Escaping the resource curse in regional development: a case study on the allocation of oil royalties

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Abstract: The aim of this paper is to evaluate the socio-economic impact of the allocation of royalties from oil extraction on regional development through a case study on the Basilicata region (Italy). We examine how the regional government's chosen policies have impacted the income of Basilicata residents and the economic development of the region and how a different set of choices may reveal a more effective approach to turning revenue into long-term public benefits. The analysis focuses on growth as well as on distributive impacts of the allocation of royalties. The results clearly show that the past allocation of the royalties accruing to regional government into regional policies generated little impact in terms of economic growth and occupation, the total well below what was expected. Appreciable impacts on incomes and occupation will not be forthcoming unless resources are redirected towards supporting a stronger competitiveness of the regional economic system.

Keywords: oil royalties; regional development; inequality; weak sustainability; social accounting matrix; SAM; Italy.

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1 Introduction

The discovery of a new natural resource, such as an oilfield, is not necessarily good news for a country. According to the 'big push' theory, the new source of income should lead to an increase in public investment, fostering growth and leading to long-term economic development. However, empirical evidence reveals time and time again the presence of a 'natural resource curse'; in other words, a negative correlation between resource abundance and economic growth (Sachs and Warner, 2001).

Yet how is it possible for the presence of a natural resource to depress an economy? Countries and regions that exploit their domestic natural resources usually experience

large inflows of financial resources, receiving both direct (royalties and dividends) and indirect (income taxes on the oil companies) benefits from the extraction. In addition, national economies also experience an increase in foreign currency inflow.

Despite this flow of money, the economic consequences of such a comparative advantage remain controversial. Indeed, over the last fifty years a high dependency on resource exports has been often associated with severe recession and poverty. A relevant vein of literature has been dedicated to theoretical interpretations and empirical evidence of the phenomenon (Van der Ploeg, 2011). The range of possible explanations has unfolded over time from the purely economic framework to a wider range of disciplinary perspectives, including political science and social and historical analysis (Larsen, 2006; Torvik, 2009; Van der Ploeg, 2011).

A first economic interpretation of the causes of a systematic, negative relation between dependence on natural resource exploitation and growth is known as 'Dutch disease' (Torvik, 2009; Van der Ploeg, 2011)[1]. According to this model, the large inflows of foreign capital from the exportation of resources inflate the real exchange rate, driving capital and labour away from agriculture and non-resource manufacturing activities. As a consequence, production costs increase while competitiveness and exports from non-resource sectors decrease, with an overall depressing effect on economic growth. Resource wealth may also induce the government to implement unsustainable macroeconomic policies, leading to a low or negative *genuine* rate of investment, that is, the rate calculated considering investments *net* of the depletion of non-renewable natural resources (Atkinsons and Hamilton, 2003). The intrinsic volatility of the international market of non-renewable resources has been recently proposed as a further driving factor in explaining the economic basis of the resource curse (Van der Ploeg, 2011).

These negative impacts are also likely to be stronger in economies with weak institutions. Misguided strategies can harm the economic system by inviting corruption and rent-seeking behaviour, with the effect of lowering standards of living [in terms of equity, political liberty, education, etc. (Ross, 1999)]. However, well-developed democracies allocate fiscal windfalls from resource exploitation towards inefficient and ineffective policies, as well. A range of political economy models have been proposed to explain this evidence. Possible causes include the role of incumbency distortion and lobbying, the short-term horizon of policymakers, the adoption of patronage strategies in public expenditure, and the possible use of investments to foster political prestige rather than economic efficiency (Robinson et al., 2006; Torvik, 2009).

Designing and implementing effective policies to counteract the resource 'curse' is a challenge for governments. The difficulty of implementing these policies in developing countries has been exemplified in recent years by the situations in Chad and Brazil, which have both received significant royalties from oil extraction; nonetheless, the standard of living for their populations has not improved to a corresponding extent (Keenan, 2005; Pegg, 2005; Caselli and Michaels, 2013).

In order to prevent such adverse effects, while supporting economic development and fostering poverty alleviation, natural resource revenues must be properly managed. Several papers suggest that the proper policy to avoid the 'curse' in developing countries is the allocation of the additional financial resources from oil revenues to policies for productivity, competitiveness, and welfare enhancement (Levy, 2006; Breisenger et al., 2010). The Norwegians' successful history in oil extraction seemed to result from a policy mix designed to pursue "the separation of resource revenues from the rest of the

economy, the maintenance of a variegated productive capacity, and a sense of fair distribution of wealth" [Larsen, (2004), p.17; Larsen, 2006].

Developing countries are not the only ones concerned. Some of the symptoms of the resource 'curse' are also likely to affect lagging regions within developed economies that start to exploit a new natural resource, such as oilfields. Caselli and Michaels (2013) provided empirical evidence of a negative impact of oil extraction on welfare and living standards in the oil regions of Brazil. A part of the explanation may be linked to the 'Dutch disease', though the usual exchange rate mechanism does not work for comparing regions across the same country. The negative impact on the non-oil export sector is likely to be more relevant in lagging regions. With the presence of a small 'export base' supporting regional development (McCann, 2001), the openness of a regional economy would lead to the 'leakage' of the largest part of the impact of royalties expenditure outside the regional borders. Moreover, the sudden increase in the 'export base' may mask the lack of competitiveness of the regional non-oil export sectors compared to the rest of the country, reducing investments to enhance their competitiveness. Additional financial resources from extraction revenues (such as royalties) may also be allocated into short-term local redistributive policies intended to limit the negative effect of the regional economic lag (such as unemployment and poverty), despite being ineffective in enhancing the competitiveness of the regional system in the long run. Finally, rent-seeking behaviour and corruption may flourish if the allocation process fails to comply with acceptable standards of transparency and fairness.

The aim of this paper is to evaluate the potential socio-economic impact of the allocation of royalties from oil extraction on regional development. A case study is proposed on the Basilicata region in Italy, which provides an example of a lagged region in a developed economy. We first supply an *ex post* assessment of the impacts of royalties allocated from 1997 to 2010 by the Basilicata regional government as an additional financial resource for regional development policies. Following an approach adopted in other studies (Levy, 2006; Breisenger et al., 2010), this assessment is based on simulations carried out on a model of the regional economy. The analysis focuses on growth as well as on the distributive impact of the allocation of royalties, given the relevant role played by social issues in determining the success or failure of development strategies based on the exploitation of natural resources (Ross, 1999).

The analysis is based on a multi-sector model of the regional economy (described in the Appendix) built on a social accounting matrix (SAM) specifically designed to assess distributive impacts (Pyatt, 1988; Round, 2003). The case study of the Basilicata Region (Italy) is presented in Section 2. In Section 3, SAM multipliers are used to study the impact of past royalty allocation policies. The model is then used to carry out a structural analysis of the distributive trade-offs (Section 4). A scenario analysis assessing alternative strategies for the allocation of royalties with desirable outcomes in terms of economic development and income distribution is provided in Section 5. Some concluding remarks close the paper.

