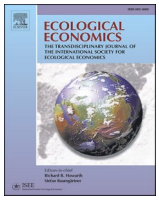
Ecological Economics 185 (2021) 107041

Contents lists available at ScienceDirect

Ecological Economics

journal homepage: www.elsevier.com/locate/ecolecon



Analysis

A regional resource curse? A synthetic-control approach to oil extraction in Basilicata, Italy

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ARTICLE INFO

Keywords:
Subnational resource curse
Extractive industries
Hydrocarbons
Gas
Petroleum

ABSTRACT

Basilicata is a region of Southern Italy where the expansion of oil operations in the 1990s was promoted as an opportunity to foster economic development. Flash-forward to 2020, Basilicata is one of the poorest regions in Italy despite the exploitation of some of the largest onshore hydrocarbon reserves within the European Union. The coincidence of high poverty rates with abundant natural resources suggests that the region is experiencing a 'resource curse'; however, socio-economic problems predate the oil boom, complicating any causality claim. To disentangle and estimate the effects of oil exploitation, we employ the synthetic control method that compares the actual trends of development indicators of Basilicata with a counterfactual that is created by taking a weighted average of trends of other Italian regions –a 'synthetic' Basilicata.

The analysis finds that the development of oil operations has generated no detectable improvement to employment, nor to a range of social indicators, nor to educational attainment. The absence of quantifiable beneficial effects is coupled with negative impacts on other dimensions of development that are more difficult to estimate with our method –especially on the environment and human health. Taken together the evidence offers a sobering prospect over the potential of resource-based development for disadvantaged regions in developed countries.

1. Introduction

Basilicata is a region in the South of Italy that historically has been economically disadvantaged and the expansion of oil operations in the 1990s was promoted as an opportunity to change its development prospects. Fast-forward to 2020, Basilicata is still one of the poorest regions in Italy despite the exploitation of the largest onshore hydrocarbon reserves within the European Union within the European Union. The coincidence of socio-economic ills with abundant natural resources suggests that the region is experiencing a 'resource curse'; however, the development issues predate the oil boom, complicating any causality claim regarding the relationship between resource abundance and development outcomes. To disentangle and estimate the effects of oil exploitation, we employ a Synthetic Control Method (SCM) that compares the actual trends of development indicators of Basilicata with a counterfactual that is created by taking a weighted average of trends of other Italian regions –a 'synthetic' Basilicata.

The potential of extractives-led development rests on the expectation that the rents generated by extractives industries can propel the growth of non-resource based economic sectors. However, the challenges associated with turning extractives' rents into a source of development were evident already in the 1930s when the Venezuelan economist Arturo Uslar Pietri described oil as a 'curse' that had transformed his countrymates into 'useless parasites' (Uslar Pietri, 1936). Uslar Pietri, referring to Aesop's tale 'The Ant and the Grasshopper', underscored the problem of wasteful consumption and proposed a programme of investing the entirety of oil rents in agriculture and industry – coining the expression 'sowing oil' (Uslar Pietri, 1936). Sowing the oil implied investing the rents generated by the exploitation of non-renewable resources in other sectors of the economy, ultimately leveraging on the extraction of rents to become independent from natural resources (Garavini, 2019, p. 46). Since then, many attempts have been made to exploit natural resource rents to facilitate development and the notion continues to hold currency. These attempts have been especially

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https://doi.org/10.1016/j.ecolecon.2021.107041
Received 25 August 2020; Received in revised form 15 March 2021; Accepted 17 March 2021
Available online 5 April 2021

ambitious and often linked to radical political changes and attempts to transform profoundly the management regime of natural resources –most notably through nationalization (Pellegrini, 2018).

Notwithstanding the continuing popularity and apparently commonsensical nature of the notion, the record of resource-based development is mixed at best. Still from Venezuela, taking stock of the poor performance of a resource-rich country that attempted to sow oil, in 1976 Juan Pablo Pérez Alfonzo wrote an influential and straight-spoken book diagnosing the causes that led the country to be 'Sinking into the devil's excrement' (Pérez Alfonzo, 1976). Discussing the 'Venezuela effect', or the 'petroleum sickness', Pérez Alfonzo, former Minister of Mines and Hydrocarbons and one of the founders of OPEC, shows the profound effects that resource abundance had on individuals, the state and society at large by enabling rent-seeking, as opposed to productive investment, to become the most profitable activity in the economy (Pérez Alfonzo, 1976).

More recently, the academic literature -especially in economics- has re-discovered the paradox of abundance and the 'resource curse'. A rich set of studies have explored the paradoxical relationship between resource abundance and development prospects (Van der Ploeg, 2011). While most of the literature on the resource curse has focused on the national level, some studies have analysed the issue of subnational curses that affect particular regions where natural resources are extracted (Poncian, 2019). However, regardless of the literature on the resource curse and the historical experience of failed projects of resource-based development, mainstream ideas in policy circles and popular belief are characterized by a hegemonic expectation that resource abundance could be leveraged upon to promote development (Pellegrini, 2018; Svampa, 2015).

Basilicata, in Southern Italy, is a promising case for resource-based development: a poorer region in a developed country that has the potential to establish an extractive industry that could spur the development of the area. In fact, in the early 1990s the surge of oil operations, accompanied by the marketing of oil companies and policymakers, generated expectations of incipient development (Alliegro, 2012) for the local population – approximately 600,000 people, or 1% of the total Italian population. Since the unemployment level was particularly high (about 30%), employment generation was a particularly pressing issue.

Nowadays, after more than two decades of large scale and ever-increasing hydrocarbon extraction, societal and economic problems persist in the region and it is tempting to attribute to oil extraction activities the current socio-economic ills. However, identifying the net effects of oil extraction remains a challenge since the general economic situation of the region could have worsened without the operations of the extractive industries. Alternatively, it is possible that the region was set to take a course of (fast) development and Basilicata, rather than taking advantage of an opportunity, experienced the deterioration of its prospects because of the resource boom –i.e., it experienced the resource curse. The objective of this paper is to quantify the effects that oil extraction activities in Basilicata have had on several indicators of social development; the effect of the extraction activities will be derived by constructing a statistical counterfactual built using values from a combination of Italian regions that historically have displayed development trends similar to the ones of Basilicata.

The contribution of the paper is three-fold. For the first time, it estimates the impact of the development of the hydrocarbon sector in Basilicata on the socio-economic performance of the region. The case of Basilicata is interesting per se since the extractivist consensus continues to operate and new investments in the area are expected to increase oil production further by 50% in the year 2021. Second, it introduces the synthetic control approach to the study of the subnational resource curse -so far addressed mainly through qualitative case studies and regression-type analysis. Thirdly, this paper adds to the incipient literature on the regional resource curse in developed countries, providing a sobering perspective on the potential of extractive industries to generate benefits in disadvantaged regions of developed countries. The case of Basilicata is particularly salient to the debate since, based on some strands of the literature on the resource curse (discussed in detail below), it is an 'ideal case' for resource-based development: the windfall takes place in a region within a relatively robust institutional setting and, given the relative importance for the economy as a whole, it is unlikely to be the source of Dutch disease, nor of a national-level institutional curse, nor do we have a case of natural resource 'dependence'.

