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THESIS PROJECT

« Essays on Public Debt and Sovereign Risk in the Context of Uncertainties and Future Challenges »

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General introduction

As the effects of climate change begin to be felt globally, it becomes increasingly imperative to take coordinated action at the international level to ensure the sustainability of the current economic system and prevent impending disasters. The Paris Agreement, which was adopted by 196 parties on December 12, 2015 (and entered into force the following year), aims to keep the global temperature increase below 2°C above pre-industrial levels, and ideally below the critical threshold of 1.5°C, according to the UN's Intergovernmental Panel on Climate Change (IPCC).

To counteract rising temperatures, the global economy must become carbon neutral by 2050, requiring significant investment in green alternatives, particularly from governments. However, following a series of major crises since the 2000s (the Great Financial Crisis, COVID-19, and the energy crisis), most countries have accumulated massive amounts of public debt that they are struggling to repay, risking long-term unsustainability. At the same time, an insidious and unprecedented phenomenon is taking place, particularly in Western countries: the average age of the population is increasing; consequently, tax revenues are declining and social transfers are increasing, further deteriorating public finances. This phenomenon has recently led to highly unpopular political decisions, the social costs of which seem unjustified in view of their impact on debt dynamics, which have continued to grow. It is now clear that governments alone cannot bear the burden of decarbonizing the economy; the private sector is expected to recognize the magnitude and necessity of the task and to continue the decarbonization efforts initiated by the public sector.

One of the levers to create the fiscal space needed for such expansionary fiscal policies is the pursuit of energy independence. In France, the systematic reliance on foreign electricity weighs heavily on the national trade balance, with one of the most worrying consequences being the recent downgrade of its public debt rating.

This thesis aims to identify sustainable means for France to achieve the NZE 2050 objective and to assess our capacity to implement them. Specifically, it will be divided into three independent essays. First, we will estimate the capacity of the private sector to take over public green investments in order to prevent the entire burden of decarbonization from falling on the public sector. Next, we will assess the extent to which demographic aging affects our ability to achieve carbon neutrality. Finally, the third chapter focuses on the European electricity market: could investments in energy independence enhance the sustainability of French public debt?

As the urgency of climate action intensifies, it is imperative to determine our capacity to take action, identify the most effective means of implementation, and assess the underestimated risks that will make the task even more challenging.

CHAPTER I. Can public and private green investments complement each other to achieve climate goals ?

Context

The 2008 and then the COVID-19 crises (and more recently the tensions in the energy markets) have highlighted the need for governments to stimulate public spending in difficult times. However, in such periods, economic agents become vulnerable; thus, financing fiscal policy through tax increases would be excessively costly, leading governments to often prefer relying on public borrowing by issuing new debt securities. As a result, public debt has soared in most advanced economies following the aforementioned crises, raising concerns about its sustainability. Therefore, when fiscal space is limited, it becomes important to determine which fiscal policy, relative to its cost, would be the most effective in stimulating economic activity. This issue is often addressed through the concept of fiscal multipliers, which measure the response of economic activity to a one-monetary-unit shock in government spending.

In my master's thesis, I estimated the fiscal multipliers for France, Italy, and Germany under three scenarios: economic recession, zero lower bound, and high public debt, using a Threshold Structural Vector Autoregressive (T-SVAR) model. As suggested by the literature, I found that a positive shock on public debt often exerted a crowding out effect on private investment. Furthermore, I found that government spending (general government consumption *plus* general government investment) generally crowded out private investment in France and Italy, but that private investment was crowded in in Germany.

In the effort of decarbonizing the economy, fiscal policy is at the center of debates. To stimulate low-carbon production, it is widely accepted that governments must invest heavily in the green sector (low carbon energy, electrification, energy saving, carbon capture). Indeed, according to Black et al. (2024), public expenditure is likely to increase significantly during the transition process to create green public infrastructure, promote innovation within the private sector, and support the deployment of green technologies. Once the process is initiated, it becomes necessary to provide financial support to households and industries weakened by the implemented policies.

Nevertheless, it is clear that public spending alone will not be sufficient to achieve the net zero emissions (NZE) target by 2050 ; most authors consider it necessary until the private sector takes over green investment. But to what extent will this takeover occur ?

Research question

Some authors believe that public investment in a sector could stimulate private investment in that same sector; but is this the case for green investment?

