Carbon Tax, Pensions and Public Deficits: The hidden cost of the compartmentalization of expertise

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Abstract

This paper aims at raising attention to two intertwined issues. The first one concerns the consequences of the prevailing intellectual compartmentalization between questions related to energy and climate on the one hand, and to the viability of social security systems on the other (the viability of those systems is challenged by the increasing exposure to international competition and the ageing of the population). The second issue is about the fact that expertise on the funding of pensions are conducted under partial equilibrium analysis and ignore the general equilibrium effects of the various funding options on competitiveness, employment and wages.

We take the methodological venture of building a general equilibrium vision of France for 2020 that is consistent with a scenario of the *Conseil d'Orientation des Retraites*. We first emphasize the limitations of policies that either *i)* use only one of the present instruments of the pension system (social contributions, retirement age), or *ii)* look for new resources by only considering an increase of income tax or VAT. Then we present a way to remove those limitations by introducing a carbon tax as a component of a policy package designed to absorb the deficits of the social accounts. We show that the current compartmentalization of expertise is dangerous, both for the funding of the pension system as well as for removing the obstacles to an ambitious climate policy.

Keywords

Tax Reform; Pensions; Carbon Tax; Public Deficits; General Equilibrium

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1 Introduction

France, like most of the industrialized countries, is facing three long-term problems: the fight against climate change, the ageing of its population and the cutting of its public deficits. Those problems must be faced simultaneously but they are usually treated separately (Quinet, 2009; Rocard, 2009; COR, 2010).

However, one cannot identify some possible economic synergies or antinomies from separated analysis. How to be sure that a solution identified for any of these problems do not jeopardize the settlement of others? How to plan the possibility of a mutually beneficial solution? This justifies addressing these problems together. A comprehensive response would clearly constitute a strategy for sustainable development (Godard et Beaumais, 1993; Jospin et Aglietta, 2010) and could ease the political acceptability of a tax reform (Agell et al. 1996).

In this paper we aim at raising attention to two intertwined issues. The first one concerns the consequences of the prevailing intellectual compartmentalization between questions related to energy and climate on the one hand, and to the viability of social security systems on the other. The second issue is about the fact that existing evaluations of the pension systems ignore the general equilibrium effects of the various funding options on competitiveness, employment and wages.

We take the methodological venture of building a general equilibrium vision of France for 2020 that is consistent with a scenario of the *Conseil d'Orientation des Retraites*. First, we show that including this forecasting analysis of the pension system into a general equilibrium framework that take into account energy and demand allows us to better understand the deadlocks of a do-nothing scenario (§ II). Then, we use this framework to precise the limitations of public policies that do not change the structure of the tax system (§ III). And lastly, we show how a carbon tax reform may contribute to reduce those difficulties, while removing the obstacles to a climate policy (§ IV).

2 Introducing the COR's trend scenario into a general equilibrium analysis: A France caught between three constraints

2.1 The issue of pensions from the COR perspective, a partial equilibrium analysis

The COR's assessment report prepared for the last French pension reform of the government Fillon (COR, 2010) gives three scenarios of the financial needs developments of the pension system. In the scenario A, the French economy is rapidly catching up the losses of production caused by the crisis. On average, over the 2011-2020 period, labor productivity is growing by 2.1% per year - which is above its long-term trend (1.8%) - but unemployment remains high, even if it declines by the end of the period (6.4% in 2020). These assumptions correspond to an optimistic view according to which the crisis has no effect on potential growth. The two more pessimistic scenarios (B and C) put the country on lower growth paths (weaker labor productivity and higher unemployment).

For each scenario, the revenues of the pension system are simply deduced by a projection of the employed labor force and two simplifying assumptions: a constant value-added sharing between

operating surpluses and compensations of employees[1], and a constant rate of social contributions applied to those compensations[2]. The financing needs of the system are given by forecasts of expenditures of the main pension schemes and an extrapolation to the whole system (DRESS[3]).

Into this purely accounting framework, the issue of pensions is framed only in redistributive terms. A reform, or a business-as-usual scenario, has no effect on production costs, wages, household demand, *etc.* so that, in the end, it is almost neutral for activity and employment. This is particularly important since the public debate focuses exactly on those parameters. Besides, it must also be noticed that only the postponement of the retirement age mechanically benefits growth by alleviating unemployment. This postponement increase the supply of work, and the economic product increase in proportion (number of hours worked ***x*** total labour productivity). In other words, with unaffected wages, the entire additional labour supply matches a corresponding demand.

Thus, the COR's trend scenarios assess one of the main macroeconomic constraints the French economy will be facing in the future: a growing financial burden of pensions. But this assessment is made independently from the climate constraint (the French "*Facteur 4*" target which requires dividing by four greenhouse gaz emissions by 2050[4]), and independently from two other important macroeconomic constraints that will develop within the same time horizon:

- An external constraint combining, on the one hand, the competitive pressure on the goods and services made in France, on the other hand, the financial pressure on households and firms of higher prices of imported hydrocarbons.

- An internal constraint: a decreasing trend of the savings available for investment due to a relative increase of the "dependent" population (people aged over 75 and below 20). Savings and investments that are compatible with scenario A are not specified by the COR or the Treasury.

Our objective is to show that diagnosis errors may occur if mutual interactions between all those constraints and growth are neglected. Omitting such interactions is equivalent to assuming that the economy will continue to rely on external debt to finance pensions and the importation of energy, in particular, if those importations continue to remain important. We can introduce this key point independently from any modelling with a simple accounting framework and reasoning.

Let us consider an open economy with a balanced external trade (X). Domestic consumption (C) and investment (I) exhaust the gross domestic product (GDP):

$$GDP - C - I = X = 0$$

For stake of simplification, let us admit in addition that all final energy consumption is imported (no refining and electric production). This imported energy (Xe) is consumed by households

[1] Total of gross labour costs, including social contributions of employers and employees.