The next section provides an overview of the potential for extractive industries to contribute to socio-economic development; section 3 provides a succinct history of the oil sector in Basilicata; section 4 presents the quantitative methods and section 5 describes data and results. Section 6 concludes and interprets our results with reference to the future of oil extraction in Basilicata and beyond.

2. The potential and challenges of non-renewables fuelled development

While the use of the evocative adjective 'curse' in the literature on the effects of resource abundance dates back to the 1930s (Uslar Pietri, 1936), the recent wave of resource curse studies started with a book by Richard Auty (1993): 'Sustaining development in mineral economies: The resource curse thesis', a study on the economic implications of natural resource abundance. Shortly afterwards, an influential paper by Jeffrey Sachs and Andrew Warner, 'Natural Resource Abundance and Economic Growth', was the first of many econometric analyses that examined and underscored the association between mineral dependence and lower economic growth across a large sample of countries (Sachs and Warner, 1995).

Numerous studies looked into the channels through which natural resources affect economic performance and identified: trade disadvantage (because of currency appreciation), price volatility and secular trends of declining commodity prices, institutions, rent-seeking and conflict, and unsustainable government policies (Papyrakis and Pellegrini, 2019; Papyrakis and Gerlagh, 2004; Van der Ploeg, 2011). The 'Dutch disease' refers to the tendency of resource booms to disadvantage traded sectors since they lead to the over-appreciation of the national currency and reduce the competitiveness of domestic products and services. Commodities are also characterized by volatile prices, which themselves create problems of exogenous boom and bust cycles led by global prices, and the hypothesized secular declining trend of commodity prices imply that countries that specialize in commodity exports will experience deteriorating terms of trade. The institutional channel would operate by making it more probable to establish and survive with sub-optimal institutions when natural resources are abundant. Two institutions-related challenges are rent-seeking and conflict. The former refers to the tendency to expend resources to appropriate rents generated by extractive industries rather than investing in productive activities. The latter refers to the conflicts that are generated by the maldistribution of resource rents as well as the possibility to use rents to support repressive and patronage-based institutions by governments and/or the possibility of rebel groups to exploit lootable resources to finance insurgencies. Finally, the abundance of resources makes it possible to engage in unsustainable policies, and in particular leads to fiscal irresponsibility, for example by using commodities as collateral for loans.

Several studies have looked at the relationship between natural resources and institutional quality in the literature on the 'institutional curse' that is particularly salient for the case of Basilicata. On the one hand, as mentioned in the previous paragraph, natural resources have been found in multiple studies to deteriorate institutional quality broadly defined, but especially in terms of democracy and corruption (Pellegrini, 2011; Ross, 2001). On the other hand, an extensive literature supports the idea that the resource curse is conditional on institutional quality and a surge of resource rents would turn detrimental when they take place in a country characterized by weak institutions (Van der Ploeg, 2011, p. 381). According to this line of thinking, the countries

that manage to escape the resource curse would be those, like Botswana and Norway, which have attained sound institutional development before beginning the large-scale exploitation of natural resources (Acemoglu and Robinson, 2012). It is worth noting that the institutional economics literature has shown long since that institutions are key to (economic) development (North, 1990), hence countries blessed by sound institutions before a resource boom would experience development regardless of resource abundance. That is, the countries that need development the most, or the least likely to experience development without some exogenous shock, are the ones that are characterized by weak institutions and are also those more likely to experience the resource curse.

An important distinction is made in the literature between 'resource abundance' and 'resource dependence', where the former refers to the absolute value of the economic activities based on natural resources and the latter refers to their importance with respect to the rest of the economy (Brunnschweiler and Bulte, 2008). Thus, a resource-rich country like Norway would be a case of resource abundance (measured for example by the value of oil rents per capita) but would not be resource-dependent since only a small portion of national income is produced by the extraction of natural resources (measured for example by the share of oil rents in the gross national product). The observation is that dependence can itself be indicative of underlying socio-economic issues and suggests reverse causality if compared to the standard resource curse: countries depend on natural resources because the rest of the economy is not developing. Thus, resource abundance could be leveraged to promote development, while resource dependence is symptomatic of underlying long-term problems.

The literature on the socio-environmental dimensions of extractive industries goes beyond impacts on average levels (and growth rates) of income and introduced the category of immiserizing growth: when the distribution of negative impacts generated by extractive industries affects already marginalized communities (Arsel et al., 2019). Within this framework, distributional issues become paramount, together with non-strictly economic effects that include social and environmental impacts (Martinez-Alier, 2002). Focusing especially on social impacts, an extensive literature has been documenting conflicts that take place at the local level, either as communities oppose extractive projects (Temper et al., 2018), or dispute the way they operate and the redistribution of rents (Pellegrini and Arsel, 2018). The environmental justice literature has produced evidence of the negative socio-environmental effects of extractive industries and their distribution across locations, time and social groups (Temper et al., 2018).

In recent times, the literature on the resource curse has been focusing also on subnational impacts of resource extraction (Cust and Viale, 2016). The findings of this literature are rather mixed, but there is evidence suggesting that the local economic impacts of resources extraction are not entirely benign. The local effects can be thought of in terms of positive and negative externalities: investment spillovers, backward and forward linkages, and revenues (royalties and taxes) to local authorities. Extractive industries are enclave capital-intensive activities resulting in limited opportunities for positive externalities of the standard type that characterize regional agglomeration (Krugman, 2011). Still, positive spillovers could be associated with infrastructural investment developed for the extractive sector, but utilized by the rest of the economy. For example, transportation infrastructure constructed primarily to serve extractive industries, such as ports or oil roads, can open markets to other economic sectors. Backward and forward linkages have to do with the creation of markets of goods and services that provide inputs or use the extractive industry products as an input. However, the highly specialized and internationally integrated nature of extractive industries makes it unlikely to source the bulk of goods and services locally. Furthermore, the integration of primary commodities as inputs in higher value-added products is an objective of many producers of commodities that often remains an aspiration (Pellegrini, 2018). Specific local content policies might increase the embeddedness of the oil and gas sector in the rest of the economy, although these policies that have been in place since the 1970s have produced mixed results (Tordo et al., 2013). Finally, the local public sector can be a recipient of substantial revenues depending on whether and to what extent the tax system is decentralized. On the one hand, arguments have been put forward on equity grounds in favour of decentralization that can compensate some of the socio-environmental burdens generated at the local level by extractive industries. On the other hand, to limit local resource Dutch disease effects and on different fairness basis, it can be argued that the rents generated by extractive industries should be managed centrally to promote national development since the resources themselves belong to the whole polity. One study on the subnational distribution of royalties from hydrocarbons in Argentina found that they increase local public spending, but quite moderately and with most resources used to repay debt (Besfamille et al., 2019). Evidence from Brazil, associated with a change in national legislation decentralizing petroleum royalties, show that the distribution of royalties to local authorities is associated with lower economic growth (Postali, 2009). Furthermore, sudden increases in resource-generated tax revenues might exacerbate mismanagement and their decentralization has been found to fuel local conflicts (Arellano-Yanguas, 2011).

