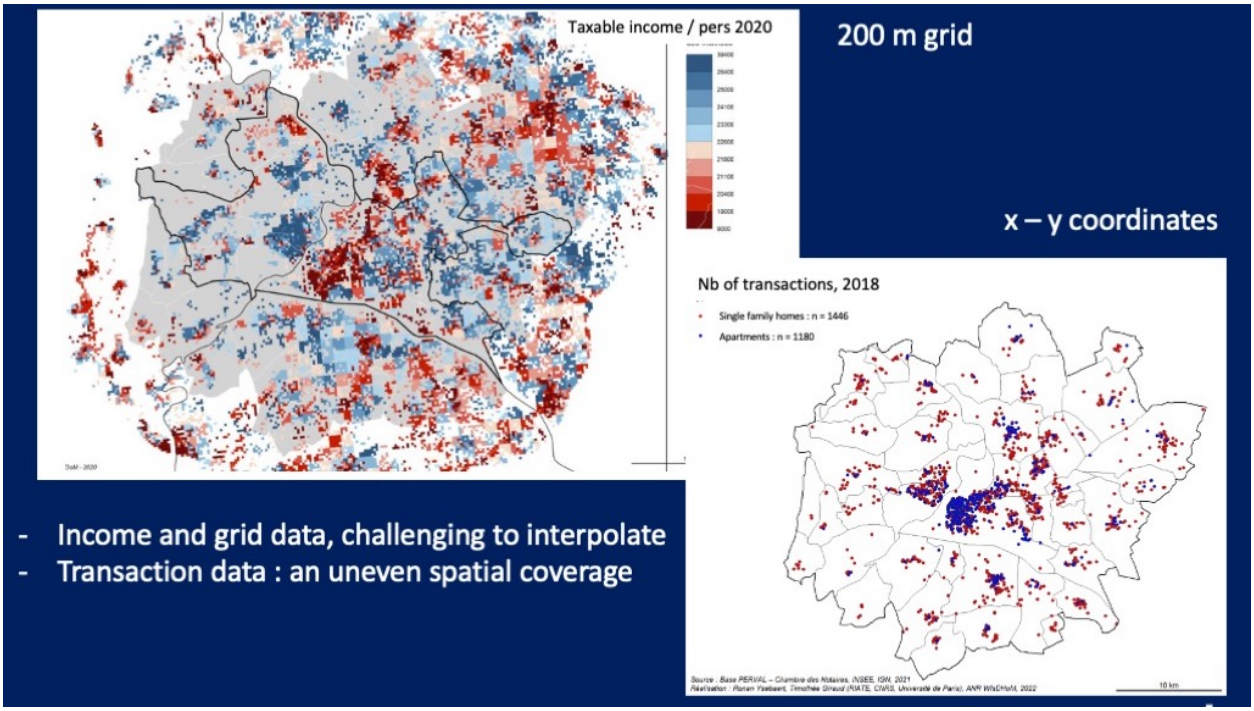

Figure 3: Data structured compared: spatial coverage of income data (left) and transactions (right).

4. Results

Price

A first obvious dimension of neighborhood change is the effect of price inflation. A first series of maps shows the spatial structure of apartments price (Figure 4).[1] In Paris,inflation started at the end of the 1990's, first in the city center, then in the western suburbs, before reaching out to the outer suburbs in 2010, after the global financial crisis. There are exceptions in the suburbs, with patches of blue shades, low prices and also a relative decline in values : inflation is also volatile and unequal. We systematically conducted our observations at different geographical levels of aggregation : Figure 4 has been prepared at the municipal and IRIS – census tracts level.