[2] In scenario A, compensations of employees correspond to 57.6% of GDP; the rate of social contributions to 22.0%; the employed labor force is obtained by applying to the active population an unemployment rate of 6.4% in 2020; the number of retired and the levels of retirement benefits are assessed under the hypothesis of constants return in the main French pensions schemes ("AGIRC" and "ARRCO").

[3] *Direction Recherche, Etudes, Evaluation et Statistiques* (assessment board of the *Ministère des affaires sociales et de la santé*).

[4] Enshrined in the French legislation since 2005.

(Ce) and industry (Ci). Therefore, the previous accounting identity may be detailed. (Cq) stands for the non-energy consumption and (Xq) the non-energy exportations:

$$GDP - Cq - Ce - I = Xq - Xe$$

Because we assume external trade balanced, exports of goods and services (Xq) must equal imports of energy (Xe). And the demand for domestic products and services (Cq + I + Xq) must exceed disposable revenue (GDP) in order to finance the energy bills of industries (Ci):

$$Cq + I + Xq = GDP + Ci$$

Now, let us consider an increase in the imported price of energy. If we assume that the "underlying fundamentals of the economy" remain unchanged, that is the same volumes of energy consumption, non-energy consumption, investment and exports, than there are two implications. On the one hand, the national disposable income decreases ($\Delta GDP = -\Delta Ci$): at a same level of domestic production the rising industry energy costs for industry must be financed. On the other hand, the higher energy import bill reduces the available savings ($\Delta [GDP - C - Ce] = -\Delta Xe$) and the deterioration of the current account balance leads to a corresponding external debt increase.

Of course, this simple reasoning says nothing about the mechanisms through which the constraint of energy dependence and the constraint of the funding of pensions interact. But it shows the importance of those interactions and the need to deepen the macroeconomic analysis.

2.2 Towards a comprehensive macroeconomic framing

To produce such an analysis we have used a version of the IMACLIM model that has been developed to study the socioeconomic impacts of a carbon tax reform in France (Combet, 2013). This version depicts an open-economy with four types of agents (households disaggregated into twenty income classes, firms, public administrations, and the 'rest-of-the-world') and four products (crude oil, fuels for transportation, other energies for housing and a 'composite' of non-energy goods and services).

The objective was to build a comprehensive macroeconomic picture of France for 2020 that is compatible with the COR's trend scenario A. Starting from the macroeconomic data for a base year (here 2004), such a projection may be built if one have sufficient information to describe all the accounting identities of a general equilibrium[5]. The COR's scenario gives us the future levels of gross domestic product, wages, social contributions, and retirement benefits. But final demand (domestic savings, investment, internal trade), foreign capital required to realize the COR's GDP, and the trends in households and firms' energy consumptions has to be specified.

The full macroeconomic table is completed by importing data from other studies. Those data and the corresponding sources are summarized in table Tableau 1. This table displays a comprehensive vision of the constraints or tensions the French economy will be facing at the 2020

[5] Details about the projection method, the IMACLIM version, data, and results are available in technical appendices: http://www.imaclim.centre-cired.fr/spip.php?article=316.

horizon. Even if those data are imported from quality studies they have been arbitrarily chosen among various possible scenarios (another quantitative vision of the future could thereby be promoted as well). As our goal is essentially heuristic, we will neglect in this paper the uncertainties about the future. What matters here is 1) to get a quantitative picture for 2020 that is consistent with explicit assumptions, and 2) to shade light on the mutual interaction between demand, energy and demographic constraints.

Financial tensions heightened by the demographic transition	2004 to 2020
Old-age dependency ratio[a] (COR, 2012)	+29 %
Retirement benefits (COR, 2012)	+215 %
Households' saving rate[b]	-37 %
Tensions on international markets and energy resources	
Oil import price	+95%[c]
Price-competitiveness of domestic productions	-0.5%[d]
Limited energy saving opportunities and technical change possibilities[e]	

Note: This table displays only the main assumptions. More details are given in technical appendices: http://www.imaclim.centre-cired.fr/spip.php?article=316.

[a] Old-age dependency ratio is the ratio of the number of retires to the number of active people.

[b] This trend in saving rate come from a simulation made by Aglietta et Borgy (2008, page 25-26) in the case of a business-as-usual scenario without pension reform.

[c] Which is equivalent to an oil import price of 60€ per barrel (scenario from Bibas et al., 2012).

[d] Ratio of the price of production of the French composite good to the price of the foreign composite good ; simulation drawn from the IMACLIM-R World model used for the *Energy Modeling Forum*,

[e] Scenario simulated with the IMACLIM-R France model which capture an explicit representation of technical inertia. This scenario gives the energy consumption levels and the CO_2 emission coefficients for households and firms in 2020. No ambitious climate policy is assumed at the global level, and no large infrastructure policy is assumed at the national level (building renovation, collective transportation, rail and river freight).

Tableau 1 Key assumptions about developments in the French context (2004-2020)

Three parameters are determinant for the calculation of the trade balance and the need for foreign capital. The first two are coming from scenarios built for the Energy Modeling Forum (Bibas et al., 2012): a 95% increase in the import price of oil relative to its 2004 level and an O.5% increase in the ratio between French and foreign production prices of composite good (the rise of labour costs is higher in France than in the rest-of-the-world due to the burden of population ageing). The third parameter – a 37% decrease in the household saving rate – comes from Aglietta et Borgy (2008).

Under these assumptions, national agents' incomes and expenditures are almost given. An additional hypothesis about the level of investment is made for filling up the national accounts. We assume this level being proportional to the capital intensity and the level of production (keeping the 1.5 proportional coefficient observed in 2004). The trade balance for non-energy composite goods therefore balance the demand for domestic products. Given the level of domestic savings, foreign capital flows balance the financial needs of the investment. Lastly, the financial positions of agents display the net accounting counterpart of their loans and borrowings assuming that all assets/liabilities are accrued linearly over the 2004-2020 period.

The corresponding projected national accounts are given in Tableau 2.