2 The Basilicata case study

The Basilicata region (Figure 1) is an interesting case in the study of the potential impact of a natural resource windfall on a regional economy.

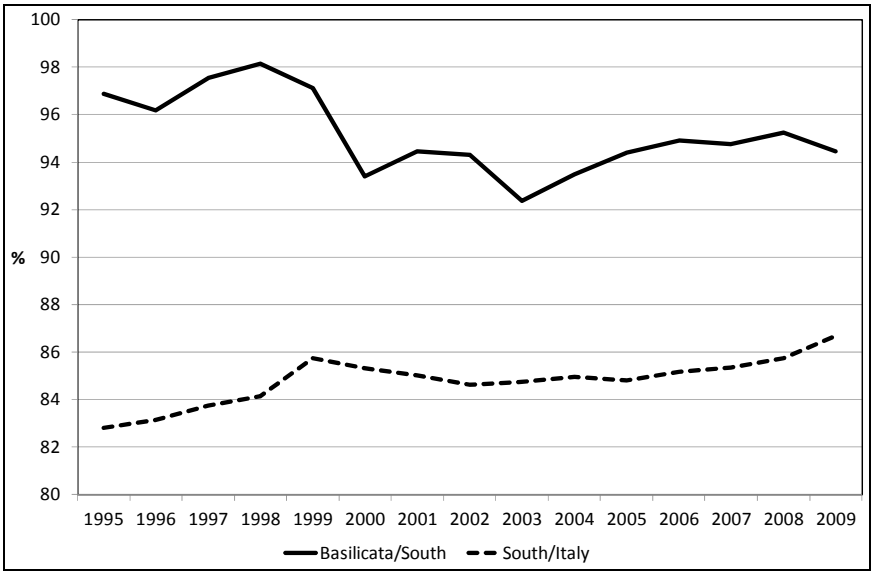
Figure 1 The Basilicata region

Source: Wikipedia

Basilicata is a depressed region in the south of Italy. Once one of the poorest regions in Italy, it now boasts the richest source of oil and concentration of associated industry in the country. However, it still struggles behind the rest of the country with a per-capita income of around 70% of the national average. When oilfields were discovered in the Val d'Agri area (in the western part of the region) at the beginning of '90s they were seen as an important opportunity for the regional economy. The regional oil industry currently produces about 100,000 bbl/d (16,000 m^3/d), meeting 11% of Italy's domestic oil demand. In 2009, there were around 230 people employed by ENI[2] (the company in charge of the extractions operations) in the Val d'Agri area. Over 50% of these workers came from Basilicata, while another 1,800 were employed in activities directly generated by ENI's operations; more than 50% of this latter group was based in Basilicata. In addition to the direct impact on employment generated by the oil extraction, there was further opportunity for regional economic development in the form of royalties. According to the formal agreement on the exploitation of the oilfields, ENI was required giving 7% of total revenues to the Basilicata region. This meant that between the beginning of drilling in 1997 and its end in 2010 the regional budget accrued more than 636 million euros from oil. Furthermore, a recent national regulation (99/2009)[3] allocated a further 3% of revenues to households in Basilicata as a 'voucher' to be used in fuel purchases (fuel card).

Astonishingly, the oil revenue made no great impact on the local economy, when measured against bordering regions, despite the huge amount of additional financial resources channelled into regional development policies. After a remarkable increase during the second half of the '90s, the evolution of regional GDP in real terms has remained fairly stable over the years since 2000, when the oilfields became fully operational. Similarly, the total number of people in employment in Basilicata also remained stable, at around 210 thousand full time labour units since 2000. In 2009, the unemployment rate was 11.2%, a figure which rose to 13% in 2010 as a consequence of the economic downturn. In the same year, unemployment among young people reached 42%. However, the stability of employment was associated with a loss of competitiveness in terms of labour productivity (Figure 2).

Figure 2 GDP per labour unit – ratio between different areas



Source: Our computations performed on Istat data

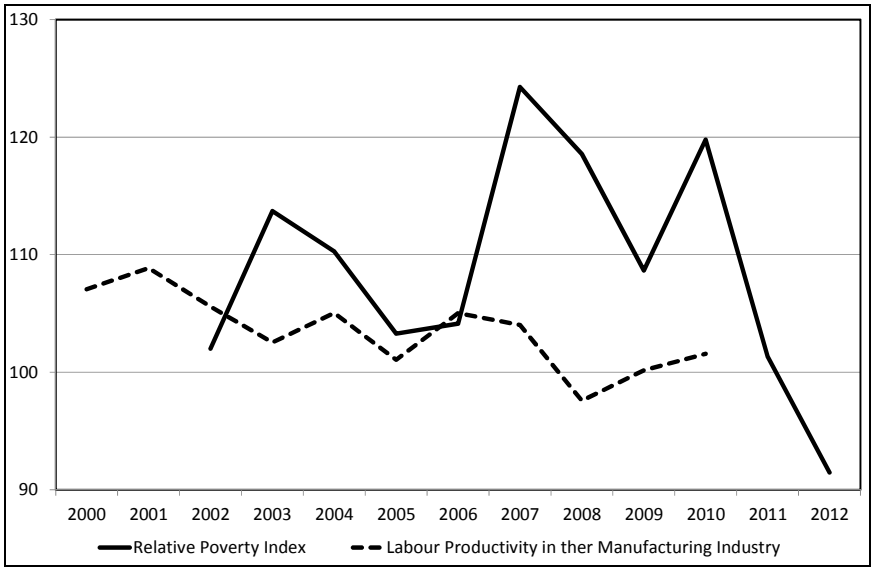
While the productivity in the regions of southern Italy[4] increased on average relative to the national average, from 1995 to 2009 Basilicata experienced a relative decline. Up to 1998 Basilicata's employment grew faster than employment in bordering regions without any increase in productivity leading to a correspondent increase in total output. From 1999 onward, while the employment remained stable, a higher loss in labour productivity than that observed in bordering regions became evident up to 2003. An incomplete recovery was observed over the following years.

Some additional figures help to outline some of the typical features of the resource 'curse' (Figure 3).

During the first decade of the millennium, the relative position of Basilicata followed an evident negative trend when considering the labour productivity in the manufacturing industry, a possible symptom of the 'Dutch disease'. Moreover, in the same period the index of relative poverty[5] in the Basilicata region increased more than the average of the Southern regions, with a strong upward movement in the first years of the economic downturn. Notably, the strongest surge in the poverty rate in Italy occurred in 2011 and 2012, the two years where Basilicata scored better than neighbouring regions, though at the end of the period the poverty index in Basilicata was still two percentage points higher (26.6%) than in 2002.

Despite the remarkable availability of fiscal resources from oil extraction[6] additional to the ordinary fiscal inflows (both from the central government and from regional taxes) the regional economy did not perform well. In the next section, the socio-economic impact of expenditure financed by the royalties on the regional economy (output, employment, household income) will be assessed through a simulation carried out on a model of the regional economy.

