The RRP multiplier effects on the Greek economy

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Abstract

This study explores the multiplier effects brought by changes in the components of autonomous demand following the Greek Recovery and Resilience Plan (RRP) for the period 2021-26. The effects are estimated in terms of output and employment of the Greek economy. The findings suggest that the 18.2 bn. euro from RRP would lead to a total (direct and indirect) increase in output of about 12.2 bn. euro and increase in employment of about 390,000 persons. Therefore, it would lead to a total increase in output of about 7.2% and in employment of about 10%. From the analysis of the effects on output and employment per cost type, it follows that the expenditures of RRP on Construction and Services would lead to a total increase in output of about 5.4%. Finally, our intersectoral analysis concludes that the RRP program would lead to a short-term boost on terms of output and employment, while the impact would be mild to the structure of the Greek economy. In other words, we are not so optimistic that the RRP would lead to a fundamental economic and social transformation that combines economic efficiency with natural, social and economic sustainability.

Keywords COVID-19, Greek Recovery and Resilience Plan, intersectoral analysis, matrix demand multiplier, Recovery and Resilience Facility

JEL Codes C67, D57, E11, E61

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1 INTRODUCTION

It is commonly accepted that the Greek economy has faced a very strong blow from the international spread of the new coronavirus (COVID-19). According to the National Statistical Service of Greece the pandemic is sinking the Gross Domestic Product (GDP) by 8.2%.[1] This result not only brought to a halt the partial recovery that followed the great economic crisis of 2008-16, but also erased all the gains of the mild economic expansion of the second half of the 2010s. In particular, in 2020 GDP stood at 168.5 bn. euro, down 29.5% from its 2008 levels.

In response to the COVID-19 pandemic associated crisis, the Greek Government in collaboration with European Union put forward, for the period 2021-26, the so-called Greece 2.0: Greek Recovery and Resilience Plan (RRP). The plan is understood as the key instrument for the restructuring of the Greek economy towards increased productivity, employment, and economic and social resilience. It is based on the recommendations of the Committee headed by Professor Pissarides and is in full alignment with the Country Specific Recommendations of the European Commission (Greek Government, 2020). It aims at mobilizing 18.2 bn. euro grants, together with 12.7 bn. euro in loans under the Recovery and Resilience Facility (RRF) over the period 2021-26. The primary consideration of the RRP is the creation of an extroverted, competitive, green and digital growth model leading to a fundamental economic and social transformation that combines economic efficiency with social cohesion and justice.

In this study, we explore the multiplier effects that the change of the components of autonomous demand due to the RRP, will have on output, employment, and budget balance of the Greek economy. For this purpose, we use (a) an extension of Kurz's (1985) matrix multiplier framework; (b) data from the Supply and Use Tables to capture the structure of the Greek economy; and (c) the detailed RRP budget (without VAT, including discounts) data which was supplied to us by the Greek RRP's Coordinator.[2]

The remainder is structured as follows. Section 2 presents the pillars and components of the RRP. Section 3 outlines the analytic framework and presents the data. Section 4 presents the empirical results.

[1] During 2020 Greece was hit by two successive waves of the ongoing COVID-19 pandemic. The first wave of the pandemic, culminating through March and April, was successfully arrested and subsequently contained by the implementation of proactive and strict social distancing measures. Restrictions on movement and economic activity were subsequently lifted, beginning from early May, as a result of the progressive normalization of conditions. However, beginning from October cases began to rise exponentially indicating the outbreak of a second wave of the pandemic. As a result, new restrictions on movement and economic activity were implemented in November that succeeded in arresting the spread of the pandemic. Lasting, in various forms and levels of severity the containment measures remained in force until May of 2021. For a complete picture of the developments in the Greek economy, see Papadimitriou et al. (2020; 2021).

[2] Until now, there is no clear view of the expected 12.7 bn. euro in loans. Therefore, we focus on the available initial RRF budget (without VAT, including discounts) data. This budget is of about 18.2 bn. euro.

Section 5 analyses the inter-sectoral structure of the Greek economy. Section 6 evaluates the RRP effects. Finally, Section 7 concludes.

2 THE RRP PILLARS AND COMPONENTS

The RRP lasts for the period 2021-26 and consists of four pillars: green transition; digital transformation; employment, skills and social cohesion; and private investment and transformation of the economy.[3] The allocation of the RRF budget (without VAT, including discounts) for the period 2021-26 is depicted in Fig. 1, while the allocation of budget to the four pillars in Fig. 2.

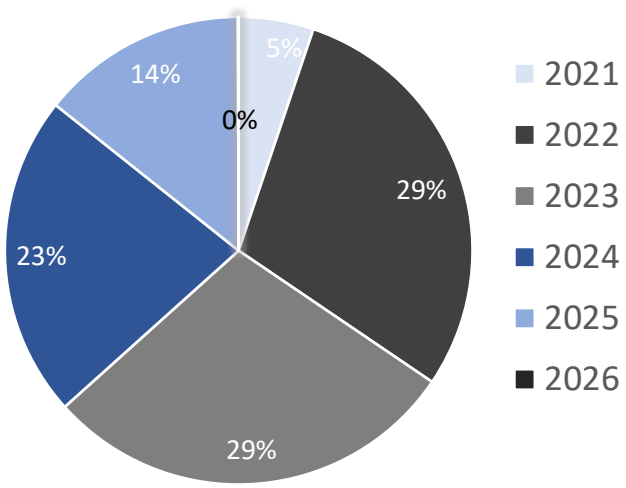


Fig. 1 Distribution (%) of RRP budget per year

[3] For, a detailed list of 68 reforms and 106 investments, see European Commission (2021a; 2021b) and Greek Government (2021).

