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Grasping Argentina's Green Transition: Insights from a Stock-Flow Consistent Input-Output Model

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Abstract

In December 2020, Argentina updated its nationally determined contributions (NDC) of greenhouse gas emissions to 359 million metric tons of CO2 equivalent in 2030, which is 25.7% lower than the initial target set four years before. This paper presents two different shapes that a green transition based on the structural reform of the energy sector could take and seeks to identify whether those transition pathways would be consistent with the structural constraints that Argentina faces, mainly the balance of payments constraint. This research question is addressed through an empirically calibrated stock-flow consistent input-output model, based on a social accounting matrix disaggregated at 31 productive sectors for the year 2017. This matrix is extended to incorporate the greenhouse gas emissions of each productive sector and the financial assets and liabilities of each institutional agent, thus obtaining a modeling tool that integrates production, income, financial and environmental accounts in a consistent way. The results of the simulations show that a stable green transition is possible, although conditional on a regular flow of financing during the period that structural change takes place.

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1. INTRODUCTION

In December 2020, Argentina updated its nationally determined contributions (NDC) of greenhouse gas emissions to 359 million metric tons of CO_2 equivalent in 2030, which is 25.7% lower than the initial target set four years before. Being the new NDC target roughly equal to the current level of greenhouse gas emissions, the fulfillment of the target finds the country at a crossroads: either it remains stagnant or it shifts its productive structure away from high emitting activities, like agriculture and cattle raising, which would entail severe consequences in terms of the balance of payments. As a result, the country finds itself in a trilemma where given its economic structure the simultaneous attainment of moderate (not even high) economic growth, external and environmental sustainability is not feasible. A possible way out of this trap would consist of undertaking a process of structural change based on the energy sector, in such a way that all the emissions except for the ones coming from the primary sector are significantly reduced.

For almost the last three decades the modeling of the interactions between the economy and climate change has been addressed by means to the so-called Integrated Assessment Models (IAMs), pioneered by Nordhaus (1992). In the last few years, however, there has been a growing critique to these models, not only from the side of academic economists (Pindyck 2013, 2020; Pollitt 2019; Keen 2020) but also from international organizations (Feyen et al 2020, p. 8), who pointed out both theoretical and methodological weaknesses. The doubts about the consistency of IAMs also were also driven by the lack of consensus within the ecosystem of IAM modelers, who did not seem to agree on some crucial aspects of the models (most notably the discount rate) to which the results of the simulations ended up being highly sensible (Nordhaus 2008, Stern 2007). Partly as a result of this lack of robustness the scientific community decided to set absolute limits for temperature change[2] instead of estimating optimal values for carbon prices. As a result of this change in the approach to climate change policy it is required a modeling framework that truly integrates a variety of economic dimensions and policy choices, not only carbon prices (Krogstrup and Oman 2019, p.6).

The goal of this paper is to build an empirically calibrated model that can represent the multiple processes underlying the trilemma that Argentina and, most likely, most Latin American economies

[2] The 2°C target for limiting temperature change was formally adopted at COP21 in Paris in 2015.

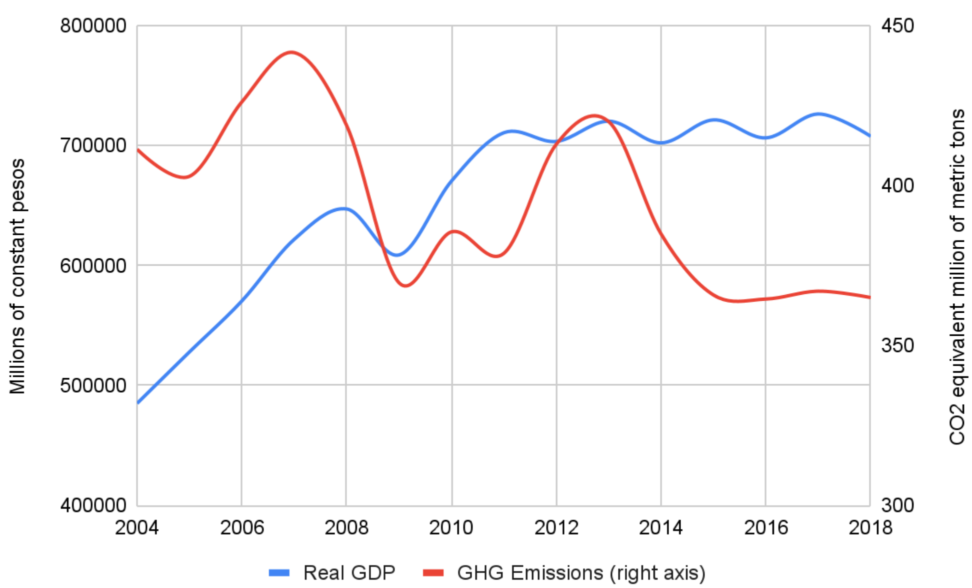
face in the context of the green transition. Such a model needs to account for the sectoral specificities of the economy as well as for the interactions between the economy, the environment and the financial side (mainly the one linking the economy to the rest of the world), and at the same time overcome the problems that have render IAMs useless for policy-making purposes. The model developed in this paper is an Environmental Stock-Flow Consistent Input-Output Model (ESFCIO) disaggregated at 31 productive sectors for the year 2017, which social accounting matrix is extended to incorporate the greenhouse gas emissions of each productive sector and the financial assets and liabilities of each institutional agent, thus obtaining a modeling tool that integrates production, income, financial and environmental accounts in a consistent way. The scenarios are simulated by changing the technical coefficients defining the unit requirements of energy and the share of that unit requirement that is supplied through clean sources. If the change in the technical coefficients requires new production techniques, which in turn requires new investment that call for, in turn, more financing, the results of the simulations are useful to simultaneously address the economic, financial and environmental dimensions of the challenge that the green transition entails.

The hypothesis that guides this study is the idea that the only possible way of Argentina succeeding at transitioning towards a development model that delivers a decent standard of living to its entire population without compromising environmental sustainability is through a structural change in its productive structure. With this hypothesis in mind, the research question that goes over the whole paper is what that structural change based green transition would look like. Although there could be numerous ways of defining the shape that this transition could take, in this paper we assume that most of the efforts are put on the energy sector, upon the stance adopted by the government (as interpreted from the official documents). The paper is structured as follows: after this introduction, in the next section we present some figures that describe the trilemma that Argentina faces in the process of transitioning towards a more sustainable development model. In section 3 the most relevant studies that contributed to the model are presented, after which the whole model is described in section 4. In section 5 several scenarios are presented, some of them showing the current long-term inconsistencies that the economy currently suffers from, and the last ones shedding light on a possible way out of these persistent limitations. Finally, section 6 concludes.

2. ARGENTINA'S PLACE IN THE FIGHT AGAINST CLIMATE CHANGE

Being a small economy Argentina does not contribute significantly to GHG emissions - while its share of world GDP was 0,8% in 2018 (measured at current dollars al PPP), its relative contribution to GHG was 0,8%. After reaching its peak in 2007, emissions started to decline alongside the chronic stagnation in which the economy was caught in the 2010s (Figure 1). Given its productive structure GHG emissions exhibit a high level of concentration, as 75% of total emissions come from only four sectors: Agriculture, cattle raising, forestry and fishing (38,5%); Transport and communication services (13,7%); Generation and distribution of electricity, gas and water (12,7%); and Bituminous mineral oils, petroleum gases and other gaseous hydrocarbons (10%)[3]. The relative sectoral contributions to GHG emissions of Argentina are in contrast with the global figures, where the energy sector dominates with 73% of emissions, and agriculture, forestry and land use total 18%.

Figure 1: Real GDP and GHG emissions of Argentina



Source: World Bank's World Development Indicators database.

The fact that in Argentina the energy sector does not lead the ranking of GHG emissions does not imply it should not play a key role in the transition towards a more sustainable development model. In fact, the greening of the energetic matrix is among the top priorities that the government has set in its 35 measures plan oriented to the achievement of the NDC target set for 2030 (MAyDS,

[3] National Survey of Greenhouse Gas Emissions, published by the Ministry of Environment and Sustainable Development: https://inventariogei.ambiente.gob.ar/

2020)[4]. One possible reason explaining the need that it is the energy sector the one that leads the transition is that the nature of the highest GHG emitting sector (the agriculture and cattle raising sector) sets a high floor for the total emissions of the economy[5]. Even though one possible way of increasing the environmental sustainability of the economy could consist of the reduction of the size of this sector, none of the three specific measures included in the plan seems to consider this a possibility[6]. The reason is straightforward: this sector is the third largest contributor to exports and the main supplier of the food manufacturing sector which, in turn, is the second in the ranking of exports by sector (in 2017, these two sectors added up to 36% of exports income). Given the subordinated integration of Argentina to global markets and, consequently, its structural demand for foreign exchange, the abandonment of the agriculture and cattle raising sector as a pillar of the Argentinean economy seems to be completely out of the discussion.

Figure 2 provides a summary of the sectoral composition of the Argentinean economy regarding production, employment, exports and GHG emissions. Besides the tension between external and environmental sustainability characterizing the agriculture and cattle raising sector, there are other facts that are worth noting. First, the trade services sector plays a positive role since it is the highest contributor to production, employment and exports, while its GHG emissions are very low (0,8% of total emissions). Second, real estate and business activities are also a driver of growth and employment, although not very important in exports. Since the GHG emissions of this sector are also low (1,2% of total emissions) it can also be considered as a sector with an overall positive contribution to the economy. Third, the transport and communications services plays an important role in terms of output and exports, but it is among the main contributors to GHG emissions (second

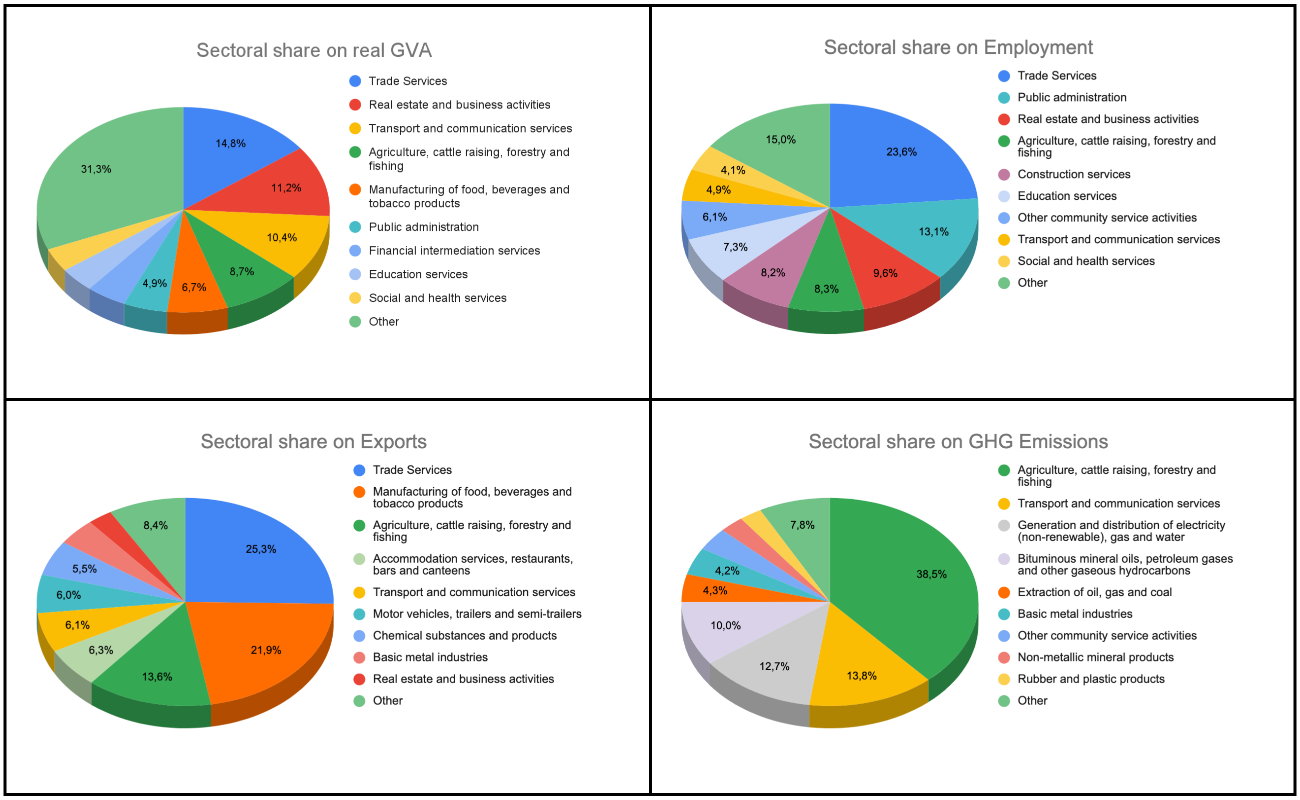
[4] The figures show that as of 2019 87% of the energy produced locally came from fossil origin, 54% corresponding to natural gas, 31% to oil and derivatives, and 1% to mineral coal. Hydraulic and nuclear energy contributed 4% and 3%, respectively, and non-conventional renewables (biomass, small hydroelectric, wind and solar) 6%. Of this 6%, wind generation represented 42%, solar 3%, small hydroelectric plants 43% and other non-conventional renewables 12%. As of the demand for energy, in 2019, the transport sector represented 33% of the country's energy demand, the residential sector 26%, the industrial sector 26%, the agricultural sector 8% and the commercial and public sectors 7% (MAyDS, 2020).

[5] Only enteric fermentation makes up 15% of total GHG emissions of Argentina. Excreta in pastures add another 6 percentage points, making cattle raising the biggest contributor to emissions in the primary sector. More generally, changes in land use contribute 10% while the agriculture sector specifically adds 6 extra percentage points (MAyDS, 2019).

[6] The three measures proposed in the document are the following: 1) Sustainable and resilient management of agroecosystems that contribute to the achievement of food security against the impacts of climate change; 2) Development and promotion of instruments for the prevention and transfer of climate risk and attention to emergencies in agricultural production; 3) Implement measures that promote research, development and capacity building for adaptation to climate change in the agricultural sector (MAySD, 2020).

in the ranking, totaling 13,8% of total emissions). A similar remark applies to the food manufacturing sector which, as mentioned before, plays a relevant role in terms of exports, but also contributes significantly to GHG emissions (not directly, as its emissions are only 1% of the total, but indirectly through its purchases to the agriculture and cattle raising sector).

Figure 2: Sectoral composition of GVA, Employment, Exports and GHG emissions



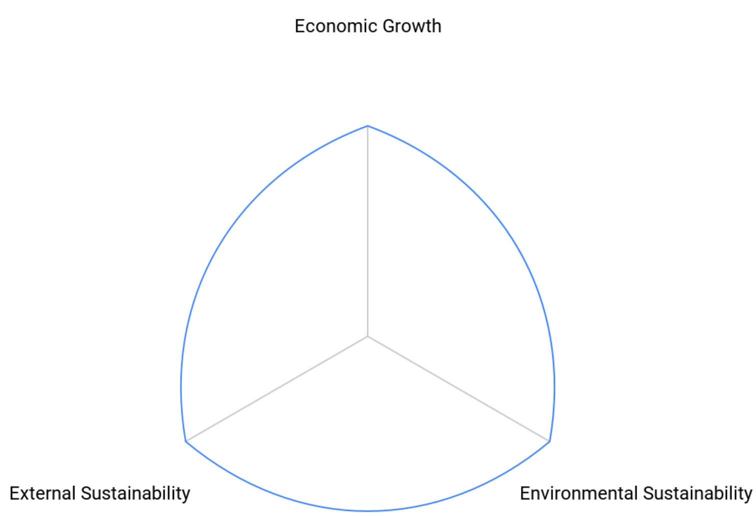
Source: Self elaborated based on Chisari et al (2020)

Being the agriculture and cattle raising sector the main source of foreign exchange and given the difficulties that reducing the emissions produced by this sector entail, the country faces a dilemma between its external and environmental sustainability[7]. A third dimension to this tension is added when the strong relationship between external stability and long run economic growth is added to the analysis (for an updated survey of the different contributions to this literature see Thirlwall, 2019). Thus, if the country chose to progressively cut its emissions generated in the primary sector it would, given its current productive structure, face serious balance of payments constraints that

[7] First, the land that is used for agricultural production must be taken away from the ecosystem services that contribute to the absorption of GHG. Second, there are no clear ways of reducing the amount of GHG emitted by this sector, as is the case of the energy sector, where the replacement of fossil fuels for renewable sources of energy will have a direct impact on total emissions.

would eventually hinder economic growth. If, on the other hand, the country opted to maximize its income from primary exports, something which we could label the business-as-usual scenario, far-reaching reforms in the industry, energy and service sectors would have to be undertaken if the NDC targets are to be met. If no structural change takes place, it would seem that the compliance with the NDC targets would come at the cost of sacrificing economic growth. With such a low level of growth it could well be the case that the country registers both external equilibrium (due to lower imports) and below target emissions (as a result of economic activity related emissions). These three different choices, none of which is free of inconveniences that can eventually backfire the whole transition, can be synthesized in the trilemma depicted in Figure 3. This graphical device will be useful when the different scenarios are built in section 5.

