Capital Shocks and Productivity in European Cities and Regions

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I. Aim of the Paper

The aim of this paper is to uncover the role which capital shocks and investment allocation processes play in shaping local and regional productivity responses. Our analysis examines how the links between the macroeconomic and national governance features of a country and the internal economic geography of a country shape the productivity-driving role of cities and regions. In order to do this, we build on an approach which is based on the integration and analysis of real estate capital inflows spanning all sectors into cities and regions across Europe.

The importance of real estate capital flows is that they are both location-specific and they also represent large scale and long-term investments into a locality which bundle together the capital from many different stakeholders and institutions, and in turn act as a key conduit for leveraging additional investment flows for other business investment purposes. We decompose the various elements of the capital asset pricing model broken down by location and city and time period and relates these to different potential explanatory features to the investment allocation characteristics.

Our analysis will exploit the enormous heterogeneity of European nations, region and cities so as to identify which national, regional, or city-specific features either mediate, ameliorate or exacerbate the productivity-related implications of national monetary shocks. In order to do this we will analyse real estate investment flows for the period 2003-2015, in other words during the years prior to the 2008 global financial crisis as well as in the years following the crisis. We use uniquely detailed real estate investment data, which provides a wide range of transaction-specific information on more than 60,000 transactions of investment-grade European real estate. These data cover 26 countries and include information on yield values, pricing, and other characteristics of the individual transactions. We enrich these real estate capital flows data with OECD-standardised national, regional, and city data as relevant to different national and regional institutional and policy settings (e.g., productivity growth, monetary and fiscal policy, trade outcomes, and a range of intra-region and intra-city productivity and productivity-related features, see e.g. OECD [2017a; b; 2018; 2020] or OECD and UCLG [2016; 2019]) which we will examine.

II. Some Key Foundations

Economists typically describe urban growth in terms of populations, such as the number of people, households or firms. Although the concentrations of people and firms are all parts of the same urban growth processes which real estate markets are also part of, in the economic literature these different manifestations of growth are not as integrated as one might expect. In particular, there are various issues about which even the related fields of urban economics and real estate economics run largely in parallel with one another, without any significant interactions.

One of these issues concerns our study's main substance, namely the pricing of capital and investment flows into cities. In urban and regional economics, the growth, internal structure and distribution of cities is examined primarily from the perspective of the spatial and structural distribution of factors. Changes to these distributions tend to be discussed largely from the perspective of various factor allocation and reallocation mechanisms including labor migration, knowledge spillovers and technology diffusion (Ellison and Glaeser 1997; Ellison, Glaeser, and Kerr 2010). The resulting impacts of the allocation mechanisms on firms and consumers across regions (Barro and Sala-i-Martin 1992) allow various explanations to be put forward as to the nature (Gabaix 1999a, b), formation (Fujita, Krugman, and Mori 1999; Duranton 2007) and characteristics (Duranton and Puga 2000) of cities and urban hierarchies.

In contrast, in real estate economics, the growth and internal structure of cities is examined primarily from the perspective of the capital and financing involved, and the portfolio issues arising from such investment and its returns (DiPasquale and Wheaton 1992; Fisher et al. 2021; Goetzmann and Wachter 1995; Williams 1999). Differences in the relative pricing of these returns, as reflected in real estate yields, signal how investors evaluate the growth prospects of cities and particular localities within them (Geltner et al. 2001; Wheaton and Nechayev 2005; Piazzi, Torous, and Valkanov 2010; Case, Cotter, and Gabriel 2011). As such, real estate markets reflect major business sentiment regarding the growth prospects of different places.

These different approaches reflect longstanding analytical trajectories. Edwin Mills (2000, 1–2) stated that "*perhaps the most difficult distinction is between real estate analysis and urban economic analysis*". Yet, as described above, in terms of explaining urban growth the differences are quite clear. Mills also contends that distinctions between urbanization and localization economies are not sufficient for explaining urban growth, and instead advocates a different

approach. Mills (1971, 48) states that "*developing a theory of city size which allowed for risk and uncertainty might be a difficult task. A possible line of approach might be to use the methods of portfolio analysis regarding each city as a portfolio of firms*." As such, Mills' view is that the explanations for urban growth must also involve the costs of capital financing, as well as discussions about location in terms of factor allocations and economic structure. These improved explanations potentially can be achieved by a better integration of the insights from urban economics and real estate economics.

In contrast, William Wheaton is less sanguine about these matters arguing that "*… in terms of fundamentals, location does seem to matter. In terms of investment return, however, location does not seem to matter – at least not very much*" (Wheaton and Nechayev 2005, 7; Chervachidze and Wheaton 2013). Wheaton's view suggests that financing markets largely correctly price-in investments in different locations, so that real estate-led urban growth patterns are less dependent on the types of issues examined in urban economics than the literature would suggest.

A third viewpoint in this discussion concerns scale. Observations also suggest that city growth rates are independent of scale, giving rise to Zipf's Law distributions (Gabaix 1999a,b). Zipf's Law states that a city's population is inversely proportional to the city's population size-based rank (Zipf 1947). This striking regularity has been observed to hold particularly well for the US city-size distribution, and to some extent for the European city-size distribution, which suggests that a possible role for both size-related as well as non-size related features of cities in determining business sentiment regarding growth is plausible. The scale of cities will be a system-level consideration in our analysis, in addition to the various city features that will be examined in terms of their association with investment risk.

III. Empirical Strategy

A – General Approach

We will run a series of models examining different aspects of how the productivity performance of localities have been affected in terms of changing capital inflows, and in turn how these investment flows shape or have been shaped by the local productivity performance of the city or region.