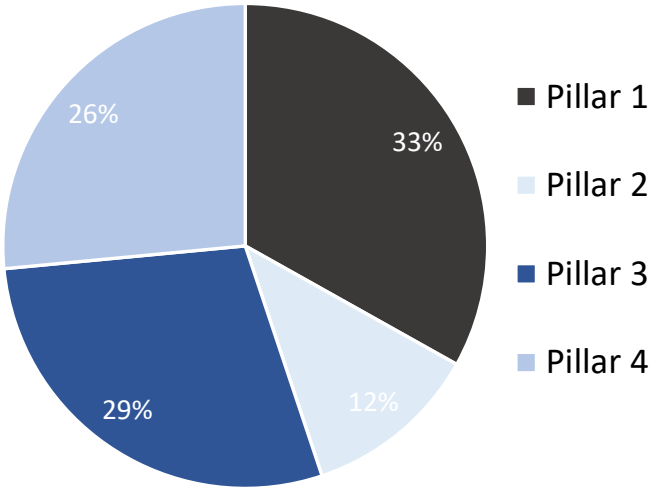


Fig. 2 Distribution (%) of RRP budget per pillar

The first pillar, green transition, accounts for 33 % of the total budget and consists of an array of measures towards a greener an more energy efficient future. It includes investments in upgrading energy efficiency of buildings (for households, firms and the public sector); energy storage, electric charge points, batteries, electric vehicles; improving electric interconnectivity of islands, national reforestation, biodiversity and strengthening of civil protection; and urban planing and strategic urban regeneration. The second pillar, digital transformation, accounts for 12% of the total budget and consists of actions towards a digital future. It includes investments in 5G infrastructure, fast broadband connections, fiber optic infrastructure in buildings, submarine fiber cables; igitisation of the public sector (Health, Education, Justice, EFKA, Urban Planning, licensing, etc.); and in digitilisation of tax authorities and real-time interconnection with firm. The third pillar, employment, skills, and social cohesion, accounts for 29% of the total budget and consists of an array of measures towards boosting job creating, educations, health services and social policies. It includes strong incentives for private investment (green, digital transformation, innovation, extroversion, economies of scale); public-private Partnerships in new, large infrastructure projects (irrigation, railways) and investments in culture, tourism and the agri-food sector. Finally, the fourth pillar, private investment and transformation of the economy, accounts for 26% of the total budget and consists of actions that aim at boosting investment and competitiveness. It includes Training, upskilling and reskilling of the workforce (with emphasis on digital skills); and investments in health, education and social inclusion of vulnerable groups. Furthermore, the described pillars are divided to components, which are reported in Table 1 and Fig. 3.

Table 1 The RRP's components and their correspondence to pillars

Pillars	Components
1 Green Transition	1.1 Power Up 1.2 Renovate 1.3 Recharge and refuel 1.4 Sustainable use of resources, climate resilience and environmental protection
2 Digital Transformation	2.1 Connect 2.2 Modernise 2.3 Digitalisation of businesses
3 Employment, skills, and social cohesion	3.1 Increasing job creation and participation in the labour market 3.2 Education, vocational education, training, and skills 3.3 Improve resilience, accessibility and sustainability of healthcare 3.4 Increase access to effective and inclusive social policies
4 Private investment and transformation of the economy	4.1 Making taxes more growth friendly, and improving tax administration and tax collection 4.2 Modernise the public administration, including through speeding up the implementation of public investments, improving the public procurement framework, capacity building measures and fighting corruption 4.3 Improve the efficiency of the justice system 4.4 Strengthen the financial sector and capital markets 4.5 Promote research and innovation 4.6 Modernise and improve resilience of key economic sectors 4.7 Improve competitiveness and promote private investment and exports

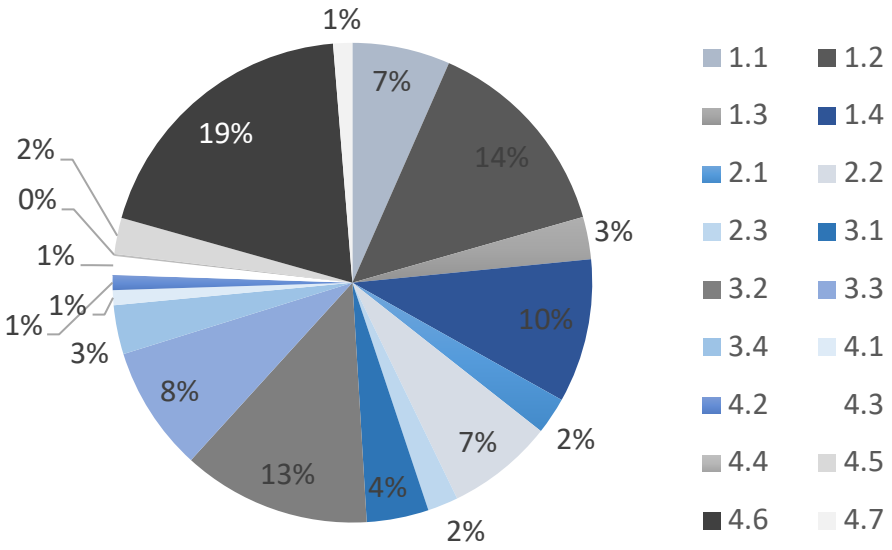


Fig. 3 Distribution (%) of RRP budget per component

We observe that from the 17 components, more than 50% of budget is concentrated in 4 components, i.e. in "Modernise and improve resilience of key economic sectors", "Renovations", "Education, vocational education, training, and skills", and "Increasing job creation and participation in the labour market".

3 METHOD AND DATA

3.1 The analytic framework

Following Kurz (1985), we consider a closed economy involving only single products that (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"); and (f) labour is homogeneous within each industry but heterogeneous across industries. Based on these assumptions, the price side of the system is described by[4]

$$\mathbf{p} = \mathbf{pA}[\mathbf{I} + \hat{\mathbf{r}}] + \mathbf{w}\hat{\mathbf{l}} \qquad (1)$$

[4] Matrices (and vectors) are delineated in boldface letters. The transpose of a $1 \times n$ vector $\mathbf{x} \equiv [x_j]$ is denoted by $\mathbf{x}^T$, and the diagonal matrix formed from the elements of $\mathbf{x}$ is denoted by $\hat{\mathbf{x}}$. Finally, $\mathbf{e}$ denotes the summation vector, i.e. $\mathbf{e} \equiv [1,1,\ldots,1]$ and $\mathbf{e}_j$ the $j-$th unit vector.

