European Commission
Directorate-General for Economic and Financial Affairs

Fiscal Measures and Corporate Investment in France

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Abstract

The purpose of this paper is to assess the effect of fiscal measures on the investment decisions of French non-financial corporations. As a reference framework, we use the model developed by Eudeline et al. (2013). We extend this framework by introducing the effect of fiscal incentives on investments. We estimate the effect of a decrease in the corporate tax rate in France, which passed from 42 % in 1990 to 33.3 % nowadays and is planned to be reduced to 28 % by 2020 and to 25% in 2022. Fiscal measures are found to have a positive effect on investment, although the growth rate of economic activity and the corporate saving rate remain the main drivers of corporate investment.

JEL Classification: C22, E22, E62.

Keywords: Business investment, aggregate demand, fiscal policy.

Acknowledgements: We would like to thank Carlos Martinez Mongay, Nathalie Darnaut, Martin Larch, Martin Hallet, Aurélien Poissonnier and Allen Monks for their comments.

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1. INTRODUCTION

The purpose of this paper is to contribute to the empirical literature on investment by estimating quantitatively the effect of fiscal reforms on the investment decisions of non-financial corporations in France. Eudeline et al. (2013) use an error-correction model to investigate the main determinants of investment decisions for French non-financial corporations, excluding the construction sector. In their framework, the long-term investment balance is the result of profit maximising behaviour among producers, using a neo-classical two-factor production function. We extend the framework proposed by these authors by assessing the effect of fiscal incentives on corporate investment. Indeed, since the 1990s, a number of fiscal measures have been taken in France in order to encourage investment: the decrease in the corporate tax rate since the 1990s, from 42 % in 1990 to 33.3 % nowadays, 28 % in 2020 and 25% in 2022; the introduction of a tax credit for research (*crédit d'impôt recherche*) , innovation and development investments; or even the introduction of the tax credit for competitiveness and employment (*crédit d'impôt pour la compétitivité et l'emploi, CICE*), which includes provisions that aim to increase investment opportunities for companies. The introduction of fiscal incentives into the econometric framework developed by Eudeline et al. (2013) allows us to calculate the effect of fiscal measures on the growth rate of investment by non-financial corporations. The growth rate of domestic economic activity remains the main driver of French non-financial corporate investment over the short term, while the saving rate is the main driver over the long term. Nevertheless, fiscal measures also help to explain French non-financial corporate investment. According to the specification used, the effect of fiscal subsidies on investment may be large and significant over the long term. In particular, introducing the tax rate on corporate income into the framework of Eudeline et al. (2013), we estimate the effect of the decrease in this variable from 33.3 % to 28 % by 2020, as announced by the 2016 French National Reform Programme.[1] We do not deal instead with the decrease from 28% in 2020 to 25% in 2022 as this measure was recently announced, with no additional specification on how the French government intends to reach this new target.

The investment decisions of individual firms or of industrial groups have already been the subject of other papers aiming at understanding the determinants of investment expenditure. For example, Jorgenson (1971) offers an extensive review of these econometric studies of investment in fixed capital, which all use the flexible accelerator model firstly developed by Chenery (1952) and Koyck (1954) as a starting point. In this model, the actual level of capital is typically a function of current and past levels of desired capital. In a nutshell, the review of empirical papers made by Jorgenson (1971) points out that the most important determinants of desired capital are the capacity utilisation of the capital of a firm or a group and the cost of external funds. In another study, Hayashi (1982) reviews Tobin's 'q' model', stressing the link between investment decisions and stock price movements. According to this theory, a firm is encouraged to invest if the market value of its capital — measured by the price of its stock — is higher than the actual replacement cost of its capital.

This paper explores the relationship between investment and fiscal incentives using an error correction model. Two studies can be cited in this regard. First, Muet and Avouyi-Dovi (1987) show the effect of fiscal incentives on firms' investment decisions in France by constructing an index summarising the key fiscal measures adopted in France between the 1960s and the 1980s that aimed to decrease the cost of capital of French firms. They find that fiscal measures have a significant and positive effect on investment, leading private investment to increase by 1.5 times their cost in terms of public finances. The more a fiscal scheme is perceived as simple and effective by firms, the more firms react, while the effect of a scheme reduces as soon as it is perceived as permanent. In addition,

[1] http://ec.europa.eu/europe2020/pdf/csr2016/nrp2016_france_en.pdf.

the authors find that, although the effect of fiscal measures can be quick enough to be employed as an instrument of economic policy, it takes more time to materialise than other economic policy actions, such as public investment, and can become negative whenever a fiscal measure is stopped. As a result, Muet and Avouyi-Dovi (1987) conclude that fiscal measures can be used as a tool to enact structural reforms, but only if clearly targeted for the development of key activities or key sectors (e.g. energy, or research and development). Second, Avouyi-Dovi et al. (1991) reach similar results using an 'accelerator model', where investment dynamics are related to output growth other than to variables such as firms' expectations about future sales, the capacity utilisation rate of a firm, and the level of economic uncertainty. In this framework, fiscal incentives let investment grow, with multiplicative effects ranging between 1.15 and 1.34, under the hypothesis that firms are not financially constrained. Indeed, fiscal incentives can decrease the cost of capital and hence lead firms to invest more, unless their profits are constrained. In this case, a decrease in the cost of capital due to a decrease in the interest rate has a larger effect in stimulating investments.

The rest of this work is organised as follows. Section 2 describes the variables and the dataset used, Section 3 describes the econometric model and the main results, and Section 4 concludes. The two appendices at the end of the paper discuss the fit of the model for the different frameworks considered, and provide a robustness check of the model by showing the results of an out of sample estimate.

2. DESCRIPTION OF VARIABLES AND DATASET

We use quarterly national accounts data (Insee), annual national accounts data on fixed assets and gross fixed capital formation (Insee) and the 10-year government benchmark bond yields (Banque de France). The main variables used in the econometric models of Section 3 are as follows.

- The **level of investment**, i_t^k is represented by the logarithm of the gross fixed capital formation of non-financial enterprises, excluding those operating in the construction sector.