Studies have examined the role of natural resource abundance on economic development at the sub-national scale in North America with contradicting findings. Evidence from the US indicates that counties that were well-endowed oil resources, measured by the presence of oil fields with more than a 100million barrels of oil at the end of the 19th century, have performed well in terms of manufacturing and agricultural employment density and income in the 1940–1990 period if compared to nearby states and counties (Michaels, 2011). More recent data at state level suggest that natural resource abundance in the 1980s has been associated with sluggish economic performance in the 1986–2001 period (Papyrakis and Gerlagh, 2007). Yet more recently, the 2000s shale gas boom in the south-central US has been associated with a marginal increase in jobs, but not in the share of total jobs in the gas industry (Weber, 2012, 2014) –suggesting that gas producing regions are not facing an incipient curse although the findings are based only on short-term effects. Evidence from Western Canada confirms a marginal positive impact of the development of the energy sector, at the census division level, on employment and income especially during boom periods (Marchand, 2012).

Coming back to the general literature on the resource curse, a line of critique is on its alleged deterministic nature (Lahiri-Dutt, 2006). However, the literature on the resource curse is mostly based on cross-country econometric analyses and, as such, uncovers systematic associations that are characteristic of average effects. As a consequence, it would be ungenerous to attribute to this literature a deterministic character that dismisses the exceptions to the resource curse. The findings of these econometric analyses are compatible with the existence of outliers. A related critique is the simplistic nature of the curse hypothesis that, in the crudest version, cannot discern cases where natural resources will be a blessing rather than a curse (Sovacool, 2010). Other critiques have looked at the econometric techniques employed in many studies and in particular endogeneity of income on extractive industries (Alexeev and Conrad, 2009). While endogeneity problems might affect some of the findings of the curse literature, we observe that the use of instrumental variables chosen by the authors is also questionable since weak instruments are themselves a source of biases and are chosen ad-hoc for their statistical properties rather than for their theoretical power (Alexeev and Conrad, 2009, p. 590). Equally concerning is the fact that the results questioning the robustness of the curse literature might be sensitive to the time frame of the analysis since the authors used as dependent variable data on income from 2000, which was one of the peak years of commodity price cycles (Alexeev and Conrad, 2009). Commodity prices experienced a steep decline throughout 2001, something that would have affected income levels of commodity-rich countries if more recent data were included in the analysis.

Interestingly, and notwithstanding the literature on the resource curse, extractive industries continue to be considered potential sources of development and, in the last decade, many countries have embarked on ambitious extractive projects that are expected to improve their national development trajectory. In particular, resource discoveries and their exploitation have been claimed to hold the potential of 'transforming Africa's opportunities' departing from a history of resource extraction that 'is not encouraging' (Collier, 2010, p. 1105). In fact, at the policy level, there is a continued 'commodities consensus' that envisages development through extractive industries throughout the developing world (Svampa, 2015). Even more concerningly, the countries whose economy depends on extractive industries experience an 'extractive imperative' and policies are set in place to allow these industries to expand and intensify operations even in the face of popular resistance and adverse market conditions (Arsel et al., 2016).

3. Oil and development in Basilicata

The first oil well was drilled in Basilicata already in 1921, but the much later exploitation of large oil reserves and the alleged opportunity to transform the economy of the region coincided with the construction of the Oil Processing Centre in Viggiano (*Centro Olio Val D'Agri*, COVA), which became operational in 1996 and completed to full capacity in 2001.[1] The Centre processes oil, separating it from gas and formation waters, and since 2001 it is connected by a 138 km long pipeline that carries the oil to the Taranto (Apulia) refinery. At full capacity, the station can produce 104,000 barrels of oil per day.[2]

While Basilicata is not the only region producing hydrocarbons in Italy, it is leading the national oil production by a large margin: out of a total of approximately 3.8 million tons of oil produced in 2019 in the 20 Italian regions, Basilicata by itself contributed 3.3 million tons.[3] Moreover, with the new oil station *Tempa Rossa*, that started operations in 2020, the oil production capacity in Basilicata has increased by almost 50% –50,000 barrel of oil a day (Total E&P Italia, 2020). Furthermore, the region has several areas that are currently in the phase of exploration or proposed concession, see Fig. 1.

The expansion of fossil fuel extraction in Basilicata was promoted in the 1990s on the premise that it would boost the local economy and create employment opportunities; in fact, it was touted as a departure from the history of underdevelopment of a peripheral region (Alliegro, 2012). These premises engendered significant hopes because of the levels of poverty Basilicata experienced in the second half of the 20th century. Since the 1950s migration from Basilicata fuelled the process of industrialization in other Italian regions, a course that continues to this day in the service sector. The propensity to emigrate is especially high among the most educated and talented youth, representing a basket case of 'brain drain' (Coniglio and Prota, 2008).

When it comes to the relation between the resource curse and institutional quality, we observe that Italy is solidly above-average governance at the global level. As an example, the ranking on the 'Regulatory Quality' index of the World Bank is, on average, in the top quartile globally in the period 1996–2018 (World Bank, 2020). At the same time, Italy as a whole is not a resource-dependent country and offers an opportunity to test the hypothesis that the natural resource curse affects countries that are resource-dependent, rather than abundant.[4] Overall, a resource windfall taking place in a country with relatively solid institutions and characterized by an economy that is not resource-dependent represents an extreme test for the resource curse hypothesis.

The public perception of oil extraction activities in Basilicata was tested by the 2016 national referendum on offshore hydrocarbon prospection. While the referendum concerned only a relatively minor issue -not directly relevant to the situation in Basilicata-[5] it offered an opportunity to gauge the opinion of the electorate on extraction activities. The region stood out with a relatively high participation rate (over 50%, compared to a national average of 31%) and an overwhelming 96.4% of the votes (compared to 85.8% of the national electorate) voting to halt offshore projects within 12 miles from the cost (Ministero dell'Interno, 2016).

3.1. Economic impacts

In terms of employment, ENI (the main oil company operating in the region) promised to generate 400 jobs directly related to the oil activities; jobs newly created were expected to increase to 1500 if counting indirect ones (Bubbico, 2016).[6] In reality, many of the jobs, and most certainly the more qualified ones, were taken by personnel coming from outside the region.[7] Furthermore, a fine-grained analysis of employment trends in the close proximity of the largest oil installations, suggests that there was a mild increase in employment generation in the municipalities where the oil wells are located and a decrease of opportunities in the surrounding areas (Bubbico, 2016).

Broader socioeconomic dynamics affected by oil extraction are related to several forms of externalities. Basilicata produces several speciality products (such as wine from the Vulture region and several varieties of cheese) generating high value-added and having even greater market potential (Trivellato et al., 2019). The production of these foods is in part overlapping with extraction activities and reputational damage due to the risks of oil-related contamination is already perceived. Such damage might further increase as the real size of the impacts becomes more evident and as extraction volumes continue to increase. Another sector that is considered to hold much potential for the region is tourism. The idea of incipient tourism development is based on the existence of stunning natural sites, many well-preserved rural villages and archaeological sites with Matera, a UNESCO heritage site, representing the crown's jewel (Scorza et al., 2017). The region is considered to have the potential for territorial specialization in the tourism sector also leveraging on the speciality products mentioned above; however, the oil operations, the associated infrastructure and traffic load of trucks and other industrial machinery has impacted the landscape and produces noise and odours that make portions of the territory unviable for the tourism industry. The picture below (Fig. 2), showing road signs of a company offering farm stays and 8 signs of various oil installations surrounding the farm, epitomizes the difficult co-existence of tourism activities and oil extraction.