This essay extends my master's thesis by focusing on one of its aspects, while broadening it to address the environmental issue. As detailed above, part of my previous work focused on what I called the public spending multiplier on investment (PSMI): the amount of change in private investment following a one-monetary-unit shock in government spending (consumption *plus* investment). This essay will instead focus on investment in the effort to transition to a low-carbon economy, conducting the empirical study on four sectors of the French economy. Specifically, this first chapter aims to answer the following question for each sector: Does green public investment encourage (or conversely hinder) green private investment? The proposed methodology will be presented further. In addition, the sectors studied will be the four main CO2 (carbon dioxide) emitters according to the Criqui Commission, namely the transport sector, the residential and tertiary sector, the manufacturing and construction sector, and the energy sector.

Literature

Very few empirical studies focus on green investment; generally, only overall investment is considered.

Afonso and St. Aubyn (2008), using a VAR approach on 14 EU countries (plus Canada, Japan, and the US), found that public investment could either crowd in or crowd out private investment, depending on the country studied. Two mechanisms are at play: first, public investment must be financed, either through an increase in taxes, which creates a negative wealth effect and thus reduces private consumption and investment, or through the issuance of government bonds. The latter raises interest rates, thereby reducing private investment. Additionally, households anticipate a tax increase to repay the new public debt issuance and thus reduce their spending; this is the so-called Ricardian-equivalence channel: regardless of the method of financing public spending, the private sector reduces its expenditures. Second, and conversely, public investment creates favorable economic conditions through the construction of new infrastructure (highways, airports, etc.), which increases the productivity and the complementarity of private investment and thus encourages it.

Pereira (2001), also using a VAR approach, concludes that public investment crowds in private investment at an aggregate level in the US; however, this effect becomes highly variable when analyzed through a sectoral approach.

Önder et al. (2021), on the other hand, observe the existence of a crowding-out channel of public spending on firm investment when fiscal policy is financed through the issuance of debt securities. In Colombia, when the government issues new debt securities, these are subscribed to by banks, which subsequently reduce their loans to firms, thus decreasing firm investment: a positive shock of 1 % in the bonds-to-assets ratio of Colombian banks reduces their lending by 0.4 %, leading to a reduction in firms' investment, profit, and wages.

The Criqui Commission (chaired by Patrick Criqui) aims to establish abatement costs for each economic sector, i.e. ,for each sector, the cost of avoiding one ton of carbon dioxide. The study has so far been conducted on six sectors: transport, electricity, hydrogen, construction, industry, and cement. The study of agriculture is yet to come. The Criqui Commission notes that between 1990 and 2020 in France, the main emitter was the transport sector (109 MtCO2eq), followed by the residential and tertiary sector (60 MtCO2eq), manufacturing and construction (42 MtCO2eq), and the energy sector (40 MtCO2eq). Therefore, the main leverage point would be the transport sector as its emissions, composed of 55% by passenger vehicles (and 45% by light commercial vehicles and heavy trucks), are expected to decrease very rapidly as the automotive fleet is replaced by new carbon-neutral vehicles.

Methodology and expected results

To determine the behavior of private green investment following a shock to public green investment, the use of the local projections (LPs) method (Jordà (2005)) is considered. As explained by Cho and Rhee (2023), LPs have three advantages compared to VAR models: i. as they impose weaker assumptions on the dynamics of the data, they are supposed to be more robust to misspecification, ii. a joint or point-wise analytic inference is readily implemented, and iii. they are easier to estimate relative to VAR models.

The model would then take the form of :

$$pi_{i,t+h} - pi_{i,t-1} = \alpha_i^h + \theta_t^h + \beta^h gi.\varepsilon_{i,t} + \omega^h X_{i,t} + u_{i,t+h}^h \quad \textbf{(1)}$$

where $pi_{i,t}$ corresponds to the log of green private investment for the economic sector *i*, at time *t ;* $gi.\varepsilon_{i,t}$ to the identified government investment shock ; α_i^h and θ_t^h to sector and time fixed effets, respectively ; and $X_{i,t}$ to a set of control variables. As all the coefficients vary with horizon *h (h = 0, 1, ... , H)*, the model will be estimated separately for each horizon. As in Cho and Rhee (2023), the standard errors will be computed using a robust covariance matrix estimator (robust to cross-sectional dependence, serial correlation, and heteroskedasticity). The data necessary for the empirical model to be estimated are readily available in the International Energy Agency (IEA) database and, as in Eyraud et al. (2013), in the Bloomberg New Energy Finance (BNEF) database.