Affordability

The core of our analysis stems from a measure of the financial effort by households and its spatial structure. Household purchasing power is estimated as the ratio between price and median income We measure

[1] 1996-2018 time series animated maps available online : https://rysebaert.gitpages.huma-num.fr/wisdhom-maps/price.html

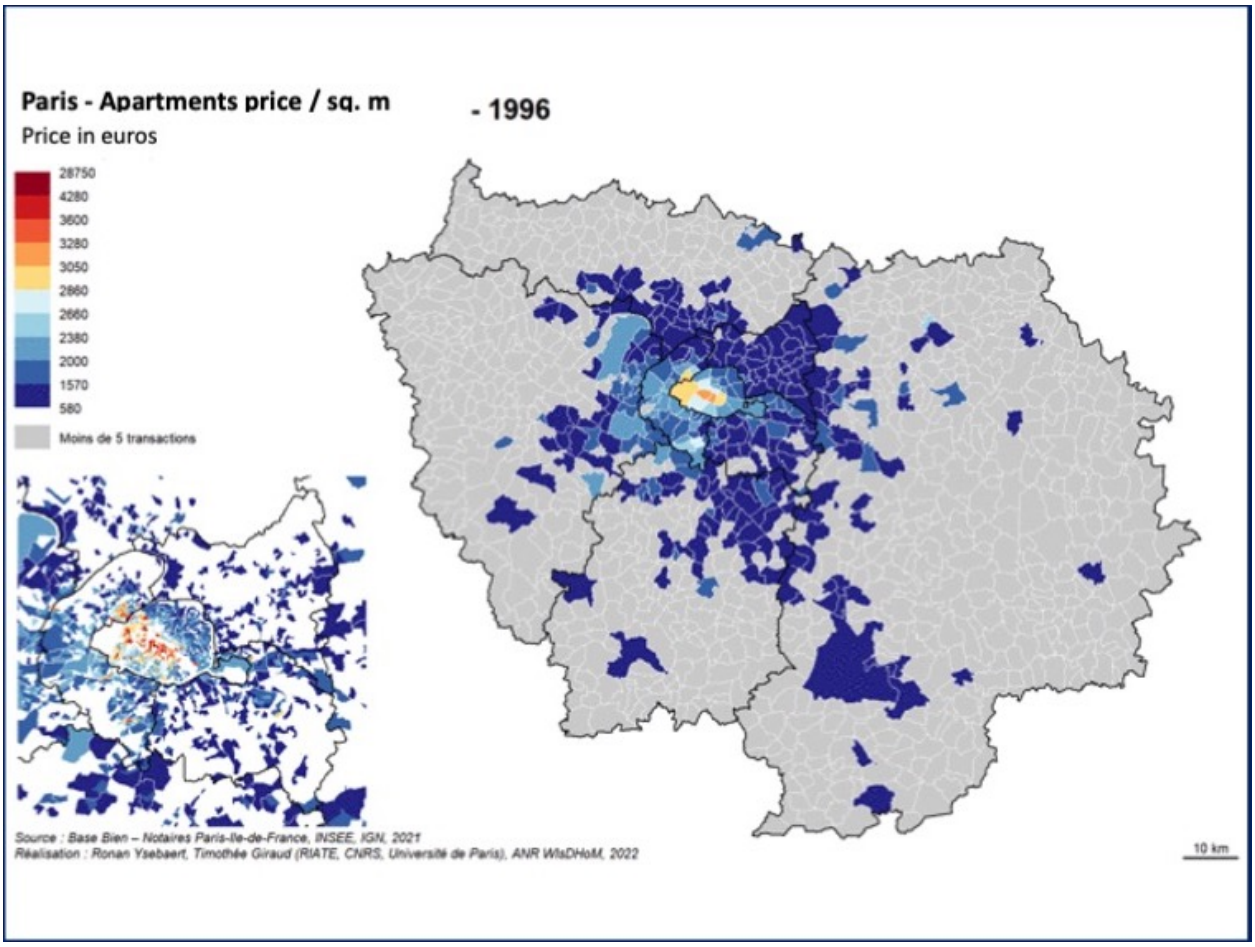

Figure 4: Inflation in Paris Functional Urban Area - 2018.

affordability as the monthly income required to buy 1 sq. meter of real estate. Grid data allow to characterize local measure of affordability, based on local income. We define the financial accessibility of neighborhoods by median households. Everything being equal in terms of income, the structure of housing markets heavily constrains the ability of households to access a property.