Billions euros	Private players	Administrations	Rest-of-the-world
Trade balance			
Energy	-	-	78
Other goods and services	-	-	227
Gross operating surpluses	632	62	-
Compensations of employees	1 100	-	-
Taxes minus subventions on production and indirect taxation[a]	-	364	-
Social contributions	-	311	-
Primary incomes[b]	1 732	737	305
Property incomes[c]	57	-336	279
Social transfers [d]			
Unemployment	36	-36	-
Retirement	352	-352	-
Other	174	-174	-
Other transfers	6	-22	16
Direct taxation[a]	-292	292	-
Gross disposable income	2 064	110	600
Consumption	1 646	620	-
Gross fixed capital formation	431	77	-
Expenditures on final use	*2 077*	*696*	
Self-financing capacity	*-13*	*-587*	*600*
Net financial position[e] (Net excess of claims over liabilities)	1 166	-6 251	5 085

[a] Without reform, the mean tax rates remain at their 2004 levels.

[b] The gross domestic product is equal to the sum of primary incomes of private players and administrations.

[c] The property income transfers reflect the trends in agents' net financial position. For public administrations, this encompasses in particular payment of a debt service.

[d] Social transfers evolve proportionally to the numbers of unemployed, retired and the total population (accordingly to the COR's assumptions). The mean level of retirement benefits is available in COR data. The other levels of social benefits follow the development of wages.

[e] The agents net financial position result from an assumption of linear accumulation of self-financing needs/capacities avec 16 years (2004-2020).

Tableau 2 Comprehensive macroeconomic accounts for France in 2020

2.3 A long-term trend towards higher debt: the role of energy and saving deficit

The projected macroeconomic accounts resulting from this exercise display higher public deficits and social transfers (respectively 24% and 23% of GDP). Due to the optimistic assumptions of the COR's scenario A, unemployment benefits weight only 1.5% of GDP. Nevertheless, this is more than offset by the rise of retirement benefits (reaching 14% du PIB).

The key element of this scenario is the great growth of the national debt (it reaches twice the level of GDP) [6]. This important inflow of foreign capital results from two contextual elements: on the one hand, export surpluses of non-energy goods and services do not meet the rise of energy imports (3.2% of GDP). On the other hand, available domestic savings do not meet the needs of productive investment. This high level of debt does not constrain the economy to growth at a slower pace than it is assumed in the COR's scenario A as in this calculation the country goes further into debt to pay his debt (creditors do not impose absolute limit on the level of the national debt).

Of course, this assumption seems unrealistic[7]. But it is useful to make in order to identify the orders of magnitude of the consequences on national debt resulting from a "do-nothing" scenario.

In fact, compared to this do-nothing scenario, each of the simulated reform schemes will trigger three mechanisms according to a set of equations that describe the behaviours of productive systems, domestic agents, the labour market and globalised product and financial markets (Figure 1).

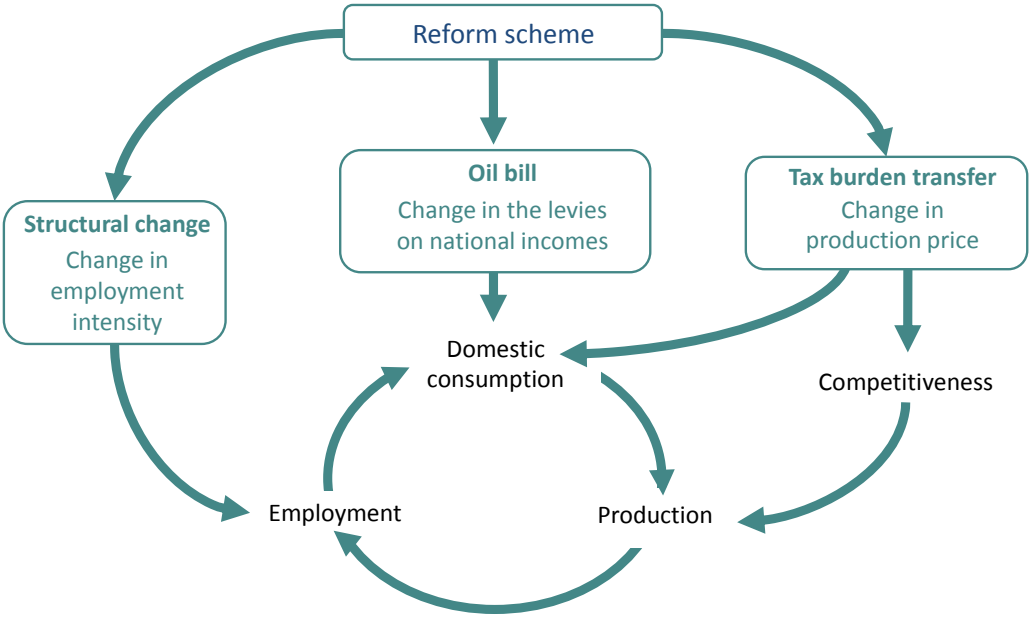


Figure 1 An Interaction of three main mechanisms

1. *Changes in production costs* will affect the trade balance and the level of domestic demand if those changes are due to a response of wages[8]. Developments in production costs will depend on simulated changes of the share of taxation bearing on those costs. But it will depend also

[6] Recall that we are talking about an extreme case (and unrealistic) where no reform at all is implemented. It is assumed also that the debt of private and public players do not alter their behaviours at the time horizon considered. In other words, we assume that those players are « myopic »: the levels of their debts impact neither the household saving rates nor the firms' investments. Those two variables only depend on growth and demographic assumptions.

[7] Typically, econometric studies shows that economic growth is significantly reduced when the ratio of public debt to GDP exceeds 90% (Reinhart and Rogoff, 2010).

[8] The link between labour costs and competitiveness is sometimes challenged. It is argued that there are many other important determinants of competiveness: product quality, organization of production and supply chains, workers' training, management *etc.* This challenges the idea that any improvement of competitiveness requires wage moderation, while such moderation has a recessionary impact on final demand. This argument is of course valid. Nevertheless, it does not challenge the fact that competiveness will be affected by higher labour costs under any set of assumptions about those determinants of productivity.

on the way any policy will impact the level of investment (assumption of induced technical change), the level of production (assumption of static decreasing returns), and the level of employment (assumption of wage sensitivity to the level of the unemployment).

