The socioeconomic impact derived from the oil royalty allocation on regional development

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Summary

The aim of this work was to assess the socioeconomic impact derived from the oil royalty allocation on regional development, using a multi-sector model based on a Social Accounting Matrix (SAM), appropriately implemented for Basilicata region (Italy), the typical case of a region lagging behind in a developed economy. Our focus was on how political decisions have influenced the economic development of the region and how a different set of choices can be more effective in transforming public receipts into long-term benefits. Results clearly show that in the past the allocation of oil royalties to the regional government (as a whole €990 million) generated a much lower impact than expected, in terms of economic growth and employment. Given the structure of the regional economy, much of the impact of investments and running expenses financed by royalties has maybe been lost outside the regional boundaries. A greater effect on income and employment will not be possible unless resources are re-directed towards greater competitiveness of the regional economic system. Better balancing the use of royalties between social expenditure and production investments would probably be the first step towards a strategy of sustainable development of the regional economy.

Keywords: social accounting matrix, multi-sector models, natural resource curse, regional development, oil allocation

JEL Classification codes: E16 – Q01 – Q35 – R15 – R58

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1. INTRODUCTION

The countries and regions that use a new natural resource, such as, for example, an oil deposit, usually see an increase in their financial resources due to the benefits (both direct and indirect) deriving from oil drilling. Their ability in managing these additional resources in a sustainable way influences the future of their entire economy. According to the *big push theory* (Rosenstein-Rodan, 1943; Hirschman, 1958), the new source of income should lead to increase public investments, promote growth and result in long-term economic development. However, empirical evidence reveals a negative correlation between the abundance of resources and economic growth, known as *natural resource curse* (Sanchs and Warner, 2001). Different studies, concerning not only economic but also political and social aspects, have provided different possible explanations of this phenomenon (Larsen 2006; Torvik, 2009; Van der Ploeg, 2011). Two main factors seem to cause of the natural resource curse: (i) the implementation of non-sustainable macroeconomic policies by governments, due to the abundance of resources (Atkinsons and Hamilton, 2003), and (ii) the intrinsic volatility of the international market of non-renewable resources (Van der Ploeg, 2011).

The planning and implementation of effective policies to contrast this process is a challenge for governments, not an easy one, especially in developing countries; typical examples are Chad and Brazil where, despite the huge financial re-sources derived from oil royalties, the living standard of populations has not improved accordingly (Keenan, 2005; Pegg, 2005; Caselli and Michaels, 2013).

Different studies suggest that the appropriate policy to prevent the curse in developing countries is based on the allocation of the financial resources derived from oil-related activities towards policies aimed at promoting productivity, competitiveness and well-being improvement (Levy, 2006; Breisenger et al., 2010; Rocchi et al., 2014).

It is worth noting that developing countries are not the unique countries involved by this curse, which may also influence, to a different extent, the regions lagging behind in developed economies that start to exploit a new natural resource, such as, for example, oil fields (Rocchi et al., 2014). The negative impact in these cases seems to be mostly due to the following: (i) the opening of the regional economy would result in the loss of most effects derived from the expenditure of royalties out of the regional boundaries; (ii) the sudden increase in the export base may conceal the lack of competitiveness of the regional non-oil exporting sectors in relation to the rest of the country, reducing the investments required to improve their competitiveness; (iii) part of oil royalties are used in short-term local redistribution policies aimed at reducing the negative effect of the regional economic gap (including unemployment and poverty), but are ineffective in improving the competitiveness of the regional system in the long run. Lastly, if the allocation of these financial resources is not implemented with due appropriateness and transparency, the entailed risks are bribery or rent-seeking behaviours.

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To prevent these adverse effects and favour the highest possible outfalls on the areas involved by financial investments based on the use of royalties, the priority for decision-makers is to better focus on the strategic objectives to promote long-term sustainable socioeconomic development, while compensating for the deployment in environmental assets resulting from the exploitation of a non-renewable resource.

The possibility of setting out regional policies, assessing the impact on the main socioeconomic indicators at the local level, monitoring the effectiveness over time, is largely dependent on the availability of an adequate territorial information system that should be complete, relevant and coherent both internally and with the national framework (Carbonaro et al., 2001). Different authors (Stone, 1961; Seers, 1970, 1972) maintain that the most suitable statistical tool, in terms of information bases and economic model, is the Social Accounting Matrix (SAM). As a matter of fact, it can include a regional dimension enabling to analyse different economic and fiscal policies within the same country, notably when large internal differences coexist (Thorbecke, 1985).

