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The Economic and Environmental Effects of a Green Employment of Last Resort. A Sectoral Multiplier Analysis for the US

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ABSTRACT
We assess the sectorial impact of the implementation of a "green" Employment of Last Resort (ELR) in the US based on an environmental modification of Kurz (1985) multiplier framework and data from OECD Input-Output tables. We use these multipliers to estimate the impact of an "optimal" ELR designed to maximize the impact on both output and employment while minimizing both imports and carbon emissions. We then test several alternative policies scenario based upon different compositions of US government expenditure. We provide evidence that 1) picking the optimal sectors in terms of output, employment, CO2 and import multipliers where to invest does not always deliver optimal results in the aggregate; 2) ecological sustainability for the US economy also fosters import sustainability; 3) rebounding effect in Co2 emissions may be tamed if the ELR satisfy the abovementioned optimality condition, although this undermines its success in terms of output and employment..

KEYWORDS
Input-Output Models; Job Guarantee Plan; Structural Change; Energy Transition

JEL CLASSIFICATION
B52; J68; Q43

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1. Introduction

The purpose of this work is threefold: a) estimate the Sraffian output, employment and import multipliers (Kurz 1985) for the US departing from the Classical assumption of the saving propensity out of profits (wages) equal to one (zero); b) estimate the Sraffian Co2 multipliers for the US, on the basis of an environmental modification of Mariolis and Soklis (2018), Apostolopoulos et al. (2022) and Rodousakis and Soklis (2021) framework ; c) estimate the effect of the adoption of a green Employer of

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Last Resort (ELR) program by testing different scenario in order to balance output, employment, imports and Co2 emissions, extending Yajima (2021) contribution. In recent years, ELR has been increasingly used in discussion of a set of policy proposals (Green New Deal, GND) to foster in the US the transition away from carbon fossil fuels, increase energy efficiency and promote both environmental and social sustainability. In accordance with Nersisyan and Wray (2021), the Green ELR should be targeting labour force with below-average skills and labour- intensive vacancies (care services, small construction and retrofitting interventions). This, in turn, would provide a boost to aggregate demand; it is estimated that for a net annual impact on the federal government's budget of roughly 400 USD billion per year over 10 years, there will be a boost to GDP of 560 USD billion annually and to employment of 19 million new workers (15 direct JG effect+4 indirect job creation). The GND-ELR proposal has received a number of criticisms, in particular on i) the implication on the external balances (current and trade account), especially when this policy is implemented in a small, open economy (Epstein 2019; Vernengo and Perez Caldentey 2020); ii) the negative consequences from the reduction of a "brown" component of aggregate demand (Yajima 2021); iii) absence of "rebounding" effects, that is the increase in energy consumption following the improvement in energy efficiency (Sorrell et al. 2007; Vivanco et al. 2016)). In order to assess the sectorial impact of the implementation of a "green" ELR we calculate output, employment and carbon dioxide emissions multipliers using data from OECD Input-Output tables. Using these multipliers, we estimate the impact of a ELR designed to maximize the impact on both output and employment while minimizing that on both imports and carbon emissions. We also test several alternative policies scenario based upon the current composition of US government expenditure. We provide evidence that 1) Kurz's employment, imports and Co2 multipliers are higher than the standard ones, while some output multipliers are lower (mostly in industry and mining) ; 2) picking the optimal sectors in terms of output, employment, CO2 and import multipliers where to invest does not always deliver optimal results in the aggregate ; 3) ecological sustainability for the US economy also fosters import sustainability; 4) rebounding effect may be tamed if the ELR satisfy the abovementioned "optimal" condition, although this undermines its success in terms of output. The structure of the paper is the following: Section 2 introduces our theoretical framework, while Section 3 describes the structure of the US economy emerging from our estimated multipliers. Section 4 carries out the policy experiments as Section 5 concludes.

2. Theoretical Model

Following Kurz (1985) and Metcalfe and Steedman (1981), we consider an open economy where: (a) all capital is circulating; (b) the input-output coefficients are fixed; (c) there are non-competitive imports; (d) the net product is distributed to profits and wages that are paid at the end of the common production period; (e) the price of a commodity obtained as an output at the end of the production period is the same as the price of that commodity used as an input at the beginning of that period ("stationary prices"); (f) labor is homogeneous within each industry but heterogeneous across industries. The price side of the system is described by:

$$\mathbf{p} = \mathbf{pA}\left[\mathbf{I} + \hat{\mathbf{r}}\right] + \mathbf{w}\hat{\mathbf{l}} \tag{1}$$

where $\mathbf{p}(>\mathbf{0})$ the $1\times n$ vector of commodity prices, $\mathbf{A}$ $(\geq \mathbf{0})$ the $n\times n$ matrix of total input-output coefficients, $\mathbf{I}$ the $n\times n$ identity matrix, $\hat{\mathbf{r}}(\neq 0 and r_j>0)$ the $n\times n$ diagonal matrix of the sectoral profit rates, $\mathbf{w}(w_j>0)$ the vector of money wage rates, $\hat{\mathbf{l}}(l_j>0)$ the $n\times n$ diagonal matrix of direct labor coefficients.

The quantity side of the system is described by

$$\mathbf{x}^T = \mathbf{A}\mathbf{x}^T + \mathbf{y}^T \tag{2}$$

or

$$\mathbf{y}^T = \mathbf{c}_w^T + \mathbf{c}_p^T - \mathbf{im}^T + \mathbf{d}^T \tag{3}$$

where $\mathbf{x}^T$ denotes the gross output vector, $\mathbf{y}^T$ the vector of net output, $\mathbf{c}_w^T(\mathbf{c}_p^T)$ the vector of consumption demand out of wages (profits), $\mathbf{d}^T$ the vector of autonomous demand, $\mathbf{im}^T = \hat{\mathbf{m}}\mathbf{B}\mathbf{x}^T$ denotes the import demand vector and $\hat{\mathbf{m}}$ the $n\times n$ diagonal matrix of imports per unit of gross output of each commodity. Total wages (4) and profits (5) amount to:

$$W = \mathbf{l}\mathbf{x} = \mathbf{\Lambda}\mathbf{y} \tag{4}$$

$$P = \mathbf{p}\mathbf{A}\hat{\mathbf{r}}\mathbf{x} = \mathbf{p}\mathbf{H}\mathbf{y} \tag{5}$$

With $\mathbf{\Lambda} \equiv \mathbf{l}[\mathbf{I}-\mathbf{A}]^{-\mathbf{1}}$ the $n\times n$ matrix of "vertically integrated labour coefficients", and $\mathbf{H} \equiv \mathbf{A}\mathbf{r}[\mathbf{I}-\mathbf{A}]^{-\mathbf{1}}$ the $n\times n$ "$\hat{\mathbf{r}}$-vertically integrated technical coefficients matrix". By considering the above equations, we derive

$$\mathbf{y}^T = \mathbf{\Pi}\mathbf{d}^T \tag{6}$$

where $\mathbf{\Pi} \equiv [\mathbf{I}-\mathbf{C}+\mathbf{M}]^{-\mathbf{1}}$ denotes the $n\times n$ matrix of multipliers linking autonomous demand to net output and $\mathbf{M} \equiv \hat{\mathbf{m}}[I-A]^{-1}$ denotes the $n\times n$ matrix of total import demand. Furthermore,

$$\mathbf{C} \equiv [\mathbf{p} - (s_w\mathbf{w}\mathbf{\Lambda} + s_p\mathbf{p}\mathbf{H})](pc^T)^{-1}c^T \tag{7}$$

denotes the $n\times n$ matrix of total consumption demand, while $(pc^T)^{-1}c^T$ is the vector of uniform consumption pattern (associated with the two types of income). Moreover, the scalar $s_w(s_p)$ is the saving ratio out of wages (profits). From equation (3) and given that $\mathbf{L}^T \equiv \hat{\mathbf{l}}\mathbf{x}^T$ denotes the vector of sectoral employment, we derive the following equation:

$$\mathbf{L}^T = \mathbf{\Lambda}\mathbf{\Pi}\mathbf{d}^T \tag{8}$$

where $\mathbf{\Lambda}\mathbf{\Pi}$ denotes the $n\times n$ matrix of employment multipliers linking autonomous investments to total employment. According to Kahn (1931) $\mathbf{\Lambda\Pi}$ can be decomposed into "primary employment" effects:

$$\mathbf{L}_1^T = \mathbf{\Lambda d}^T \tag{9}$$

And "secondary emplyment":

$$\mathbf{L}_2^T = \mathbf{\Lambda}(\mathbf{\Pi} - I)\mathbf{d}^T \tag{10}$$

Let us now turn on the estimation of Carbon Dioxide multipliers. The volume of emissions of Co2 is given by

$$\mathbf{Co_2} = \mathbf{ex}^T \tag{11}$$

where $\mathbf{x}^T$ is the activity levels and $\mathbf{e}$ is the carbon emissions intensity vector (i.e. emission factor, Yamano and Guilhoto 2020).