From this estimation, it seems clear that the transport sector will benefit from strong positive externalities following public investment. Indeed, public investment in electrification is likely to be rapidly taken up by the private sector, given the significant rise in fuel prices for internal combustion vehicles. Hydrogenation of the automotive fleet, as detailed by the Criqui Commission, could emerge subsequently: initially too expensive, these vehicles could become viable and affordable by 2040.

In France, direct emissions from the residential and tertiary sector account for only 17% of its emissions; this is due to its high share of emissions related to electricity consumption. Due to its low share of direct emissions, it seems plausible that public spending will not incentivize the private sector to invest. The conclusions are very similar for the industrial sector.

Finally, the carbon tax will play a significant role in electricity production: the demand for electricity produced by CO2 emissions will decrease, leading producers to invest heavily in decarbonizing their activities.

Scientific Interest

At a time when public investment is crucial in the transition towards a decarbonized economy, this essay aims to identify the sectors of the economy where domestic spillovers are most significant. This essay addresses a significant gap in the literature regarding the determinants of private green investments, which are essential for achieving climate goals without compromizing a government's ability to repay its sovereign debt.

CHAPTER II. Green transition, demographic challenges and public debt sustainability

Context

According to the World Meteorological Organization, global temperatures are likely to increase by more than 1.5 degrees above pre-industrial levels in the next five years. To tackle climate change, 140 countries have pledged to achieve net zero emissions (ZNE) by 2050. In addition, the 2015 Paris Agreement led several countries to adopt Nationally Determined Contributions (NDCs) aimed at reducing greenhouse gases (GHG) emissions to stay below the 2-degree increase above pre-industrial levels.

It is now clear that the latter goal can only be achieved if environmental policies are coordinated across countries. According to Black et al. (2024), in developed countries with well-designed carbon tax policies, decarbonization of the economy would have effects ranging from moderately positive to moderately negative on fiscal balances.

It seems clear that climate change could have detrimental effects on the level of public debt and on its sustainability, and some authors have already shown that transition efforts towards ZNE would have a lower cost for public debt sustainability than a business-as-usual scenario. Agarlawa et al. (2021) listed nine physical and transition risks to public debt. Among the climate change risks are climate-related disasters, which are expected to affect economic activity, thus reducing tax revenues for states: floods, extreme temperatures and weather events, droughts, and so on ; the literature is extensive on this subject (Mirza (2003), Avril et al. (2023), Tintchev and Jaramillo (2024), etc.). In order to finance repairs and aid to the population, the government has no choice but to borrow from abroad, increasing public debt along with the sovereign risk perceived by lenders, thus reducing public debt sustainability. However, the transition to a low-carbon economy requires substantial public investment (as seen in Chapter 1), some of which would also need to be foreign-financed. Again, if not financed through tax increases, public debt increases, but the potential returns on investment mitigate the risk perceived by lenders; hence, the transition to a low-carbon economy is expected to minimize sovereign risk.

Some authors, as we will see later, aim to estimate and/or model the impact of environmental policies on public finances (mainly the level of debt): carbon pricing and green investments in particular. In order to ensure that public debt remains sustainable in the long run and increases only moderately, they often conclude with a policy mix: the public sector undertakes part of the expenditure, but it is assumed that the private sector would be incentivized to fill the gap.

At the same time, many developed countries are experiencing a seemingly unrelated phenomenon: demographic aging. According to United Nations' population projections, the old-age dependency

ratio (the proportion of people aged 65 over to those aged 15 to 64) is expected to double by 2050, leading to significant changes in supply and demand. As a result of two concurrent trends, namely increased life expectancy and lower birth rates, this could have serious consequences for public finances (through reduced contributions and increased transfers) and thus for the effectiveness of the policies to be implemented towards the low-carbon transition.

Research question

In a theoretical model, this essay introduces the assumption of heterogeneous agents, including a proportion of retired population. This work will serve three purposes: i. to test whether the assumption of household heterogeneity changes the model's conclusions regarding public debt sustainability, ii. by altering the share of retired households in the economy, to observe how demographic aging affects the impact of environmental policies, and iii. to observe the impact of such policies on different types of households.

In particular, and more generally, should these demographic trends be considered when designing evironmental policies? Moreover, will these policies exert different effects on households depending on their income level and retirement status?