Figure 5 describes the unequal geography of affordability for single family homes at the 1 km grid level. The hierarchy of neighborhoods follows a center-periphery gradient in Paris and Lyon, with patches of higher prices in suburban markets such as Ambérieux, North of Lyon, Genas, Pusinian, East of Lyon. This is also the case in the western parts of Paris, along the Seine valley corridor (from Carrière sous Poissy, an epicenter of the car-building industry), to les Mureaux, an epicenter of the aerospace industry. Nearby Disneyland, North of Meaux, in the far-eastern suburbs of Paris, single family home markets fuel high levels of financial efforts for households. Results differ a bit in Avignon, with a donut pattern, higher financial effort being observed to the west and to the East (Saint Saturnin les avignns, Pernes les Fontaines) and to the west (Pujaut, Rochefort du Gard).

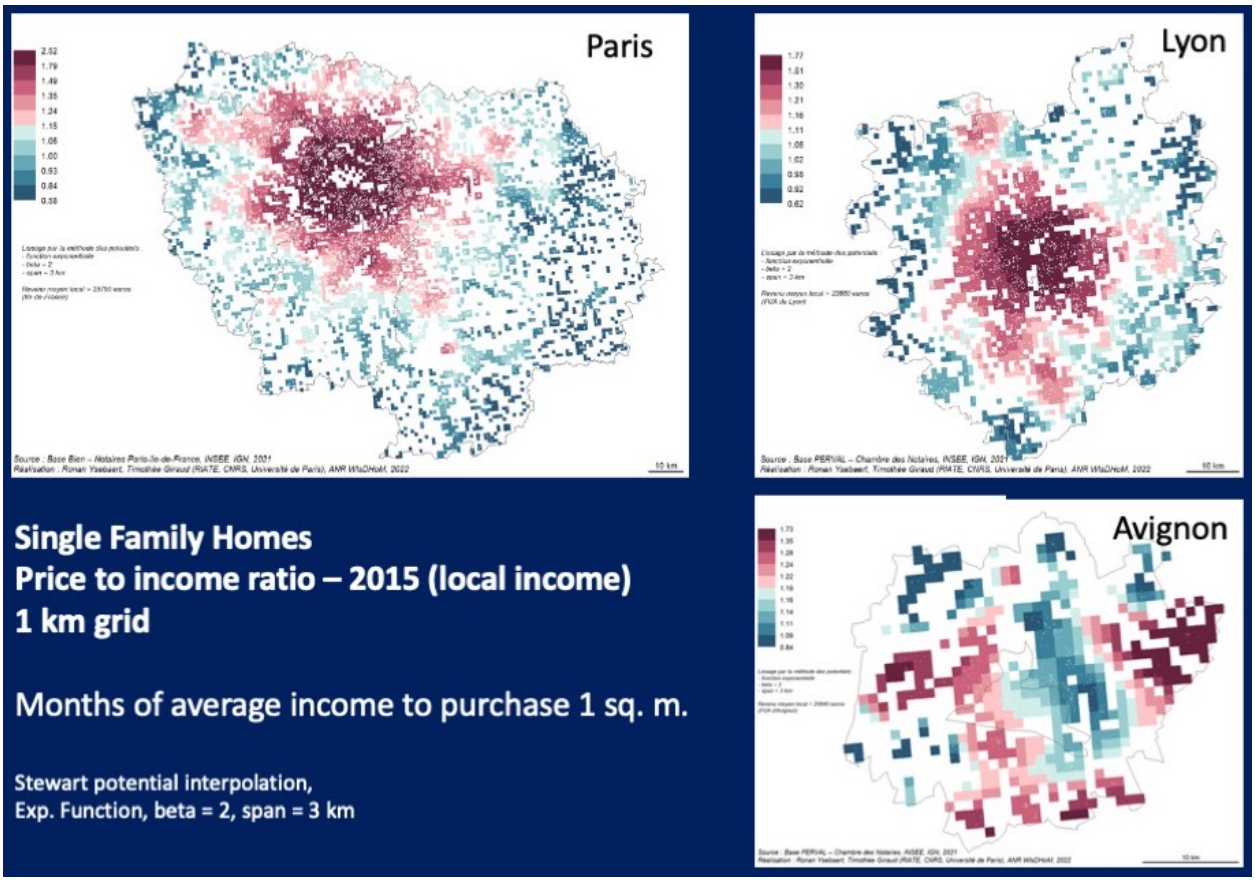

Figure 5: Inflation in Paris, Lyon and Avignon Functional Urban Areas - 2015.

