No 2019-09 - September

Working Paper

CEPII

Sectoral Reallocations, Real Estate Shocks, and Productivity Divergence in Europe

Thomas Grjebine, Jérôme Héricourt & FabienTripier

Highlights

- This paper investigates the role of sectoral reallocations in the divergence of productivity in Europe, based on a database for 33 sectors and 14 countries between 1995 and 2015.
- Variations in the relative size of sectors have been at the origin of variable productivity losses in main European countries.
- We investigate real estate shocks as a potential source for those sectoral reallocations through a collateral mechanism.
- Boom-bust cycles turn out to be a strong driver of productivity divergence between European countries.

Abstract

This paper investigates the role of sectoral reallocations in the divergence of productivity in Europe, based on a database for 33 sectors and 14 countries between 1995 and 2015. Using the contribution of sectoral productivity growth to Total Factor Productivity (TFP) at the country level, we highlight that variations in the relative size of sectors - less productive sectors growing relatively to more productive ones - have been at the origin of variable productivity losses in main European countries. Parallel to this divergence, European countries experienced heterogeneous real estate price dynamics, which took the form, in some economies, of massive boom-bust cycles. We investigate real estate shocks as a potential source of sectoral reallocations through a collateral mechanism. These shocks turn out to be a strong driver of productivity divergence between European countries.

Keywords

Productivity, Sectoral Reallocations.

JEL

D22, F45, R30, O45.

Working Paper

CEPII

CEPII (Centre d'Etudes Prospectives et d'Informations Internationales) is a French institute dedicated to producing independent, policy-oriented economic research helpful to understand the international economic environment and challenges in the areas of trade policy, competitiveness, macroeconomics, international finance and growth.

CEPII Working Paper
Contributing to research in international economics

Editorial Director:
Sébastien Jean

Production:
Laure Boivin

No ISSN: 1293-2574

CEPII
20, avenue de Ségur
TSA 10726
75334 Paris Cedex 07
+33 1 53 68 55 00
www.cepii.fr
Press contact: presse@cepii.fr

RESEARCH AND EXPERTISE
ON THE WORLD ECONOMY

Sectoral reallocations, real estate shocks, and productivity divergence in Europe[1]

Thomas Grjebine*, Jérôme Héricourt†, and Fabien Tripier‡

1. Introduction

The creation of the European Monetary Union (EMU) in 1999 was expected to become a catalyst for real convergence in Europe. Far from being the case, real divergence increased from the early 1990s as evidenced by low productivity growth in the "periphery" of the Euro area relatively to "core" countries. This divergence was accompanied by massive capital flows from EMU's core - Germany, Netherlands - to its periphery - e.g., Portugal or Spain that left peripheral economies with financial and real estate bubbles (Spain being emblematic of the latter), together with a continuously weakening manufacturing sector, while this sector was strengthening in Germany (Krugman, 2012). Figure 1 provides a striking illustration of the divergence process at work in the EMU since the beginning of the 21st century.[2] It focuses on three countries emblematic of the structural divergences within the EMU[3]: Germany and Spain, for the previously mentioned motives, as well as France, often presented as an "in-between" situation. Between 2000 and 2015, whereas Spanish TFP stagnates, French TFP increases half more slowly than the German one.

Parallel to this real divergence, European countries experienced heterogeneous real estate price dynamics which took the form, in some economies, of massive boom-bust cycles. These housing booms occurred in Spain and France notably, and were parallel to the productivity slowdown or even productivity losses, whereas house prices stagnated in Germany.[4] There is so far little systematic evidence

[1]We would like to thank Sophie Piton for her collaboration on this project when she was economist at the CEPII. We also thank Anne-Laure Delatte and Sébastien Jean for helpful comments.

*CEPII. Email: thomas.grjebine@cepii.fr

†Université de Lille, LEM & CEPII. Email: jerome.hericourt@univ-lille.fr

‡EPEE, Univ Evry, Université Paris-Saclay & CEPII. Email: fabien.tripier@univ-evry.fr

[2]This Figure used EU KLEMS data and measures TFP as a weighted average of sectoral TFP based on a classification with 33 sectors. See the Data Section below for more details.

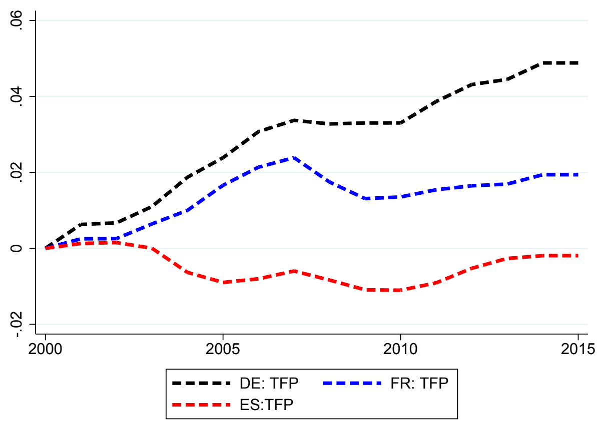
[3]For the sake of results readability, we will keep this focus in the core of the paper. However, key related results for other countries are provided in Appendix 3, and will be commented throughout the paper.

[4]Figure 3.2 in the Appendix compares real estate prices dynamics in Germany, France and Spain. See Section 2.3 for a

on the links between these two dynamics: this paper investigates the effects of housing booms on the dynamics of misallocation between countries and on productivity divergence in Europe.

A recent, though flourishing, literature studies the role of resources misallocations in explaining international differences in productivity, with a clear focus on within-industry reallocation, i.e. on the (in-)efficiency of resources' allocation between firms (see e.g., Restuccia and Rogerson, 2008 for the US, Hsieh and Klenow, 2009 for the US, China and India, and Bartelsman et al., 2013 for a cross-country analysis). Based on an exhaustive firm-level dataset, Garcia-Santana et al. (2018) also argue that the source of bad relative TFP performance in Spain was the increase in the within-industry misallocation of production factors across firms.

Figure 1 – TFP dynamics



Note: Log-Level of TFP using historical share $\log(A_{it})$ "TFP". See Appendix for the construction of series.

However, sectoral reallocations may have been overlooked in previous research, precisely due to this focus of most papers on within-industry reallocation among firms. In addition, these studies focus on the manufacturing sector due to data coverage, and miss an important aspect of these reallocations which is the growing share of services industries. Few papers have already focused on the importance of sectoral reallocations for macroeconomic divergence (Reis, 2013; Benigno and Fornaro, 2014; Piton, 2018). However, these papers most often focus on reallocations from tradable to non-tradable sectors, for which the aggregate effect on productivity is unclear[5] and is very sensitive to the classification of tradable sectors. Dynamics in these two broad sectors might also hide significant reallocations among sub-sectors of the tradable or non-tradable sector –such as the reallocation from manufacturing to business services in the tradable sector. Some recent papers started investigating the links between financial booms and sectoral reallocations. Cecchetti and Kharroubi (2015) and Borio et al. (2015)

discussion of these dynamics.

[5]More details on this are provided in the Data and Stylized facts section.

investigate how credit booms tend to undermine productivity growth by inducing labor reallocations towards lower productivity growth sectors, in particular the construction sector. For example, credit booms in Spain and Ireland coincided with rapid growth of employment in construction at the expense of the more productive manufacturing sector. However, there is so far little systematic evidence on the dynamics of misallocation between countries and the importance of inter-sectoral reallocations in explaining them. Housing shocks could not only lead to reallocations towards the construction sector but change the whole structure of the economy and the relative size of every sector.

In this paper, we investigate how real estate shocks lead to reallocations involving all sectors of the economy, and not only towards construction. We use variations in (real estate) collateral at the country-sector level to identify the impact of real estate shocks on sectoral reallocations. The collateral mechanism is linked to the "financial accelerator" (Bernanke and Gertler, 1989, Kiyotaki and Moore, 1997): with imperfect financial markets, financially constrained sectors (and firms in these sectors) will use their pledgeable assets as a collateral to finance their investment (e.g. Chaney et al., 2012). An increase in the value of the collateral should therefore allow sectors to increase their investment, the more so if the sector has relatively more collateral (which we measure through the amount of real estate capital owned by the sector). Adapting Chaney et al. (2012)'s approach to a country-sector environment, we identify exogenous shocks to domestic real estate prices through a combination of (world) demand shocks and (country-level) supply constraints on the real estate market. This allows us to recover the causal impact of real estate sectoral intensity on investment, share of total value added (as a proxy for sectoral size) and TFP growth at the country-sector level. It is worth mentioning that we are not interested in the dynamics of the real estate sector per se, but in the use of real estate capital in other sectors (excluding the real estate one).[6]

Our results notably show that exogenous real estate prices shocks increase sectoral investment and size: a 10 percentage points (pp) increase of real estate sectoral intensity brings additional 0.8 pp in the ratio of investment to capital stock, and + 6 pp to the ratio of gross value added to capital stock. Conversely, we find no significant impact on sectoral TFP. Put differently, real estate shocks (identified through real estate price variations) may impact aggregate TFP exclusively through a sectoral reallocation mechanism. To quantify the latter, we build a counterfactual TFP at the country level which corresponds to the TFP that would have been observed in the economy if its sectoral composition was entirely determined by real estate prices shocks. Then, this TFP is compared with the TFP that would have been observed if the sectoral composition of the economy had remained

[6] On average, real estate capital represents more than 60% of total capital.

unchanged. Interestingly, we find that these productivity effects of real estate price shocks are not only quantitatively important but also point to a greater divergence between these European countries. Going back to the three countries pointed out previously, these effects strengthen productivity gains in Germany, where they are already more important than in Spain and France, while they generate productivity losses in France and Spain. Finally, we discuss the potential responsibility of some specific sectors in explaining these TFP losses and diverging dynamics, based on various sensitivity tests.

