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Abstract: This paper provides an ex-ante assessment of the impact on income distribution of a social card to support poor families in the Basilicata Region, Italy, funded by fiscal revenues from oil extraction. The distributive effects of this policy are assessed by combining microeconomic information from the European Survey on Incomes and Living Conditions (EU-SILC) with a two-region social accounting matrix (SAM). The simulations show that a proper design of the policy could lead to relevant improvement of equity and poverty indicators, contributing to regional sustainability. The analysis has shown that the EU-SILC data sample, combined with a SAM, can be used to support the design of an evidence-based regional development policy.

Keywords: sustainable development; regional policy; oil royalties; social welfare; EU-SILC; Social Accounting Matrix.

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1. Introduction

The aim of this study is to assess the impact on income distribution of a social card funded by oil royalties to support the income of poor families in the Basilicata Region, Italy. Basilicata is a region rich in natural resources in Southern Italy, lagging behind in economic development with respect to the rest of Italy, despite having the largest onshore oil field in Europe. According to Italian national regulations, the local institutions of Basilicata receive the total amount of oil royalties (10% of revenues from oil extraction). Since 1996, this revenue has been used for both current and investment expenditure, with negligible impacts on the region's economy (Rocchi et al., 2015; Viccaro et al., 2015). Among other forms of expenditures of oil revenues, from 2009 to 2013, a fuel voucher (Fuel Card) was implemented to which an average amount of over 50 million euros per year was allocated. This program is currently undergoing revision to be transformed into a social transfer (Social Card) no longer limited to fuel purchase. The aim of the revision is to improve the effectiveness of the policy in supporting disadvantaged households.

Our paper refers to a wide stream of studies using economy-wide, multisector models to assess the economic impact of alternative resource policies. Social accounting matrices (SAM) are used as a basis to calibrate both linear models and computable general equilibrium (CGE) models (Miller and Blair, 2009). SAM-based models are a tool commonly used in applied regional economics (McCann, 2001). For example, Albornoz-Mendoza and Mainar-Cusape (2016) use a hybrid environmental and social accounting matrix to analyse the interactions of the local economy with the use of resources, environment and income distribution; Dautaj Senerdem (2013) analyses the impact of the electricity sector reform in Turkey using a SAM model; an "energy social accounting matrix" for Ireland is used by De Bruit and Yakut Meirt (2019) to calibrate an intertemporal CGE model to assess the impact of an increasing carbon tax; a CGE model has recently been used to analyse the impact of the discovery of oil and gas in the "Pre-salt layer" in Brazil (Souza Magalhães and Domingues, 2014). Input-output and SAM based models have already been used also to analyse the economic impact of oil extraction in the Basilicata region (IEFE 1997; Rocchi et al., 2015; Viccaro et al., 2015).

In this paper, in addition to the above mentioned literature, we extend a SAM-based model of the Basilicata region economy with a microeconomic dataset on households, with the aim of improving the analysis of distributive impacts. An ex-ante impact assessment of the distributive effects of alternative design of the oil revenue allocation for social policies is provided by combining microeconomic information from the European Survey on Incomes and Living Conditions (EU-SILC) for Basilicata with a multi-sector model of the regional economy based on a two-region social accounting matrix specially tailored to Basilicata. The possible outcomes of the regional policies are described through the analysis of poverty and inequality indicators.

The Case Study is introduced in Section 2. In section 3, the rationale for the policy is discussed, based on the concept of weak sustainability. Data and methods are presented in Section 4. Section 5 provides the results from a set of alternative policy scenario simulations. The paper ends with a section containing some final remarks.

2. The case study

Basilicata is the typical case of a region that has fallen behind the rest of the national economy. Despite having the largest onshore oil field in Europe, the economy in this region is in severe difficulty compared with the rest of the country (ISTAT, 2015a).

When oil fields were discovered in the Agri Valley (south-western Basilicata) in the early 1990s, they were seen as an important opportunity for the regional economy. The output in 2014 was about 3.98 million tons, i.e. 6.9% of gross domestic consumption and about 69% of Italy's total crude oil output (Ministero dello Sviluppo Economico, 2015a, 2015b, 2015c). There are good opportunities for regional economic development (in addition to the impact on growth and employment of extraction activities) in the form of oil revenues. The agreement between the Italian State and oil companies states that companies must transfer 7% of their earnings to the local government (Region and municipalities) of the drilling area in the form of royalties (Ministero dello Sviluppo Economico, 2015d). The local government has received over 1.23 billion euros in royalties (2014 prices) since the start of drilling in 1997 until the end of 2014. In addition, a national regulation (No. 99/2009) allocates an additional 3% of earnings to a special income support system for Basilicata households via the introduction of a "social card".

Empirical evidence shows that the exploitation of oilfields generated a negligible impact on regional growth and employment. Using a regression discontinuity design approach with geographic forcing variables, Percoco (2012) evaluates the impact of oil extraction on the creation of new firms finding evidence of a significant, although small, positive impact at the regional level. However, this increase did not result in a structural change able to foster a long-run positive differential in the regional development. The large initial investments to set up the extraction plants only marginally affected the local economic system, resulting in large imports of materials and human capital from other Italian regions. Moreover, a poor dynamic effect on the regional economy was observed in the following years, with the local economy mainly supplying complementary activities (such as transportation, cleaning and security services) while the provision of high value productions (technology) and advanced services (engineering) remained essentially exogenous to the regional system (Bubbico, 2016). Not surprisingly, using a set of VAR models with macroeconomic variables (such as GDP, employment, value added by the construction sector), Florestano (2013) found very weak evidence that hydrocarbon exploitation produced economic growth in Basilicata. More recently, Iacono (2015) carried out an impact evaluation exercise comparing the economic performance of the Basilicata region with that of a "counterfactual" control region created using "synthetic control" techniques. Also in this case, the provided evidence suggests that the development of the oil industry had no detectable effects on Basilicata's economy. The author proposes a set of possible political economic explanations, such as the structure of control rights, the low level of taxation of oil revenues and the quality of institutional settings (presence of organized crime in the region). According to this view, the lack of any evident positive impacts on the regional economy may be a signal that at least some of the possible causes of the "resource curse" (Van der Ploeg, 2011) were at work, even if Iacono's empirical exercise doesn't allow an empirical test of any possible causal chain.