Figure 3 Poverty and labour productivity indexes – ratio between Basilicata and southern regions



Source: Our computations performed on Istat data

3 The impact of royalty allocation on the regional economy

The SAM-based model[7] was first used to assess the impact of the allocation of the royalties received by the Basilicata region from the beginning of oil drilling to date. The available information on the allocation of receipts from royalties among different uses is summarised in Table 1, where the total amount of royalties is disaggregated by year and action.

For the majority of the revenue it was impossible to link expenditures to specific policy actions. About two thirds of total spending (more than €466 million) was simply used to finance the current expenditure of the Basilicata region (under 'other actions'). The remaining third was shared among various initiatives mainly directed towards the mitigation of and compensation for the negative impacts of oil industry activities in the region. The total amount of royalties increased up to 2006, following the building of extraction plants and transportation networks. In the last years of the observed period, with the major part of installations completed, the variability of revenues depended for the most part on the dynamics of oil price in the international market; revenues in 2007 were clearly affected by the oil price spike observed that year.

The environmental issues involved in the exploitation of the largest on-shore oil source in Europe are clearly relevant. The location of the oilfields impacted high natural value areas, with relevant potential for the development of tourism and agricultural activities. Furthermore, the extraction plants and the distribution pipelines to the processing plants on the coastal area affect the same area where the most important resource of water for southern Italy is collected. As the level of harnessing the oil source is beyond its control (the oil sources fall under the authority of the national government), the regional government took the approach of mitigating the possible negative impacts

(by setting up a monitoring system) and compensating the areas most directly impacted by the oil operations.[8]

Table 1 Allocation of royalties by action – 000 Euro, 1997–2010

	Natural gas distribution network	*Environmental monitoring*	*Environmental compensation*	*University grants*	*Val d'Agri plan*	*Other actions*	*Total*
1997	0	0	0	0	0	425	425
1998	0	0	0	0	0	2,247	2,247
1999	0	0	0	0	0	1,241	1,241
2000	0	5,010	11,021	0	0	3,165	19,196
2001	1,033	0	5,581	0	0	8,039	14,653
2002	0	0	0	0	0	10,044	10,044
2003	0	0	5,600	0	0	24,047	29,648
2004	9,852	910	5,609	0	1,125	30,310	47,806
2005	1,788	0	5,615	86	4,332	32,811	44,632
2006	1,791	1,458	5,681	172	13,809	61,871	84,782
2007	18,565	1,572	5,669	258	21,378	72,574	120,015
2008	2,272	1,937	0	258	26,891	71,328	102,685
2009	1,284	1,083	3,099	172	19,562	79,472	104,673
2010	3,430	2,927	0	258	19,008	28,622	54,246
Totale	40,017	14,897	47,875	1,205	106,104	426,196	636,293

The most important scheme funded with royalties is the Val d'Agri plan (POV), an expenditure programme aimed at fostering economic development and improving quality of life in the area around the oilfield. The POV plan is organised along four axes concerned with exploiting local resources, improving infrastructure, promoting a better quality of life, and enhancing systems which support local production. The POV plan includes both current and investment expenditure.

To calculate the total impact of the use of royalties over the time period examined, these expenditure flows were considered as an exogenous shock directed towards the regional economy and reclassified according to the disaggregation of the SAM accounts. The 'other actions' were modelled as an exogenous increase in public administration expenditure at the regional level towards endogenous accounts, according to SAM shares. Expenditures referring to different years were transformed into Euro 2006 using discount factors estimated by Istat[9].

Table 2 displays some figures on the estimated economic impact of royalties in the Basilicata region. Overall, the use of royalties generated an additional output of almost €500 million over the study period, corresponding to about €318 million of income earned by households. Royalties also generated a total of 5,331 annual full time labour units, estimated by multiplying the vector of additional output by industry by a vector of properly disaggregated unitary labour coefficients.

Table 2 Impact of royalty uses by allocation type – Euro 2006, 1997–2010

	Allocation type		
	POV	*Other*	*Total*
Royalty receipts (€1,000)	126,813	503,336	630,150
Total impacts:			
Output (€1,000)	224,119	271,403	495,522
Household income (€1,000)	82,743	235,385	318,128
Labour units (n)	2,276	3,055	5,331
Average impacts:			
Output (€/€1,000)	1,767	539	786
Households' income (€/€1,000)	652	468	505
Labour units (n/€ million)	18	6	8

As expected, we found that a large share of the impact was lost to the regional economy through leakages to the 'rest of the world' account. The typical openness of a regional economy is reflected by the value of the ratio between additional output and the total value of allocated royalties: on average, only €786 of additional output was produced at the regional level for every €1,000 spent. The average impact on incomes was even smaller, with only 50% of expenditure transformed into income actually earned by families within the region.

The total impact was quite small compared with the absolute value of the available budget that stabilised during the second half of years 2000–2010, after a period of increasing receipts, at around €100 million/year (about 3% of the annual expenditure of public administration in the Basilicata region). These results can only partially be accounted for by the static nature of simulations[10]. The use of additional budget from royalty receipts likely played a role in contrasting the economic decline of the regional economy, but without a relevant dynamic effect on the economic structure.

Nonetheless, even from a short-term perspective the allocation of these additional financial resources could be improved considerably. In the table, the budget allocated to the POV plan is considered separately from the rest of the royalties. A finalised program, such as the POV plan, seems far better at promoting growth and occupation, showing a ratio between additional output and allocated budget which is more than three times larger than that for other allocations (€1,767 vs. €539 of additional output for every €1,000 of royalties) and generating about two thirds of the new labour units while using only 20% of the total budget. These higher impacts are mainly due to a relevant share of expenditure being directed towards 'buildings and construction' (both for infrastructure improvement and for conservation of cultural heritage), an industry largely based on local firms. Moreover, an investment plan like the POV plan, tailored towards a specific local economy, is more likely to generate positive dynamic effects than a nondescript support package to bolster the current expenditure of the regional public administration.

These results from the SAM model allow us to make some preliminary remarks about the allocation of royalties at the regional level. Financing the expenditure of the public administration is a typical response of local governments to fiscal resource abundance due to oil windfalls (Robinson et al., 2006; Torvik, 2009; Caselli and Michaels, 2013). Moreover, it is probably unavoidable during a time of increased funding cuts from the central government to local institutions. The additional financial resources from royalties

can support welfare policies at the regional level, softening the adverse effects of austere policies. However, this form of allocation is unlikely to generate long-term benefits and shows limited efficiency in terms of growth and employment in the short-run.

In the current macroeconomic context, both equity and growth are valuable goals for the regional government. On the one hand, a steady growth rate is a necessary condition to trigger development processes that lead to a more competitive structure of the economy, fostering investments and promoting economies of aggregation. On the other hand, the current long-standing slump of the economic cycle, with increasing unemployment, a heavy fiscal burden, and growing constraints in public expenditure for social purposes, requires an acceptable distributive balance of potential growth. In the following paragraph, a structural analysis of the SAM multipliers matrix will be carried out to better characterise the distributive features of the regional economy.