The next section presents the data and some stylized facts on the role of sectoral reallocations in productivity dynamics in Europe. Section 3 details our identification strategy for estimating the impact of sectoral real estate intensity on sector-level investment, size and TFP. Section 4 describes our methodology to assess the role of real estate booms in sectoral reallocations, and discusses related results and tests to identify specific sectors originating TFP divergences. The last section concludes.

2. Data and Stylized Facts

2.1. Data

We present the EU Klems database we use to measure sectoral productivity and real estate assets. The series used to construct the instrumental variable (see section 3.2) are described in the Appendix 1.

EU KLEMS. We use the sector-level growth and productivity data up from the EU KLEMS database (Eurostat, 2017). This database relies on NACE, the "statistical classification of economic activities in the European Community" developed since 1970 in the European Union. More precisely, we use NACE Rev. 2, the new revised version of the NACE Rev. 1, which is based on the fourth revision of the United Nations "International Standard Industrial Classification of All Economic Activities" (ISIC Rev. 4). Concerning the level of aggregation, we use the "intermediate aggregation", one of the two standard aggregations of ISIC/NACE categories defined by national accountants to be used from a wide range of countries.[7] It is composed of 33 categories (see Section 1 in the Appendix for a description of the categories). Our list of countries includes all the European countries from the EU Klems database: Austria, Belgium, Croatia, Cyprus, Czech Republic, Denmark, Germany, Hungary, Estonia, Greece, Spain, Finland, France, Ireland, Italy, Luxembourg, Latvia, Lithuania,the Netherlands, Poland, Portugal, Romania, Slovenia, Slovakia, Sweden, the United Kingdom.

[7] The other classification, known as "high-level aggregation", aggregates the ISIC/NACE sections into 10 or 11 categories.

Real estate assets and Sectoral Data. To measure the value of real estate assets and real estate prices, we use also the EU KLEMS database. Real estate prices are defined as the value of total non-residential investment ("OCon"). Real estate assets ("real estate capital") include "Buildings and structures" and more precisely the following assets: "other buildings and structures" (OCon) and "dwellings" (RStruc). The capital stock is the sum of all available assets (non-financial capital) – for the structure of the asset boundary, see Figure 1.1 in the Appendix. It includes in particular the intangible capital. Our results are inchanged excluding these assets. It is important to notice that land is not included in the capital stock. In our sample, real estate capital represented 55% of total capital in 1995 and 60% in 2015. In 2015, this share accounted for 53% of total capital in Germany, 39% in France and 70% in Spain (see Figure 3.3 in the Appendix for details).

2.2. Measuring the contribution of sectoral reallocations to TFP

The sectoral TFP growth in sector k, country i as of time t is denoted $\Delta \log(A_{kit})$ and constructed as the Solow residual at the sectoral level:

$$\Delta \log(A_{kit}) = \Delta \log(\mathtt{VA}_{kit}) - \mathtt{LS}_{kit} \times \Delta L_{kit} - (1 - \mathtt{LS}_{kit}) \times \Delta K_{kit}$$

where $\mathtt{VA}_{kit} = p_{kit} \times q_{kit}$ is the nominal sectoral value-added, L_{kit} and K_{kit} are the measures of labor input and capital services, respectively, and $\mathtt{LS}_{kit}$ is the sectoral share of labor compensation in value-added.

The country log-level of TFP, denoted $\log(A_{it})$, is constructed using sectoral TFP growth rate, $\Delta \log(A_{kit})$, and sectoral value-added shares, ω^{va}_{kit}, to get the country TFP growth rates which are then cumulated over time as follows

$$\log(A_{i\tau}) = \sum_{t=0}^{\tau} \sum_{k=1}^{K} \omega^{va}_{kit} \Delta \log(A_{kit}) \tag{1}$$

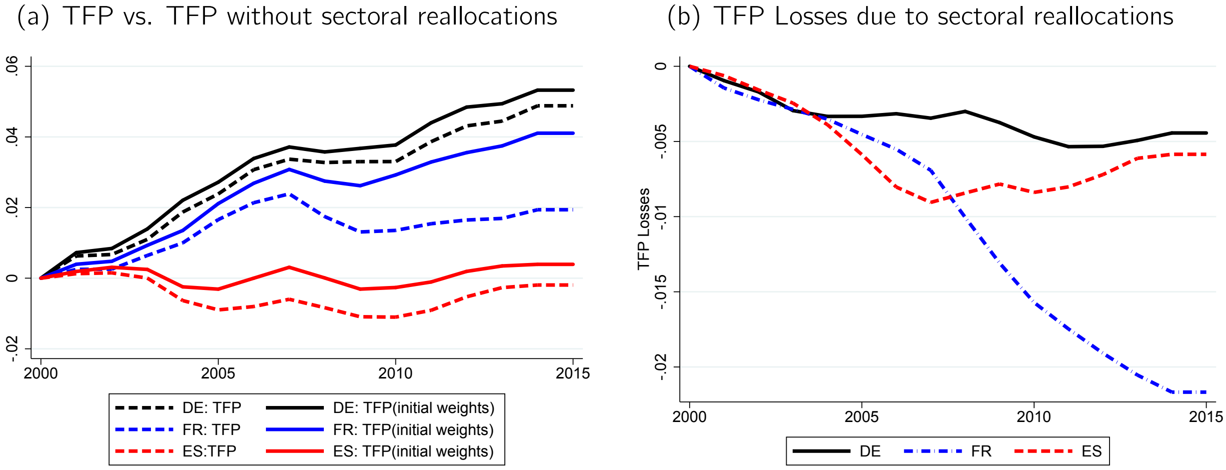
To assess the role of sectoral reallocation, we construct a counterfactual TFP using sectoral TFP growth rate, $\Delta \log(A_{kit})$, and the initial values for the sectoral value-added shares, ω^{va}_{ki0}, as follows

$$\log(\overline{A}_{i\tau}) = \sum_{t=0}^{\tau} \sum_{k=1}^{K} \omega^{va}_{ki0} \Delta \log(A_{kit}) \tag{2}$$

Using these definitions, we can compute the difference between the two log-levels of TFP

$$\log(\overline{A}_{i\tau}) - \log(A_{i\tau}) = \sum_{t=0}^{\tau} \sum_{k=1}^{K} (\omega^{va}_{ki0} - \omega^{va}_{kit}) \Delta \log(A_{kit}) \tag{3}$$

Figure 2 – TFP Gains/Losses due to sectoral reallocations



Note: Log-Level of TFP using historical share $\log(A_{it})$ "TFP" and Log-Level of TFP using initial weights $\log(\overline{A}_{it})$ "TFP(initial weights)" (Left-hand side) and the gap between the two series: $\log(A_{it}) - \log(\overline{A}_{it})$ (Right-hand side). See Appendix for the construction of series.

which measures the effect of sectoral reallocation on TFP. A positive (respectively negative) value means that sectoral reallocations have been at the origin of productivity gains (respectively losses). Note that, since we use the nominal value-added, namely $\texttt{VA} = \texttt{Price} \times \texttt{Quantity}$, as a measure of sectoral size, these composition effects include both quantity and price channels. The price channel is in line with the Baumol et al. (1966)'s cost-disease literature: an increase in the TFP of the manufacturing sector which decreases its relative price would lead to a decrease of its share in the total nominal value-added with a potential negative effect on aggregate TFP. Our composition effects thus encompass both price and quantity channels. For instance, in Spain, the real estate boom led to an increase in both price and quantity of the construction sector leading to a higher share of this sector in total value-added with a negative impact on aggregate TFP given the slow productivity growth in construction.

2.3. Stylized facts: the role of sectoral reallocations in productivity dynamics

Based on the EU KLEMS database for the period 1995-2015, our empirical assessment supports that reallocation between sectors appears as a strong candidate in explaining both the productivity slowdown observed in most EU countries and the divergence between them. This can be seen in Figure 2 for Germany, France and Spain. All three countries would have experienced higher levels of TFP if their economy had kept the same sectoral structure than in 2000, as suggested by plain lines (all systematically above their dotted counterparts), reporting a counterfactual aggregate TFP, based on a weighted sum of sectoral TFP, for which the share in value added for each sector has been set to its 2000 level.[8] In France, the TFP level would have been twice higher without sectoral reallocations. In Spain, the TFP dynamics would not have been negative without these reallocations. The right panel shows for each of the three considered countries the difference between the plain and the dotted lines, revealing the extent of the divergences in TFP dynamics fueled by sectoral reallocations: whereas losses have been limited in Germany, they have been significant in Spain until a reversal appears in 2008, while they keep increasing in France. Figure 3.4 (left panel (a)) in the Appendix reports TFP losses due to sectoral reallocations for all our sample of European countries but Czech Republic. TFP losses due to sectoral reallocations are the biggest in France (we discuss in Section 4.2 the potential part of some sectors in explaining this phenomenon), followed closely by Denmark, Finland and Portugal. Losses are also substantial in the UK, Italy and Austria.