According to the "staple theory" proposed in the field of economic history to explain the causal link between natural resource exploitation and regional development (Innis, 1956; MacKintosh, 1964), the specialisation of a territory in the extraction of a natural resource can deploy its full economic potential only when the local industry is strong enough to support the development of a cluster of economic activities linked to the new extraction industry. On the contrary, the empirical evidence provided by the studies cited above suggests that the oil industry in Basilicata still remains a sort of "enclave" with poor linkages with the rest of the regional economy. Oil extraction is a capital intensive production activity, with a small direct impact on employment and using technologies produced elsewhere than in the Basilicata manufacturing sector. Furthermore, the development of the oil industry is driven by factors (financial resources, strategic decision making, policy design) that

are largely exogenous to the small, fragile and lagging behind Basilicata's economy. A potential problem of long-run sustainability for the regional economy exists and should be addressed by proper regional policies. In the following section, the rationale for such policies will be discussed in the light of the concept of weak sustainability.

3. Oil extraction and policies for long-run regional social sustainability

The concept of sustainability is still the object of a wide scientific debate. For the purpose of this paper, sustainable development can be defined as "*a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations*" (Hediger, 2000; WCED, 1987).

This is especially true in the case of the exploitation of a non-renewable natural resource. According to the concept of "weak" sustainability, exploited natural capital should be replaced with other produced assets to ensure a non-declining welfare long-run dynamic. Starting from this theoretical perspective, Hamilton and Atkinson (2006) propose to test economies for sustainability estimating their "genuine" rate of saving. Genuine savings are the aggregated savings produced by an economy in a given year corrected to account for the depletion of non-renewable natural assets and for the investments made in human capital. According to the so-called "Hartwick rule" (Hartwick, 1977 and 1990), a non-negative rate of genuine saving is compatible with a long-run not decreasing growth path. Such a theoretical perspective implies at least a partial substitutability between natural and produced capital and has been widely contested from "stronger" perspectives on sustainability (Common and Perrings, 1992). The advantage of the genuine saving approach, however, is its relatively simple empirical implementation starting from the aggregates of national accounts. The World Bank updates yearly the estimates of "Adjusted Net Savings" for a large group of countries according to a standard methodology (World Bank, 2004; Gnègnè, 2009).

One of the main "adjustments" of aggregate savings to account for sustainability refers to the value of oil stocks exploited in the considered periods. This is the reason why it represents an interesting indicator of sustainability in the case of the Basilicata Region. Estimates of genuine savings at the sub-national level are not frequent but have recently been produced for Italian regions (Biasi and Rocchi, 2016; Biasi et al., 2019). Basilicata is the only region in Italy showing a non-sustainable development path. The genuine savings of the Basilicata region steadily declined during the whole 1995-2006 period, becoming negative in 2005. The "adjustment" of aggregate savings due to oil extraction is the main determinant of the negative performance of the region, even after depletion of the oil resource is re-distributed among Italian regions according to their share in the aggregate final demand.

Despite energy policies are beyond the control of regional policy makers, a regional policy to deal with the adverse consequences of oil extraction may be supported by a proper allocation of oil revenues. Investments in physical assets as well as human resources, according to the logic of weak sustainability, could compensate the depletion of non-renewable natural assets in the short-run (reducing the negative balance in regional capital formation) and foster the competitiveness of regional economy in the long-run. A national regulation assigned to Basilicata a huge amount of additional financial resources (relative to the size of the regional Government budget) in the form of oil royalties. From 1996 to 2014, the total oil royalties earned by the local government in Basilicata amounted to over 1 billion euros (Viccaro et al., 2015). Oil revenues have been used both to finance dedicated investment programs in the area where extraction activities are carried out and to support the current expenditure of the regional government. Nevertheless, oil earnings have not likely had a great impact on the local economy (Viccaro et al., 2015).

A further adverse negative effect should be considered on sustainability in a social perspective. The so called "resource curse", that is the observed negative relation between resource abundance and economic growth of regions, has been widely debated both on empirical and theoretical grounds

(Van der Ploeg, 2011). The empirical evidence on the correlation seems robust despite the *causal* relation between resource abundance and weak economic growth is still widely debated. Several economic interpretations have been proposed. Among them, the widespread diffusion of rent-seeking behaviour in resource abundant areas lead to a short-seeing policy in the use of extraction revenues, to support political prestige more than economic efficiency (Torvik, 2009). The exploitation of non-renewable natural resources is likely to generate adverse distributive impacts linked to the structure of property rights, unequal access to capital and technologies, and territorial distribution of the resources themselves. These mechanisms are likely to operate when large windfalls from resource extraction affect a relatively small regional economy (as in the case of Basilicata), reinforcing the negative impact on growth generated by strong inequalities in income distribution (Deaton, 2016).

A structural bias is also likely to yield an adverse redistributive impact, even when oil revenues are invested to foster economic growth. Using a SAM-based model of the regional economy Rocchi et al. (2015) showed that a structural trade-off exists in Basilicata's economy between growth and equity that is likely to affect regional investment programs. Due to the structure of the regional economy, the allocation of oil revenues to support industries more likely to produce growth and employment at the regional level is also likely to have regressive impacts on income distribution, generating an increased overall inequality as well as asymmetries in income distribution between urban and rural households. These distributive impacts would reinforce the negative impacts on growth generated by strong inequalities in income distribution (Deaton, 2016).

Based on the above mentioned considerations, a sustainable management of oil revenues at the regional level should aim at achieving a good balance between investment programs directed at improving the performance of the regional economy in the long term, and social transfers compensating the adverse effects of growth on income distribution. From this point of view, the introduction of a "social card" can be considered as a complementary policy tool addressing the *social* side of sustainability and may be a promising policy for the Basilicata regional government.