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, $\hat{\mathbf{r}}$ $(r_j>0)$ the $n\times n$ diagonal matrix of the sectoral profit rates, $\mathbf{w}$ $(w_j>0)$ the $1\times n$ vector of money wage rates, $\hat{\mathbf{l}}(l_j>0)$ the $n\times n$ diagonal matrix of direct labour coefficients. On the other side, the quantity side of the system is described by

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

or

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

where $\mathbf{x}^{\mathrm{T}}$ denotes the gross output vector, $\mathbf{y}^{\mathrm{T}}$ the vector of net output, $\mathbf{c}_w^{\mathrm{T}}$ $(\mathbf{c}_p^{\mathrm{T}})$ the vector of consumption demand out of wages (profits), and $\mathbf{d}^{\mathrm{T}}$ the vector of autonomous demand (government consumption, investments).[5]

By considering the above equations, we derive

$$\mathbf{y}^{\mathrm{T}}=\mathbf{\Pi}\mathbf{d}^{\mathrm{T}} \tag{4}$$

Where $\mathbf{\Pi}\equiv[\mathbf{I}-\mathbf{C}]^{-1}$ denotes the $n\times n$ matrix of multipliers linking autonomous demand to net output. Furthermore, $\mathbf{C}\equiv[\mathbf{p}-(\mathrm{s}_w\mathbf{w}\mathbf{\Lambda}+\mathrm{s}_p\mathbf{p}\mathbf{H})](\mathbf{p}\mathbf{c}^{\mathrm{T}})^{-1}\mathbf{c}^{\mathrm{T}}$ denotes the $n\times n$ matrix of total consumption demand, $\mathbf{c}^{\mathrm{T}}$ the uniform consumption pattern (associated with the two types of income), s_w (s_p) the saving ratio out of wages (profits), $\mathbf{\Lambda}\equiv\hat{\mathbf{l}}[\mathbf{I}-\mathbf{A}]^{-1}$ the $n\times n$ matrix of "vertically integrated labour coefficients", and $\mathbf{H}\equiv\mathbf{A}\hat{\mathbf{r}}[\mathbf{I}-\mathbf{A}]^{-1}$ the $n\times n$ "$\hat{\mathbf{r}}-$vertically integrated technical coefficients matrix".

From equation (3) and given that $\mathbf{L}^{\mathrm{T}}\equiv\hat{\mathbf{l}}\mathbf{x}^{\mathrm{T}}$ denotes the vector of sectoral employment, we derive the equation

$$\mathbf{L}^{\mathrm{T}}=\mathbf{\Lambda}\mathbf{\Pi}\mathbf{d}^{\mathrm{T}} \tag{5}$$

where $\mathbf{\Lambda}\mathbf{\Pi}$ denotes the $n\times n$ matrix of employment multipliers linking autonomous investments to total employment.

Now, in order to increase the reliability of our results, we extended the analysis to the cases of open economy (Metcalfe and Steedman, 1981) and pure joint production (Mariolis, 2008), i.e. equation (3) becomes[6]

[5] According to Kurz (1985), the consumption demands out of wages and out of profits, in physical terms, amount to $\mathbf{c}_w^{\mathrm{T}}=[(1-\mathrm{s}_w)(\mathbf{p}\mathbf{c}^{\mathrm{T}})^{-1}\mathbf{c}^{\mathrm{T}}]\mathbf{w}\mathbf{\Lambda}\mathbf{y}^{\mathrm{T}}$ and $\mathbf{c}_p^{\mathrm{T}}=\left[\left(1-\mathrm{s}_p\right)(\mathbf{p}\mathbf{c}^{\mathrm{T}})^{-1}\mathbf{c}^{\mathrm{T}}\right]\mathbf{p}\mathbf{H}\mathbf{y}^{\mathrm{T}}$, respectively. Furthermore, we have differentiated from the original Kurz's framework including in autonomous demand not only investments but also government consumption.

[6] In the case of the joint production, the relationships expressed by (1) and (2) are formulated by

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

where $\mathbf{im}^{\mathrm{T}} = \hat{\mathbf{m}}\mathbf{B}\mathbf{x}^{\mathrm{T}}$ denotes the import demand vector, $\hat{\mathbf{m}}$ the $n \times n$ diagonal matrix of imports per unit of gross output of each commodity, and $\mathbf{B}\ (\geq \mathbf{0})$ denotes the $n \times n$ output coefficients matrix, while the vector of autonomous demand now includes (except from the government consumption and the investments) also the exports. Therefore, the matrix of multipliers enlarges to $\mathbf{\Pi}_m \equiv [\mathbf{I} - \mathbf{C} + \mathbf{M}]^{-1}$ and equations (4) and (5) become

$$\mathbf{y}^{\mathrm{T}} = \mathbf{\Pi}_m \mathbf{d}^{\mathrm{T}} \tag{4a}$$

$$\mathbf{L}^{\mathrm{T}} = \mathbf{\Lambda}\mathbf{\Pi}_m \mathbf{d}^{\mathrm{T}} \tag{5a}$$

where $\mathbf{M} \equiv \hat{\mathbf{m}}\mathbf{B}[\mathbf{B} - \mathbf{A}]^{-1}$ denotes the $n \times n$ matrix of total import demand. Finally, we can derive the matrix multiplier linking autonomous demand to imports as

$$\mathbf{im}^{\mathrm{T}} = \hat{\mathbf{m}}\mathbf{B}[\mathbf{B} - \mathbf{A}]^{-1}\ \mathbf{\Pi}_m \mathbf{d}^{\mathrm{T}} \tag{6}$$

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; and (e) imports per unit of gross output.[7]

3.2 Data description

The SUT of the Greek economy for the year 2015 and the levels of sectoral employment are provided via the website of the National Statistical Service of Greece, http://www.statistics.gr/. The available SUT describes 65 products and industries. However, the elements associated with the product/industry "Services provided by extraterritorial organizations and bodies" are all equal to zero and, therefore, we remove them from our analysis. Moreover, the industry "Imputed rents of owner-occupied dwellings" has no labor inputs and, therefore, we aggregate this product/industry with the product/industry "Real estate". Therefore, we derive a SUT that describes 63 products and industries. The described products and their correspondence to CPA (Classification of Products by Activity) are reported in Table 2, where commodities 1 to 3 belong to Primary production; commodities 4 to 27 belong to Industry; and commodities 28 to 63 belong to Services.

$$\mathbf{p}\mathbf{B} = \mathbf{p}\mathbf{A}[\mathbf{I} + \hat{\mathbf{r}}] + \mathbf{w}\hat{\mathbf{l}} \tag{1a}$$

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

and therefore now $\mathbf{\Lambda} \equiv \hat{\mathbf{l}}[\mathbf{B} - \mathbf{A}]^{-1}$ and $\mathbf{H} \equiv \mathbf{A}\hat{\mathbf{r}}[\mathbf{B} - \mathbf{A}]^{-1}$.