4 Growth or equity? A structural analysis

The existence of a trade-off between growth and equity is confirmed by the structural analysis of the regional economic system. In Table 3, SAM multipliers and distributive indicators are displayed for the six major partitions of the productive system[11].

Table 3 SAM multipliers and distributive impacts for exogenous shocks on regional output. Euro 2006 and percentage values

	Agriculture	*Industry*	*Building*	*Trade services*	*Hotels and restaurants*	*Other services*
Output (€)	1.779	1.825	1.930	1.944	1.947	1.738
Value added (€)	1.029	0.629	0.880	0.883	0.935	1.103
Incomes (€)	0.757	0.466	0.685	0.688	0.745	0.816
Distributive bias (%)						
Equity	61.8	78.0	70.8	56.0	65.3	74.4
Rural	80.8	89.3	87.5	78.5	81.2	89.2
Distributive balance (%)						
Equity	–61.8	–74.7	–70.8	–56.0	–65.3	–74.4
Rural	3.0	–21.4	–12.3	3.0	–1.1	–22.5

Output and value added multipliers clearly show that the regional system mainly supplies goods and services to satisfy the *domestic* demand. Industrial activities, despite a lower value added to output ratio (not included in the table), show an output multiplier lower than ‘building’, ‘trade’, and ‘hotels and restaurants’ (H&R), and the lowest value-added multiplier. Notably, the three activities with the highest output multipliers account for the largest part of the regional economy in terms of GDP. ‘Other services’, including public services (such as public administration and health and education services), despite a typically high value added to output ratio, show the largest multiplier of household incomes. All these features signal a small export base (McCann, 2001) for the Basilicata economy.

The distributive indicators detect a structural bias against rural groups. Only the growth of ‘agriculture’, ‘trade services’, and H&R activities would reduce the negative trend in the relative position of rural households (lower bias and positive or small

negative balance). Interestingly, despite an overall adverse effect (both considering equity and rural indicators), 'industry' alone shows positive (though small) redistributive effects directed towards the two poorest quintiles of the population (equity balance lower in module than equity bias).

In order to design an alternative allocation of royalties with desirable growth and/or distributive features, we focused on the sub-matrix of income multipliers of exogenous output increases in regional production activities[12]. A singular value decomposition (see the Appendix for details) of the sub-matrix was carried out to extract the endogenous 'policy structures' linking changes in output with impact on household incomes.

Table 4 shows the multiplicative 'power' of the ten endogenous structures. Only the first one actually 'multiplies' (macro-multiplier higher than 1) the initial exogenous shock on output into a larger final impact on households' incomes. All the other structures show far smaller values, transmitting a minimal share of the initial shock to households' incomes.

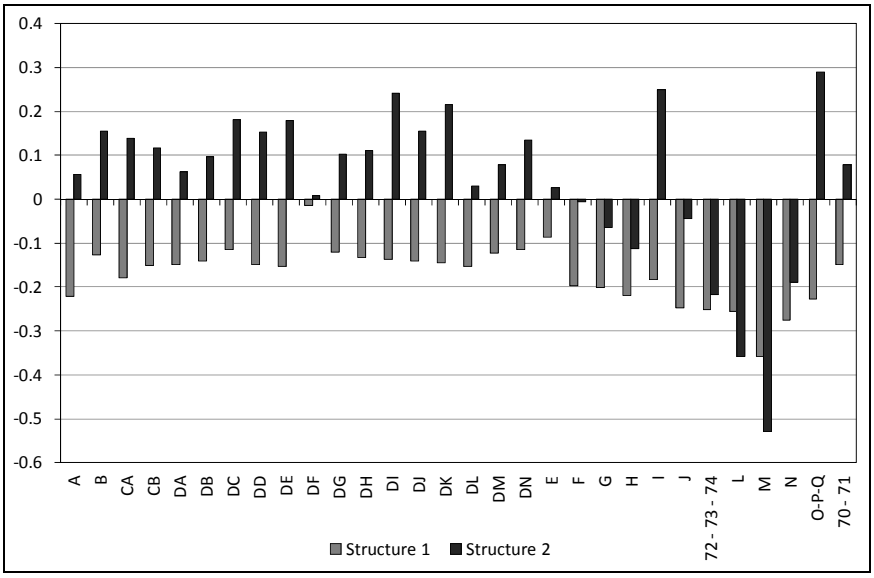
Table 4 Macro-multipliers of the impact of output growth on household incomes

	Value	*%*	*Cum.%*
1	1.465	92.0%	92.0%
2	0.059	3.7%	95.7%
3	0.037	2.3%	98.0%
4	0.028	1.8%	99.8%
5	0.002	0.1%	99.9%
6	0.001	0.1%	100.0%
7	0.000	0.0%	100.0%
8	0.000	0.0%	100.0%
9	0.000	0.0%	100.0%
10	0.000	0.0%	100.0%

The first two structures account for more than 95% of the total multiplicative effect; in other words, considered together they account for the largest part of the total effects.[13] An allocation of royalties according to the shares of the first structure may be viewed as the policy with the maximum impact on incomes, given the module of the vector of initial shocks[14]. Whichever policy represents a linear combination of the first structure with one of the others would reduce the total income increase generated by expenditure.

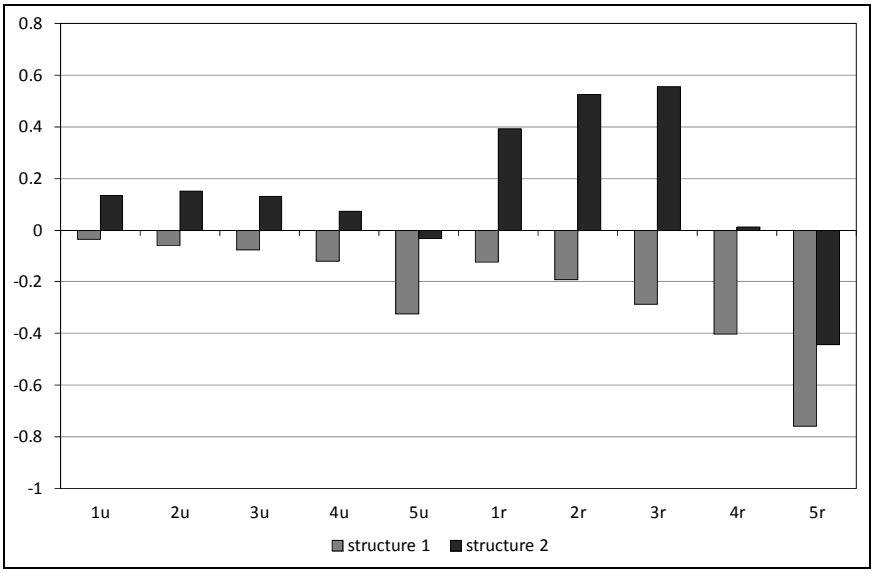
Figure 4 shows the composition of the first two policy structures graphically. Some relevant differences emerge. The first structure has a balanced composition, with more than 50% of exogenous shocks concentrated on building and services (industries on the right side of the graph, starting from letter F), about 40% directed towards manufacturing, and a residual amount directed towards agriculture, forest, and fishing (A and B industries). In contrast, the second structure shows a different composition, with positive shocks towards industrial activities and negative shocks towards most services. The relative role of each industry within the structure is relevant: the second structure represents an exogenous shock with opposite consequences on the output of industry and service activities. A vector with the same absolute values and opposite signs would generate an opposite final impact with the same total multiplier effect (Ciaschini and Socci, 2006).

