Special Analyis

Real estate prices appear to have no direct effect on investment in productive assets

Yaëlle Hauseux
Bertrand Marc

Département de la Conjoncture

David Audenaert
Charles-Marie Chevalier

Département des Etudes économiques

Although corporate investment in France has been slow to pick up since the period of recession in 2008, the investment rate remains high today compared to its long-term average. This feature is the result not only of the buoyancy of investment in real estate assets, both in volume and in value, which has more than compensated for the downward trend in the investment rate for machinery and equipment, but also the weakness of value added over the last six years. The capital structure of French companies has therefore become distorted across the whole period considered, to the detriment of productive capital.

Investment expenditure depends mainly on demand and on user cost of capital. However, choices between assets are also based on relative prices, via the substitution effect (for example the price of a building compared with machinery). In addition, companies' financing capacity, which may be increased by the addition of collateral when they are unable to self-finance their investment entirely, may also have an effect on their expenditure decisions. However, during the 2000s, real estate prices, and particularly the land prices, increased considerably in France, which inflated companies' assets and could be used as collateral for obtaining bank loans. This could therefore have favoured access to credit and improved lending conditions and, ultimately, investment. According to various studies based on corporate data, this positive effect does indeed seem to be present.

At macroeconomic level, econometric modelling of investment expenditure behaviour by French enterprises shows the influence of these different factors. Unsurprisingly, demand remains the main determinant of investment in volume, which is also influenced by user cost of capital. The positive link with the addition of collateral is a more delicate matter, as the increase in the price of land is accompanied by a similar increase in the price of buildings. At this point, it is useful to distinguish between expenditure on machinery and equipment, where in theory the effects of collateral and substitution move in the same direction, and expenditure on non-residential buildings, where the two effects are competing. In practice, the results for substitution effects are paradoxical, suggesting that banks may have been selective in agreeing to loans guaranteed with collateral. For productive assets, no substitution effect appears: in addition, from estimates carried out, it is not possible to show that the price of land has any effect. Conversely, for buildings, when a company provided collateral, this appears to have sustained investment in buildings despite the higher cost and negative substitution effect.

Since 2013, land prices have fallen, which probably contributed to the effect on corporate investment expenditure on buildings. It has even dropped considerably since mid-2014 and is unlikely to regain stability until the end of 2015. At the same time, productive investment has for the most part shown the same sluggishness as economic activity; it is expected to pick up in the course of 2015, buoyed up by more favourable prospects for both foreign and domestic demand.

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In France, the corporate investment rate still remains relatively high, primarily due to the dynamism of expenditure on buildings since the start of the 2000s

Investment remains lower than its 2008 level but the investment rate is holding out

Corporate investment in France has taken a long time to pick up...

Investment has taken a long time to pick up in France since 2008, but 2014 showed the first signs of improvement: investment in volume by non-financial enterprises (NFE) accelerated in 2014 (+2.0% as an annual average) after moderate growth in 2013 (+0.8%) and a slight decline in 2012 (-0.1%). This upturn concerns all products: +2.3% in 2014 for investment in manufactured products, +3.0% in construction and +1.1% in services.

However, until now this recent dynamism has not been enough to make up for the sluggishness of previous years: in 2014, investment in volume by NFEs was still lower than its 2008 level, showing that the recession of 2008-2009 has weighed heavily on investment.

...but the investment rate has stayed high

Nevertheless, although investment in value as compared to value added has decreased since 2008, especially during the period of recession in 2008-2009, it has remained above the long term average over the last five years: the investment rate[1] of non-financial corporations (NFC) reached 23.1% in 2014 (after 22.7% on average between 2011 and 2013), against an average of 21.4% since 1980 (*Graph 1*).

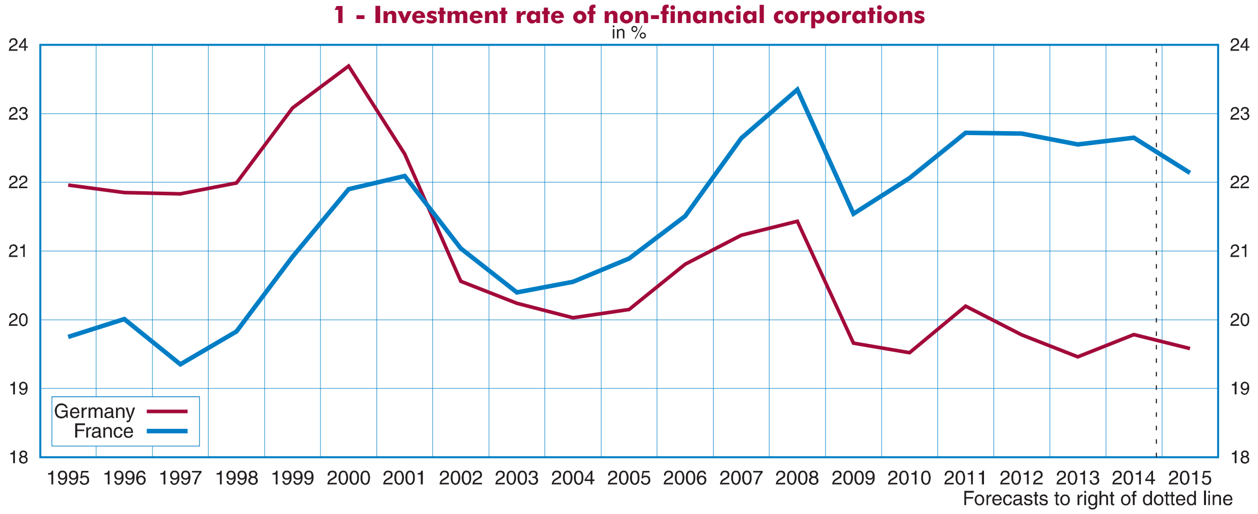
Over the last fifteen years, the structure of investment has changed substantially, in favour of building assets

Companies have had a growing propensity to spend on buildings over the last fifteen years...

A more detailed analysis of investment by type of asset (*Box 1*) gives a better understanding of the dynamics of the investment rate. While the rate of investment in intellectual rights has increased continuously since the 1990s, this is not the case for machinery and equipment, or for buildings. The investment rate for machinery and equipment has a profile that is in line with the cycle of economic activity: 1990 and 2000 are therefore high points in previous cycles for

(1) The investment rate is the ratio of gross fixed capital formation to value added, at current prices. Here it is measured for non-financial corporations and the model covers this institutional sector. Investment by product, on the other hand, is given for all non-financial enterprises combined (corporations and unincorporated enterprises), as quarterly accounts are not produced at a more detailed level.

1 - Investment rate of non-financial corporations



Sources: INSEE, national accounts

this rate. Until the beginning of the 1990s, the investment rate for machinery and equipment and for buildings (residential or otherwise) developed in tandem. After the recession in 1993, a first disconnection emerged, with the investment rate in buildings seeming to be less in phase with the cycle of activity: while the investment rate for machinery and equipment stabilised around 8%, in buildings it started to tumble, and this eased off only in 1999.

The start of the 2000s next marked a period of adjustment; it was the turn of investment in machinery and equipment to fall in relation to value added, whereas the rate of investment in buildings rose rapidly, from 5.2% in 1998 to 7.9% in 2008. Since 2009, real estate investment in value has been much less affected by the sluggishness of economic activity and levels are even higher than investment in machinery and equipment. To a large extent, these changes in investment rates reflect relative price movements. Nevertheless, in volume, investment expenditure per asset still shows the same trends, although these are a little less pronounced. Since 1999, investment in buildings (+49% in volume against +131% in value) increased more rapidly than value added (+29% against +53% in value), as did investment in intellectual property rights (+51% against +77% in value). In contrast, investment in machinery and equipment was less dynamic (+16% against +26% in value).

... which contributed to the distortion of capital over the period considered...

This relative increase in investment in buildings has led to a distortion in the structure of the non-financial assets of French companies. The proportion of buildings has increased constantly since 2002, at the expense of machinery and equipment. As a result, taking all branches together, buildings increased from 62.2% of fixed assets in value in 2002 to 64.2% in 2008 (*Graph 2*). In 2013, this share rose to 65.5%, a rise of over 3 points in a decade. In contrast, the proportion of machinery and equipment consistently declined (-2.7 points between 2002 and 2013), settling at 22.5% in 2013. The share of intellectual property rights has also decreased, but to a lesser extent (-0.6 points between 2002 and 2013).