When comparing the dynamics of real estate prices with those of TFP reported in Figure 2, it is striking to see that periods of booming real estate prices coincide with sectoral reallocations detrimental to TFP – Figure 3.2 in the Appendix reports real estate prices for Germany, France and Spain on the left panel, and relatively to Germany for France and Spain on the right panel, between 2000 and 2015. Conversely, when real estate prices stagnate or even decrease, TFP losses due to sectoral reallocation stop deepening, or even revert –this is the case for Spain, starting in 2008-2009. Germany and France appear as two polar cases: the first experienced the most recent and limited increase in real estate prices, together with the smallest negative between-sectors reallocation; for the second, real estate prices have been continuously rising since 2000, before starting into a modest decline in 2012, and the detrimental impact on TFP from sectoral reallocations is the largest of the three countries.

3. Empirical strategy and results

3.1. Baseline Specification

Our main objective is to identify how the value of of real estate assets, driven by real estate shocks, affect Investment, TFP and Gross value Added (GVA, as a proxy for size) at the country-sector level.

[8]If reproducing Figure 2 with a two sector decomposition, we find no differences in the evolution of TFP including or excluding sector reallocations - see Figure 3.1 in the Appendix. This highlights the importance to move to a more disaggregated sectoral decomposition to identify between-sectors reallocations.

In general, we want to estimate a specification of the following form:

$$Z_{kit} = c + \beta_z \frac{K^h_{ki0} P^h_{it}}{K_{kit-1}} + \gamma P^h_{it} + \mu_{ik} + \lambda_{kt} + \varepsilon_{kit} \quad (4)$$

Where $Z_{kit} = \{I_{kit}/K_{kit-1}, VA_{kit}/K_{kit-1}, \Delta \log(A_{kit})\}$ is, alternatively, the ratio of total investment to lagged Property Plant and Equipment (PPE), the ratio of Gross Value Added to lagged PPE, and the growth rate of TFP for country i and sector k during year t. $K^h_{ki0} P^h_{it}/K_{kit-1}$ is the sectoral intensity in housing capital, defined as the ratio between the value of the real estate assets at the beginning of the period (as a first mean to tackle endogeneity issues) divided by the lagged PPE. The part of the collateral channel is identified through the variation in country housing prices, P^h_{it}. μ_{ik} denotes country-sector-specific unobserved characteristics, and λ_{kt} represents sector×year dummies. The latter capture in particular industry-specific business cycle conditions and sectoral price dynamics. Consequently, Equation (4) is merely a country-sector adaptation of the reduced-form equation proposed by Chaney et al. (2012), with similar interpretation: with imperfect financial markets, financially constrained firms will use their pledgable asset as collateral to finance their investment. In addition to assess how exactly this effect translates at the sectoral level, we investigate how this collateral constraint distorts relative size and TFP at the sectoral level. More specifically, we are interested in changes in the value of the real estate assets driven by exogenous variations in real estate prices. Our coefficient of interest is β_z : we expect $\beta_z > 0$ when $Z_{kit} = \{Inv_{kit}, GVA_{kit}\}$, the relaxation of financial constraints supporting investment and production in the considered sector, and are agnostic when $Z_{kit} = \{\Delta \log(A_{kit})\}$.

More importantly, β_z will be used to infer the share of Z_{kit} dynamics driven by real estate shocks. Put differently, we will deliver a prediction $\widehat{Z}_{kit}$ as follows:

$$\widehat{Z}_{kit} = \widehat{\beta}_z \frac{K^h_{ki0} P^h_{it}}{K_{kit-1}} \quad (5)$$

This prediction will be afterwards key for the TFP decomposition exercise implemented in the next section, where we will provide an assessment of the extent of sectoral reallocations driven by the collateral mechanism. However, Z_{kit} and the sectoral intensity in housing capital $K^h_{ki0} P^h_{it}/K_{kit-1}$ are theoretically driven by a variety of demand and supply shocks, specific to the sector, the country, or both. This implies that the OLS estimates for β_z may be heavily biased, as it is affected by a multitude of factors, not necessarily related to the real estate dynamics. First, both variables are likely to be simultaneously determined by common shocks, such as those driven by the business cycle, pushing β_z upwards. We reduce the bias by controlling for time-varying sectoral shocks, as well as country-sector unobserved characteristics. Another obvious issue relates to reverse causality: investment dynamics in sufficiently large sectors may trigger a real estate price appreciation, due to higher demand for labor and other inputs. Here again, the bias should be positive.

3.2. Identification Strategy

To identify how variations in the sectoral intensity in housing capital driven by exogenous real estate price shocks affect Z_{kit}, we need an instrument that affect real estate prices without influencing directly investment, GVA or TFP (exclusion restriction), and that is orthogonal to any country or country-sector-specific characteristics which may drive simultaneously both left- and right-hand side variables. Therefore, we propose to rely on a measure of the world (i.e., common to all countries in our sample) real estate price cycle, proxying for (real estate) demand shocks, combined with country-level indicators of housing supply constraints. Put differently, we build instrumental variables measuring how regulatory constraints affect the sensitivity of real estate prices to changes in demand.[9] This should allow having sufficient country-time variability, delivering a strong predictor of local real estate prices. Concerning the real estate price world cycle, we choose to rely on the US commercial real estate price index, consistently with a recent literature pointing out the US as the originator of the global financial cycle (e.g. Rey, 2015). Note that the country-sector and more specifically, sector-year dummies included in our baseline specification (4) are crucial to ensure the plausibility of our exclusion restrictions, since they control for most of the demand-driven shocks simultaneously correlated with US real estate price and domestic demand (business cycle) conditions.[10]

As for country-level constraints making housing supply inelastic, the literature typically distinguishes between regulatory and physical supply constraints (see e.g. Hilber and Vermeulen, 2016). In order to get the highest possible variability at the country level, we build a composite indicator of housing supply constraint which mainly relies on a combination between rent regulation indicators, measures on the ease of dealing with construction permits, and decentralization indexes as the literature has documented that more decentralized countries are generally characterized by more dispersed residential development, more urban sprawl, and lower house price growth. The exact construction of the composite indicator of housing supply constraint is described in Appendix 1.

[9] This approach is similar to the one implemented by Chaney et al. (2012), who use an indicator of local housing supply elasticity on the US case.

[10] Table D.3 in the Appendix reports results of an even more demanding specification including, together with the already presented sets of fixed effects, country-year dummies, controlling for country-level business cycle dynamics. Results are almost identical to our benchmark reported in Table 1, preferred to preserve degrees of freedom.

Therefore, our instrumental variable is built by interacting US real estate prices with a local supply constraint. Our main econometric strategy estimates the effect of exogenous changes in the housing capital intensity (through variations in our synthetic indicator of - world - demand and- country-level - supply shocks on real estate prices) on the ratio of investment and GVA to lagged PPE, and on the growth rate of TFP. Formally, the first-stage regressions are as follows:

$$P_{it}^{h} = a_1 + \delta_1 SC_i \times P_t^h + \gamma_1 \frac{K_{ik0}^{h}}{K_{ikt-1}} SC_i \times P_t^h + \mu_{ik;1} + \lambda_{kt;1} + \epsilon_{ikt;1} \quad (6)$$

and

$$\frac{K_{ik0}^{h} P_{it}^{h}}{K_{ikt-1}} = a_2 + \delta_2 SC_i \times P_t^h + \gamma_2 \frac{K_{ik0}^{h}}{K_{ikt-1}} SC_i \times P_t^h + \mu_{ik;2} + \lambda_{kt;2} + \epsilon_{ikt;2} \quad (7)$$

Where $SC_i \times P_t^h$ represents our IV, product of our synthetic index of country-level supply constraints SC_i and of the US commercial real estate price index P_t^h.

Then, the second stage equation is estimated as:

$$Z_{ikt} = c + \beta_z \widetilde{\frac{K_{ik0}^{h} P_{it}^{h}}{K_{ikt-1}}} + \gamma \widetilde{P}_{it}^{h} + \mu_{ik} + \lambda_{kt} + \varepsilon_{ikt} \quad (8)$$

where $\widetilde{P}_{it}^{h}$ and $\widetilde{\frac{K_{ik0}^{h} P_{it}^{h}}{K_{ikt-1}}}$ are the predicted values for, respectively, the country-level housing price index produced by Equation (6) and the sectoral housing intensity produced by Equation (7). We expect a positive impact from $SC_i \times P_t^h$ on both variables. All other things equal, a positive worldwide demand shock for housing (as captured by US commercial real estate prices) is expected to push domestic real estate prices up. Symmetrically, for a given level of US housing prices, domestic real estate prices will display an all the more positive reaction that domestic supply is inelastic because of various above mentioned supply constraints. This is what confirms Table D.1 in the Appendix which describes the First Stage of the IV approach: sectoral housing intensity increases with a positive variation of our preferred IV (column (2)), or alternative combinations restricting supply constraints to a smaller number of indicators (column (1)) or conversely, including new ones, such as the concentration of employment (column (3)). Not only our results are robust using various indicators for the supply constraint index but also for the real estate world demand shock measures. Table D.2 in the Appendix shows in particular that our results are robust using a world real estate price index for the worldwide real estate demand shock instead of the US commercial real estate prices.