Figure 4 Unitary vectors of exogenous changes of regional output with maximum impacts on household incomes



The two structures yield opposite distributive effects (Figure 5). An exogenous shock according to the first structure would increase the income of all groups with an evident bias in favour of higher quintiles (both in the urban and in the rural context); conversely, an exogenous shock according to the second endogenous structure would enhance the relative position of households included in the first three quintiles, with a negative impact only on households included in the higher quintile.

Figure 5 Unitary vectors of impacts on household incomes of the two first endogenous structures



Jointly considered, the two graphs clearly outline the structural trade-off between growth and equity implicit in the SAM multiplier matrix (and in the structure of the Basilicata economy). Taking into account all direct, indirect, and induced impacts, the distributive bias could be corrected only by reducing the overall growth of incomes, i.e., if the exogenous shock affecting final demand shows a composition by sector that is a linear combination of the first and the second 'endogenous' structures. A policy aimed at softening adverse (i.e., regressive) impacts of growth on income distribution should combine the 'maximum potential growth' first endogenous structure with the 'equity enhancing' second one. The more weight carried by the latter, the lower the overall final growth of incomes will be, and the better the distributive outcomes.

In the following paragraph, the decomposition of the multiplier matrix proposed above will be used to define hypothetical scenarios in the allocation of royalties, 'optimised' both on the growth and the equity sides.

5 Policy simulations

The aim of policy simulations was to assess the potential long-term impacts of the allocation of royalties at the regional level.[15] Besides the allocation implemented to date (mitigation and compensation measures, POV Plan, and current expenditure of the regional government) the scenarios considered in the analysis also included new investment programmes aimed at transforming the exploited natural assets into produced ones, mirroring the so-called 'Hartwick rule' (Hartwick, 1977) in a perspective of 'weak sustainability' (Mazzanti and Zoboli, 2013). The composition of investments by sector was designed to obtain a suitable compromise between output growth and equity in income distribution, given the current structure of Basilicata's economy. Furthermore, the scenarios mimicked a policy aimed at maintaining a 'variegated product capacity' (Larsen, 2004), excluding strategies of 'unbalanced growth' (Hischmann, 1958). The distribution of investments on a wide range of production activities may also be interpreted as a policy choice aiming at avoiding investments in the so-called 'white elephants', namely, investments in projects with high political but poor economic pay-off (Robinson et al., 2006; Torvik, 2009). As a consequence, the two first 'endogenous' policy structures extracted from the multiplier matrix (see Section 4) were used as a basis for the allocation of royalty expenditure. Indeed, given the average size of direct impacts on the whole productive system, the two structures 'optimise' growth and equity effects, respectively.

Table 5 summarises the policy simulations. The results refer to a ten-year perspective, assuming a constant annual allocation of royalties according to the scenarios described in the Appendix.

Table 5 Policy simulations – ten-year scenarios

	Without increase in exogenous demand			*With increase in exogenous demand*		
	Baseline	*Growth*	*Equity*	*Growth*	*Equity*	*Balanced growth*
Total impact on regional growth						
Annual value added increase (%)	0.51%	0.61%	0.66%	9.20%	4.73%	9.27%
Present value of value-added increases	432,611	518,121	558,296	3,982,935	2,202,308	4,038,017
Present value of royalties	1,004,235	1,004,235	1,004,235	1,004,235	1,004,235	1,004,235
Value-added per euro of royalty	0.43	0.52	0.56	3.97	2.19	4.02
Average annual impact after ten years						
Output (€/€1,000)	797	1,030	1,073	15,884	9,097	15,960
Households' income (€/€1,000)	792	778	811	6,351	3,268	6,396
Labour units (n/€ million)	9	11	12	177	96	178
Distributive impact						
Gini index	26.5	26.5	26.3	27.0	26.5	26.8
% change from Baseline scenario	–	–0.3	–1.1	1.5	–0.6	0.7
Bias						
Equity	0.0	0.0	17.3	72.4	37.7	48.2
Rural	65.6	62.8	76.2	90.9	93.0	94.0
Balance						
Equity	94.2	97.4	82.7	–72.0	55.7	–21.5
Rural	12.5	12.3	1.3	–18.0	–15.0	–17.1

In the simulations, two different exogenous shocks contributed to define alternative scenarios:

1 the expenditure of royalties across the POV plan and other programmes to cope with environmental issues, current regional government expenditure, and Hartwick-style investment programmes

2 the long-term increase on external demand towards domestic industries generated by investments themselves[16].

The first three columns of Table 5 show the short-term impacts of the baseline, status-quo scenario contrasted with two alternative allocations of royalties, including investments 'optimised' to foster output growth and to improve equity in income distribution (growth and equity scenarios, respectively). In the absence of any increase in extra-regional demand, the total impact on regional growth would be small, whatever the use of royalties. The increase in regional value added is less than 1%, compared with the initial

situation. The present value of increases in value added for the whole decade is about half of the present value of allocated royalties. The adoption of the two investment schemes (growth and equity) improves the 'average' performance of expenditure, but without significant differences compared to the baseline. The impact on output, incomes, and labour are of the same magnitude, whatever the assumed scenario.

However, the equity scenario yields a larger impact on growth. This apparently counterintuitive result is simply due to the composition of investments for the supported industries[17]. Indeed, if the investments do not noticeably enhance the competitiveness of regional industries, enabling them to increase their market share in the off-region (national and foreign) markets, the impact would only be generated by the short-term growth of sectors supplying investment goods to the regional industries supported by the investment schemes.

The second three columns show results that the simulation yields assuming that the investment schemes would actually foster the competitiveness of the supported sectors, increasing external demand. An average 0.5%[18] annual increase is hypothesised. As a consequence, the figures reflect the total impact of the allocation of royalties and the cumulative impact of an increased external demand, holding the structure of the economy constant[19].

As expected, the growth scheme shows a better performance in terms of regional output and value added, with impacts that are roughly twice those of the equity scenario. Nonetheless, the adoption of a more redistributive investment strategy also leads to a substantial improvement in the performance of the regional system compared with the baseline: a 4.73% increase in the regional value added would be recorded after ten years, with the average impact of expenditure increased about tenfold.