Box 1 - Components of corporate investment

The national accounts, and to be more precise, the balance sheet account of non-financial corporations (NFC), provide information on the distribution of gross fixed capital formation (GFCF) by type of assets.

"Assets" versus "products"

The "assets" rationale is different from the "products" rationale: classification by asset refers to the function of the good or the service provided to the buyer, whereas the product rationale refers to the activity of the unit that has sold this good or service. For example, the purchase of office buildings is entered in the accounts under products as a "construction" but under assets as "non-residential buildings"; architects' or notaries' fees associated with this investment are listed under products as "services" (of an architect or services to businesses), but they are also included under assets as "non-residential buildings", which includes costs related to their purchase. Thus, studying investment by "assets" has a greater economic significance from the point of view of utility for the purchaser.

The GFCF of NFC in assets

The gross fixed capital formation of non-financial corporations includes acquisitions net of fixed asset disposals. Fixed assets are tangible or intangible assets resulting from production processes and used repeatedly or continuously in other production processes for at least a year. More specifically, for "buildings" assets, GFCF covers the purchase of new buildings (residential or non-residential), major maintenance of these buildings and the purchase net of disposals of old buildings from other institutional sectors (e.g. households or general government). The purchase of an old building by one NFC from another NFC is not included in the GFCF: it consists of a flow between agents in the same institutional sector; in other words, this transaction does not alter the fixed capital of the sector as a whole. Moreover, land is not the result of a production process and therefore land acquisition is not included in the GFCF. All in all, the GFCF of NFCs in buildings consists essentially of purchases of new buildings and maintenance and improvements to these buildings.

Fixed assets can be broken down into four main groups: housing (8% of flows of NFC fixed assets in 2014), other buildings (non-residential: offices, shops, warehouses, factories, etc.: 19%) and other structures (civil engineering: 8%), machinery and equipment (33%) and intellectual property rights (32% including expenditure on R&D and software).

In this study, two types of asset in particular are considered: first, productive assets, which include machinery and equipment and intellectual property rights, and second, non-residential buildings. All in all, these two types of asset represented 85% of investment by NFCs in 2013. NFC investment in housing (which mainly concerns social housing enterprises, for building low-cost housing), and in civil engineering structures are not covered in this report.■

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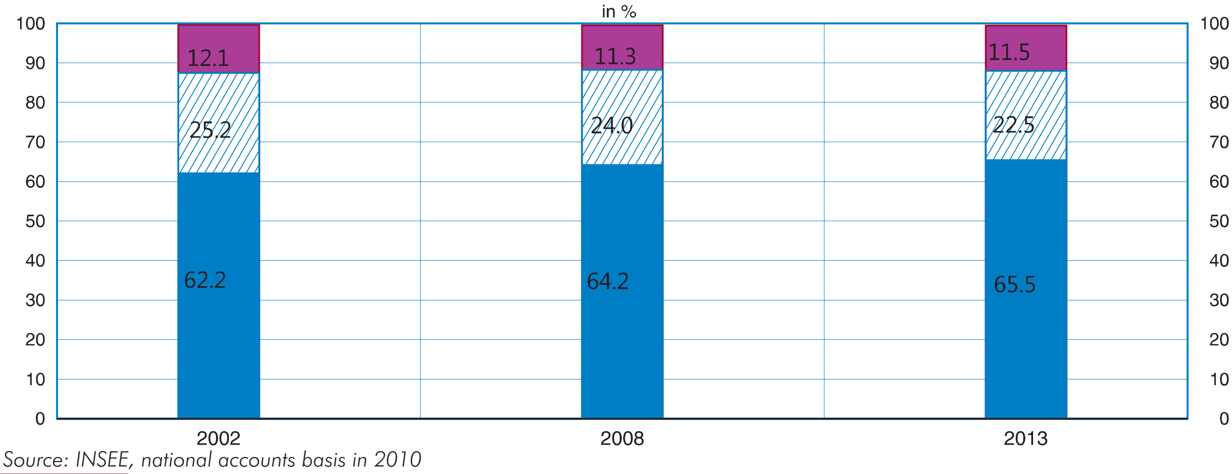
... and also to the ageing of productive capital

The corollary to this lack of momentum in investment in value in machinery and equipment is the ageing of capital. Although it is difficult to measure this directly, the method used in the French national accounts gives a good approximation when considering the difference between the amortisation and decommissioning of capital (*Graph 3*). From 2000 to 2013, the age of capital increased particularly rapidly for machinery and equipment: about three times faster than for all assets as a whole. The ageing of productive capital certainly seems to follow a counter-cyclical profile. However, companies have never renewed their machinery and equipment so infrequently since 2000. In comparison, between 1990 and 1999, the age of capital for machinery and equipment stabilised at a level that was much lower. This ageing is therefore a phenomenon that is specific to the last decade, and has been exacerbated by the recent crisis.

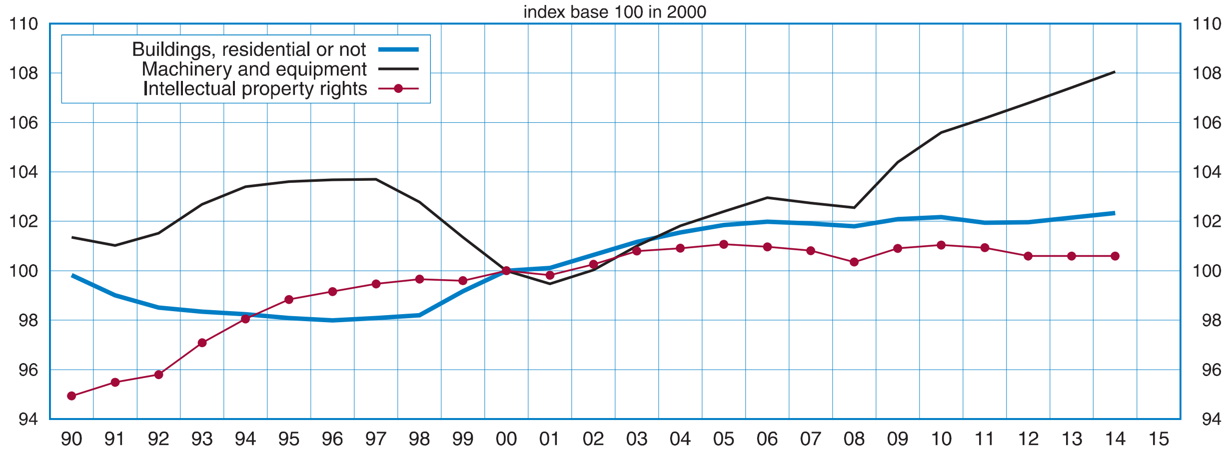
2 - Capital structure of non-financial corporations, as a percentage of fixed assets



Source: INSEE, national accounts basis in 2010

Note: Biological resources (dairy , vineyards, fruit trees , etc.) which represent less than 0.5% of the total were not represented on the chart.

3 - Age of capital of French NFCs



Source: INSEE, national accounts basis in 2010

Note: The age of capital is estimated by the formula (net capital - gross capital) / gross capital, that is to say (consumption of fixed capital - derating) / gross capital. More capital is old, more amortization (CFC) is important, so that decommissioning is the disposal.

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What is the role of prices in investment choices by non-financial corporations?

In theory, corporate investment depends on financing and substitution effects, in addition to demand

In addition to demand and the user cost of capital...

The decision to invest depends mainly on companies' expectations of outlets, but it is also influenced by economic conditions at the time, especially prices, which affect financial arbitrations.

In a normal theoretical framework, it is common to model production using two factors of production: capital and labour. Investment then depends on the demand for the goods of companies and the user cost of capital. By considering both the value of company assets and capital that can be broken down into different types of assets used for production, additional effects can be expected (*Box 2*).

... investment expenditure may be a function of financing capacity, increased by the input of collateral...