Literature

Some authors aim to model the effects of environmental policies on national accounts. These include Dées and Seghini (2024), who employ a dynamic general equilibrium (DGE) model with risky government debt to estimate the impact of environmental policies on public debt sustainability, incorporating the dimensions mentioned above. If the government relies too heavily on fiscal policy, it affects its ability to repay loans, thus raising interest rates on government bonds. As discussed in Chapter 1, the rise in sovereign risk could alter financing conditions for private investment, thereby reducing the effectiveness of fiscal policy. Conversely, carbon pricing policies to finance public expenditures could reduce consumption and investment due to the negative wealth effect on households and firms.

Simultaneously, some authors aim to estimate the impact of demographic aging on the efficiency of fiscal policy. Using the local projections (LPs) method (Jordà, 2005), Cho and Rhee (2023) compute government spending multipliers in a panel of 24 OECD countries, isolating the effect of public debt from population aging. They find that fiscal policy is ineffective in aging economies, regardless of the level of debt. Miyamoto and Yoshino (2020) obtain similar results, explaining that fiscal stimulus increases employment opportunities for the unemployed and raises incomes for the employed. However, since retirees are not part of the productive labor force, the effect of government spending on economic activity diminishes as the average age of the population

increases. In addition, the marginal propensity to consume is lower among retirees, reducing the impact of fiscal stimulus on consumption.

The extensive academic literature on the effects of environmental policy often overlooks this dimension, which appears crucial given the empirical evidence on the consequences of an aging population.

Methodology and expected results

In Dées and Seghini (2024), the economy is inhabited by a representative infinitely-lived household who maximizes intertemporal utility. This essay proposes to extend this model to heterogeneous households. Specifically, it assumes the existence of constrained (poor) households, unconstrained (rich) households, and a fraction of retirees. This would allow the simulation of population aging through an overlapping generations (OLG) model. Households would become finitely-lived and save throughout their lives to maintain their consumption levels during retirement. In addition, their consumption, investment, and saving levels are determined by their initial wealth; for instance, constrained households have a high marginal propensity to consume and do not invest, unlike unconstrained households.

By calibrating this model on French data (as done, among other countries, in Dées and Seghini (2024)), it will help explain the impact of proposed environmental policies on the country's economy (particularly on public finances) and on the households that make up its population. The data needed to calibrate this OLG model are readily available in the INSEE database: primary income brackets, proportion of retirees, consumption by household category, etc.

On the basis of the results obtained so far in the literature briefly reviewed above, it can be assumed that population aging negatively affects the ability of fiscal policy to achieve the NZE target, particularly by mitigating the impact of public spending on GDP components. Moreover, aging is expected to deteriorate public finances: it reduces government revenues (tax receipts) and requires increased social security spending (Lee et al. (2022)), thus limiting fiscal policy's room for maneuver concerning public debt sustainability. In the case of transition financing through carbon pricing, it is likely that the working population would be more heavily taxed (e.g. they have to commute daily to work). Consequently, aging would affect the revenues from these new taxes. Dées and Seghini (2024) conclude with a welfare-maximizing optimal policy mix involving 25% to 40% of the mitigation effort undertaken by the public sector between 2030 and 2050, with the private sector expected to bear the rest. The new hypothesis of heterogeneous households could alter the government's share of the effort, thus changing the approach to the transition effort.

Regarding households, it can be assumed that carbon tax, proportionally, would weigh more heavily on the income of poor households. However, the new policy would benefit households investing in

green technology, while reducing the income of those investing in brown technology (due to stranded assets and, more broadly, carbon-intensive assets, which require significant decarbonization efforts).

Scientific Interest

Decarbonizing the economy requires substantial public and private expenditures, and the impact of carbon taxes is often evaluated through the representative agent hypothesis. However, it is widely accepted that population aging will have significant medium- and long-term effects on economies experiencing this phenomenon. Few authors analyze the implications of this phenomenon for environmental policies, and none have yet linked it to the effects of these policies on debt sustainability. Once again, this essay seeks to clarify an area of uncertainty: are the proposed policies still sustainable for public finances in the long run, given the increasing average age of the population, without leading to severe losses in household income levels? This question, although seemingly essential for decision-making, remains unanswered.