There is a widespread consensus around the idea that pro-social and poverty-reducing policies also foster economic growth (Ravallion, 2007, 2009; Fosu, 2010; Cingano 2014). Furthermore, a reduction in inequality may increase the duration of growth periods (Berg et al, 2012). The effectiveness of social policies may be improved by an increasing fiscal capacity and autonomy at the local level (Hasso, 2010). Scarlato (2010) highlights two interesting aspects linking inequality and poverty to economic growth: (i) vulnerable social groups face great uncertainty about the future, and this shortens the time horizon of their choices, therefore an effective social protection system may reduce the risk, increasing incentives to invest in physical and human capital and improving the allocation of resources; (ii) growth is fuelled by social capital that a cohesive society produces, but because social balances are continually destabilized, and uncertainty and risk dominate the new international scenario, social cohesion needs to be maintained by a social protection system that ensures an acceptable level of equity.

As stated above, from 2009 a national regulation (No. 99/2009) allocates a further 3% of oil revenues (additional to 7% of the royalties accruing to the local Government) to a special income support system for Basilicata households via the introduction of a social card. These additional resources were first distributed in late 2011 as fuel vouchers. Article no. 45 of Law No.99/2009 established a fund to finance a social card used for «… *fuel discounts at filling stations* …» (Ministero dello Sviluppo Economico, 2015e). The Fuel Card issued in Basilicata is similar to other instruments adopted in social welfare policies (Scarlato, 2010), such as conditional cash transfers (CCTs) (De Brauw and Hoddinott, 2008; Skoufias, 2005; World Bank, 2009), cash on delivery aid (COD) (Birdsall and Savedoff, 2010), and social vouchers (Devereux and Sabates-Wheeler, 2004). These forms of income support are becoming increasingly popular at an international level, since they allow weaker social groups to access goods and services. They are used in social welfare policies to tackle poverty, reduce inequality and to promote and strengthen social capital.

The Fuel Card was initially issued only to Basilicata residents aged over 18 who held a driving license, but the regulations about the bonus and its beneficiaries have changed over the years

(Ministero dello Sviluppo Economico, 2015e). Subsequently, the system was extended to include all Basilicata residents aged over 18, and the payment differentiated according to income level, so that those with higher incomes receive less and those with lower incomes receive more benefits. Despite these adjustments the poor performance of the policy leads to its stop after 2013.

From a weak sustainability perspective, the FC issued in Basilicata is a controversial policy measure. The income of poorer households is supported at the cost of incentivising the use of private cars for transportation, negatively affecting the environmental side of sustainability at the regional level[1]. Furthermore, the adopted distribution of funds was not likely to efficiently target poor families, reducing the redistributive (social) effect of the policy. The reform of the vouchers is still under debate. A preliminary agreement in March 2015 between the Ministero dello Sviluppo Economico and the regional Government of Basilicata allows the latter to issue a new Social Card essentially aimed at providing income support for disadvantaged households and no longer limited to fuel purchase.

The analysis below provides an ex-ante assessment of the distributive impacts generated by alternative designs of the policy. The analysis will be performed using microeconomic information on household income integrated with a SAM-based model of the regional economy. The distribution of this aid under the original Fuel Card system will be used as a benchmark to assess the effectiveness and targeting of alternative designs.

4. Data and Methods

Data

The assessment of the impacts on poverty and inequality is based on microeconomic information taken from the European Union Survey on Incomes and Living Conditions (EU-SILC), an annual household survey carried out in EU member states and other European countries (Eurostat, 2013). It gathers information on approximately 450 variables referring to demographics, income and living conditions. Most notably, EU-SILC serves as a database for measuring poverty risk and social cohesion in Europe (Eurostat, 2013).

This study used the 2011 EU-SILC micro-economic data for Italy to simulate the direct and indirect impacts of alternative methods of distributing the social card fund, according to a set of poverty and inequality indicators.

The analysis was based on 11 variables taken from the original database, providing information on the income, size and composition of households, as well as on the degree of urbanization of the municipality of residence. From the initial sample of 19,578, a sub-sample of Basilicata households consisting of 398 observations was extracted. Based on these data, we envisaged alternative procedures for the distribution of the social card fund to households. Firstly, distribution procedures were replicated according to the Fuel Card system (essentially based on a flat payment to all resident adults). Subsequently, alternative allocations of transfers to beneficiaries were hypothesized limiting income support to poor households (with an income below the poverty threshold) and vulnerable households (with an income close to the poverty threshold).

Simulations

The simulation based on micro-data enabled an assessment of the *direct* impacts of alternative income support systems on the income levels of potential beneficiary households. The analysis was then extended to include also the *indirect* impacts of income support, taking into account the structure of the region's economic system. This result was obtained by associating the microeconomic dataset to a model of the regional economy based on a Social Accounting Matrix (SAM) (Viccaro et al., 2015, 2018).

The SAM used in this study is a two-region (Basilicata vs. Rest of Italy) matrix referring to year 2011 produced by the Regional Institute for Economic Planning of Tuscany (IRPET, Florence). The

flows within the two regions and between Basilicata and the rest of Italy are represented in great detail. The structure of the matrix includes 301 accounts; in each region, the accounts are disaggregated among others into 37 industries (NACE Rev.2 classification), 54 commodities (CPC 2.0 classification), 23 consumption functions (COICOP classification), three production factors (employed labour, self-employed labour and capital) and into three types of institutions (households, firms and Government). Interestingly, the same EU-SILC data used in this study were used by IRPET in the construction of the SAM to disaggregate the household sector account by income deciles.

The main advantage of using a two-region model is the possibility of considering the rest of Italy as endogenous in the model, making it possible to break down intraregional and interregional impacts (spillovers and feedbacks). Based on the analysis of impacts, it is evident that for all simulated scenarios, the new income generated is mostly due to the use of the card inside Basilicata (99%), and only to a minimum extent from its use in the rest of Italy (1%).

To obtain the matrix of SAM multipliers, the model was closed considering as exogenous the accounts for government, capital formation and for flows to and from the rest of the world. Endogenous accounts can be represented as a system of linear equations

$$x = Ax + f \qquad (1)$$

where x is the vector of endogenous accounts, f is the vector of total inflows from exogenous to endogenous accounts and A is the matrix of direct (column) coefficients for endogenous accounts.