- The **level of economic activity**, y_t is proxied by the logarithm of value added produced by firms operating in the business sector, instrumented by data on quarterly household consumption (excluding agricultural products and non-market services) and on quarterly exports of non-agricultural market branches.

- The **savings rate of non-financial corporations**, s_t is defined as the ratio between the gross savings of non-financial corporations divided by their gross value added. We choose not to use the saving rate of the economy, as this would have introduced some endogeneity, being strictly linked to the aggregate consumption and hence to the level of economic activity of a country.

- The **cost of capital,** $c_t^k = p_t^i\,(\delta_t + r_t - \dot{p}_t^i)\,/p_t^y$ is obtained as the product between the deflator (p_t^i) of non-financial enterprises' gross fixed capital formation and the sum of the capital depreciation rate (δ_t) and the interest rate (r_t) proxied by the 10-year French government benchmark bond yield, net of the year-on-year percentage change in the value of the investment deflator ($\dot{p}_t^i$). The cost of capital is then divided by the value-added deflator, p_t^y. In turn, the capital depreciation rate is calculated using the annual data on the fixed assets non-financial corporations' (a_t) and the gross fixed capital formation of the market sector excluding construction, financial and real estate services (i_t^m): $\delta_t = 1 - \frac{a_t}{a_{t-1}} + \frac{i_t^m}{a_{t-1}}$. Given the different frequencies of data concerning gross fixed capital formation, government bond yield and depreciation rate, exponential smoothening has been applied to capital depreciation for reducing the steps visible in the series at the end of each year. While this improves the estimates described in the following section, it comes at the cost of truncating the sample in 2012, hence reducing its length by two years.

- The **cost of capital modified by the index of fiscal measures,** $c_t^{k*} = c_t^k \theta$. In the following section, the cost of capital is modified in order to take into account the index of fiscal measures. This index is constructed on the basis of the methodology developed by Muet and Avouyi-Dovi (1987), as explained in Box 1. This modified cost of capital allows for the effect of fiscal measures on the investment decisions of French non-financial corporations to be quantified.

- The **corporate income tax rate,** τ. The corporate income tax rate is the statutory rate on corporate taxable profits. It is used as an alternative way to estimate the effect of fiscal measures on investment, at the cost of reducing the field of analysis to only one specific fiscal measure.

Box 1: CONSTRUCTION OF AN INDEX OF FISCAL MEASURES[2]

In this study, we incorporate into the model a variable which is most often not considered in other studies about investment: taxation. Over the last decades, different fiscal measures have been taken in France in order to encourage investment and research.

This topic has been studied previously. Muet and Avouyi-Dovi (1987), for example, show the effect of fiscal incentive, using delayed investment (because there is a period of time between when the investment decision is taken and when the investment is actually realised). They introduce a fiscal measure index taking into account, for example, tax deduction to reduce tax rates or increase the depreciation rate. The result is that fiscal incentives for investment are effective in the short term, but less efficient in the long term because there is a reduction of the effects of the measures. Besides, there may be a negative impact when a measure is stopped.

Another important article on this question (Avouyi-Dovi and al. 1991) also finds that French companies are reactive to incentive measures regardless of their form, but the scale of effects remains limited compared to a policy aiming at raising demand. The authors still argue that the direct tax seems to have higher effects on investment than the other types of incentive measures.

The cost of capital is the product of three elements: the price of investment (q), an actualisation factor (AC) and an index of fiscal measures (θ).

The actualisation factor is the sum of the real actualisation rate (i.e. the nominal rate (r) modified by corporate tax rate τ, minus the rise in the production price ($\dot{p}$): $[(1-\tau)r-\dot{p}]$) and the replacement cost of equipment. This latter stems from the combination of two factors, namely the physical depreciation of equipment goods (δ) and the obsolescence limiting its usefulness duration to T years:[3]

[2] We thank Mr Frédéric Pinto Da Rocha for his efficient contribution for the construction of this index.

[3] The numerator, $[(1-\tau)r-\dot{p}+\delta]$, which multiplies the cost of investment, is constructed as an opportunity cost. Indeed, the cost of using a given sum to buy a unit of capital corresponds to the yield (adjusted for fiscal rate) that this sum would have granted, if it had been alternatively allocated on financial markets, plus the depreciation of capital that will be undergone, minus the appreciation of capital value linked to inflation (investing today and not in the next period enables to save money if the investment's value increases, taking into account that there is some depreciation at the same time that alters this favourable effect). The denominator follows a different logic since it captures the cost linked to obsolescence of the investment, which will be all the higher as duration is short: even if the investment good is physically unaltered, its usefulness diminishes over time in particular in connection with technical progress. Exponential is used for denominator because obsolescence follows the same idea as amortisation, which is most often taken into account with an exponential law.

$$AC = [(1-\tau)r - \dot{p} + \delta][\frac{1}{(1-e^{-((1-\tau)r-\dot{p}+\delta)T})}]$$

The formula for the calculation of the index of fiscal measures, θ, taken from Avouyi-Dovi and Muet (1987) synthetises the different types of incentives used over the period: k_1, k_2 (see definitions hereafter) and the actualised value of the reduction of taxes paid in connection with the fiscal amortisation of equipment (see last part of the formula). This latter comes from the fact that a sizeable part of equipment is amortised following an exponential rule over an amortisation time T_f, α being the coefficient used for amortisation. The overall formula of fiscal index is as follows:

$$\theta = \frac{1}{(1-\tau)}[1 - k_1 - k_2\tau - \frac{(1-k_1)\alpha\tau}{(1-e^{-\alpha T_f})}\frac{1-e^{-(\alpha+(1-\tau)r)T_f}}{\alpha+(1-\tau)r}]$$

With:

τ the corporate income tax rate ('*impôt sur les sociétés*');

k_1 the rate that reduces taxes / the rate of fiscal deduction that diminishes the amount of tax and the amortisable basis;