First, the value of assets on the balance sheet can facilitate corporate debt and increase investment in productive capital and buildings. For this to happen, we assume that a typical company will maximise the updated flow of dividends paid but under three constraints: these dividends must be positive or zero; a budget must be maintained where expenditure and resources are balanced, including servicing the debt, and a collateral constraint limits the debt to a threshold proportional to the value of the company's assets. It is this third, very powerful constraint that represents the collateral effect by assuming that companies can only acquire debt on the basis of their assets. Under these conditions, investment is linked positively with the value of the assets.

Box 2 - Modelling investment by asset

Corporate investment behaviour can be represented using a stylised model to understand the differences between expenditure on productive assets and on buildings. Two models are shown here to explain the collateral effect and the effect of the relative factor cost. The first simple model is based on a Cobb-Douglas production function and shows that the price of land can be a determinant of investment. The second model presents a constant elasticity of substitution production function with three factors of production and tends to show that independently of collateral effects, the relative cost of the two types of asset can influence demand for each asset.

1. Modelling collateral effect

There are three factors of production: productive capital (K_t, these are machinery and equipment and intellectual property rights, *Box 1*), buildings (E_t) and labour (L_t). The company also holds land T_t=T in a supposedly fixed quantity. This is a reasonable simplifying assumption. The amount of land held by NFCs is indeed virtually constant, and for the most part any impact on real estate holdings is because of revaluations due to price changes. A representative company maximises its discounted dividends under three constraints, budget (1), solvency (2) and collateral (3).

The programme is written:

$$\max_{\{d_t\}_{t=0\ldots+\infty}} \left\{ \sum_{t=0}^{+\infty} \left[\prod_{i=0}^{t} (1+\beta_i) \right]^{-1} d_t \right\}$$

under constraints:

$$(1) \quad d_t + b_{t-1} \leq q_t^Y Y_t(K_t, E_t, L_t) - q_t^K \left(K_t - (1-\delta_t^K) K_{t-1} \right) - q_t^E \left(E_t - (1-\delta_t^E) E_{t-1} \right) - \omega_t L_t + \frac{b_t}{(1+r_t)}$$

$$(2) \quad 0 \leq d_t$$

$$(3) \quad b_t \leq \theta_t q_{t+1}^T T$$

The following denotations are used:

- d_t are dividends paid by companies at date t;
- β_t is the discount rate;
- Y_t is the production function which is dependent on productive capital (K_t), buildings (E_t) and labour (L_t);
- q_t^Y, q_t^K, q_t^E, q_t^T and ω_t are respectively the price of production, of investment in productive capital, of investment in buildings, land and labour;
- b_t is credit on date t, with r_t the interest rate;
- θ_t is the share of land at market value that can be put up for collateral (in this way, this is a similar constraint to a loan to value ratio, except that the value on which the amount is loaned

is not based on the value of goods to be acquired but on the value of goods already held);

- δ_t^K *and* δ_t^E are the depreciation rates for productive capital and buildings.

The budget constraint (1) requires that the sum of dividends and credit repayments on a given date t should be less than the resources. As it is assumed to be fixed, land does not appear within the production function. The solvency constraint (2) requires that the dividends paid in each period should be positive or zero.

The collateral constraint (3) (similar to Kaas *and al.*, 2014) requires that the company's credit on date t should be less than the share θ_t of its land.

If we simplify by taking a Cobb-Douglas production function, then in addition to a capital user cost specific to each asset, we also see a collateral effect emerging in the expression of optimal amounts chosen by the company with regard to productive capital and buildings:

$$k_t - y_t = cst - ln\left(\frac{C_t^K}{q_t^y} + \nu_t \Omega_t^K\right)$$

and

$$e_t - y_t = cst - ln\left(\frac{C_t^E}{q_t^y} + \nu_t \Omega_t^E\right)$$

Variable ν_t[1] corresponds to that used by Bloch and Cœuré (1995), who studied the scale of credit constraints using individual data from French companies. This variable measures the strength of the collateral constraint. The higher the value of ν_t, then the more constrained the company is in its debt, or in other words, the greater the difference between the debt the company hopes for and the maximum it can obtain. When this variable increases, it produces a negative effect on investment through the term

$$\nu_t \Omega_t^i \quad \text{où} \quad \Omega_t^i = \left(q_t^i / q_t^y\right)\left(1 + q_t^i + \delta_{t+1}\right)$$

and where $i \in \{K, E\}$

Like Bloch and Cœuré (1995) who represented this variable with company bond spreads, here we shall use land prices[2].

2. By applying a CES production function, relative cost effects can be identified

When only two factors of production are considered, then the production function used is generally with a constant elasticity of substitution (CES). However, it is difficult to define a CES production function when there are three factors. As explained in studies by Uzawa (1962) and McFadden (1962), CES production functions with three factors need a common elasticity of substitution between the factors, which is fairly restrictive. A more general case was introduced by Sato (1967) who interconnected two levels of CES production function. Whatever the interconnection selected, some elasticities remain restrictive. The following production function is an example of a CES production function with three factors of production:

$$Y_t(K_t, E_t, L_t) = \left[\begin{array}{l} \alpha_1\left(\alpha_2 K_t^{\frac{\omega-1}{\omega}} + (1-\alpha_2) E_t^{\frac{\omega-1}{\omega}}\right)^{\frac{\omega(\sigma-1)}{\sigma(\omega-1)}} \\ +(1-\alpha_1) L_t^{\frac{\sigma-1}{\sigma}} \end{array}\right]^{\frac{\sigma}{\sigma-1}}$$

The degree of substitutability differs on the one hand between labour and capital (σ) and on the other hand between buildings and productive capital (ω). However, elasticities between labour and productive capital on the one hand and between labour and buildings on the other are identical. This choice of production function is fairly common, as it results in either a very strong complementarity or a substitutability between factors. When ω and σ are zero, there is perfect complementarity between factors, giving a Leontieff production function. When both these parameters have a value of 1, the production function is a Cobb-Douglas type. Finally, when they are infinite, there is perfect substitutability between factors.

When the company's simplified programme is resolved using a CES production function (i.e. without taking the collateral constraint into account), then a term for relative cost appears in the expression of the optimal quantities selected:

$$k_t - y_t = cst - \sigma ln\left(\frac{C_t^K}{q_t^y}\right) + \frac{\sigma-\omega}{\omega-1} ln\left(1 + \left(\frac{1-\alpha_2}{\alpha_2}\right)^{\omega}\left(\frac{C_t^K}{C_t^E}\right)^{\omega-1}\right)$$

and

$$e_t - y_t = cst - \sigma ln\left(\frac{C_t^E}{q_t^y}\right) + \frac{\sigma-\omega}{\omega-1} ln\left(1 + \left(\frac{\alpha_2}{1-\alpha_2}\right)^{\omega}\left(\frac{C_t^E}{C_t^K}\right)^{\omega-1}\right)$$

Finally, the first model underlines the link between the price of land and the demands of factors of production. The second model shows that with a fairly general production function with three factors (with the constraint of constant elasticity substitution between factors), the relative cost of factors of production is a determinant of investment. This is why the land prices and relative cost affect the proposed estimates (Box 3). ■

(1) This is the Lagrange coefficient associated with the collateral constraint divided by that for the budget constraint

(2) More specifically, Bloch and Cœuré (1995) consider a debt that must not exceed a certain fixed upper bound. Here the upper bound is variable and is a function of land prices.

...and of the relative cost of invested assets, via a substitution effect

Second, productive capital and buildings are assets that can in part be substituted for one another: the density of occupancy of a building can be increased for a while if constructing a new building is very costly; conversely, construction can result in certain productive investments being postponed. By using a constant elasticity of substitution production function, which is more usual than the Cobb Douglas production function frequently found in the literature (British Columbia, 2011), a new investment determinant emerges: the relative cost of the two types of capital. For example, productive investment depends on the difference between the user cost of productive capital and that of real estate capital. The greater the cost of the productive capital in relation to the real estate capital, the lower the productive investment will be, as the company is substituting investment in buildings for productive investment.

The usual model of corporate investment demand can then be enhanced: in addition to demand and the cost of the factor of production, modelling also takes into account financial constraints, approximated by available collateral, and a substitution effect which allows a choice in the type of good invested, according to its relative price.

Pledging an asset as collateral can facilitate corporate financing by credit

A company that presents its bank with an asset as collateral can more easily obtain credit...