Table 1 – IV

	(1) Inv. OLS	(2) Inv. IV	(3) GVA OLS	(4) GVA IV	(5) TFP OLS	(6) TFP IV
RE Value	0.0781***	0.0806***	0.5724***	0.5951***	0.0000	-0.0002
	(0.0021)	(0.0010)	(0.0186)	(0.0139)	(0.0001)	(0.0001)
RE Prices	0.0162	-0.2534**	0.9317***	-1.3667**	0.0001	-0.0002
	(0.0213)	(0.1008)	(0.2162)	(0.5467)	(0.0002)	(0.0010)
Observations	8,175	6,279	8,137	6,268	4,056	3,648
Kleibergen-Paap F-Stat		19.59		20.16		14.47

Note: Robust standard errors, clustered by country-year, in parentheses. All estimations include country-sector fixed effects and sector-year dummies. The critical value for the weak instruments test is based on a 10% 2SLS bias at the 5% significance level, which is 7.03. IV is built by interacting US real estate prices with a local supply constraint index.

3.3. Estimation results

Table 1 reports estimates of our main specification, where the dependent variable is alternatively the ratio of total investment to lagged PPE (columns (1) and (2)), the ratio of gross value-added to lagged PPE (columns (3) and (4)), and the growth rate of TFP (columns (5) and (6)). For each pair of columns, we report a simple OLS estimation of equation (4) (columns (1), (3) and (5)), jointly with the result of a 2SLS estimate based on the procedure and IV described above (columns (2), (4) and (6)). For the latter, we also report the F-stat form of the Kleibergen-Paap statistic (at the bottom of each relevant column), the heteroskedastic and clustering robust version of the Cragg-Donald statistic suggested by Stock and Yogo (2005) as a test for weak instruments. All statistics are comfortably above the critical value, confirming that our instrument is a strong predictor of domestic housing prices.

First of all, it is worth noting that OLS and IV estimates are actually very close, emphasizing that the bias arising from various endogeneity concerns is actually limited, at least on our sample. Interestingly, this is also the case in Chaney et al. (2012), who also find, based on a dataset of US listed firms, estimates of the β coefficient for Investment very close to ours (between 0.06 and 0.07, vs. 0.08 for us). This is comforting in the sense that it tends to support that moving from (large)-firm- to sector-level does not generate major aggregation biases.[11] More generally, estimates reported in Table

[11] It is also consistent with a flourishing literature devoted to granularity, showing that most of aggregate dynamics are

1 highlight that variations in domestic real estate prices driven by exogenous shocks (as measured by our synthetic indicator of world demand and country-level supply constraints) do bring an increase in the investment and size (as proxided by gross value added), but not in the dynamics of TFP.

4. On the impact of real estate shocks on aggregate TFP dynamics

4.1. Predictions

This section investigates the implications of our regression results for the dynamics of aggregate TFP at the country level. Results described in the previous section support that real estate shocks have no significant impact on the TFP at the sectoral level, but affect aggregate productivity by reallocating resources across sectors. Put differently, all variations in aggregate TFP driven by real estate shocks come from composition effects, i.e. from the reallocation of value-added between sectors.

To quantify the between-sectors reallocation of value-added, we build a counterfactual TFP at the country level which corresponds to the TFP that would have been observed in the economy if its sectoral composition was entirely determined by exogenous real estate prices shocks. We previously compared the TFP log-level series using historical value-added shares, namely ω^{va}_{kit}, or the initial value-added shares, namely ω^{va}_{ki0}, to gauge the importance of the sectoral reallocation in aggregate TFP dynamics – see Figure 2. Similarly, we compare here the TFP log-level series using initial value-added shares, that is still ω^{va}_{ki0}, and using value-added shares predicted by real estate shocks, denoted $\widehat{\omega}^{va}_{kit}$. The gap between ω^{va}_{ki0} and $\widehat{\omega}^{va}_{kit}$ measures the sectoral reallocation of value-added shares between sectors that can be attributed to real estate shocks. Because sectors differ in terms of productivity dynamics, the aggregate TFP at the country level will be impacted by sectoral reallocation driven by real estate shocks even if the productivity dynamics within sectors is unchanged.

The construction of the predicted value-added shares $\widehat{\omega}^{va}_{kit}$ is explained in details in Appendix 2. The key point is these predicted value-added shares are computed using predictions of our regressions (5) to get

$$\widehat{Z}_{kit} = \widehat{\beta}_z \frac{\widetilde{K^h_{ki0} P^h_{it}}}{K_{kit-1}} \tag{9}$$

where $\widehat{Z}_{kit}$ is the predicted value of variable Z by real estate shocks derived from the IV estimation. We first use equation (9) for physical capital growth to generate series of predicted physical capital by sectors, denoted $\widehat{K_{kit}}$. These series are then multiplied with ratio of value-added to capital predicted

shaped by big players at the micro level (see, among many others, Gabaix, 2011 or Carvalho and Grassi, 2019).

by equation (9) to get series of sectoral value-added predicted by exogenous real estate prices, denoted $\widehat{VA}_{kit}$. Then, predicted value-added shares are directly deduced as follows

$$\widehat{\omega}_{kit}^{va} = \frac{\widehat{VA}_{kit}}{\sum_k \widehat{VA}_{kit}} \tag{10}$$

and the counterfactual aggregate TFP log-level computed as follows

$$\log\left(\widehat{A}_{i\tau}\right) = \sum_{t=0}^{\tau}\sum_{k=1}^{K}\widehat{\omega}_{kit}^{va}\Delta\log\left(A_{kit}\right) \tag{11}$$

Figure 3 shows that sectoral reallocations driven by exogenous real estate price shocks generate sizable TFP gains or losses. Indeed, gaps betweeen TFP using initial versus predicted sectoral shares are quantitatively important. For Germany, TFP gains would have been three times higher if the sectoral composition of this economy had been entirely determined by real estate shocks. France would have experienced TFP losses in amounts equivalent to the gains actually observed over the period if one considers the sectoral composition implied by real estate shocks. In Spain, these shocks have been at the origin of TFP losses while TFP would have remained stable if sectoral shares had remain at their initial values.

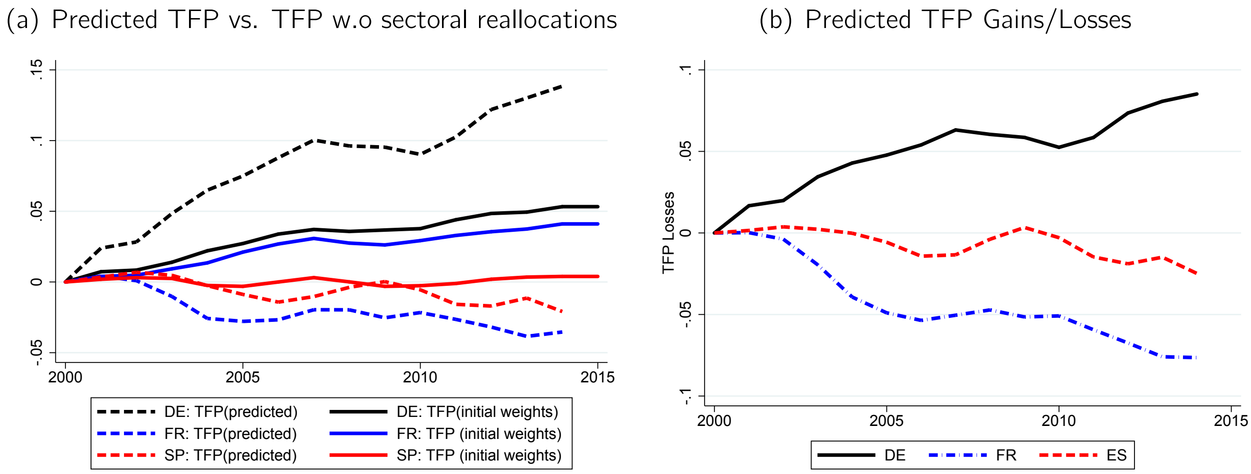
Interestingly, these productivity effects of real estate shocks are not only quantitatively important but also point to a greater divergence between these European countries. Indeed, these effects strengthen productivity gains in Germany, where they are already more important than in Spain and France, while they generate productivity losses in France and Spain. More generally, Figure 3.4 (panel (b) on the right) shows a striking heterogeneity in the effects of the collateral mechanism between the various EU countries of our sample.[12] On the one hand, a group of countries where real estate shocks generate TFP losses, including countries where real estate booms started early and were substantial (such as Ireland, UK, France or Spain). On the other hand, another group of countries for which our mechanism generates TFP gains, including Germany, Austria or Italy, i.e. countries where real estate prices grew later or at a slower path.

4.2. Discussion

Are there any specific sectors playing a key role for reallocations and the resulting effect on aggregate TFP? For example, it has been argued that the construction sector would be detrimental to growth

[12]It is important to stress that this divergence is the outcome of external shocks which are common to all countries considered and that the elasticity of sectoral size to these shocks is also identical for all countries.