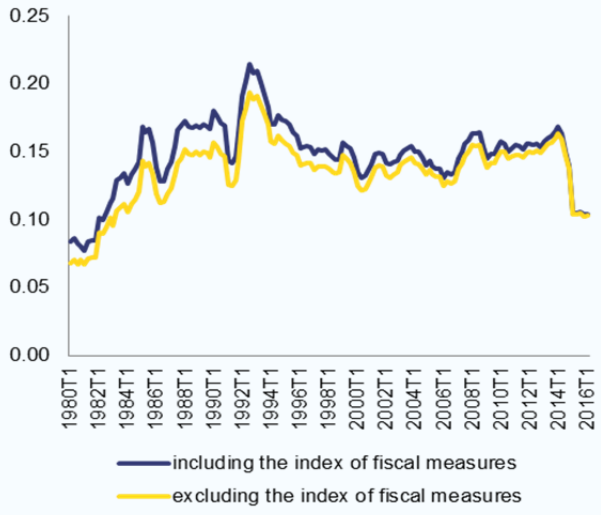
k_2 the rate that reduces the taxed benefit, without any effect on the amortisable basis. Such measures, for instance, have been taken in 1979-1980 and in 1981-1982;

T_f the time over which investment is amortised;

α the amortisation coefficient, which is obtained based on official fiscal amortisation rates. This is different from the physical depreciation of equipment goods (δ), which corresponds to the effective depreciation and is obtained with national accounts, knowing that the stock of capital of a given period is equal to the stock of capital of the previous period multiplied by one minus depreciation rate, augmented by investment between these two dates;

r the anticipated long-term interest rate. Having no homogenous measure of anticipations over the period, the current level is used instead.

Figure: **Cost of capital, including and excluding the index of fiscal measures**



Source: own calculations

3. DESCRIPTION OF THE MODEL AND RESULTS OF THE ESTIMATION

The econometric analysis carried out in this paper is based on an error correction model, where investments depend both on short-term determinants, such as value added or past changes in investments, and long-term determinants, like the saving rate and the cost of capital.[4] On the basis of Eudeline et al. (2013), investment decisions of French non-financial corporations are assessed and their main macroeconomic determinants are discussed looking at the period 1980-2010.[5] To this framework, we then add an index of fiscal measures (see Box 1 for the construction of this index), similarly to what Muet and Avouyi-Dovi (1987), to assess the effect of fiscal incentives on investments.

As Eudeline et al. (2013), we can use the following equation as a baseline:

Equation 1: baseline, excluding fiscal variables.

$$\Delta i_t^k = \underset{(0.002)}{-0.002} + \underset{(0.291)}{1.50}\,\Delta y_t + \underset{(0.072)}{0.31}\,\Delta i_{t-1}^k - \underset{(0.018)}{0.044}\,(i_{t-1}^k - y_{t-1} + \underset{(*)}{0.38}\,c_{t-1}^k - \underset{(*)}{1.98}\,s_{t-1})$$

s.e.

Adjusted R^2 = 0.558, RMSE = 0.0119.

No. of observations = 127.

where, as introduced in section 2, i^k represents non-financial corporate investment, y the economic activity, c^k the cost of capital, and s the saving rate. Instrumenting the level of activity with household consumption and non-agricultural exports allows avoiding endogeneity, since investment is itself a component of aggregate value added.[6]

The equation used as the baseline framework is an error correction model, resulting from the sum of two main components. The first component drives the changes in the observed growth rate of the French non-financial corporations' investment (Δi_t^k) over the short-term. It is made up by the growth rate of economic activity (Δy_t) and by the growth rate of French non-financial corporate investment observed in the previous period (Δi_{t-1}^k). The second component, instead, drives the changes in the observed growth rate of the French non-financial corporations' investment over the long-term. It is the sum of the level of the investment rate ($i_{t-1}^k - y_{t-1}$), their saving rate (s_{t-1}) and the cost of capital (c_{t-1}^k) in the previous period. In other words, the long-term component in Equation 1 can be interpreted as the equilibrium level towards which investment of non-financial corporations tends in the long-run, while the short-term component contains the adjustment speed of changes in the current level of investment towards the long run equilibrium.

A faster economic activity growth rate, higher investments in the previous period, or an increase in the saving rate, lead to a faster growth of investment, while a rise in the cost of capital reduces

[4] For similar model of investments, see Eudeline *et al.* (2013), Fortin et al. (2015), Barkbu et al. (2015) and Bussière et al. (2015). Note that all variables entering into the long-run equation are all order one-integrated.

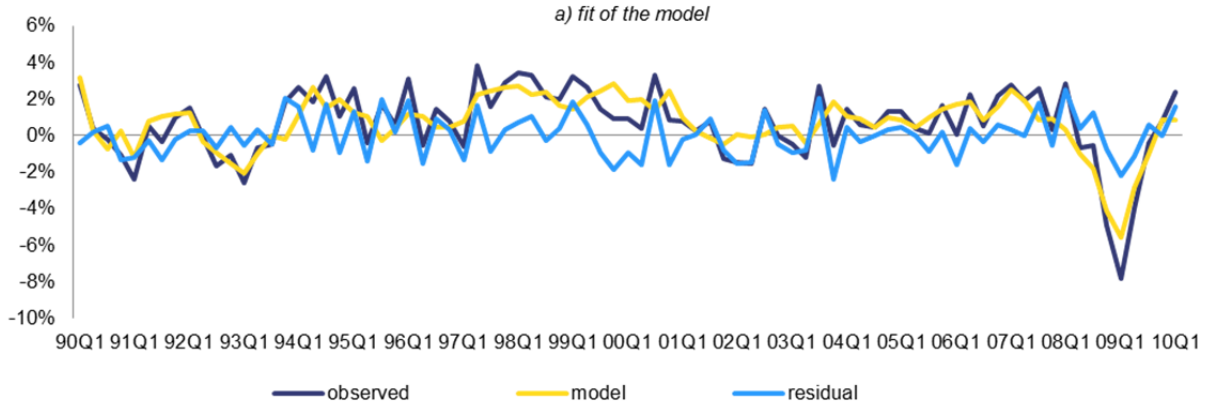
[5] In contrast to the original equation estimated by Eudeline *et al.* (2013), we use the savings rate of non-financial corporations instead of the profit margin of non-financial enterprises as it was done in the updated version of this equation presented in Hauseux et al. (2015). .