Figure 3: The Green Transition Trilemma



Source: Self elaboration.

3. MODELING BACKGROUND

For almost the last three decades the modeling of the interactions between the economy and climate change has been addressed by means to the so-called Integrated Assessment Models (IAMs). This approach, pioneered by Nordhaus (1992), quickly gained adoption from governments and international organizations. In a nutshell, IAMs rely on an optimization framework whose aim is to determine an optimal "social cost of carbon", which is the point at which the damage from an additional unit of greenhouse gas emissions is equal to the economic damage that measures to reduce emissions would incur. Among some current examples of large scale IAMs are the IMAGE model[8], the GCAM model[9] and the MESSAGE- GLOBIOM model[10]. In the last few years, however, there has been a growing critique to these models, not only from the side of academic economists (Pindyck 2013, 2020; Pollitt 2019; Keen 2020) but also from international organizations (Feyen et al 2020, p. 8), who pointed out both theoretical and methodological weaknesses. The doubts about the consistency of IAMs also were also driven by the lack of consensus within the ecosystem of IAM modelers, who did not seem to agree on some crucial aspects of the models (most notably the discount rate) to which the results of the simulations ended up being highly sensible (Nordhaus 2008, Stern 2007). Partly as a result of this lack of robustness the scientific community decided to set absolute limits for temperature change[11] instead of estimating optimal values for carbon prices. As a result of this change in the approach to climate change policy it is required a modeling framework that truly integrates a variety of economic dimensions and policy choices, not only carbon prices (Krogstrup and Oman 2019, p.6).

In regard to the nature of the policies, as an IMF working paper has recently recognized (Krogstrup and Oman 2019), a combination of fiscal, monetary and financial policies is needed to make the transition possible. Among these policies the following sub-types can be distinguished:

- Fiscal instruments: price policies (taxation, subsidies), spending and investment, and public guarantees.
- Financial policies can be divided into three categories: first, policy tools that redress possible underpricing and lack of transparency of climate risks in financial markets and regulatory prudential frameworks; second, policy instruments that can help reduce the short-term bias and improve governance frameworks of financial institutions; and third, tools to support the development of markets for green financial instruments.
- Monetary policies can be divided into two subtypes: adapting central banks' collateral frameworks, and using environmental, social and governance criteria in their large-scale asset purchases; and actively purchasing green assets or eliminating assets with high carbon

[8] https://models.pbl.nl/image/index.php/Welcome_to_IMAGE_3.0_Documentation
[9] http://jgcri.github.io/gcam-doc/
[10] https://data.ene.iiasa.ac.at/message-globiom/
[11] The 2°C target for limiting temperature change was formally adopted at COP21 in Paris in 2015.

intensity from central bank portfolios, beyond what is justified by adjusting risk weights to correctly reflect climate risks.

As governments, international organizations and researchers start to consider a broader set of climate policies, the models used to address their impact also need to be adapted in such a way that they can answer the most relevant questions of the public debate. According to the European Commission's regulation guidelines (European Commission, 2017) the design of economic policies in the pursuit a desired objective should be derived from the answering of seven specific questions, the fourth, fifth and sixth being:

4. What are the various options (i.e., combination of policies) to achieve the desired objective?
5. What are the economic, social and environmental impacts of each of these options, and who will be affected?
6. How do the different options compare (effectiveness, efficiency and coherence)?

The model building process should begin with Step 4, where inputs from different disciples are gathered to define an initial set of policies that could eventually be part of a general strategy. The types of questions being asked in Steps 5 and 6 are well suited to a simulation-based assessment approach, where the policies defined in Step 4 are jointly modeled and tested in a holistic and dynamic framework. It should be noted that in the guidelines provided by the European Commission there is no mention of optimal outcomes in the questions. In other words, policy makers require an estimate of what will happen if a chosen policy is implemented, not what should happen if economic agents behave optimally (Pollitt 2019). It is with this concrete need in mind that this paper proposes the use of an environmental stock-flow consistent input-output model (ESFCIO).

An ESFCIO is a tool that offers a high level of disaggregation both at the production and the household level, alongside the integration of environmental and financial accounts. It is based on a social accounting matrix where the most relevant transactions are registered (intermediate and final consumption, income and tax payments, transfers, etc.) on a whom-to-whom basis with a coherent representation of their corresponding financial transactions (quadruple entry bookkeeping) and environmental impacts. The detailed representation of the social and economic structure enables the analysis of the impact of climate policies on income distribution, one of the shortcomings of IAMs

(Feyen et al, 2020). Moreover, it allows to address the sectoral effects of macroeconomic policies and, most importantly, to design and test fine-tuned sector specific policies. Moreover, the explicit modeling of the main financial assets and liabilities of the key sectors of the economy allow for a coherent description of the multiple ways of financing climate policies, as well as the risks inherent to their implementation. In order to overcome some of the critiques that fall on IAMs, ESFCIO can incorporate endogenous technological change, demand-led growth (in such a way that it is possible that there are scenarios where climate policies conduct to more, and not always less, growth), and do away with discount rates and damage functions[12].

In the last few years there have been some attempts to model the interactions between the economy and the environment in a more coherent way than the IAM literature does. A first worth mentioning example is the DEFINE model, developed by Dafermos, Nikolaidi and Galanis (2017). This model presents a stock-flow-fund ecological macroeconomic framework that analyses the interactions between the ecosystem, the financial system and the macroeconomy with the goal of examining the impact of a wide variety of economic policies. The DEFINE model draws on the post-Keynesian and ecological economics tradition, combining the stock-flow consistent approach with the flow-fund model of Georgescu-Roegen. By doing so it provides an integrated approach to the combined analysis of physical and monetary stocks and flows. Among its advantages is the detailed description of the multiple interactions between the economy and the environment, which are found in the explicit modelling of the laws of thermodynamics, the effects of emissions on temperature, climate damages and the waste generation process. The model does not describe a single country or region, but the world economy as a single entity that produces a single good.

A second relevant contribution to the modelling of the integration of the economy and the environment was produced by Bovari, Giraud and Mc Isaac (2018), who developed an integrated ecological macroeconomic model combining two sources of instability: global warming and private over indebtedness. Unlike standard IAMs, the model assumes myopic behavior of imperfectly competitive firms, allows for multiple long-run equilibria, and exhibits endogenous monetary cycles, sticky prices, endogenously determined private debt, and underemployment. By contrast

[12] The neglect of feedback effect is valid only if the goal of the model is to address the feasibility of a certain combination of mitigation and adaptation policies, as is the case of the model presented in this paper. It is worth mentioning that there is no scientific consensus about how these feedback effects should be modeled, which drives us to conclude that the investigation of these phenomena constitute a research project on its own.

with more conventional general equilibrium approaches, the model is built to describe the fact that the current state of the economy may be already following a path leading to a future severe economic recession if no shift away from a business-as-usual scenario is implemented. Regarding the climate module, this model shares with the DEFINE model a detailed description of the carbon cycle, its impact on GHG concentration in the atmosphere and therefore on average temperature, and the resulting damages that this might have on the economy[13]. Like the DEFINE model as well, Bovari, Giraud and Mc Isaac model a single good global economy and its interactions with the environment - no attempts to describe a specific country or region are made. The model is used to examine the deployment of a carbon price policy that may help cope with the possible climate and financial disasters.

Another important antecedent for the model developed in this paper is the work done by Berg et al (2015), who take elements of the SFC and the IO literature with insights from ecological economics to pave the way for the analysis of the interrelations between the monetary economy and the physical environment. The model represents a closed economy with households, industries and the governments as its institutional agents. The main contribution comes from the use of the IO matrix, which allows breaking down the industrial sector into its different subsectors, thereby obtaining a full description of all the inter-industry linkages. The general framework presented by the authors is then simplified to describe a two-sector economy (the sectors being consumption/capital goods and energy) which is calibrated with data for Germany in the year 2010. The model is used to evaluate the macroeconomic effect of an increase in the price of energy and to describe the environmental impact of energy conversion.

An also relevant antecedent of the model presented in this paper is the work developed by Jackson and Victor (2020), who build an open economy model empirically calibrated with data for Canada. Being a country specific model, the main goal is not to measure the impact of economic activity on the environment and its related feedback effects, but to simulate how the economy would behave under three different scenarios describing Canada's possible paths in regard to the transition towards a more sustainable model. The model focuses the green transition on the energy sector and specifies four specific targets related to the greening of the energetic matrix: the electrification of the

[13] The description of the carbon cycle and its effect on atmospheric temperatures is taken from the seminal works of Nordhaus (1993, 2014).

economy; the decarbonization of the electricity sector; the decarbonization of the non-electricity sector; and non-carbon related environmental improvement. The block describing the processes involved in the transition distinguishes between different types of investment goods (conventional and "green") and energy generation resources (existing renewable sources, new renewable sources, new non-renewable sources and existing non-renewable sources). The authors also introduce an alternative way of measuring the impact of the transition by means of two indicators: the Environmental Burden Index (EBI) and the Sustainable Prosperity Index (SPI). The EBI is designed to capture the environmental impacts of economic activity notably absent from GDP. The SPI is based on a combination of economic, environmental and social variables that provides a more comprehensive measure of how well or badly the economy is doing.

Also using the SFC tradition Monasterolo and Raberto (2018) build a neo-Schumpeterian open economy model featuring heterogeneous economic sectors and subsectors characterized by adaptive behaviors and expectations, and heterogeneous capital goods (green and non-green) characterized by different resource intensity. The model is designed to describe the behavior of policy agents, such as a government that decides on the fiscal policy and issues green financial products (i.e., green sovereign bonds), and a Central Bank in charge of setting the monetary policy. The model contributes to the field of ecological macroeconomics and environmental economics literature by endogenizing green technology investments and displaying their effects on the changes in green technology adoption and thus on the level of resource efficiency of the production process and on the structure of the real economy. Another relevant contribution of their work is the simulation of two different sets of green public policies through which the government covers the cost of the introduction of green subsidies: green sovereign bonds and green fiscal measures.

The interactions between the economy and climate change have also been addressed through the agent-based modelling approach. A relevant contribution in this domain is found in Lamperti et al (2018), who do away with the single economy assumption to build a model composed of heterogeneous firms belonging to three productive sectors: capital goods, consumption goods and energy sectors. As in the previous modelling antecedents mentioned above, production and energy generation lead to greenhouse gas emissions, which affect temperature dynamics. However, the agent-based nature of the model allows for the description of climate damages at the individual level, which is done as stochastic shocks hitting workers' labour productivity, energy efficiency, capital stock and inventories of firms. As a result, aggregate damages emerge from the aggregation of losses suffered by heterogeneous, interacting and boundedly rational agents, and not from an aggregate damage function as is usual in standard IAM and in the Dafermos, Nikolaidi and Galanis (2017) and Bovari, Giraud and Mc Isaac (2018). The model is not used to test any specific economic policy, but to examine the impact of different types of shocks, finding much higher climate damages compared to the ones observed in standard IAM for comparable simulation experiments.

With all this background in mind the model presented in the next section is based on the empirical SAM developed by Chisari et al (2020) for Argentina for the year 2017.

4. THE MODEL

At an aggregate level the economy is composed of four institutional agents: the private non-financial sector (that includes households and firms), the financial sector, the public sector (which comprises the government and the central bank) and the rest of the world. Following the structure of stock-flow consistent models as developed in Godley and Lavoie (2007) it is useful to begin by describing the structure of real and financial assets and liabilities. As shown in Table 1 the model incorporates seven financial assets and capital. The subscripts denote who issues (with an "s", that goes for "supply") and who demands (with a "d", that goes for "demand") each of the assets. All minus signs indicate that for the institutional agent designated in the corresponding column that asset constitutes a liability.

In the Money asset it is included not only the bills and coins but also demand and saving deposits. The credit variable includes both consumption, commercial and production credit. The bills and bond variables comprise all the domestic currency denominated securities issued by both the Treasury and the central bank. Foreign assets include the various types under which both the private and the public sector can keep their wealth in foreign currency denominated assets. Similarly, foreign liabilities represent a composite variable that includes the total liabilities of the three domestic institutional agents, as informed in the international investment position. Regarding green bonds, although the domestic market of this asset is still very small, they were included because they can become important in the future if the green transition is successfully undertaken. As for equity, it is assumed that the totality is issued by the firms of the private non-financial sector, and that only households, the financial system and the rest of the world can have them as an asset.

This implies that the stock of equity held by the private non-financial sector will always be negative, since households will always hold only a share of the total equity issued by firms. The amount of equity held by the rest of the world is taken from the foreign direct investment stock of the international investment position. The data to build the balance sheet was taken from the National Institute of Statistics and Surveys (INDEC) and the Central Bank of Argentina (BCRA).

Table 1: Balance sheet

	Private Non Fin.	Private Fin	Public	Rest of the World
Money	H_d^{PNF}	$-H_s^F$	$-H_s^P$	
Foreign Assets	$FA_d^{PNF}E$	$FA_d^F E$	$FA_d^P E$	$-FA_s^{RW}E$
Credit	$-L_d^{PNF}$	L_s^F		
Bills and Bonds		B_d^{NF}	$-B_s^P$	
Foreign Liabilities	$-FL_s^{PNF}E$	$-FL_s^F E$	$-FL_s^P E$	$FL_d^{RW}E$
Green Bonds	$-GB_s^{PNF}$	GB_d^F	$-GB_s^P$	GB_d^{RW}
Equity	$-EQ_s^{PNF}$	EQ_d^{FS}		EQ_d^{RW}
Capital	K^{PNF}		K^P	

The other pillar of a stock-flow consistent model is the social accounting matrix (SAM). Considering the structuralist nature of the research questions that the model is aimed to address, it is required to disaggregate the production account into the different sectors that participate in the production of the economy's total value added. This detailed view of the supply side can be obtained through input-output tables, which offer a detailed representation of the interlinkages between productive sectors, as well as the sectoral composition of the different elements that comprise final demand. Although in Argentina there is not an official social accounting matrix, several authors such as Coremberg et al (2016), Mastronardi et al (2017) and Michelena (2019) have made different attempts to construct this important element (in most of the cases, with the aim of building a model along the lines of the computable general equilibrium tradition).

The SAM used in this model is based on Chisari et al (2020), who gathered different sources of information to build a matrix for the year 2017. This matrix is composed of 30 productive sectors, two factors of production among which income is distributed (labor and capital), two types of households (the first one comprising the first five income deciles and the second one the last five), the government (which, in turn, collects four types of taxes), the capital accumulation account (which is divided into private and public accumulation) and the rest of the world. In order to make the SAM more suitable for the SFC tradition and the purpose of the model the following adaptations were made. First, the renewable energies sector was separated from the one named "generation, transportation and distribution of electricity, water and gas", and taken as an independent sector. Thus, the input-output matrix used in this model contains 31 productive sectors[14]. Second, three specific income accounts were added to the matrix: the interest payments on external liabilities, the interest payments on bills and bonds and the interest payments on green bonds. Third, the financial sector was taken as an additional institutional agent, apart from its role in production. This allows for the accounting of some relevant transactions that go beyond the scope of the ones that were computed in the matrix developed by Chisari et al (2020). The importance of these last two modifications relies in the fact that, as the SFC tradition underlines, it is important to model not only real flows (like, for instance, investment) but also how they are financed (which is captured in the changes in the balance sheet) and the dynamic implications of the chosen financing instrument (future interest payments)[15]. In order to produce dynamically consistent results it is required not only that the stocks and the flows are coherently related (through the balance sheet and the SAM)

[14] Since the renewable energy sector is not explicitly defined in the supply and use tables, the following procedure was applied to create it. Using the energetic matrix for the year 2017 it was computed that 1.4% of total electricity came from renewable sources. Thus, the gross value of production of the renewable energy sector was assumed to be 1.4% of the gross value of production of the sector "generation, transportation and distribution of electricity", which according to the supply table for the year 2004 (the last available at the moment of writing this paper) was 62% of the broader sector labeled "generation, transportation and distribution of electricity, gas and water". The same rule was applied to determine the imports and intermediate consumption, except for the cases of the sectors producing non-renewable sources of energy, whose supply to the renewable energy sector was assumed to be zero. The final demand of renewable energy was assumed to be zero, implying that all the generation of clean energy is allocated as intermediate purchases of the sector "generation, transportation and distribution of electricity, gas and water". Finally, the compensation to labour and capital, as well as direct and indirect taxes, were computed as a share of the sectoral gross value of production using the same shares of the "generation, transportation and distribution of electricity, gas and water" sector.