[7] The main differences from Kurz's framework are that the technical conditions of production include **B** and the inclusion imports.

Table 2 Product classification

CPA	Nomenclature
A01	Products of agriculture, hunting and related services
A02	Products of forestry, logging and related services
A03	Fish and other fishing products; aquaculture products; support services to fishing
B	Mining and quarrying
C10-C12	Food products, beverages and tobacco products
C13-C15	Textiles, wearing apparel and leather products
C16	Wood and of products of wood and cork, except furniture; articles of straw and plaiting materials
C17	Paper and paper products
C18	Printing and recording services
C19	Coke and refined petroleum products
C20	Chemicals and chemical products
C21	Basic pharmaceutical products and pharmaceutical preparations
C22	Rubber and plastics products
C23	Other non-metallic mineral products
C24	Basic metals
C25	Fabricated metal products, except machinery and equipment
C26	Computer, electronic and optical products
C27	Electrical equipment
C28	Machinery and equipment n.e.c.
C29	Motor vehicles, trailers and semi-trailers
C30	Other transport equipment
C31-C32	Furniture; other manufactured goods
C33	Repair and installation services of machinery and equipment

D35	Electricity, gas, steam and air-conditioning
E36	Natural water; water treatment and supply services
E37-E39	Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services
F	Constructions and construction works
G45	Wholesale and retail trade and repair services of motor vehicles and motorcycles
G46	Wholesale trade services, except of motor vehicles and motorcycles
G47	Retail trade services, except of motor vehicles and motorcycles
H49	Land transport services and transport services via pipelines
H50	Water transport services
H51	Air transport services
H52	Warehousing and support services for transportation
H53	Postal and courier services
I	Accommodation and food services
J58	Publishing services
J59-J60	Motion picture, video and television programme production services, sound recording and music publishing; programming and broadcasting services
J61	Telecommunications services
J62-J63	Computer programming, consultancy and related services; information services
K64	Financial services, except insurance and pension funding
K65	Insurance, reinsurance and pension funding services, except compulsory social security
K66	Services auxiliary to financial services and insurance services
L68B	Real estate services (excluding imputed rent)
M69-M70	Legal and accounting services; services of head offices; management consulting services
M71	Architectural and engineering services; technical testing and analysis services

M72	Scientific research and development services
M73	Advertising and market research services
M74-M75	Other professional, scientific and technical services; veterinary services
N77	Rental and leasing services
N78	Employment services
N79	Travel agency, tour operator and other reservation services and related services
N80-N82	Security and investigation services; services to buildings and landscape; office administrative, office support and other business support services
O84	Public administration and defence services; compulsory social security services
P85	Education services
Q86	Human health services
Q87-Q88	Social work services
R90-R92	Creative, arts and entertainment services; library, archive, museum and other cultural services; gambling and betting services
R93	Sporting services and amusement and recreation services
S94	Services furnished by membership organisations
S95	Repair services of computers and personal and household goods
S96	Other personal services
T	Services of households as employers; undifferentiated goods and services produced by households for own use

The RRF budget (without VAT, including discounts) data are available for the years 2021-26.[8] The budget of each project is divided in 10 types of cost: Construction cost, Equipment cost, Manmonths cost, Benefits cost, Studies cost, Project Management Cost, Archiving, Licenses, Voucher Cost and Cloud Upgrades/Hosting. However, the Benefit cost cannot be associated with any of the commodities described in Table 2 and, therefore, we remove it from our analysis. Therefore, our analysis considers

[8] It should be noted that the only detailed budget information regarding 2021-2026 pertains to RRF budget (without VAT, including discounts).

9 types of cost. The described types of cost and their correspondence to CPA are reported in Table 3,[9] where the Construction cost and Equipment cost correspond to "Constructions and construction works" and «Machinery and equipment n.e.c.», respectively. Manmonths cost corresponds to a combination of "Legal and accounting services; services of head offices; management consulting services", "Constructions and construction works", "Scientific research and development services", and "Computer programming. consultancy and related services; information services". Project Management Cost corresponds to a combination of "Architectural and engineering services; technical testing and analysis services", and "Legal and accounting services; services of head offices; management consulting services". Archiving and Cloud Upgrades/Hosting correspond to "Computer programming. consultancy and related services; information service". Finally, Licenses and Voucher Cost correspond to "Computer, electronic and optical products".

Table 3 The RRF's cost types and their correspondence to CPA

Cost types	CPA
Construction cost	F
Equipment cost	C28
Manmonths cost	M69-M70; F; M72; J62-J63
Benefits cost	-
Studies cost	M72
Project Management Cost	M71; M69-M70
Archiving	J62-J63
Voucher Cost	C26
Licenses	C26
Cloud Upgrades/Hosting	J62-J63

[9] For an analytical description of each project, see Ministry of Finance (2020).

4 EMPIRICAL APPLICATION

The application of the previous analysis to the SUT of the Greek economy gives the net output and employment multipliers for all the 63 products (Table 4). The first row of Table 4 indicates that an increase (decrease) of 1 monetary unit in the autonomous demand for "Products of agriculture, hunting and related services" induces an increase (decrease) of 0.74 monetary units in net output, an increase (decrease) of 0.74 monetary units in imports, and an increase (decrease) of 48.60 units in employment. The remaining rows of this table are read in the same way. Thus, it follows than an increase (decrease) of 1 million euros in the autonomous demand induces, on average, an increase (decrease) of 0.74 million euros in net output, and an increase (decrease) of 48.60 persons in the employment.