[6] The stationarity of the residuals has been successfully tested for all the equations presented in this paper.

investment growth. Over the short term, a faster growth rate of economic activity in the current period or a faster growth rate of investments in the previous period lead to a faster growth of investment. The strength with which changes in economic activity lead to changes in corporate investment reveals the presence of an accelerator effect, given that the coefficient attached to the variable Δy_t is larger than 1 (1.50). This accelerator effect is comparable with the results of other papers that have estimated an investment model for non-financial corporations using data for France. For example, the forecasting model developed by Daubaire et al. (2017) estimates investment as a function of the growth rate in the economic activity, cost of capital and capacity utilisation rate. The economic activity growth rate is equally found to be the main determinant of investments, with an accelerator effect of 1.17. Besides, even if small, the lagged change in the level of investment has a positive and significant effect on the current change in the level of investment (0.31). In turn, observed changes in the level of investment are magnified by the economic cycle and take some time to build.[7] Moreover, over the long run, past increases in the cost of capital lower the growth rate of investment by French non-financial corporations, while higher saving rates lead to higher investment. In the same fashion as for the short term, changes in the saving rate have a stronger effect on the investment of French non-financial corporations, being associated with a coefficient of 1.98. The effect of a variation in the cost of capital on investment is instead positive, but rather contained (0.38).

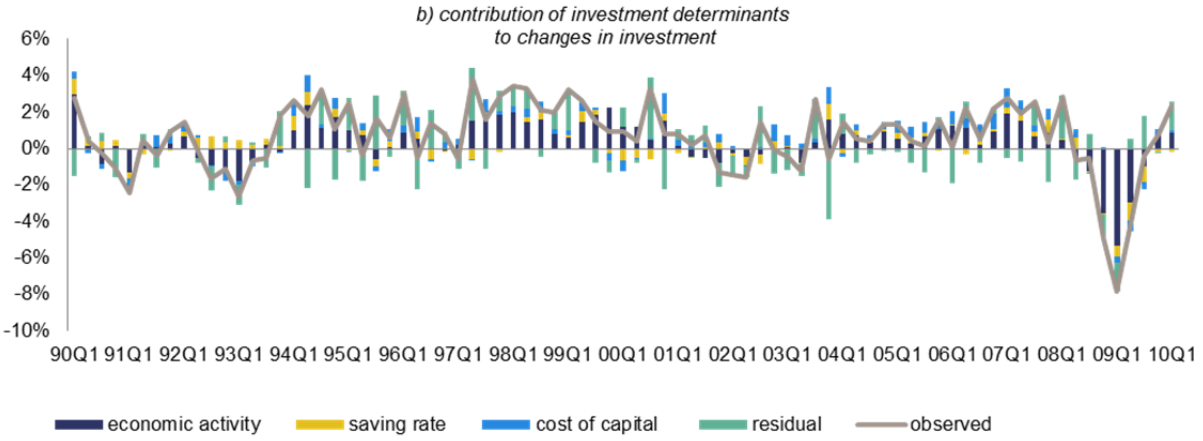
Calculating the contribution of the different investment determinants, Figure 1 (b) points out that changes in the economic activity can explain the bulk of the observed changes in investment.[8] The importance of changes in the economic activity in determining changes of investment rose over the 1990s. Between 1990 and 1992, the growth rate of the observed changes in the investment of French non-financial corporations oscillated within a range of about -2 % and 2 %, due to a decrease in the economic activity rate in the last quarters of 1992, followed by a gradual accumulation in the level of savings and by a decrease in the cost of capital. Between 1993 and 1994, a new deceleration in the economic activity, a decrease in the saving rate and an increase in the cost of capital led to an additional period of negative investment growth. This period was followed by seven years, from 1994 to 2001, of investment growth and another long slump, from 2001 to 2005. Lastly, between 2005 and 2008, the decrease in the cost of capital and the acceleration in economic activity led to a new period of investment growth, interrupted by the unfolding of the financial crisis in 2008. That led to a drop in the growth rate of investment, partially caught up in 2010.

Figure 1: **Fit of the model described in equation 1 (a) and contribution of the different investment determinants to changes in investment (b)**



[7] Note that this is either from inside or outside the borders of France (i.e. consumption and exports).

[8] The figures included in the Appendix C of this work replicate Figure 1 on the basis of the economic framework including the index of fiscal measures.



Source: own calculations

Next, in the baseline framework discussed above, we replace the original time series for the cost of capital (c^k) with its modified version (c^{k*}). As explained in Section 2, this latter takes into account the index of fiscal measures that we construct on the basis of Muet and Avouyi-Dovi (1987). In turn, the model represented by Equation 1 is modified as follows:

Equation 2: baseline framework modified with the cost of capital including the index of fiscal measures realised on the basis of Muet and Avouyi-Dovi (1987).

$$\Delta i_t^k = \underset{s.e.}{\underset{(0.002)}{-0.002} + \underset{(0.295)}{1.48\,\Delta y_t} + \underset{(0.072)}{0.31\,\Delta i_{t-1}^k} - \underset{(0.022)}{0.053}\,(i_{t-1}^k - y_{t-1} + \underset{(*)}{0.62}\,c_{t-1}^{k*} - \underset{(*)}{2.35}\,s_{t-1})}$$

Adjusted R^2 = 0.559, RMSE = 0.0119.

No. of observations = 127.

The introduction of the index of fiscal measures reinforces the effect of the cost of capital on investment, although the rate of economic growth and the saving rate remain the two fundamental investment determinants. By comparing Equation 2 with Equation 1 used as a baseline framework, it appears that modifying the cost of capital by considering the effect of fiscal measures improves the overall performance of the model, as it increases the adjusted R^2 while not rising the root-mean-square error (RMSE) of Equation 2. Also, it appears that the balance between the short-term and the long-term determinants of the investment of French non-financial corporations is shifted towards the long term once fiscal measures are taken into account. Indeed, the weight attributed to the long-term part of the equation taking into account the index of fiscal measures increases, as the coefficient introducing the terms into the parenthesis — i.e. the long-term component of the error correction mechanism — rises (0.053 compared with 0.044).[9] Also, the coefficients attached to the cost of capital modified by the index of fiscal measures (c^{k*}) and to the saving rate increase (respectively from 0.38 to 0.62 and from 1.98 to 2.35) and remain significant in the long term equation. This implies that introducing fiscal policies into the baseline framework increases the long-run equilibrium linking investment decisions with the cost of capital and the saving rate. By contrast,

[9] The difference between the two coefficients becomes not statistically different from 0 when taking into account the two standard errors.

short-term coefficients are only marginally changed. However, fiscal measures do not change the overall picture coming out from the baseline framework, as the key additional determinant of the French non-financial corporations remain the growth rate of activity and the saving rate.