Using an asset as collateral means putting it forward as a guarantee when obtaining a loan from the bank. This extra security for the lender can make it easier to negotiate a loan and hence to gain access to credit: according to Aghion *and al*. (2012), pledging collateral correlates positively with the supply of bank credit. With easier access to credit, companies that hold real estate capital are likely to have a greater investment capacity. Offering a guarantee may also reduce the cost of financial intermediation (Myers, 1977). Indeed, by offering a guarantee, the borrower reduces the information needed by the lender to assess its solvency. As it is less costly for the lending establishment to assess the value of the collateral than the value and the solvency of the company, the creditor can therefore reduce the time spent in dealing with the loan application and hence the cost.

... and with better terms...

In addition, credit terms can be all the more interesting when the good that has been provided as collateral is a tangible fixed asset (Berger and Udell, 1995). When the borrower presents "accounts receivable and inventory" as a guarantee, the creditor has to carry out much more monitoring work, which results in higher lending costs.

...especially in the case of land holdings

Any type of asset can be used to secure a loan. However, the microeconomics literature has focused more particularly on real estate, and even more specifically in land holdings, as collateral. Compared with other types of asset like machinery, land represents more security for a creditor. It does not depreciate, there is less risk of a fall in prices, and should the collateral be released, it is easier for the creditor to resell land than second-hand machinery.

By pledging collateral the company is committed to respecting loan terms and repayments

Once the loan has been agreed, collateral can resolve questions of moral hazart by ensuring implementation of commitments and the renegotiation of loans in case of a problem (Gorton and Kahn, 1997). Also, once a company has developed a relationship of confidence with a creditor, it has less need to provide collateral in order to borrow (Rajan and Winton, 1995): the smallest and youngest companies are probably most in need of providing collateral in order to borrow.

Real estate prices appear to have no direct effect on investment in productive assets

Studies of individual corporate data and different countries confirm this

Estimates using individual corporate data and for different countries suggest that the increase in land prices has had an effect on the value of assets used as collateral and has subsequently fostered investment via easier bank loans. In France, over the period 1987-1998, companies appear to have invested €0.24 more on average per extra euro of collateral (Chaney, Sraer, Thesmar, 2007). This effect is net of any surplus investment in real estate due to rising prices: the authors separated corporate investment behaviour involving collateral (before the rise in real estate prices) from investment behaviour of other companies, irrespective of their other individual characteristics. This positive effect on investment was found to be three times stronger for companies that borrowed and did not belong to groups. In fact, the same effects have also been identified in the United States (Chaney, Sraer and Thesmar, 2012), Spain (Carbo-Valverde *and al.*, 2009) and Japan: in Spain, over the period 1994-2002, a 1% increase in collateral (measured by the ratio of tangible fixed assets to all assets) increased available credit by 0.45%; and in Japan, Gan (2007) considers that over the period of the collapse of the real estate bubble between 1990 and 1993, a 10% decrease in real estate prices caused a drop in the corporate investment rate of around 0.8 points.

The collateral effect concerns only some companies, those that finance their investments through debt. However, estimated effects using microeconomic data are considerable and suggest that a collateral effect could appear in a macroeconomic model, i.e. in a model dealing with all NFCs, as demonstrated in recent studies (Liu, Wang, Zha, 2014 and Kaas, Pintus and Ray, 2014).

In the next part of this study, we look only at land holdings as an asset used as collateral. This involves studying changes in real estate prices, and more especially the land prices held by companies in the course of the 2000s in France.

In the course of the 2000s, the price of land in France soared

When compared internationally, real estate prices in France increased sharply during the 2000s and have remained high ever since

House prices have developed very differently on either side of the Rhine: between 2000 and 2010 the price of second-hand dwellings more than doubled in France, whereas it grew at a much steadier pace in Germany, by about 10% over the same period (*Graph 4*). After this, the rise in prices in France was much slower (+1.7% between 2010 and 2014). Prices in Spain, Italy and the Netherlands, on the other hand, have fallen sharply since 2008 (around 15% to 35%). The profile of prices in France is therefore fairly unusual when compared with the main European countries. Only the United Kingdom comes close to France, with house prices in 2014 being more than double those of 2000. Although house prices are associated mainly with households, they can nevertheless shed a great deal of light on transactions that may be of interest to companies[2].

The land prices also experienced a tremendous surge...

Of course, variations in house prices are mainly the result of variations in land prices. Land prices have been very dynamic since the end of the 1990s, also affecting companies. Between 1978 and 1998 these prices remained relatively steady in France, apart from fluctuations between 1987 and 1993, which correspond to the previous real estate cycle. Between 1998 and 2006, on the other hand, land prices increased five-fold, before a slight adjustment in 2008-2009 as a result of the 2008 financial crisis; they have remained virtually stable since 2010 (*Graph 5*). As the amount of land is more or less fixed, this

(2) The price of commercial real estate is much less well covered statistically than the price of residential property. It is generally assumed that the two markets share the same profile, as any tensions over land would on the face of it have the same impact on all types of construction. For this reason, to estimate any revaluation of land and building assets, the price of residential property is used in national accounting, as it is assumed to be similar to that of commercial property.

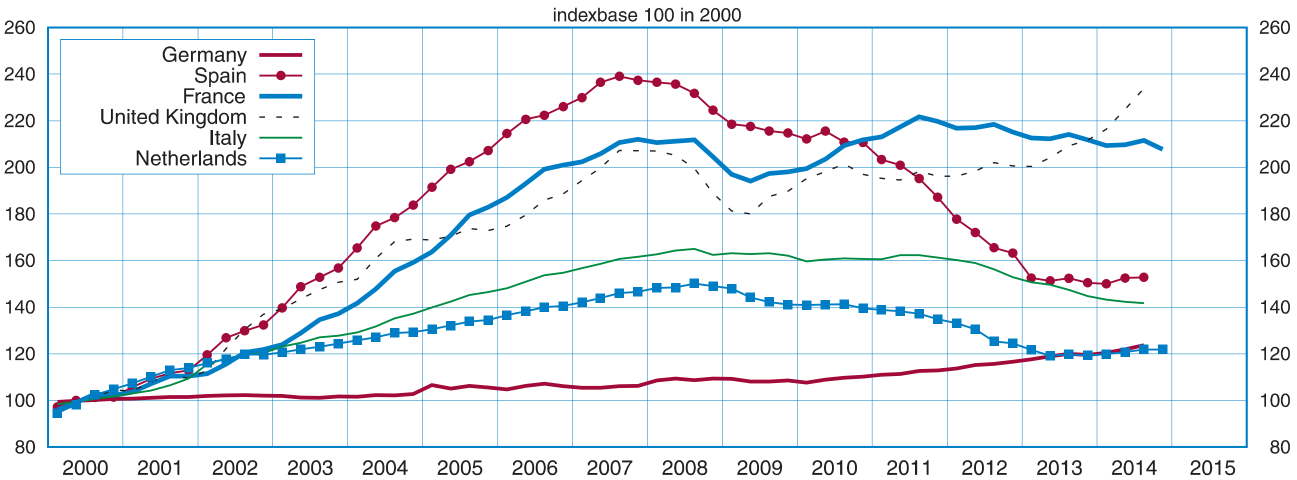
buoyancy in prices was due to the increased value placed on land held by companies[3] .In current Euros, the value of corporate land holdings increased from €200 billion to €1,000 billion between 1999 and 2006. The rise in land prices inflated corporate assets, notably facilitating companies' access to credit via the collateral effect.

...and might have favoured corporate financing through credit since the end of the 1990s

The rise in corporate debt since the 1990s could be explained not only by an increased need for finance due to the rise in the prices of real estate investment but also by an improvement in credit terms via the collateral effect. While self-financing remains an important method of corporate financing, the use of loans took off in 1999, at the same time as real estate inflation (Graph 6). After a period of stagnation between 1994 and 1999, outstanding investment loans almost doubled between 2000 and 2010. The debt ratio of French NFCs - which includes investment loans, and also short-term credit facilities - increased by 20 points of value added between 2000 and 2010 to reach 120%, whereas in Germany it remained relatively stable at around 80% (Graph 7).