Since $\mathbf{x}^T = [\boldsymbol{I} - \boldsymbol{A}]^{-\mathbf{1}}\mathbf{y}^T$, we get

$$\mathbf{Co_2} = \boldsymbol{e}[\boldsymbol{I} - \boldsymbol{A}]^{-\mathbf{1}}\mathbf{y}^T \rightarrow \mathbf{Co_2} = E\mathbf{y}^T \tag{12}$$

where $\boldsymbol{E} \equiv \boldsymbol{e}[\boldsymbol{I} - \boldsymbol{A}]^{-\mathbf{1}}$. Given that $\mathbf{y}^T = \mathbf{\Pi d}^T$, we get

$$\mathbf{Co_2} = \boldsymbol{E}\mathbf{\Pi d}^T \tag{13}$$

where $\mathbf{\Pi}$ is the input multiplier and $\boldsymbol{E}\mathbf{\Pi}$ the Co2 multiplier. Similar to Employment, Co2 multipliers can be decomposed into primary effects (eq. 14-15):

$$\mathbf{Co_2}_1^T = \boldsymbol{E}\mathbf{d}^T \tag{14}$$

And "secondary effects":

$$\mathbf{Co_2}_2^T = \boldsymbol{E}(\mathbf{\Pi} - I)\mathbf{d}^T \tag{15}$$

Hence, the changes on the money value of net output, Δ_y^i (output multiplier), the money value of imports, Δ_{imp}^i (import multiplier), total employment, Δ_L^i (employment multiplier), total Co2 emissions, Δ_E^i (emission multiplier), induced by the increase of one unit of the autonomous demand for commodity i , are given by

$$\Delta_y^i \equiv p\mathbf{\Pi}\boldsymbol{\varepsilon}_i^T \tag{16}$$

$$\Delta_{imp}^i \equiv p\hat{\mathbf{m}}[\mathbf{I} - \mathbf{A}]^{-\mathbf{1}}\mathbf{\Pi}\boldsymbol{\varepsilon}_i^T \tag{17}$$

$$\Delta_L^i \equiv p\mathbf{\Lambda\Pi}\boldsymbol{\varepsilon}_i^T \tag{18}$$

$$\Delta_E^i \equiv p\boldsymbol{E}\boldsymbol{\Pi}\boldsymbol{\varepsilon}_i^T \tag{19}$$

Therefore, the multiplier effects depend, in a rather complicated way, on the:
(a) technical conditions of production; (b) income distribution; (c) savings ratios out of wages and profits; (d) consumption pattern; (e) imports per unit of gross output.

3. Empirical Findings

Based on the theoretical framework outlined in the previous section, we will estimate the Sraffian multipliers for the US economy. We employ data from the OECD IOTs table (2021 edition) for gross output, imports, consumption and interindustry flows. Total employment and wages per sector were obtained from OECD Structural Analysis database (STAN-2021), while emission factors were provided by the TECO2 database (Carbon dioxide emissions embodied in international trade 2021 edition). As for the propensities to save out of profits, we did not rely on an econometric exercise, but we use as a rule of thumb the OECD retention ratio for the US. Similarly, we use for the propensity to save out of wages the personal saving rate in the US. All the observation were obtained for the year 2018.

The results for the output, employment, Co2 and import multipliers of the 44 sectors of the US economy are presented in figure 1 and 2, while table 1 summarize the aggregate figures at the industry level (as defined by OECD and detailed in the appendix). In accordance with table 1, an increase of 1 dollar in autonomous demand leads to 1) an increase in output by 1.46 dollar 2) an addition to total employment of roughly 11 new workers 3) a rise in imports by 0.3 dollars and 4) an increase in 0.00043 Mtons or 430 tonnes in Co2 emissions. The figures for output, employment and import multipliers are slightly different with respect those provided by Rodousakis and Soklis (2021) and Apostolopoulos et al. (2022), as our employment multiplier is slightly lower than theirs. Conversely, both our output and import multipliers are higher than the one estimated by these authors for the US in 2015 assuming the classical hypothesis. If we take the average results for Primary, Secondary and Tertiary activities we can observe that the latter present higher than national average output and employment multipliers, and a lower than average import multiplier. Tertiary activities comprises either distributive trade, information and finance services and public and other services, whose output and employment multipliers (import multiplier) are higher (lower) than the US average in all but in one case. In fact, within information and finance services Publishing, audiovisual and broadcasting activities, Telecommunications, Financial and insurance and Real estate activities present smaller employment multiplier than the US economy. As for the Co2 multipliers, Primary activities are the ones that have a milder carbon footprint with respect the other industries; this is true in particular for the case of Agriculture, hunting, forestry, fishing and aquaculture. Conversely, these industries display lower (higher) than average output and employment multipliers (import multiplier). Among the industries responsible for the bulk of emissions stands out the Electricity, gas, steam and air conditioning supply sector whose Co2 multiplier is 0,0041 (that is, a dollar spent in this sector is responsible for the emission of 4100 tonnes of Carbon Dioxides), followed by transport activities (Air, Water, Land and via pipeline). In order to further grasp the features of the US economy table 1 presents also some structural indicators as in Apostolopoulos et al. (2022), namely the output-employment, output-import, employment-import and output-Co2 ratios. These provides sectorial proxies for labour productivity, relative import dependency (both in terms of output and employment) and relative Co2 intensity. In accordance with these ratios, Mining, Information and finance services and Material manufacturing are the most productive industries, while tertiary activities present a smaller dependency upon imported inputs with respect to the country's average (together with Construction). In addition, the tertiary sector is relatively more efficient in terms of Co2 intensity, although this applies only for Information, finance, public and other services. In this sense, also Agriculture, Machinery and Equipment and Construction provides better emission efficiency than the US economy. Following equations (9, 10, 14, 15), table 2 presents the results for Employment and Co2 multipliers in terms of their respective Kahn (1931) decomposition between primary and secondary effects. Furthermore, the ratio between secondary and primary Employment and Co2 effects are provided, whose object is to capture the size" beneficial repercussion" in the multiplier process. A ratio below (above) one points toward stronger (weaker) first round effects of an increase in autonomous expenditure with respect to the second-round ones and a less (more) effective propagation process. Khan's ratios for the Employment multipliers are lower than one in all but one industry, that is Information and finance services; this sector present a value above one also in the case of the Co2 multipliers ratio. Likewise, this threshold is surpassed by the Public and other services sector and on average by the Tertiary sector. This signals that any additional expenditure in Information and services activities triggers beneficial repercussions of almost equal size than the initial stimulus (in our case, secondary effects are slightly stronger than the primary ones). As for Co2 ratios that trespass one, it is implied here that more emissions are produced during the subsequent phases of the multiplier process. As a matter of fact, services in both the private and the public sector present the highest output multipliers (together with Construction), which means that in accordance with equation 6 these activities present a higher degree of interconnectivity with the rest of the economy, causing a further increase in emission. The case of Agriculture is peculiar, since it presents negative secondary multipliers effects (and a negative Khan ratio) for both Employment and Co2. Notice that equation 9 and 14 are the standard Leontief multipliers for employment and Co2, respectively. It is also useful to provide a comparison with respect to output multipliers in Miyazawa (1960) case, that is adding to the standard Leontief inverse the nxn matrix of total import demand. [1] From figure 6, one can grasp that Kurz's Employment, Co2 and Import multipliers are always higher than Miyazawa's. In turn, Output multipliers as estimated in equation 6 tends to be lower in ten industries, mostly concentrated in the secondary sector (in particular within material manufacturing activities).[2] An explanation for this result may be obtained by looking at their respective sectorial rate of profits. As a matter of fact, the profit rates $\hat{\mathbf{r}}$ in these industries are lower than the US economy average. Moreover, in six out of ten cases (Agriculture, hunting, forestry; Food products, beverages and tobacco; Motor vehicles, trailers and semi-trailers; Wood and products of wood and cork; Rubber and plastics products; Paper products and printing), their wage rate is lower than the national average. Interestingly, the sectors that display lower

[1] Miyazawa (1960), introduced an input-output system, incorporating imports. $\boldsymbol{x} = [\boldsymbol{I} - \boldsymbol{A} + \boldsymbol{M}]^{-1}(\boldsymbol{d^T} + \boldsymbol{f^T})$ Where $\boldsymbol{d^T}$ is the vector column of consumption and $\boldsymbol{f^T}$ is the vector column of final demand (excluding consumption). In this context, $\boldsymbol{\Pi_M} \equiv [\boldsymbol{I} - \boldsymbol{A} + \boldsymbol{M}]^{-1}$ denotes the $n \times n$ matrix of multipliers linking autonomous demand to net output and $\Delta^i_{M,y} \equiv \boldsymbol{p}\boldsymbol{\Pi_M}\boldsymbol{\varepsilon}_i^T$, $\Delta^i_{M,imp} \equiv \boldsymbol{p}\hat{\mathbf{m}}[\mathbf{I} - \mathbf{A}]^{-1}\boldsymbol{\varepsilon}_i^T$, $\Delta^i_{M,L} \equiv \boldsymbol{pl}\boldsymbol{\Pi_M}\boldsymbol{\varepsilon}_i^T$, $\Delta^i_{M,E} \equiv \boldsymbol{pe}\boldsymbol{\Pi_M}\boldsymbol{\varepsilon}_i^T$, stand for output, import, employment and Co2 multipliers, respectively.