The scenarios with increase in the extra-regional demand also show differentiated distributive effects. The trade-off between equity in income distribution and growth of the economy is evident in the growth scenario, showing the largest increment on the Gini index (+1.5%). Conversely, the equity scheme is able to reduce inequity (Gini –0.6%). The equity bias clearly shows that the equity scenario is less adverse to the first two quintiles of total population in a distributive perspective (37.7% vs. 72.4% of negative redistributive effects). In the balanced growth scenario, where a substantial part of the budget is allocated with redistributive aims[20], despite a small increase on the Gini index (+0.7%), the equity bias is similar to that in the equity scenario. Indeed, only the growth scenario implies adverse redistributive effects for the households included in the first quintile[21]. In the balanced growth scenario, the targeting of the direct transfers (in the form of a fuel card) seems able to compensate for the adverse redistributive effects of growth on low income households. The positive sign of the balance index in the equity scenario shows that those negatively affected within the target group (the first two quintiles) may be compensated by those positively affected (holding the total available income constant). The redistributive impacts disaggregated across the ten household groups[22] show that the first quintile would account for more than 90% of the positive redistributive impacts in the equity scenario and more than 25% in the balanced growth scenario.

These results seem to suggest that the design of productive investments, as well as a careful targeting of the 'compensative' allocation of the available budget, may enable the policymaker to support economic growth while easing the structural trade-off between growth and equity. The distributive impacts with respect to the rural/urban classification are more controversial. Rural bias and balance show that the relative position of rural

households in the 'distributive game' would be worsened in all scenarios. If investments were effective in increasing the competitiveness of Basilicata's economy, rural households would have to bear more than 90% of the negative redistributive effects. Furthermore, the negative sign of the 'balance' index shows that rural households improving their relative position would not be able to 'compensate' rural losers[23].

6 Concluding remarks

In this paper, a multi-sector, SAM-based model of the Basilicata economy was used to evaluate the socio-economic impact of the allocation of royalties from oil extraction on regional development policies. The analysis included both an *ex post* evaluation of the impact of the overall amount of royalties allocated up to 2010 and an *ex ante* scenario analysis aimed at identifying an 'optimised' allocation of royalties in accordance with relevant policy goals.

The results clearly show that the past allocation into regional policies of the royalties accruing to the regional government (overall, €623 million) generated little impact in terms of economic growth and occupation, well below that expected. Given the structure of the regional economy, a large part of the impact of investment and current expenditure financed with royalties was likely leaked in off-region economies. Overall, the allocation of funds to the current expenditure of the regional government was less likely to increase incomes and employment, but had a better 'redistributive' impact. Conversely, the allocation to 'finalised' expenditure schemes, such as the POV plan – and including both investment expenditure and measures to support incomes and well-being in the oilfield area – showed a larger multiplier effect on incomes and employment, but also less desirable redistributive effects.

These results, together with the macroeconomic indicators presented in Section 2, clearly show that the Basilicata's economy is at risk for the 'resource curse'. The opacity itself in the allocation of royalties is a clue of an inefficient and policy-distorted use of such a remarkable amount of additional financial resources. A formal documentation of the allocation of royalties was available only for one third of the revenues from oilfield exploitation received by the Basilicata region from 1997 to 2010. In the public debate on local mass media, rumours are frequent regarding an allocation of fiscal windfalls according to a policy of short-term social support; for example, supporting employment in low-productivity sectors (such as forest management).

As a consequence, a complete revision of the royalty allocation strategy should be undertaken. The current economic downturn and the substantial cuts in budget transfers from the national to the regional government are a strong incentive towards allocating revenue to short-term goals. Nonetheless, an increased focus on the longer-term horizon cannot be postponed. In Section 5, a scenario analysis was proposed to assess the potential impact that a revised policy for the allocation of royalties might yield within a ten-year period. Alternative 'packages' in the allocation of royalties were defined adopting a 'weak sustainability' approach. First of all, a larger part of the royalties was dedicated to investments aiming at compensating the depletion of a non-renewable natural resource with produced assets likely to increase the competitiveness of non-oil domestic sectors and the export base of the regional development (mimicking the 'Hartwick rule'). Second, the composition of investments was spread among the whole productive structure of the regional economy, to better represent a 'real world' policy

approach, as suggested by Mazzanti and Zoboli (2013), in the use of revenue from natural resource taxation at the regional level. Finally, the investments were 'optimised', according to the structure of the regional economy, to foster the short-run impact on policy objectives desirable in a context of lagging regional development and macroeconomic downturn, such as economic growth or equity in the distribution of income. The promotion of a feasible compromise between growth and equity adds a 'socio-economic' dimension to the concept of sustainability driving the analysis.

The main results of the scenario analysis suggest that, despite a significant amount of additional financial resources from royalties (on average about 3% of the Basilicata region's annual current expenditure), an appreciable impact on incomes and occupation will not be forthcoming unless resources are redirected towards supporting an increase in the competitiveness of the regional economic system.

Both structural analysis and simulations suggest that exogenous demand has a strategic role to play in fostering regional growth. Financing of the regional budget alone, although likely to generate progressive distributive effects, would not yield an appreciable impact on economic growth. If the allocation of royalties was able to support a modest but stable growth rate in the exogenous (off-region) demand supplied by regional industries, the total impact on incomes and occupation would be of a higher magnitude compared with the mere short-term impacts of royalty expenditure. The allocation of royalties should favour investments aimed at increasing the competitiveness of firms in off-region markets, attracting foreign (national and international) direct investment, strengthening industrial interdependencies within the regional system, and supporting the development of industrial clusters (Porter, 1998, 2003).

The analysis provides further policy suggestions with regard to distributive issues. A structural trade-off between economic growth and distributive equity exists and should be taken into account in designing regional policies. But when the financed investments are effective in fostering the competitiveness of regional firms, a careful targeting of industries to support may reduce the equity bias by itself. Moreover, the abundant availability of additional financial resources may facilitate the design of 'compensative' measures (such as transfers towards specific social groups) to further soften the main adverse redistributive effects.

The analysis shows the suitability of the SAM framework in the study of regional development processes. The availability of a regional SAM allows the researcher to ground impact estimates on a coherent macroeconomic framework. Moreover, the disaggregation of accounts in the input-output and institutional components of the economic system can support the design of sector-specific regional policies. This paper also shows that a highly disaggregated regional SAM can be estimated for Italian regions, building on official estimates of regional accounts and readily available microeconomic sources of information.

The main limitation of the analysis lies in the static nature of the model. The simulations were performed by simply pre-multiplying the matrix of SAM multipliers with vectors of exogenous shocks representing the different scenarios. This limitation is probably more relevant for the ten-year perspective policy scenarios with increase in off-region demand. The proposed simulations do not include any dynamic effects on the structure of the regional economy. Conversely, a successful investment scheme would likely trigger a permanent change in the regional productive system, with cumulative effects on regional competitiveness. Such structural dynamics may generate a supply-side stimulus to the regional economy to be added to the demand-side stimulus considered in

the proposed model. The expansion of the export base through the exploitation of a region-specific resource, as the case of oil extraction in the Basilicata region, may affect the marginal multiplier effect according to the nature of the stimulus directed toward the traded sector (Swales, 2005). Furthermore, in an open, regional economy, a supply-side stimulus for the competitiveness of the non-oil export sector may lead to complex effects on growth and employment in the short run, mainly owing to feedback via the other regions' economies (Ha and Swales, 2012). Further developments of the analysis should address these analytical issues, first of all by designing a complete regional disaggregation of the SAM accounts between Basilicata and the rest of Italian economy. Also, a bi-regional model would probably improve the quality of results in a static framework of analysis. A dynamic approach to modelling, however, would be necessary to extend the policy lessons that may be learned from the case study to a long-run perspective.