Solving the model in the usual way allows us to calculate the matrix M of SAM multipliers (Miller and Blair, 2009):

$$x = (I - A)^{-1}f = Mf \qquad (2)$$

The matrix of direct coefficients A shows the following structure

$$A = \begin{bmatrix} A_{BB} & A_{BI} \\ A_{IB} & A_{II} \end{bmatrix} \qquad (3)$$

where the blocks along the main diagonal account for flows within the two regions (B= Basilicata and I= rest of Italy) while the blocks along the other diagonal represent the (commodity and financial) flows between the two regions. Given the structure of the original matrix each "regional" sub-matrix shows the following structure:

$$A_{RR} = \begin{bmatrix} 0 & U & 0 & F & 0 \\ S & 0 & 0 & 0 & 0 \\ 0 & V & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & C \\ 0 & 0 & Y & 0 & T \end{bmatrix} \qquad (4)$$

where S is the (industry by commodity) matrix of coefficients representing the market shares of industries in producing commodities, U is the (commodity by industry) matrix of intermediate consumption coefficients, V is the matrix of value added factor shares, Y is the matrix of coefficients distributing factor incomes to endogenous institutions (households by income decile and firms), F is the matrix of coefficients representing the composition of each consumption function in terms of commodities, C is the matrix representing the composition final expenditure of institutions in terms of consumption functions, T is the matrix of transactions among institutions.

Sub-matrices C, Y and T are present also in the A_{IB} and A_{BI} blocks of the A matrix (i.e. the inter-regional blocks) accounting for the final expenditure in one region of residents of the other region (C_{IB} and C_{BI}), the incomes earned in one region by residents in the other region (Y_{IB} and Y_{BI}) and the transaction of institutions in one region with institutions of the other region (such as transfers among households or among households and firms: T_{IB} and T_{BI}).

Let C_B the matrix of coefficients representing the final expenditures of Basilicata households both within and outside the regional borders:

$$C_B = \begin{bmatrix} C_{BB} \\ C_{IB} \end{bmatrix} \qquad (5)$$

The distribution by income deciles of the transfers allocated to households, resulting from the simulation of different distribution scenarios on the microeconomic dataset, was used to define a set of vectors of additional exogenous shocks on the final demand corresponding to each of the

alternative designs of the policy. The composition of vectors was defined according to the composition of final expenditure inside and outside Basilicata for each decile of households, as shown in the SAM.

The increase of final expenditure generated by the distribution of the social card was calculated using the following expression:

$$dfe = C_B dsc \qquad (6)$$

where *dsc* is the vector representing the distribution of the social card budget among income deciles in a given scenario.

The indirect impact on household incomes of the additional expenditure on goods and services was calculated using the multiplier matrix derived from the SAM-based model. The elements of vectors *dfe* corresponding to each scenario were included in the proper position in vectors of exogenous shocks to be post-multiplied by the *M* matrix. The resulting additional increase of household incomes was then used to calculate an average increase by income decile, to be applied to individual incomes of households included in the EU-SILC sample to get the post-simulation income distribution. Consequently, the post-simulation income includes both the direct impact of card distribution and the further increase in income generated by the circular flow of the economy, resulting from the use of the card for final consumption. The resulting new microeconomic dataset was used to assess the distributive impacts of alternative policies.

Poverty, vulnerability and inequality indicators

A set of poverty, vulnerability and inequality indicators were estimated based on the equivalised per capita disposable income, defined as the total household disposable income divided by the equivalised household size, according to the modified OECD equivalence scale (OECD, 2013). The chosen indicators are widely used in social analysis and allow us to address different features of income distribution (Fields, 2012). First of all, we estimated both relative and absolute poverty thresholds to identify poor and vulnerable households within the sample. According to the at-risk-of-poverty rate defined by Eurostat, we decided to set the relative poverty threshold (RPT) at 60% of the median equivalised disposable income. Households with a per capita income below the thresholds were classified as *poor,* while a per-capita income between 60% and 70% of the median were classified as *at risk of poverty* or *vulnerable*.

Households were classified also according to an *absolute* definition of poverty. A household is judged to be in *absolute* poverty when it cannot afford the expenditure to access a range of goods and services considered necessary to ensure a minimum standard of living acceptable in the residence area (ISTAT, 2015b). The Italian National Institute of Statistics (ISTAT) updates and releases these thresholds every year, according to family size, composition and age, geographical distribution and the size of population of the municipality where the households resided (ISTAT, 2015c). For example, a household living in a small city in Southern Italy, with two people aged 18-59 years, was considered poor in 2011 if it had a monthly income equal to or lower than 801 euros. Based on these data and on information about family composition (available in the EU-SILC dataset), a specific absolute poverty threshold was calculated for each sample observation and the households living in absolute poverty were identified.

Based on the poverty threshold, we calculated three poverty indicators based on the equation proposed by Foster, Greer and Thorbecke (Eq. 7) (World Bank, 2005).

(1) Headcount index. This is defined as the proportion of poor households with a disposable income below the poverty line.

(2) Poverty gap index. This index measures the extent to which individuals fall below the poverty line (where the "non-poor" have a poverty gap of 0) as a proportion of the poverty line. It allows us to calculate how much should be transferred to poor families in order to bring their income above the poverty line. The cost of eliminating poverty by perfectly targeted transfers is just the sum of all the individual poverty gaps (in absolute terms) of a population.

(3) Squared poverty gap or "poverty severity" index. This poverty indicator measures inequality among the poor and allows us to detect the presence of a particularly disadvantaged group at the bottom of income distribution. The poverty severity index is the weighted sum of poverty gaps, where weights are the individual poverty gaps. The poverty gaps of the households furthest from the poverty line are given a greater weight: a poverty gap of 10% of the poverty line is given a weight of 10%, whereas a poverty gap of 50% is given a weight of 50%. Moreover, squaring the gap further increases the weight on the index value of observations far below the poverty line.