To give more evidence to the effect of fiscal measures on investment, we separate the index of fiscal measures (θ) from the cost of capital, modifying as follows Equation 2:

Equation 3: baseline framework including the index of fiscal measures realised on the basis of Muet and Avouyi-Dovi (1987), separated from the cost of capital.

$$\Delta i_t^k = -0.002 + 1.51\,\Delta y_t + 0.31\,\Delta i_{t-1}^k - 0.19\,\Delta\theta_t - 0.050\,(i_{t-1}^k - y_{t-1} + 0.60\,c_{t-1}^k - 2.36\,s_{t-1} + 0.63\,\theta_{t-1})$$

s.e. (0.002) (0.295) (0.071) (0.091) (0.022) (*) (*) (*)

Adjusted R^2 = 0.570, RMSE = 0.0118.

No. of observations = 127.

With the index of fiscal measures set apart, the coefficient of fiscal measures on investment remains close to the one attached to the cost of capital, confirming the results of Equation 2. The specification of Equation 3 further improves the performance of the model, both in terms of adjusted R^2 and RMSE. In addition, in Equation 3 the fiscal index has a significant impact on the investment growth rate over the long run. This impact is significant at the 1 % level and shows the expected sign, i.e. an increase in the value of the fiscal index has a negative effect on the growth rate of investment. Notably, when looking at the long term component of Equation 3 and assuming the absence of any short term adjustment, a fall in the fiscal index by 1 % involves an increase in the investment rate with approximately the same magnitude of the cost of capital (0.63). In the short run, the fiscal index is also significant but only at the 5 % level, consistently with the fact that short-term punctual measures to support investment have been rather limited in number and scope over the period considered. The resulting short-term elasticity is -0.19, implying that a 1 % increase in the index of fiscal measures leads to a -0.2 % change in the growth rate of investment over the short run.

The framework developed above can be further modified to assess the impact of the planned reduction in the corporate income tax rate from 33 % to 28 % at horizon 2020. The corporate income tax rate represents between 34 % and 41 % of the index of fiscal measures. Although not being a perfect substitute for the whole index of fiscal measures, it is possible to isolate this variable and use it to replace the index of fiscal measures in Equation 3:

Equation 4: modified framework, including the corporate tax rate instead of the index of fiscal measures realised on the basis of Muet and Avouyi-Dovi (1987).

$$\Delta i_t^k = -0.002 + 1.50\,\Delta y_t + 0.32\,\Delta i_{t-1}^k - 0.01\,\Delta\tau_t - 0.048\,(i_{t-1}^k - y_{t-1} + 0.70\,c_{t-1}^k - 2.20\,s_{t-1} + 0.24\tau_t)$$

s.e. (0.002) (0.288) (0.073) (0.060) (0.020) (*) (*) (*)

Adjusted R^2 = 0.554, RMSE = 0.0119.

No. of observations = 127.

Also the corporate income tax rate (τ) has a positive and significant effect on the growth rate of investment. The effect of changes in the corporate tax rate on the growth rate of investment is significant in the long run (at the 1 % level), although the magnitude of the coefficient linked to changes in the corporate income tax rate is relatively small (0.24) with respect to the other long term determinants of investment considered in Equation 4. Indeed, passing from Equation 3 to Equation 4

there is a reduction in the overall level of significance of the model, measured in terms of both adjusted R^2 and RMSE. This is due to the inclusion of the corporate income tax rate in the baseline framework. Although this brings new information to the model, it is not able to fundamentally change the results of the baseline framework in Equation 1. The growth rate of economic activity and the corporate saving rate remain the fundamental drivers of the investment decisions for French non-financial corporations.

Considering the tax rate separated from other fiscal variables allows calculating the direct impact of changes in the corporate tax rate on the investment growth rate. Table 1 reports the impulse response functions of the different explanatory variables used in the different frameworks illustrated above. Using Equation 3 and under the 'everything else being equal' hypothesis,[10] if the corporate income tax diminished from 33.3 % to 28 % for all companies, non-financial corporation investments would rise by around 0.18 % after a year, to 0.27 % after 5 years and to 0.30 % after 20 years.[11] This effect is the result of the indirect link existing between the corporate income tax rate and the investment growth rate. This indirect link implies that the effect of a change in the corporate income tax rate on investment is given by the combined effect of the θ's impulse response function based on Equation 3 and of the index of fiscal measures θ's reaction to a 1 % change in the corporate income tax rate (0.09 %). By contrast, on the basis of Equation 4, the direct estimate of this decrease in the corporate income tax rate would be positive and increasing over time, with a rise in the French non-financial corporate investments by 0.35 % after a year, 0.99 % after 5 years and up to 1.26 % after 20 years. The difference between the estimate obtained on the basis of Equation 3 and on the basis of Equation 4 is due to the fact that estimates based only on the corporate income tax rate do not take all effects that may influence the investment's reaction into account, such as those deriving from changes in other fiscal measures or in the amortisation rate. In Equation 3, indeed, a reduction in the tax rate reduces the fiscal incentives granted through the amortisation factor and other fiscal deductions. In turn, these reduced fiscal incentives diminish the effect of a change in the tax rate. In Equation 4, by contrast, the indirect effects of a change in the tax rate on other fiscal incentives do not play any role. Only the direct effect of a change in the tax rate on investment is taken into account. Hence, Equation 4 constitutes a simpler framework with respect to the one of Equation 3, which may lead to estimate larger effects of a change in the tax rate on the investment decisions of French non-financial corporations.