The aim of this work is to assess the socioeconomic impact derived from the allocation of oil royalties on the regional development, using a multi-sector model based on a two-region SAM, specially tailored to Basilicata region, a typical example of a region lagging behind in a developed economy.

2. MATERIALS AND METHODS

2.1. Case study: Basilicata region

The Basilicata region is the typical case of a region lagging behind the rest of the national economy. Despite the presence - in its territory - of the largest onshore oil field in Europe, Basilicata's economy shows strong difficulties compared with the rest of the country, with a poverty index more than double the national average (Istat, 2014).

When oil fields were discovered in the Agri valley (in the south-western part of the region) in the early '90s, they were considered as an important opportunity for the regional economy. The oil regional industry currently produces about 16,137 ton/d of crude oil: in 2013 the production was about 5.48 million tons, i.e. 9.3% of the gross national domestic consumption and about 71.7% of Italy's total crude oil production (Ministero dello Sviluppo Economico, 2014). There are indeed good opportunities for the regional economic development (in addition to the direct impact on employment) in the form of royalties. Under the agreement between the State and oil drilling companies, above a given (small) output threshold, the companies must give 7% of their earnings to the regions in the form of royalties and an additional 3% for safety and environmental monitoring (Ministero dello Sviluppo Economico, 2014). This has meant that between the start of drilling in 1997 and the end of 2013, the regional balance has matured over €990 million earnings from oil. Moreover, a recent national regulation (N° 99/2009) allocates an additional 3% of earnings the households living in Basilicata as vouchers to purchase fuel (fuel card).

Surprisingly, oil earnings have not had a great impact on the local economy, despite the development of the extraction industry and the huge quantity of additional financial resources channeled into regional development policies. According to recent empirical studies, the Basilicata Economy didn't show an increase in its competitiveness after the starting of oil exploitation (Florestano, 2013; Iacono, 2015). Figure 1 shows that the regional GDP grew quite steadily till 2008, when it experienced a decline - partly due to the overall economic recession - resulting in a decrease of employment to 195 thousand labour units recorded in 2012. In

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accordance with the national trend, the unemployment rate has increased starting from 2007 till 16% in 2013 (Istat, 2014).

Figure 1: GDP (M€) and labour unit (K)
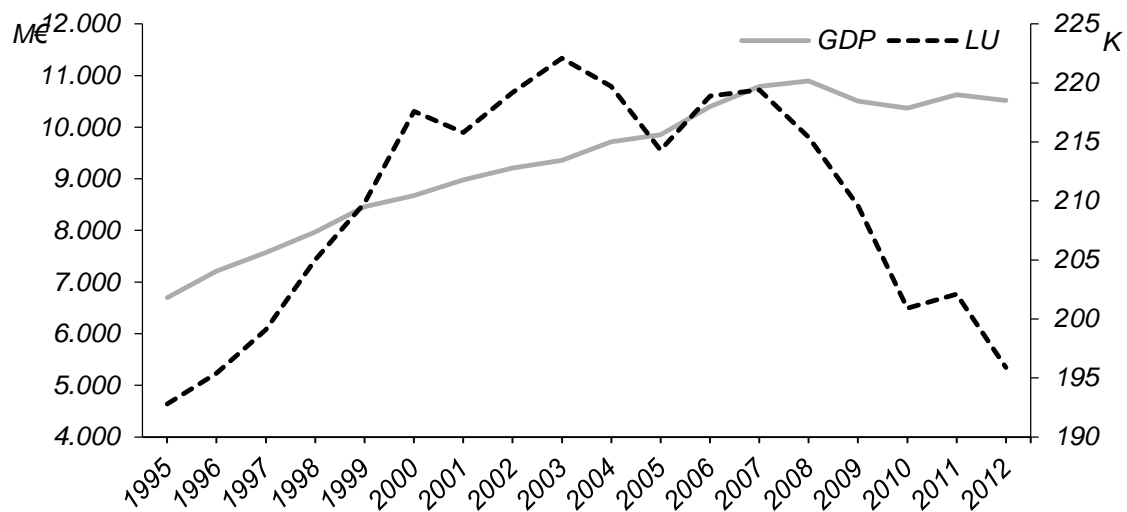
This results in a loss of competitiveness, in terms of labour productivity (Figure 2). While the average productivity of the other southern Italy regions has slightly decreased, between 1995 and 2009 the Basilicata region has seen a considerable decline: although the regional employment till 2003 has grown more rapidly than in the neighbouring regions, this has not resulted in a substantial increase in terms of productivity.