2. *Changes in the oil bill burden* will impact the purchasing power of households and affect the capacity of the country to control its trade balance and its national debt. The introduction of energy-carbon taxation will have an incentive effect on energy efficiency and the penetration of renewable energies that depend on a parameterisation coming from the set of scenario made with the IMACLIM-R model. This model includes an explicit representation of energy production techniques and equipments (Bibas et al., 2012). By 2020, the prices-elasticities of household consumptions of fuel and housing energy are respectively -0.57 and -1.03, and the corresponding income-elasticities +0.29 and +0.52. But these elasticities decrease with the carbon tax as some level of energy consumption is constraint at medium run by some level of "basic energy needs".

3. *A structural change* will modify the labour and energy intensities of production patterns accordingly to changes in the relative cost of labour and the other costs of inputs. We are talking about *structural change* because, at this level of aggregation, substitution between labour and energy encompass both technical change within industries and the relative weights of industries within the whole production structure of composite good. We use here a given aggregated substitution elasticity of +1.2. But again, technical inertia is modelled by the existence of constraint levels of inputs consumptions (not responsive at all to any economic signals, like relative prices).

3 Funding plans without tax reform: some partially disappointed hopes

Two solutions are mentioned for avoiding both the deadlocks of do-nothing scenarios and the difficulties of a process of tax reform: an increase in the retirement age (IRA)[9] and a decrease in public spending (DPS). The former has been favoured in France for the previous reforms[10], while the latter is more and more advocated in order to offset the rise in retirement benefits.

3.1 Increase in the retirement age

The COR estimates that balancing the financing of pension schemes until 2020 by using only this lever would require "an increase of more than 3 years in the average retirement age (a total of over 4 years compared to 2008)" (COR, 2010, page 46).

Within the COR's modelling framework, a larger active population (here, increased by 4.8%) is the only way to boost economic growth: with constant unemployment rate and productivity, the

[9] In what follows, we will not consider the impact of such a reform on the activity behaviours or on the date of retirement. Those consequences are studied in micro-simulations models (in France, the COR use the DESTINI model). We will not make any distinction between *effective* and *legal* ages of retirement. Therefore, any postponement of the retirement age will trigger mechanically a corresponding decrease in the proportion of retired people.

[10] Under the presidency of N. Sarkozy (2010 Fillon reform), but also for the 1993 Balladur reform (an increase in the length of the contribution period from 150 to 160 quarters to get the full benefit rate) and the 2003 Fillon reform (implementation of a discount rate for missing years of contribution and a premium rate for additional years).

additional labour supply favours mechanically production. But this implicitly assumes a comparable increase in domestic demand and exports, and therefore in labour demand (Chérèque et al., 2010).

This measure is equivalent to a 13% increase in the demographic ratio (labor force population / retirees)[11]. In order to test the response of the labour market to this additional labour supply (which is far from marginal), we have used a "wage curve" which formalises the mean net wage sensitivity to change in unemployment rate. This formulation may be used to represent a balance of power in wage bargaining. We assume a negative elasticity of -10%. In literature, this parameter is discussed at length, particularly with regards to the long run (Blanchet, 2003). But this particular assumption shall be enough to illustrate our point: it is neither certain nor mechanical that the economic system would be able to absorb this excess supply.

Our specification allows us to simulate a de-indexation of wages to consumption prices, and thus to impact the level of real wages. This may be used to reflect an assumption of "wage moderation" in a context of economic crisis, high energy prices, and emergence of new industrial competitors. This assumption is quite different from the constant value-added hypothesis used by the COR: a constancy that is not affected whatever retirement funding and economic conditions.

Compared to our do-nothing scenario (with unlimited debt), the increase in the retirement age allows a better control of deficits and the external debt (Tableau 3, « 3 years IRA » scheme). The foreign balance deficit decrease by 9.8%, public deficits by 10.0%, and the public debt to GDP ratio by 4.9%. But this result has a cost: GDP is 1.4% lower and the unemployment rate increase by 1.4 percentage point. Indeed, the reform scheme triggers the following mechanism:

- The additional labour supply pushes down wages (-3.3%).
- This erodes the purchasing power of households, but benefits to price-competitiveness
- The rise of exports (+0.9%) and the lower share of imported consumptions (-1.5%) are not sufficient to offset the lower household domestic consumption (-2.4%).
- This depressive effect is not eliminated by a structural change towards a higher employment path because the relative prices between labour, capital and energy do not vary much.

Therefore, the additional labour supply is only partially absorbed. The potential increase in domestic product is not released, and at last, only 79% of the social debt is funded. To reach 100%, the increase in the retirement age must be higher (Tableau 3, « IRA > 3 years » scheme). In this case, we see an improvement in the trade balance (-7.2%) and in the debt repayments (-18.3%). But the previous negative mechanisms are stronger. They lead to a 4.2% contraction of wages and a 3.2% erosion of household consumption. GDP is reduced by 1.9% and this increase unemployment by 1.8 percentage point with respect to the do-nothing scenario situation.

[11] This equivalence is given by the accounting equation describing the financing of pension schemes (COR, 2006, page 49).

Reform scheme	3 years IRA	IRA > 3 years
Funding of pension deficits over 2011-2020	79%	100%
Demographic ratio	+13%	+17%
CO_2 emissions	-1.5%	-1.9%
Real gross domestic product	-1.4%*	-1.9%
Unemployment rate (% points)	+1.4**	+1.8
Labour intensity of composite production	+0.0%	+0.0%
Oil bill to GDP ratio	+1.9%	+2.4%
Composite household consumption	-2.4%	-3.2%
Composite production price	-1.7%	-2.1%
Volumes of composite goods exports	+0.9%	+1.2%
Proportion of imported composite goods	-1.5%	-1.9%
Trade balance deficit	-5.6%	-7.2%
Net nominal wages	-3.3%***	-4.2%
Public debt to GDP ratio	-4.9%	-6.2%
National debt to GDP ratio	-6.7%	-8.5%
National debt repayments	-14.6%	-18.3%

Note: results are expressed relatively to the 2020 situation resulting from the do-nothing scenario.