An externality associated with waste management is the expansion of

[1] See (Ministero dello sviluppo economico, 2020a). In 1996, the Oil Processing Centre Monte Alpi started to operate and its extension was completed in 2001 when it was renamed *Centro Olio Val D'Agri*, COVA (Bubbico and Nardozza, 2013; Minichilli et al., 2018).

[2] See, (*Il Centro Olio Val d'Agri*, 2018).

[3] Italy as a whole has extracted from onshore wells, 3,819,902 tons of oil, and Basilicata 3,304,856 tons −87% of the total. Other producing regions are Emilia Romagna, Molise, Piedmont and Sicily. The latter is the second largest producer with 454,306 tons −12% of the total. Source, (Ministero dello sviluppo economico, 2020c).

[4] In 2017 total natural resources rents represented a modest 0.1% of the Italian GDP if compared to a global average of 2.1% (World Bank, 2020)

[5] The promoters of the referendum eyed a much more comprehensive change in the legislation to limit hydrocarbon activities, but their initiative was prevented by last minute changes made to the regulation enacted by decree of the Italian government (Schirru, 2016).

[6] The data refer to 'regular' activities at the wells, oil centres and other infrastructure and excludes employment generated for temporary activities, such as drilling of new wells and construction of the pipeline.

[7] As exemplified by the service provision of global contractors such as Halliburton (Strippoli et al., 2010). The Basilicata Oil Contractors Network, an association of oil contractors whose members are based in Basilicata, counts 20 members (Basilicata Oil Contractors Network, 2020).

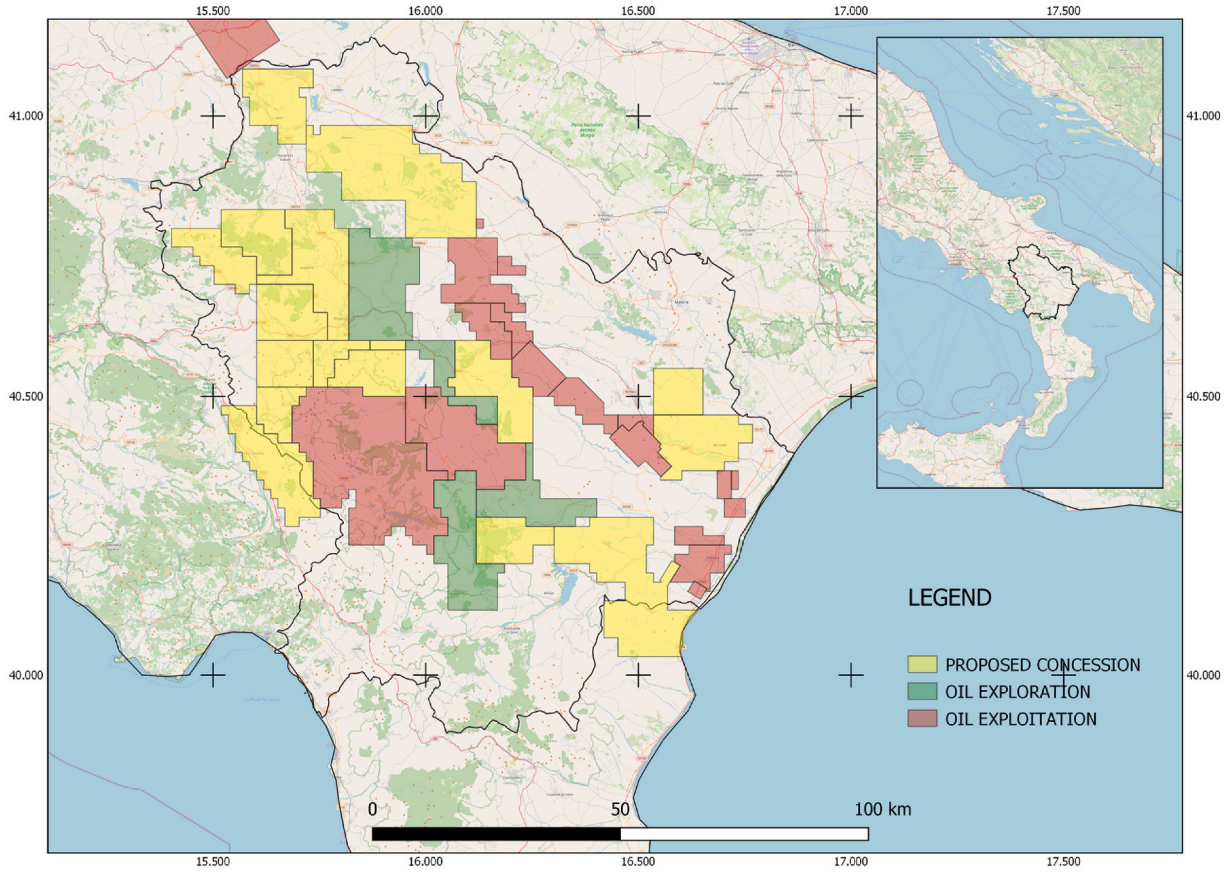

Fig. 1. The geographical distribution of hydrocarbon activities in Basilicata.
Source: own elaboration based on Ministero dello sviluppo economico (2020b).

organized crime to Basilicata, a region that traditionally -and unlike the rest of Southern Italy- was only marginally affected by criminal activities. Numerous forms and large amounts of waste are associated with exploration, sites construction, wells perforation and oil extraction and the primary product of the oil industry is waste. For example, the volume of highly contaminated produced waters globally is more than three times the volume of oil extracted (Fakhru'l-Razi et al., 2009, p. 532). Throughout Italy, but especially in the South, the term '*Ecomafia*' has become a common neologism used to characterize criminal activities centred on environmental crimes and primarily on the illegal disposal of waste (Past, 2013). The expansion of the extractive industries and with them the production, transportation and disposal of huge amounts of waste have coincided with the increased presence of organized crime originating from adjacent regions. Investigations by the prosecutors indicate that these organizations are taking advantage of the opportunities generated by the oil industry (Commissione parlamentare d'inchiesta sul ciclo dei rifiuti e sulle attivita' illecite ad esso connesse, 1997). The spread of criminal organizations, apart from being detrimental to development per se, also contributes to making the whole economy less attractive and crowds out other economic activities.

Another potential channel by which oil extraction can affect local development is through the distribution of royalties that in Italy are equal to 7% of the average net value for onshore operations. These royalties are decentralized with 55% assigned to the Regions, 15% to the Municipalities where the wells are located and the remaining 30% to the central Government (Senato, 2012). Since 1999, the share appropriated by the Regions (if located in the South of the country, as is the case for Basilicata) has increased from 55 to 85%. Furthermore, an additonal 3% royalty going to the central government can be returned to the regions in order to promote economic development and cash handouts to disadvantaged households through the form of a 'social card'. The contribution of the royalties to the budget of the regional government is substantial (oscillating between 3% and 9% of the total budget in the years 2010–2014; Bubbico, 2016), but highly volatile since it depends on the quantity of oil being extracted and on its international price. Most recently, the amount of royalties paid to the region Basilicata was 71 million euros (2% of the total regional budget) and 100 million euros (2.4% of the total) in 2018 and 2019 respectively (Basilicata, Presidenza della Giunta, 2020; Ministero dello sviluppo economico, 2020d).