Given the equation:

$$P_\alpha = \frac{1}{N}\sum_{i=!}^{N}\left(\frac{G_i}{z}\right)^\alpha , \ (\alpha \geq 0) \tag{7}$$

where α is the measure of sensitivity of the poverty index, z is the relative poverty threshold, G_i is the poverty gap of the ith poor household (given by the difference between the relative poverty threshold and disposable income) and N is the sample size (number of households), we have:

- $\alpha = 0 \rightarrow P_0$ is the Headcount Index;
- $\alpha = 1 \rightarrow P_1$ is the Poverty Gap Index;
- $\alpha = 2 \rightarrow P_2$ is the Poverty Severity Index.

Finally, the overall inequality in income distribution was assessed by calculating the Gini coefficient (World Bank, 2005). The Gini coefficient is the most widely-used index to analyse income distribution inequality. Ranged between 0 (equal distribution) and 1 (higher inequality), it is based on the Lorenz curve, i.e. a cumulative frequency curve that compares the distribution of a specific variable (e.g. income) with a uniform distribution representing equity. The Gini coefficient is defined as the ratio of cumulative shares of the population arranged according to the level of equivalised disposable income to the cumulative share of their equivalised total disposable income.

Policy scenarios

In simulating the policy, the available budget has been distributed among the eligible households, not only according to the number of driving license holders and adults, but also based on the different income support systems adopted so far (Ministero dello Sviluppo Economico, 2015e).

The first step in our study was to simulate the distributive impacts of the policy as applied so far, in which the card was issued as a Fuel Card.

(1) Fuel Card (FC scenario): decreasing payment by income band to all adults. In this scenario, the Fuel card can be used by beneficiaries to purchase only fuel, *both inside and outside Basilicata*[2].

Three additional scenarios in the distribution of income support were defined to represent the implementation of a new social card designed to contrast poverty and reduce inequality:

(2) Social Card I (SC-I scenario): progressive payments *only to poor households*. In this scenario, individual payments are proportional to the share of individual to total poverty gap. In this system, the transfer can be used by beneficiaries to purchase goods and services *only within Basilicata regional borders*;

(3) Social Card II (SC-II scenario): progressive payments *to poor and vulnerable households*. Individual payments are proportional to the share of individual to total poverty gap, calculated according to a threshold equal to 70% of median income. In this scenario, the social card can be used by beneficiaries to purchase goods and services *only within Basilicata regional borders*;

(4) Social Card III (SC-III scenario): similar to SC-II scenario, but in this system, the social card can be used by beneficiaries to purchase goods and services *both inside and outside Basilicata* (as in the FC scenario).

In order to make the results of different simulations comparable, we decided to consider the average amount of money allocated to the Fuel Card fund 2009-2013 as the income support fund to distribute among the different families, i.e. a total of 56 million euros per year.

Robust estimates

Poverty and inequality indicators were calculated using the subsample of 389 observations referring to households in Basilicata. The small sample size and the structure of sample weights, designed to ensure unbiased estimates at the national level, required a robust approach to estimation. The analysis was implemented in the open source statistical computing environment R (R Core Team, 2013), using the *laeken* add-on package. Unlike other available packages, *laeken* has been specifically developed to analyse EU-SILC data and provides functionality for standard and robust estimation of social exclusion and poverty indicators from complex survey samples (Alfons and Templ, 2013).

The basic idea for robust estimation is firstly to detect non-representative outliers among the selected observations, and secondly to reduce their influence on the estimates by either down-weighting the outliers and recalibrating the remaining observations, or by replacing the outlying values with values from a fitted distribution. The main advantage of this general approach is that it can be applied to any indicator that can be calculated from the available dataset (Alfons and Templ, 2013).

The *laeken* package includes recently developed methods (Alfons et al., 2013b) that allow sampling weights to be incorporated into a Pareto distribution model estimation. The user can detect and manage outlier observations by following alternative approaches. We used the Kerm rule (Kerm, 2007) to identify outliers and reduce their influence on the estimates, based on the *calibration of non-representative outliers* (CN) approach (Alfons et al., 2013b, Alfons and Templ, 2013). According to the CN approach, the sample weights of outliers are set to 1, as these observations are considered to be somewhat unique to the population data. The weights of the remaining observations are adjusted accordingly by calibration to reproduce the original sum of weights (Deville et al., 1993).

The Pareto Quintile Plot of the EU-SILC sub-sample for Basilicata is represented in Figure 1: in the upper right corner, a single observation is detected as an outlier.

[Figure 1 near here]

Relative poverty and inequality indicators were estimated using the R package *ineq* (Zileis and Kleiber, 2015). A bootstrap procedure with 1000 replications was carried out using the R package *boot* (Canty and Ripley, 2015) to provide standard deviations in order to test the robustness of produced estimates.

5. Results

Baseline poverty profile

The microeconomic data were first used to outline a baseline poverty profile of the Basilicata region in the reference year. The regional median household income was 19,442 euros in 2011, lower than the national one of about 24,811 euros but in line with the median income of other Southern regions (20,717 euro) (ISTAT, 2020a). Twenty-two percent of the total income is owned by the households of the last decile: the richer families have an income equal to the total income of those of the first five deciles (Table 1). The data show that about 41,000 households (18%) are below the relative poverty threshold. The poorest ones live in rural areas (84%), where there is also a higher share of families at risk of poverty (57%).

[Table 1 near here]

Table 2 shows a set of poverty and inequality indicators estimated with the EU-SILC subsample of households living in Basilicata. Despite the small size of the sample, the variance of estimates is acceptable.

[Table 2 nearhere]

On average, the income of poor households should increase by 8.6% (poverty gap) to reach the relative poverty thresholds (€7,233 per capita equivalent income). The poverty severity index is quite close to the poverty gap index, showing the existence of inequality in income distribution within the poor group. The Gini index for the total population is about 0.33, which is a relatively high level, in line with the values of the other Southern regions (excluding Puglia showing a Gini index of 0.29), but a bit higher than the national value (0.30) (ISTAT, 2020b).

Considering the type and the size of households (Table 3), it is evident that the poorest households and households at risk of poverty consist of a single person, followed by those in which there are parents with two dependent children. Lastly, there are households with no dependent children and with at least one member aged at least 65.

From the information available on household composition, it has been estimated that 12.54% i.e. 28,974 households are below the absolute poverty threshold.