* A 1.4% decrease in GDP in 2020 as compared to the do-nothing situation is equivalent to a 0.12 variation point of annual growth over the 2004-2020 period, which corresponds to slightly more than a five month delay in growth.

** A 1.4 point higher unemployment is equivalent to an unemployment 1.8 point lower than the 2004 historical level (from 9.6% to 7.8%), or to a mean job creation of about 22 000 jobs per year.

*** A 3.3% decrease in the purchasing power of employees is equivalent to a 0.29 point variation of annual growth rate over the 2004-2020 period, which corresponds to about nine month delay in wage development.

Tableau 3 Macroeconomic impacts of an increase in the retirement age (IRA) as compared to the do-nothing scenario (without reform)

We can always discuss this pessimistic conclusion arguing that an effective extension of the working period will produce some important productivity gains (higher qualifications, improved organisation of production, and better accumulation of work experience). It should nonetheless be noted that additional conditions are necessary in order to sufficiently foster employment and to resolve the issue of pensions through an increase in the retirement age.

3.2 Decrease in public spending

The choice of decreasing public spending has something to do with the valuation of the right "weight of the state" and the assessment of the relative efficiency of public and private expenses with respect to social Welfare. We will not open here the debate on the "cost of public funds"[12]. A cost-benefice analysis would have to be undertaken in order to balance the expected gains for entrepreneurial risk-taking arising from a reduction of the whole tax burden, against the losses due to fewer public resources devoted to R&D, the development of new sectors (Bompard, 2009), and

[12] The ambiguity of this concept has been discussed in the context of France by Guesnerie (2007).

investments in education (Askénazy, 2011), health and public infrastructure (Glomm et Ravikumar, 1992). In what follows, we will simply assume that all those long term impacts offset.

Under those hypotheses, the volume of public expenditures[13] must to be reduced by 6.1% to fund pensions over the period (Tableau 4). Impacts on activity and employment are very similar to those triggered by an increase in the retirement age: as compared to COR's scenario A, GDP and unemployment are slightly less affected (-1.7% against -1.9%, and +1.7 against +1.8 point).

Budgetary objective	Funding the pension deficit over the 2011-2020 period	
Reform scheme	IRA > 3 years	DPS
Demographic ratio	+17%	id.
Volume of public expenditures	id.	-6.1%
CO_2 emissions	-1.9%	-1.5%
Real gross domestic product	-1.9%	-1.7%
Unemployment rate (% points)	+1.8	+1.7
Labour intensity of composite production	+0.0%	+0.0%
Oil bill to GDP ratio	+2.4%	+1.9%
Composite household consumption	-3.2%	-1.4%
Composite production price	-2.1%	-2.0%
Volumes of composite goods exports	+1.2%	+1.1%
Proportion of imported composite goods	-1.9%	-1.8%
Trade balance deficit	-7.2%	-6.8%
Net nominal wages	-4.2%	-4.0%
Public debt to GDP ratio	-6.2%	-6.2%
National debt to GDP ratio	-8.5%	-8.5%
National debt repayments	-18.3%	-18.3%

Note: results are expressed relatively to the 2020 situation resulting from the do-nothing scenario.

Tableau 4 Macroeconomic impacts of a decrease in public spending (DPS) as compared to the do-nothing scenario (without reform)

A sustainable reduction of public expenditures has a depressive effect on the whole effective demand. But this activity contraction affects less employment than the increase in the retirement age, because a higher proportion of the population leaves the labour market. Thus, wage pressure is lower and the purchasing power of households is less impacted. Consequently, private consumption is holding up. But higher wages mean higher production costs, and lower trade performance.

Hence, in the model, the results are slightly better with a decrease in public spending than with an increase in the retirement age. But those results are qualitatively not very different. Nevertheless, one must keep in mind that this comparison implicitly assumes the development of

[13] With constant proportion between current consumption and investment in the public budget.

private structures able to produce collective services at a comparable quality/cost ratio. This is of course required to maintain productivity and ensure social cohesion.

4 Carbon taxation as a leverage to unlock a well-established situation

We are facing true limits when we try to fund the pensions without reforming the tax system. But we know as well the important difficulties we encounter when we try to follow this path: higher social contributions may favour undeclared work; higher VAT rates may have strong distributional impacts, higher income taxation may worsen tax evasion. As those arguments are sufficiently well-know it is not necessary to insist any further. But surely, the fact that discussions on tax reform are locked by very public arguments, seemingly inescapable, has become a major problem for public action. Here, we aim to show that carbon taxation could help providing new room for manoeuver.

4.1 A potential for economic synergy

To reach this conclusion let us compare three different options that all allow a funding of the pension system (consistently with the financial needs evaluated in the COR's scenario A)[14]:

1. The increase in the retirement age that fund deficits of the pensions system (IRA > 3 years);
2. An increase in employers and employees contributions (SC), which is after all the natural solution within the current system;
3. A carbon tax introduced as partial substitute for social contributions on labour income and increasing gradually to reach 200€/tCO_2 in 2020. The remaining deficit of the pension system is filled with an increase in income tax (IT).