Affordability Dynamics

Our analysis however rely on disaggregated and heterogeneous data and samples, and we have quickly reached the sample limits at which detailed data allow to compare case-studies in both space and time. Available data in relatively large datasets ends up with sometimes scarse sub-samples, and we need to trade-off between the best level of disaggregation possible and the relevance of time analysis. This implies space-time analysis of affordability dynamics have to be conducted at a more general level of data aggregation, i.e. municipalities, as discussed by Le Goix, Ysebaert, et al. (2021). Maps on Figure 6 analyze the monthly median income

required to a buy 1 sq. meter. Data show two major spatial patterns of affordability dynamics :

- First, as expected, the center-periphery gradient paramounts ;
- But the dynamics of increased financial pressure in suburban areas are also important, especially in Avignon's outer suburbs, as seen on dynamic maps.[2]

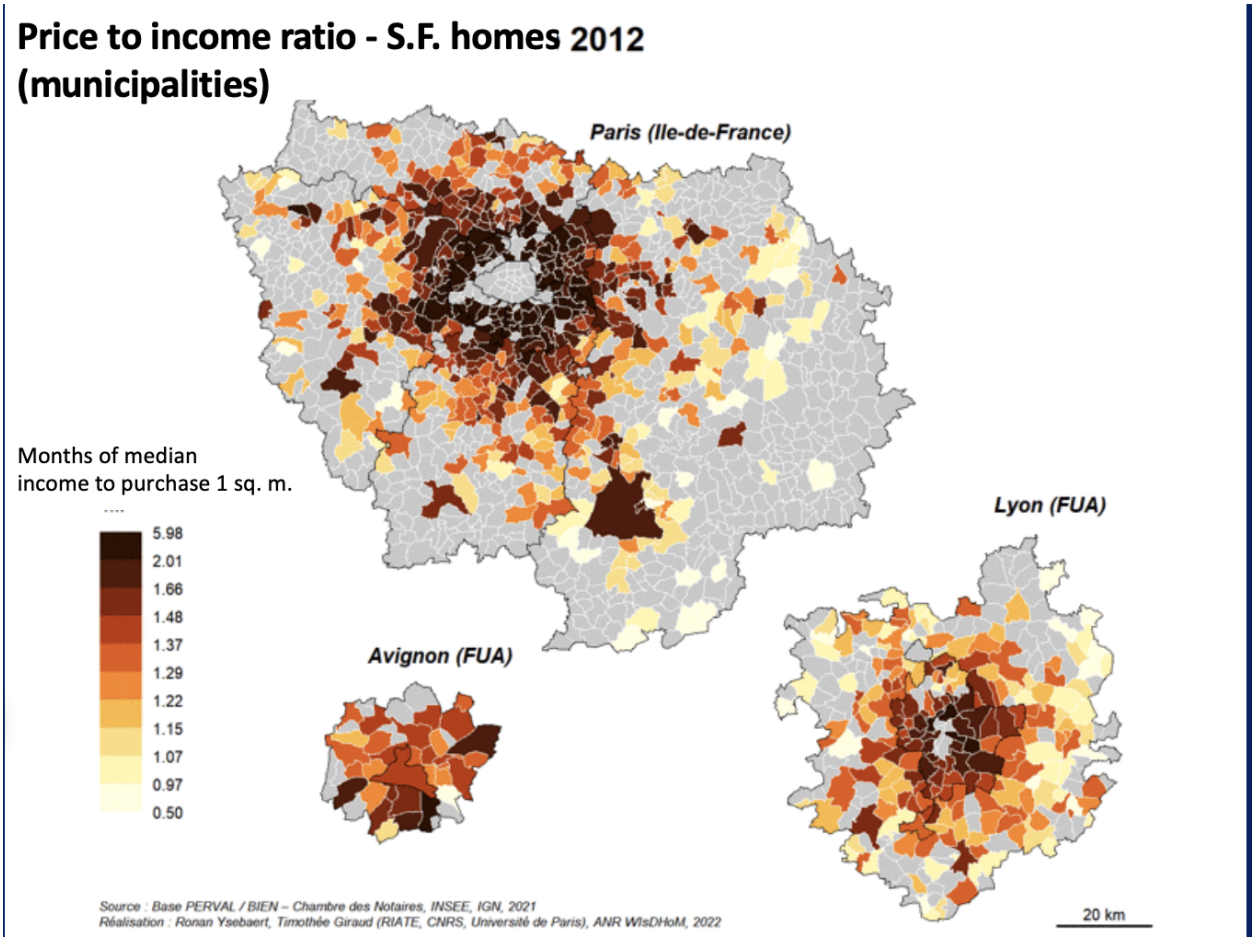

Figure 6: Price to income ratio - 2012.

Debt-to-value

We finally move to another financial indicator of neighborhood change, debt-to-value. This is another facet we use to explore the financial effort: the less the housing debt, the more housing wealth, to be reinvested elsewhere (secondary homes, rental investment, etc.). A first finding, on this series of three maps on our case studies for single family homes show that the average level of debt-to-value is strongly related to the urban hierarchy (Figure 7).

A more detailed dynamic analysis shows the patterns of debt-to-property values ratio for apartments in Paris. As expected, in the already richer areas (blue shades) where housing wealth is higher, debt-to-values ratios are lower. As on Figure 8, in the center and west of Paris for instance. But reddish shades tell another story: data show in the northern and eastern suburbs of Paris a strong trend of increased debt burden (and even

[2]2002-2018 affordability time series animated maps available online : https://rysebaert.gitpages.huma-num.fr/wisdhom-maps/abord.html