[15] For a detailed description of the main features that characterize SFC models and their consistency both within a period and across time, see Zezza and Zezza (2019).

but also that the income payments arising from the holding of the different assets and liabilities feed back into the future values of the variables included in the SAM.

In order to facilitate the description, the SAM is disaggregated in two separate matrices. Table 2 represents the so-called Macro SAM, which captures all the current transactions that take place in the economy within a period without disaggregating production into different sectors. Table 3 presents the 31-sector input-output matrix that is plugged into the Macro SAM in the intersection between the column and the row named "Sectors". In appendix 1 the list of the 31 productive sectors is presented, together with the matrix with the technical coefficients for both intermediate consumption and final demand. As is standard in input-output analysis, the rows (columns) of Table 3 represent the intermediate sales (purchases) of each sector as part of the production process. For its part, the SAM incorporates the transactions that go beyond the production process but that determine the change in the net financial position of each institutional agent. From the structure of the SAM the following assumptions about the economy are deduced.

1. The total income produced as a result of the production process is distributed among labor and capital. Labor, in turn, can be supplied by the two types of households and foreign workers (whose compensation is paid under the form of remittances). For its part, the compensation to capital, the gross operating surplus, is distributed among the two types of households (who own the firms), the government (who owns some enterprises) and the rest of the world (who owns firms under the form of foreign direct investment).
2. The production sector (i.e., each of the 31 subsectors that constitute the input-output matrix) pays taxes, both indirect and direct.
3. Part of the production process involves the imports of goods and services from the rest of the world.
4. Apart from the production taxes mentioned in item 2, the government collects taxes (direct and indirect) from households. The final demand for investment goods is also subject to indirect taxes.
5. Government expenditures are given by its consumption of goods and services to the production sector, its transfers to households, the capital expenditure (public investment) and the interest payments to the rest of the world on its stock of foreign liabilities.

6. Households earn income from production and receive transfers from the government. Their outlays are given by consumption, taxes and interest payments to the rest of the world on their stock of foreign liabilities.
7. Both household consumption and private investment entail the purchase of goods from the rest of the world.
8. The financial sector not only earns income from the production process (which is captured in the input-output matrix and in the vectors of final demand) but also from the holding of bills and bonds, and eventually green bonds. It pays interests to the rest of the world on its foreign liabilities.
9. Green bonds can be issued by the private non-financial sector (in the matrix represented by households, who own the firms that issue these bonds) and purchased by both the financial sector and the rest of the world.
10. As a result of all these transactions the institutional agents obtain a saving, the sum of which must add up to zero. Each agent's saving is equal to the change in its net worth, which composition is reflected in the flow-of-funds.

Table 2: Macro SAM for 2017 (in millions of current pesos)

		Sectors	Value added		Taxes	Interest payments			Households		Government	Capital Accumulation		Financial Sector	Rest of the World	Total
			Labor	Capital		Bills and Bonds	External Debt	Green Bonds	Type 1	Type 2		Private	Public			
Sectors		Table 3							2,388,957	4,102,586	1,880,517	1,203,278	504		1,196,764	6.937.925
Value added	Labor	4,033,922														0
	Capital	3,922,299														0
Taxes	Indirect taxes	1,317,597							42	73		20				135
	Labor contrib.	679							0	0						679
	Income taxes Firms	558							0	0						558
	Income taxes Households	0							31	48						79
Interest payments	Bills and Bonds										93					93
	External Debt									36	132					168
	Green Bonds									0	0					0
Households	Type 1		882	491							472					1.844
	Type 2		3,042,109	2,292,167							1,334,691					0
Government				829	2,768,021											829
Capital Accumulation	Private								45	1,447,306						45
	Public										504	0	0		0	504
Financial Sector				176		93										269
Rest of the World		766	110	135			168	0	167	286	0	269	0	4	0	1.905
Net Saving									-829	676	-820	0	0	265	708	0
Total		**6.939.424**	**992**	**1.630**	**2,768,021**	**93**	**168**	**0**	**-545**	**1.119**	**382**	**289**	**504**	**269**	**708**	**0**

Table 3: Input-output table for 2017 (in millions of current pesos)

	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31
S01	97,125	0,000	0,000	473,840	8,448	9,605	231,000	9,000	0,000	4,737	715,000	78,000	1,000	0,000	14,000	1,000	85,000	0,000	4,000	0,000	19,000	100,000	37,030	0,000	3,000	146,000	829,000	184,000	96,000	863,000	0,000
S02	0,000	18,327	0,000	0,000	0,000	0,000	0,000	191,000	48,000	153,764	10,126	345,000	0,000	2,827	2,000	0,000	134,000	0,000	0,000	62.537,000	0,000	0,000	0,000	13,437	0,000	0,000	18,000	19,000	0,000	0,000	0,000
S03	25,000	2,817	7,447	3,661	528,000	370,000	190,000	279,000	0,000	2,204	4,829	51,000	21,074	11,425	237,000	80,000	2,471	47,000	98,000	204,000	30,230	0,000	1,382	0,000	0,000	3,383	1,403	17,000	20,000	1,000	1,771
S04	10,633	165,000	79,000	189,313	3,096	3,427	235,000	857,000	849,000	6,399	6,832	726,000	611,000	193,000	212,000	1,577	837,000	52,000	329,000	22,000	117,000	781,000	121,098	1,516	360,000	1,550	3,926	1,839	4,285	6,476	0,191
S05	604,000	510,000	2,000	4,780	28,097	1,432	143,000	1,125	421,000	840,000	1,386	1,532	275,000	408,000	333,000	1,203	533,000	27,000	799,000	37,000	185,000	1,655	4,590	1,528	55,000	4,494	2,579	1,252	1,616	1,361	0,321
S06	17,000	3,000	0,000	3,630	4,968	8,917	29,000	182,000	143,000	293,000	351,000	89,000	45,000	15,000	3,000	205,000	178,000	4,000	164,000	0,000	29,000	87,000	55,000	296,000	82,000	269,000	432,000	40,000	8,000	21,000	0,000
S07	3,182	35,000	56,000	7,824	221,000	41,000	1,928	5,454	2,683	33,000	765,000	300,000	440,000	227,000	681,000	1,230	255,000	13,000	2,428	10,000	4,262	4,259	472,000	691,000	355,000	1,345	345,000	280,000	270,000	220,000	0,087
S08	1,075	157,000	370,000	23,856	811,000	64,000	2,039	24,627	11,958	65,000	2,880	990,000	1,440	764,000	432,000	2,541	663,000	23,000	459,000	58,000	484,000	2,984	2,084	3,213	1,956	2,808	1,261	1,614	1,177	1,303	0,503
S09	496,000	293,000	308,000	6,541	443,000	41,000	235,000	1,976	3,405	141,000	2,230	408,000	219,000	379,000	274,000	2,027	597,000	22,000	153,000	152,000	111,000	4,758	1,107	3,746	6,914	7,661	3,199	2,497	539,000	1,244	1,319
S10	7,404	880,000	2,107	15,814	1,068	79,000	1,579	624,000	280,000	12,899	42,790	10,882	2,475	2,044	1,478	5,638	906,000	205,000	551,000	38.988,000	10,792	26,175	3,846	107,743	1,768	9,681	27,105	855,000	1,910	16,984	0,000
S11	102,149	343,000	1,156	14,970	8,650	4,222	1,950	2,541	3,004	5,180	53,567	19,146	2,164	4,079	1,643	5,026	2,326	125,000	927,000	800,000	6,020	2,503	1,947	3,334	422,000	6,679	1,823	756,000	22,053	6,884	6,944
S12	5,260	576,000	119,000	29,740	3,151	252,000	1,085	5,571	1,439	870,000	14,720	25,142	778,000	840,000	1,181	13,648	10,197	207,000	2,504	207,000	2,643	2,893	3,236	6,625	202,000	2,818	1,433	68,000	773,000	782,000	1,797
S13	3,000	814,000	55,000	20,954	67,000	41,000	220,000	108,000	129,000	105,000	2,279	745,000	13,599	3,197	879,000	4,928	5,999	33,000	227,000	100,000	55,800	1,548	132,000	155,000	35,000	8,112	435,000	167,000	1,235	332,000	0,868
S14	59,000	2,554	272,000	2,592	76,000	43,000	270,000	196,000	62,000	343,000	921,000	503,000	487,000	27,623	20,171	33,141	20,318	486,000	1,981	14,000	14,032	7,000	49,000	250,000	31,000	629,000	155,000	21,000	81,000	13,000	0,122
S15	304,000	2,525	25,000	5,488	154,000	41,000	487,000	275,000	260,000	693,000	1,234	454,000	369,000	3,256	5,503	21,518	23,974	204,000	814,000	168,000	14,066	127,000	207,000	1,915	136,000	1,250	289,000	79,000	550,000	973,000	1,458
S16	3,909	1,045	207,000	2,488	351,000	82,000	240,000	439,000	598,000	1,674	597,000	285,000	417,000	5,532	2,306	52,615	18,841	180,000	369,000	985,000	12,392	1,723	597,000	13,409	543,000	5,106	2,337	590,000	2,654	2,649	8,550
S17	467,000	23,000	4,000	200,000	23,000	7,000	16,000	16,000	10,000	18,000	28,000	18,000	24,000	98,000	103,000	1,181	23,647	18,000	13,000	39,000	637,000	434,000	34,000	1,842	19,000	178,000	87,000	19,000	24,000	42,000	0,339
S18	27,000	27,000	27,000	148,000	24,000	6,000	19,000	19,000	12,000	6,000	46,000	26,000	23,000	57,000	29,000	99,000	193,000	480,000	6,000	25,000	19,000	35,000	57,000	1,580	85,000	100,000	161,000	28,000	79,000	80,000	0,217
S19	9,323	651,000	11,000	370,000	306,000	25,000	26,000	71,000	215,000	63,000	142,000	98,000	49,000	2,367	199,000	738,000	6,840	7,000	575,000	36,000	1,590	355,000	323,000	101,000	217,000	1,304	229,000	323,000	272,000	731,000	0,312
S20	6,327	1,317	3,409	17,358	1,270	237,000	1,089	1,589	641,000	2,365	14,702	2,700	1,996	8,518	1,344	2,735	2,425	53,000	395,000	69.715,000	0,000	2,154	4,442	8,171	955,000	2,707	7,542	12,200	3,674	7,194	0,000
S21	0,000	911,000	99,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	101,000	0,000	173,000	61,000	0,000	0,000	0,000	2.280,000	0,000	4,993	1,322	16,536	1,660	33,571	11,796	7,856	7,022	22,677	19,790
S22	79,731	6,037	2,802	180,902	7,555	1,032	2,762	5,986	11,896	69,184	90,491	12,684	5,608	6,855	8,964	29,969	30,121	1,171	16,546	2.714,000	134,071	176,159	91,098	121,683	102,841	145,049	43,366	25,463	111,375	97,952	23,558
S23	1,646	3,284	100,000	25,064	2,480	178,000	891,000	2,243	3,610	1,211	8,678	3,408	2,228	4,987	4,131	15,676	13,417	746,000	1,351	370,000	0,000	3,580	25,317	7,925	4,083	4,549	14,357	6,020	6,882	3,697	3,212
S24	69,116	4,860	6,148	49,652	4,688	348,000	1,607	2,491	3,980	11,528	17,473	4,137	5,986	9,370	3,482	16,227	6,160	383,000	1,528	20.483,000	1,187	49,695	8,867	354,219	29,342	36,594	33,924	20,538	6,951	16,179	177,792
S25	12,971	3,278	2,064	18,931	3,544	466,000	1,000	1,777	1,825	2,754	4,654	2,248	1,642	4,246	3,004	10,339	4,898	295,000	1,203	1.707,000	5,989	29,240	13,878	42,372	30,476	17,880	54,262	7,329	4,976	7,603	14,817
S26	12,856	5,417	4,893	44,102	4,365	979,000	2,135	3,334	5,424	2,986	16,136	4,911	3,169	9,857	4,480	17,151	12,591	618,000	1,488	3.942,000	4,881	60,356	61,526	92,939	63,054	71,163	45,623	25,260	24,675	32,454	34,217
S27	16,524	164,000	560,000	1,024	79,000	3,000	38,000	138,000	127,000	6,000	388,000	157,000	91,000	101,000	206,000	944,000	123,000	15,000	71,000	0,000	0,000	6,233	7,000	659,000	699,000	517,000	12,025	0,000	307,000	821,000	0,000
S28	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
S29	18,000	368,000	3,000	440,000	47,000	16,000	12,000	36,000	163,000	21,000	275,000	65,000	93,000	69,000	173,000	513,000	189,000	3,000	19,000	65,000	0,000	1,579	254,000	3,106	2,000	13,440	2,808	3,312	69,008	23,143	0,564
S30	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
S31	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	2.863,532	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	24,855

As in every SFC model, the net saving of each institutional agent plus its capital gains (or losses) arising from revaluation effects, must equal the change in its net worth. The flow-of-funds matrix decomposes the total change in the net wealth into the changes in the assets and liabilities that make up the balance sheet. Table 4 presents an approximation to the flow-of-funds for 2017[16]. The data for Money (given by the M2 aggregate), Credit and Bills & Bonds were taken from BCRA. The Foreign Assets and Foreign Liabilities variables are given by the aggregates presented in the international investment position, which is informed by INDEC. This means that inside these two variables several assets with different durations are synthesized. The change in green bonds is zero because no emissions have been made in 2017. For the change in the equity held by the rest of the world the variation in the stock of foreign direct investment was taken. For the case of the financial sector, the datum was taken from BCRA. For the private non-financial sector, the change in the stock of the remaining agents was subtracted from the change in the total capitalization of the equity market.

Table 4: Flow-of-funds for 2017 (in millions of pesos)

	Private Non Fin.	Private Fin	Public	Rest of the World	Total
Δ Money	297.238	-143.445	-153.793		0
Δ Foreign Assets	465.484	55.053	273.131	-793.667	0
Δ Credit	97.789	-97.789			0
Δ Bills & Bonds		187.531	-187.531		0
Δ Foreign Liab.	-162.385	11.454	-910.051	1.060.981	0
Δ Green bonds	0	0	0	0	0
Δ Equity	-163.072	8.547	0	154.525	0
Δ Aux	477.948	-250.439	-49.369	-178.142	0

Once all the economic accounts have been described in a consistent way it is left to make the link to the environmental impact of their underlying processes. Given the lack of information

[16] Since there are now official integrated financial accounts in Argentina the main components of each institutional agent's balance sheet were selected. In order to ensure accounting consistency an additional auxiliary variable (*Aux*) was incorporated for each agent. This variable is given by the difference between the net saving obtained in the social accounting matrix, the revaluation arising from the holdings of assets and liabilities denominated in foreign exchange (*FA* and *FL*) and the sum of all the changes of the assets and liabilities that were explicitly defined in the flow-of-funds.

available for Argentina only GHG emissions are included in the model. The data is obtained from the national inventory of emissions carried out by the Ministry of Climate Change and summarized in Figure 2 (bottom right panel). Even if including other measures of the impact that economic activity has on the environment (e.g., waste management and water use) would provide a more complete picture, the available data allows us to address two important issues. First, the number of emissions that arise from Argentina's productive structure and its pattern of specialization. This is relevant because it allows for the analysis of the implications of a structural change based green transition on growth and balance of payments sustainability. Second, the available data allows us to estimate the number of emissions that could be reduced if, taking the productive structure as given, the generation of energy is shifted towards renewable resources in a significant amount. Several intermediate scenarios can also be made, where the transition combines both structural change and the greening of the energetic matrix.

From the structure of the matrices, it is possible to write a system of equations that describes the dynamic behavior of the model. In the remainder of this section the complete model is presented.