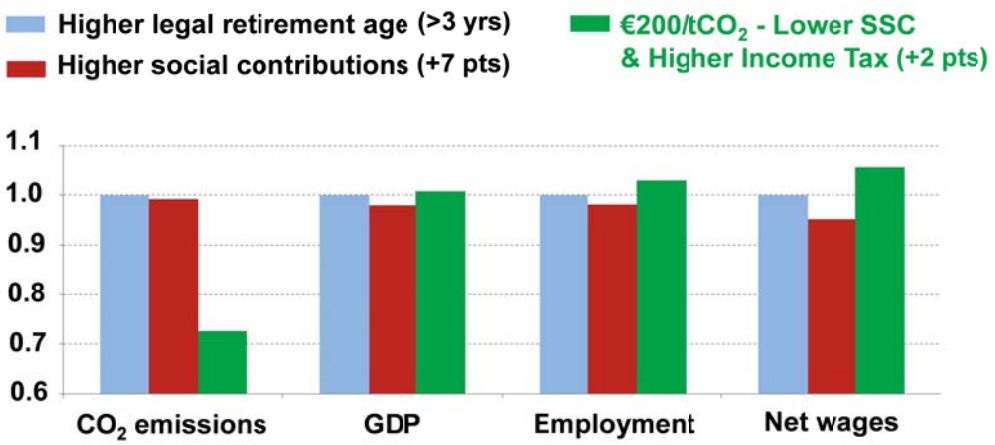
According to economic analyses conducted since the 90s, the best way to achieve CO_2 emissions reductions at the lowest possible cost is to implement of a carbon tax and to use its revenue to cut existing labour tax[15]. We will not discuss here the theoretical questionings about the possibility to get a "strong double dividend", that is a *net* gain for economic activity and employment. It would be necessary to discuss the reasons why a reallocation of the tax burden away from labour has not been implemented before, and independently from the challenge of climate change. And why this has not been done without resorting to energy tax[16] (Guesnerie, 2010, p. 35-37). Notwithstanding this theoretical debate, two important questions remain: do we want to reduce our CO_2 emissions and our energy dependence? Within which scheme of tax reform do we want to insert the carbon tax?

[14] In our model the impacts of higher TVA rates are very similar to the impacts of higher income tax (IT). We thus only present the impact of higher IT. To capture the specificities of higher VAT, a model must have a greater number of different goods and services. This would have taken us too far. Our objective here is only to introduce the fact that the current compartmentalization of expertise has a cost.

[15] See the first and second IPCC reports (IPCC, 1995, 2001).

[16] Theoretically, the best option would be to substitute income tax for labour tax. Given a same level of labour tax cuts (-7.0%), we get into the model a consumption level slightly higher (+0.5%) and an employment rate lower (-0.2 percentage point). But this comes at a cost of higher trade deficit (+4.0%), because the oil bill is much heavier (+20.1%). In addition, the increase in IT must reach +3 points (1 point more than with a carbon tax component), and the increase should be even higher at high income levels, if lower and middle classes have to be preserved.

Figure 2 gives an overview of the results. It shows the comparison of the two usual reforms of the pension system with the previous comprehensive carbon tax reform. Not surprisingly, we see that the increase in social contributions is the most costly reform scheme for activity, wages and employment. More surprisingly, we observe that the comprehensive scheme that includes a carbon tax, decrease social contributions (-7 points) and increase IT (+2 points), is better, not only with regards to the environmental indicator, but also regarding to the three other economic indicators.



Note: the three tax reforms fund the deficit of the pension system over the 2004-2020 period. Results are expressed relatively to the 2020 situation resulting from the do-nothing scenario. ("IRA > 3 years").

Figure 2 Carbon tax reform: potential room for a no-regret action

In view of these results, the reader may feel uncomfortable as he may some time is required to assess and understand the numerical model from which those results are drawn. We shall detail the economic mechanisms involved in a minute. At this point, we just want to use those aggregated results to introduce our main conclusion. These results illustrate well the fact that analysing independently the design of a climate policy and the one hand, and the design of a pension reform on the other, may deprive us from identifying potential synergies or antinomies. This is true with regard to the problem of funding social security systems. But this true as well with regard to the objective of CO_2 emission reduction and climate change mitigation.

Of course, only the scheme that include a carbon tax allows the French economy to follow a path compatible with the French "*Facteur 4*" objective, which implies a volume of CO_2 emissions below 317 $MtCO_2$ en 2050 (a 19% decrease since 2008, Syrota report, 2008)[17]. In the "IRA > 3 years" and "CS" scenarios, the deficits of CO_2 emission reduction are respectively of 215 and 219 $MtCO_2$. The level of emission would be 68% higher than the target. But an ambitious environmental tax reform will not be implemented if it jeopardizes the attainment of other socioeconomic objectives. In other worlds, the success of an environmental transition depends on its acceptability with regard to those other public policy dimensions. For instance, we will see below that a carbon tax which is not compensated by a reduction in social contributions would have too negative impacts for households and firms. The rise in energy bills would spread from one sector to another, leading at last a general

[17] This climate objective has been enshrined in the French law the 13th of July, 2005.

price increase. This would be too negative both for the purchasing power of households and the competitiveness of domestic productions. Implementing a carbon tax in this way would be equivalent to achieve a CO_2 reduction target at a much higher economic cost[18]. The risks of two strong negative economic impacts of badly-designed climate policies constitute, in our opinion, the main obstacle to the required long-term rise in carbon price signals.

4.2 Understanding synergy mechanisms

As we shall see the different components of our comprehensive tax reform contribute to reinforce the three positive mechanisms that determine the levels of activity and employment. They trigger positive changes in 1) wages and production costs, 2) fossil energy imports, 3) labour intensity of domestic production.

To understand the mechanisms that generate these results, it is useful to look at the macroeconomic impacts of each tax component separately. We compare the resulting economic situations to the one produced by the increase in the retirement age (Tableau 5). In each case, a same level of funding of the pension system and a same level of national debt are achieved.

The result of an increase in social contributions (CS) is hardly surprising: this increase should reach 7.2 points to fund social benefits, the cost of production increase by 2.3%, and the price of the composite good rises greatly. These higher domestic prices induce: 1) a decline in net exports (-1.2%), 2) a rise of the import share of products in domestic markets (-2.0%)[19], and 3) a reduction in the purchasing power of households. In this competitive context, the resulting contraction of demand is increased by a downward pressure on net wages (-4.7%). This affects strongly the purchasing power of households and their consumption, even if the latter only decreases by 1.7%. Consumption is indeed sustained by social transfers that are indexed on prices, and non-wage incomes that are less affected. As a result, as compared to the increase in the retirement age, activity and particularly employment deteriorate faster (-2.1% of GDP and +2.2 points of unemployment).