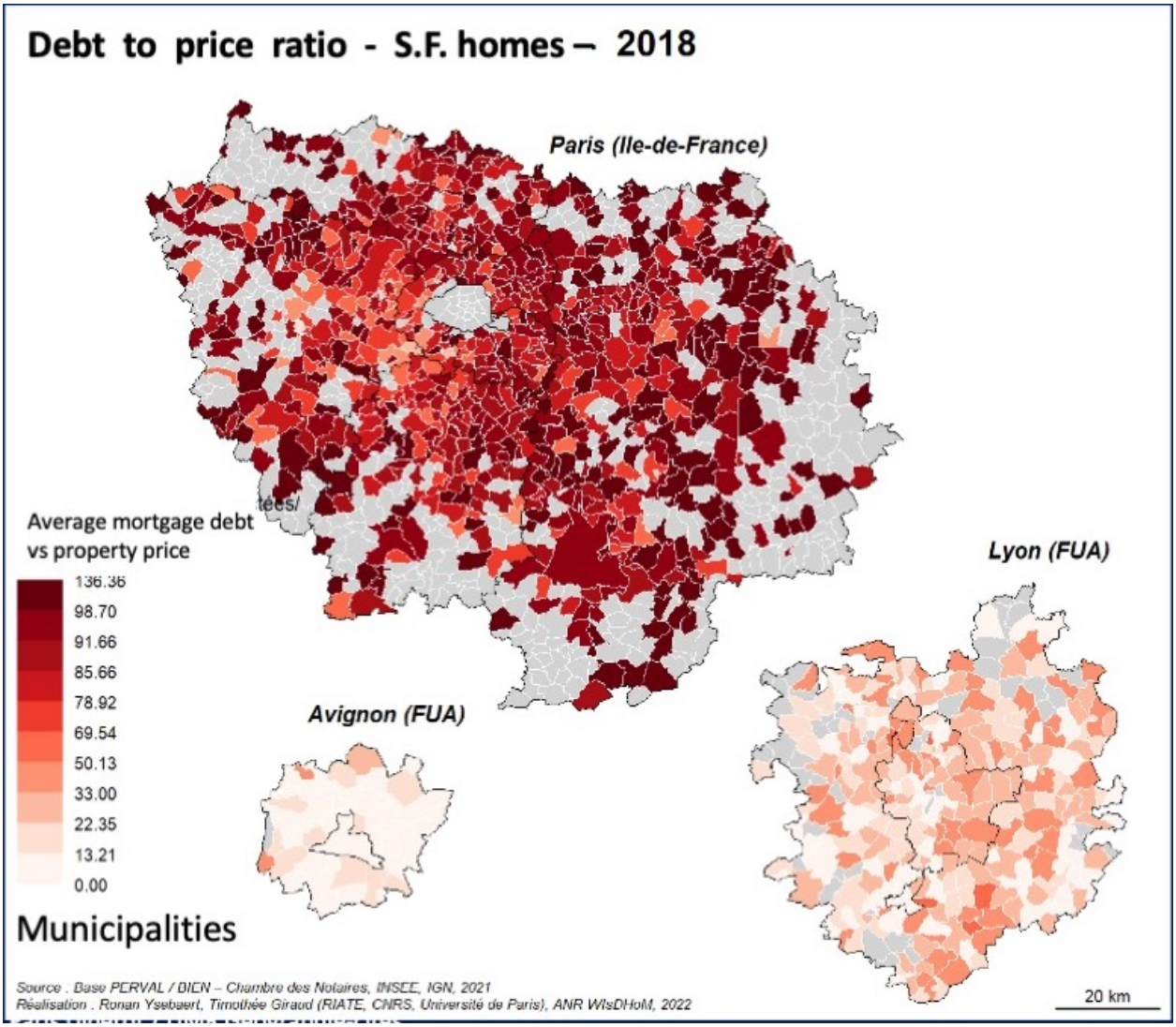

Figure 7: Debt-to-value ratio 2018.

negative equity, above the 100% mortgage threshold).[3]

Negative equity is a major cause for financial imbalance, with households and failed neighborhoods caught in spiral debts and very vulnerable to property values decline, obsolescence of the built environment, and also energy and transportation costs. The socio-economic aspects of vulnerability are multifaceted.