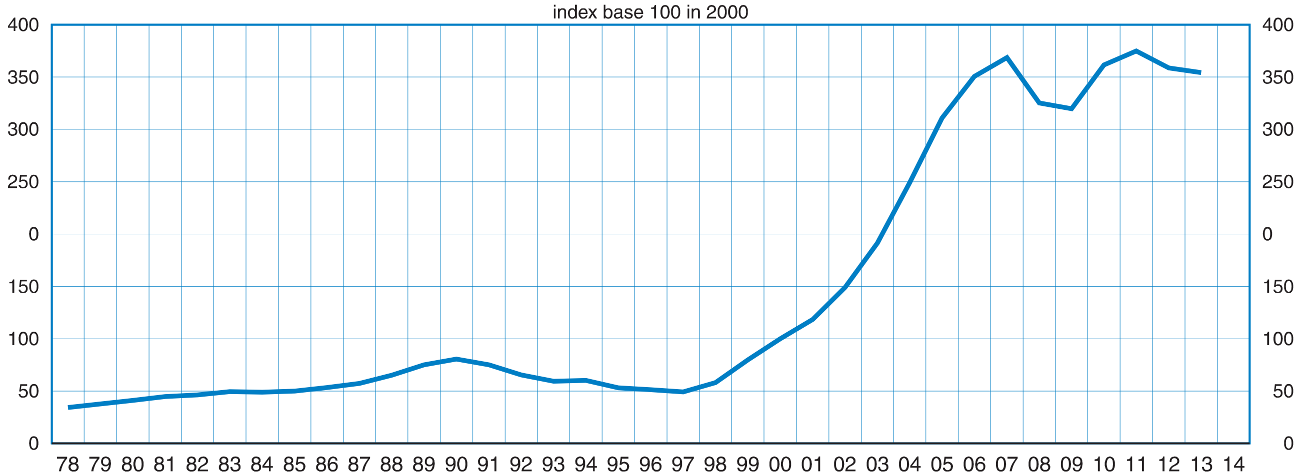
(3) Here, we consider land held by companies and which underlies residential or other types of building, or civil engineering structures. Other types of land are not considered, especially cultivated land, for example.

4 - House prices



Source: Bank for International Settlements

5 - Land price of non-financial corporations



Note: The price of land is calculated as the ratio of the revaluation of land NFCs and their value last year
Source: INSEE, national accounts basis in 2010

Real estate prices appear to have no direct effect on investment in productive assets

The effect of land prices on investment differs according to asset type

An empirical estimate does not differentiate the effect of collateral alone

An empirical estimate to try to separate collateral and substitution effects

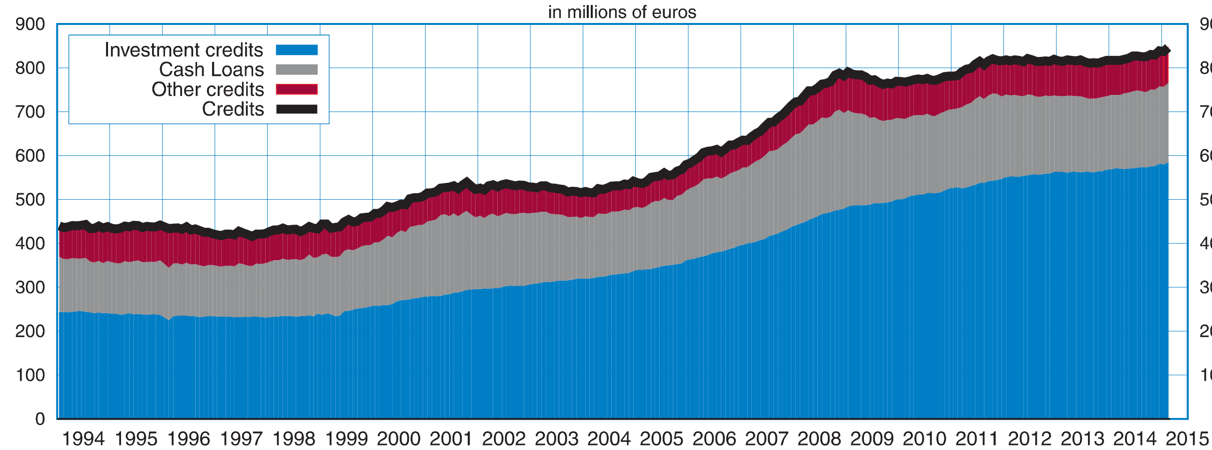
To measure the effect of the rise in the price of land on corporate investment in buildings and productive assets, an estimate was carried out based on the theoretical notions described.

In principle, investment by asset is assumed here to depend on the user cost specific to each asset, the price of the land (as collateral) and the relative difference between user costs. Finally, the savings ratio is added to the long term to measure the effect of financing capacity on investment decisions.

However, changes in the price of land and the price of investment in buildings are similar, thus these two effects cannot be differentiated

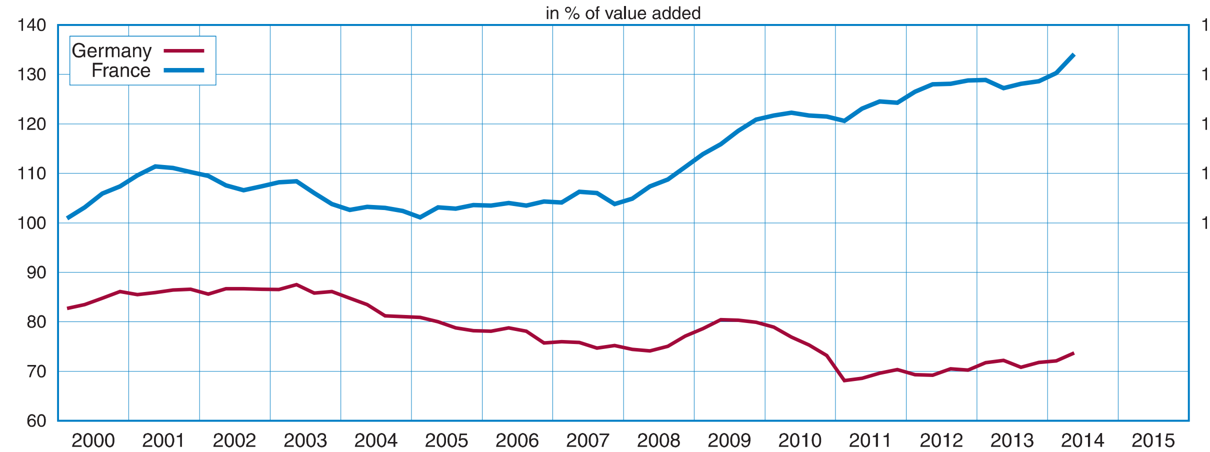
From the estimates obtained for investment in non-residential buildings and productive assets the effects of the rise in the price of land can be illustrated (*Box 3*). However, it is difficult to distinguish the effect of collateral from the substitution effect. Indeed, as a result of the similar changes in the price of land and the price of investment in buildings, the main determinant of the user cost of real estate capital, it becomes critical to make a distinction between these two effects (*Graph 8*). When testing the robustness of the equations, the result is that they are closely linked (*Box 4*). For this reason these two effects are subsequently analysed together.