[Table 3 near here]

Policy simulations

The use of funds according to simulated scenarios SC-I and SC-II would generate much higher income increases across income deciles (from 0.13 to 0.23%) than they would according to the scenario replicating the policy actually implemented (FC scenario), which gives increases from 0.10 to 0.20% (Table 4). This is because the additional expenditure in the SC I and SC II cases concerns only goods and services purchased within Basilicata, whereas in the FC case some expenditures take place also in the rest of Italy. This effect is confirmed by results for scenario SC-III, in which the use of the card outside Basilicata reduces the impact on incomes across deciles relative to SC-I and SC-II.

Moreover, results show that all scenarios produce greater income increases among households in the higher decile groups, even for SC policies distributing aid only to the poor and vulnerable households in the lower decile groups. This reflects the structural asymmetry in income distribution that is typical of Basilicata (Rocchi et al., 2015): the multiplier effect of an increased expenditure of beneficiary groups is mainly directed towards households in the higher deciles. The better targeting of poor households in SC scenarios increases the total impact on incomes (higher variations across all deciles) and slightly re-balances the distribution of the total impact on incomes in favour of the poorest households (despite these changes are not likely to be significant from a statistical point of view).

[Table 4 near here]

Table 5 shows the impact of support on poverty and inequality. The first column shows the values of indicators in the baseline scenario, without any income support.

[Table 5 near here]

Unsurprisingly, the effects on income distribution of the FC scenario are negligible. These results show that the distribution policies adopted so far poorly target poor families and scarcely improve income distribution.

The following three columns provide results for hypothetical policy scenarios referring to the implementation of a social card designed to contrast poverty and reduce inequality. The indicators show a general improvement in the equality of income distribution. Despite the larger income increase observed in the higher deciles (Table 4), the Gini index decreases by 4% for all these distribution systems in comparison with the baseline scenario, from 0.330 to 0.319. This is mainly due to the reduction of inequality among the poor, as shown by the improvement of the poverty severity index.

Moreover, the better targeting of the hypothetical scenario results also in narrowing the poverty gap. An interesting result is that if SC-I policy was implemented, a further 6.4% mean rise in income of poor families would be sufficient to allow them to escape poverty, although approximately 18% of households would still fall below the relative poverty threshold as in the Baseline scenario. This is because the overall rise in income generated by support raises also the relative poverty threshold, while the better targeting (support only to households under the poverty thresholds proportional to individual poverty gaps) reduces inequality in income distribution among households below the thresholds. In fact, this scenario gives the best result for the poverty severity index (0.036), reducing it by 44% compared to the Baseline.

Policies SC-II and SC-III give income support also to households at risk of poverty (income between 60 and 70% of median), and have a slightly different effect. Also in these cases, the rise in income needed to allow all poor households to escape poverty would be lower than the baseline and equal to 6.6%. Increasing the number of beneficiaries to include vulnerable households, however, leads to better results in terms of absolute poverty, reducing the index to 9.1 (-27%), which is approximately three times the effect of the FC scenario. This means that increased expenditure of vulnerable households is likely to indirectly support the income of the most disadvantaged group among the poor ones.

One may wonder if the estimated changes in poverty and inequality indexes referring to policy scenarios alternative to the business-as-usual FC scenario would be significant from a statistical point of view. In Figure 2 the robustness of results is tested by comparing the estimate of the Poverty Severity index under the Baseline scenario, in the FC scenario and in the SC-II scenario which achieve the largest reduction of poverty HC both in relative and absolute terms. The curves are Kernel Density Plots of the index estimates obtained by a bootstrap procedure. The confidence interval of estimated impacts in the FC scenario basically overlaps that of the Baseline, whereas the curve relating to scenario SC-II is displaced significantly leftwards, with a reduced overlapping interval. Although the average changes across income deciles in percentage terms (Table 3) are small, the simulated policy seems likely to significantly affect income distribution in the target group.

[Figure 2 near here]

So far, all scenarios have been simulated assuming that available funds were equal to the average amount distributed in the years of actual implementation (€56 M). To assess the effect of budget constraint on the results, we simulated the impact of scenario SC-II on the absolute poverty headcount ratio as the budget increases (Figure 3).

[Figure 3 near here]

Figure 3 shows that the marginal effect of expenditure, given the structure of the policy envisaged, is decreasing. Beyond 80 million euros the additional impacts are limited. Table 6 compares the impacts on absolute poverty under FC and SC-II policy scenarios, with two different amounts of funding available: the average distributed during the period of implementation of the fuel card (€56.0 M) and the maximum distributed in a single year (€76.7 M in 2013).

[Table 6 near here]

The data confirm and strengthen the results of Figure 3, proving that in order to make social policies more effective it is more important to properly define the target beneficiaries than increasing the amount of money available. A budget of 56 M€ would reduce the households in absolute poverty by 27.2 % (- 7,894) in the case of SC-II, against a reduction of just 10% (-3,091) in the FC scenario. The marginal impact of additional funds strictly depends on the design of the implemented policy: increasing the budget by about 37% (+20.7 M€) would increase the number of households leaving the state of absolute poverty from 7,894 to 8,980 (+13.7%) in scenario SC-II, and from 3,091 to 3,354 (about +8%) in scenario FC. Similar differences in the impact of the two scenarios are recorded in the variation of the headcount ratio.

6. Concluding remarks

This paper analyses social policies implemented in the Basilicata Region (Southern Italy) funded by royalties from oil-drilling.

Basilicata is an underdeveloped region rich of non-renewable natural resources in the form of the largest on-shore oil field in Europe. The exploitation of these resources in a fragile and non-competitive economy poses major challenges for the long-term sustainability of the region's economy. Following a weak sustainability approach, oil royalties should be used to improve the competitiveness of the regional system and to support social policies addressing the structural asymmetries in income distribution.

From 2009 to 2013, Basilicata spent about 30% of its oil royalties funding a social card. An annual average of 56 million euros was distributed as vouchers to get discounts on fuel prices at the filling station. After five years of implementation, the policy was stopped and is still under revision.