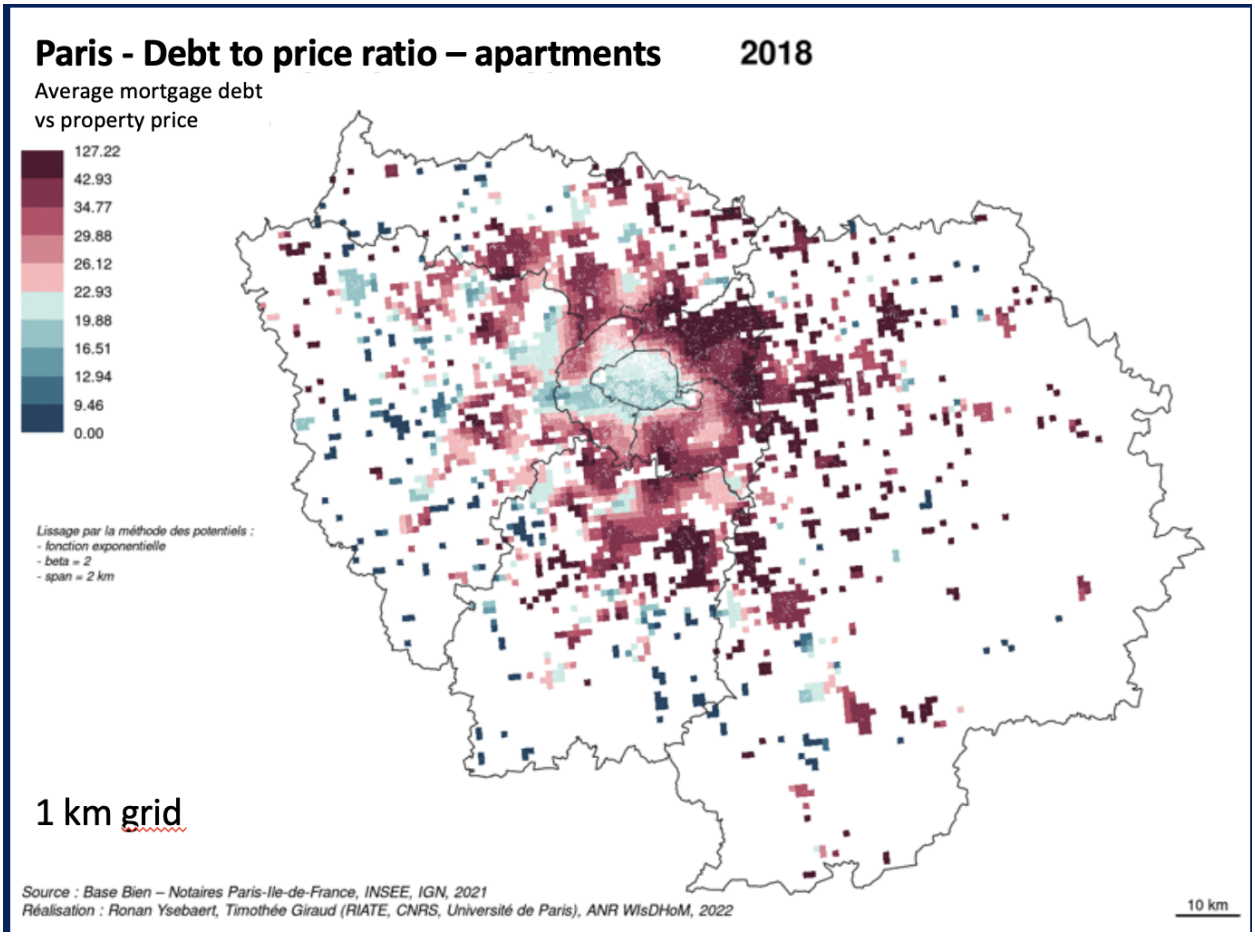

Figure 8: Detailed Debt-to-value ratio in Paris Functional Urban Areas, apartments, 2018 - 1 km grid.

5. Conclusion

As a conclusion, getting a broader sense of these maps and results requires to get back to our broader theorization. Specifically, the overarching goal of our research is to analyze the neighborhood dynamics of social inequality in the context of housing financialization. The work in progress in this paper will be further developed into typologies, circumscribing the different local markets regimes and how they evolve in time.

We interpret the relationships between the different points addressed as a feedback loop connecting together price, income, and debt, that can be linked together by the means of dynamic cartography :

- First, prospective homeowners employ diverse forms of purchasing power defined by their income, current assets, credit scores and embedded knowledge of market opportunities.

[3] 2002-2018 debt-to-value time series animated maps available online : https://rysebaert.gitpages.huma-num.fr/wisdhom-maps/debt.html

- Second, buyers and sellers operate on markets that spatially structure their inclusion and financial capabilities on the market : real estate agents are sorting prospective buyers according to the spatial structure of affordability, and its representation. Our findings shows that financial effort have increased (both price to income and debt to value). While lower-income households have not been excluded from home buying : they have been included at a greater cost, or displaced.
- Third, the dependency of home value upon local, diverse and segmented markets determine trends and restratification between neighborhoods.

This stems not only from the effects of urban development cycles, but also from different policy decisions taken in regard to housing supply (s.a. public incentives and land restrictions). All this influences the local conditions through which household wealth is accumulated or lost. Some loose housing wealth under such market conditions. Beyond global inflation, we observed volatily and patches of property values lagging behind market trends, as in Avignon city center. But some are able to reinvest housing wealth, as a financial assets, and this also affects neighborhoods in other parts of the country.

Acknowledgements

This paper was prepared under the ANR WIsDHoM project, *Wealth inequalities and the dynamics of housing markets*. (ANR-18-CE41-0004). Projet's website : https://wisdhom.hypotheses.org. Special thanks to team members Laure Casanovo-Enault, Guilhem Boulay, Loïc Bonneval, Antoine Peris, William Kutz, Timothée Giraud.

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