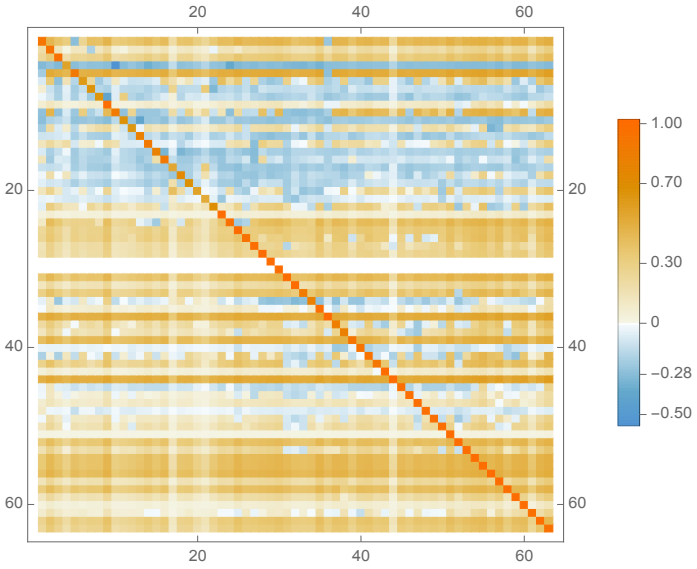
Table 4 Commodity multipliers by CPA

CPA	Net Output	Employment
A01	0.74	48.60
A02	1.07	68.96
A03	0.87	25.80
B	0.14	2.73
C10-C12	0.69	23.52
C13-C15	0.25	11.26
C16	0.32	32.63
C17	0.29	9.17
C18	0.89	31.30
C19	0.19	2.71
C20	0.28	4.25
C21	0.27	6.79
C22	0.38	9.85
C23	0.69	14.96
C24	0.56	6.09
C25	0.71	16.28
C26	0.07	0.71
C27	0.37	6.88
C28	0.34	9.25
C29	0.13	3.71
C30	0.06	1.45
C31-C32	0.28	13.36
C33	1.01	15.71

D35	0.77	6.36
E36	1.12	21.45
E37-E39	0.94	12.20
F	0.88	34.88
G45	1.11	32.76
G46	1.04	24.31
G47	1.18	62.07
H49	0.99	31.86
H50	0.86	13.96
H51	0.60	12.97
H52	0.65	11.82
H53	1.12	34.46
I	0.93	29.66
J58	0.86	26.42
J59-J60	0.84	29.08
J61	0.87	5.48
J62-J63	1.03	25.55
K64	1.10	16.68
K65	0.94	16.39
K66	1.11	31.31
L68B	0.98	1.67
M69-M70	1.08	30.74
M71	0.94	46.73
M72	1.13	20.68
M73	1.05	22.18
M74-M75	1.09	28.57
N77	1.02	30.70
N78	1.38	40.64
N79	1.01	29.15
N80-N82	1.23	46.81
O84	1.40	34.70
P85	1.52	45.84
Q86	1.08	29.81
Q87-Q88	1.37	89.65
R90-R92	1.04	20.39
R93	1.20	48.73

S94	1.34	42.76
S95	0.94	19.47
S96	1.24	79.31
T	1.63	100.62

For a more detailed analyses, Fig. 4 gives a visual representation of the output, employment and import multiplier matrices and their values.



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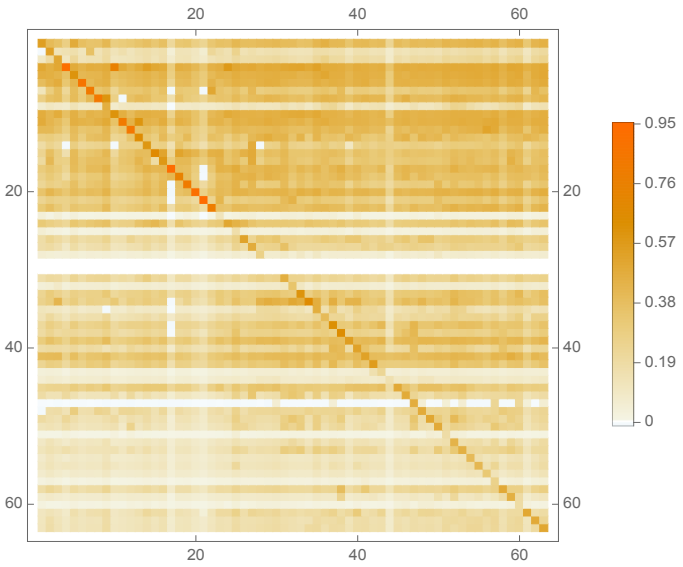

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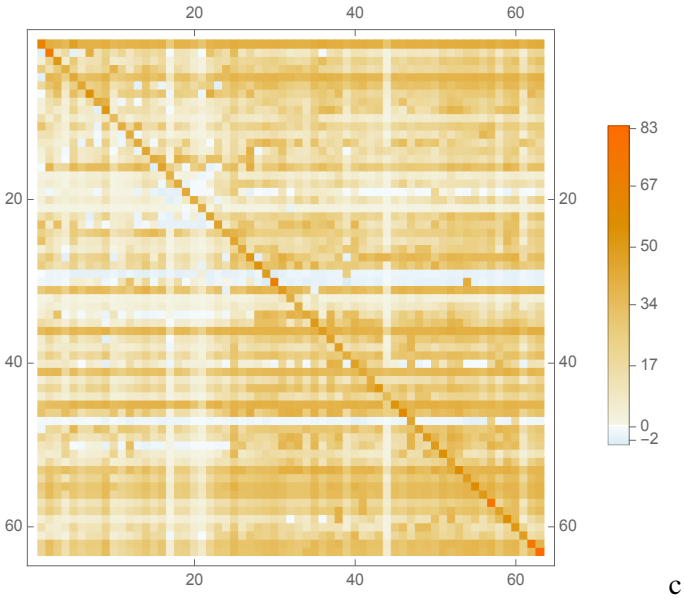

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Fig. 4 The matrices of (a) output, (b) import, and (c) employment multipliers

To estimate the multiplier effects of RRP on net output and total employment, we set the elements of the vector of autonomous demand equal to the weighted distribution of RRP budget of each project to the 63 commodities of the Greek economy.[10] On this basis we are able to provide the multiplier effects of each RRP project on the economy's total net output and levels of employment.[11]

The application of the previous analysis indicates that the 18.2 bn. euro from RRP would lead to a total (direct and indirect):

- increase in output of about 12.2 bn. euro
- increase in employment of about 390,000 persons

Taking now into account the GDP of the Greek economy for the year 2020, the level of employment the RRP would lead to a total (direct and indirect):[12]

- increase in output of about 7.2%
- increase in employment of about 10%

Tables 5 (6) provides an estimate of the impact of the plan in absolute terms and as a % difference from the net output and the level of employment for the year 2020 for each of the cost types (each of the

[10] The elements of the RRP budget that correspond to more than one commodity are distributed according to the weight of the respective commodity to the total investments of the Greek economy, directly obtained from the SUT of the Greek economy.