In particular, we will examine national-, regional- and city-level productivity growth, monetary and fiscal policy, trade outcomes, with region and city data on a whole range of productivity and productivity-related features, including the structure (Hooghe and Marks 2016; Hooghe et al. 2016), fiscal autonomy (Ladner et al. 2019) and quality (Charron et al. 2019) of sub-national governance, as well of national governance (World Bank 2019).

As a framework for decomposing feature-specific effects in terms of how these link to capital markets, we will employ the Capital Asset Pricing Model (CAPM). While there are more sophisticated models of investment finance, the CAPM framework allows us to decompose many of the different elements of the changing capital flows, especially in the context of the radical uncertainty unleashed by the 2008 global financial crisis.

In specific, in regression analysis of outcomes from the CAPM-decomposition, we will examine the ways in city and regional productivity shapes, and is shaped by, local capital flows, pricing and shocks, and in turn how these productivity-capital interrelationships are influenced by the economic geography and institutional and governance structure of a country.

B – Elements of the Capital Asset Pricing Model

In order to make sense of how risk assessment and pricing processes are related to the features of clusters and cities, we need to consider the underlying investment model driving such behavior. None of the existing systems-of-cities schema (Fujita, Krugman, and Mori 1999; Gabaix 1999a, b; Batty 2013; Bettencourt 2013) are helpful in modelling how real estate pricing relates to urban hierarchies because they do not incorporate portfolio theory into their frameworks in a manner which Mills (1971) hoped for. Nor does portfolio theory explicitly relate to Zipf's Law types of arguments. However, although there are many different and sophisticated approaches to modelling real estate investment risks and returns, for our purposes,[1] the simplest framework, namely the Capital Asset Pricing Model (CAPM), works surprisingly well.

The simple CAPM can be written as (Armitage 2005):

[1] It may be noted that, unlike for individual stocks, for which high-frequency price series are available to assess investment risks in fine detail, the market for real estate is characterized by a relative infrequency of transactions. While for REITs higher-frequency price series can be observed, these do not provide the in-depth detail on returns-by-location as captured in our direct investment data, and which our analysis requires.

(1) $$E(R_i) - R_f = \beta_i[E(R_m) - R_f]$$

or:

(2) $$E(R_i) - R_f = \rho_{im}\frac{\sigma_i}{\sigma_m}[E(R_m) - R_f]$$

where:

$E(R_i)$ = Expected return on investment *i*;

$E(R_m)$ = Expected return on market *m*;

$E(R_f)$ = Expected return on risk-free investment *f* (sovereign bond yield);

σ_i = Standard deviation of investment *i*;

σ_m = Standard deviation of market *i*;

ρ_{im}= Correlation between investment *i* and market *m*;

and where the investment beta can be written as:

(3) $$\beta_i = \rho_{im}\frac{\sigma_i}{\sigma_m}$$

If we treat each cluster, respectively, as *i*, and we can calculate all of the country-wide market *m* values in the real estate investment sector as the average values across all cities, then the average yield in each cluster *i*, as observed by year, is denoted as r_i and the average year-specific yield across the whole market for the observed country is denoted as r_m. Given that the yields reflect the expected return on each investment, across the whole system of an observed country's clusters we can now write a CAPM equation of:

(4) $$r_i - r_f = \rho_{im}\frac{\sigma_i}{\sigma_m}[r_m - r_f].$$

For each cluster *i* and also for the observed country's real estate market as a whole *m* from our dataset we know the values for r_i , r_m , r_f, σ_i and σ_m , and we can also calculate the value of ρ_{im}. This allows us to plot the relationships between the risk premium $(r_i - r_f)$ for an individual investment and the investment's risk premium predicted by the CAPM $(\rho_{im}\frac{\sigma_i}{\sigma_m}[r_m - r_f])$, and also to examine the beta values $\rho_{im}\frac{\sigma_i}{\sigma_m}$ for individual clusters.

If changes in the expected returns on investment in a particular cluster exactly mirrors the movement in the expected returns in the market as a whole, then the cluster's beta will be equal to unity. Alternatively, if the calculated beta value is less or more than unity the rate of return on the individual investment has deviated away from the market-wide average. Beta as such here captures the systematic market risk associated with clusters.

Importantly, with our real estate data we will be to examine how the individual elements of the CAPM equation are distributed across clusters, cities, and regions in European OECD countries. Subsequent regression analysis will examine how the risk and return profiles of places relate to the economic and governance features of these places.

IV. Study Area and Data

We observe uniquely detailed real estate investment data sourced from Real Capital Analytics that provides a wide range of transaction-specific information on more than 60,000 European real estate transactions. Within this sample yields are observed for roughly a quarter of all observations. The price of the transaction is observed for all transactions, with a lower threshold in prices of at least 5 million USD; as such, all the properties in the dataset have sold for at least that price and are considered to be investment-grade properties. For each of the transactions we know the transaction date and location, as well as the transaction price in the local currency. Furthermore, with substantially varying degrees of coverage, the transaction data include information on structural characteristics (floor size, number of floors, number of buildings, age etc.) as well as information on the buyers and sellers, involved brokerage houses, and other characteristics specific to the property and deal. The data cover 25 European countries.

We enrich these real estate capital flows data with OECD-standardised national, regional, and city data as relevant to different national and regional institutional and policy settings (e.g., productivity growth, monetary and fiscal policy, trade outcomes, and a range of intra-region and intra-city productivity and productivity-related features.

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