Table 1: **Impulse response functions**[12]

	Equation 1: **no fiscal measures**	**Equation 2:** **cost of capital including index of fiscal measures**	**Equation 3:** **index of fiscal measures separated from cost of capital**	**Equation 4:** **corporate income tax rate replacing the index of fiscal measures**
Value added (y)				
1 year	1.88 %	1.80 %	1.86 %	1.86 %

[10] The ceteris paribus hypothesis consists in assuming constant all the other variables considered by companies when deciding to invest (e.g. the amortisation coefficient).

[11] These values are obtained by multiplying by 16 % the value of the impulse response functions reported in Table 1.

[12] The values reported in Table 1 are not expressed in cumulative terms.

5 years	1.29 %	1.21 %	1.25 %	1.25 %
10 years	1.07 %	1.04 %	1.05 %	1.05 %
15 years	1.02 %	1.00 %	1.01 %	1.01 %
20 years	1.00 %	1.00 %	1.00 %	1.00 %
Saving rate (s)				
1 year	0.57 %	0.79 %	0.75 %	0.69 %
5 years	1.51 %	1.93 %	1.89 %	1.75 %
10 years	1.86 %	2.27 %	2.25 %	2.10 %
15 years	1.95 %	2.33 %	2.34 %	2.18 %
20 years	1.97 %	2.34 %	2.35 %	2.20 %
Cost of capital (c^k)				
1 year	-0.11 %	-0.21 %	-0.19 %	-0.22 %
5 years	-0.29 %	-0.51 %	-0.48 %	-0.56 %
10 years	-0.35 %	-0.60 %	-0.58 %	-0.67 %
15 years	-0.37 %	-0.61 %	-0.60 %	-0.70 %
20 years	-0.38 %	-0.62 %	-0.60 %	-0.70 %
Index of fiscal measures/corporate income tax rate (θ/τ)				
1 year	-	-	-0.39 %	-0.07 %
5 years	-	-	-0.56 %	-0.19 %
10 years	-	-	-0.61 %	-0.23 %
15 years	-	-	-0.63 %	-0.23 %
20 years	-	-	-0.63 %	-0.24 %

Source: own calculations

4. CONCLUSIONS

The aim of this study is to provide an empirical estimate of the impact of fiscal measures on investment in France. We introduce an index summarising the key fiscal measures adopted in France between 1980 and 2014 in the model presented in Eudeline et al. (2013) and we assess how fiscal incentives have changed over this period and their impact on investment. We construct an index of the key fiscal measures following Muet and Avouyi-Dovi (1987) to modify the original cost of capital time series.

The main drivers of corporate investment are the growth rate of economic activity and the corporate saving rate. The former affects the growth rate of investment by French non-financial corporations over the short term, while the latter affects it over the long term. In the short term, the growth rate of investment positively depends both on the growth rate of economic activity and on its own lagged value. The main determinants of non-financial corporate investment over the long run are the cost of capital and the saving rate.

Fiscal measures have yet a positive and significant impact on non-financial corporate investment, especially in the long run. The direct introduction of fiscal measures into the framework of Eudeline et al. (2013) allows us to calculate the effect of a change in fiscal variables on the rate of investment growth of French non-financial corporates. The effect of fiscal measures is significant both in the long and the short term. Moreover, the effect of fiscal measures seems quite robust to the way in which fiscal variables are inserted into the framework of Eudeline et al. (2013). As an example, in Section 3 we calculated the effect of the decrease in the corporate income tax rate announced in the 2016 French National Reform Programme. Such a decrease would lead to a rise in corporate investment up to 1.26 % after 20 years.

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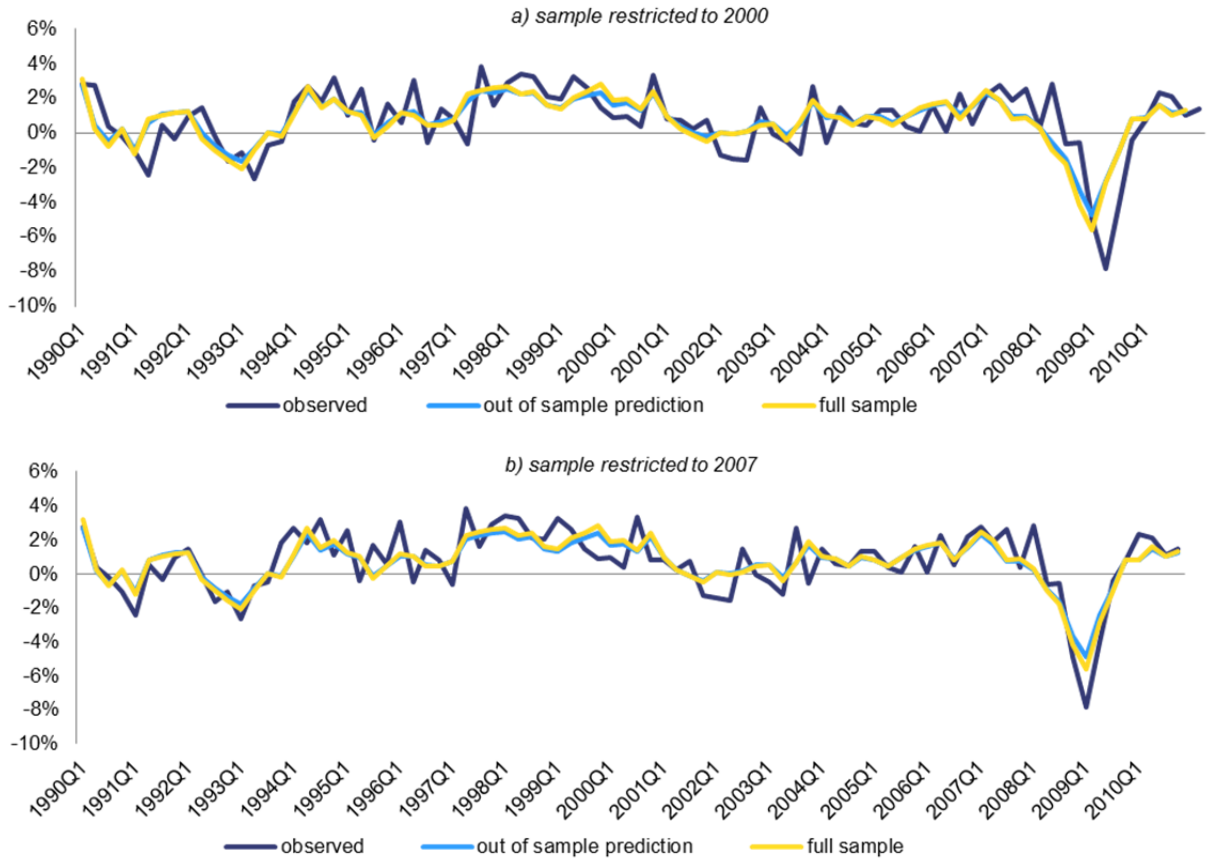
ANNEX I