[11] Our estimations for net output correspond to GDP minus net taxes on products.

[12] These results are in line with the analyses of the Council of Economic Experts and Bank of Greece, see Greek Government (2021a).

years 2021-26). For a brief per project description and estimate of the impact of the plan and its components see the supplemental material.

Table 5. The RRF multiplier effects on output and employment per year

Impact	2021	2022	2023	2024	2025	2026
output	500,604,876	3,442,164,763	3,501,999,740	2,890,015,893	1,827,289,346	8,787,243
output %	0,30%	2,04%	2,08%	1,72%	1,08%	0,01%
employment (persons)	15,877	108,758	111,746	94,169	60,702	236
employment %	0,41%	2,80%	2,88%	2,43%	1,56%	0,01%

Table 6. The RRF multiplier effects on output and employment per cost type

Cost type	Impact on output	Impact on output %	Impact on employment (persons)	Impact on employment %
Construction	5,603,940,443	3,33%	222,353	5,73%
Equipment	1,436,062,523	0,85%	39,002	1,01%
Manmonths	3,524,671,378	2,09%	95,627	2,46%
Benefits	0	0,00%	0	0,00%
Studies	713,135,464	0,42%	13,014	0,34%
Project Management	11,660,329	0,01%	332	0,01%
Archiving	592,156,751	0,35%	14,650	0,38%
Voucher Cost	10,941,872	0,01%	117	0,00%
Licenses	35,030,619	0,02%	375	0,01%
Cloud Upgrades/ Hosting	243,262,482	0,14%	6,018	0,16%

Our estimates suggest that the 18.2 bn. euro from RRP would lead to a total (direct and indirect) increase in output of about 12.2 bn. euro and increase in employment of about 390,000 persons. Focusing now on the effects on output and employment per cost type, Construction, Manmonths and Equipment would

lead to a total increase in output of about 6.27% (87% of the total output impact) and in employment of about 9.2% (92% of the total employment impact).

Figs. 5-8 provide an estimate of the impact of the plan in absolute terms and as a percentage (%) difference from the net output and the level of employment for the year 2020 for each of the pillars and the components.