Production and income generation

The real gross value of production of each sector (gvp_i) is given by the sum of its intermediate sales to the other j-1 sectors (ic_{ji}) plus the final demand from both types of households and the government ($c_{H1,i}$, $c_{H2,i}$and $c_{G,i}$), the investment demand from both the private not financial and the public sector ($inv_{PNF,i}$ and $inv_{G,i}$) and the demand from the rest of the world (x_i).

$$gvp_i = c_i^{H1} + c_i^{H2} + inv_i^{PNF} + inv_i^{G} + c_i^{G} + x_i + \sum_{j=1}^{31} ic_{ji} \quad (1)$$

Intermediate sales are obtained from production (*gvp*) using the technical coefficients (a_{ji}). Since the model is concerned with research questions related to the long run, it is assumed that in every period supply adjusts to demand instantaneously (thus, there are no inventories). The specific sectors where there can be supply-side bottlenecks are described later.

$$ic_{ji} = gvp_j a_{ji} \quad (2)$$

Both the gross value of production and intermediate purchases can be expressed in nominal terms (as they appear in the matrices) using the respective price indices (p_i)[17]. Note that to compute the intermediate purchases of each sector the order of the subscripts of the ic variable is changed (equation 4). The value of imported inputs M^{IC} is obtained using the coefficient η, which denotes the unit requirement of imported inputs, the price of imports p_m and the nominal exchange rate E (equation 5). With this information it is possible to compute nominal value added, which is in turn equal to the income that is then distributed among labor, capital and indirect taxes (equation 6). Real value added is obtained through the price index of each sector (equation 7)[18]. The sum of sectoral nominal (real) gross value added gives the total production of the economy in nominal (real) terms (equation 8-9).

$$GVP_i = gvp_i p_i \quad (3)$$

$$IC_i = \sum_{j=1}^{31} ic_{ij} p_j \quad (4)$$

$$M_i^{IC} = \eta_i gvp_i p_m \quad (5)$$

$$GVA_i = GVP_i - IC_i - M_i^{IC} E \quad (6)$$

$$gva_i = \frac{GVP_i - IC_i - X_i}{p_i} + \frac{X_i}{Epx_i} - \frac{M_i^{IC}}{p_m} \quad (7)$$

$$GVA = \sum_{i=1}^{31} GVA_i \quad (8)$$

$$gva = \sum_{i=1}^{31} gva_i \quad (9)$$

As part of the production process each sector pays two types of taxes to the government: labor contributions and indirect taxes. These payments are obtained by means of the respective taxes rates $\tau^L and\ \tau^I$, which are exogenous and obtained from the input-output table.

$$T_i^L = GVP_i \tau_i^L \quad (10)$$

[17] It is worth mentioning that since the export price of each sector differs from the domestic price (for more details see the section where the external sector is described) the accounting consistency of the model requires that x_i . p_i is deducted from equation 3, and x_i . px_i . E is added. Otherwise, nominal aggregate demand would not be equal to nominal gross value added, thereby rendering the model inconsistent.

[18] Not all the components of sectoral gross value added have to be deflated by the price index of the sector, as some sales are made at a different price (mainly exports).

$$T_i^I = (IC_i + M_i^{IC} E)\tau_i^I \tag{11}$$

Greenhouse Gas Emissions

As part of the production process each sector emits greenhouse gases to the atmosphere. A linear relationship between production and emissions is assumed, being the number of emissions (in metric tons of carbon dioxide equivalent, MTCO2e) per unit of output is given by the coefficient θ (equation 12). This parameter synthetizes a number of aspects such as energy intensity, the share of clean energies out of the sector's total demand for energy and the greenness of the resources used in production (e.g., capital). Since we are interested in the analysis of long-term scenarios where production techniques, technology and the environmental sustainability of the inputs used in the production process can change, the sectoral coefficient θ is defined as the sum of two components: energy consumption related emissions (θ^E) and production process related emissions (θ^P). It is further assumed that the energy related emissions coefficient varies depending on energy efficiency and the type of energy (renewable and non-renewable) that is used in the production process (equation 14). Energy intensity is captured by the technical coefficients that represent each sector's demand for the main sources of energy identified in the input-output table: bituminous mineral oils, petroleum gases and other gaseous hydrocarbons (sector 10); generation and distribution of electricity, gas and water (sector 20); and generation of renewable energy (sector 31). As regards the production process related emissions, they are assumed exogenous, although in the scenarios simulating the green transition they will be allowed to reduce over time as a result of the increase in investment directed to build a "greener" economy.

$$EMIS_i = gva_i \theta_i \tag{12}$$

$$\theta_i = \theta_i^E + \overline{\theta_i^P} \tag{13}$$

$$\theta_i^E = \theta_{i_{-1}}^E \frac{a_{i,10} + a_{i,20} + a_{i,31}}{a_{i,10_{-1}} + a_{i,20_{-1}} + a_{i,31_{-1}}} \frac{\left(1 - \frac{a_{i,31}}{a_{i,10} + a_{i,20} + a_{i,31}}\right)}{\left(1 - \frac{a_{i,31_{-1}}}{a_{i,10_{-1}} + a_{i,20_{-1}} + a_{i,31_{-1}}}\right)} \tag{14}$$

Prices and Income Distribution

The price of each good is obtained using the technical coefficients, the sectoral nominal wage, the different tax rates, the import intensity, the price of imports and the nominal exchange rate. Thus, the price equation follows a Post Keynesian mark up on normal costs pricing formulation (Lavoie, 2001; Downward & Lee, 2001) according to which the price is given by the sum of production, including imported intermediate goods, costs plus a markup. The technical coefficients, the import intensity and the tax rates are obtained from the SAM. The sectoral nominal wages and the price of imports were collected from INDEC. For its part, labor demand is determined by production and the unit labor requirement a_{il}, which is the inverse of labor productivity (equation 16). This coefficient is taken from the input-output table. The product of labor demand L and the nominal wage w give the wage bill paid by each sector, WB(equation 17). The gross operating surplus is computed as the difference between nominal value added (total income) and the sum of the wage bill, labor contributions and indirect taxes (equation 18). The difference between the gross operating surplus and income taxes on firms gives their net profit P(equation 19). Finally, the sum of the sectoral wage bill, gross operating surplus, labor contributions and indirect taxes gives the aggregate nominal income (equation 20), which must be equal to aggregate nominal gross value added[19].

$$p_i = (1 + \mu_i)\left(\sum_{j=1}^{31} a_{ij} p_j + a_{il} w_i + \tau_i^I + \tau_i^L + \eta_i p_m E\right) \quad (15)$$

$$L_i = a_{il} gvp_i \quad (16)$$

$$WB_i = w_i L_i \quad (17)$$

$$GOS_i = GVA_i - WB_i - T_i^L - T_i^I \quad (18)$$

$$P_i = GOS_i - T_K^i \quad (19)$$

$$Income = \sum_{i=1}^{31} WB_i + GOS_i + T_i^L + T_i^I \quad (20)$$

$$Income = GVA$$

[19] Since both aggregate income and gross value added have already been defined in other equations, this identity cannot be explicitly written. However, it is written outside of the model to check for the overall accounting consistency. More specifically, the fulfillment of the relationship *Income = GVA = AD* is a requirement for model consistency, as there has to be a coherent relation between what is demanded, what is produced and the income that that production brings about.

Public Sector

The government has several income sources. Those related to the production process were defined in equations 10-11. Firms and households (both, type 1 and 2) also pay direct taxes, which are computed as a fixed proportion τ of their net profit and their labor income, respectively (equation 21-23). The coefficient ϖ defines the share of the wage bill that is distributed to type 1 households. The private sector also pays indirect taxes on consumption and investment transactions, as shown in equations 24-26. Finally, since some of the domestic firms are owned by the government, it also receives a transfer of net profits from these enterprises (in case the profits of public enterprises are negative, this deficit will increase the financing needs of the public sector), as shown in equation 27.

$$T_i^K = GOS_i \tau_i^K \tag{21}$$

$$T_{H1} = \tau_{H1} \varpi_{H1} \sum_{i=1}^{31} WB_i \tag{22}$$

$$T_{H2} = \tau_{H2} \varpi_{H2} \sum_{i=1}^{31} WB_i \tag{23}$$

$$T_{H1}^I = (C_{H1} + M_{H1} E) \tau_{H1}^I \tag{24}$$

$$T_{H2}^I = (C_{H2} + M_{H2} E) \tau_{H2}^I \tag{25}$$

$$T_{NFP}^I = I_{NFP} \tau_{NFP}^I \tag{26}$$

$$P_G = \upsilon^G \left(\sum_{i=1}^{31} P_i - P_{25}\right) \tag{27}$$

On the expenditure side, nominal government consumption is exogenously determined and directed to the different productive sectors using the coefficients obtained from the SAM (equation 28). The real demand from the government that each sector faces is obtained through the prices indexes (equation 29). The government also contributes to aggregate demand through public investment, which is also considered exogenous and allocated into the different sectors using the coefficients obtained from the SAM (equations 30-31). A part ε^G of public investment takes the form of green goods, and the remaining is given by conventional capital (equations 32-33). Capital accumulation both “green” and “conventional” is determined by investment and the rate of depreciation δ(equations 34-35). Government spending is also composed of the transfers to households (TR assumed exogenous) and the interest payments on the outstanding stock of debt (equations 36-37).

$$G_i = \rho_i^C \bar{G} \tag{28}$$

$$g_i = \frac{G_i}{p_i} \tag{29}$$

$$INV_i^G = \rho_i^I \overline{INV^G} \tag{30}$$

$$inv_i^G = \frac{INV_i^G}{p_i} \tag{31}$$

$$inv_G^G = \varepsilon^G inv^G \tag{32}$$

$$inv_C^G = (1 - \varepsilon^G) inv^G \tag{33}$$

$$k_G^G = k_{G_{-1}}^G (1 - \delta) + inv_G^G \tag{34}$$

$$k_C^G = k_{C_{-1}}^G (1 - \delta) + inv_C^G \tag{35}$$

$$INT^{BB} = GB_{FS_{-1}}^d r_{-1}^{BB} \tag{36}$$

$$INT_{G,RW}^{FL} = r^{FL,G} FL_{RW,G_{-1}}^d E \tag{37}$$

As a result of these transactions the government obtains a financial balance, which defines its financing needs (equation 38). Part of the public sector liabilities take the form of central bank money held by the private non-financial sector $H_{PNF,G}^d$(notes and coins), which is endogenously given by demand. Being a peripheral economy with a lowly ranked currency in the international currency hierarchy, it is assumed that the government finances its financing needs through bills and bonds (denominated in domestic currency) up to the point where the private financial sector is willing to purchase them. The remaining part of the financing needs is covered through the issuance of external debt, which is assumed to be entirely denominated in foreign currency. External debt is assumed to be determined exogenously ($\overline{\Delta FL_{RW,G}^d}$), more in line with the dynamics of the global financial cycle than the government's financing needs or idiosyncratic factors (in other words, the so-called *push factors* are assumed to be stronger than *pull factors*, as shown in Kang and Kim (2019) for the general case of emerging and developing economies). Since the nominal exchange rate is assumed to be flexible (more details are provided in the section describing the external sector) the government's stock of foreign assets is taken as exogenous. Nevertheless, this does not imply that the central bank refrains from intervening in the foreign exchange market - at every point of time it can purchase or sell foreign assets (if it has sufficient stock) in order to move the nominal exchange rate in the desired direction. With all the components of the flow-of-funds of the government being defined it must be the case that its budget constraint becomes redundant in the model[20] - as is typical in SFC models there is always one relation that is not explicitly written but used to verify the overall accounting consistency of the model.

$$SAV^G = \sum_{i=1}^{31}(T_i^L + T_i^I + T_i^K) + T_{H1} + T_{H2} + T_{H1}^I + T_{H2}^I + T_{PNF}^I + P_G - \sum_{i=1}^{31}(G_i + I_i^G) - \qquad (38)$$
$$= -INT^{BB} - INT^{ED} - \overline{TR_{H1}} - \overline{TR_{H2}}$$

$$BB_G^s = BB_{FS}^d \qquad (39)$$

$$SAV^G + \Delta BB_G^s + \Delta H_{PNF,G}^d - \Delta AS^G + \Delta FL_{RW,G}^d E - \Delta FA_{RW,G}^s E = 0 \qquad \text{(40 - redundant)}$$

Private Non-Financial Sector

The private non-financial sector is composed of households and firms (excluding the financial intermediation activities). The labor income that each type of household earns depends on two factors. First, the functional income distribution, which is defined in the price setting process at the sectoral level, defined on equation 14, and the wage setting process, which for the sake of simplicity are assumed to grow at a constant rate (equation 41)[21]. Second, the composition of the labor force in each specific sector, i.e., the share of workers of households of type 1 and 2 in the workforce of each sector, given by the coefficient ϖ. Moreover, firms distribute their net profits to households[22], the distribution among the two types of households being given by the coefficient υ, which represents the ownership structure of firms[23]. In order to obtain households' disposable income, the transfers from the government and income taxes have to be added (equations 42-43).

[20] The change in the adjustment stock variable is assumed to be zero for all the institutional sectors. Its inclusion in the structure of the model obeys to the need to reach accounting consistency between the SAM and the FoF given the different sources of information from where the data were collected. However, since this model draws on one single observation of the transaction flows matrix, the correction that the auxiliary stock variable makes is not needed beyond the base year. The variable is kept in the structure of the model for future uses, when more observations of the TFM are available.

[21] As is described in the next section where the features of the baseline simulation are presented, all the nominal exogenous variables are assumed to grow at the same rate.

[22] Mixed income is included in the gross operating surplus and hence in the net profits that firms transfer to households.

[23] As is observed in the balance sheet and the SAM, firms can also be owned by the government, the financial sector and the rest of the world. These agents' income from their ownership of domestic firms is included in their respective subsections.

$$w_i = w_{i_{-1}}(1 + \varsigma_i) \tag{41}$$

$$YD_{H1} = \varpi^{H1} \sum_{i=1}^{31} W_i + \upsilon^{H1} \sum_{i=1}^{31} (P_i - P_{25}) + \overline{TR_{H1}} - T_{H1} \tag{42}$$

$$YD_{H2} = \varpi^{H2} \sum_{i=1}^{31} W_i + \upsilon^{H2} \sum_{i=1}^{31} (P_i - P_{25}) + \overline{TR_{H2}} - T_{H2} \tag{43}$$

Households can decide to consume both domestic and foreign goods and services. This decision is driven by their relative price, which is reflected in the real exchange rate, e. The coefficients $\eta^{H1}$and η^{H2}represent the share of imports on total private consumption and should thus always lay between zero and one (equation 44). It is assumed that each type of household has a specific real exchange rate based on its consumption pattern (equation 45). The coefficients λ represent the share of total consumption that each household allocates under the form of each type of good.

$$\eta^{Hk} = \frac{1 + e_c^{Hk}}{\kappa^{Hk} e_c^{Hk}} \quad for\ k = 1,2 \tag{44}$$

$$e_c^{Hk} = \frac{E p_m}{\sum_{i=1}^{31} \lambda_i^{Hk} p_i} \quad for\ k = 1,2 \tag{45}$$

For households of type 1, private consumption is assumed to be determined by the totality of disposable income (the saving rate is zero or negative, but never positive) and a flow of consumption credit CC provided by the financial sector[24]. Total nominal consumption is allocated into the different productive sectors and imports using the coefficients λ and η. The final flow of imports may be restricted by the imposition of quotas (q). Real consumption is obtained by deflating the nominal flows with their respective price index.

$$C_i^{H1} = \lambda_i^{H1}(YD^{H1} + CC^{H1} - M^{H1}E) \tag{46}$$

$$M^{H1} = \left[\frac{\eta^{H1}(YD^{H1} + CC^{H1})}{E}\right](1 - q) \tag{47}$$

$$c_i^{H1} = \frac{C_i^{H1}}{p_i} \tag{48}$$

[24] As can be seen in the SAM, households of type 1 had a negative saving in 2017. In particular, their consumption was 41% larger than disposable income. The assumption that their consumption is partly financed by bank loans follows from this fact.

$$m^{H1} = \frac{M^{H1}}{p_m} \tag{49}$$

For households of type 2, nominal private consumption and imports is assumed to be determined by a share of disposable income, which is given by the average propensity to consume α, and the import coefficient η. Real consumption and imports are then obtained by dividing nominal flows by their respective price deflators.

$$C_i^{H2} = \lambda_i^{H2}(\alpha YD^{H2} - M^{H2}E) \tag{50}$$

$$M^{H2} = \left[\frac{\eta^{H2}\alpha YD^{H2}}{E}\right](1-q) \tag{51}$$

$$c_i^{H2} = \frac{C_i^{H2}}{p_i} \tag{52}$$

$$m^{H2} = \frac{M^{H2}}{p_m} \tag{53}$$

The consumption of households also bear greenhouse gas emissions, which are added to the ones that are derived from the production process of the 31 sectors of the economy, as well as from their consumption of energy. It is assumed that consumption related emissions are a fixed proportion of total final consumption (equation 54).

$$EMIS_C = \left(\sum_{i=1}^{31} c_i^{H1} + \sum_{i=1}^{31} c_i^{H2}\right)\theta_C \tag{54}$$

Real private investment is determined by net profits (which are taken as a proxy of the future profit expectations), the rate of capacity utilization u, and the real interest rate on loans r^L (equation 55). The total flow of investment is distributed into the demand for the different productive sectors (where construction, vehicles, and machinery and equipment have a predominant share) and imports (equations 56-57). The rate of capacity utilization is computed as the ratio of real output to the stock of capital (equation 59). The real interest rate on loans is given by the difference between the nominal rate R^L and the rate of inflation π. The nominal flow of private investment is obtained using the sectoral prices indexes and can be distributed into the two types of households (who make the investment decision) according to the proportions derived from the SAM (equations 60-62). A proportion ε^{PNF} of real private investment takes the form of green goods, and the remaining is given by conventional capital (equations 63-64). Capital accumulation both "green" and "conventional" is determined by investment and the rate of depreciation δ(equations 65-66).