Figure 2: GDP per labour unit - ratio between different areas
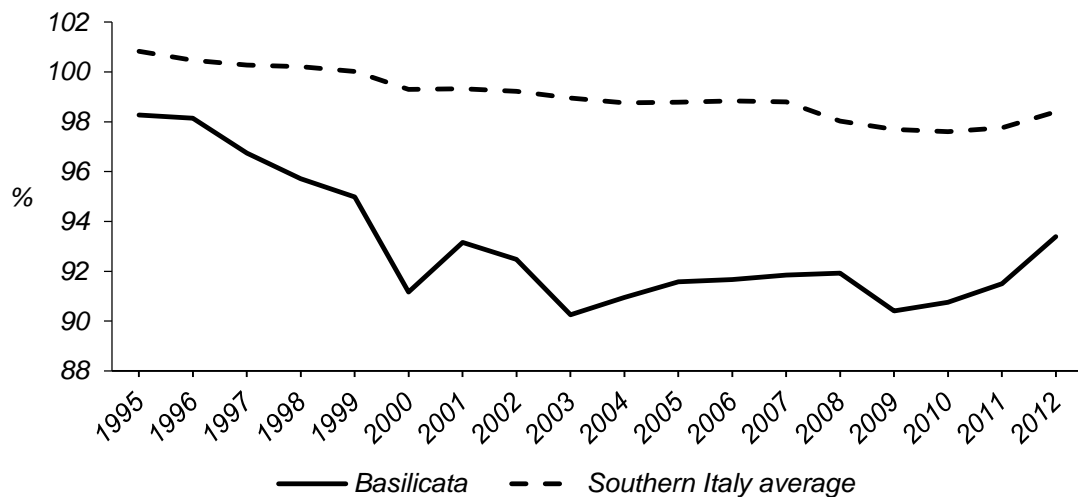
It is evident that oil exploitation has not generated the expected benefits according to the big push theory, due maybe to all of the causes that contribute to explain the so-called natural resource curse (Van der Ploeg, 2011). It is thus crucial to understand how resources are allocated, and to assess their impact on the socioeconomic system for trying to provide an explanation of the current situation.

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2.2. SAM: a two-region model

A model based on a SAM has been used to assess the impact of the allocation of the oil royalties earned by Basilicata region since the start of drilling till now. The SAM (Pyatt 1991a, 1991b, 1994a, 1994b, 1999; Pyatt and Round 1977, 1985) is a two-entry matrix that records the flows occurring between all actors of an economic system, in a given place and for a given time period (usually one year). Each row/column pair represents respectively the inflows and outflows of a given account, so that by definition the matrix is balanced (the row totals equal the column totals). It may be considered as an expansion or a generalization of Leontief's input-output table (1936). While in the latter, emphasis is laid on the production system, in the SAM the perspective is larger. The simultaneous representation of the accounts of production activities, production factors, institutions (households, businesses, and public administration), capital formation and exchanges with the rest of the world makes it possible to follow the formation of value-added and its distribution and redistribution in the form of income to the institutions.

The utilization of SAMs in the analysis of development is by now a well-established branch of the economic literature (Stone, 1961; Pyatt and Round, 1977, 1985; Pyatt, 1991a, 1991b, 1994a, 1994b, 1999; Round, 2003; Miller and Blair, 2009). Applications refer both to developed and developing economies, because it is not only an important tool to improve the consistency of national accounting estimates (United Nations et al., 1993), but also the first step for the calibration of impact simulation multi-sector models, both linear and computable general equilibrium ones (Pyatt, 1988). Through the implementation of a linear model based on the calculation of multipliers (Miller and Blair, 2009), it is possible to calculate the impact that variables have on the economic system. Endogenous accounts normally include the institutional sectors of households and firms; the unique accounts that are considered, either alternatively or simultaneously, exogenous to the model are those of Government, of the rest of the world and the capital account. Deciding which and how many of these three accounts are exogenous means establishing the "closing rule" of the model based on the SAM (Miller and Blair, 2009).