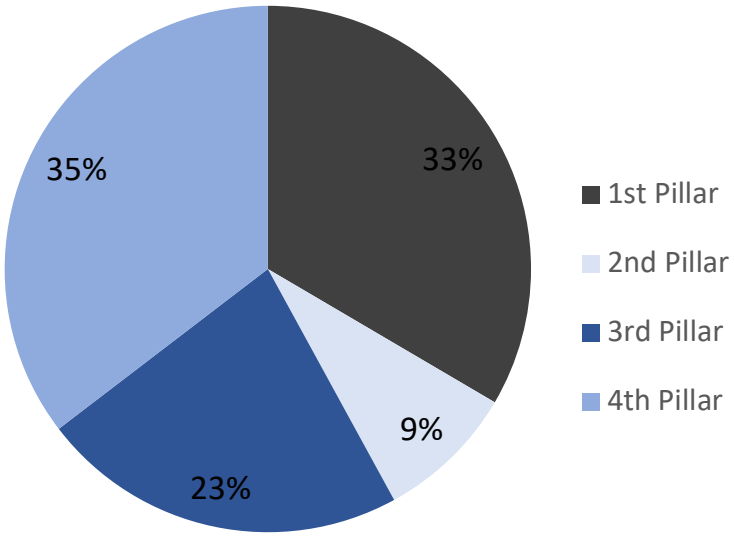

Fig. 5 Contribution (%) of the output multiplier per pillar

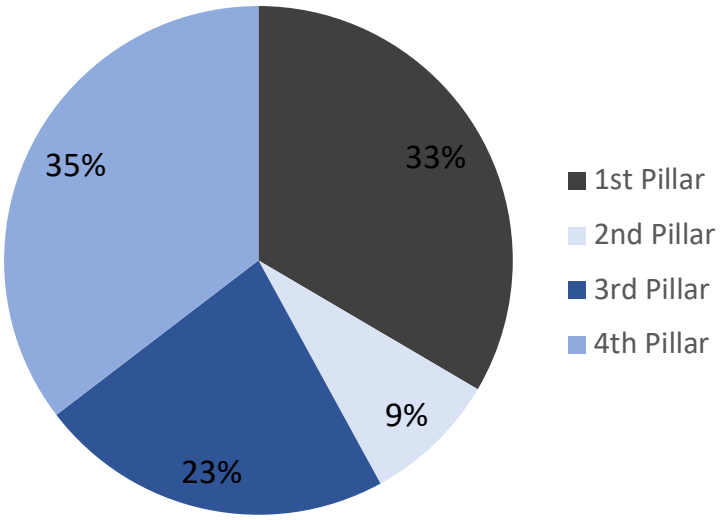

Fig. 6 Contribution (%) on the employment per pillar

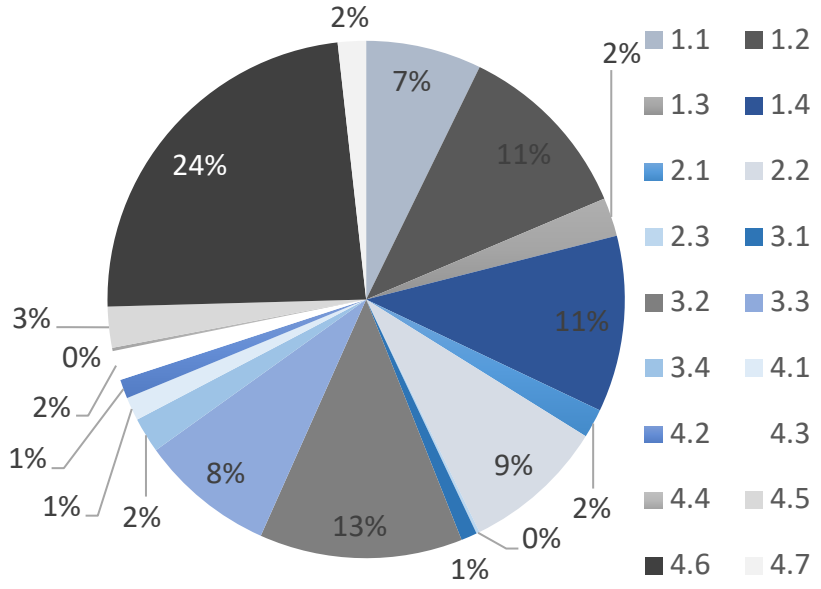

Fig. 7 Contribution (%) on the output growth per component

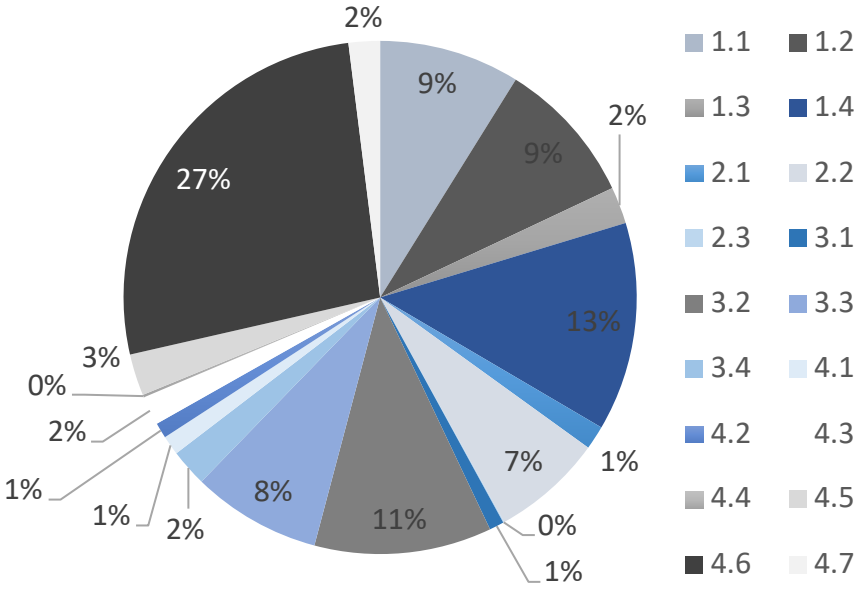

Fig. 8 Contribution (%) on the employment per component

From Figs. 5-8, we observe that most of the growth of the economy (increase of the employment) is expected to be caused by the positive effects of the pillars 1, 3 and 4. In terms of components we

observe that 60% of multiplier effects concentrated in "Modernise and improve resilience of key economic sectors", "Renovations", "Education, vocational education, training, and skills", and "Increasing job creation and participation in the labour market".

5 AN INTER-SECTORAL ANALYSIS OF THE GREEK ECONOMY

Returning back and analyzing the commodities that are described in Table 1, we can detect which of these commodities are characterized by an output and employment multiplier that are above the average multipliers of the economy, and, at the same time, by an import multiplier that is below the average import multiplier of the economy, i.e. the key commodities for effective demand management policy (see the first column of Table 7).[13] All these commodities belong to services, with the only exceptions forestry products and construction work. However, none of these commodities are characterized by an incremental output-employment ratio, i.e. output multiplier relative to employment multiplier, that is above the economy's average (compare the two columns of Table 2). Since, the incremental output-employment ratios can be conceived of as labor productivity indices, it follows that none of the key commodities for effective demand management policy is characterized by a relatively high labor productivity index. This fact rather indicates that an effective demand management policy can have a positive impact on the growth potential of the economic system only in the short-term. A long-term policy to enhance the overall labor productivity should be directed towards commodities that are characterized by high labor productivity indices. And in the case of Greece most of those commodities belong to industry (see the second column of Table 7).

Table 7 Commodities for effective demand management policy and with high labor productivity index

Key commodities for effective demand management policy	Commodities with high labor productivity index
A02 Products of forestry, logging and related services	C19 Coke and refined petroleum products
F Construction work	C20 Chemicals
G45 Wholesale and retail trade; repair of motor vehicles	C24 Basic metals

[13] This section draws on Mariolis et al. (2021).

G47 Retail trade except for motor vehicles	C26 Computer, electronic and optical products
H49 Land transport and transport via pipeline	C27 Electrical equipment
H53 Postal and courier services	C33 Repair and installation of machinery and equipment
I Accommodation and food services	D35 Electricity and gas
K66 Services related to financial and insurance services	E36 Water supply services
M69-M70 Legal and accounting services	E37-E39 Sewerage, waste and remediation services
M71 Architectural and engineering services	H50 Water transport services
M74-M75 Other professional, scientific and technical services	H52 Storage and auxiliary to transport services
N77 Rental and leasing services	J61 Telecommunications
N78 Employment services	K64 Financial services
N79 Travel agency, tour operator and other reservation services and related services	K65 Insurance services
N80-N82 Security and investigation services	L68 Real estate services
O84 Public administration services	M72 Scientific research and development services
P85 Education services	CPA Nomenclature
Q86 Human health services	C19 Coke and refined petroleum products
Q87-Q88 Social services	
R93 Sport and entertainment services	
S94 Services provided by organizations	
S96 Other personal services	
T Services from private households with employed persons	

We continue our analysis focusing on the primary, industrial, and service sector. Table 2 reports (a) the arithmetic means of output, import and employment multipliers for the primary, industrial, and service sector; and (b) their incremental output-employment and output-import ratios which can be conceived of as indices of relative import dependency. Finally, we consider the composition of the elements of autonomous demand in relation to their participation to the Greek economy (see Table 8).[14]