$$\frac{inv^{PNF}}{k} = \kappa_0 + \kappa_1 \frac{\sum_{i=1}^{31} P_i - P_{25}}{K} + \kappa_2 u + \kappa_3 (r^L - \pi) \quad (55)$$

$$inv_i^{PNF} = \lambda_i^{PNF} inv^{PNF} \quad (56)$$

$$m_{inv}^{PNF} = \eta_{inv}^{PNF} inv^{PNF} \quad (57)$$

$$M_{inv}^{PNF} = m_{inv}^{PNF} p_m \quad (58)$$

$$u = \frac{gva}{k_G^{PNF} + k_C^{PNF}} \quad (59)$$

$$INV^{PNF} = \sum_{i=1}^{31} inv_i^{PNF} p_i + M_{inv}^{PNF} E \quad (60)$$

$$INV^{H1} = \xi^{H1} INV^{PNF} \quad (61)$$

$$INV^{H2} = (1 - \xi^{H1}) INV^{PNF} \quad (62)$$

$$inv_G^{PNF} = \varepsilon^{PNF} inv^{PNF} \quad (63)$$

$$inv_C^{PNF} = (1 - \varepsilon^{PNF}) inv^{PNF} \quad (64)$$

$$k_G^{PNF} = k_{G_{-1}}^{PNF} (1 - \delta) + inv_G^{PNF} \quad (65)$$

$$k_C^{PNF} = k_{C_{-1}}^{PNF} (1 - \delta) + inv_C^{PNF} \quad (66)$$

The private non-financial sector pays interests on its financial liabilities: bank loans, foreign liabilities and green bonds. The interest on loans have already been considered in the households' final consumption of financial services. The interest payments on foreign liabilities are computed using the implicit interest rate $r^{FL,PNF}$. The same is done for the case of green bonds, that can be acquired by both the domestic financial sector and the rest of the world[25]. The private non-financial sector saving is obtained as the sum of all current inflows and outflows (equations 70-71).

$$INT_{PNF,RW}^{FL} = r^{FL,PNF} FL_{RW,PNF_{-1}}^{d} E \quad (67)$$

$$INT_{PNF,RW}^{GB} = r^{GB} GB_{RW,PNF_{-1}}^{d} \quad (68)$$

[25] Since in 2017 there have not been issues of green bonds all these stocks and their corresponding flows are initially set to zero. Their presence in the model is important for the design of scenarios with alternative ways of financing the green transition.

$$INT_{PNF,FS}^{GB} = r^{GB} GB_{FS,PNF_{-1}}^{h} \tag{69}$$

$$S_{H1} = YD_{H1} - \sum_{i=1}^{31}(C_i^{H1} + INV_i^{H1}) - M^{H1} - T_{H1}^{I} \tag{70}$$

$$S_{H2} = YD_{H2} - \sum_{i=1}^{31}(C_i^{H2} + INV_i^{H2}) - M^{H2} - T_{H2}^{I} - T_{PNF}^{I} - INT_{PNF,RW}^{FL} - INT_{PNF,RW}^{GB} \tag{71}$$
$$= -INT_{PNF,FS}^{GB}$$

The only remaining issue to complete the description of the private non-financial sector is its portfolio allocation. It is assumed that only type 2 households can have a positive saving rate, part of which is allocated under the form of foreign assets (given by β^{H2}) (equation 72). The final actual demand for foreign assets may be restricted by the establishment of capital controls on outflows (kc). The share of the portfolio that is allocated to foreign assets depends on the relative return of money (for instance, deposits) to foreign assets, considering the expected depreciation of the exchange rate (equation 73). The change in non-financial private sector liabilities are assumed to be given by a share of investment γ^{INV}, meaning that only part of capital accumulation is financed by own funds. Investment financing can be made through four different sources: bank loans, green bonds, foreign liabilities (e.g., corporate debt) and equity (equations 74-77). In the specific case of the financing via equity, it is assumed that this flow is determined by foreign direct investment flows, which are considered exogenous. The amount of money that is held under the form of money is assumed to be a buffer that ensures that the budget constraint of the private non-financial sector is always fulfilled (equation 78). As shown in the balance sheet, the non-financial private sector demand for money constitutes a liability for both the financial sector and the public sector. The share of the demand for money that falls in each of these two sectors is given by the coefficient θ (equations 79-80). This completes the description of the private non-financial sector.

$$\Delta FA_{PNF}^{d} E = S_{H2} \beta^{H2} (1 - kc) \tag{72}$$

$$\beta^{H2} = beta_1 + beta_2 (r - r^* - \frac{\Delta E^E}{E_{-1}}) \tag{73}$$

$$\Delta L_{PNF}^{d} = \gamma_1 \gamma^{INV} INV^{PNF} \tag{74}$$

$$\Delta GB_{PNF}^{s} = \gamma_2 \gamma^{INV} INV^{PNF} \tag{75}$$

$$\Delta FL_{RW,PNF}^{d} E = (1 - \gamma_1 - \gamma_2) \gamma^{INV} INV^{PNF} \tag{76}$$

$$\Delta EQ_{PNF}^{s} = \Delta EQ_{RW}^{d} E \tag{77}$$

$$\Delta H_{PNF}^{d} = S_{H1} + S_{H2} - \Delta FA_{PNF}^{d} E + \Delta L_{PNF}^{d} + \Delta FL_{RW,PNF}^{d} E + \Delta GB_{PNF}^{s} + \Delta EQ_{PNF}^{s} \tag{78}$$

$$= -\Delta AS_{PNF}$$

$$H_{G,PNF}^{s} = \theta H_{PNF}^{d} \tag{79}$$

$$H_{FS,PNF}^{s} = (1 - \theta) H_{PNF}^{d} \tag{80}$$

Financial System

The financial intermediation activities (including the provision of deposit and credit services) carried out by the actors that make up the financial are included in gross value added, which was defined in the production subsection. As a result of its contribution to value added the members of the financial system make a profit[26]. Also, they earn interest from their holdings of bills and bonds, which were already defined in equation 35, and pay interest to the rest of the world on the outstanding stock of foreign liabilities (equation 81). As a result of current income and outlays, the financial sector obtains its net saving (equation 82). The flow-of-funds of the financial sector is comprised of money (deposits), which was defined in equation 80, foreign assets and liabilities, which are assumed exogenous[27], bank loans (which are assumed to be demand determined, as defined in equation 83), bills and bonds issued by the government, and green bonds issued by the non-financial private sector. It is on these two last assets that the financial sector decides how to allocate their liquidity arising from the funds raised via deposit taking and the issue of foreign liabilities, once these funds have been netted out of the loans granted to the non-financial private sector. The desired demand for green bonds is given by their relative return respective to the securities issued by the government (equation 84). It is further assumed that as part of the green transition policy framework, there is a regulation that establishes that institutional investors must keep at least a share $\psi$of their assets under the form of green bonds (equation 85). The demand for green bonds is given by the minimum between the desired demand and the minimum demand established by the regulation (equation 86). The actual demand, which gives the amount of green bonds ultimately held by the financial system, is given

[26] The subscript 25 in equation 82 denotes the financial intermediation sector, which in the input-output table appears in the order 25th.

[27] This assumption rests on the very low share of financial sector foreign assets and liabilities in the total of each of these two variables. Yet, they are included in the model in order to leave open the possibility of making simulations where the domestic financial sector plays a more important role in the green transition.

by the minimum between supply and demand (equation 87). Lastly, the demand for government bills and bonds is obtained as a residual in such a way that the budget constraint of the financial sector is fulfilled (equation 88).

$$INT^{FL}_{FS,RW} = r^{FL,FS} FL^{d}_{RW,FS_{-1}} E \tag{81}$$

$$S_{FS} = P_{25} + INT_{BB} - INT^{FL}_{FS,RW} \tag{82}$$

$$L^{s}_{FS} = L^{d}_{PNF} \tag{83}$$

$$\Delta GB^{des}_{FS} = \left[\Delta H^{s}_{FS,PNF} + \Delta FL^{d}_{RW,FS} E - \Delta L^{d}_{PNF}\right]\left(\gamma_3 + \gamma_4 r^{GB} + \gamma_5 r^{BB}\right) \tag{84}$$

$$GB^{min}_{FS} = \psi\left[BB^{d}_{FS_{-1}} + L^{s}_{FS_{-1}} + GB^{h}_{FS_{-1}} + FA^{d}_{FS_{-1}} E_{-1}\right] \tag{85}$$

$$GB^{d}_{FS} = min\left\{GB^{min}_{FS}; GB^{des}_{FS}\right\} \tag{86}$$

$$GB^{h}_{FS} = min\left\{GB^{d}_{FS}; GB^{s}_{PNF}\right\} \tag{87}$$

$$\Delta BB^{d}_{FS} = S_{FS} - \Delta FA_{FS} E - \Delta L^{s}_{FS} - \Delta GB^{h}_{FS} + \Delta H^{s}_{FS,PNF} + \Delta FL^{d}_{RW,FS} E - \Delta AS_{FS} \tag{88}$$

Rest of the World

The rest of the world receives income from Argentina from many sources that have already been defined: intermediate and final imports, remittances, profits and dividends, and interests on foreign liabilities. For its part, Argentina obtains income from the rest of the world through exports (equation 89). It is assumed that the exports of each sector are given by the external demand (which is exogenous) and the real exchange rate, which is computed for each sector using the corresponding price index (equation 90). The same index is used to obtain nominal exports (equation 91). The saving of the rest of the world (which is equivalent to the inverse of the current account) is given by the difference between incomes and outlays (equation 92).

$$ln(x_i) = \rho_0 + \rho_1 ln(ed_i) + \rho_2 ln(e_i) \tag{89}$$

$$e_i = \frac{Epx_i}{p_i} \tag{90}$$

$$X_i = x_i px_i E \tag{91}$$

$$S_{RW} = \left(\sum_{i=1}^{31} M^{IC}_i + M^{H1} + M^{H2} + M^{PNF}_{inv}\right)E + \left(1 - \varpi^{H1} - \varpi^{H2}\right)\sum_{i=1}^{31} W_i + \tag{92}$$

$$= +\left(1 - \upsilon^{H1} - \upsilon^{H2} - \upsilon^{G}\right)\left(\sum_{i=1}^{31} P_i - P_{25}\right) + INT^{FL}_{PNF,RW} + INT^{GB}_{PNF,RW} + INT^{FL}_{G,RW} +$$

$$= +INT^{FL}_{FS,RW} - \sum_{i=1}^{31} X_i$$

The rest of the world's saving has direct implications on its balance. As mentioned before, it is assumed that the rest of the world clears the green bond market (equation 93) and that it fulfills the financing needs of the non-financial private sector, while its demand for liabilities issued by the government and the domestic financial sector are exogenous. The change in the stock of foreign direct investment is also assumed exogenous[28]. The supply of foreign assets to the domestic institutional agents is such that the balance sheet equilibrium of the rest of the world is always met (equation 94). The nominal exchange rate is assumed to be flexible, i.e., there are no endogenous central interventions, although at every point of time the central bank can exogenously change its stock of foreign reserves in order to keep the exchange rate within certain limits. As shown in Godley and Lavoie (2007) when the central bank lets the exchange rate float the equilibrium in the foreign exchange market is reached through price adjustments, which are determined by the overall excess demand of foreign assets[29] (equation 95). For the sake of consistency, the demand for foreign assets by the private non-financial sector is written in domestic currency (equation 96). Trivial as it may seem, this is a key element defining the macro-financial instability that is characteristic of Argentina: the fact that there is a constant flow of private saving in domestic currency that is leaked from the system as demand for foreign assets (Rúa and Zeolla, 2018).

$$GB^{d}_{RW} = \frac{GB^{s}_{PNF} - GB^{h}_{FS}}{E} \tag{93}$$

$$\Delta FA^{s}_{RW} = -\frac{S_{RW}}{E} + \Delta EQ^{d}_{RW} + \Delta GB^{d}_{RW} + \Delta FL^{d}_{RW,PNF} + \Delta FL^{d}_{RW,FS} + \Delta FL^{d}_{RW,G} \tag{94}$$

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[28] In the baseline scenario they are assumed to grow at a constant rate. The rationale of assuming these variables exogenous is to simulate different scenarios representing the external context and its impact on the likelihood of Argentina doing a successful green transition.

[29] In Godley and Lavoie (2007) the flexible exchange rate closure is based on the equilibrium in the domestic bond market. However, given the macro-financial characteristics of Argentina, it seems more realistic in this case to close the domestic bond market through quantity adjustments (as defined in equation 39) and let the nominal exchange rate be defined in the interplay between the supply and demand for foreign exchange. Note that all the real and financial flows that involve the supply and demand for foreign exchange, all of them in the balance of payments, enter the exchange rate determination through the supply of foreign exchange of the rest of the world (equation 93).

$$= -FA^{s}_{RW_{-1}} \Delta E + \frac{\Delta AS_{RW}}{E}$$

$$E = \frac{FA^{d,ARS}_{PNF}}{FA^{s}_{RW} - FA^{d}_{G} - FA^{d}_{FS}} \quad (95)$$

$$\Delta FA^{d,ARS}_{PNF} = FA^{d}_{PNF_{-1}} \Delta E + \Delta FA^{d}_{PNF} E \quad (96)$$

$$\Delta AS_{RW} = -\Delta AS_{PNF} - \Delta AS_{FS} - \Delta AS_{G} \quad (97)$$

These equations complete the core of the prototype model that is used to carry out the simulations presented in the next section. The sectoral disaggregation of the model implies, however, that many of the equations presented before need to be written 31 times, each of them for each of the 31 productive sectors of the economy. As a result, the model to be solved totals 3120 equations. Between exogenous variables and parameters (most of them are the technical coefficients of the input-output table presented in appendix 2), 1551 additional variables complete the specification of the model. A non-exhaustive list of the main parameters of the model is presented in the appendix. The model is solved in discrete time using the Broyden approximation algorithm.

5. SIMULATIONS

The model presented in the previous section is now used for three different goals. The first one is to generate a baseline scenario that reproduces the main stylized facts of the Argentinean economy, mainly the stagnant economic growth produced by a persistent balance of payments crisis combined with an also persistent high inflation rate. The baseline scenario can also be used to project the likelihood of Argentina meeting its commitments of GHG emissions in the long run, and the possible tensions between these targets, economic growth and balance of payments stability. Based on the results of the baseline a second simulation is carried out with the goal of assessing whether a higher growth rate (associated with a green transition program) could be possible should the country manage to get the required external financing. Finally, the input-output matrix is harnessed to simulate two types of policies: one where the all the sectors transition to a cleaner production technique (represented by an increase of energy efficiency and a substitution of fossil fuels for renewable energy in energy demand) and another one where only the most important sectors from the perspective of exports, employment and greenhouse gas emissions are selected to lead the transition.

As is standard in the majority of the theoretical SFC literature, the model is statically calibrated. In this case, this means that the values obtained from the TFM for 2017 are used to obtain most of the parameters that enter the behavioral equations. Although this method could be biased by temporary events that might deviate variables from their long run relationships, it is the only possibility if there is only one available TFM. Hence, the results of the simulations should be interpreted with this caveat in mind, and with more emphasis on the qualitative behavior of the series rather on the numerical values. It should also be born in mind that since it is a theoretical model, time should be interpreted in logical rather than historic terms. The use of a dynamic calibration method constitutes the next step of this research agenda, and therefore goes beyond the scope of this paper.

The baseline scenario is calibrated to represent a stagnant economy (growth of GDP around 1%, below the rate of growth of population) with a 20% inflation rate, a current account deficit and limited access to foreign financing. The 20% inflation rate is generated by setting growth of nominal wages in all sectors at an exogenous 20%. The exogenous components of government expenditure, such as public consumption, investment and transfers to the private sector, are also set to grow at 20% nominal growth rate. In other words, the baseline assumes income distribution to be relatively constant over time. The representation of the current account deficit does not require any specific adjustment beyond the use of the sectoral exports and imports coefficients obtained from the input-output table. Finally, the most important exogenous variables of the model, such as the rate of growth of the rest of the world, financial stocks, interest rates, and some parameters, like the propensity to consume, capital controls and import quotas, were given values close to the actual ones for the years 2018, 2019 and 2020 in order to represent the recession from which Argentina is (or rather would be) starting its green transition.