The SAM used in this study is a two-regions matrix referred to 2010, in which the existing flows between Basilicata region and the rest of Italy are represented with a high level of detail. The structure of the matrix includes 301 accounts, subdivided into 37 production activities, 54 production factors, 3 institutions (households, businesses and Government). The household sector is subdivided by income deciles into ten groups, whereas the Government is distinguished as local and central. There are of course also the accounts entitled to the capital formation and to the rest of the world.

The advantage of a two-region model lies in the possibility of considering the rest of Italy as being endogenous to the model; this makes it possible to break down impacts and estimate not only the total but also the intraregional and interregional ones (spillovers and feedbacks).

In the present study, for the analysis of the impacts derived from the use of oil royalties considered as exogenous shocks to the regional economy, a static analysis has been carried out, considering a closure of the model with respect to the Government, capital formation and rest of the world: the estimated multipliers take thus the meaning of Leontevian-Keynesian multipliers.

The structure of the block matrix of accounting coefficients of the two-region model is shown below (Miller and Blair, 2009):

$$A = \begin{bmatrix} A^{rr} & A^{rs} \\ A^{sr} & A^{ss} \end{bmatrix}$$

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where r = Basilicata region and s = rest of Italy.

By solving the linear system $x = Ax + f$ (where x is the vector of totals of endogenous accounts and f is the vector of exogenous account flows) for x you have:

$$x = (I - A)^{-1} f$$

where $M = (I - A)^{-1}$ is the matrix of SAM multipliers.

Each coefficient m_{ij} quantifies the total increase for each account i generated by a unit exogenous shock on the account j.

While the matrix of multipliers M enables the estimate of the total impact, the breakdown of the matrix of accounting coefficients A into intraregional $\begin{bmatrix} A^{rr} & 0 \\ 0 & A^{ss} \end{bmatrix}$ and interregional elements $\begin{bmatrix} 0 & A^{rs} \\ A^{sr} & 0 \end{bmatrix}$ enables to estimate (Round, 1985, 2001; Dietzenbacher, 2002; Miller and Blair, 2009) the following:

- *Intraregional effects*: $M_1 = (I - \tilde{A})^{-1}$

where $\tilde{A} = \begin{bmatrix} A^{rr} & 0 \\ 0 & A^{ss} \end{bmatrix}$;

- *Interregional spillover effects*: $M_2 = I + A^*$

where $A^* = (I - \tilde{A})^{-1}(A - \tilde{A})$;

- *Interregional feedback effects*: $M_3 = [I - (A^*)^2]^{-1}$

Let us consider the intraregional sub-matrix A^{rr} and the blocks constituting it:

$$A^{rr} = \begin{bmatrix} B & 0 & C \\ V & 0 & 0 \\ 0 & Y & H \end{bmatrix}$$

where B is the matrix of inter-industry technical coefficients, C is the matrix of endogenous final expenditure coefficients, V is the matrix of endogenous value-added factors shares, Y is the matrix of endogenous coefficients distributing income to institutions and H is the matrix of endogenous coefficients for income re-distribution among institutions. The intraregional effect of impacts may in turn be broken down as follows (Miller and Blair 2009):

- *Regional direct effect*: $M_1^{rr} = (I - Q)^{-1}$

where $Q = \begin{bmatrix} B & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & H \end{bmatrix}$

- *Regional indirect effect*: $M_2^{rr} = I + T$

where $T = (I - Q)^{-1}R, R = \begin{bmatrix} 0 & 0 & C \\ V & 0 & 0 \\ 0 & Y & 0 \end{bmatrix}$;

- *Regional feedback effect*: $M_3^{rr} = (I - T^2)^{-1}$

Once the multipliers required for the analysis are calculated and the vector of shocks df defined, it will be possible to define the vector of impacts dx as follows:

$$dx = Mdf$$

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In the present study the vector of shocks is made up of the current and capital expenditures of the oil royalties according to different scenarios.

2.2.1. *The vectors of exogenous shocks: allocation of oil royalties*

The available information on the allocation (or distribution) of royalties earnings among different uses is summarised in Table 1, where the total amount is disaggregated by year and action. For most receipts it has been impossible to allocate expenses by specific political actions. About the three quarters of total expenditure (over €723 million) have been just used to fund running expenses of Basilicata region (itemized as *"other actions"*).