Figure 3 – TFP Gains/Losses due to sectoral reallocations driven by real estate shocks

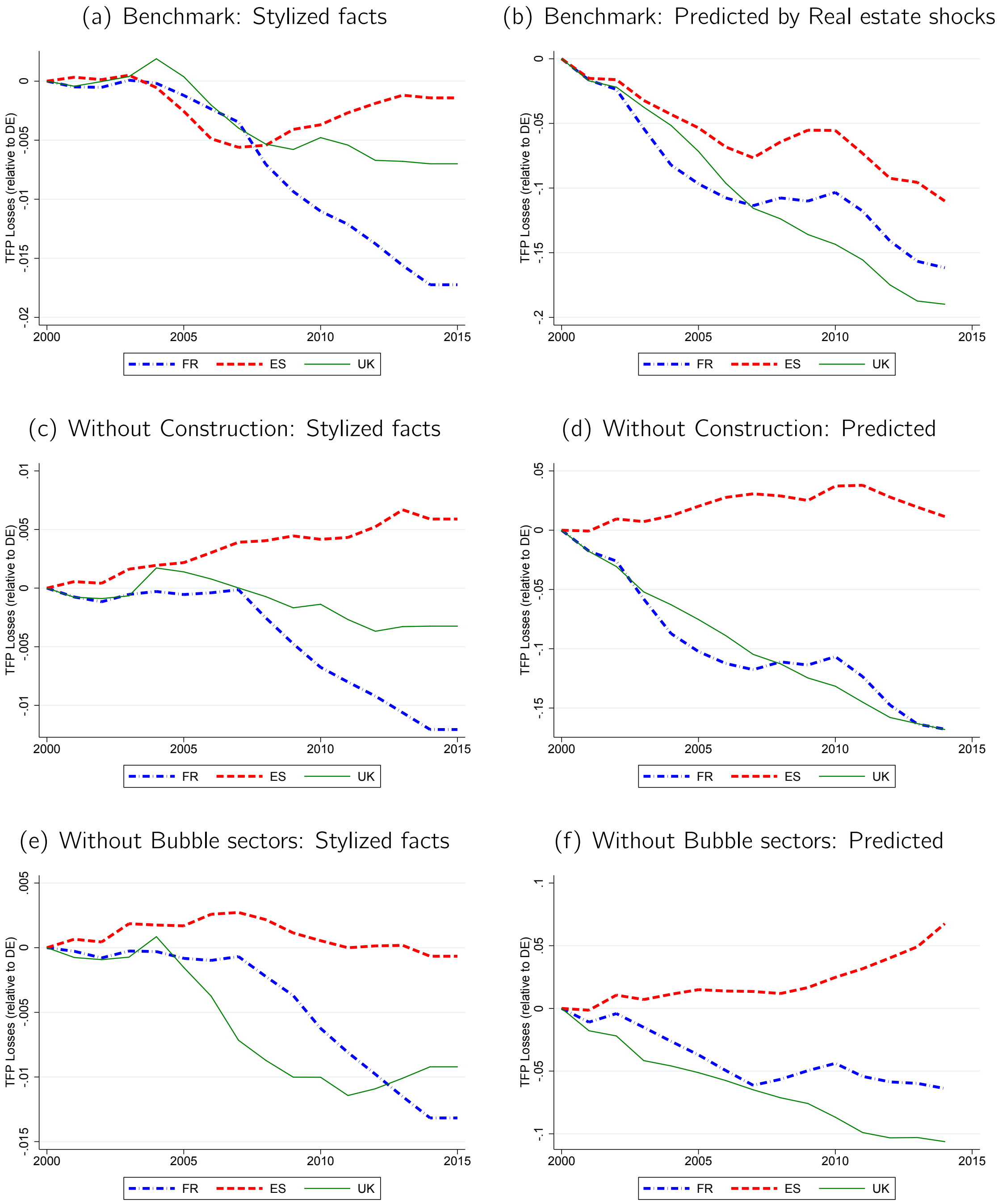


Note: Log-Level of TFP using predicted share $\log\left(\widehat{A}_{it}\right)$ "TFP(predicted)" and Log-Level of TFP using initial weights $\log\left(\overline{A}_{it}\right)$ "TFP(initial weights)" (Left-hand side) and the gap between the two series: $\log\left(\widehat{A}_{it}\right) - \log\left(\overline{A}_{it}\right)$ (Right-hand side)."Predicted" refers to predicted by real estate shocks. See the Appendix for details.

in particular in Spain or France. According to Borio et al. (2015), "the credit booms in Spain in the decade to 2007 coincided with the rapid growth of employment in construction and real estate services at the expense of the more productive manufacturing sector." We can test this assertion with our empirical framework. We measure TFP losses due to sectoral reallocations excluding specific sectors. For comparison purposes, we construct our series in relative terms with respect to Germany and we add in Figure 4 the United Kingdom for comparison with France and Spain, three countries well-known for their housing boom in the years 2000 (more details on the UK productivity puzzle are given in Appendix 5). Construction is excluded from the list of sectors to measure the role played by construction in sectoral reallocations. Figures 4(c) and 4(d) show that in this case, sectoral reallocations have affected TFP dynamics positively in Spain, meaning that the construction sector is the main driver of TFP losses in Spain over the period. However, this is not the case in France or in the United Kingdom.

Concerning France, a specific sector responsible for sectoral productivity losses cannot be specifically pointed out. In particular, "Bubble sectors" are excluded (that is, construction, finance, and natural resource) or "IT-producing industries" following the classification proposed by Cette et al. (2016). Excluding "Bubble sectors" does not reduce significantly TFP losses when looking at stylized facts (Figure 4(e)) but divides almost by 3 the predicted TFP losses relative to Germany (Figure 4(f)). These sectors played negatively in TFP dynamics in France but structural TFP losses cannot be reduced to them. Excluding "IT-producing industries" worsen predicted TFP losses, but cannot explain *per se* the negative pattern observed in France. To our knowledge, no study investigates the role of sectoral reallocations in TFP dynamics in France. The literature focuses on the microeconomic drivers of productivity growth and dispersion within industries, and ignores the role of any sectoral compositional effect (e.g. Fontagné and Santoni, 2015). However, several papers study productivity dynamics focusing not only on the manufacturing sector but on various sectors of the economy. Cette et al. (2017) argue that productivity in France saw a downward trend before the financial crisis, which was widespread over the sectors. This argument was also developed by Askenazy and Erhel (2015) who underlie that the productivity slowdown cannot be attributed to particular market industries as an overwhelming majority of sectors were affected. However, OECD (2019) points out that "while labor productivity has grown in the average manufacturing industry, it has stagnated in market service industries, with a consequent negative effect on the aggregate performance, given the important and increasing weight of this sector in GDP".

Figure 4 – TFP Gains/Losses due to sectoral reallocations without Construction and without Bubble sectors



Note: We measure TFP Gains/Losses due to sectoral reallocations. For comparison purposes, we construct our series in relative terms with respect to Germany. "Predicted" refers to predicted by real estate shocks.

5. Conclusion

In this paper, we have shown that sectoral reallocations were at the origin of productivity losses in many European countries, in particular in the "periphery" of the EMU, and contributed significantly to real divergence in Europe. This is important since sectoral reallocations may have been overlooked in previous research, most articles focusing on within-industry reallocations. Then, we have investigated how the substantially diverging real estate prices could explain those sectoral reallocations. Real estate shocks turn out to be a strong driver of productivity divergence, causing for instance the lag of Spain behind Germany before the Great Recession and that of France afterwards. We have shown in particular that real estate shocks did not only lead to reallocations towards the construction sector but changed the relative size of every sector, and consequently the whole structure of economies.

Besides, it is important to notice that our approach is informative on the effects of sectoral reallocations on productivity dynamics beyond real estate shocks. If our empirical framework allows drawing inferences about the effects of real estate fluctuations, we remain relatively agnostic about fundamental shocks that drive real estate prices. Diverging financial or housing cycles – in particular between France and Spain on the one hand and Germany on the other hand – could be due to diverging demand shocks at the national level – for instance diverging fiscal policies could both drive house prices and investment dynamics (Geerolf and Grjebine, 2018), leading to diverging productivity patterns.[13] From a policy perspective, institutions that want to promote the convergence of productivity in Europe should thus not only focus on supply-side policies but should also take into account the effects of diverging national demand shocks on the European productivity divergence.

[13]This would be the case for instance if tax measures affect differently investment in the various sectors of the economy leading to sectoral reallocations, that affect country-level productivity dynamics.

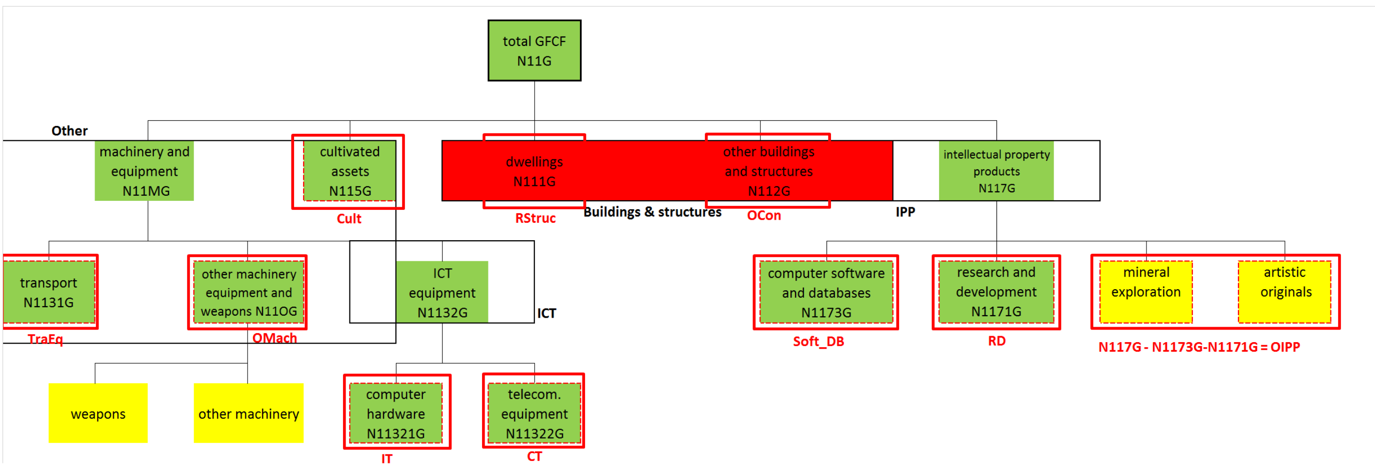
Appendix

Appendix

1. Data

EU KLEMS. We use the sector-level growth and productivity data up from the EU KLEMS database (Eurostat, 2017). This database relies on NACE, the "statistical classification of economic activities in the European Community" developed since 1970 in the European Union. More precisely, we use NACE Rev. 2, the new revised version of the NACE Rev. 1, which is based on the fourth revision of the United Nations "International Standard Industrial Classification of All Economic Activities" (ISIC Rev. 4). Concerning the level of aggregation, we use the "intermediate aggregation", one of the two standard aggregations of ISIC/NACE categories defined by national accountants to be used from a wide range of countries.[14] It is composed of 33 categories (see Table 1.1 for a description of the categories). Because of data limitations, we exclude "U" ("Activities of extra-territorial organisations and bodies") and "T" ("Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use") as Eurostat, 2017 asserts that "All of U and part of T (division 98) are outside the SNA production boundary, and will be empty for SNA data reporting, but are included for completeness". We also exclude real estate activities ("L") as this category mostly includes imputed rents of owner-occupied dwellings (Eurostat (2017)).