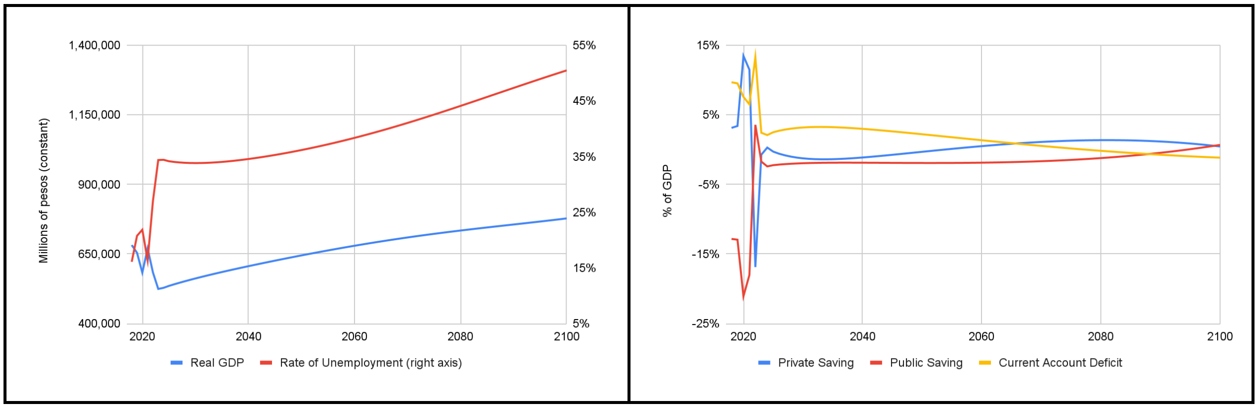
Each of the simulations is described with four graphs. The first one will describe the trajectory of real GDP and the rate of unemployment, to provide a general overview of the behavior of the economy as informed by the most traditional performance indicators. The second graph plots the financial balances of the three aggregate sectors of the economy: the private sector, the public sector and the rest of the world (the latter given by the negative of the current account). This graph is useful to assess the macroeconomic sustainability of the underlying growth regime. The third graph pictures the total and unit greenhouse gas emissions, which is useful to analyze how close the underlying growth regime is from achieving the emission targets committed in the NDC. Finally, the fourth graph shows the total impact of some selected sectors on total GHG emissions. In order to make the comparison of the scenarios easier, all the graphs are plotted using the same scale.

Baseline scenario

The baseline scenario shows a stagnant economy stuck in a balance of payments crisis produced by a persistent current account deficit that is not able to be financed through external credit. After the recovery from the coronavirus crisis the economy suffers a sharp endogenous devaluation[30] that produces a deep contraction and a surge in the unemployment rate but, at the same time, a reduction in the current account deficit. Thenceforth, a mild recovery takes place. But this recovery exhibits a growth rate that is lower than the growth rate of the population, leading to an increasing rate of unemployment (and presumably to a worsening of the related welfare indicators that are not explicitly included in the model). Under such a low growth scenario the economy manages to stabilize its financial balances. In terms of the trilemma presented in the beginning of this paper, under this scenario Argentina would position itself somewhere in between external and environmental sustainability. However sustainable as this scenario may seem, it is highly unlikely that policy makers find themselves at ease with a situation where the economy is doomed to stagnation and low welfare conditions for most of the population.

[30] This devaluation is endogenous in the sense that is not being imposed exogenously in the construction of the scenario. Instead, it is an endogenous result that the model produces with the values given to the exogenous variables and the parameters. Most notably it is assumed a serious scarcity of external financing to cope with the balance of payments crisis in which Argentina is trapped. The sensitivity analysis carried out showed that this sharp devaluation can be avoided when the government manages to increase its external debt by 20%.

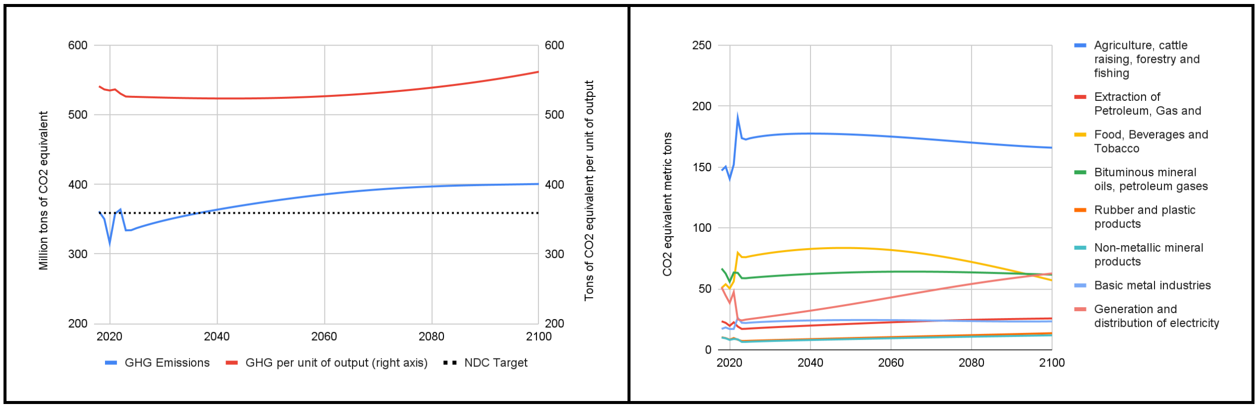
Figure 4: GDP, Rate of Unemployment and Financial Balances in the Baseline



Under the current economic structure such a poor economic performance implies that Argentina is close to complying with its NDC commitments, although the fact that no changes are made in its productive structure, energy intensity and emissions per unit of output imply that even with very mild growth the economy would tend to surpass the established threshold in the long run (see that in the left panel of Figure 5 the blue line never surpasses the black dotted line). However, the same as we concluded in the case of the sustainability of the financial balances, it does not seem to be acceptable that the economy must resign the welfare of its population to be both macroeconomic and environmentally sustainable. In the last two scenarios we assess whether a green transition can provide a way out of this trilemma.

As regards the sectoral GHG emissions it is evident that the agriculture sector stands out, given its high intensity in GHG emitting production techniques and its importance in total production. On the second and third places come the bituminous mineral oils and petroleum gases sector, an inherently high GHG emitting sector, and the generation and distribution of energy sector, which in Argentina currently relies mostly on conventional sources of energy. Since in the baseline no process of structural change or green transition is being assumed, both the total sectoral emissions and their share in the total remain roughly unchanged. What this picture seems to suggest is that given the current contributions to GHG emissions, whatever the specificities of the green transition program that Argentina eventually implements, both the agriculture and the energy sectors will have to play a key role.

Figure 5: Total and sectoral GHG emissions (right panel) in the baseline



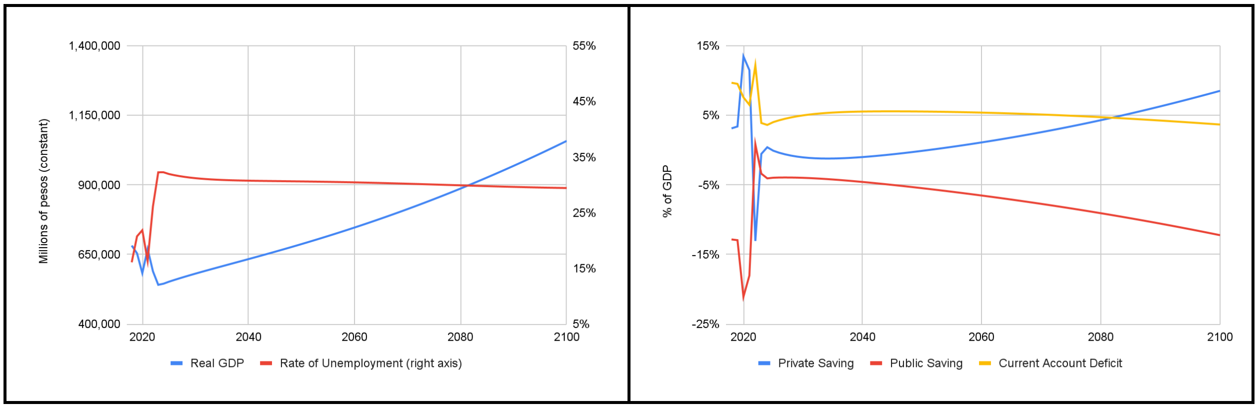
Scenario 1: Unconstrained External Financing

If Argentina's poor long term economic performance is caused by a persistent balance of payments crisis it is worth exploring whether this could be solved should the country be able to find a persistent flow of financing from the rest of the world. In order to model this, it is assumed that the external demand for Argentina's sovereign debt increases at an annual rate of 2%, matching up the assumed rate of growth of the rest of the world. This increased resource availability for the government is combined with a 1% increase in the rate of growth of real public expenditures. As can be observed in Figure 6, the result is a higher growth rate of GDP and a consequent reduction in the long-term level of the rate of unemployment. The main driver of the higher growth rate compared to the baseline is private consumption, which in turn implies more sales and production, and therefore an increase in the wage bill and profits that make up disposable income. The trigger that sets into motion this virtuous circle of consumption and growth is the increased purchasing power of government's transfers to households. As a result of this higher growth rate, capacity utilization also increases leading to a higher private investment that reinforces the virtuous growth cycle. However, as is observed in the right panel of Figure 6 this better economic performance does not come without a cost - under this scenario the current account deficit stabilizes around 5% of GDP matched by an increasing budget deficit. As a result of this succession of budget and current account deficits the external debt of the government increases significantly reaching presumably unsustainable levels (Figure 12)[31]. Thus, the

[31] The spike in the public debt to GDP ratio observed in the beginning of the sample of Figure 12 is given by the initial devaluation that follows the recovery from the coronavirus crisis.

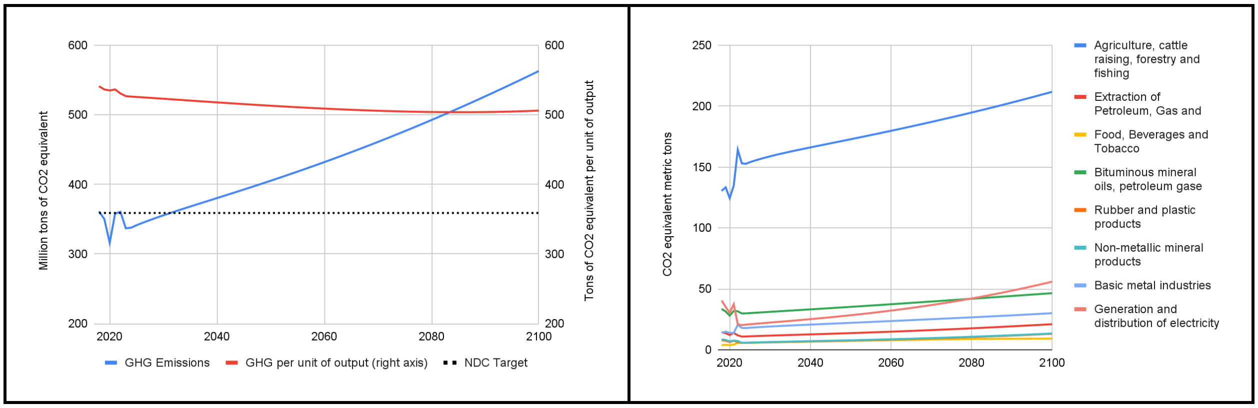
question about the feasibility of the better economic performance obtained in this scenario remains open, as the sources of financing would be beyond the economy's control. This result seems to be in line with the balance of payments dominance hypothesis stated by Ocampo (2013).

Figure 6: GDP, Rate of Unemployment and Financial Balances in Scenario 1



Besides the macro-financial concerns that this higher growth scenario would produce, it must be noted that this growth regime also proves to be unsustainable from an environmental perspective, as the NDC targets are far from being complied (Figure 7). This is not surprising since the higher growth rate induced in this scenario is not combined with any attempt to reduce the production techniques, the energy efficiency and the share of clean energies in total energy generation. As the right panel of Figure 7 shows the sectoral share in total GHG emissions remains unchanged, but unlike the baseline all sectors exhibit increasing emissions (in line with their higher growth rate). Thus, the result of this scenario is in line with the trilemma that runs across this paper, to the point that it even makes a stronger point: if Argentina attempts to boost growth without changing its way of financing it (which requires a change in its economic structure) and, at the same time, keeps its production processes and energetic matrix unchanged, rather than facing a trilemma it will be doomed to a multidimensional failure.

Figure 7: Total and sectoral GHG emissions (right panel) in Scenario 1



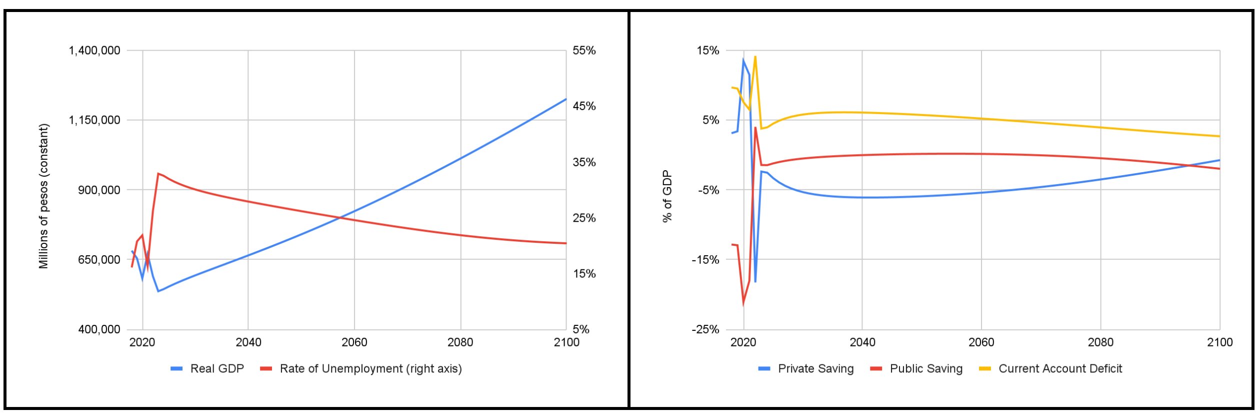
Scenario 2: Generalized Green Transition

With the background of the structural limitations that Argentina faces to growth sustainably, represented both in the baseline and scenario 1, we attempt to simulate the effects of a green transition involving all productive sectors. The changes entailed in the green transition are the following: i) 1% annual increase of energy efficiency; ii) 1% annual decrease in the intermediate demand for fossil fuel based energy (as represented by the output of sector 10); iii) 1% annual decrease in the fossil fuel based energy sector demand for extracted petroleum and gas (sector 2); iv) 1% annual decrease of the generation and distribution of electricity sector self-demand and its demand for fossil fuels based energy; v) 4% annual increase in the generation and distribution of electricity sector demand for renewable energy (sector 31); vi) 1% annual decrease in all sector's production process related emissions. It is worth mentioning that since there is no data available on the varying environmental sustainability of goods and services within each productive sector, the description of the green transition made in the model does not account for the possibility of having two types of substitute goods, each of them with a specific price and environmental impact, within a same sector (for instance, the manufacturing of food and beverages sector). Overcoming this difficulty constitutes one of the challenges for future versions of the model.

The starting point is the calibration of scenario 1, to which the following changes are made: first, the κ_0 and the κ_2 coefficients of the private investment equation are increased to reflect a higher capital accumulation coming from both the exogenous and the induced components of the equation[32]. Also, it is assumed that since the structural transformation entailed in the green transition is led by investment, it is the private sector and not the government (as was the case in scenario 1) who takes external debt.

The economic impact of a green transition of the type described above seems to be very positive, as observed in the left panel of Figure 8. However, the external imbalances found in scenario 1 seem to be further enlarged, rendering the whole process unsustainable from the perspective of the balance of payments. What changes with respect to scenario 1 is that now it is the private sector, and not the government, who runs the persistent deficit that mirrors the current account deficit. As observed in Figure 12, when the transition is financed through private external debt the unsustainability of the transition is slightly lower, as the debt-to-GDP ratio stabilizes around a lower level. This is due to both the lower initial level of the private external debt-to-GDP ratio and the higher growth rate that characterizes scenario 2 and 3 (it is worth mentioning that the trajectories of the private external debt-to-GDP ratio are almost completely overlapping in Figure 12). Nevertheless, it should be borne in mind that in a scenario like this one the whole process is conditional to a continuous flow of external financing, thereby rendering the transition highly vulnerable to the upheavals of the global financial cycle.