[2] These are: TTL_01T02: Agriculture, hunting, forestry; TTL_10T12: Food products, beverages and tobacco; TTL_16: Wood and products of wood and cork; TTL_17T18: Paper products and printing; TTL_19: Coke and refined petroleum products; TTL_20: Chemical and chemical products; TTL_22: Rubber and plastics products; TTL_24: Basic metals; TTL_29: Motor vehicles, trailers and semi-trailers; TTL_50: Water transport.

or equal than average import multiplier tend to have higher than average output and employment multipliers- as shown in figure 3. These are the Tertiary sectors plus Construction. Conversely, Manufacturing and Agriculture present opposite properties due to their higher-than-average imports multipliers. Mining is an exception with respect these two clusters, since it has a lower degree of dependency upon imported inputs although coupled with smaller employment and output multipliers. This applies only partially for the case of Co2 multipliers, since as we have observed previously, there are a number of sectors with an exceptionally stronger carbon footprint (transports and energy supply). Yet, from figure 5 emerges that the industries with below than national average Co2 multipliers located in the upper right quadrant - i.e., those with higher employment and output multipliers - are again the service sector except for distributive trade. Mining in the lower left quadrant is joined by Material Manufacturing, Machinery and Equipment and Agriculture, although these latter two sectors showcase the smallest Co2 multipliers. However, one can infer form figure 3 and 5 that the sectors in the US economy performing the best in terms of employment and output are also the most sustainable ones both in terms of carbon dioxide emissions and imported intermediate goods.

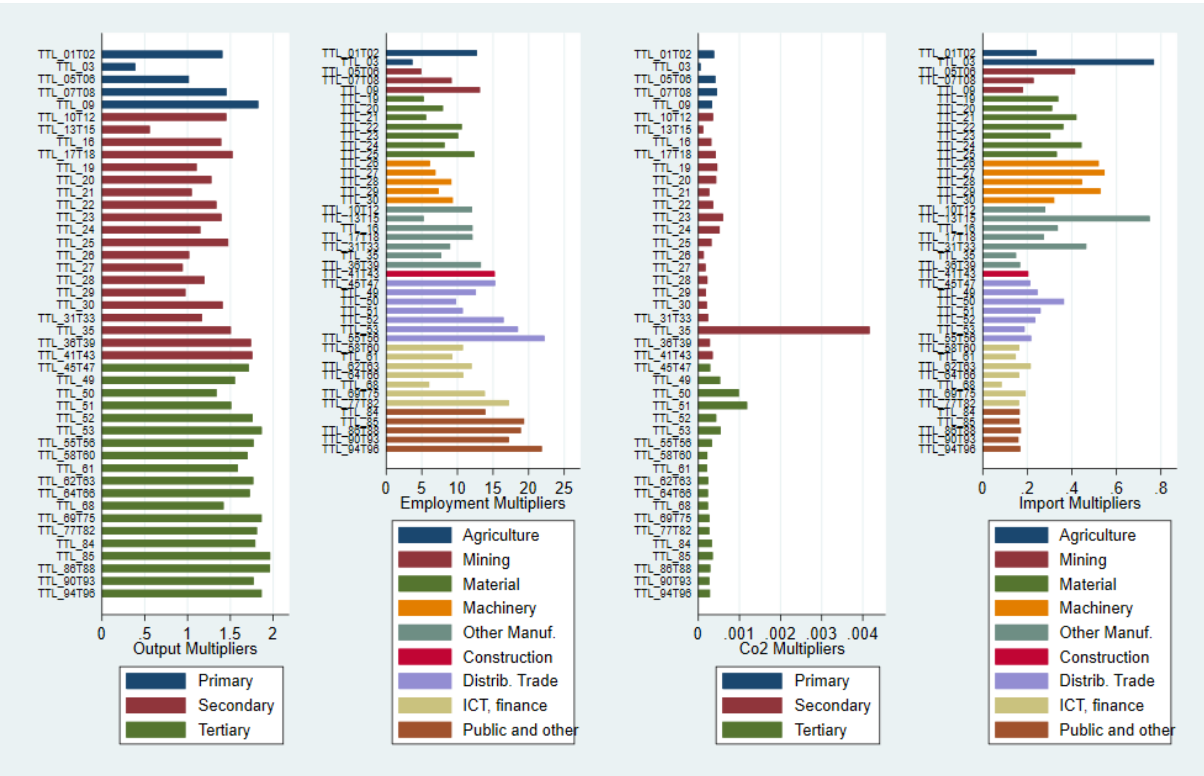

Figure 1.: Output, Employment, Co2 and Import Multipliers

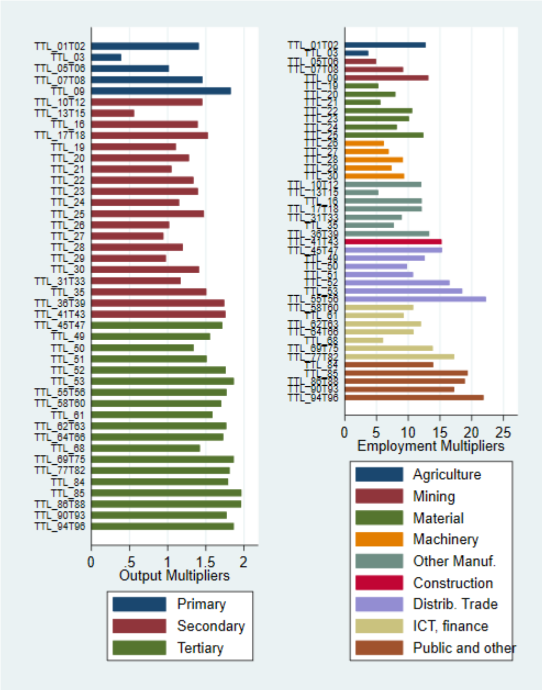

Figure 2.: Output and Employment Multipliers

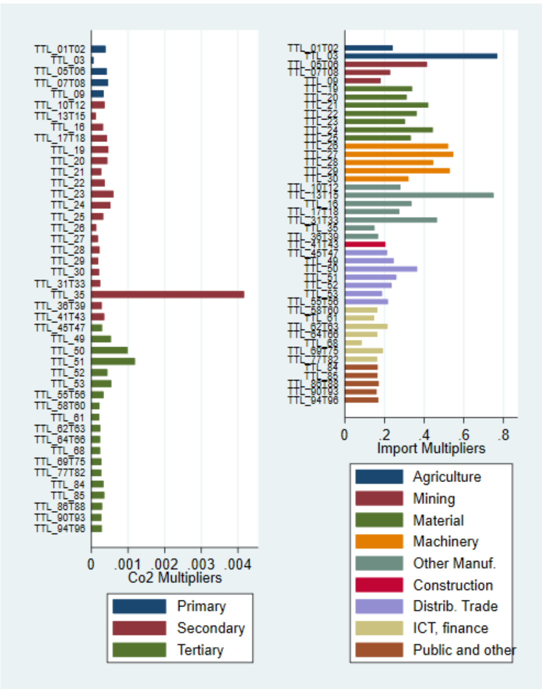

Figure 3.: Co2 and Import Multipliers.