Figure 1.1 – Assets



Construction of the composite indicator of housing supply constraints. In order to get the highest possible variability at the country level, we build a composite indicator of housing supply

[14] The other classification, known as "high-level aggregation", aggregates the ISIC/NACE sections into 10 or 11 categories.

Table 1.1 – Classification of Sectors

NACE Rev. 2	Description
"A"	Agriculture, forestry and fishing
"B"	Mining and quarrying
"10-12"	Manufacture of food products, beverages and tobacco products
"13-15"	Manufacture of textiles, apparel, leather and related products
"16-18"	Manufacture of wood and paper products, and printing
"19"	Manufacture of coke, and refined petroleum products
"20-21"	Manufacture of chemicals, chemical products, pharmaceuticals, medicinal chemical and botanical products
"22-23"	Manufacture of rubber and plastics products, and other non-metallic mineral products
"24-25"	Manufacture of basic metals and fabricated metal products, except machinery and equipment
"26-27"	Manufacture of computer, electronic and optical products, electrical equipment
"28"	Manufacture of machinery and equipment n.e.c.
"29-30"	Manufacture of transport equipment
"31-33"	Other manufacturing, and repair and installation of machinery and equipment
"D-E"	Electricity, gas, steam and air-conditioning supply, Water supply, sewerage, waste management and remediation
"F"	Construction
"45"	Wholesale and retail trade and repair of motor vehicles and motorcycles
"46"	Wholesale trade, except of motor vehicles and motorcycles
"47"	Retail trade, except of motor vehicles and motorcycles
"49-52"	Transport and storage
"53"	Postal and courier activities
"I"	Accommodation and food service activities
"58-60"	Publishing, audiovisual and broadcasting activities
"61"	Telecommunications
"62-63"	IT and other information services
"K"	Financial and insurance activities
"L"	Real estate activities
"M-N"	Legal, accounting, management, architecture, engineering, technical testing and analysis activities, Scientific research and development, Other professional, scientific and technical activities, Administrative and support service activities
"O"	Public administration and defence, compulsory social security
"P"	Education
"Q"	Human health services, Residential care and social work activities
"R"	Arts, entertainment and recreation
"S"	Other services
"T"	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use
"U"	Activities of extra-territorial organisations and bodies

constraint which mainly relies on a combination between a rent regulation indicator, the number of days required to obtain a construction permit, and a decentralization index. As in Johansson (2011), the rent regulation indicator is a composite indicator which measures the extent of tenant-landlord regulation within a tenancy. It includes the ease of evicting a tenant, degree of tenure security and deposit requirements. The scale of this indicator is 0-6 (increasing in protection for tenants). For example, rent regulation is strict in Sweden with an indicator of 4.33 or in Germany (4.17), while rent control is lax in the United Kingdom or in Ireland with a composite indicator of 1.17. Besides, our composite indicator of supply constraints includes various measures on the ease of dealing with construction permits. The objective is to track the procedures, time and cost to build a warehouse - including obtaining the necessary licenses and permits, submitting all required notifications, requesting and receiving all necessary inspections and obtaining utility connections. Finally, the literature also documented that more decentralized countries are generally characterized by more dispersed residential development, more urban sprawl, and lower house price growth. We use as a decentralization indicator, the regional autonomy index as measured by Ehrlich et al. (2017). This country-level indicator aggregates decentralization measures computed for sub-national tiers. There are 10 categorical measures entering this index, with low values corresponding to heavily centralized institutional settings and high values to heavily decentralized ones. This index is available for 81 countries from 1950 to 2010.[15]

[15] We use a decentralization indicator instead of an urban sprawl index to limit endogeneity concerns. Housing booms and in particular house price growth tend to encourage urban sprawl as a way to reduce supply constraints. On the contrary, it is more difficult to argue that decentralization policies are linked to housing booms or housing policies. The choice of this decentralization indicator thus limits endogeneity concerns (Davidoff et al., 2016).

2. Sectoral shares predicted by real estate shocks

We are interested in the sectoral shares of value-added induced by real estate shocks, which are defined as the aggregate growth rate of TFP

$$\widehat{\omega}_{kit}^{va} = \frac{\widehat{VA}_{kit}}{\sum_k \widehat{VA}_{kit}} \tag{B-1}$$

where $\widehat{VA}_{kit}$ are the predicted values for value-added. To get these values, we combine predictions for the value-added to capital ratio and the capital stock, as follows

$$\widehat{VA}_{kit} = \left(\widehat{\frac{VA_{kit}}{K_{kit-1}}}\right) \times \widehat{K}_{kit-1} \tag{B-2}$$

For the capital stock $\widehat{K}_{kit}$, we use the predictions for capital growth

$$\widehat{G}_{kit}^{k} = \widehat{\frac{K_{kit}}{K_{kit-1}}} \tag{B-3}$$

to get

$$\widehat{K}_{kit+1} = K_{ki0} \times \Pi_{\tau=1}^{t} \widehat{G}_{ki\tau}^{k} \tag{B-4}$$

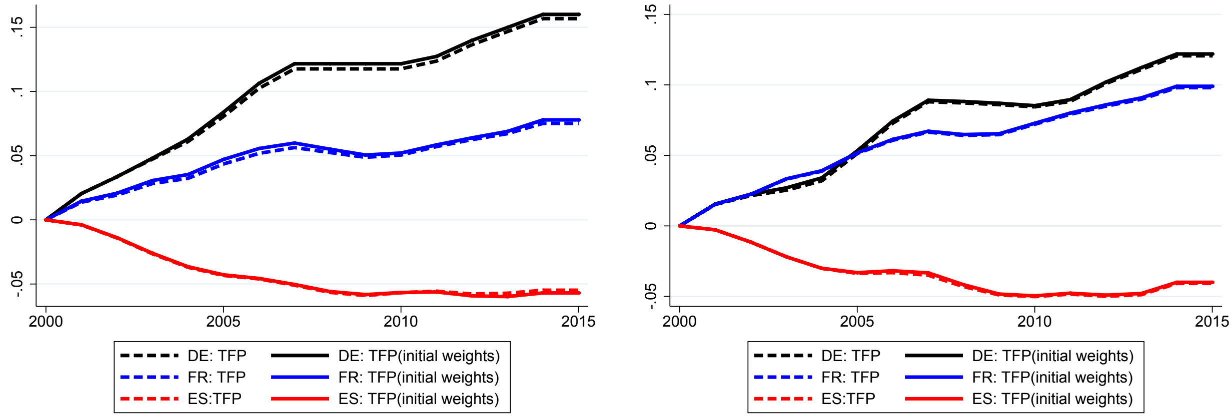
With $\widehat{G_{ki0}} = 1$, and using $\widehat{g}_{kit} = \log\left(\widehat{G}_{kit}\right)$, it becomes

$$\begin{aligned} \widehat{K}_{kit+1} &= K_{ki0} \times \Pi_{\tau=0}^{t+1} \exp\left(\widehat{g}_{kit}\right) && \text{(B-5)} \\ &= K_{ki0} \times \exp\left(\sum_{\tau=0}^{t+1} \widehat{g}_{kit}\right) && \text{(B-6)} \end{aligned}$$