6 - Loans to non-financial corporations



Source: Banque de France

7 - Rate debt of non-financial corporations



Sources: Central bank, national institutes

Real estate prices appear to have no direct effect on investment in productive assets

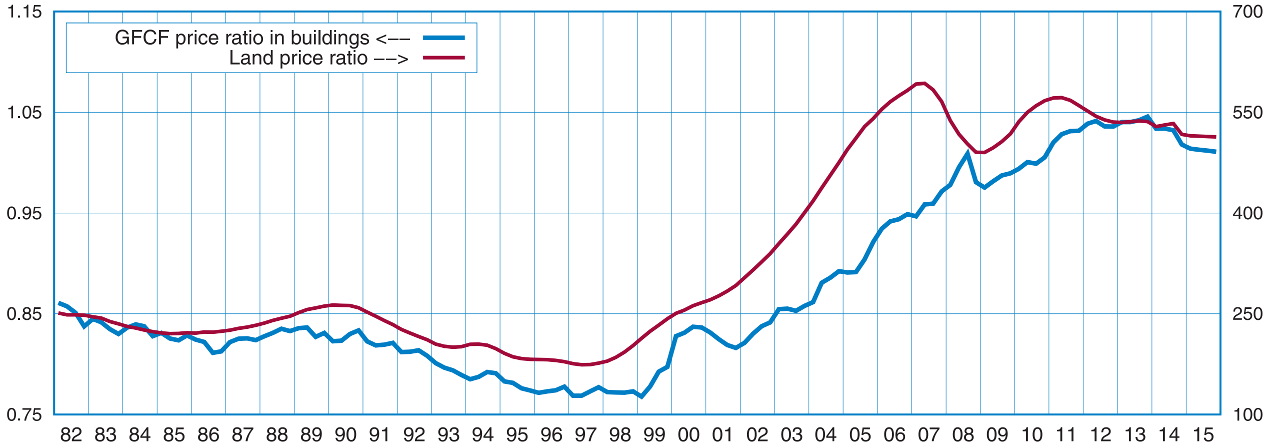
The increase in land prices seems not to have had a significant effect on investment expenditure on productive assets

The main determinant of investment is demand

Estimates produce comparable models for productive assets and non-residential buildings. The major determinant of investment, whether in non-residential buildings or in productive assets, is demand, *via* the "accelerator effect". Demand can indeed account for the increases in investment over the periods 1985-1989 and 1999-2007, and also the slowdown in 1992-1997 and after the 2008-2009 crisis.

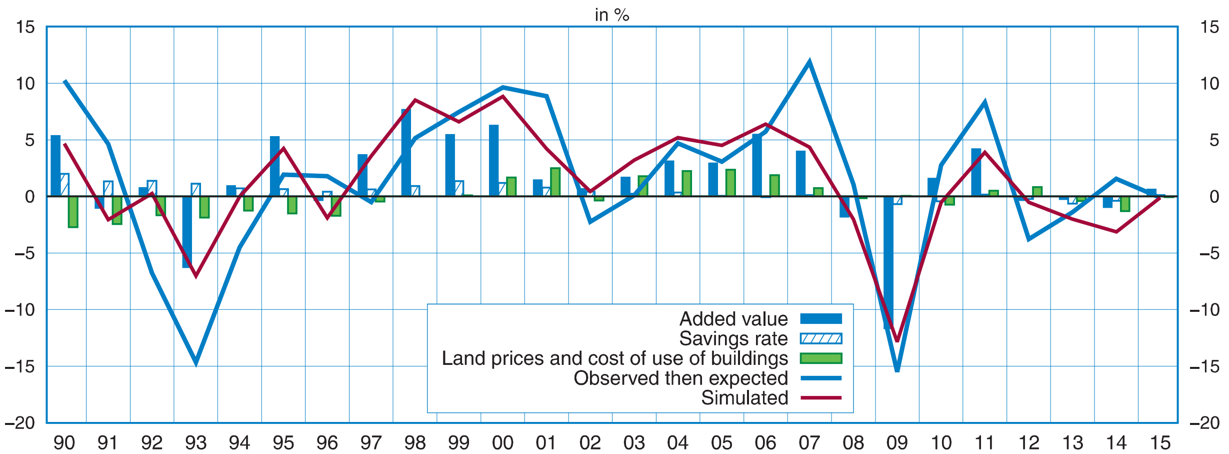
The corporate savings ratio is another important determinant of investment expenditure. It has a similar effect in the two models. It contributed positively to investment during the periods when it experienced a surge (1986-1990 and 1996-2000), and negatively in periods of financial constraint (2006-2010).

8 - Correlation between the price of land and the price of investment in non-residential buildings



Note: The price ratio of GFCF in buildings is the price ratio of GFCF NFCs in non-residential buildings on the price of the added value of SNF . The land price ratio is the ratio between the price of land NFCs and the price of the added value of SNF .
Source: INSEE, national accounts basis in 2010

9 - Contributions to investment in non-residential buildings



Source: INSEE

Box 3 - Estimation of investment equations

The investment equations selected for non-residential buildings and productive assets are error-correction equations giving the target for the investment rate in the long term. In the short term, variations in investment react to variations in value added and to the distance from its long-term target. Estimates are carried out by a two-step DOLS estimation of the long-term equation (Stock and Watson, 1993) over the period 1982Q1-2013Q4. As investment is a component of demand, value added is instrumented for the short term using household consumption and exports of products from the non-farm sectors. The variables entering into the long-term equation are all order 1 integrated. Using the Johansen test (1991), the existence of a unique cointegration relationship was verified. Robustness tests were carried out (*Box 4*).

Productive assets equation

In the selected equation, the long term takes into account user cost of capital in productive assets and savings ratio. The model is very similar to that estimated in Eudeline *and al*. (2013) but is valid across a longer period (1982-2013 instead of 1989-2010), with 2010 as the base, and it no longer depends on margin rate but on savings ratio. The relative cost and the price of land do not emerge as significant.

$$\Delta(i_t^K) = \underset{(-2{,}33)}{-0{,}27} + \underset{(3{,}96)}{0{,}95}.\Delta y_t + \underset{(4{,}11)}{0{,}34}.\Delta i_{t-1}^K - \underset{(-2{,}32)}{0{,}05}.\left(i_{t-1}^K - \left(y_{t-1} - \underset{(-12{,}50)}{0{,}59}\ \ln\left(\frac{C_{t-1}^K}{q_{t-1}^Y}\right) + \underset{(13{,}66)}{2{,}64}\, taux\_épargne_{t-1} \right)\right) + \varepsilon_t$$

The Student statistics for the coefficients are given in brackets under the coefficients.

Non-residential buildings equation

In the selected equation, the long term takes into account the user cost of capital in non-residential buildings, the relative user cost between the two types of assets, the price of land and the savings ratio. As the price of the GFCF in non-residential buildings is very much correlated to the price of land, it was not highlighted spontaneously in a satisfactory manner; the coefficient for the user cost of the buildings was therefore constrained to the same value as the coefficient of the user cost of productive capital estimated freely in the preceding productive assets equation (-0.59). Some variants are shown in *Box 4*.

$$\Delta(i_t^E) = \underset{(-2{,}40)}{-0{,}28} + \underset{(5{,}86)}{1{,}60}.\Delta y_t + \underset{(3{,}21)}{0{,}23}.\Delta i_{t-2}^E - \underset{(-2{,}36)}{0{,}03}.\left(i_{t-1}^E - \left(y_{t-1} - 0{,}59 \ln\left(\frac{C_{t-1}^E}{q_{t-1}^Y}\right) - \underset{(-3{,}21)}{0{,}50} \ln\left(\frac{C_{t-1}^E}{C_{t-1}^K}\right) + \underset{(4{,}46)}{0{,}19} \ln\left(\frac{q_{t-1}^{terrains}}{q_{t-1}^Y}\right) + \underset{(5{,}72)}{2{,}35}\, taux\_épargne_{t-1} \right)\right) + \varepsilon_t$$

The data:

- y_t: value added of NFCs in volume at chained prices. q_t^Y is its price.
- i_t^X investment by NFCs in asset X is measured by the GFCF of the NFCs in volume at chained prices and in asset X.

E groups together "non-residential buildings" assets and K consists of productive assets (i.e. machinery and equipment and intellectual property rights). Annual series are available in the annual accounts. Quarterly accounting supplies series of GFCF to Eurostat by asset in volume at chained prices for all institutional sectors. A quarterly series of GFCF is constructed for NFCs by the calibration-benchmarking method (used in the quarterly accounts), using the series sent to Eurostat as a quarterly indicator for each asset. The price is written q_t^X and δ_t^X the depreciation rate (ratio of consumption of fixed capital in value of asset X to net capital in value in asset X).

- C_t^X: user cost of capital in asset X. It is calculated using the formula:

$$C_t^X = q_t^X\left(r_t - \dot{q}_t^X + \delta_t^X + fisca_t \right)$$

where r_t is the interest rate of 10-year fungible Treasury bonds, $fisca_t$ is the corporate tax rate calculated as the ratio of an aggregation of income tax, various taxes on production and production subsidies, to gross operating surplus and $\dot{q}_t^X$ is the year-on-year price of GFCF in asset X.

$q_t^{terrains}$ is a price index that stood at 100 in 1978 and which evolves in the same way as the ratio of land revaluation to its value the previous year in the NFC balance sheet account. This ratio is an approximation of the annual growth rate of the price of land. The index has been quarterised.