[18] For instance, in our model, a same emission reduction target can also be reached with a non-recycled 200€/tCO_2 carbon tax in 2020. But the resulting GDP is 1.0% lower, unemployment 1.3 point higher, net wages and household consumption 3.2% and 0.2% lower, and the public and national debts to GDP ratio 2.4% and 4.2% higher.

[19] The moderate deterioration of the trade balance we observe in table 5 may surprise the reader. Indeed, the country exports a composite production at a higher price compared to the increase in the retirement age scenario (IRA > 3 years).

Budgetary objective	Funding the pension deficit over the 2011-2020 period			
Reform scheme	SC	CT	IT	CT/DSC & IT
Rates adjustments	+7.2 pts	709 €/tCO_2	+1.4 pts	200 €/tCO_2 -7.0 pts (SC) +2.0 pts (IT)
Household saving rate	-0.0 pts	+0.3 pts	+0.0 pts	0.2 pts
CO_2 emissions	-0.8%	-54.7%	+0.1%	-27.7%
Real gross domestic product	-2.1%	-4.4%*	+0.1%	+0.4%
Unemployment rate (% points)	+2.2 pts	+1.3 pts	-0.1 pts	-1.9 pts
Labour intensity of composite production	-0.3%	+1.2%	-0.0%	+0.9%
Oil bill to GDP ratio	-1.1%	-28.9%	-0.0%	-17.2%
Composite household consumption	-1.7%	-2.5%	+0.1%	+1.3%
Composite production price	+2.3%	+3.7%	+0.1%	+0.1%
Volumes of composite goods exports	-1.2%	-1.9%	-0.0%	-0.1%
Proportion of imported composite goods	+2.0%	+3.3%	+0.1%	+0.1%
Trade balance deficit	-1.0%	-9.0%	0.2%	-2.6%
Net nominal wages	-4.7%	-2.8%	+0.1%	+4.8%
Public debt to GDP ratio	id.	id.	id.	id.
National debt to GDP ratio	id.	id.	id.	id.

CT: implementation of a carbon tax; SC: increase in the rate of social contribution; IT: increase in income tax.

Note: results are expressed relatively to the 2020 situation resulting from the increase in the retirement age scenario (more than three years increase required to fund the pension system of the period, "IRA > 3 years" scheme).

Tableau 5 Macroeconomic impacts of four tax reform schemes as compared to the increase in the retirement age scenario (IRA > 3 years)

A carbon tax that is not recycled through lower labour tax weights even more on activity (-4.4% of GDP). This highly negative impact is due to a strong increase in production costs (+3.7%). This strong increase results from the high level of carbon tax required to fund social benefits (709€/tCO_2). The resulting depressive consequences on demand and production are neither offset by the reduction of the oil bill (-28.9%) nor the increase in labour intensity (+1.2%).

Nevertheless, the constancy of social contributions favours lower labour costs compared to what we observed with the previous option. These labour costs increase less than capital and energy costs. Thus, this benefits to labour-intensive sectors[20] and employment (+1.3 point of unemployment, against +2.2 with SC). The constancy of social contributions also allows a smaller contraction in net wages (-2.4% against -4.7%). But those positive effects do not offset the negative effects of higher fuel prices (187%) and other energy prices (108%)[21]:

[20] Profitability of high labour intensive sectors increases in comparison to the profitability of high energy intensive sectors.

[21] The *ex ante* impact of the carbon tax on fuel prices is higher because the energy aggregate used for residential and tertiary uses includes electricity that is not taxed.

- The purchasing power of households decrease. The budget share of energy is multiplied by 1.5 and the household saving rate must increase by 0.3 point to achieve the same level of national debt (as compared to the increase in the retirement age scenario).

- The trade balance of the non-energy goods and services composite is deteriorated. The burden of energy bills on production costs doubles. Exports decrease by 1.9% and the share of imported products in final demand by 3.3%.

The high rate the carbon tax must reach exacerbates this very bad performance (709€/tCO_2). This rate is required to fund with this single lever the social expenditures. The negative impacts of higher prices are magnified at this rate since we enter an area where the "decarbonisation potentials" of the economy are saturated[22] (Figure 3).

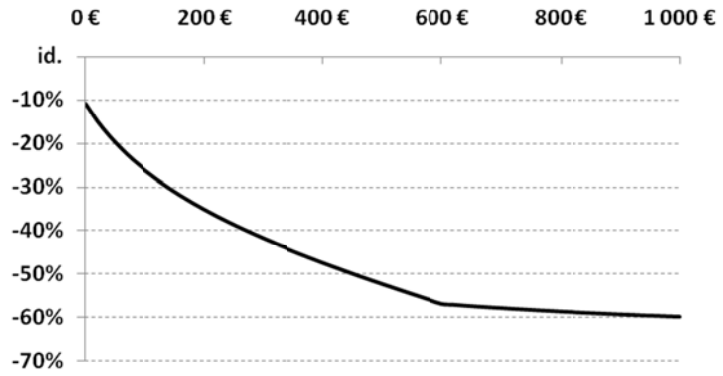


Figure 3 **Changes in the CO_2 content of growth, as compared 2004, by the level of non-recycled carbon tax reached in 2020 (0 to 1000€/tCO_2)**

An increase in income tax (IT) has better macroeconomic impacts compared to the two previous options. Those impacts are rather similar to the "IRA > 3 years" scheme (+0.1% of GDP, -0.1 point of unemployment)[23]. This measure has a smaller effect on the price of composite (+0.1%). Unlike the two previous tax adjustments, the tax burden on production costs is indeed alleviated. Consequently, exports and imports are almost similar to the "IRA > 3 years" scenario. But the whole demand for domestic products is slightly higher. Indeed, the negative impact of higher IT on disposable income and household consumption is more than offset by higher net wages (+0.1%). The balance of power in wage bargaining benefits workers because the number of job seekers is lower compared to a situation where the age of retirement is higher. Therefore, at last, the household consumption and GDP are greater compared to the "IRA > 3 years" scenario (+0.1%).