Out of sample forecast

As robustness test of the framework used throughout the main body of this work, we perform out of sample forecasts, in order to assess to what extent estimates depend on the period used. In particular, we restrict the dataset in two ways. First, we consider only data up to 2000 and we re-run the model as described in Equation 1. Second, we restrict the sample of data up to 2007 (again, not including the crisis period, which may have changed the investment behaviour) and run again the model of Equation 1. In both cases, the estimated investment growth rate of French non-financial corporations is not affected by the restriction of the sample, as shown in Figure B.1. Indeed, in both cases, the growth rate of French non-financial corporations estimated using the whole data sample is in line with the one obtained either on the basis of the data sample restricted up to 2000 or to 2007.

Figure B.1.: **Out of sample forecast**

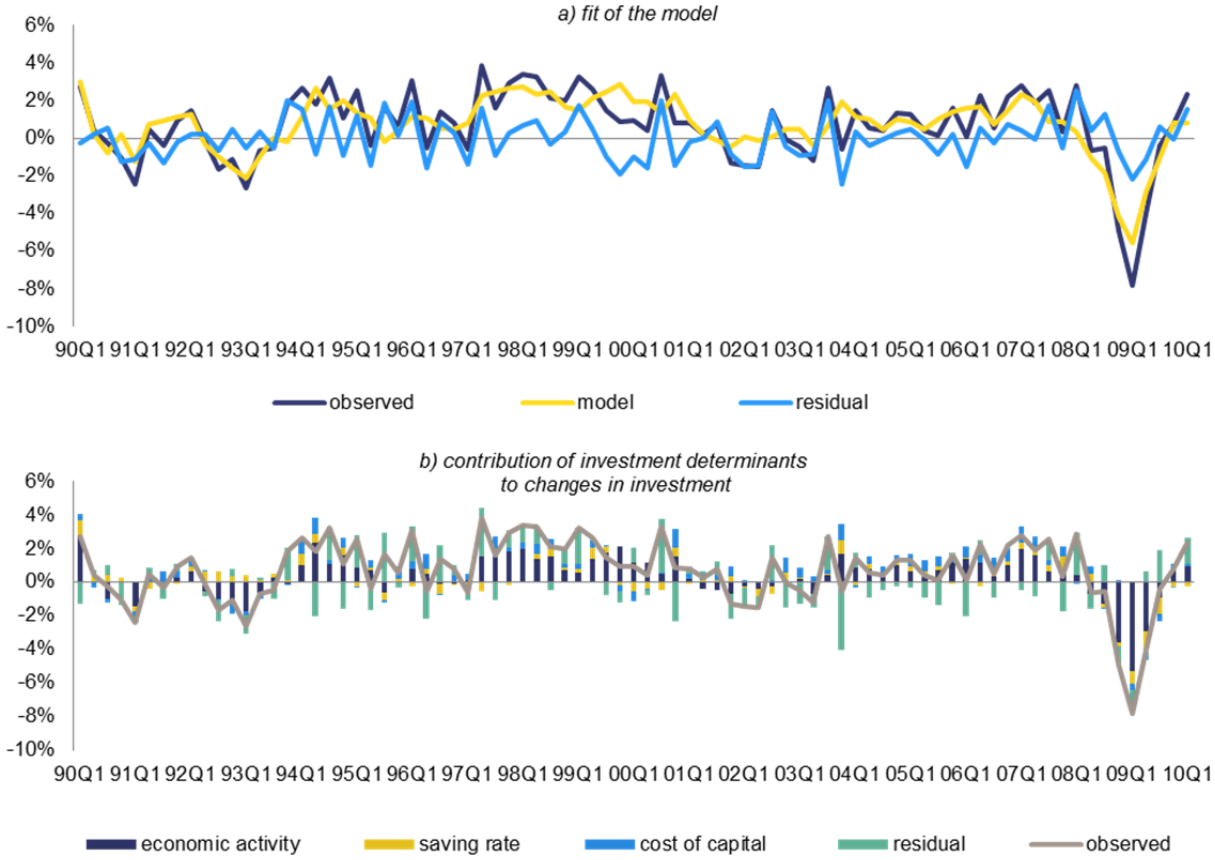


Source: own calculations

ANNEX II

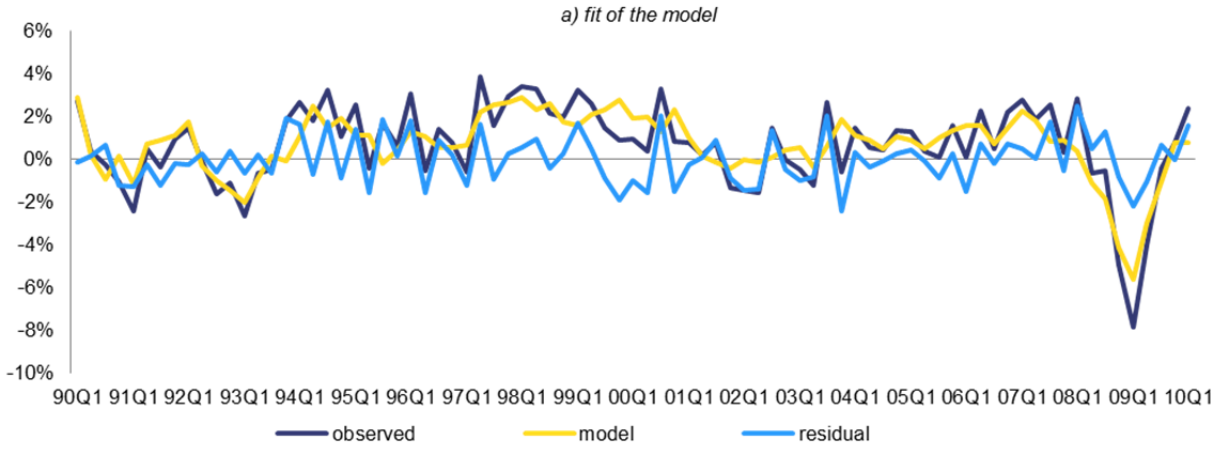
Fit of the model including fiscal measures