- $taux\_épargne_t$: the ratio of gross savings by NFCs to value added of NFCs in value.■

Box 4 - Robustness of estimates

To test the robustness of the estimates, models were estimated with different long-term equations.

Robustness of the productive assets model

According to the theoretical model, investment in productive assets depends, among various other things, on the relative user cost between productive capital and buildings. However, this term does not appear as significant in the long-term equation (*Table 1*. Column "Variant 1"). Similarly, to estimate the effect of collateral in this model, land prices were introduced into the long-term equation. Once again, the coefficient did not show up as significant ("Variant 2"). These two results suggest that land prices have no effect (positive or negative) in the long term on investment in productive assets.

Robustness of the non-residential buildings model

As the price of the GFCF in non-residential buildings is very much correlated to the price of land holdings, the coefficients corresponding to the user cost of the buildings and to the price of the land are very closely linked. In particular, when freely estimated, the user cost of the buildings does not have the expected negative coefficient, but a positive coefficient, as for the price of land. According to the theoretical model, the coefficient for this user cost should be the same as that for the user cost of productive capital in the productive assets equation (*Box 2*). It is for this reason that in the selected model, the coefficient for the user cost for buildings was constrained. To check that this constraint does not have an excessive influence on the specifications of the selected model, several variants were tested by modifying this constraint. From this analysis it is clear that constraining this term mainly modifies the coefficients associated with the price of land and relative cost (*Table 2*): the higher the absolute value of the imposed coefficient, the more the range of these coefficients is reduced. The investment simulated here is similar in each of these different models. The contributions of the investment determinants are coherent between the different models tested. ■

1 - Different estimates from the long-term equation of investment in productive assets

	Selected model	Variant 1	Variant 2
Long-term variables			
Value added*	1.00	1.00	1.00
User cost	-0.59 (-12.50)	-0.68 (-7.29)	-0.58 (-5.14)
Savings ratio	2.64 (13.66)	2.64 (12.95)	2.64 (10.27)
Relative cost		-0.08 *(-1.10)*	
Ratio of land prices			0.00 *(0.14)*
Short term			
Speed of adjustment	-0.05 (-2.32)	-0.04 (-2.18)	-0.05 (-2.28)
Accelerator effect	0.95 (3.96)	0.99 (4.10)	0.99 (4.45)
Delayed investment as difference	0.34 (4.11)	0.33 (4.06)	0.33 (4.09)

Notes: * means that the coefficient is constrained to 1.
In variant 1, in the presence of relative cost, the coefficient for the user cost of the capital is in fact -0.69 - (-0.08) = -0.60.
In brackets, Student statistics.

2 - Different estimates from the long-term equation of investment in non residential assets

	Selected model	Variant 1	Variant 2
Long-term variables			
Value added*	1.00	1.00	1.00
User cost	-0.59	-0.10	-1.00
Savings ratio	2.35 (5.72)	1.64 (4.52)	2.95 (6.44)
Relative cost	-0.50 *(-3.21)*	-0.69 (-5.00)	-0.35 *(-2.01)*
Ratio of land prices	0.19 (4.46)	0.21 (5.70)	0.17 (3.59)
Short term			
Speed of adjustment	-0.03 (-2.36)	-0.05 (-2.65)	-0.03 (-2.16)
Accelerator effect	1.60 *(5.86)*	1.57 *(5.76)*	1.62 *(5.93)*
Delayed investment as difference	0.23 (3.21)	0.24 (3.24)	0.23 (3.19)
Total year-on-year average contribution of land prices sum of the contributions of land prices and user cost , including the relative cost			
1993-1999	-0.96	-0.76	-1.11
2000-2007	1.60	2.11	1.20
2008-2010	-0.28	-0.14	-0.45
2011-2014	-0.09	0.01	-0.22

Notes: * means that the coefficient is constrained to 1.
In brackets, Student statistics.

Real estate prices appear to have no direct effect on investment in productive assets

The price of land appears to be a significant determinant of investment in non-residential buildings

The price of land affects investments in productive assets and in non-residential buildings differently. Land prices appears to have a significant and positive impact on fluctuations in investment in buildings (*Graph 9*), which could be a result of the collateral effect. During the period 2000-2007, a time of very high real estate inflation, real estate prices taken as a whole (i.e. including user cost of non-residential buildings) contributed an annual average of around +1.8 points to the 5% rise in the annual average of investment in non-residential buildings over the period. Conversely, when land prices fell, for example during the period 1993-1999, they accounted for -0.7 points per year in investment. It is important to point out, however, that the share of investment not accounted for by the determinants in the model is still considerable.

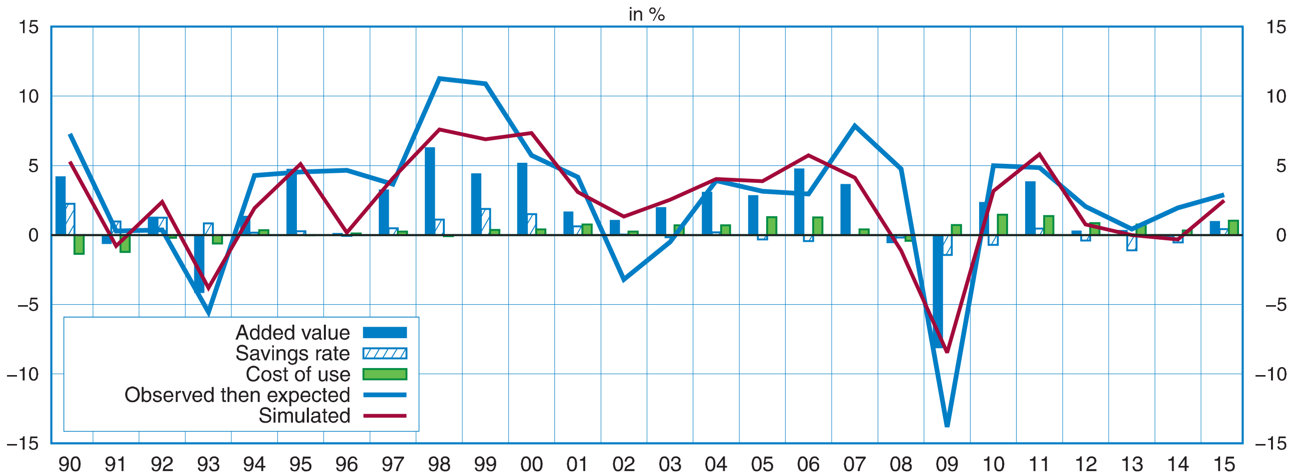
By introducing the price of land as a determinant of investment in non-residential buildings, the model can be improved for periods of real estate inflation, which are also the periods when investment differed according to the type of asset. Indeed, for the period 1999-2007, investment in buildings was much more vigorous than investment in productive assets and this difference seems to result partly from this price rise.

On the other hand, real estate inflation appears to have had no net effect on productive investment

The equation for investment in productive assets shows that user cost is a major determinant, after demand (*Graph 10*). Whereas the investment rate has seen an upward trend since the beginning of the 1990s, the cost of productive capital has decreased relative to the price of value added. This drop has been marginally accentuated by the increase in real estate prices, which has sustained the increase in added value prices. Nevertheless, apart from this contribution *via* the value added price, the steep increases in land prices do not seem to have had a significant effect on investment in productive assets.

Thus the increase in land prices appears to have had a significant and positive impact on investment in buildings but has not influenced investment in productive assets. It therefore appears that companies have not utilised their capacity to use land as collateral in order to borrow more for their productive investment. There are several possible interpretations for this finding. First, when they lend to a company, creditors analyse the risks and the return on the project for the investor. Banks are best qualified to judge the profitability of a project when it includes purchases of real estate, since it is relatively easy and cheaper for them to estimate the price and the return from real estate compared with investment in machinery or R&D. In addition, in the event of liquidation, there is a greater probability of their being reimbursed when the company owns real estate assets. All in all, financing the purchase of real estate can appear to be a safer prospect. In a period of high inflation in real estate, this trend might have increased.