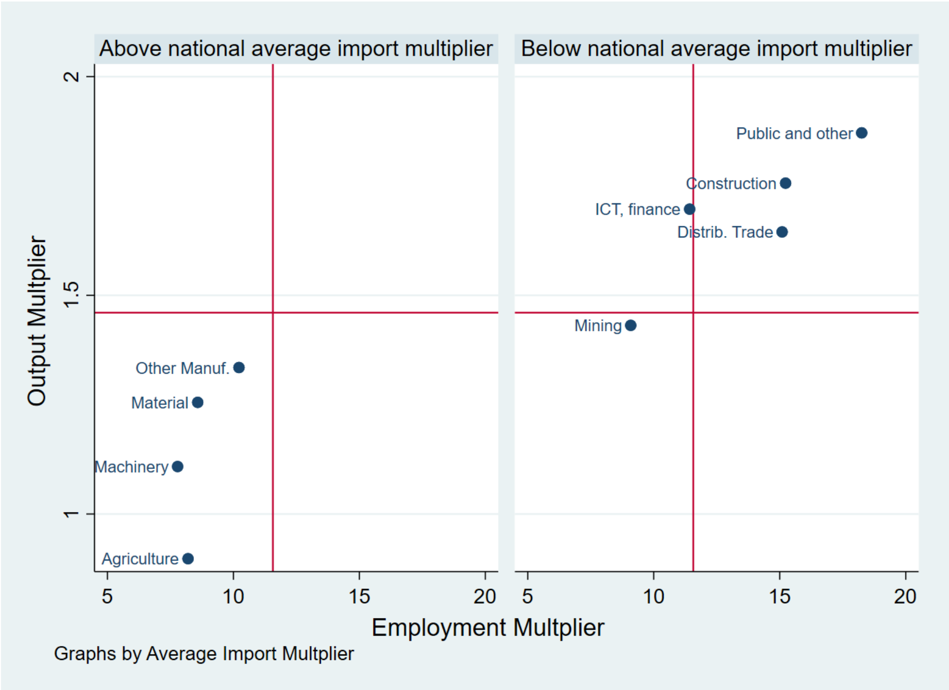

Figure 4.: Output, Employment and Import Multipliers.

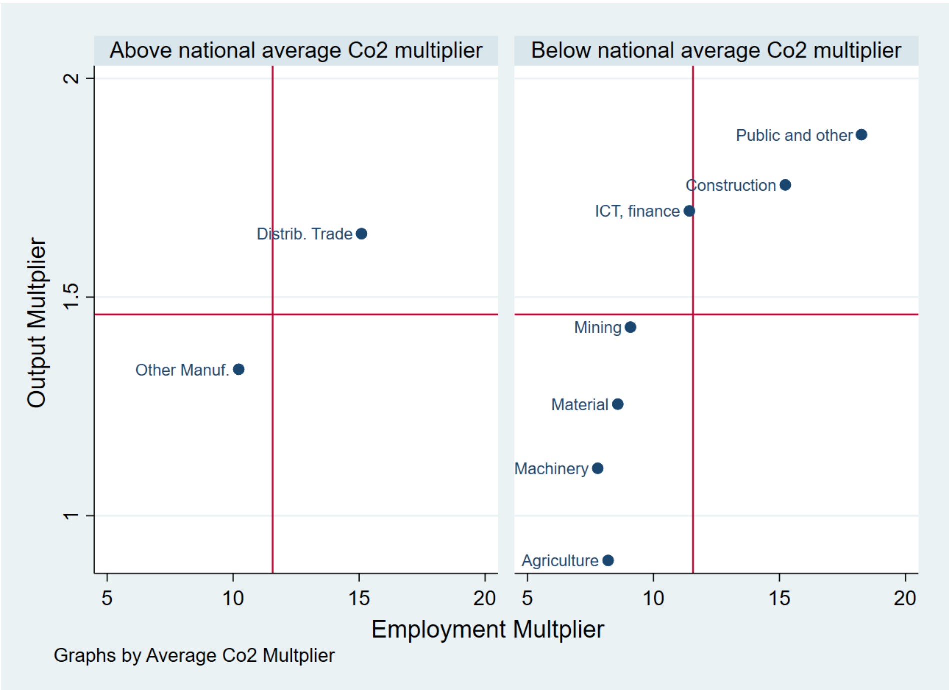

Figure 5.: Output, Employment and Ecological Multipliers.

Table 1.: Multipliers, summary

	Output Multipliers	Employment Multipliers	Import Multipliers	Co2 Multipliers	output employment ratio	output import ratio	employment import ratio	output co2 ratio
Agriculture	0.90	8.27	0.50	0.00021826	0.11	3.17	29.05	5498.89
Mining	1.43	9.14	0.27	0.000399528	0.17	6.31	41.81	3722.51
Material Manufacturing	1.26	8.63	0.36	0.000423157	0.15	3.60	24.78	3162.66
Machinery and Equipment	1.11	7.82	0.47	0.000183551	0.14	2.52	17.69	6133.75
Other Manufacturing	1.33	10.26	0.35	0.000842943	0.13	5.51	40.24	4034.51
Construction	1.76	15.28	0.20	0.000348038	0.11	8.59	74.78	5046.23
Distributive Trade	1.64	15.15	0.25	0.000612973	0.11	7.06	66.30	3486.70
Information, finance services	1.70	11.46	0.16	0.000238552	0.16	11.07	71.62	7134.96
Public and other services	1.87	18.44	0.17	0.000303386	0.10	11.28	111.08	6212.70
Primary Sector	1.22	8.79	0.37	0.000327021	0.14	5.05	36.70	4433.06
Secondary Sector	1.27	9.33	0.38	0.000506425	0.14	4.25	30.92	4304.76
Tertiary Sector	1.72	14.65	0.19	0.000393558	0.13	9.65	80.04	5548.16
US Economy	1.46	11.57	0.30	0.0004373	0.14	6.67	52.79	4856.26

Table 2.: Multipliers, summary

	Primary Employment Multipliers	Primary Co2 Multipliers	Secondary Employment Multipliers	Secondary Co2 Multipliers	Khan ratio (Employment Multipliers)	Khan ratio (Co2 Multipliers)
Agriculture	9.99	0.000205578	-1.72	1.26826E-05	-0.15	-0.12
Mining	4.94	0.000347403	4.20	5.21253E-05	0.79	0.37
Material Manufacturing	5.91	0.00042445	2.72	-1.29274E-06	0.48	0.03
Machinery and Equipment	6.23	0.000141023	1.59	4.25283E-05	0.28	0.49
Other Manufacturing	7.73	0.000783881	2.53	5.90621E-05	0.44	0.27
Construction	9.10	0.000193476	6.19	0.000154563	0.68	0.80
Distributive Trade	9.93	0.000528734	5.21	8.42393E-05	0.55	0.48
Information, finance services	5.73	8.45325E-05	5.73	0.000154019	1.08	2.02
Public and other services	11.40	0.000117259	7.04	0.000186127	0.65	1.70
Primary Sector	6.96	0.000290673	1.83	3.63482E-05	0.41	0.18
Secondary Sector	6.79	0.000467845	2.54	3.85795E-05	0.43	0.27
Tertiary Sector	8.77	0.000256798	5.88	0.00013676	0.77	1.37
US Economy	7.66	0.000356578	3.90	8.07221E-05	0.57	0.73

4. Policy Scenarios

Based on the analysis of the properties of the US economy, we can design a number of experiments in order to achieve our multiple policy goals, namely, to increase output and employment while taming imports and emissions. Based on the figures provided by Nersisyan and Wray (2021) for the initial budget of a JG program (400 Billion US dollars) we devised five policy scenarios in which this additional expenditure is channelled into the US economy. We considered the original results in terms of output and employment provided by these authors as our baseline or" Scenario 1". In accordance with this work, while the increase in output should be of 560 billion US dollars, employment should rise by 19 million workers, as a result of the direct addition provided by the ELR program, and the indirect multiplier effect caused by a boost in autonomous demand. The other five scenarios are the following:

- **Scenario 2**: government stimulus evenly distributed to all sectors;
- **Scenario 3**: government stimulus to the green demand management sectors;
- **Scenario 4**: government stimulus to the green structural change sectors;
- **Scenario 5**: government stimulus to the" optimal" sectors combining scenario 2 and 3;
- **Scenario 6**: government stimulus to all sectors according to the composition of gov expenditure;

In the next subsections, we will explore the properties of each scenario and break down how the JG budget is allocated.

4.1. *Scenario 2*

In this scenario we devised a 400 BLN USD stimulus which is distributed evenly across all the 44 sectors of the US economy. This means that each sector receives a 9.09 BLN boost in autonomous demand, irrespective of its characteristics in terms of output, employment, Co2 and import multipliers or the ratio presented in table 1. As a matter of fact, this experiment is conceived as a" rising tide that lifts all the boats" approach to economic policy, whose results may be contrasted with more sectoral-specific policies. Unsurprisingly, the results in terms of Output and Employment closely resemble the ones in Nersisyan and Wray (2021), since output increases by 584 billion US dollars (+1,63% with respect the initial level of output) as 4.62 million more workers are generated in the process (+2,82% with respect the initial stock of workforce) [3]. Therefore, we can interpret the results for Co2 and imports as if they were those generated by Nersisyan and Wray (2021) experiment. The stock of new emissions is increased by 174,92 Mtons (+3,51%), while imports rise by 118,33 billion dollars (+4,07%). Clearly, such indiscriminate approach is detrimental to both import and ecological sustainability, as import and emission intensive sectors are equally stimulated.