CHAPTER III. Energy independence and sustainability of public finances

Context

In France, the question of sovereignty (particularly energy independence) has been raised regularly over the past thirty years. Increasingly present on political agendas, the need for a country to produce its own energy becomes essential during periods of tension in global energy markets. The recent energy crisis has placed significant strains on global value chains, and households in most countries have suffered a significant reduction in their purchasing power: soaring prices for energy, goods and services, and supply chain disruptions. In France, the wholesale price of electricity (the price paid by suppliers to producers) exceeded €1,000 per MWh (megawatt-hour) in August 2022, compared to €85 the previous year. As detailed further, the increase in Russian gas prices following the outbreak of the Russian-Ukrainian conflict was the main cause. Specialist Nicolas Goldberg, in a note for the think tank Terra Nova, highlighted a "triple curse" of the European electricity market: "an over-reliance on Russian gas to balance its power grid, under-investment in electricity production due to the short-sightedness of wholesale markets, and an insufficiently regulated retail market". In response to the growing criticism of the European electricity market, the European Union decided to reform it in May 2024; a reform that, according to Belgian Energy Minister Tinne Van der Straeten, "will pave the way for a more stable, predictable and sustainable energy market", relying in particular on long-term electricity supply contracts and guaranteeing more stable revenues for electricity producers (notably through the use of bidirectional difference contracts). However, despite the stabilization of prices, a problem remains in France and many other EU countries: due to chronic underproduction of national electricity, the import of foreign electricity has a significant impact on the current account balance.

At the same time, following massive public spending during the two major recessions of the 21st century (the Great Financial Crisis of 2008-2009 and COVID-19), public debt has skyrocketed: from 66% of GDP in the first quarter of 2008, it reached 85% two years later, and from 97% in the fourth quarter of 2019, it peaked at 118% of GDP in the first quarter of 2021, according to data from the European Central Bank (ECB). This situation has led to a re-evaluation of risk assessments, with, for example, the downgrade on Friday, May 31, 2024, by the rating agency Standard & Poor's (S&P) of the French debt (previously rated "AA" and downgraded to "AA-"). For the first time, France is concerned about the potential unsustainability of its public debt.

An overview of the European electricity market

The operation of the electricity market is based on the fact that this energy cannot be stored. Power plants with the lowest marginal costs are activated first and only deactivated when their use is no

longer necessary to meet the demand of a given day. Their priority of use is therefore determined by their operating costs, in ascending order. According to Engie and ACE Energie, the ranking is as follows: wind, photovoltaic, hydro, nuclear, coal, gas, oil. Consequently, the price paid by suppliers is determined by the last power plant needed to meet demand.

The recent energy crisis resulted from an unprecedented increase in the price of fossil fuels, especially gas, which drove up electricity prices on the wholesale market, especially for long-term contracts. As most electricity is traded on long-term contracts, the impact on the real economy is generally felt with a lag of several months. To make matters worse, low-cost power plants sometimes match the prices of higher-cost plants in order to generate excess profits.

Moreover, within the EU, certain countries are interconnected by cables: if one of them does not produce enough to meet its domestic demand, electricity is automatically imported from abroad; this is particularly the case for France, Germany and Belgium, which often results in the same electricity prices for the three countries.

The May 2024 reform of the European electricity market aims to develop the renewable energy sector on European soil, with low operating costs, to avoid the systematic use of fossil fuels, whose prices are much more volatile. In addition, to ensure stable profits for producers, there will be greater reliance on bidirectional difference contracts (or Contracts for Difference, CFDs): a reference price is set; below this threshold, the state commits to paying the difference to cover the producer's operating costs. Conversely, if the price threshold is exceeded, the producer pays the surplus to the government.

Research question

Generating enough electricity at low cost avoids dependence on fossil fuels, which are subject to high price fluctuations. In addition, this type of production will be prohibited in the context of achieving net zero emissions (NZE). Investment in low-carbon (and low-cost) electricity is therefore essential in the near future.

At a time when energy independence is mainly considered from a European perspective, national dependence on electricity from this market affects the balance of payments of countries where demand exceeds supply, thus reducing the sustainability of public debt. In addition, when a country's current account runs a persistent deficit, international lenders become more concerned about the risk of default and reduce the amount they are willing to lend.

Could energy independence, if financed by public investment, therefore improve the sustainability of the French public debt? And at what cost(s)?