3.2. Socio-environmental impacts

While most socio-environmental impacts are not part of the analysis produced below, we briefly discuss them to provide a full picture of the industry and because some of these impacts might underpin the socio-economic dynamics that we identify with the SCM method. For example, the evidence of environmental contamination and the related perception of chemical odours in large areas surrounding the oil treatment facilities might underpin a crowding-out effect that the oil sector has for tourism.

The extraction of hydrocarbons is associated with numerous environmental liabilities and affects air, soil and water quality. There is scant official information and no comprehensive overview of emissions, their distribution and the impacts on environmental quality that further complicates the standard challenges of attribution of contaminants to specific sources (Cosmi et al., 2000; Margiotta et al., 2015). The lack of competences at the regional environmental protection agency is often cited as a reason underpinning the paucity of available data (Bubbico and Nardozza, 2013, p. 69). Other relevant factors that might arguably motivate the lack of data and transparency is that regional authorities

Fig. 2. Road signs in Corleto Perticara: tourism and the oil industry.
Source: Photo by the authors, October 2020. The tourist company has been de-identified.

that are supposed to invigilate the environmental impacts of oil extraction, are also the recipients of the royalties and manage part of the waste generated by the industry through public-private joint ventures. The conflicts of interest are further exacerbated by a system of revolving doors by which former employees of public institutions are offered, directly, or indirectly through family and friends, employment and consultancies in the private sector (Santoriello, 2019). Ultimately, much of the monitoring and the evaluation of the impacts is based on data provided directly by the oil companies, or it is the result of volunteer-run community-based environmental monitoring initiatives.[8] The limitations of the existing system of data gathering became apparent when an estimated 400 tons of oil have been spilt from a poorly maintained tank at the COVA in Viggiano. The estimation of the amount of oil being spilt and the subsequent damages caused were produced by the oil company and the accident itself was communicated to the public authorities only years after it took place (Perrone, 2017).

In any case, some studies have produced evidence of contamination associated with specific locations, points in time and pollutants. Biomonitoring of atmospheric pollution found higher than normal concentrations of sulphate (Sph) and anthropogenic trace elements (ATE) in the proximity of (and probably originating from) the COVA (Caggiano et al., 2017); data derived from the regional monitoring network matched with experimental measurements indicate that several contaminants specific to the combustion processes of the COVA (i.e. nitrogen oxides, benzene and toluene) are present in higher concentration in the area surrounding the plant (Calvello et al., 2014). Analyses of bovine and ovine samples from oil extraction areas, albeit conducted without control groups, found lead (Pb) and cadmium (Cd) concentrations in excess of limits established by EU regulation in approximately 10% of the samples (Miedico et al., 2016).

The impacts of oil extraction over the Pertusillo reservoir, a source of water for the aqueduct serving Apulia and Basilicata, exemplify indirect health risks and the lack of transparency thereof. The reservoir is only 3 km away from the COVA and since 2010 it has experienced a phenomenon of water colouration and bouts of fish mortality. Moreover, sediments have been found to be contaminated by hydrocarbons, heavy metals and other compounds that can be associated with oil extraction and whose presence is more preponderant on the side of the lake nearest to the COVA (Colella and D'Orsogna, 2014).

The environmental impacts of hydrocarbons extraction can translate into health risks (O'Callaghan-Gordo et al., 2016). In the case of Basilicata, little epidemiological evidence has been collected to study the extent of health impacts, but the available evidence suggests that the local population could be exposed to oil-related compounds through inhaling, ingestion, and dermal exposure. While a number of circumstantial cases suggest that the health-related impacts might be serious, the epidemiological evidence is lacking and local activists have alleged that obstruction to such studies is motivated by the authorities' fear that serious health impacts would result in extraction activities being blocked (Santoriello, 2019). Only one systematic epidemiological study has focused on the health implications of oil operations but is limited to the municipalities of Viggiano and the adjacent Grumento Nova and focused solely on the impacts of air quality associated with nitrogen oxides (NO_x). The study analysed cardio-respiratory diseases associated with air pollution, with a medium-short latency induction period that is consistent with the time frame of the oil processing related operations of the centre of Viggiano, showing a correlation between the oil operations and significantly higher than normal mortality and hospitalization rates (Minichilli et al., 2018). Given the limited scope of the study, the findings might represent only the tip of the iceberg of widespread and serious health impacts. In the same area, a study analysed respiratory symptoms in a sample of 200 people living in proximity of the oil treatment facility in Viggiano and identified several higher-than-normal respiratory conditions associated with living in the area and whose incidence is inversely correlated to the distance from the oil treatment facilities (Bustaffa et al., 2018). Another study focusing on oncological cases found that they correlate with the spatial distribution of energy-related plants in Basilicata (Rampone and Simonetti, 2019) and a study focusing on Val Basento, where part of the oil-related waste is treated, found inconclusive results (Zona et al., 2019).

4. Synthetic-control analysis

This paper uses the Synthetic Control Method (SCM) to estimate the effect that the presence of oil extraction industries in Basilicata has had on socio-economic indicators. We perform a treatment and control units' comparison, with the control unit here being created synthetically by using a linear combination of control units from the donor pool (Abadie et al., 2015). We estimate how Basilicata would have performed -had the extraction activities not been present in the region- by using the estimated synthetic values as a counterfactual. The objective is to determine whether oil extraction in the region -and the associated investments needed to extract and process oil- have generated employment, have increased the standard of living and raised the educational attainment levels in the region.

The SCM is preferred to other econometric techniques (such as ordinary panel estimation with random or fixed effects) since the approach

[8] See (Bubbico and Nardozza, 2013; COVA Contro, 2020; Minichilli et al., 2018; Santoriello, 2019).

reduces the weaknesses of conventional time series analysis and is robust to time-varying confounding factors (Jandoc et al., 2015). Also, SCM reduces the biases arising from the erroneous selection of comparison units (Abadie and Gardeazabal, 2003). To overcome the counterfactual challenge, SCM employs a data-driven approach to select and combine one or more comparison units -among those in the donor pool- which have a statistical affinity with the treated observation, the region of Basilicata (Abadie et al., 2010). The donor pool is here constituted by all the Italian regions, excluding Basilicata itself. This represents a methodological innovation if compared to employing a single comparison unit (e.g., the average value of indicators for other Italian regions); SCM produces a weighted combination of other Italian regions providing a better fit for the unit of observation. If compared to most of the empirical literature on the resource curse, our approach reduces the risk of finding spurious correlations between time-variant characteristics and the dependence on natural resources and decreases the problem of country heterogeneity.

Columns (2) and (3) of Table 1 show the average values of socio-economic and education indicators for Basilicata and the rest of Italy in the period before the oil boom -from 1971 to 1991. Statistics -which come from Italian census data and other ad-hoc surveys, and collected by the Italian Statistical Office (Istat)[9]- show that, relative to the rest of the country, Basilicata was underperforming in terms of employment -overall and for the youth- social indicators -share of households living in overcrowded dwellings and share of young economically depending on the elderly- and education indicators -the share of Basilicata citizens with a high school diploma and with a bachelor degree.