4.2. *Scenario 3*

We depart from a" rising tide that lifts all the boats" approach as we introduce some conditionalities for the sectors to obtain the additional expenditure provided by the

[3] Since we are not taking into account the direct effect of a JG program, the results for employment are also in line with the figure provided by Nersisyan and Wray (2021), in particular those related to the indirect multiplier effects

JG program. In this scenario, a 400 BLN USD stimulus is distributed only to the sectors that satisfy the following properties:

- Higher than average output multipliers (Δ_y^i >1.460359);
- Higher than average employment multipliers (Δ_L^i >11.56784);
- Lower than average Co2 multipliers (Δ_E^i <.0004373);
- Lower than average import multipliers (Δ_{imp}^i <.2958394).

The fifteen sectors that satisfy these properties receive each almost 27 Billion USD as additional expenditure and they are presented in table 3; Primary, Secondary and tertiary activities are represented, although the bulk of the JG budget is distributed mainly to services and in particular to Public and other services industries. This is in line with what observed in section 3, in which this sector occupies the upper right quadrant in both figure 3 and 5, meaning that this is the most efficient sector in terms of emission and imports use among those that generates more employment and income effects. It is worth pointing out that several other activities that are usually demanded as base commodities/services are selected, such as Construction, retail trade and water supply alongside more composite activities such as IT, professional and scientific services and mining support activities.

Table 3.: Sectors involved

Economic Activity	Sector	d^T (BLN USD)
Mining	TTL_09: Mining support service activities	26,667
Other Manufacturing	TTL_17T18: Paper products and printing	26,667
	TTL_36T39: Water supply; sewerage, waste management and remediation activities	26,667
Construction	TTL_41T43: Construction	26,667
Distributive Trade services	TTL_45T47: Wholesale and retail trade; repair of motor vehicles	26,667
	TTL_52: Warehousing and support activities for transportation	26,667
	TTL_55T56: Accommodation and food service activities	26,667
Information, finance services	TTL_62T63: IT and other information services	26,667
	TTL_69T75: Professional, scientific and technical activities	26,667
	TTL_77T82: Administrative and support services	26,667
Public and other services	TTL_84: Public administration and defence; compulsory social security	26,667
	TTL_85: Education	26,667
	TTL_86T88: Human health and social work activities	26,667
	TTL_90T93: Arts, entertainment and recreation	26,667
	TTL_94T96: Other service activities	26,667

In order to grasp further the technological features of these sector, we have also matched them with the revised Pavitt classification based upon Bogliacino and Pianta (2016) [4]. Most of the activities involved are either supplier dominated (Wholesale and retail trade repair of motor vehicles; Warehousing and support activities for transportation; Accommodation and food service activities; Administrative and support services), with only one Specialised suppliers (Professional, scientific and technical activities) and the rest being undetermined. Among those without a clear classification the case of IT and other information services sector stands out. The budget allocation described above delivers an increase of output by 717,24 BLN dollars (+2%), of Employment by 6,4 million workers (+3,96%), together with a rise in emissions by 126,23

[4] Pavitt (1984) identified the following four groups: Science Based industries (SB), which include sectors where innovation is based on advances in science and R&D and where research laboratories are important, leading to intense product innovation and a high propensity to patent; Specialized Suppliers industries (SS), such as the sectors producing machinery and equipment, in which R&D is present but an important innovative input comes from tacit knowledge and design skills embodied in the labour force; Scale and Information Intensive industries (SI), in which scale economies are relevant (automotive and basic metals) and a certain rigidity of production processes exists, so that technological change is usually incremental; Supplier Dominated industries (SD), which encompass traditional sectors (such as food and textile) where small firms are prevalent and technological change is introduced through inputs provided by suppliers from other industries.

Mtons (+ 2,53%) and in imports by 77,16 BLN dollars (+ 2,65%). As expected, this scenario delivers better outcomes in terms of output and employment with respect scenario 4.1, coupled with a cheaper bill in terms of Co2 and imports.

4.3. *Scenario 4*

In this experiment, we distribute our 400 BLN dollars stimulus to the US economy in accordance to a different set of criteria. We impose that the recipient sectors should possess:

- Higher than average output-employment ratio ($\frac{\Delta_y^i}{\Delta_L^i}$ >.1354549);
- Higher than average output-import ratio ($\frac{\Delta_y^i}{\Delta_{imp}^i}$ >6.671675);
- Higher than average employment-import ratio ($\frac{\Delta_L^i}{\Delta_{imp}^i}$ >52.79055);
- Higher than average output-Co2 ratio ($\frac{\Delta_y^i}{\Delta_E^i}$ >4856.264);

The rationale for this choice is to select activities the most efficient activities in terms of either labour productivity, relative import dependency and relative Co2 intensity, as discussed above. Unsurprisingly, the industries that fall within these criteria belong to Information, finance services, with the relevant exception of Mining support service activities. Moreover, they present a slightly higher technological content, with one Science-Base (Telecommunications), two Scale and Information intensive (Publishing, audiovisual and broadcasting activities; Financial and insurance activities) and one Specialised Supplier (Real estate activities) plus IT and other information services. By distributing roughly 67 billion USD to each of these six industries an increase of output by 668,68 billion dollars (+1,86%) is obtained, jointly with one of employment by 4,13 million units (+2,54%), as well as a rise in emissions by 97,85 (+1,96%) Mtons and in imports by 63,74 billion dollars (+2,19%). Scenario 4 outperforms Scenario 3 in containing Co2 and imports increase but underperforms both Scenario 4.1 and 3 in terms of employment creation and Scenario 3 in terms of output addition.

Table 4.: Sectors involved

Economic Activity	Sector	d^T (BLN USD)
Mining	TTL_09: Mining support service activities	66,667
Information, finance services	TTL_58T60: Publishing, audiovisual and broadcasting activities	66,667
	TTL_61: Telecommunications	66,667
	TTL_62T63: IT and other information services	66,667
	TTL_64T66: Financial and insurance activities	66,667
	TTL_68: Real estate activities	66,667

4.4. *Scenario 5*

The following scenario combines the conditionalities of both Scenario 3 and 4 to distribute the JG budget:

- Higher than average output multipliers (Δ_y^i >1.460359);
- Higher than average employment multipliers (Δ_L^i >11.56784);
- Lower than average Co2 multipliers (Δ_E^i <.0004373);
- Lower than average import multipliers (Δ_{imp}^i <.2958394).
- Higher than average output-employment ratio ($\frac{\Delta_y^i}{\Delta_L^i}$ >.1354549);

- Higher than average output-import ratio ($\frac{\Delta_y^i}{\Delta_{imp}^i}$ >6.671675);
- Higher than average employment-import ratio ($\frac{\Delta_L^i}{\Delta_{imp}^i}$ >52.79055);
- Higher than average output-Co2 ratio ($\frac{\Delta_y^i}{\Delta_E^i}$ >4856.264).

Ideally, this experiment should also combine the final properties of Scenario 4.1 and 3. As a matter of fact, there are only two sectors left here, namely Mining support service activities and IT and other information services, both receiving an additional expenditure of 200 BLN USD each. Whilst the former it is not included in the revised Pavitt taxonomy, the latter constitutes a peculiar case, since in accordance with the NACE rev. 2 (and also ISIC rev.4) it comprises both Computer programming, consultancy and related activities and Information service activities, with the former being identified as Science Based while the latter falls into Scale and information intensive. Yet, Scenario 5 underperforms all the other experiments but Scenario 4.1 when it comes to employment and output growth (+2% and +3,08%) and in taming emissions and import demand growth (+2,30 % and +2,72%). Noticeably, the absolute increase in output in this scenario is lower than the initial JG budget committed; in fact, the vector y contains several negative entries, most notably in primary, material manufacturing, construction, machinery and equipment industries, meaning that these sectors are net importers[5]. In general, by having the JG expenditure focused only on these two sectors, aggregate gross output is dwarfed by import demand while the other industries do not receive enough spillovers from Mining services and IT.