Table 1. Allocation of royalties by action (M€)

Year	POV[1]	Other actions	Natural gas distribution network	Environmental monitoring	Environmental compensation	Total
1997	0	0.43	0	0	0	0.43
1998	0	2.25	0	0	0	2.25
1999	0	1.24	0	0	0	1.24
2000	0	3.17	0	5.01	11.02	19.20
2001	0	8.04	1.03	0	5.58	14.65
2002	0	10.04	0	0	0	10.04
2003	0	24.05	0	0	5.60	29.65
2004	4.89	30.31	7.00	0	5.61	47.81
2005	6.23	32.80	0	0	5.62	44.63
2006	17.26	61.84	0	0	5.68	84.78
2007	23.98	72.57	17.79	0	5.67	120.02
2008	31.39	71.30	0	0	0	102.69
2009	22.10	79.47	0	0	3.10	104.67
2010	26.10	28.15	0	0	0	54.25
2011	25.88	59.21	0	0	0	85.09
2012	12.04	111.58	0	0	0	123.62
2013	17.82	127.49	0	0	0	145.31
Total	187.67	723.94	25.82	5.01	47.88	990.31

[1] POV Piano Operativo Val d'Agri

The remainder has been shared among various initiatives mostly designed towards the mitigation and compensation of adverse effects derived from the oil mining industry. The environmental issues involved in the exploitation of the major inshore oil source in Europe are obviously very important. The location of oil fields influences high nature value areas, which have a considerable potential for the development of tourism and agricultural activities. Moreover, the mining plants and the distribution pipelines of the existing processing plants on the coast concern an area that stores the major water resource for southern Italy. For this reason, the regional government has decided to mitigate the possible negative impacts by setting up a system for the monitoring and compensation of the areas directly affected by oil drilling operations.

One of the most important actions funded by royalties is the Piano Operativo Val d'Agri (POV), an expenditure operating plan aimed at promoting economic development and the improvement of life quality in the area neighboring the oil fields. The POV is structured into four pillars related to the enhancement of local resources, the improvement of infrastructures, the improvement of life quality and of the local production supporting systems. The POV includes both current expenditures and investments.

To calculate the total impact of the use of royalties in the time period under study, all these expenditure flows have been considered as an exogenous shock directed towards the regional economy and reclassified based on the disaggregation of accounts in the SAM. While in the case of allocation towards specific actions there have been no problems in identifying the accounts on which they are directed, the expenses concerning

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other actions, in the basic simulation, have been considered as an exogenous increase of the local public administration expenditure and have been distributed as inputs towards the endogenous accounts, based on the current expenditure coefficients of the regional administration included in the SAM.

Moreover, the analysis also takes into account the shares for the fuel card supplied so far[1]. These shares have been considered as an exogenous increase in income of the households living in the region, according to a distribution based on what is declared by the Ministry of Economic Development (2014) (Table 2).

Table 2. Amounts concerning the supply of the *fuel card*

Year	Amounts (M€)	n° beneficiaries
2009	32.22	320,000
2010	44.88	320,000

Since the envisaged uses refer to different years, the values have been converted into 2013 Euros (Istat, 2014). In this way it was possible to conduct an ex-post analysis of the total impacts derived from the total expenditure of royalties till now, based on their actual use.

Moreover, to provide helpful indications on the possible effects of an alternative use of the financial resources derived from mining, the four following simulations have been made that assume a different use of the shares allocated to other actions:

1. Increase in current consumption for public administration (scenario I);
2. Increase in the current consumption of public administration and in transfers to households (scenario II);
3. Funding of current activities of private enterprises (scenario III);
4. Funding of investments of private enterprises (scenario IV).

3. RESULTS

If considering the total impact derived from the use of royalties since the beginning of drillings till now (Table 3), it results clearly - in this case as well - that the POV seems much better in promoting growth and employment. Overall, royalties have generated an extra output of about 1 billion Euros, 593 million Euros of gross households' income and 10,258 total annual full-time labour units.