The existence of these differences before the development of oil activities confirms that a simple comparison of economic and social indicators between Basilicata and Italy would likely produce biased results. The weighted average of other Italian regions combined is the 'synthetic' Basilicata and a comparison of the statistics in column (2) -observed Basilicata- and (4) -synthetic Basilicata- in Table 1 shows a strong similarity and indicates that the synthetic Basilicata is a superior counterfactual compared to a simple average of the rest of Italy.

In terms of notation, we indicate with m the 19 control regions (i.e. the 20 Italian regions minus Basilicata, the treated unit)- and with $W = (w_2, \ldots, w_{20})$ an $(m \times 1)$ vector of non-negative weights which sum to one. The weights attributed to the m control regions jointly minimize the difference between the synthetic Basilicata and the observed one before the treatment. Using our notation, the vector of weights w_m is chosen to minimize the distance:

$$\left(X_1 - \sum_{m=2}^{20} X_m W\right)^2 \quad subject\ to\ w_m \geq 0 \tag{1}$$

where X_1 represents the the value of the variable for Basilicata and the second term indicates the synthetically generated Basilicata (built by summing the product of variable X for each region m with its corresponding weight in vector W). We find an ideal synthetic Basilicata when the difference in (1) is minimized, so that the synthetic Basilicata is statistically similar in the observables to actual Basilicata (column (2) and (4) of Table 1).

For the construction of the donor pool the regions affected by the treatment -or by events similar to the treatment- in the same period should be excluded. As previously mentioned, Basilicata is the Italian region where the bulk of oil extraction is taking place, however, we cannot exclude that oil extraction in Basilicata may have generated spillover effects in other Italian regions. We assume that these effects would be minor in absolute terms and, in any case, since the size of the synthetic Basilicata is much larger than the actual Basilicata, this type of bias would be relatively small (Abadie et al., 2015).

Table 1
Comparison between observed and synthetic Basilicata (column (2) and (4)) and the rest of Italy (3), 1971–1995.

Indicator	Basilicata	Rest of Italy	'Synthetic' Basilicata
Employed citizens (in %)	39.45	42.93	39.45
Young citizens outside work (in %)	18.47	15.30	18.48
Young depending on elderly (in %)	36.33	29.67	36.34
Over-crowded houses (in %)	14.59	6.43	14.19
Citizens with high school diploma (in %)	14.18	16.37	14.27
Citizens with a bachelor degree (in %)	2.21	3.01	2.45

Notes: Authors' calculation from Istat data.

5. Data, analysis and robustness checks

The data used to investigate the effects of extraction activities on economic and social indicators in Basilicata cover the period 1971–2011. The pre-treatment period goes from 1971 to 1995 as the oil industry experienced substantial development in the years 1996—2001 (see the discussion in Section 3); the remaining years -from 1996 to 2011- are the treatment period. Data comes from the Italian census and from other surveys of the Istat. Data from the census are available at 10 years intervals -since 1971 or from 1991- and have been interpolated to produce yearly time series; in case of non-census data available from 1995 onward, only the 1995 value has been used for the pre-treatment period. The post-treatment period we take into consideration -from 1996 to 2011- allow us to capture short and medium-term effects.

To construct a synthetic Basilicata, we compile a list of predictors for the indicators of employment, social conditions and education. The list of variables together with their summary statistics is presented in the Appendix, Table 3. The covariates have been chosen on the basis of availability and also include variables which have been identified as significant determinants for the indicators taken into consideration here (e.g., see Badinger and Url, 2002); a complete list of the variables is available in the Appendix, Table 4.[10] In addition to the covariates -and in line with other studies relying on the SCM technique- we include the indicators of employment, social condition and education pre-treatment as predictors (Abadie et al., 2015; Sills et al., 2015). The inclusion of dependent variables -but only for the pre-1996 values- helps to reduce the sensitivity of the weighting procedure to unobservable factors and to produce a better fitting pre-intervention model (Villar and Papyrakis, 2017).

Fig. 3 displays how synthetic Basilicata behaves vis-à-vis the observed one in the period 1971–2011. The synthetic trends mimic closely the observed trends in the pre-1996 period. The estimated effects of extraction industries in terms of employment-related indicators are the difference between the observed and the synthetic Basilicata in the period after 1996 -indicated by the continuous and dotted line respectively. Overall, extraction activities do not seem to have had much of an effect on the two employment-related indicators. The effects are modest for the indicators related to general employment; youth unemployment seems to have decreased starting in 2001 –the average decrease is in the range of 1%. As discussed below, the treatment effects for all the

[9] For more information on the way Istat collects data, refer to the website http://www4.istat.it/en/, lastly accessed on the 25/06/2020.

[10] The list of predictors includes variables related to the size and composition of the population, to the size of the economy and the value added of the sectors, to the size of private and public investments and to social indicators.

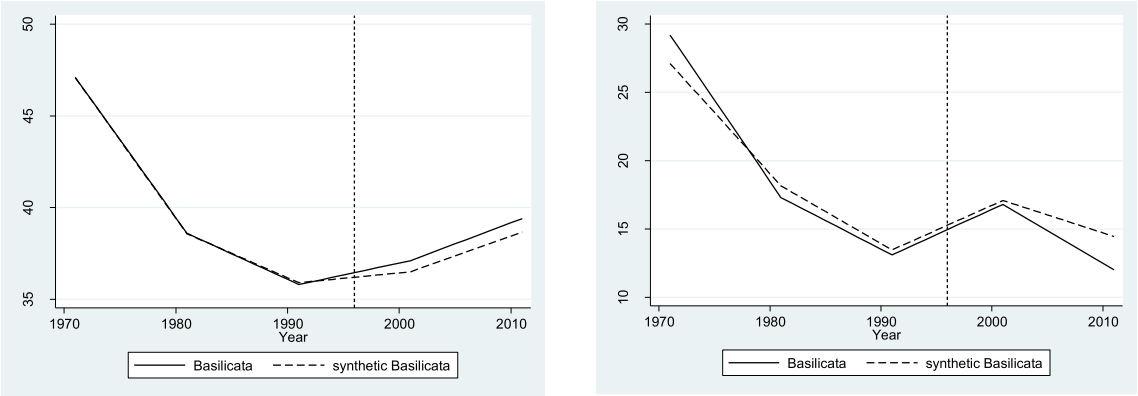

Fig. 3. Comparison of Basilicata and synthetic Basilicata's trend in employment indicators (in %).
Notes: Authors' elaboration from Istat data. The figure on the left shows the share of employed citizens and the figure on the right shows young citizens outside work.

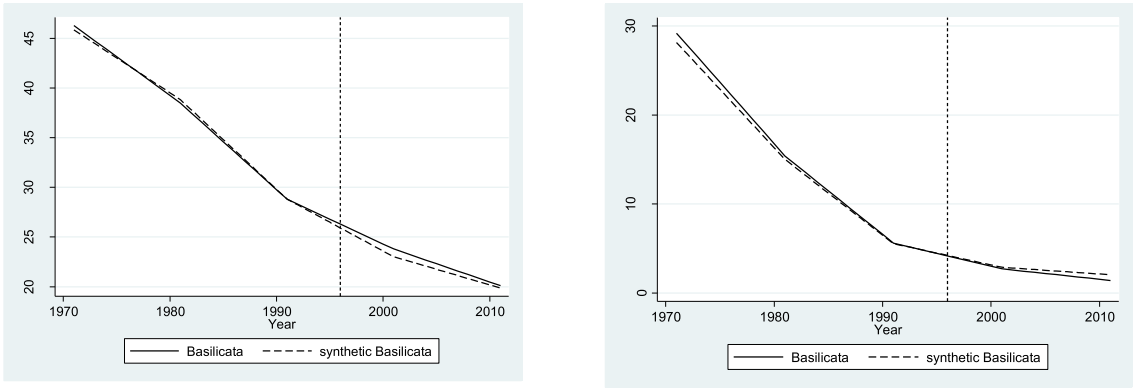

Fig. 4. Comparison of Basilicata and Synthetic Basilicata's trend in social indicators.
Notes: Authors' elaboration from Istat data. The figure on the left shows the share of young citizens depending on elderly citizens, the figure on the right shows the share of overcrowded houses.

variables are statistically insignificant when compared to the distribution of the placebo effects.