Table 5.: Sectors involved

Economic Activity	Sector	$\boldsymbol{d^T}$ (BLN USD)
Mining	TTL_09: Mining support service activities	200
Information, finance services	TTL_62T63: IT and other information services	200

4.5. *Scenario 6*

In our final experiment, we allocated the JG budget in accordance with the current composition of US federal government expenditure. That is, we devise a Scenario in which this boost is distributed according to a" business as usual" criterion. Notice that among the sector where Federal Government expenditure is concentrated the most (those that receive more than 1 billion dollars) there is Pharmaceuticals, medicinal chemical and botanical products, which falls into the Science Based category. Nonetheless, the bulk of the JG budget goes to public services such as administration, social security, education and social health. As a result, output is increased by 737,48 billion dollars (+ 2,06%), employment by 6,24 million workers (+ 3,83%) as Co2 rises by 132,44 Mtons (+ 2,65%) and Import demand by 66,75 billion dollars (+ 2,29%). Interestingly, this scenario outperforms Scenario 3, 4 and 5 in terms of output while outperforming Scenario 4 and 5 in term of employment creation. Moreover, this experiment presents the second lowest increment in import demand and the second

[5]More precisely, these industries are: Fishing and aquaculture; Mining and quarrying, energy producing products; Mining and quarrying, non-energy producing products; Wood and products of wood and cork; Basic metals; Fabricated metal products; Computer, electronic and optical equipment; Electrical equipment; Machinery and equipment, nec; Construction. As a matter of fact, also the vector $\boldsymbol{y}$ in Scenario 3, 4 and 6 contains negative entries, but in these cases the increase in the other sectoral components of autonomous demand delivers better results in the aggregate.

highest addition in Co2. This highlights the fact that the current sectorial pattern of US government expenditure does have a sizeable impact on employment and output while minimizing import demand, but fails to maintain in check emissions increase.

Table 6.: Sectors involved (only those whose d^T >1 BLN USD)

Economic Activity	Sector	d^T (BLN USD)
Material Manufacturing	TTL_21: Pharmaceuticals, medicinal chemical and botanical products	1,722
Public and other services	TTL_84: Public administration and defence; compulsory social security	266,170
	TTL_85: Education	114,894
	TTL_86T88: Human health and social work activities	1,4370

Table 7.: Wrap-up of the results

	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Output					
(in Billions USD)	+ 584,29	+ 717,24	+ 668,68	+ 718,72	+ **737,48**
(in % of y)	+ 1,63	+ 2	+ 1,86	+ 2	+ **2,06**
Employment					
(in Millions)	+ 4,6	+ **6,4**	+ 4,13	+ 5	+ 6,24
(in % of L)	+ 2,82	+ **3,96**	+ 2,54	+ 3,08	+ 3,83
Co2					
(in Mtons)	+ 174,95	+ 126,23	+ **97,85**	+ 114,52	+ 132,44
(in % of Co2)	+ 3,51	+ 2,53	+ **1,96**	+ 2,30	+ 2,65
Imports					
(in Billions USD)	+ 118,35	+ 77,16	+ **63,74**	+ 79,22	+ 66,75
(in % of imp)	+ 4,07	+ 2,65	+ **2,19**	+ 2,72	+ 2,29

5. Final Remarks

This article attempted to map the sectorial impact of the implementation of a green ELR. For the purpose of this analysis, a process of extended Kurz (1985) output, employment and carbon dioxide emissions multipliers was applied taking data from the latest OECD I-O tables, i.e. 2018. This framework in contrast to the traditional I-O framework can be considered as more realistic considering the technical conditions of production, income distribution, savings ratios and consumption patterns associated with the two types of income. In order to further grasp the features of the US economy we also estimate some structural indicators namely the output-employment, output-import, employment-import and output-Co2 ratios. Hence, based on the initial budget of a JG program proposed by Nersisyan and Wray (2021), we devised six policy scenarios in which this additional expenditure is channeled into the US economy. Firstly, we considered the original results in terms of output and employment provided by Nersisyan and Wray (2021) as Scenario 1. In accordance with this work, while the increase in output should be of 560 Billion US dollars, employment should rise by 19 million workers, as a result of the direct addition provided by the ELR program and the indirect multiplier effect caused by a boost in autonomous demand. Then we assume that the government stimulus is evenly distributed to all sectors, Scenario 4.1, and the outcome is detrimental to both import and ecological sustainability, as import and emission intensive sectors are equally stimulated. Focusing on the government stimulus to the green demand management sectors, Scenario 3, we have better outcomes in terms of output and employment with respect scenario 4.1, coupled with a cheaper bill in terms of Co2 and imports. In Scenario 4, we assume that government stimulus to the green structural change sectors. This scenario outperforms Scenario 3 in containing Co2 and imports increase but underperforms both Scenario 4.1 and 3 in terms of employment. Combining the above scenarios we get Scenario 5, i.e. the government stimulus to the" optimal" sectors combining Scenario 4.1 and 3. Scenario 5 performs better in taming emissions growth than Scenario 3 and it underperforms when it comes to employment growth. Last but not least we consider that government stimulus to all sectors according to the composition of gov expenditure, Scenario 6. In this case the outcome outperforms Scenario 3, 4 and 5 in terms of output while outperforming Scenario 4 and 5 in terms of employment creation; and we get the second lowest increment in import demand and the second highest addition in Co2. Summing up the previous empirical findings, it follows that

(i) Picking the optimal sectors in terms of output, employment, CO2 and import multipliers where to invest does not always deliver optimal results in the aggregate ;
(ii) the current sectorial pattern of US government expenditure does have a sizeable impact on employment and output while minimizing import demand, but fails to maintain in check emissions increase;
(iii) ecological sustainability for the US economy also fosters import sustainability (Scenarios 3, 4 and 5);
(iv) rebounding effect may be tamed if the ELR satisfy the abovementioned "optimal" condition, although this undermines its success in terms of output (Scenario 5).

Thus, the current analysis provides an analytical view of the structure and the interrelationships of the US economy in terms of a green ELR and shows that the policy makers can choose from a variety of alternative policy plans the most appropriate to achieve the goals set by the authorities. Yet, we are not arguing that the JG should be the only game in town in terms of policy proposals. In fact, in response not only to the COVID-19 pandemic-associated crisis but also to other significant problems in the US economy and society, many scholars have mentioned the necessity for a significant infrastructure plan and have shown that such a plan will also have significant benefits on a macroeconomic level (see, i.e., Antonopoulos et al. 2014 and Nikiforos and Zezza 2018). In the same line, and mostly to increase the social cohesion of the US society, it also stressed the need for more education and health care. These proposals are relevant today because of the two main pillars of President Biden's policy plan, i.e., "the American Jobs Plan and the American Families Plan". It is easy to understand that if a green ELR program may not perfectly fit with the aforementioned Plans, at least it does not come into conflict with them. Finally, future research efforts should incorporate into the analysis a comprehensive modelling of an additional sector that will combine directly with the ELR (see Antonopoulos et al. 2014), as well as the fixed capital and the degree of its utilization. Also, it would have a particular interest the intratemporal and intertemporal comparison of the multiplier effects between the states of the US economy.

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Appendix

Table 8.: Data source

Variable	Database
$\boldsymbol{x}$	OECD Input-Output Tables 2021 (IOTs)
$\boldsymbol{y}$	OECD Input-Output Tables 2021 (IOTs)
$\boldsymbol{im}$	OECD Input-Output Tables 2021 (IOTs)
$\boldsymbol{c}$	OECD Input-Output Tables 2021 (IOTs)
$\boldsymbol{w}$	OECD Structural Analysis 2021 (STAN)
$\boldsymbol{l}$	OECD Structural Analysis 2021 (STAN)
$\boldsymbol{e}$	OECD Carbon dioxide emissions embodied in international trade 2021 (TECO2)
$\boldsymbol{s_p}$	OECD Retention ratio 2021
$\boldsymbol{s_w}$	Statista Personal saving rate in the US 2021

Table 9.: Agriculture

code	Output	Employment	Imports	Co2
TTL_01T02	1,406580343	12,84110627	0,24099167	0,000383988
TTL_03	0,385308785	3,701520117	0,768339867	5,25323E-05

Table 10.: Mining

code	Output	Employment	Imports	Co2
TTL_05T06	1,012400378	4,929119016	0,414452135	0,000413243
TTL_07T08	1,463715981	9,291870674	0,229388261	0,000452439
TTL_09	1,82512331	13,20186717	0,180791554	0,000332902

Table 11.: Material Manufacturing

code	Output	Employment	Imports	Co2
TTL_19	1,104362734	5,282348852	0,33853377	0,000460805
TTL_20	1,277479483	8,002472133	0,311238841	0,00043382
TTL_21	1,048145208	5,625302499	0,4203316	0,00026623
TTL_22	1,336789287	10,64493854	0,361563204	0,000360626
TTL_23	1,397376941	10,15315139	0,30413946	0,000600565
TTL_24	1,150596982	8,244076022	0,443571599	0,000520181
TTL_25	1,476138964	12,42462036	0,332563799	0,000319871

Table 12.: Machinery and Equipment

code	Output	Employment	Imports	Co2
TTL_26	1,017853846	6,180659354	0,520353711	0,000131609
TTL_27	0,94292177	6,943697573	0,546992565	0,000175052
TTL_28	1,196926084	9,184523002	0,445339245	0,000220915
TTL_29	0,974027354	7,396627937	0,528181136	0,000184346
TTL_30	1,409266069	9,379350787	0,320619836	0,000205835