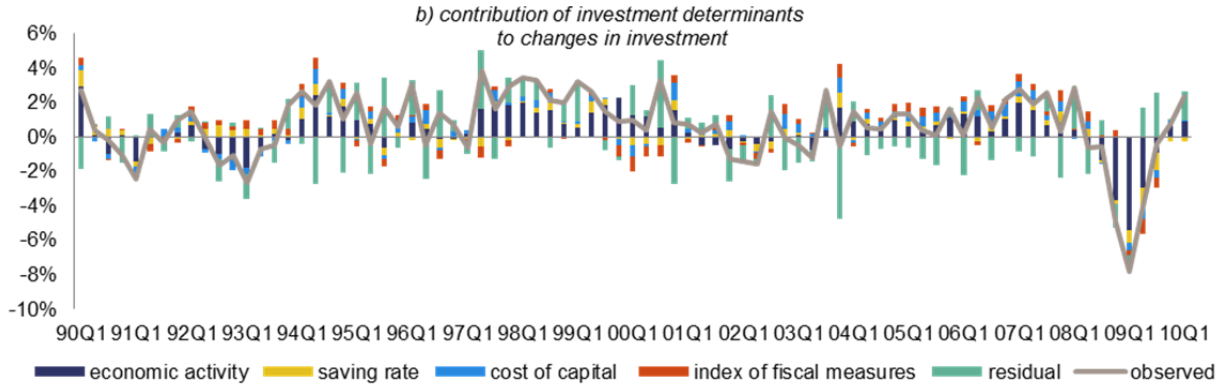
Figure C.1.: **Fit of the model described in equation 2 (a) and contribution of investment determinants to changes in investment (b)**



Source: own calculations

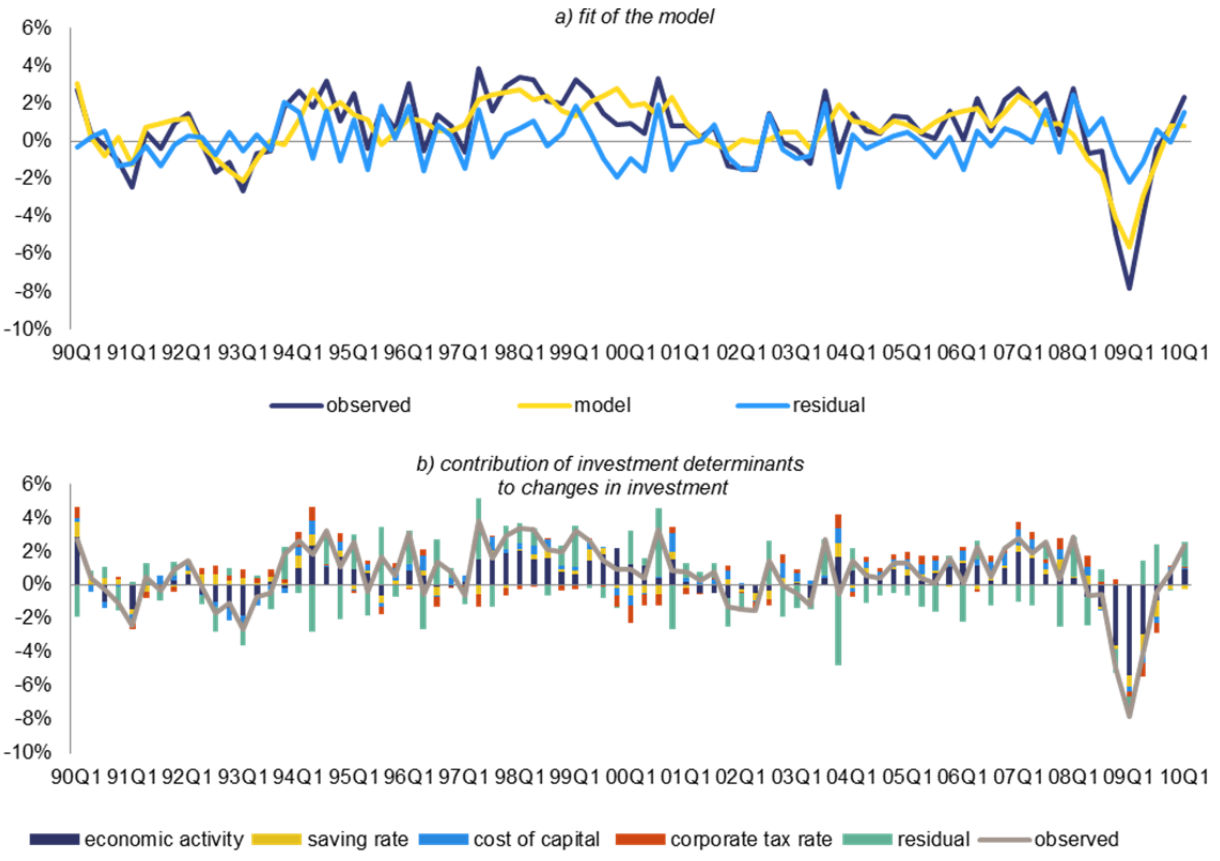
Figure C.2.: **Fit of the model described in equation 3 (a) and contribution of investment determinants to changes in investment (b)**





Source: own calculations

Figure C.3.: **Fit of the model described in equation 4 (a) and contribution of investment determinants to changes in investment (b)**



Source: own calculations