Fig. 4 shows how indicators related to the standards of living -share of young people depending on the elderly and the share of overcrowded houses- perform in the observed and the synthetic Basilicata. In the period pre-extraction activities, the synthetic line mimic extremely well the trend of the observed values. Also, the differences in the post-extraction activities period -from 1996 to 2011- are minimal, suggesting that those two indicators had not been impacted by the investments in the oil sector.[11]

Fig. 5 presents the effects that extraction activities have had in Basilicata on two indicators related to the formal education of the population: the share of residents with secondary schooling and those with a bachelor degree.[12] These indicators -and generally speaking all education-related aggregates- may need more years to be affected if compared to employment rates. In any case, once again, the differences between the observed and the synthetic values do not show remarkable differences, nor before nor after treatment, indicating that the observed post-treatment positive trends cannot be imputed to the development of the oil sector.

Table 2 shows the average values for the six indicators taken into consideration in the analysis in the observed (column 2) and synthetic Basilicata (column 3), providing a quantification of the modest differences estimated. To evaluate the credibility and the robustness of the results presented here, we conduct two types of tests. Firstly, we check whether the estimated values of the economic, social and educational indicators taken into consideration in the analysis is generated spuriously by the SCM by applying the same method to another region in our sample. In other words, we want to measure what would happen if we would assign the treatment to another Italian region, instead of Basilicata. Secondly, we can see what happens to our estimates when we restrict the donor pool by excluding some of the donor regions.

The first technique, examining the placebo effects, is performed on the 8 indicators previously used and applied to the remaining 19 Italian regions. From a technical point of view, to conduct the placebo analysis, we rerun the models with the only difference being the fact that the treatment is reassigned to each of the remaining 19 regions. In this way, we can obtain 19 synthetic control estimates for those regions that did not experience the treatment. Graphically, the placebo will allow us to compare the estimated effect of the extraction industries in Basilicata to the distribution of placebo effects obtained for the other regions. The effect of the extraction activities on Basilicata is significant if the estimated effect for Basilicata 'is unusually large relative to the distribution of placebo effects' (Abadie et al., 2015). Fig. 6 shows the difference in terms of the share of employed citizens (figure on the left) and citizens

[11] The analysis on the effect of extraction activities on social indicators has been extended to indicators related to property houses and houses in improper condition; the comparison of the observed and synthetic values do not show any significant impacts.

[12] The SCM has been done taking into consideration other literacy related indicators -share of citizens without any formal education, with an elementary school certificate and without any formal education; the comparison between the observed and the synthetic Basilicata does not suggest any difference in the indicators.

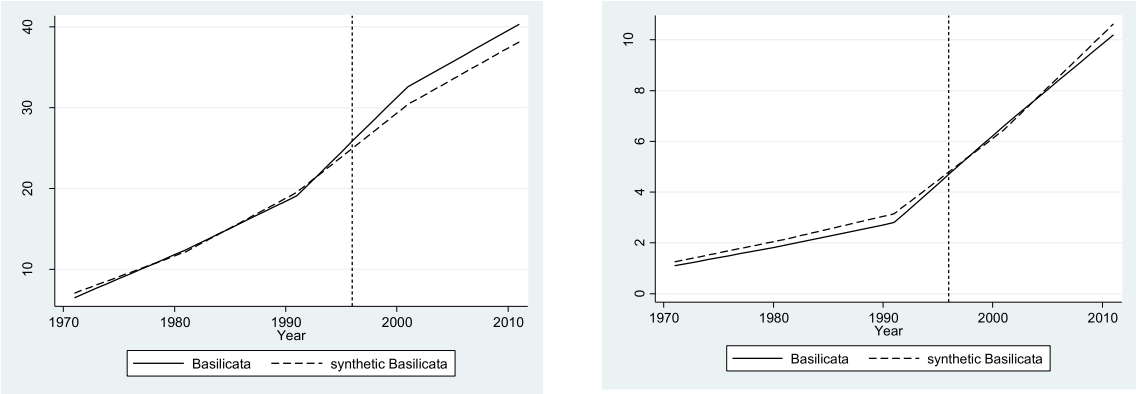

Fig. 5. Comparison of Basilicata and Synthetic Basilicata's trend in education indicators.
Notes: Authors' elaboration from Istat data. The figure on the left shows the share of citizens with a high school diploma, the figure on the right shows the share of citizens with a bachelor degree.

Table 2
Summary statistics for Basilicata and synthetic Basilicata, 1996–2011.

Variable	Basilicata	Synthetic Basilicata
Employed citizens (in %)	37.76	37.17
Young citizens outside work (in %)	14.80	15.84
Young depending on elderly (in %)	22.99	22.47
Over-crowded houses (in %)	2.52	2.84
Citizens with high school diploma (in %)	33.98	32.04
Citizens with a bachelor degree (in %)	7.48	7.57

Notes: Authors' elaboration from Istat data.

Fig. 6. 'In Place' placebo effects for the indicators share of employed citizens (figure on the left) and citizens with a bachelor degree (figure on the right).
Notes: Authors' elaboration from Istat data.

having a degree (figure on the right) between the observed and the synthetic region.[13] The trend of this difference is indicated with a black line for Basilicata and with grey lines for the remaining 19 regions; values above the zero indicates a positive difference between the observed and the synthetic value; in the case of the indicators in Fig. 6, the line above zero indicates that the extraction industries have increased the share of those citizens being employed and having a degree. As the figures suggest, the estimated effects for Basilicata are not large compared to those estimated for the other regions, confirming negligible impacts of the extractive industries in the region. The placebo effect has been estimated also for the remaining indicators; the resulting figures (not reported here) similarly suggest that the effects of extraction activities have not been significant in Basilicata. We also found that, for all the variables, the estimated effects of the treatment are statistically insignificant when compared to the distribution of placebo effects.

The second test looks at whether restricting the donor pool would impact the results. As previously indicated, the synthetic Basilicata in Table 1 is the result of a weighted average of several other Italian regions which are part of the donor pool. The majority of the regions used to create the synthetic Basilicata are regions located in the South of Italy (in the Appendix, Table 5); out of 19 regions in the donor pool, between 2 and 5 of them have been used per indicator. This happened as the

[13] Figure 6 shows that some of the synthetic units developed for those regions in the donor pool -grey lines- do not reproduce the donor outcomes well, i.e. the grey lines is far from the x-axis. This indicates that the model we use to predict the synthetic Basilicata does not predict equally well other synthetic regions.

combination of these regions was able to mimic closely Basilicata before 1996. Reducing the number of regions in the donor pool may affect the way the synthetic control fits the characteristics of the unit of interest. We replicated the results omitting the main donor from each estimate. As expected, the pre-treatment fit deteriorates, but the post-treatment results are not changing substantially.

