8 Virgin material taxation of construction aggregates

The construction sector is pivotal for Italy's transition to a circular economy, mainly due to its demand for raw materials and the substantial levels of waste generation. Virgin material taxes have been used by some countries to lower virgin material demand, promote a more efficient use of resources as well as accelerate a shift to secondary and other recovered materials.
This chapter offers practical guidance for the possible introduction of virgin material taxation on construction aggregates in Italy. It provides key data and considerations for instrument design and implementation, including information on current trends in mineral extraction in Italy, various options for defining the tax, and an evaluation of the associated economic and environmental implications. The chapter concludes with policy recommendations on the definition of a national legislative framework on extractive activities and considerations for creating an effective policy mix.

8.1. Introduction

Construction is a strategic sector for the circular transition in Italy, mainly due to its raw material demand and significant waste generation. As discussed in Chapter 2, baseline projections suggest a marked increase in the sector's output and material intensity by 2050. Furthermore, the sector's dependency on virgin materials raises concerns over security of supply, potentially impacting the competitiveness of the Italian economy. This dependence, magnified by infrastructure projects funded by the National Recovery and Resilience Plan as well as tax incentives for building renovations, underscores the need to focus on reducing waste and boosting recycling in the sector.

In Italy, sub-national levels of government have authority over extractive activities. Currently, most Italian regions impose fees on the extraction of materials such as sand, gravel and rock. Regional laws specify the tax rates, the allocation of revenues, and any requirements for restoration. They can also determine the configuration of municipal or provincial plans that can specify, among other things, extraction sites or exploitation criteria. In general, the Regional Board collects the tax and disperses the revenues, ideally to municipalities with extractive activities to compensate for the environmental impact of the activities.

Due to their design, existing fees do not alter behaviour at the level of material extraction and sourcing. As previously discussed, Italy could benefit from the introduction of a virgin material tax applied to construction materials. By definition, virgin material taxes are designed and implemented to encourage lower virgin material demand, resulting in a faster shift to secondary and other recovered materials, and more efficient resource use, unlike fees (which are payments for the use or right to use land) or consumer product taxation (which is levied on final products). From a legislative point of view, such a tax could be introduced at the national level, either as a new instrument or as a reform of the existing royalty system.

This chapter considers the design and implementation of a national taxation framework for the extraction of construction aggregates in Italy. It includes:

- Key information on current trends in aggregates extraction in Italy, which is useful to inform decisions on tax definition and its ex-ante assessment (section 8.2).
- The development of possible options for tax definition, including on the taxable event, the tax base, the tax rates, and options for revenue allocation (section 8.3).
- An evaluation of the possible environmental outcomes on virgin demand and greenhouse gas (GHG) emissions and other environmental impacts (section 8.4). This combines insights from the Computable General Equilibrium (CGE) modelling of a virgin material tax on construction aggregates with insights from analysis performed with an input-output methodology.
- An evaluation of possible economic implications, including revenue generation, behavioural implications, distributional impacts, as well as employment and VAT implications (section 8.5). This also combines insights from both the CGE modelling with the analysis performed with an input-output methodology.
- A conclusion with policy recommendations regarding the tax definition (section 8.6).

Even though, at the time of writing, the latest available annual data by the Italian National Institute of Statistics (ISTAT) on quarrying in Italy are for 2020, the study uses 2019 as the reference year because the country’s quarrying activity was affected by the COVID-19 pandemic in 2020.