Table 8 Commodity multipliers for the Greek economy

		output	Imports	Employment	output /Empoyment	output /Import
Sectors	**Primary products**	0.83	0.46	36.5	0.023	1.80
	Industrial products	0.59	0.67	12.8	0.046	0.88
	Services	1.28	0.32	33.7	0.038	4.00
Aut. Demand	**Government**	1.49	0.36	33.5	0.044	4.14
	Investment	0.68	0.61	18.9	0.036	1.11
	Exports	0.78	0.51	16.6	0.047	1.53
	Tourism	1.08	0.32	26.4	0.041	3.38
	Average	0.99	0.46	26.3	0.038	2.15

We observe that only services demonstrate output and employment multipliers above the economy's average and, at the same time, import multiplier below economy's average. Industry which, as we have already realized from Table 7, characterized by the highest labor productivity, characterized also by the highest import dependency. This means that a long-term policy to enhance productivity of the Greek economy should be directed towards industrial production. Moreover, taking account the composition of the elements of autonomous demand in relation to the participation of each sector of the economy to each category of autonomous demand (see Table 8), we realize that primarily, government expenditures and, secondarily, tourism can be chosen for effective demand management policy of the economy.

14 The available data from the SUTs provides information about the composition of government's final consumption expenditure, gross fixed capital formation (i.e. investments), and exports. Given the importance of tourism for the Greek economy, we examine separately the multiplier effects of international travel receipts.

Finally, we observe that government expenditures and tourism are characterized by relatively high labor productivity indices and, at the same time, by low import dependency indices, while the exports are not only characterized by the highest labor productivity index but also by a relatively high import dependency index. Investments demonstrates the lowest labor productivity and, at the same time, the highest import dependency indices.[15] These results suggest that a short-term growth-oriented policy for the Greek economy could be implemented, primarily, through government expenditures and, secondarily, through the tourism, while the exports, which demonstrates the highest labor productivity index, could be the basis of a long-term growth-oriented policy.

6 RRP'S EVALUATION

A main criticism that can be made of the RRP is that it is shaping up as essentially the plan the government would have rolled out anyway – even without the COVID-19 pandemic. In its defense, the government can respond that it will implement the program on which it ran in last year's elections. "In economic terms", as it has been declared, "the primary consideration of the Plan is to cover the large investment, output and employment gap endemic to the performance of the Greek economy over the last decade which deteriorated due to the current pandemic". Therefore, "the plan aims to enhance growth, productivity, job creation and economic and social resilience".

Our findings suggest that the projected changes of 18.2 bn. euro in investments correspond to an increase in output of 7.2% and increase in the levels of total employment of 10%. Furthermore, the intersectoral analysis of the Greek economy has shown that favourable multiplier effects for effective demand management policy are concentrated in commodities such as "Construction work" which is consecrate more than 1/3 of the 18.2 bn. euro of the plan. Therefore, our analysis has shown that the plan satisfies the short-term goals of growth and job creation.

On the other hand, for a long-term policy, we have identified only two commodities with high labour productivity index (see Table 7) that are included to the RRP budget. These two commodities are "Computer, electronic and optical products" and "Scientific research and development services", which constitute a very small percentage of the total budget. Furthermore, it should be stressed that investments, i.e., all the commodities that correspond the RRP, demonstrate the lowest labour productivity and, at the same time, the highest import dependency index (see Table 8). Therefore, our

[15] It should be noted that the implementation of internal devaluation has hindered the export capacity of the economy through a negative effect of lackluster demand on productivity, see e.g. Pierros (2021). Furthermore, for the recent experience of the Greek economy and its prospects in the post-COVID-19 era, see Nikiforos (2021).

intersectoral analysis shows that the plan does not satisfy the long-term goals of a higher productivity and economic resilience.

Focusing on social resilience, a criticism that can be made is that RRP does not contain funds for social programs, health and education, the guiding philosophy behind its remedies for economic inequality and improving social justice is that investments and liberal economic reforms will lead to increased prosperity and incomes – with a rising tide lifting all boats.[16] Furthermore, the digital transformation in term of pillars and components corresponds only to 12% of the 18.2 bn. euro. On the other hand, the green transition corresponds to 33% (from which more than 1/3 corresponds to renovations); however, there is not any research about the RRP's carbon emissions and therefore we cannot evaluate the efficiency of green transmission.[17]

7 CONCLUSIONS

This study provided estimations of the effects of the RRP budget on output and total employment of the Greek economy, using a multisectoral model of joint production and data from the from the Supply and Use Tables for the year 2015. Based on the available facts and figures, it has been estimated that the RRP budget of 18.2 bn. euro would lead to a total (direct and indirect) increase in output of about 12.2 bn. euro and to an increase in employment of about 390,000 persons. Furthermore, considering the GDP of the Greek economy and the level of employment for the year 2020, the RRP would lead to a total increase in output of about 7.2% and in employment of about 10%. Focusing now on the effects on output and employment per cost type, Construction and Manmonths would lead to a total increase in output of about 5.4% (75% of the total output impact) and in employment of about 8.2% (82% of the total employment impact).

In other words, for the period 2021-26 the RRP would lead to a great increase of output and employment and therefore it satisfies the goal of economic recovery after the COVID-19 pandemic, of course this recovery is not enough for Greek economy to reach its 2008 levels. On the other hand, our intersectoral analysis shows that the plan does not satisfy the long-term goals of a higher productivity and economic and social resilience, emerging the low productivity and high import dependency of the Greek economy.

In summary, our analysis concludes that the program would lead to a short-term boost on terms of output and employment, while the impact would be mild to the structure of the Greek economy. Without doubt, a comprehensive evaluation of the RRP requires convergence with the recovery plans of other EU countries. Therefore, future research efforts should extend the current framework to other EU

[16] For the conditions of inequality and poverty in Greece, see Missos (2021).

[17] See footnote 3. Furthermore, for the WWF's evaluation of the green recovery in Greece see, WWF Greece (2020).

countries that have been granted funding from the scheme and mapping the RRP multiplier effects across the EU.

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