6. Conclusions

The expansion of oil operations in the mid-1990s in Basilicata has been touted as an opportunity to change the course of development for a disadvantaged region of Southern Italy. This paper provides the first estimates of the impacts of oil extraction on several socio-economic indicators, finding negative results. That is, the estimates indicate that the impacts of the development of oil operations have not engendered major changes to employment prospects, nor to other social indicators, nor to educational attainment. Our results are generated by a case study (employing qualitative and quantitative techniques) and refer to the specific case of Basilicata, but are adding to the incipient literature on the lack of local development potential of the extractive industries (e.g., Cust and Viale, 2016).

A priori, based on the literature on the resource curse, Basilicata appears to be an ideal location for resource-based development: it is a poorer region in a country with a highly diversified economy, thus a resource boom creates resource abundance, but not resource dependence; it has relatively solid institutions if compared to global averages, making it an unlikely case of the resource curse generated through weak institutions.[14] However, the quantitative evidence suggests that the oil sector has not benefitted the rest of the regional economy, but if substantial positive impacts have taken place, they might have been compensated by crowding-out of other sectors or might have accrued outside the region. The results offer a sobering prospect also for the future impacts of the further increase of the capacity to produce oil that will occur now that the *Tempa Rossa* oil has become operational increasing capacity in the region by almost 50%. The absence of quantifiable beneficial effects is coupled with additional impacts on other dimensions of development that are more difficult to estimate. These, minimally, include the extensive negative impacts on the environment and human health.

Finally, putting the evidence on the impacts of oil operations in the context of a broader understanding of development from the perspective of capabilities and freedom (Sen, 1999), it appears that oil constrained the choice set available to individuals and communities without creating new forms of socio-economic opportunities. Oil companies act according to the profit motive that is embodied by the company's strategies. Profits are themselves affected by technical considerations and global prices that are entirely outside the scope of local participation. The locals are mostly resigned to the idea that oil extraction will proceed, regardless of their views and the impacts on their lives, and feel powerless vis-à-vis economic interests that can unduly influence policymakers, state actors and even locally elected officials (Alliegro, 2012; Arsel et al., 2019). Ultimately, the impact of the oil industry on collective goods (such as the environment and public health) and primary goods (such as those created in the agricultural sector) undermines the foundations of the social economy of the region while generating rents that do not translate into improved development prospects (Barbera et al., 2016; Bentham et al., 2013).

Declaration of Competing Interest

None.

Acknowledgements

We would like to thank Martí Orta Martínez who prepared Fig. 1 and Giorgio Santoriello who generously shared his profound knowledge of the oil industry in Basilicata. The contributions of Elissaios Papyrakis and two anonymous referees who provided useful comments are gratefully acknowledged.

Appendix A

Table 3
Descriptive statistics for Basilicata and for the donors' pool, years 1971–2011.

Variable	Basilicata	Donor pool		
		Average	Min	Max
Employed citizens (in %)	38.79	43.24	29.80	55.9
Young citizens outside work (in %)	17.03	13.90	6.50	34.2
Young depending on elderly (in %)	31.12	26.30	15.60	50
Over-crowded houses (in %)	9.88	4.46	0.4	28.7
Citizens with high school diploma (in %)	21.91	23.69	6.8	49.04
Citizens with a bachelor degree (in %)	4.27	5.09	1.20	14.09

Notes: Authors' elaboration from Istat data.

Table 4
List of independent control variables used to estimate the dependent variables.

Dependent variables	Independent variables
Employed citizens (in %)	Employed citizens in the years before the treatment (in %) Fixed gross investment (as a % of the GDP) Number of workers producing services for enterprises (intermediate service sector, as a % of workers in the service sector) Private gross investments (as a % of the GDP) Value added of the industrial sector per unit of worker (in thousands of euro 2010 PPP)

(*continued on next page*)

[14] The related deterioration of institutional quality associated with resource booms has been discussed as one of the mechanisms underpinning the natural resource curse (see Section 2, above). Therefore, it would be also interesting to investigate the trends regarding institutional quality of Basilicata, however data on institutional quality of Italian regions are not available for the period analysed in this study.

Table 4 (*continued*)

Dependent variables	Independent variables
	Population with a diploma degree (in %)
	Population with completed elementary education (in %)
Young citizens outside work (in %)	Young citizens outside work in the years before the treatment (in %)
	Population with a diploma degree (in %)
	Population with completed elementary education (in %)
	Male work participation (in %)
	Female work participation (in %)
	Employed citizens (in %)
Young depending on elderly (in %)	Fixed gross investment (as a % of the GDP)
	Number of workers employed in the sector servicing the enterprises (intermediate service sector, as a % of workers in the service sector)
	Private gross investments (as a % of the GDP)
	Population with a diploma degree (in %)
	Population with completed elementary education (in %)
	Male work participation (in %)
	Female work participation (in %)
	Employed citizens (in %)
Over-crowded houses (in %)	Over-crowded houses in the years before the treatment (in %)
	Fixed gross investment (as a % of the GDP)
	Number of workers producing services for enterprises (intermediate service sector, as a % of workers in the service sector)
	Private gross investments (as a % of the GDP)
	Population with a diploma degree (in %)
	Population with completed elementary education (in %)
	Male work participation (in %)
	Female work participation (in %)
	Employed citizens (in %)
Citizens with high school diploma (in %)	Citizens with high school diploma in the years before the treatment (in %)
	Fixed gross investments (as a % of the GDP)
	Number of workers producing services for enterprises (intermediate service sector, as a % of workers in the service sector)
	Private gross investments (as a % of the GDP)
	Male work participation (in %)
	Unemployed youth (in %)
	Young citizens not working nor studying (in %)
Citizens with a bachelor degree (in %)	Citizens with a bachelor degree in the years before the treatment (in %)
	Fixed gross investment (as a % of the GDP)
	Number of workers producing services for enterprises (intermediate service sector, as a % of workers in the service sector)
	Private gross investments (as a % of the GDP)
	Citizens with high school diploma (in %)
	Citizens without formal education
	Male work participation (in %)
	Unemployed youth (in %)
	Young citizens not working nor studying (in %)

Notes: Authors' elaboration from Istat data.

Table 5
List of donors and associated weights for each of the indicators.

Employed citizens (in %)		Young citizens outside work (in %)	
Region	Weight	Region	Weight
Molise	57.1	Sardegna	47.6
Puglia	21.8	Campania	34.6
Campania	15.5	Umbria	17.8

Young depending on elderly (in %)		Over-crowded houses (in %)	
Region	Weight	Region	Weight
Calabria	47.2	Calabria	72.8
Molise	29.1	Campania	27.2
Sardegna	23.7		

Citizens with high school diploma (in %)		Citizens with a bachelor degree (in %)	
Region	Weight	Region	Weight
Sardegna	54	Valle d'Aosta	81.6
Veneto	46	Puglia	18.4

Notes: Authors' elaboration from Istat data. Up to the three most important donors have been included.

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