Literature

Collard, Habib, and Rochet (2014) develop a measure of maximum sustainable debt (MSD) for advanced countries, which they set at 146.56% of GDP for France. They explain that this level is determined by lenders: when lenders believe that a country will not be able to repay its debt, they cut off loans, preventing the country from refinancing and forcing it to default if it is indeed unable to repay. Lenders closely monitor the development of national accounts, especially the balance of payments. A country that cannot generate current account surpluses (its investments persistently exceed its savings) will certainly have more difficulty repaying its debt (due to the reluctance of debt security buyers) and will therefore suffer from a lower MSD.

France structurally has a current account deficit: its imports, expressed in value, exceed its exports (hence, accounting-wise, its agents invest more than they save). The cause lies in the imports of goods, which are much higher than exports. After two short periods of current account surpluses (for the two years 2019 and 2021), the current account deficit reached rarely seen levels during the energy crisis that began at the end of 2021: the deficit peaked at 19.8 billion euros in the third quarter of 2022, according to data from the Banque de France. Such a deficit could be explained by the rise in energy prices and, consequently, by a significant increase in the prices of imported goods. As a result of the rise in prices, the European Central Bank (ECB) has significantly raised its interest rates since July 2022, thereby increasing the risk premium on French government debt. According to Agence France Trésor (AFT), the yield on French government bonds, which was negative in 2021, rose to 1.04% in 2022 (over short and long maturities).

On the other hand, rising energy prices increase the production costs of domestic goods, prompting households to import in order to maintain their purchasing power. Two phenomena then come into play: i. As demand for domestic products declines, the government collects fewer taxes from businesses, and ii. Some firms are forced to lay off workers, further reducing the taxes collected from households. With reduced revenues, the government has no choice but to borrow in order to implement its fiscal policy. In addition, the operating costs of public administrations rise, and the cost of fiscal policy also increases (notably through higher prices for consumption goods). Herein lies the triple interaction: the increase in prices (of energy and thus of goods) within the country worsens the finances of all its agents, reducing tax revenues while increasing the cost of public spending. During an energy price shock, not only is the sustainability of the public debt reduced due to the loss of investor confidence, but the debt is also pushed higher.

The recent energy crisis has thus reminded us of the importance of this sector. In particular, it has reignited debates about the necessity for a country to produce its own energy; in other words, no longer relying on external supply. This topic, however, seems to give rise to only a scant amount of studies, and its benefits (and limitations) can thus far only be hypothesized.

Methodology and expected results

This final chapter, by focusing on the electricity market, aims to determine the optimal fiscal policy to achieve energy sovereignty. Once achieved, it details the mechanisms through which the sovereignty reduces public debt, and makes it sustainable. It employs an Integrated Assessment Model (IAM) (the model by Catalano et al. (2022) is considered), adding, as in Zenios (2022), a (Stochastic) Debt Sustainability Analysis (DSA / SDSA) module, and develops a system of equations representing the European electricity market in all its complexity, and as accurately as possible. By incorporating mutual interactions between the electricity market, the current account balance, and the level of sovereign debt, this model will be able to describe the improvement of public finances based on the level of national electricity production.

Once calibrated on French data (thanks to the Eurostat database), it will enable the suggestion of policies to be implemented in order to achieve energy independence.

Scientific interest

The scientific interest of this chapter lies in filling a significant gap in the literature on the topic of energy independence, at a time when it appears crucial for addressing future national challenges. Given the complexity of the electricity market (specifically the European market in our case), a comprehensive modeling of this market would allow its integration into a wide range of theoretical models, thus significantly improving their accuracy. In addition, this essay aims to assess the extent to which public investment in low-cost (low-carbon) electricity production would ultimately strengthen public finances and national trade balances.