In this paper, we provide an ex-ante assessment of distributive impacts on poverty and inequality of alternative design of the policy using microeconomic data from the Italian EU-SILC survey and a SAM-based model of the regional economy.

The proposed analysis confirms that the implemented policies have probably had a small impact on poverty and inequality indicators. However, this negative outcome does not depend on the absolute amount of funding available, but on an ineffective design of the policy. The simulation of the impacts of different alternative scenarios shows that an improved mechanism for identifying beneficiaries may potentially give much more relevant results from a social point of view. Although the amounts of money available would not be sufficient to completely resolve the problem of poverty in Basilicata, an appropriate design of the policy could significantly reduce the number of households below the poverty threshold (up to 27% fewer, considering the absolute poverty threshold and an annual budget similar to that actually used during the implementation of the Fuel Card). Moreover, income support concentrated on poorer households would significantly improve also inequality indicators for the whole population (with a Gini index reduction of around 4%) and even more among poor households (with a possible reduction of over 40% in the poverty severity index). Results provide evidence that a properly targeted policy could have considerable effects even with a limited budget, increasing the marginal impact of additional resources, thus avoiding a waste of funds that could be channelled into other kinds of regional development policies.

The three SC scenarios imply that an effective "income-testing" tool was available to identify the eligible beneficiaries. This often is not the case for several reasons. The recent experience of social security systems in several countries shows that the effectiveness of "means-tested" social transfers is often flawed by problems of incomplete coverage of eligible beneficiaries (see Atkinson, 2015) and/or biased application caused by unreliable recording of income conditions. This is the reason why in recent years the implementation of unconditional universal payments (basic income) has been proposed as a valuable alternative to the current systems of social security in developed countries (OECD, 2017). The policy assessed in this paper is a regional one, aiming at complementing national

social security policy, and would be necessarily targeted only to disadvantaged households. The design of a reformed Social Card in Basilicata should address this problem, looking for observable, non-monetary indicators likely to target most disadvantaged households.

Some aspects of the methodology applied to this analysis deserve special attention. Results have been obtained using microeconomic data from a sample of Basilicata households collected within the EU-SILC survey for Italy. Data have been combined with a model based on a bi-regional Basilicata vs. Rest of Italy social accounting matrix. On one hand, the availability of micro data improved the assessment of impacts on equity and poverty opposed to the simple use of the multi-sector model (as in standard SAM analysis, see for example Roland Holst and Sancho 1995 and Pyatt and Round, 2006). On the other hand, the use of the SAM-based model made it possible to quantify even the indirect impacts on household incomes generated by income support inside Basilicata and in the form of inter-regional feedbacks. This allowed us to consider also distributive asymmetries present in the economy (as in Basilicata) that could not be captured by a simple simulation on microdata.

The use of appropriate techniques has produced robust estimates of indicators, despite the small size of the sample. The most important results of the analysis can be considered reliable from a statistical point of view. The availability of microeconomic information is very often one of the main constraints in the design and implementation of evidence-based policies at the sub-national level. This analysis shows that the EU-SILC sample can be used to support policy analysis also at the regional level.

This is a promising result for the future development of research. The possibility of using national surveys on the households' sector significantly expands the prospects for policy impact assessment and evaluation at the regional level and reduces its costs. Data from national surveys can provide baseline information making a separate baseline survey unnecessary and supporting the evaluation when the timing of the policy does not make it possible to select a comparison group in advance (Blomquist, 2003). EU-SILC is an official annual survey directed to assess the impacts of inclusion and social cohesion policies in the European Union. In addition to standard income-related indicators, it also measures a wide range of non-monetary indicators of well-being. These could provide an essential tool for the design of social policies at the regional level, making it possible to associate objective well-being indicators (easy to use in the implementing phase) with the target low income groups of households. The use of non-monetary well-being indicators at the design stage would also enable the definition of an appropriate benchmark on which to base subsequent analyses of policy impact evaluation, according to an appropriate counterfactual logic (Khandker et al., 2010).

Two final remarks can be made on the limitations of this study. First of all, it is important to highlight that we provide an ex-ante assessment for a set of alternative designs of a social card to be implemented at the regional level. Even though one of the policy options was shaped to replicate the features of the Fuel Card issued in Basilicata from 2009 to 2013, the FC scenario should be considered simply as a "business as usual" option. A proper "evidence-based", ex-post evaluation of the actual implementation of the Fuel Card should be carried out using proper techniques of impact analysis (Banjeree and Duflo, 2008; Ravaillon, 2008).

A second point refers to the nature of the SAM-based model used together with microeconomic information. We used a highly disaggregated bi-regional SAM to solve a linear model of the Basilicata (vs. rest of Italy) economy. This allowed us to include in the estimated impacts both the intraregional and the interregional feedbacks via inter-industry and consumption interdependencies. However, the matrix of SAM multipliers used in simulations reflects the standard assumption of this family of models that are not designed to account for income and substitution effects in consumption. This feature of the model is more likely to yield a bias in results mainly for the FC scenario, where the card can be used by beneficiaries only to purchase fuel. The use of a CGE framework would allow us to better model this feature of consumption behaviour and could represent a natural development of the analysis. The move towards a non linear model, however, requires accepting a set of hypotheses about agent's behaviour to be included as a model parameter (such as income elasticity of demand), for which a reliable estimate at the regional level could hardly be found. Furthermore, due to the small

size of individual payments, in our view this should not question the overall validity of our results. Finally, our analysis aims at assessing the progressive/regressive nature of short-run impacts on income distribution of alternative policies, a purpose for which a static linear model, as the one presented here, is a suitable one.

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Notes

1 The GS indicator of sustainability takes into account air pollution, including an economic quantification of its adverse effect on public health as a negative component of regional saving: for details see (Biasi et al, 2019).

2 We simulated also two different FC scenarios with flat or progressive payments only to adults with driving licence obtaining similar results.