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Appendix

Data and methods

A SAM is a representation of the circular flow within an exchange economy in a matrix form. While an input-output matrix captures only interdependencies between sectors in a disaggregated production account, a SAM accounts for the interrelationships among production activities, production factors, income, consumptions, and capital formation.

A SAM is a square table. Each row of the SAM matrix shows the receipts for a specific sector of the economy (production activity, factor of production, institution) while the corresponding column lists the sector expenditure. Being a double-entry accounting system, the totals of corresponding rows and columns must equal. The economic meaning of this balance is:

a costs must be equal to revenues in each production sector

b expenditure must be equal to income for each institutional actor

c total saving must be equal to total investments plus financial capital accumulation.

The 'core' of the SAM used in this study is the supply-use table of Basilicata's economy produced by the Regional Institute for Economic Planning of Tuscany (Irpet, http://www.irpet.it). The input-output table was integrated with disaggregated flows accounting for primary and secondary income distribution; the information used was mainly based on the official estimates of regional accounts and household disposable incomes annually produced by the Italian National Bureau of Statistics (Istat). Three sources of microeconomic information were used in disaggregating the account for the household institutional sector: two surveys on household budgets (Istat, 2011; Bank of Italy, 2012) and the sample from the European Survey on Incomes and Living Conditions (EUSILC; Istat, 2006)[24].

The final SAM refers to the year 2006. The structure of the matrix includes 141 accounts with flows divided into 37 blocks. The household sector is divided into ten groups: households are classified into five income quintiles and each quintile is divided into two subgroups according to urban/rural residence[25].

Because the economic system in this study is small and regional and the simulation was performed static, we have adopted a standard closure of the model with the 'government', 'rest of the world', and 'capital formation' accounts as exogenous. For descriptive purposes, the endogenous accounts can be divided into four sets: 88 accounts for the input-output block (58 commodities plus 30 industries), eight value-added distribution accounts, 23 accounts for institutions (12 private consumption accounts and 11 collective consumption accounts), and 13 accounts for institutional sectors (ten households groups plus three firms groups). The structure of the matrix of accounting coefficients is represented below:

$$\mathbf{B} = \begin{bmatrix} \mathbf{A} & & \mathbf{C} & \\ \mathbf{F} & & & \\ & & & \mathbf{E} \\ & \mathbf{H} & & \mathbf{T} \end{bmatrix}$$

where $\mathbf{A}_{(88\times88)}$ is the matrix of input-output coefficients, $\mathbf{F}_{(8\times88)}$ is the matrix of coefficients for primary income distribution to production factors, $\mathbf{H}_{(13\times8)}$ is the matrix of coefficients of factor earnings to institutions, $\mathbf{C}_{(88\times23)}$ is the matrix of average composition of consumption functions in terms of commodities, $\mathbf{E}_{(13\times23)}$ is the matrix of average expenditure propensities of institutions, and $\mathbf{H}_{(13\times13)}$ is the matrix of transactions among institutions; those remaining are zero blocks. The matrix **M** of SAM multipliers has been derived by solving the usual linear model.

$$\mathbf{y} = \mathbf{B}\mathbf{y} + \mathbf{x} \tag{1}$$

where **y** is the vector of totals for endogenous accounts and **x** is the vector of exogenous inflows from exogenous accounts. The matrix $\mathbf{M} = (\mathbf{I} - \mathbf{B})^{-1}$ of multipliers is obtained solving the system in the vector **y**.

Each entry m_{ij} of the **M** matrix quantifies the increase of totals for account *i* generated by a unitary exogenous injection on account *j*. In a SAM-based model, multipliers are *Keynesian*, including further effects due to the income distribution – final consumption secondary loop within the circular flow of the economy, in addition to the effect of inter-industry interdependencies.

The matrix of SAM multipliers may be used as a basis for simulations as follows:

$$d\mathbf{y} = \mathbf{M}d\mathbf{x} \tag{2}$$

where $d\mathbf{x}$ is a vector of changes in exogenous injections, representing a given scenario.

Two particular transformations of the **M** matrix were carried out to support analysis. The first one accounts for *redistributive effects* among household groups, according to the definition proposed by Roland-Host and Sancho (1992):

$$\mathbf{R}_h = \left[\mathbf{I} - \hat{\mathbf{y}}_h \mathbf{i}'\right]\mathbf{M}_h \tag{3}$$

where $\mathbf{R}_h$ is the $(n \times m)$ redistribution matrix, $\hat{\mathbf{y}}_h = \mathbf{y}_h(\mathbf{i}'\mathbf{y}_h)^{-1}$ is a normalised measure of income shares accruing to the *n* household groups represented in the SAM, **i** is a unit vector, and M_h is the $(n \times m)$ submatrix of **M** corresponding to household income multipliers for *m* different exogenous shocks on the final demand directed towards the *m* industries of Basilicata's economy. The impact of an exogenous shock is represented as a redistributive zero-sum game among different socio-economic groups. The matrix $\mathbf{R}_h$ includes positive and negative elements (with column totals equal to 0) showing the changes of income that each household group would perform if only the redistributive effects of exogenous impacts were taken into account, excluding output/income changes due to the multiplier effect.

A matrix $\mathbf{R}_h^*$ of redistribution *shares* was obtained by dividing each element of $\mathbf{R}_h$ by the sum of absolute values of the relevant column[26]. Two summary indicators of redistributive effects were calculated based on matrix $\mathbf{R}_h^*$. Let $T \in H$ be the target sub-group of households among the *H* household groups represented in matrix $\mathbf{R}_h^*$. For a given column *j* of the matrix we define:

$$\text{Distributive balance} = \text{DBI} = \frac{\sum_{i\in T} r^*_{ij}}{0.5 * \sum_{i\in H} \left| r^*_{ij} \right|} \tag{4}$$

$$\text{Distributive bias} = \text{DBs} = \frac{\sum_{i \in T} |r^*_{ij}|}{\sum_{i \in H} |r^*_{ij}|} \left[f \text{ or } r^*_{ij} < 0 \right] \tag{5}$$

The balance indicator shows how gains and losses offset each other across household groups included in a given target, while the bias focusing only on negatively affected groups, provides a measure of concentration of losses. In the present study, these indicators were computed with reference to two targeting groups: 'equity' indicators refer to the first two poorest quintiles of total population (irrespective of rural or urban residence) and 'rural' indicators refer to all rural households (irrespective of income quintile).