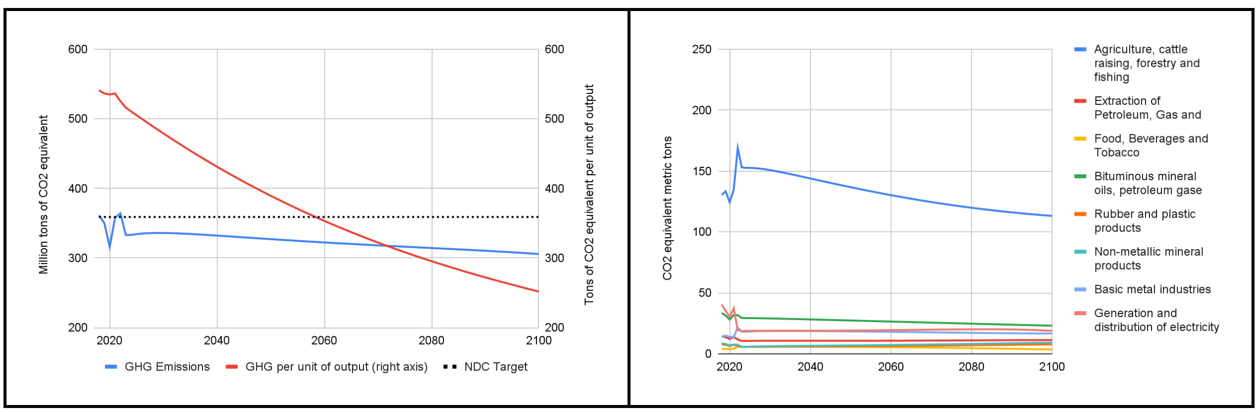
Figure 8: GDP, Rate of Unemployment and Financial Balances in Scenario 2



[32] More specifically, the exogenous component is linearly reduced along the sample from its initial value of -0.02 to 0. The coefficient associated to the rate of capacity utilization is linearly increased from the initial value of 0.1 to a final value of 0.2.

Not surprisingly, the green transition scenario outmatches the previous one in terms of environmental sustainability, as reflected in the left panel of Figure 9. According to the simulations, a green transition of the type defined in this scenario would put the economy in a trajectory leading to compliance with the NDC (recall the caveat that being a theoretical model time cannot be given a historical interpretation, meaning that it is not possible to take the year 2030 of the simulations as the actual year 2030). As the right panel of Figure 9 shows, the sectoral GHG emissions would be reduced as a result of the increased energy efficiency and the shift towards a greener energetic matrix. Still, the relative sectoral contributions to total emissions would remain roughly unchanged, which is straightforward as the simulations are not inducing any type of structural change process. It is interesting to note, however, how the change in the structural parameters of the economy like the technical coefficients of the input-output table open a whole new range of possibilities for the economy - in this case, unlike the baseline, the economy can grow at a faster pace and at the same time increase its environmental sustainability.

Figure 9: Total and sectoral GHG emissions (right panel) in Scenario 2

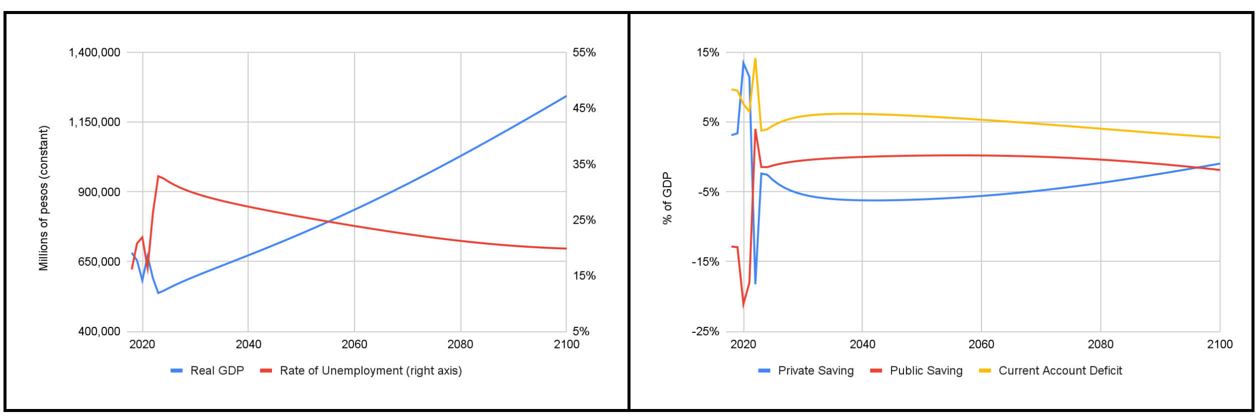


From this third set of simulations we conclude that a green transition like the one described would not provide Argentina a way out of the trilemma. Later on, we will assess whether this trap can be overcome by means of an upgrading of the technological conditions of Argentina's industrial sectors, reflected by a reduction in the import propensities of private consumption and investment. Before doing that a different approach to the green transition is explored.

Scenario 3: Focalized Green Transition

Another shape that the green transition could take is one where only some specific sectors are selected to lead the process. These simulations were built taking the top five sectors in terms of exports, employment generation and GHG emissions. The top five in exports and employment generation were selected as they constitute key sectors for growth, general welfare and external sustainability. The top five sectors in terms of GHG emissions were selected as an attempt to achieve environmental sustainability focusing on the most contaminating sectors. This selection criterion gives that the green transition would be led by the following sectors (in parenthesis we indicate the ordering number as presented in the input-output table): agriculture (1), manufacturing of food (4), bituminous mineral oils, petroleum gases and other gaseous hydrocarbons (10), non-metallic mineral products (13), basic metal industries (14), Generation and distribution of electricity (non-renewable), gas and water (20), construction services (21), trade services (22), accommodation services, restaurants, bars and canteens (23), transport and communications services (24), real estate and business activities (26), and public administration (27). This focalized type of green transition assumes that the pace at which these selected sectors reduce their production process related emissions and increase their energy efficiency doubles the one assumed in the previous scenario (i.e., energy efficiency increases at a yearly rate of 2%). The rest of the features of this simulation, including the assumed shift of the energetic matrix, are the same as the ones described in scenario 2.

Figure 10: GDP, Rate of Unemployment and Financial Balances in Scenario 3



The result of this focalized green transition scenario in terms of GDP growth, unemployment and the financial balances of the three aggregate sectors are almost the same as the ones obtained in scenario 2 (Figure 10), and so are the conclusions. What seems to change is the impact on the overall environmental sustainability of the economy, which becomes higher in this scenario (Figure 11). Although this could seem trivial as the increase in energy efficiency is being assumed to grow double with respect to scenario 2, it should be borne in mind that only 38% of the sectors (which add up to 68% of GDP in the base year) are increasing their energy efficiency. What these results suggest is that although it is desirable that the whole economy transitions towards a more environmentally sustainable production model, the overall environmental sustainability of the economy as well as the goals established in the NDC can be achieved by a more focalized transition process. It goes without saying that in order to fine tune such a strategy it would be required to use a much more disaggregated model than the one being used in this paper.

Figure 11: Total and sectoral GHG emissions (right panel) in Scenario 3

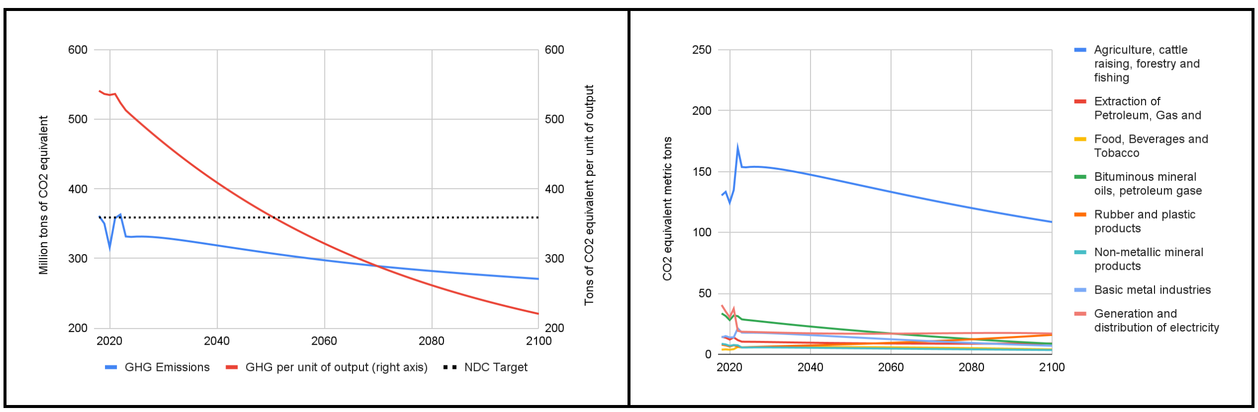
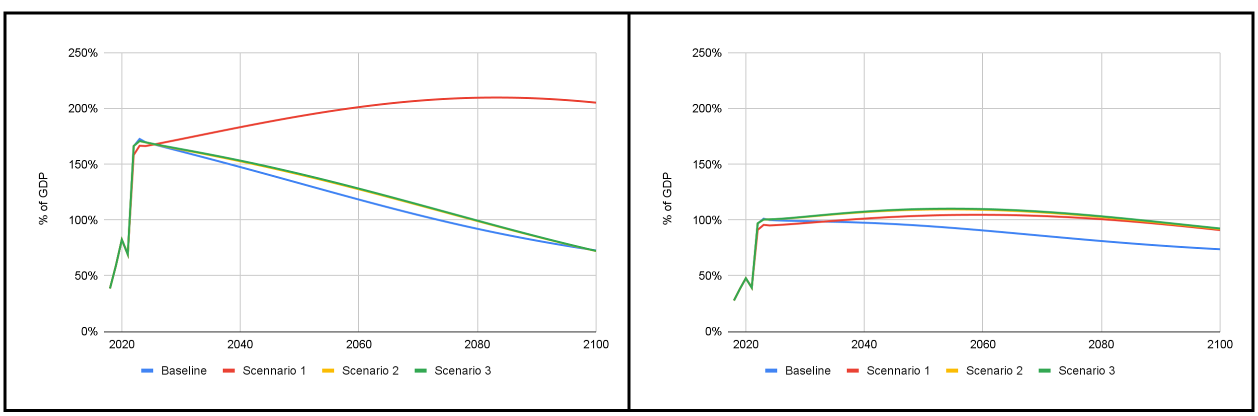


Figure 12: Public (left panel) and Private (right panel) External Debt



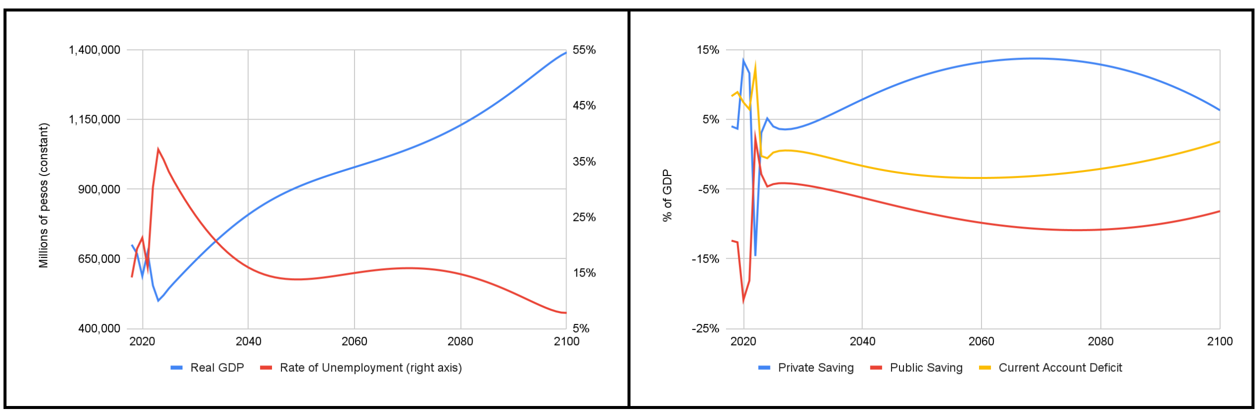
Scenario 4: Focalized Green Transition with Structural Change

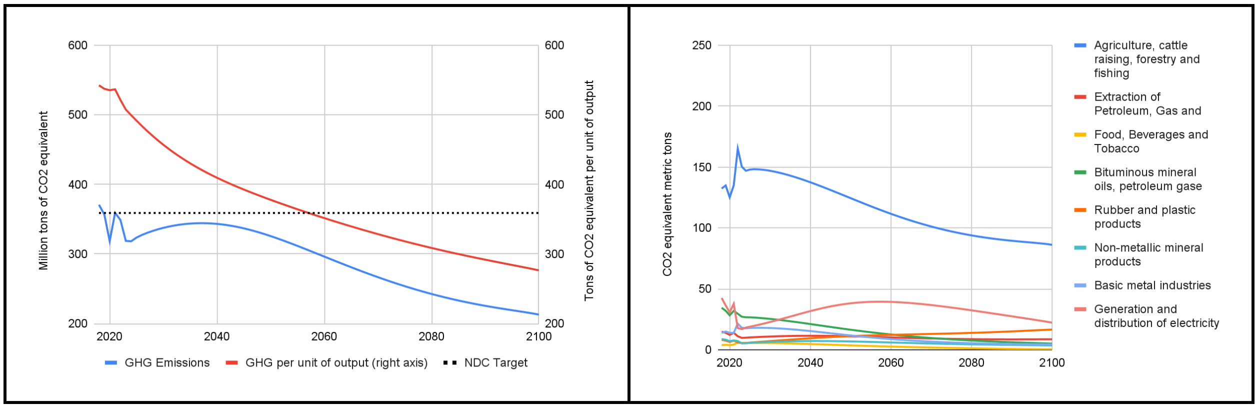
From the results of the previous simulations, it is deduced that none of the corresponding policy combinations is able to take Argentina out of its trilemma. The goal of this last scenario is to show what a sustainable green transition would consist of. Arbitrary as the description that follows might seem, the core message that we intend to transmit is that Argentina not only requires to make transformations in its energy efficiency and energetic matrix, but also in its whole production structure. This would mean both reducing its dependence on imported intermediate and capital goods and shifting its exports away from low value added and high emitting GHG primary products to more innovation intensive goods and services that contribute both to a lower GHG emissions and higher exports.

The focalized green transition with structural change scenario is based upon scenario 3, to which the following features are added. First, the imports propensities of private consumption, investment and intermediate consumption are lowered at a yearly rate of 1% to reflect the decreasing technical dependency of the economy. Second, and in line with the reduced technical dependency, the technical coefficients defining the intermediate sales are increased at a yearly rate of 1% for the following sectors: manufactured metal products; machinery and equipment; motor vehicles, trailers and semi-trailers; other transport equipment, and other manufacturing industries. Third, the autonomous component of the exports equation is progressively increased for the following sectors: manufacturing of food, beverages and tobacco products; basic metal industries; machinery and equipment; trade services; accommodation services, restaurants, bars and canteens; and transport and communication services. These sectors were selected given their current relative importance in the export basket of the country and their growth potential. Alongside these increases in the exports of these sectors, it is further assumed a progressive decrease in the autonomous component of the exports of the agriculture, cattle raising, forestry and fishing sector, which is currently the third most important one in terms of exports, but also the highest GHG emitting. Finally, the autonomous component of private investment is assumed to be larger than in scenario 3, as capital accumulation not only needs to cover the replacement of the energetic part of the productive structure but also all the necessary transformation that structural change entails.

As observed in Figure 13 under the calibration described there is at least one stable path along which the economy could transition towards a sustainable future, both in terms of macro-financial and environmental sustainability. As the current account exhibits a better performance (given by the higher and more diversified exports and the lower import propensity) there is an increased flow of private saving that helps to self-finance the costs of transition and structural change. Moreover, the resulting trade surplus induces a lower depreciation of the exchange rate, leading to a higher disposable income explained by both higher real wages and government transfers (note that for the sake of comparability the rate of growth of nominal wages and transfers is being kept the same in all the scenarios). It is these higher real transfers paid by the government what explains its budget deficit. Should these transfers be reduced both the private sector financial surplus and the government deficit would narrow down. As regards environmental sustainability, the graphs in the bottom panels show that GHG emissions would be reduced more than in the scenario without structural change, making the green transition deeper and faster. The main driver of this result is the loss of weight of the agricultural sector in total production.