Table 1. Household income distribution in Basilicata region, year 2011

| | | Disposable Income | | | |
Deciles	Households	Total	Share (%)	Mean	Median
1	23,197	76,009,571	1%	3,277	869
2	23,468	287,710,413	5%	12,260	10,984
3	22,923	303,502,241	5%	13,240	13,000
4	23,150	387,890,766	7%	16,755	15,585
5	22,987	444,388,117	8%	19,332	17,571
6	23,392	494,893,270	9%	21,157	20,525
7	22,800	583,182,719	10%	25,578	23,196
8	23,442	773,130,972	14%	32,980	33,583
9	23,834	1,017,417,552	18%	42,688	44,282
10	21,855	1,231,829,237	22%	56,365	51,984
Total	231,048	5,599,954,857	100%		

Table 2. Poverty and inequality indicators

Indicators	Baseline	Standard deviation	Coefficient of variation
Relative-poverty threshold (€)	7,233	369	5.1%
RP Headcount ratio	17.7%	0.2%	1.1%
Poverty gap index	0.086	0.001	1.4%
Poverty severity index	0.065	0.001	1.7%
Gini index	0.332	0.001	0.4%

Table 3. Incidence of relative poverty by household type and size

| | Poor | | At risk of poverty | |
	No.	%	No.	%
Household type				
One-person household	15549	38.11	5562	42.52
2 adults, no dependent children, both adults under 65 years	2511	6.15	377	2.88
2 adults, no dependent children, at least one adult 65 years or over	3254	7.98	1563	11.95
Other households without dependent children	5019	12.30	902	6.90
Single-parent household, one or more dependent children	1764	4.32	479	3.66
2 adults, one dependent child	1140	2.79	781	5.97
2 adults, two dependent children	9521	23.34	2482	18.97
2 adults, three or more dependent children	239	0.58	-	-
Other households with dependent children	1801	4.41	933	7.13
Household size				
One member	15549	38.11	5562	42.52
Two members	6819	16.71	1941	14.84
Three members	4520	11.08	2162	16.53
Four members	13110	32.13	2482	18.97
Five or more members	799	1.96	933	7.13

Table 4. Percent increase of household income induced by the use of the social cards according to different scenarios

	Scenarios			
Decile	FC	SC I	SC II	SC III
I	0.10	0.13	0.13	0.12
II	0.10	0.13	0.12	0.12
III	0.10	0.12	0.12	0.11
IV	0.10	0.12	0.12	0.11
V	0.14	0.15	0.15	0.14
VI	0.14	0.16	0.16	0.15
VII	0.16	0.18	0.18	0.17
VIII	0.18	0.20	0.20	0.18
IX	0.18	0.19	0.19	0.18
X	0.20	0.23	0.23	0.21

Table 5. Impact of the social card on poverty and inequality: current policies and alternative scenarios

	Scenarios				
	Baseline	FC	SC I	SC II	SC III
Relative poverty threshold (€)	7,233	7,332	7,244	7,244	7,243
Relative poverty headcount ratio					
60% of median income	17.70%	17.10%	17.70%	16.80%	16.80%
70% of median income	23.40%	23.20%	23.40%	23.40%	23.40%
Poverty gap index	0.086	0.085	0.064	0.066	0.066
Poverty severity index	0.065	0.062	0.036	0.039	0.039
Gini index	0.332	0.330	0.319	0.319	0.319
Absolute poverty headcount ratio	12.70%	11.20%	10.30%	9.10%	9.10%

Table 6. Impact on absolute poverty of different budgets: FC vs SC II scenario

Baseline	Available Budget	Scenarios	
		FC	SC II
Poor households			
Number	*€56.0 M*		
	Absolute variation	-3091	-7894
28974	*HC % variation*	-10.6%	-27.2%
Headcount Ratio	*€76.7 M*		
	Absolute variation	-3354	-8980
12.7%	*HC % variation*	-11.4%	-31.0%

FC: fuel card scenario; HD: headcount; SC: social card scenario

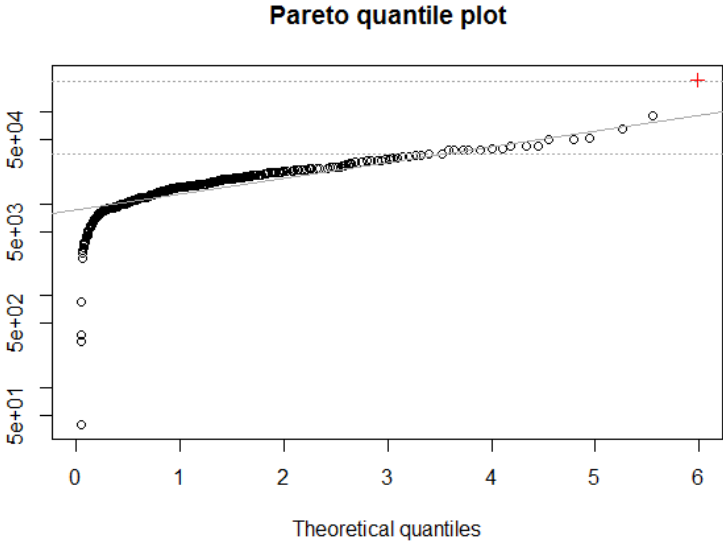**Figure 1**. Income distribution of the EU-SILC regional sample according to Pareto distribution.

Figure 2. Confidence intervals of Poverty Severity Index estimates
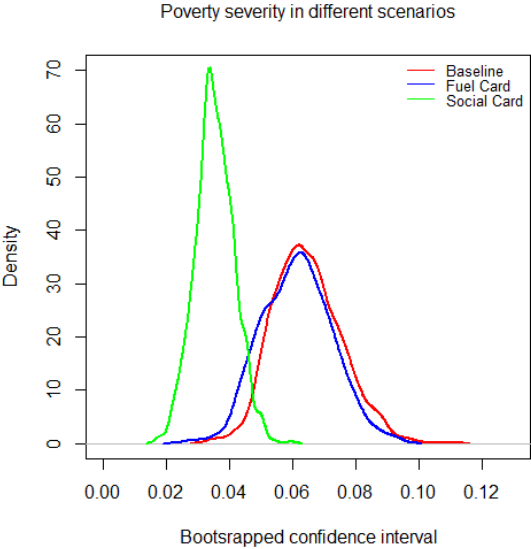
Figure 3. Absolute Poverty Headcount ratio with increasing budgets: SC II scenario