Table 13.: Other Manufacturing

code	Output	Employment	Imports	Co2
TTL_10T12	1,452402587	12,129094	0,280708437	0,000358079
TTL_13T15	0,55768031	5,28227717	0,749471435	0,000118188
TTL_16	1,391732732	12,16015288	0,336831985	0,000315413
TTL_17T18	1,524218249	12,15373182	0,275065696	0,000425687
TTL_31T33	1,166443398	8,989027953	0,464328404	0,000236235
TTL_35	1,504481883	7,758173227	0,149309641	0,004165096
TTL_36T39	1,740759993	13,36030126	0,167336329	0,000281903

Table 14.: Construction

code	Output	Employment	Imports	Co2
TTL_41T43	1,756279623	15,28292552	0,204365249	0,000348038

Table 15.: Distributive Trade services

code	Output	Employment	Imports	Co2
TTL_45T47	1,715190089	15,43740477	0,212753774	0,000287591
TTL_49	1,551869257	12,63187367	0,245798452	0,000528366
TTL_50	1,33625636	9,836370491	0,364495991	0,000983348
TTL_51	1,508710493	10,7774568	0,2595335	0,001185708
TTL_52	1,761156121	16,53790185	0,23580312	0,000434501
TTL_53	1,867441943	18,56006218	0,187940351	0,000543102
TTL_55T56	1,766580094	22,24797629	0,216468287	0,000328194

Table 16.: Information, finance services

code	Output	Employment	Imports	Co2
TTL_58T60	1,70079221	10,80026884	0,163831088	0,000219153
TTL_61	1,586749255	9,316413274	0,148023134	0,000208814
TTL_62T63	1,767177436	12,02912994	0,215165322	0,000239411
TTL_64T66	1,727053391	10,85341051	0,163644749	0,0002333
TTL_68	1,420398568	6,056184269	0,084372661	0,000233508
TTL_69T75	1,864772915	13,89166426	0,19239511	0,000269112
TTL_77T82	1,809646233	17,27589608	0,162621659	0,000266563

Table 17.: Public and other services

code	Output	Employment	Imports	Co2
TTL_84	1,790914094	13,95847302	0,165555318	0,000326394
TTL_85	1,963439902	19,38203973	0,164691153	0,000348864
TTL_86T88	1,962478506	18,95008717	0,170905157	0,00028973
TTL_90T93	1,771156427	17,27328273	0,159955841	0,00026966
TTL_94T96	1,864978281	22,62629262	0,168170447	0,00028228

Table 18.: List of sectors

TTL_01T02: Agriculture, hunting, forestry	TTL_35: Electricity, gas, steam and air conditioning supply
TTL_03: Fishing and aquaculture	TTL_36T39: Water supply sewerage, waste management and remediation activities"
TTL_05T06: Mining and quarrying, energy producing products	TTL_41T43: Construction
TTL_07T08: Mining and quarrying, non-energy producing products	TTL_45T47: Wholesale and retail trade repair of motor vehicles"
TTL_09: Mining support service activities	TTL_49: Land transport and transport via pipelines
TTL_10T12: Food products, beverages and tobacco	TTL_50: Water transport
TTL_13T15: Textiles, textile products, leather and footwear	TTL_51: Air transport
TTL_16: Wood and products of wood and cork	TTL_52: Warehousing and support activities for transportation
TTL_17T18: Paper products and printing	TTL_53: Postal and courier activities
TTL_19: Coke and refined petroleum products	TTL_55T56: Accommodation and food service activities
TTL_20: Chemical and chemical products	TTL_58T60: Publishing, audiovisual and broadcasting activities
TTL_21: Pharmaceuticals, medicinal chemical and botanical products	TTL_61: Telecommunications
TTL_22: Rubber and plastics products	TTL_62T63: IT and other information services
TTL_23: Other non-metallic mineral products	TTL_64T66: Financial and insurance activities
TTL_24: Basic metals	TTL_68: Real estate activities
TTL_25: Fabricated metal products	TTL_69T75: Professional, scientific and technical activities
TTL_26: Computer, electronic and optical equipment	TTL_77T82: Administrative and support services
TTL_27: Electrical equipment	"TTL_84: Public administration and defence compulsory social security
TTL_28: Machinery and equipment, nec	TTL_85: Education
TTL_29: Motor vehicles, trailers and semi-trailers	TTL_86T88: Human health and social work activities
TTL_30: Other transport equipment	TTL_90T93: Arts, entertainment and recreation
TTL_31T33: Manufacturing nec repair and installation of machinery and equipment	TTL_94T96: Other service activities

Table 19.: Parameters and initial values

Variables and parameters of the economy	**Baseline**
TTL_01T02: Agriculture, hunting, forestry	
TTL_03: Fishing and aquaculture	
TTL_05T06: Mining and quarrying, energy producing products	
TTL_07T08: Mining and quarrying, non-energy producing products	
TTL_09: Mining support service activities	
TTL_10T12: Food products, beverages and tobacco	Suppliers dominated
TTL_13T15: Textiles, textile products, leather and footwear	Suppliers dominated
TTL_16: Wood and products of wood and cork	Suppliers dominated
TTL_17T18: Paper products and printing	Scale and information intensive
TTL_19: Coke and refined petroleum products	Scale and information intensive
TTL_20: Chemical and chemical products	Science based
TTL_21: Pharmaceuticals, medicinal chemical and botanical products	Science based
TTL_22: Rubber and plastics products	Scale and information intensive
TTL_23: Other non-metallic mineral products	Scale and information intensive
TTL_24: Basic metals	Scale and information intensive
TTL_25: Fabricated metal products	Suppliers dominated
TTL_26: Computer, electronic and optical equipment	Science based
TTL_27: Electrical equipment	Specialised suppliers
TTL_28: Machinery and equipment, nec	Specialised suppliers
TTL_29: Motor vehicles, trailers and semi-trailers	Scale and information intensive
TTL_30: Other transport equipment	Specialised suppliers
TTL_31T33: Manufacturing nec repair and installation of machinery and equipment	Suppliers dominated
TTL_35: Electricity, gas, steam and air conditioning supply	
TTL_36T39: Water supply sewerage, waste management and remediation activities	
TTL_41T43: Construction	
TTL_45T47: Wholesale and retail trade repair of motor vehicles	Suppliers dominated
TTL_49: Land transport and transport via pipelines	Suppliers dominated

Continued on next page

Table 19 – continued from previous page

Variables and parameters of the economy	Baseline
TTL_50: Water transport	Suppliers dominated
TTL_51: Air transport	Suppliers dominated
TTL_52: Warehousing and support activities for transportation	Suppliers dominated
TTL_53: Postal and courier activities	Suppliers dominated
TTL_55$T$56: Accommodation and food service activities	Suppliers dominated
TTL_58$T$60: Publishing, audiovisual and broadcasting activities	Scale and information intensive
TTL_61: Telecommunications	Science based
TTL_62$T$63: IT and other information services	
TTL_64$T$66: Financial and insurance activities	Scale and information intensive
TTL_68: Real estate activities	Specialised suppliers
TTL_69$T$75: Professional, scientific and technical activities	Specialised suppliers
TTL_77$T$82: Administrative and support services	Suppliers dominated
"TTL_84: Public administration and defence compulsory social security	
TTL_85: Education	
TTL_86$T$88: Human health and social work activities	
TTL_90$T$93: Arts, entertainment and recreation	
TTL_94$T$96: Other service activities	