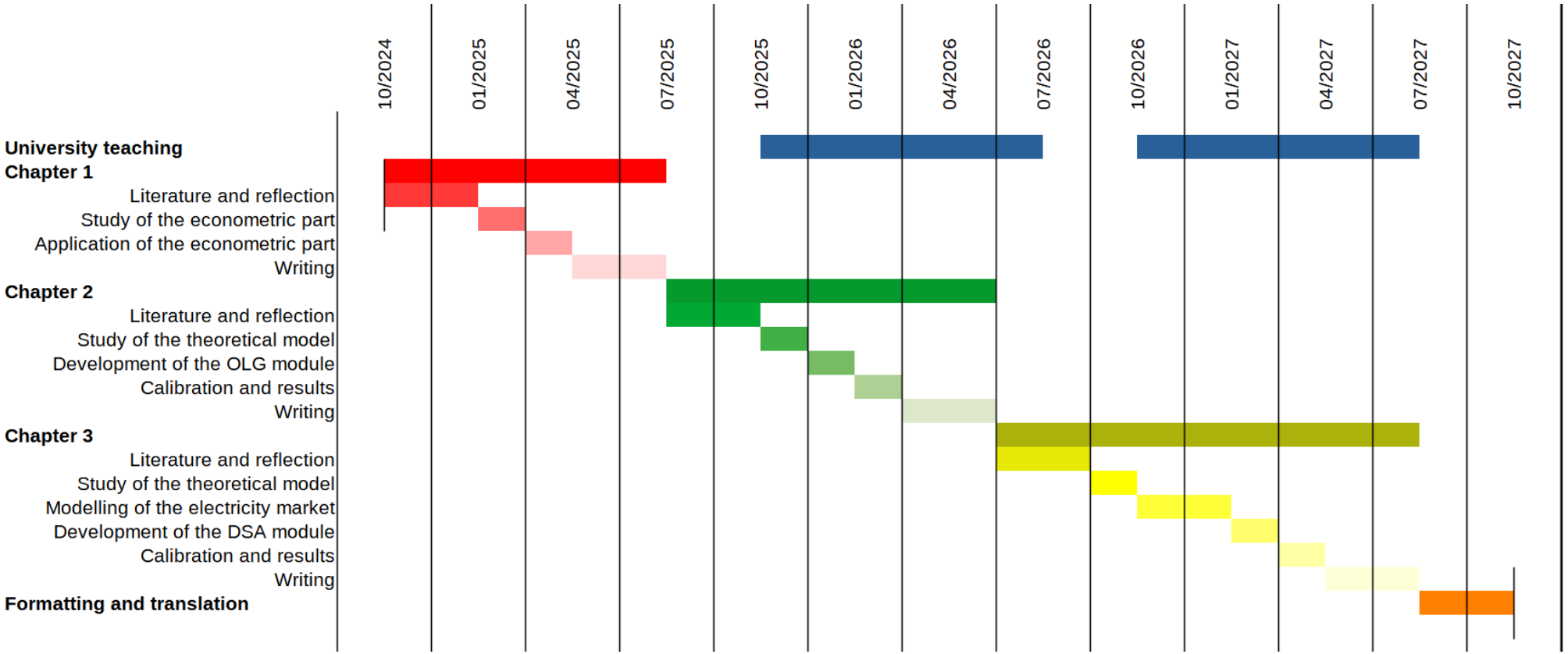
Research environment

I had the opportunity to complete my Master's thesis on "Sovereign Debt, Public Spending Multipliers, and Private Investment" under the supervision of Stéphane Dées. This work allowed me to gain extensive knowledge on the topic of sovereign debt, which is the main focus of my Ph.D. thesis "Essays on Public Debt and Sovereign Risk in the Context of Uncertainties and Future Challenges", again under the supervision of Mr. Dées. This thesis delves deeper into the question of public debt sustainability, linking it to environmental concerns and future challenges (particularly demographic aging and energy sovereignty). The Economics of Climate Change course taught by Mr. Dées aligns perfectly with the three proposed chapters and will serve as a foundational support throughout the preparation of this thesis. In addition, the International Finance course taught by Mr. Dupuy, head of the IBEF Master's program, helps me to better understand the functioning of the current and financial accounts, which are crucial for the successful completion of the final chapter.
Moreover, as the topic of this thesis is one of the research focuses of the Banque de France, a collaboration with this institution and/or with the Network for Greening the Financial System (NGFS) is envisaged. Furthermore, thanks to Mr. Dées, a collaboration with Stavros A. Zenios (University of Cyprus and Wharton Financial Institutions Center, USA) is also considered.

Conferences

- October 3, 2024, in Paris, France : 'The Impact of Climate Change and the Ecological Transition on Employment' (organized by the Institut de la Gestion Publique et du Développement Economique (IGPDE)).
- March 29-30, 2025, in Kuwait, Kuwait : International Conference on Advances in Environmental Economics (organized by the World Academy of Science, Engineering and Technology).
- September 20-21, 2025, in Toronto, Canada : International Conference on Sustainable Economic Development (organized by the World Academy of Science, Engineering and Technology).
- February 15-16, 2026, in Istanbul, Turkey : International Conference on Public Finance, Public Economics, and Public Policy (organized by the World Academy of Science, Engineering and Technology).

Provisional timetable



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