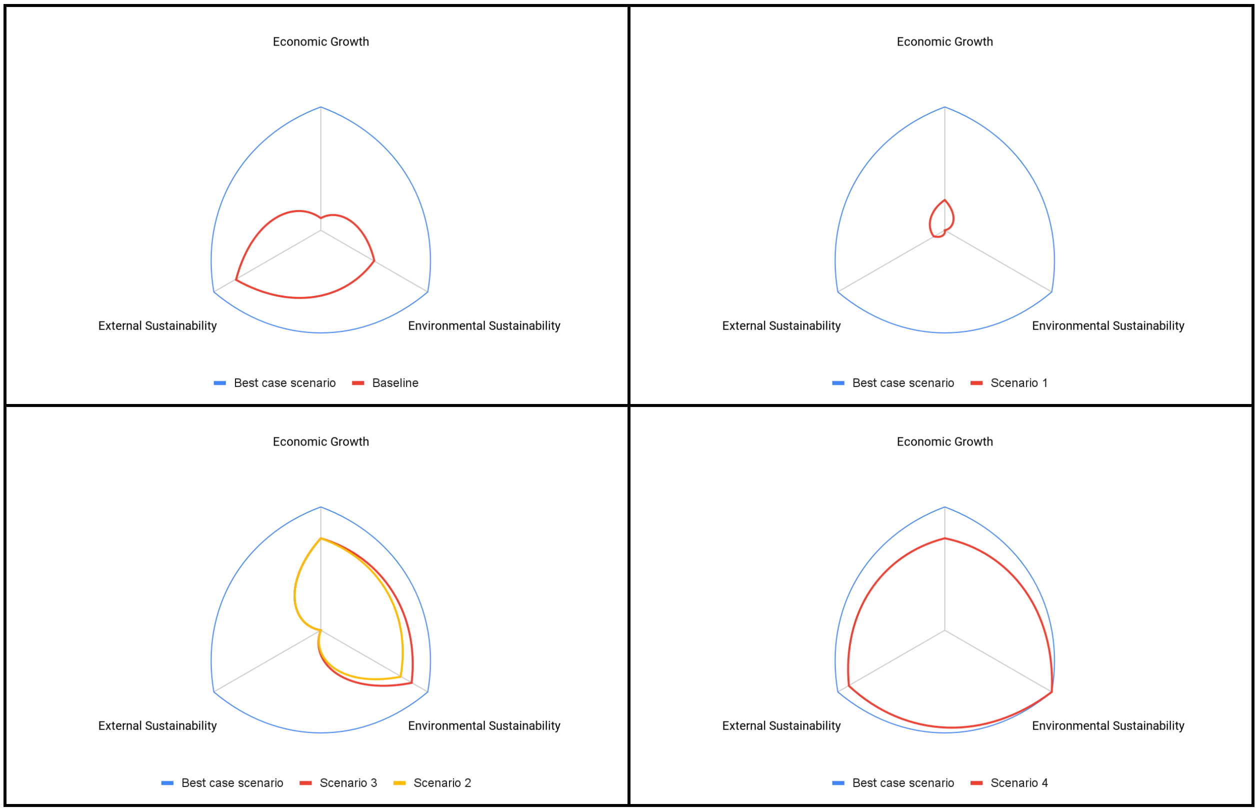
Figure 13: GDP, Rate of Unemployment and Financial Balances in Scenario 4





To wrap up, the different performance of these scenarios in terms of the green transition trilemma can be compared through Figure 14. The baseline scenario, which intends to describe the current trajectory of the economy, is clearly undesirable since none of the long-term goals comprised in the trilemma are being achieved (the seeming good performance in terms of external sustainability is mostly due to the low level of imports that the stagnation implies, and not to the fact that the economy is gaining markets overseas). Scenario 1, where the economy manages to get around the balance of payments crisis through external financing, allows for slightly higher growth, but with the downside of a higher external vulnerability and a lower environmental sustainability. Scenarios 2 and 3, describing the generalized and focalized green transitions, show a very similar performance, characterized by higher long run growth and environmental sustainability. However, the persistent balance of payments fragility can eventually put the whole transition process in jeopardy. It is only through structural change, as described in scenario 4, that the economy can solve the green transition trilemma and, more generally, the persistent stop-and-go cycles that characterized its dynamics since the 1960s (Braun and Joy, 1968; Diamand, 1972).

Figure 14: The Green Transition Trilemma



6. CONCLUSIONS

Based on Argentina's recent amendment to its NDC, in this paper we set ourselves a double objective. On the one hand, and in order to have a tool that facilitates the design process and the simulation of economic policies and scenarios in the framework of the green transition, we built an environmental stock-flow consistent input-output model that describes the Argentine productive structure and its link with the financial sector and the environment. On the other hand, once the model was developed, we set out to model some of the different ways that this transition could take in the specific case of Argentina, with special emphasis on the reconversion of the energy matrix.

In line with the hypotheses and with the ample empirical evidence relative to the Argentine economic history of the last sixty years, the constructed model can generate a baseline scenario where the external constraint (that is, the difficulties in financing the imbalances in the balance sheet of payments) limits the possibilities of long-term growth. On top of this finding, a new dimension is added to the dilemma between economic growth and external sustainability that characterizes the Argentinean economy: the need to reduce greenhouse gas emissions in a context where a big part of them come from the primary export sector, whose activity helps to relax the external restraint.

The incorporation of the environmental block is carried out through the greenhouse gas emissions that the production, energy consumption and final consumption of the private sector entail. Based on this, three of the many possible forms that the green transition could take are simulated: a reconversion towards the use of clean energy throughout the production structure; a partial reconversion, focused on the most relevant sectors in terms of exports, job creation and GHG emissions; and this same partial reconversion combined with a process of structural change, in which the economy reduces its technical dependence on the rest of the world. According to the simulations carried out, only in the last scenario is it possible for Argentina to free itself from the consequences of the green transition trilemma - in all the others, some of the objectives cannot be met, putting even the fulfillment of the others at risk.

Given that the model developed in this work constitutes a preliminary version, which is susceptible to being improved in various aspects, the results presented here should be taken with caution. In line with the developments that have been registered in recent years (mainly since the Post Keynesian school), great efforts must be made to improve and strengthen these new tools for modeling the links between the economy, finance and the environment, in order to provide the scientific community with an analysis tool that improves the performance that the integrated assessment models have given so far.

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APPENDIX 1: PRODUCTIVE SECTORS INCLUDED IN THE SAM

Code	Name
S01	Agriculture, cattle raising, forestry and fishing
S02	Primary extraction of oil, gas and coal
S03	Mining
S04	Manufacturing of food, beverages and tobacco products
S05	Textile and clothing products
S06	Tanning and finishing of leathers
S07	Production of wood and its products
S08	Manufacture of paper and its products
S09	Editing and printing
S10	Bituminous mineral oils, petroleum gases and other gaseous hydrocarbons
S11	Chemical substances and products
S12	Rubber and plastic products
S13	Non-metallic mineral products
S14	Basic metal industries
S15	Manufactured metal products
S16	Machinery and equipment
S17	Motor vehicles, trailers and semi-trailers
S18	Other transport equipment
S19	Other manufacturing industries
S20	Generation and distribution of electricity, gas and water
S21	Construction services
S22	Trade Services
S23	Accommodation services, restaurants, bars and canteens
S24	Transport and communication services
S25	Financial intermediation services
S26	Real estate and business activities
S27	Public administration
S28	Education services
S29	Social and health services
S30	Other community service activities
S31	Generation of renewable energy

APPENDIX 2: TECHNICAL AND FINAL DEMAND COEFFICIENTS

		Sectors															
		S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13	S14	S15	S16
Sectors	S01	0,087	0,000	0,000	0,371	0,043	0,150	0,006	0,000	0,000	0,008	0,001	0,000	0,000	0,000	0,000	0,000
	S02	0,000	0,061	0,000	0,000	0,000	0,000	0,000	0,001	0,000	0,183	0,012	0,001	0,000	0,008	0,000	0,000
	S03	0,000	0,009	0,071	0,002	0,002	0,004	0,003	0,002	0,000	0,003	0,006	0,000	0,110	0,033	0,001	0,000
	S04	0,006	0,001	0,001	0,099	0,010	0,036	0,004	0,005	0,006	0,007	0,008	0,003	0,003	0,001	0,001	0,002
	S05	0,001	0,002	0,000	0,004	0,135	0,021	0,003	0,010	0,004	0,001	0,002	0,008	0,002	0,002	0,002	0,002
	S06	0,000	0,000	0,000	0,003	0,028	0,155	0,001	0,002	0,002	0,001	0,001	0,001	0,000	0,000	0,000	0,000
	S07	0,002	0,000	0,001	0,005	0,001	0,001	0,040	0,041	0,025	0,000	0,001	0,001	0,003	0,001	0,004	0,002
	S08	0,001	0,001	0,004	0,016	0,004	0,001	0,045	0,196	0,117	0,000	0,004	0,005	0,009	0,003	0,003	0,004
	S09	0,000	0,001	0,003	0,004	0,002	0,000	0,005	0,014	0,029	0,000	0,003	0,002	0,001	0,001	0,002	0,003
	S10	0,009	0,006	0,038	0,016	0,007	0,002	0,052	0,007	0,004	0,029	0,093	0,083	0,024	0,011	0,015	0,014
	S11	0,095	0,002	0,017	0,012	0,046	0,068	0,051	0,024	0,035	0,009	0,092	0,116	0,017	0,017	0,013	0,010
	S12	0,004	0,002	0,001	0,020	0,014	0,003	0,024	0,044	0,014	0,001	0,021	0,128	0,005	0,003	0,008	0,022
	S13	0,000	0,004	0,001	0,016	0,000	0,001	0,005	0,001	0,001	0,000	0,004	0,004	0,097	0,012	0,007	0,009
	S14	0,000	0,014	0,004	0,002	0,000	0,001	0,008	0,002	0,001	0,001	0,002	0,003	0,004	0,125	0,175	0,067
	S15	0,000	0,011	0,000	0,004	0,001	0,001	0,011	0,002	0,003	0,001	0,002	0,002	0,003	0,012	0,040	0,036
	S16	0,004	0,006	0,003	0,002	0,002	0,001	0,007	0,004	0,007	0,003	0,001	0,002	0,003	0,025	0,020	0,105
	S17	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,001	0,002
	S18	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
	S19	0,008	0,003	0,000	0,000	0,002	0,000	0,001	0,001	0,002	0,000	0,000	0,001	0,000	0,010	0,002	0,001
	S20	0,004	0,004	0,033	0,009	0,004	0,003	0,019	0,010	0,005	0,003	0,017	0,011	0,010	0,024	0,007	0,003
	S21	0,000	0,002	0,001	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,001	0,000
	S22	0,047	0,019	0,026	0,094	0,025	0,011	0,046	0,036	0,088	0,079	0,099	0,049	0,028	0,019	0,047	0,036
	S23	0,001	0,008	0,001	0,010	0,006	0,001	0,011	0,010	0,021	0,001	0,007	0,010	0,009	0,010	0,017	0,015
	S24	0,062	0,024	0,085	0,039	0,024	0,005	0,041	0,023	0,045	0,020	0,029	0,024	0,045	0,039	0,028	0,030
	S25	0,008	0,011	0,019	0,010	0,012	0,005	0,017	0,011	0,014	0,003	0,005	0,009	0,008	0,012	0,016	0,013
	S26	0,008	0,019	0,049	0,025	0,016	0,011	0,039	0,022	0,044	0,004	0,019	0,021	0,017	0,029	0,025	0,023
	S27	0,006	0,000	0,003	0,000	0,000	0,000	0,000	0,001	0,001	0,000	0,000	0,000	0,000	0,000	0,001	0,001
	S28	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
	S29	0,000	0,001	0,000	0,000	0,000	0,000	0,000	0,000	0,001	0,000	0,000	0,000	0,000	0,000	0,001	0,000
	S30	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
	S31	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
	Imports	0,042	0,081	0,049	0,044	0,096	0,062	0,109	0,132	0,126	0,011	0,129	0,199	0,067	0,104	0,116	0,144

		Sectors															Households		Gov.	Investment		ROW
		S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	H01	H02		PNF	Public	
Sectors	S01	0,000	0,000	0,000	0,000	0,000	0,000	0,100	0,000	0,000	0,000	0,002	0,001	0,000	0,002	0,000	0,031	0,018	0,000	0,094	0,100	0,172
	S02	0,000	0,000	0,000	0,187	0,000	0,000	0,000	0,005	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,011	0,018	0,007
	S03	0,006	0,003	0,001	0,001	0,049	0,000	0,003	0,000	0,000	0,002	0,002	0,000	0,000	0,000	0,001	0,000	0,000	0,000	0,000	0,000	0,007
	S04	0,002	0,003	0,002	0,000	0,000	0,000	0,218	0,001	0,000	0,001	0,005	0,004	0,007	0,010	0,000	0,247	0,145	0,000	0,032	0,051	0,184
	S05	0,002	0,003	0,008	0,000	0,000	0,001	0,012	0,001	0,000	0,004	0,005	0,003	0,004	0,003	0,000	0,021	0,017	0,000	0,009	0,010	0,004
	S06	0,001	0,000	0,002	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,001	0,000	0,000	0,000	0,000	0,002	0,003	0,000	0,007	0,006	0,012
	S07	0,001	0,001	0,022	0,000	0,008	0,003	0,001	0,000	0,001	0,001	0,001	0,001	0,001	0,000	0,000	0,001	0,001	0,000	0,001	0,001	0,001
	S08	0,002	0,002	0,004	0,000	0,001	0,002	0,005	0,002	0,003	0,002	0,002	0,004	0,003	0,003	0,000	0,003	0,004	0,000	0,001	0,002	0,005
	S09	0,002	0,002	0,001	0,001	0,000	0,003	0,002	0,002	0,010	0,005	0,005	0,005	0,001	0,002	0,001	0,010	0,008	0,000	0,003	0,004	0,000
	S10	0,004	0,026	0,008	0,223	0,033	0,025	0,014	0,084	0,005	0,011	0,073	0,003	0,006	0,052	0,000	0,010	0,011	0,000	0,000	0,000	0,020
	S11	0,008	0,013	0,010	0,004	0,015	0,002	0,005	0,002	0,001	0,006	0,004	0,002	0,056	0,017	0,004	0,037	0,029	0,000	0,011	0,012	0,072
	S12	0,030	0,018	0,024	0,001	0,005	0,002	0,008	0,003	0,000	0,002	0,003	0,000	0,002	0,002	0,001	0,004	0,006	0,000	0,007	0,009	0,007
	S13	0,019	0,003	0,002	0,000	0,124	0,001	0,000	0,000	0,000	0,007	0,001	0,000	0,003	0,001	0,000	0,002	0,002	0,000	0,002	0,002	0,002
	S14	0,075	0,053	0,024	0,000	0,036	0,000	0,000	0,000	0,000	0,001	0,000	0,000	0,000	0,000	0,000	0,001	0,001	0,000	0,025	0,024	0,059
	S15	0,074	0,019	0,008	0,001	0,030	0,000	0,001	0,001	0,000	0,001	0,001	0,000	0,001	0,002	0,001	0,001	0,001	0,000	0,022	0,025	0,003
	S16	0,069	0,019	0,004	0,005	0,032	0,001	0,002	0,009	0,001	0,005	0,005	0,002	0,007	0,007	0,005	0,015	0,015	0,000	0,151	0,147	0,017
	S17	0,065	0,001	0,000	0,000	0,001	0,000	0,000	0,001	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,011	0,020	0,000	0,069	0,090	0,062
	S18	0,001	0,038	0,000	0,000	0,000	0,000	0,000	0,001	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,006
	S19	0,023	0,001	0,006	0,000	0,004	0,000	0,001	0,000	0,000	0,001	0,000	0,001	0,001	0,002	0,000	0,011	0,007	0,000	0,006	0,006	0,001
	S20	0,006	0,004	0,003	0,211	0,000	0,001	0,008	0,003	0,001	0,002	0,011	0,024	0,006	0,012	0,000	0,026	0,019	0,000	0,000	0,000	0,000
	S21	0,000	0,000	0,000	0,005	0,000	0,002	0,002	0,005	0,002	0,015	0,012	0,011	0,009	0,026	0,005	0,000	0,000	0,000	0,205	0,444	0,000
	S22	0,067	0,077	0,118	0,008	0,207	0,085	0,163	0,048	0,134	0,084	0,059	0,048	0,181	0,153	0,009	0,020	0,015	0,000	0,014	0,023	0,211
	S23	0,023	0,038	0,007	0,001	0,000	0,001	0,035	0,002	0,004	0,002	0,015	0,009	0,009	0,004	0,001	0,051	0,086	0,000	0,000	0,000	0,040
	S24	0,021	0,038	0,017	0,090	0,003	0,036	0,024	0,213	0,058	0,032	0,070	0,059	0,017	0,038	0,101	0,143	0,108	0,000	0,000	0,000	0,078
	S25	0,011	0,020	0,009	0,005	0,009	0,014	0,025	0,017	0,041	0,011	0,075	0,014	0,008	0,012	0,006	0,042	0,083	0,004	0,000	0,000	0,002
	S26	0,031	0,044	0,012	0,012	0,008	0,032	0,121	0,040	0,090	0,045	0,068	0,052	0,044	0,055	0,014	0,094	0,142	0,021	0,017	0,025	0,025
	S27	0,000	0,001	0,000	0,000	0,000	0,002	0,000	0,000	0,001	0,000	0,010	0,000	0,000	0,001	0,000	0,002	0,002	0,592	0,000	0,000	0,001
	S28	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,039	0,038	0,256	0,000	0,000	0,000
	S29	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,001	0,000	0,005	0,002	0,004	0,073	0,023	0,000	0,067	0,105	0,127	0,000	0,000	0,000
	S30	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,075	0,122	0,000	0,000	0,000	0,003
	S31	0,000	0,000	0,000	0,008	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,009	0,000	0,000	0,000	0,000	0,000	0,000
	Imports	0,266	0,138	0,087	0,269	0,261	0,051	0,051	0,085	0,055	0,059	0,107	0,037	0,143	0,005	0,484	0,065	0,065	0,000	0,312	0,000	0,000