Table 20.: Parameters and initial values

code	Symbols	Baseline	Symbols	Symbols
TTL_01T02	1,406580343	12,84110627	0,24099167	0,000383988
TTL_03	0,385308785	3,701520117	0,768339867	5,25323E-05
TTL_05T06	1,012400378	4,929119016	0,414452135	0,000413243
TTL_07T08	1,463715981	9,291870674	0,229388261	0,000452439
TTL_09	1,82512331	13,20186717	0,180791554	0,000332902
TTL_10T12	1,452402587	12,129094	0,280708437	0,000358079
TTL_13T15	0,55768031	5,28227717	0,749471435	0,000118188
TTL_16	1,391732732	12,16015288	0,336831985	0,000315413
TTL_17T18	1,524218249	12,15373182	0,275065696	0,000425687
TTL_19	1,104362734	5,282348852	0,33853377	0,000460805
TTL_20	1,277479483	8,002472133	0,311238841	0,00043382
TTL_21	1,048145208	5,625302499	0,4203316	0,00026623
TTL_22	1,336789287	10,64493854	0,361563204	0,000360626
TTL_23	1,397376941	10,15315139	0,30413946	0,000600565
TTL_24	1,150596982	8,244076022	0,443571599	0,000520181
TTL_25	1,476138964	12,42462036	0,332563799	0,000319871
TTL_26	1,017853846	6,180659354	0,520353711	0,000131609
TTL_27	0,94292177	6,943697573	0,546992565	0,000175052
TTL_28	1,196926084	9,184523002	0,445339245	0,000220915
TTL_29	0,974027354	7,396627937	0,528181136	0,000184346
TTL_30	1,409266069	9,379350787	0,320619836	0,000205835
TTL_31T33	1,166443398	8,989027953	0,464328404	0,000236235
TTL_35	1,504481883	7,758173227	0,149309641	0,004165096
TTL_36T39	1,740759993	13,36030126	0,167336329	0,000281903
TTL_41T43	1,756279623	15,28292552	0,204365249	0,000348038
TTL_45T47	1,715190089	15,43740477	0,212753774	0,000287591
TTL_49	1,551869257	12,63187367	0,245798452	0,000528366
TTL_50	1,33625636	9,836370491	0,364495991	0,000983348
TTL_51	1,508710493	10,7774568	0,2595335	0,001185708
TTL_52	1,761156121	16,53790185	0,23580312	0,000434501
TTL_53	1,867441943	18,56006218	0,187940351	0,000543102
TTL_55T56	1,766580094	22,24797629	0,216468287	0,000328194
TTL_58T60	1,70079221	10,80026884	0,163831088	0,000219153
TTL_61	1,586749255	9,316413274	0,148023134	0,000208814
TTL_62T63	1,767177436	12,02912994	0,215165322	0,000239411
TTL_64T66	1,727053391	10,85341051	0,163644749	0,0002333
TTL_68	1,420398568	6,056184269	0,084372661	0,000233508
TTL_69T75	1,864772915	13,89166426	0,19239511	0,000269112
TTL_77T82	1,809646233	17,27589608	0,162621659	0,000266563
"TTL_84	1,790914094	13,95847302	0,165555318	0,000326394
TTL_85	1,963439902	19,38203973	0,164691153	0,000348864
TTL_86T88	1,962478506	18,95008717	0,170905157	0,00028973
TTL_90T93	1,771156427	17,27328273	0,159955841	0,00026966
TTL_94T96	1,864978281	22,62629262	0,168170447	0,00028228

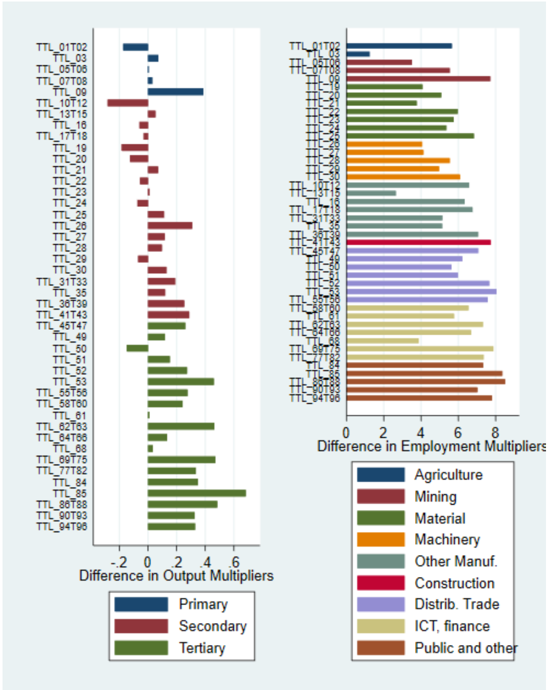

Figure 6.: Difference between Kurz's and Leontief's Output and Employment Multipliers

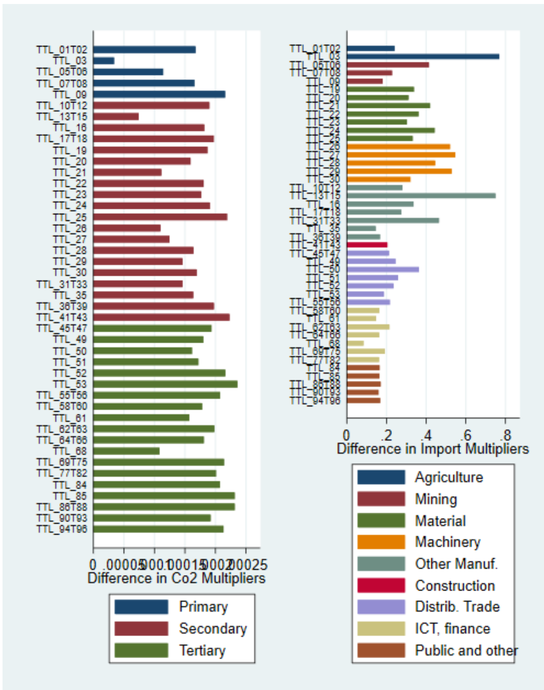

Figure 7.: Difference between Kurz's and Leontief's Co2 and Import Multipliers.

Table 21.: Khan's ratios

code	$\mathbf{L}_2^T$	$\mathbf{Co_2}_2^T$	$\frac{\mathbf{L}_2^T}{\mathbf{L}_1^T}$	$\frac{\mathbf{Co_2}_2^T}{\mathbf{Co_2}_1^T}$
TTL_01T02	3.202145237	7.15379E-05	0.332208544	0.228957728
TTL_03	-6.640533288	-4.61727E-05	-0.64209038	-0.467785001
TTL_05T06	1.751812582	-9.7875E-05	0.551351488	-0.191492096
TTL_07T08	4.084082199	7.97364E-05	0.784225821	0.213940963
TTL_09	6.752883375	0.000174515	1.047123671	1.101824641
TTL_10T12	3.603182235	8.48199E-05	0.422615469	0.310401082
TTL_13T15	-5.196873393	-9.83637E-05	-0.495925069	-0.454226375
TTL_16	3.016167459	7.38674E-05	0.329852611	0.305811554
TTL_17T18	4.31883527	9.50595E-05	0.551230669	0.28751272
TTL_19	2.104956699	-5.66312E-05	0.662479341	-0.109445624
TTL_20	2.832010407	1.89219E-05	0.547728717	0.045606129
TTL_21	1.876883476	-1.29028E-05	0.500713348	-0.046224587
TTL_22	2.911726094	4.34084E-05	0.376522183	0.136841267
TTL_23	3.539056489	2.15752E-05	0.535077989	0.037263528
TTL_24	1.808504334	-9.79729E-05	0.281016886	-0.158492595
TTL_25	3.942945289	7.45521E-05	0.464878142	0.303898245
TTL_26	1.787623093	7.206E-05	0.406922013	1.210098386
TTL_27	0.19391236	-6.1659E-06	0.028728671	-0.034024816
TTL_28	1.917935809	4.39693E-05	0.263938993	0.248490319
TTL_29	0.206988214	-1.87374E-06	0.02878979	-0.010061976
TTL_30	3.827987534	0.000104652	0.689558089	1.034280896
TTL_31T33	1.615087581	3.64423E-05	0.219026402	0.182400286
TTL_35	4.326715429	6.49801E-05	1.26089716	0.015848357
TTL_36T39	6.040550865	0.000156629	0.825240016	1.250293493
TTL_41T43	6.18759771	0.000154563	0.680305064	0.798873723
TTL_45T47	5.691574326	0.000158655	0.584000945	1.230500937
TTL_49	4.537094643	9.02633E-05	0.56049639	0.20603238
TTL_50	3.094654013	-0.000134912	0.459030569	-0.120644465
TTL_51	4.35960008	-2.05268E-05	0.679292202	-0.01701724
TTL_52	6.024848598	0.000154289	0.573082685	0.550613523
TTL_53	7.083042944	0.000175333	0.617150068	0.476746351
TTL_55T56	5.697727246	0.000166574	0.344268382	1.030650854
TTL_58T60	5.786067074	0.000155399	1.15393579	2.437460423
TTL_61	4.852355149	0.000129017	1.086982965	1.616821527
TTL_62T63	6.402701521	0.000176459	1.137969017	2.80310607
TTL_64T66	6.023841871	0.000162014	1.247283578	2.272699833
TTL_68	3.442890086	8.91151E-05	1.317452192	0.617170513
TTL_69T75	7.061792635	0.000191266	1.033956885	2.456959724
TTL_77T82	6.532881891	0.000174864	0.608105123	1.906937599
TTL_84	6.48671416	0.000166108	0.868164301	1.036322236
TTL_85	7.787808313	0.000204288	0.671696842	1.41301012
TTL_86T88	7.797991813	0.000206489	0.699240088	2.48062706
TTL_90T93	6.170489076	0.000167145	0.555760026	1.630451798
TTL_94T96	6.949193121	0.000186605	0.443270326	1.950408697