3. Figures

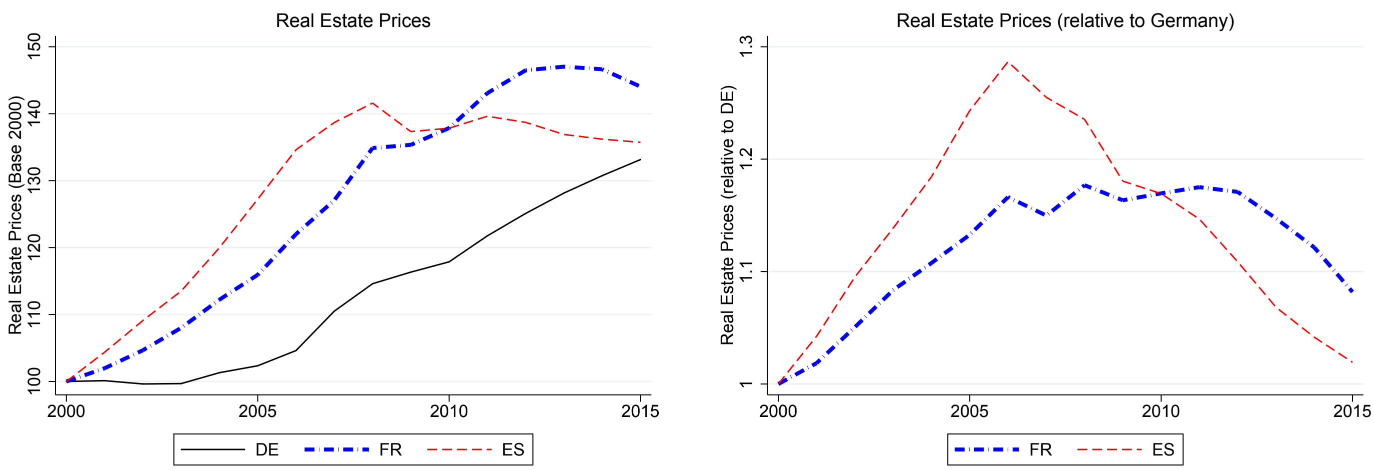
Figure 3.1 – Decomposition into Goods and Services (Left) and Tradable and Non-Tradable Sectors (Right)

(a) Decomposition into Goods and Services (b) Tradable and Non-Tradable Sectors



Note: Log-Level of TFP using historical share $\log(A_{it})$ "TFP" and Log-Level of TFP using initial weights $\log(\overline{A}_{it})$ "TFP(initial weights)". Figure (a) uses a decomposition into Goods and Services and Figure (b) between tradable and non-tradable sectors.

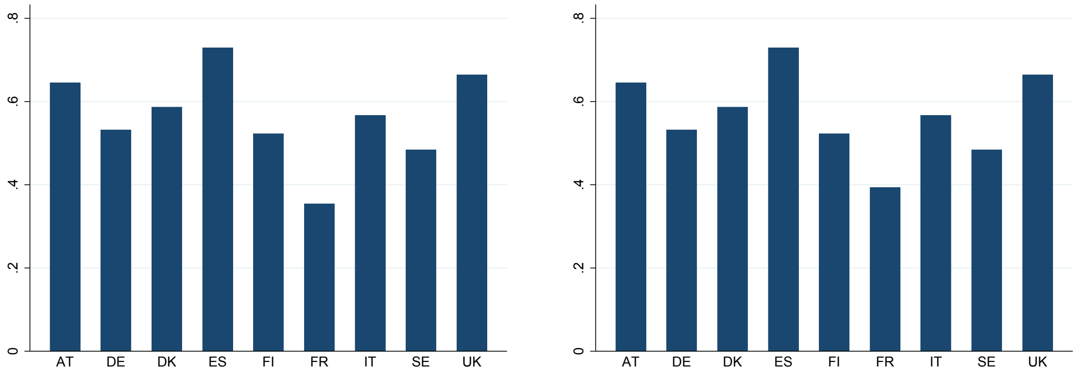
Figure 3.2 – Real Estate Prices



Note: Source: EU KLEMS. Base 100 = 2000.

Figure 3.3 – Real Estate: a large share of total capital

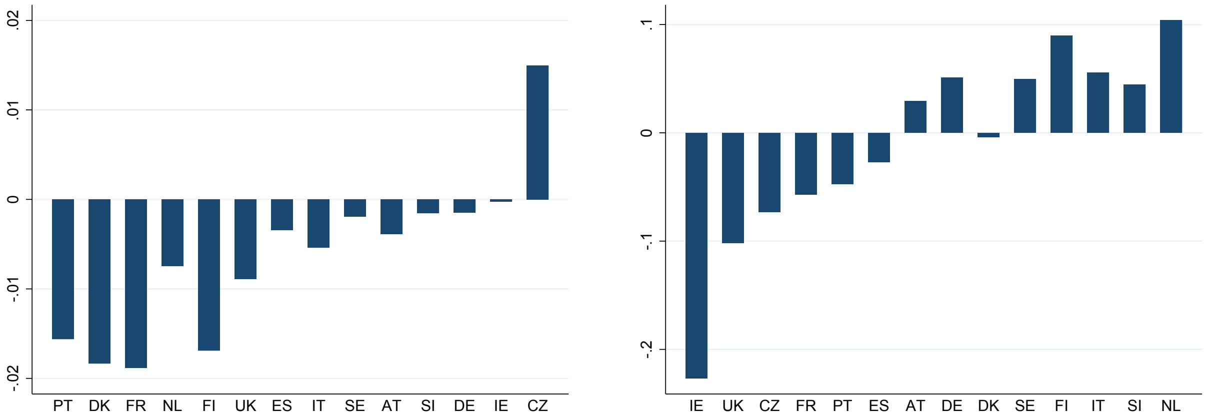
(a) Share of Real Estate capital in 1995 (b) Share of Real Estate capital in 2015



Note: "Buildings and structures" include the following assets: "other buildings and structures" (OCon) and "dwellings" (RStruc). See Section 2.1 for the construction of the variables.

Figure 3.4 – TFP Gains/Losses due to sectoral reallocations: All countries

(a) TFP losses due to sectoral reallocations (b) Predicted TFP losses



Note: We measure TFP Gains/Losses due to sectoral reallocations. These are the cumulated losses in 2015 relative to the initial year. Figure (a) shows the gap between the two following series: $\log(A_{i2015}) - \log(\overline{A}_{it})$ as described in Section 2.3. Figure (b) shows the gap between the two following series: $\log\left(\widehat{A}_{i2015}\right) - \log(\overline{A}_{it})$ as described in Section 4.1. "Predicted" refers to predicted by real estate shocks.

4. Tables

Table D.1 – First Stage Regressions

	(1)	(2)	(3)	(4)	(5)	(6)
	RE Prices	RE prices	RE prices	Inv.	Inv.	Inv.
	1st. Stage	1st. Stage	1st. Stage	IV1	IV2	IV3
IV1	0.0750***					
	(0.0176)					
RE Value*IV1	0.0042*					
	(0.0023)					
IV2		0.0003***				
		(0.0001)				
RE Value*IV2		0.0000				
		(0.0000)				
IV3			0.00006***			
			(0.00001)			
RE Value*IV3			0.00001*			
			(0.00000)			
RE Value				0.0802***	0.0806***	0.0806***
				(0.0012)	(0.0010)	(0.0010)
RE Prices				-0.2401**	-0.2534**	-0.2472**
				(0.1204)	(0.1008)	(0.1091)
Observations	6,284	6,284	6,284	6,279	6,279	6,279
Kleibergen-Papp F-Stat				10.48	19.59	15.79

Note: Robust standard errors, clustered by country-year, in parentheses. All estimations include country-sector fixed effects and sector-year dummies. The critical value for the weak instruments test is based on a 10% 2SLS bias at the 5% significance level, which is 7.03. All IV are built by interacting US real estate prices with a local supply constraint. Various measures are used for measuring the local supply constraint. "IV1": rent regulation/decentralization index. "IV2": rent regulation×days construction permits/ decentralization index. "IV3": rent regulation×days construction permits×number procedures×building quality×concentration of employment/decentralization index)

Table D.2 – IV with a World Real Estate Price Index

	(1)	(2)	(3)	(4)
	RE Prices	Inv.	GVA	TFP
	1st. Stage	IV	IV	IV
IV: World Prices*Local supply constraint	0.0006***			
	(0.0001)			
RE value*IV	0.0000*			
	(0.0000)			
RE Value		0.0804***	0.5900***	-0.0002
		(0.0009)	(0.0102)	(0.0001)
RE Prices		-0.2253**	-1.0587**	-0.0002
		(0.0944)	(0.4963)	(0.0010)
Observations	6,172	6,168	6,172	3,626
Kleibergen-Papp F-Stat		20.76	20.76	15.35

Note: Robust standard errors, clustered by country-year, in parentheses. All estimations include country-sector fixed effects and sector-year dummies. The critical value for the weak instruments test is based on a 10% 2SLS bias at the 5% significance level, which is 7.03. The IV is built by interacting a world real estate price index with a local supply constraint. We use for the local supply constraint: rent regulation×days construction permits/ decentralization index. The world real estate price index is the mean value of real estate price growth among our group of countries.

Table D.3 – Robustness Check: with Country×Year Fixed effects

	(1)	(2)	(3)	(4)	(5)	(6)
	Inv.	Inv.	GVA	GVA	TFP	TFP
	OLS	IV	OLS	IV	OLS	IV
RE Value	0.0766***	0.0788***	0.5694***	0.5853***	0.0000	-0.0002*
	(0.0028)	(0.0009)	(0.0189)	(0.0144)	(0.0001)	(0.0001)
Observations	8,175	6,279	8,137	6,268	4,035	3,640
FE: Country*Year	Yes	Yes	Yes	Yes	Yes	Yes
Kleibergen-Papp F-Stat		288.3		291.5		10.40

Note: Robust standard errors, clustered by country-year, in parentheses. All estimations include country-sector fixed effects and sector-year dummies. The critical value for the weak instruments test is based on a 10% 2SLS bias at the 5% significance level, which is 7.03. All IV are built by interacting US real estate prices with a local supply constraint.