8.2. Current trends in Italy

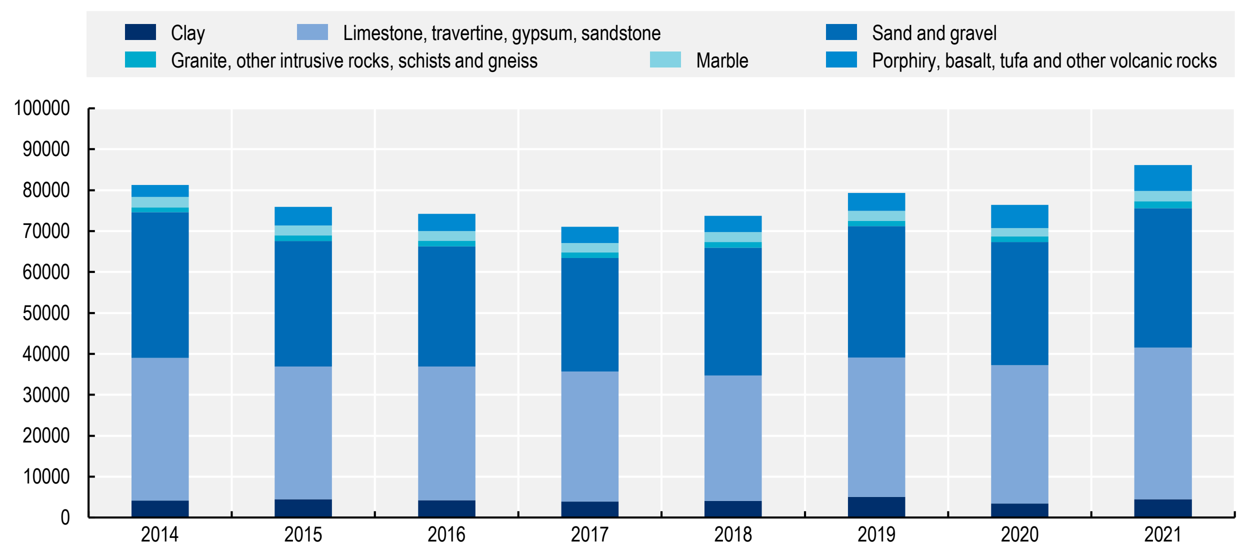
This section provides key information regarding aggregates extraction in Italy to be considered when defining the tax and estimating its impacts.

8.2.1. Extraction of virgin construction aggregates

According to data on mining activities published by ISTAT, in 2021, 86 million cubic metres (m^3) of virgin construction aggregates were extracted annually in Italy. Figure 8.1 illustrates extraction data for 2014-2021. The “limestone, travertine, gypsum, sandstone” and “sand and gravel” categories account for more than three-quarters of total extraction, while the rest is clay, marble, basalt and granite.

Figure 8.1. Extraction levels of construction aggregates in Italy have been relatively stable in recent years

Construction aggregates extracted in Italy (million m^3) by type, 2014-2021



Notes: “Clay” includes clay and peat; "limestone, travertine, gypsum, sandstone" includes alabaster, sandstone, limestone, calcarenite, dolomite, gypsum, marl, quartzarenite, travertine, limestone tuff, verdello; "sand and gravel" includes breccias, conglomerates, inert, alluvial aggregates, mixed material of quarry, stones, sand and gravel, silica sands, tout venant; "granite, other intrusive rocks, schists and gneiss" includes slate, beole, calcareous, diabase, jasper and shingle, diorite, gneiss, granite, repen, serpentine, quartz; "porphiry, basalt, tufa and other volcanic rocks" includes basalt, lapillo, lava and basalt, pepper, pumice, porphyry, pozzolan, trachyte, tuff, volcanic tufa.
Source: Authors’ elaboration based on (ISTAT, 2023[1]).

As detailed in Annex 8.A:

- More than 35% of the limestone was extracted in the South of Italy, primarily in Puglia and Campania.
- Most of the sand and gravel extractions occurred in the North of Italy, with over 39% in the Northwest (mainly in Lombardia) and more than 32% in the Northeast (with the largest extraction in Veneto).
- Over 54% of alluvial aggregates are extracted in Piemonte (Northwest) and more than 26% in Emilia-Romagna (Northeast).
- The extraction of clay was distributed fairly evenly across the Italian territory. Approximately one-quarter of the extractions occurred in the Northeast, one-quarter in the Centre, and one-quarter in the South. Additionally, more than 9% was extracted in the Northwest and over 6% in the Islands.

- More than half of the basalt was extracted from the Islands, and over one-third in Lazio (Centre).
- Most of the silica sand was extracted in Piemonte and Emilia-Romagna.

The report leverages data from the mines and quarries survey (ISTAT, 2023[2]). Another source of data now available is the Economy-wide material flow accounts (EW-MFA) database. This database was not used because some data processing/assumptions were needed to estimate extracted amount per type of material and because there is some misalignment with data used for the current application of fees in Italy.