Table 3. Impact of royalty uses by allocation type - 2013 Euro (M€)

	Allocation type		
	Total	Other actions	POV
Royalties receipts	1,166	786	203
Total impacts:			
Output	1,027	432	370
Value-added	593	274	194
Households' income	668	402	111
Labour unit (n)	10,258	4,422	3,634
Average impacts:			
Output	0.88	0.55	1.82
Value-added	0.51	0.35	0.95
Households' income	0.57	0.51	0.55
Labour unit (n)	9	6	18

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[1] The shares concerning the fuel card have been supplied starting from 2011; till now the two first supplies concern the shares allocated for 2009 and 2010.

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Table 3 shows that the ratio of generated output to the expenditure allocated to the POV is more than three times the one recorded for the *other actions* (€1.82 vs €0.55 of additional output for each additional € of expenditure). The POV has generated almost the same labour units using only 25% of the budget available for the *other actions*. These higher impacts are mainly due to the fact that a considerable portion of the POV expenditure is directed towards *construction activities* (both to improve infrastructures and to preserve the cultural heritage), a sector mainly based on local businesses.

Through an analysis of the breakdown of impacts on the regional economy (Table 4), it seems clear that a targeted programme like the POV results in a higher direct and indirect impact (through the production system) on the output, as compared to that related to the expenses incurred by other actions aimed at supporting the public administration expenditure. This expenditure has actually a direct impact on households' income leading to an induced impact on output and value-added (multiplier effect) only through the increase in consumption.

Table 4. Breakdown of impacts by allocation of royalties (M€)

		Output	Value-added	Households'income
Direct impact				
	POV	152.78	0.00	0.00
	Other actions	0.000	0.25	231.98
Indirect impact				
	POV	144.08	0.00	0.00
	Other actions	22.71	1.72	5.82
Induced impact				
	POV	72.86	193.60	110.95
	Other actions	408.03	271.13	164.08
Regional total impact		800.46	466.70	512.84
Interregional feedback				
	POV	0.53	0.33	0.20
	Other actions	0.81	0.54	0.31
Total impacts		801.80	467.57	513.35

As resulting from Figure 3, the sectors that most bear on the output and employment include constructions, trade, private and public services. As for agriculture and fishery, despite their low multiplying effect on output (Table 5), their capacity to generate more employment on the produced output is double compared to the other sectors.

Figure3. Percent distribution of impacts on output and employment

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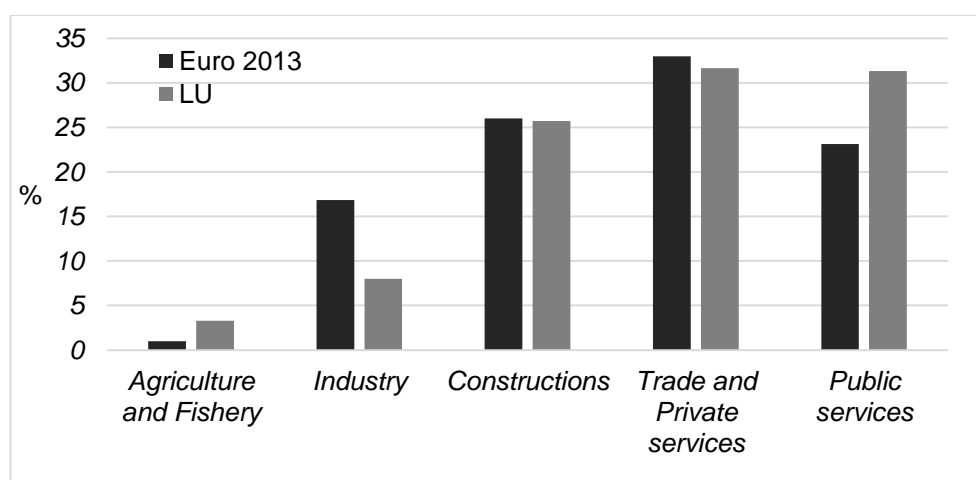
Table 5. Sector output multipliers

Sector	Output multipliers
Agriculture and Fishery	1.56
Industry	1.78
Constructions	2.04
Trade	1.82
Public services	1.84

In general, however, most effects derived from the use of royalties have been lost by the regional economy. The typical opening of a regional economy is expressed by the ratio of the generated output to the total value of spent royalties: on average, only €0.88 of additional output has been produced at the regional level for each € spent. The mean incidence on the income is even smaller, with only 51% of expenditure converted into actual income earned by the households living in the region. The overall impact is thus moderate compared to the absolute value of the available budget, which has stabilised around 100 million €/year (about 3% of the annual expenditure of public administration in Basilicata region). These results may only partly be assessed by static simulations. The use of supplemental financial resources derived from royalties has maybe played a fundamental role to tackle the regional economic decline. However, the allocation of these additional financial resources could be significantly improved also in the short run.