10- Contributions to investment in productive assets



Source: INSEE

Inflation in real estate also leads to a drop in economic profitability and in investment capacity

Nor is this use of company real estate as collateral and its potentially beneficial effect on investment the only possible channel. Two other economic mechanisms operate in opposite directions: return on assets and production costs. Return on assets is usually defined as operating surplus net of fixed-capital consumption as a ratio to capital, which includes non-financial assets. When land prices increases, the total value of corporate assets also increases, which causes the return on assets to decline in accounting terms. Conversely, this decline can make external financing more difficult.[4] In addition, as real estate prices increase, this may lead to a rise in production costs, which may reduce companies' overall investment capacity (Askenazy, 2013).

Companies were also able to use real estate as a financial management tool

Companies were also able to use their real estate investment as a financial management tool. Buildings differ from productive assets in that their operating life is longer, so that the question of deciding between buying and leasing this type of asset arises to a much greater extent.

Variations in real estate prices can expose companies to future financial risk, which could therefore have an effect on the appropriateness of buying or selling real estate. In 2011, for example, Carrefour announced the sale of 97 supermarkets to a financial corporation for the sum of €365 million, while they continued to operate these stores on a rental basis. Conversely, when purchases and sales concern second-hand property rather than new, and they take place within the same institutional sector (NFCs), these individual choices have no influence on investment at macroeconomic level.

All in all, despite the different possible effects of real estate prices on investment, real estate inflation in the 2000s appears to have sustained investment in non-residential buildings, without this being detrimental to productive investment. Since land prices became relatively stable in 2010, they have no longer contributed to the investment momentum, although the rate of investment by NFCs remains high.

Since 2013, land prices can no longer sustain investment in buildings

For the last three years, the turnaround in the real estate market has been accompanied by a downward turn in land price ...

From its high point in 2011, the price of land dropped 3.4% in 2012, then 0.8% in 2013. The price of second-hand residential real estate and the price of land are historically very closely linked: as the former continued to fall in 2014 (-2.4%), it was probable that the downward trend in land prices would do the same. In the estimates, a 4% fall in the price of land in 2014 then a stabilisation in 2015 were selected.

... which may have affected investment expenditure slightly, especially on buildings

According to the model used here, the drop in the price of land contributed negatively to the fall in investment in non-residential buildings, by -0.2 points per year on average between 2009 and 2014. Similarly, the savings ratio and the accelerator effect put a strain on this expenditure at the end of the period concerned, by 0.8 points per year on average since 2009. In 2015, the expected upturn in the savings ratio and the acceleration in demand meant that investment in non-residential buildings could be sustained. All in all, given the determinants, NFC investment in non-residential buildings is likely to be sluggish in 2015 (+0.3% on average) after a rise of 1.6% in 2014. Nevertheless, the earlier variations in housing starts for non-residential buildings and the sharp fall in investment by NFEs in construction products in Q1 mean that stability is not forecast. Growth forecasts for the GFCF of NFEs in construction products, on the basis of housing starts, suggest a downturn of 2.4% on average in 2015 after +3.2% (Investment sheet).

(4) Pamies-Sumner (2009) qualifies this argument by highlighting the difficulty of interpreting the usual profitability indicator and the fragility of the revaluations measurement. This author prefers an economic profitability indicator adjusted for the revaluations effect.

Real estate prices appear to have no direct effect on investment in productive assets

Since 2012, the determinants of productive investment do not account for the dynamism in this sector

Since 2012, productive investment has been more buoyant than what its determinants would suggest. Productive investment has increased 1.5% as an annual average over the period 2012-2014 while value added made only a small contribution (+0.2 points as an annual average for the same period) and the contribution of the savings ratio was negative (-0.7 points as an annual average). These contributions were unfavourable for investment but were partly offset by a fall in user cost (contribution of +0.7 points as an annual average).

In 2015, investment in productive assets is set to accelerate: +2.9% after +2.0%, with the increase in value added contributing +1.2 points and, following on from the rise in the margin rate, the expected sharp rise in the savings ratio accounting for +0.7 points. Notably, the model used here leads to an acceleration in the second half of the year. This forecast is consistent with that for the GFCF of NFEs in products excluding construction (+2.2% in 2015), which takes into account the improvement in prospects described by business leaders in the business tendency surveys.

Conclusion

Although it is likely that the dynamism of land prices contributed to the increase in investment expenditure on buildings between 1999 and 2008, their sluggishness in recent years means that they are no longer making a positive contribution to this type of expenditure. However, the price of land does not seem to have affected expenditure on productive assets, whose fluctuations remain principally dependent upon demand. The downward trend in land prices in the last few years is unlikely ultimately to be unfavourable in the medium to long term: indeed, it is more likely to penalise investment in non-residential buildings, which is less productive than investment in machinery and equipment and in intellectual property rights.■

Bibliography

Aghion P., Askenazy P., Berman N., Cette G. and Eymard L. (2012), "Credit constraints and the cyclicality of R&D investment: evidence from France", *Journal of the European Economic Association*, 10: 1001-1024.

Askenazy P. (2013), "Capital Prices and Eurozone Competitiveness Differentials", Cepremap, *Document de travail* n°13.01.

Berger A. and Udell G. F. (1995), "Relationship lending and lines of credit in small firm finance", *Journal of Business*, vol. 68, p. 351-381.

Bloch L. and Cœuré B.(1995), "Imperfections du marché du crédit, investissement des entreprises et cycle économique", *Économie & prévision,* n° 120, 1995-4, p. 161-185.

British Columbia, Ministry of Finance (2011), "The British Columbia macroeconomic model", *Occasional Working Paper*.

Carbo-Valverde S., Rodriguez-Fernandez F. and Udell G. (2009), "Bank Market Power and SME Financing Constraints", *Review of Finance*, vol. 13, p. 309-340.

Chaney T., Sraer D. and Thesmar D. (2007), "Collateral Value and Corporate Investment, Evidence from the French Real Estate Market", *Document de travail de la Dese* G2007/08, INSEE.

Chaney T., Sraer D. and Thesmar D. (2012), "The Collateral Channel: How Real Estate Schocks affect Corporate Investment", *American Economic Review,* 102 (6) : 2381-2409.

Eudeline J. F., Gorin Y., Sklénard G. and Zakhartchouk A. (2013), "En France, l'investissement des entreprises repartira-t-il en 2014 ?", *Note de conjoncture*, INSEE, December 2013.

Gan J. (2007), "Collateral, Debt Capacity, and Corporate Investment: Evidence from a Natural Experiment", *Journal of Financial Economics* 85 (3): 709-34.

Gorton G. and Kahn J. (1997), "The design of bank loan contracts, collateral, and renegotiation", University of Pennsylvania *Working Paper*.

Johansen S. (1991), "Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models", *Econometrica*, vol. 59, n°6, November 1991, p. 1551-1580.

Kaas L., Pintus P. A. and Ray S. (2014), "Land Collateral and Labor Market Dynamics in France", *Document de travail* n° 530, Banque de France.

Liu Z., Wang P. and Zha T. (2014),"Land-prices and macroeconomic fluctuation", *Econometrica*, 81, 1147-1184.

Mc Fadden D. (1962), *Factor Substitution in the Economic Analysis of Production",* Dissertation, University of Minnesota.

Myers S. (1977), "Determinants of corporate borrowing", *Journal of Financial Economics*, Volume 5, Issue 2, November 1977, p. 147-175.

Observatoire du financement des entreprises (2014), *Rapport sur la situation économique et financière des PME*.

Pamies-Sumner S. (2009), "La rentabilité des entreprises a-t-elle pu justifier le dynamisme de l'investissement ?", *Trésor-Éco* n°44.

Rajan R. G. and Winton A. (1995), "Covenants and collateral as incentives to monitor", *Journal of Finance* 50, 1113-1146.

Sato K. (1967), "A Two-Level Constant-Elasticity-of-Substitution Production Function", *The Review of Economic Studies*, Vol. 34, n° 2, April 1967, p. 201-218.

Stock J. H. and Watson M. W. (1993), "A Simple Estimator of Cointegrating Vectors in Higher Order Integrated Systems", *Econometrica*, vol. 61, n°4, July 1993, p. 783-820.

Uzawa H. (1962), "Production Functions with Constant Elasticity of Substitution", *Review of Economic Studies*, 30, p. 291-299. ■