5. Shedding light on the UK productivity puzzle

The so-called UK "productivity puzzle" has gained much attention in recent years. This puzzle refers to the unexplained and sustained low productivity growth since the 2008-09 Great Recession in the United Kingdom, so that productivity has fallen below its pre-crisis trend, and much more than in any other advanced economies. This low productivity growth is at the heart of the Bank of England's concerns[16] for the definition of its monetary policy and the government for its industrial strategy.[17]

Sectoral dynamics have been extensively discussed as a key aspect of this puzzle. According to Tenreyro (2018), just two sectors, finance and manufacturing, explain most of the low aggregate productivity growth. For Kierzenkowski et al. (2018), non financial services are the main driver of the productivity shortfall –they would explain half of the shortfall followed by financial services for one fourth. The misallocation of resources between sectors was also pointed out as a cause of slowing productivity gains. Barnett et al. (2014) provide evidence of an increase in the standard deviation of productivity shortfalls across sectors and Broadbent (2012) of more cross-sectoral volatility in capital returns since the Great Recession.[18]

Our methodology can shed light on the role of sectoral reallocation and real estate shocks in the UK productivity puzzle.[19] First, Figure 5.1 confirms the evidence of a UK productivity puzzle: TFP growth halted abruptly around 2006 with a very modest recovery since 2014. Second, cross-sectoral heterogeneity in productivity gains played a role in this process. As shown by Figure 5.1, sectoral reallocations have led to substantial TFP losses, as evidenced by the gap between TFP in absence of any reallocations (solid line) and observed TFP (dotted line). From this point of view, the UK looks more like France than Spain: TFP losses are sustained and even increased after the Great Recession compared to the previous period. Third, when it comes to the role of real estate shocks, UK seems more importantly impacted than other countries. TFP losses induced by real estate shocks through the sectoral reallocation of resources are found to be the highest among the countries considered, as evidenced by the gap between predicted between TFP in absence of any reallocations (solid line) and the predicted TFP (dashed line). Sectoral reallocations driven by real estate shocks are then an

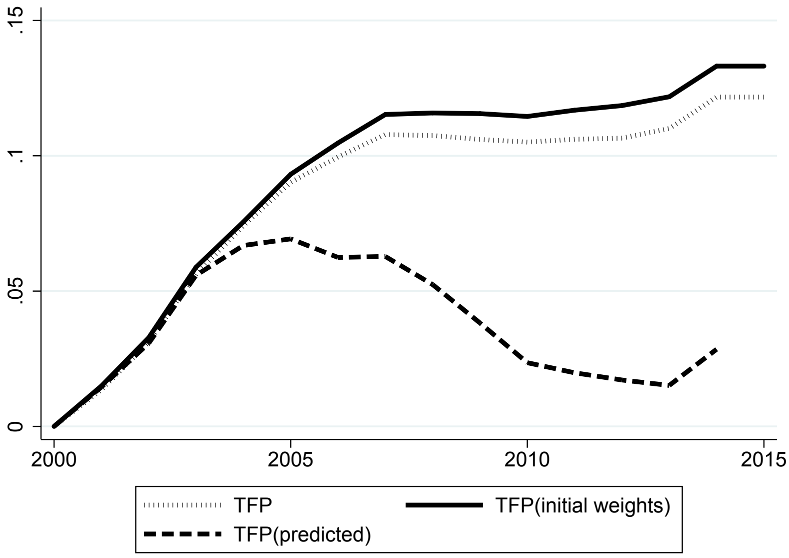
[16] See the speeches by Dale (2011) and Tenreyro (2018), among others, and Barnett et al. (2014).

[17] See the white paper "Industrial strategy: Building a Britain fit for the future" published in 2017.

[18] See Pessoa and Van Reenen (2014) for a discussion of this evidence and other related issues on the UK productivity puzzle.

[19] Most studies on this puzzle look at labor productivity, we here focus on total factor productivity, that is joint labor and capital productivity.

Figure 5.1 – TFP Gains/Losses due to sectoral reallocations in the United Kingdom



Note: Log-Level of TFP using historical share $\log(A_{it})$ "TFP", Log-Level of TFP using initial weights $\log\left(\overline{A}_{it}\right)$ "TFP(initial weights)" and Log-Level of TFP using predicted share $\log\left(\widehat{A}_{it}\right)$ "TFP(predicted)". "Predicted" refers to predicted by real estate shocks. See the Appendix for details.

important element of the UK productivity puzzle.

References

Askenazy, P. and Erhel, C. (2015). The french productivity puzzle. CEPREMAP Working Papers 1512, Centre pour la recherche économique et ses applications.

Barnett, A., Batten, S., Chiu, A., Franklin, J., and Sebastia-Barriel, M. (2014). The uk productivity puzzle. *Bank of England Quarterly Bulletin*, page Q2.

Bartelsman, E., Haltiwanger, J., and Scarpetta, S. (2013). Cross-country differences in productivity: The role of allocation and selection. *American Economic Review*, 103(1):305–34.

Baumol, W. J., Bowen, W. G., et al. (1966). *Performing arts-the economic dilemma: a study of problems common to theater, opera, music and dance.* Cambridge, Mass.: M.I.T. Press.

Benigno, G. and Fornaro, L. (2014). The Financial Resource Curse. *Scandinavian Journal of Economics*, 116(1):58–86.

Bernanke, B. and Gertler, M. (1989). Agency Costs, Net Worth, and Business Fluctuations. *American Economic Review*, 79(1):14–31.

Borio, C., Kharroubi, E., Upper, C., and Zampolli, F. (2015). Labour reallocation and productivity dynamics: financial causes, real consequences. BIS Working Papers 534, Bank for International Settlements.

Broadbent, B. (2012). Productivity and the allocation of resources. *speech given at Durham Business School, Bank of England*, 12.

Carvalho, V. and Grassi, B. (2019). Large firm dynamics and the business cycle. *American Economic Review*, 109(4):1375–1425.

Cecchetti, S. G. and Kharroubi, E. (2015). Why does financial sector growth crowd out real economic growth? BIS Working Papers 490, Bank for International Settlements.

Cette, G., Corde, S., and Lecat, R. (2017). Stagnation of productivity in france: A legacy of the crisis or a structural slowdown? *Economie et Statistique*, 494(494):11–36.

Cette, G., Fernald, J., and Mojon, B. (2016). The pre-great recession slowdown in productivity. *European Economic Review*, 88:3–20.

Chaney, T., Sraer, D., and Thesmar, D. (2012). The collateral channel: How real estate shocks affect corporate investment. *American Economic Review*, 102(6):2381–2409.

Dale, S. (2011). Productivity and monetary policy. In *speech to the South Tyneside Manufacturing Forum, Bank of England*. Citeseer.

Davidoff, T. et al. (2016). Supply constraints are not valid instrumental variables for home prices because they are correlated with many demand factors. *Critical Finance Review*, 5(2):177–206.

Ehrlich, M. V., Hilber, C. A., and Schöni, O. (2017). Institutional settings and urban sprawl: Evidence from europe. *Journal of Housing Economics*.

Eurostat (2017). Nace rev. 2, statistical classification of economic activities in the european community. Technical report, European Commission.

Fontagné, L. and Santoni, G. (2015). Firm Level Allocative Inefficiency: Evidence from France. Working Papers 2015-12, CEPII research center.

Gabaix, X. (2011). The granular origins of aggregate fluctuations. *Econometrica*, 79:733–772.

Garcia-Santana, M., Moral-Benito, E., Pijoan-Mas, J., and Ramos, R. (2016 - revised in 2018). Growing like spain: 1995-2007. CEPR Discussion Papers 11144, C.E.P.R. Discussion Papers.

Geerolf, F. and Grjebine, T. (2018). The macroeconomic effects of lump-sum taxes. *Working Paper*.

Hilber, C. A. and Vermeulen, W. (2016). The impact of supply constraints on house prices in england. *The Economic Journal*, 126(591):358–405.

Hsieh, C.-T. and Klenow, P. J. (2009). Misallocation and manufacturing tfp in china and india. *The Quarterly journal of economics*, 124(4):1403–1448.

Johansson, Å. (2011). Housing policies in oecd countries: survey-based data and implications. *OECD Economics Department Working Paper*.

Kierzenkowski, R., Machlica, G., and Fulop, G. (2018). The uk productivity puzzle through the magnifying glass. (1496).

Kiyotaki, N. and Moore, J. (1997). Credit Cycles. *Journal of Political Economy*, 105(2):211–248.

Krugman, P. (2012). *Revenge of the Optimum Currency Area*, pages 439–448. University of Chicago Press.

OECD (2019). France. *OECD Productivity Insights*.

Pessoa, J. P. and Van Reenen, J. (2014). The uk productivity and jobs puzzle: does the answer lie in wage flexibility? *The Economic Journal*, 124(576):433–452.

Piton, S. (2018). Do unit labor costs matter? A decomposition exercise on European data. Working Papers 2018-07, CEPII.

Reis, R. (2013). The Portugese Slump and Crash and the Euro Crisis. *Brookings Papers on Economic Activity*, 44(1 (Spring):143–210.

Restuccia, D. and Rogerson, R. (2008). Policy distortions and aggregate productivity with heterogeneous establishments. *Review of Economic dynamics*, 11(4):707–720.

Rey, H. (2015). Dilemma not trilemma: the global financial cycle and monetary policy independence. NBER Working Papers 21162, National Bureau of Economic Research, Inc.

Stock, J. H. and Yogo, M. (2005). Testing for weak instruments in linear iv regression. In Andrews, D. W. and Stock, J. H., editors, *Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg*. Cambridge: Cambridge University Press.

Tenreyro, S. (2018). The fall in productivity growth: causes and implications. *Peston Lecture Theatre, Queen Mary University of London, Bank of England*.