We can deduce that a specific program like the POV is a better solution in promoting economic growth in the short run; moreover, since this is a program supporting investments in production activities, it has greater probabilities to improve the competitiveness of the regional economic system. An alternative use of the resources, allocated so far to the public administration expenditure, might further contribute to development.

Based on the simulations run (Table 6), it would seem that the uses of royalties directed to support only the public administration consumptions (scenario I), or the latter and the households' income (scenario II), are those that would generate greater impacts, in terms of output, value-added, income and employment. These results are however controversial: the uses of part of oil royalties in supporting Government expenditure and in local redistribution policies are ineffective in improving the regional system competitiveness in the long run. This would have short-term effects mostly aimed at reducing the negative impact of the regional economic gap (such as unemployment and poverty).

Table 6. Simulations on the alternative use of royalties allocated to *other actions* (M€)

	Allocation type				
	Current use	Scenario I	Scenario II	Scenario III	Scenario IV
Royalties receipts	786				
Total Impacts:					
Output	432	1,072	869	792	1,049
Value-added	274	704	559	395	521
Households' income	402	469	849	225	292
Labour unit (n)	4,422	11,012	8,982	7,344	9,454
Average impacts:					
Output	0.55	1.36	1.11	1.01	1.34
Value-added	0.35	0.90	0.71	0.50	0.66
Households' income	0.51	0.60	1.08	0.29	0.37
Labour unit (n)	6	14	11	9	12

An alternative solution would be provided by scenario IV, in which royalties are entirely spent to support the investments of private enterprises operating on the local scale, for the purpose of enhancing the competitiveness of the regional production system. The impact on the output and employment is comparable to that of scenario I. Although it presents, among the scenarios, one of the lowest impacts on the households' income in the short run (€0.37 of income generated per €1 of royalty spent), the strengthening of the regional

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production system competitiveness might lay the bases for sustainable economic development of the entire region in the long run. A strategy that is in line with the notion of sustainability of natural resources and involves a progressive replacement of the deployed natural assets (oil in this case) with the produced capital (Hamilton and Atkinson, 2006).

4. CONCLUSIONS

In this work, a multi-sector model based on a two-region SAM was used to study the socioeconomic impact of the use of oil royalties on the economic system of Basilicata region.

To this purpose, it was necessary to carry out an ex-post analysis of royalty allocation since the beginning of drillings till now. Some simulations were performed to estimate the effect that might have been generated by a different use of the royalties actually utilized in funding the Government expenditure.

Results clearly show that in the past the allocation of oil royalties granted to the regional government (as a whole €990 million) generated a much lower impact than expected, in terms of economic growth and employment. Given the structure of the regional economy, a large part of the impacts of investments and current expenses funded by royalties have been probably lost outside the regional boundaries. As a whole, the use of part of the royalties to support the regional Government expenditure has been less effective in promoting the regional economic growth compared to a targeted program like the POV, aimed at supporting the areas where oil fields are found.

These results, together with the macroeconomic indicators that describe the economic system of the region, show clearly that Basilicata's economy is at risk for the natural resource curse. The same opacity in the distribution of royalties is a symptom of a potentially distorted policy and of the ineffective use of a considerable amount of additional financial resources. Detailed information about the use of royalties was actually available only for a quarter of the earnings received by Basilicata region between 1997 and 2013.

The additional financial resources derived from the exploitation of oil fields over the last few years have undoubtedly played a role to mitigate the impacts of the overall macroeconomic crisis. This use is understandable in a region, like Basilicata, that has an economic gap with the rest of Italy. However, the absence of a clear strategy targeted to increase the regional economic system competitiveness might, paradoxically, result in a deterioration of the relative position of Basilicata within the national economy. The exploitation of non-renewable natural resources could also crowd-out the other production activities. Simulations show that even expenditure programs directed to implement investments could favour economic growth in the short run, without jeopardizing the regional system competitiveness prospects. Better balancing in the allocation of royalties between social expenditure and production investments would probably constitute the first step towards a sustainable development strategy of the regional economy.

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