To support the analysis of optimal policy scenarios, a singular value decomposition of the $\mathbf{M}_h$ matrix was also performed (Ciaschini and Socci, 2006, 2007). With this decomposition, we can identify a set of 'endogenous' policy profiles (i.e., vectors of exogenous inflow), the corresponding profiles of policy outcomes (i.e., vectors of impact on household incomes), and a vector of 'macro multipliers' that represents the total multiplicative effects associated with each couple policy profile – policy outcome:

$$\mathbf{M}_h = \mathbf{USV}' \tag{6}$$

where

$\mathbf{U}_{(n \times n)}$ $[\mathbf{u}_1, \mathbf{u}_2, ..., \mathbf{u}_n]$ is the system of the first n eigenvectors of the square matrix $\mathbf{M}'_h\mathbf{M}_h$

$\mathbf{V}_{(m \times n)}$ $[\mathbf{v}_1, \mathbf{v}_2, ..., \mathbf{v}_n]$ is the system of eigenvectors of the square matrix $\mathbf{M}_h\mathbf{M}'_h$

$\mathbf{S}_{(n \times n)}$ diag($\mathbf{s}$) is the diagonal matrix of macro multipliers, i.e., the square roots of the n non-zero common eigen values of the two square matrices.

According to equation (6), the matrix $\mathbf{M}_h$ can be decomposed into n (with $n < m$) additive components whose 'impact scales' are equal to macro multipliers:

$$\mathbf{M}_h = s_1\mathbf{u}_1\mathbf{v}'_1 + s_2\mathbf{u}_2\mathbf{v}'_2 + \ldots + s_n\mathbf{u}_n\mathbf{v}'_n \tag{7}$$

In the components of equation (7) each endogenous (unitary) 'policy structure' $\mathbf{v}_i$ is mapped to affect income distribution among n household groups by the vector of endogenous (unitary) 'policy outcomes' $\mathbf{u}_i$, with the scalar s_i summarising the multiplicative effect of the policy. The n 'structures' are ordered by decreasing values of the macro-multipliers s_i; i.e., the sum of the first k terms in the right side of the equation (7) gives the $(n \times m)$ matrix of rank k that is the best approximation of the original matrix $\mathbf{M}_h$ [Krzanowski, (1988), p.126].

In carrying out the simulations, four scenarios of allocation of royalties were defined. An annual budget equal to the average of years 2008–2010 was allocated (€82.4 million/year). All policy scenarios hypothesise a follow-up of the POV plan funded with the same share of total resources as well as the same allocation of funds as in the 1996–2010 periods. Furthermore, an additional 3% of total revenues from oil extraction (€35.3 million/year) were distributed among households as a 'voucher' for the purchase of fuel (fuel card).

A baseline scenario was defined assuming that the residual budget after financing 'dedicated' programmes (POV plan and the fuel card) was allocated as in the past years to finance the regional government's current expenditure.

Conversely, in the following three alternative policy scenarios, the remaining part of the total available budget was equally allocated to finance the current regional expenditure and investment programmes 'optimised' according to different policy goals:

- *Growth scenario:* Investment expenditures in production activities more likely to foster growth: the available budget for investments is shared among industries in proportion to the shares of the first 'endogenous' policy structure (Figure 3); the fuel card budget is distributed among all households, proportionate to the number of household members of age[27].
- *Equity scenario:* Investment expenditures into production activities more likely to foster equity: the available budget for investments is subdivided among industries, proportionate with the positive shares of the second 'endogenous' policy structure (Figure 3); the fuel card budget is distributed among households included in the first quintile, proportionate to the number of household members of age.
- *Balanced growth scenario:* Investment expenditures into production activities more likely to foster growth: the available budget for investments is subdivided among industries, proportionate to the shares of the first 'endogenous' policy structure (Figure 3); the fuel card budget is distributed among households included in the first quintile, proportionate to the number of household members of age.

Notes

1 An expression referring to the decline of the manufacturing activities observed in the Netherlands after the discovery of a large reservoir of natural gas at the end of the '50s.

2 ENI is an Italian multinational oil and gas company.

3 Not yet implemented.

4 Excluding islands; the regions bordering with Basilicata are Campania, Abruzzi, Molise, Calabria, and Puglia.

5 The index is calculated by Istat as the percentage of total population living with a per-capita expenditure lower than the national average.

6 In the starting years of the economic downturn (2007–2009), due to the spike in the oil price in the world market, the revenues from royalties reached their maximum level since the beginning of extractions, remaining above €100 million per year; see Table 1 below.

7 Details on the model are provided in the Appendix.

8 Environmental policy carried out at the regional level is likely to use taxation on revenues from non-renewable natural resources to compensate for the external costs, rather than reducing the external costs themselves (Mazzanti and Zoboli, 2013).

9 Coefficients can be downloaded from the website, http://www.istat.it/it/archivio/30440.

10 Indeed, the total estimated impact accounts for direct, indirect, and induced effects with a constant economic structure; the dynamic effects of investments funded by the royalties on the regional economic performance are not considered.

11 Details on the calculation of distributive indicators can be found in the Appendix.

12 The sub-matrix is a 10 (household groups) by 30 (industries) block of the M multiplier matrix.

13 More precisely, the first two terms on the right side of equation (7) in the Appendix would approximate the original matrix of multipliers, accounting for 95% of total multiplicative effects. Details on the interpretation of macro-multipliers can be found in the Appendix.

14 The module can be considered as a measure of the average exogenous impact on demand for all industries in the economy.

15 Details on the design of the policy scenario can be found in the Appendix.

16 Such a stylisation of long-term impacts implies that investments made are able to enhance the competitiveness of domestic industries through the qualification of output or the reduction of transaction costs to access external markets. Investments may also provide a supply-side stimulus to export through a reduction in the output price of the export sector, but also result in complex effects on overall regional growth (Ha and Swales, 2012). Supply-side effects were not included in the simulations.

17 Investment expenditures were modelled according to shares in the capital formation account in the SAM.

18 In the simulation, the exogenous increase of the output of supported activities was differentiated according to their share in the allocation of royalties. The greater the investments in the sector, the more an increase in the extra-region demand were found.

19 Despite its long-term perspective, the simulation exercise is not a dynamic one. The capital account is exogenous to the model and no impacts on SAM input-output coefficients are hypothesised as a consequence of investments.

20 In this scenario, 30% of royalties' revenue was distributed as a voucher for fuel purchase to households included in the first income quintile of the total population. More details on the hypothesised policy scenarios can be found in the Appendix.

21 Result not included in the table.

22 Not included in the table.

23 Note that the redistributive effects directed towards the rural population may differ in a dynamic context of the analysis, according to the territorial pattern shown by the structural economic dynamics.

24 Information on the Italian sample can be found at the website http://www.istat.it/it/archivio/4152, while the European survey is available at the website http://epp.eurostat.ec.europa.eu/portal/page/portal/microdata/eu_silc.

25 Details on the construction of the SAM can be found in Ditec (2011).

26 In matrix notation this is given by $\mathbf{R}_h^* = \mathbf{R}_h(|\,\mathbf{R}_h\mathbf{i}\,|\,2)^{-1}$.

27 The 'fuel card' was modelled as an exogenous increase of household income.