[22] The possibility of describing those saturation levels is one of the main feature of 'hybrid' models (Ghersi and Hourcade, 2006).

[23] In our model, we get very similar results with an increase of VAT or IT. In particular, the labour supply impacts of higher IT are not modelled, neither are the impacts of higher VAT on the relative competitiveness of sectors. An increase in VAT gives a slightly better result, because it favours more the household consumption (+0.4 against +0.1%). This favorable effect is not outweighed by lower trade performances (+1.0 against +0.6%).

The superior performance of our comprehensive tax reform (« CT/DSC & IT ») results from a combination of the three positive mechanisms we have seen before:

1. The implementation of the recycled carbon tax allows a 7 percentage points reduction in social contributions. The tax burden on production costs are alleviated as a whole. Part of the carbon tax is indeed paid by non-wage incomes[24]. Thus, the composite production costs are hardly higher compared to the increase in the retirement age (+0.1% more than with the "IRA > 3 years" scheme). And this increase is due to the faster wage progression (+4.8%)[25].

2. The control of production costs and the wage progression benefit demand for domestic production. The external trade balance of composite products is hardly impacted, while the purchasing power and the consumption of households are greater. The positive consequences of job creations and wage progression exceed the negative consequences of higher IT and energy bills.

3. Le contrôle des coûts de production et la progression des salaires favorisent la demande adressée aux producteurs français. Les échanges extérieurs de bien composite sont peu dégradés, alors que le pouvoir d'achat et la consommation des ménages progressent. Les hausses d'emploi et de salaire compensent en effet les hausses de facture énergétique et d'IR.

4. The lower relative price of labour compared to energy gives a stronger incentive to induce a structural change towards a higher employment path. The labour intensity of the non-energy goods and services composite rises (+0.9%) and the overall burden of the oil bill is alleviated (-17.2%).

Overall, a virtuous cycle is released. As compared to the "IRA > 3 years" scheme, this comprehensive tax reform allows a combination of CO_2 emission reductions (-27.7%) with lower unemployment (-1.9 point), and higher GDP and consumption (+0.4 and +1.3%). The key point is that decarbonisation potentials are not saturated at this rate of 200€/t$C0_2$: the benefits of lighter tax burden thus outweigh the costs of heavier energy bills.

5 Conclusion

The objective of this paper was to raise attention to the prevailing intellectual compartmentalization between analyses of the "funding of pensions" on the one hand, and the "energy transition" on the other. Our aim was to show that disregarding the general equilibrium interactions between those issues may lead to important diagnostic errors. This has been done by introducing a forecasting scenario of the pension system into a broader macroeconomic picture that includes a description of future energy and demand constraints. This methodological innovation allowed us to compare the impacts of various schemes of public finance reform with respect to all objectives. On the one hand, this investigation shows that the limits of the proposed solution are

[24] Part of the carbon tax falls on transfers, property and financial incomes. Of course, some specific sectors, like energy intensive industries, may bear a heavier tax burden. Nevertheless, a majority will gain and the administration may compensate those vulnerable sectors without entailing the whole good performances of the tax reform (Bovenberg et al., 2008).

[25] The faster wage progression makes the higher income taxation more acceptable (+2.0 points against +1.4 when only IT is increased). Overall, the purchasing power and the consumption of households are higher (+1.3% against +0.1%).

under-estimate when these solutions are assessed within a “partial equilibrium” setting. On the other hand, it shows that, within such a setting, we also neglect some room for manoeuvre available for responding to the future challenges that many actual industrial countries are facing.

The fact that the solutions proposed to finance the social expenditures do not allow the French economy to meet its “Facteur 4” climate target will not disappoint those who are sceptical about ambitious climate policies at national level in this time of economic crisis. But those sceptics will notice that all those non-environmental measures have other significant economic limitations (their impacts on production costs, the purchasing power of wages, domestic demand and international trade). This is true for an increase in the mean retirement age, in social security contribution, in income tax, and for a decrease in public spending. This is equally true for a carbon tax whose revenue is directly affected to a deficit reduction, or entirely redistributed through lump sum transfers to consumers (Combet et al., 2010). This last measure is proposed for the sake of equity, in order to deal with the distributive consequences of a carbon tax. But this carbon tax revenue-recycling option will spread the negative impacts of higher energy costs in production, leading to a general increase in production costs and prices. These negative impacts would not be compensated by the direct lump sum redistribution of the carbon tax revenue. It will also affect competitiveness and employment. An increase in social security contributions on labour income will nevertheless be the worst solution. It will increase production costs, while restraining energy savings. The profitability of labour-intensive sectors and their expansion will thus be challenged. Hydrocarbon imports will continue to constrain future economic developments.

Those mechanisms explain the benefit of tax reform schemes that include a carbon-energy component and use its revenue in order to reduce the level of labour tax. Such a scheme as the advantage of limiting the negative impacts of higher energy bills in the whole economy. It lightens the overall tax burden bearing on production costs, limits the contribution of national incomes to the payment of the oil bill, taxes non-labour incomes, increase the incentive for inducing a structural change towards a job-intensive economy, and – what does not appears in the previous simulations – allows a diversification of tax bases (required to limit the rises of tax evasion and parallel economies).

Overall, this warning has two implications for public policy. On the one hand, the required long-term rise in carbon price signals will not be achieve if the carbon tax component is not included into a reform that contribute more generally to socioeconomic progress. Only a consistent and comprehensive reform scheme will limit the number of “loosers” and will provide room for helping the most vulnerable (Combet et al., 2010): energy intensive industries exposed to international competition, isolated areas and the most energy-dependent and vulnerable households. On the other hand, it will worth of dealing with the issue of ageing-social protection without neglecting the resources that a carbon tax may bring. This line of reasoning shows that a carbon tax may be adapted to the various challenges a modern economy may be facing. This measure should not therefore be perceived and caricatured as ‘green fancy’.

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