8.2.2. Recycled construction aggregates

In 2021, 42.3 million tonnes (Mt) of the mineral waste from the construction and demolition sector were prepared for reuse, recycling and other forms of recovery in Italy (ISPRA, 2023[3]), corresponding to 79% of the total mineral waste generated in the same year (53.3 Mt). This represents a high recycling rate, indicating that the construction industry reintegrates substantial amounts of materials back into the economy. However, current recovery of construction and demolition waste (CDW) largely relies on backfilling or lower-grade uses, such as in road sub-bases (European Environmental Agency, 2020[4]). Although information is limited, as of 2015, Italy supplied only around 3% of its demand for aggregates through recycling (Ortiz, 2017[5]).

8.2.3. Prices of construction aggregates and transport costs

Prices of construction aggregates fluctuate over time and vary depending on the type of material, its quality, and the region where it is extracted. Table 8.1 shows the price estimates used in this study. No differentiation was made between primary and secondary construction aggregates, as no price comparisons for Italy or Europe were found in the literature.

Table 8.1. Price and density per type of aggregate included in the study

	Price (EUR per tonne)*	Density** (t/m^3)	Price (EUR per m^3)
Clay (argilla)	5.4	1.9	10.1
Limestone (calcare)	8.0	2.3	18.1
Gypsum (gesso)	12.5	2.1	26.2
Sandstone (arenaria)	24.1	2.3	55.0
Sand and gravel (sabbia e ghiaia)	9.1	1.9	17.6
Alluvial aggregates (inerti alluvionali)	10.7***	2.0	21.5
Silica sands (sabbie silicee)	13.0	1.7	21.9
Granite (granito)	52.6	2.5	130.2
Basalt (basalto)	11.1	2.6	29.0

* The prices per unit of weight were calculated as weighted averages for the period 2016-2022 based on the quantities sold of aggregates in Italy every year (ISTAT, 2023d).
** Densities were estimated using the annual Italian statistics on mineral resource extracted in 2020 in weight and volume (ISTAT, 2023[2]). These densities were used to convert prices per tonne to prices per m^3.
*** The price of alluvial aggregates was not available, and it was assumed to be equal to the weighted average of all aggregates.
Source: Authors' elaboration based on (ISTAT, 2023[2]; ISTAT, 2023[6]).

In general, prices of recycled materials can vary significantly based on factors such as the quality of the material, regional market conditions and the type of material, as well the price of virgin materials. Recycled construction aggregates are expected to be more affordable and cost-effective compared to virgin aggregates, as recycled construction aggregates are not quarried and involve less transportation and processing.[1] Furthermore, they can offer a higher volumetric yield per tonne compared to virgin construction aggregates (McLanahan, 2023[7]). Nevertheless, quality concerns may hinder the use of secondary construction aggregates. Although recycled alternatives are recognized for being just as durable and strong as virgin construction aggregates for most applications (with the possible exception of certain load-bearing applications), the construction industry often favours virgin materials for their perceived superior performance (McLanahan, 2023[7]). Measures to support the supply and demand of recycled construction aggregates could further improve their competitiveness.

Aggregates are usually not transported over long distances from the quarry site as transportation costs significantly impact the overall pricing (European Environmental Agency, 2008[8]). According to the Italian Ministry of Infrastructure and Transportation, the average unit cost of transport for lorries heavier than 26 t was EUR 2.54/km as of January 2023 (category D) (MIT, 2023[9]). Consequently, the unit cost of transporting aggregates 50 km away from the quarry, using full capacity lorries (assumed 32t), would be EUR 3.97/t or EUR 8.37/m^3 (assuming a weighted density of 2.11 t/m^3).

8.2.4. Price elasticity of construction aggregates

Based on the experience of selected EU countries in implementing virgin material taxes, it can be concluded that the demand for construction aggregates is relatively inelastic. Chapter 4 presents the following insights on the price elasticity of aggregates in certain countries:

- The Danish tax on aggregates extraction led to a slight reduction in extraction, but the consumption of aggregates did not significantly decrease, suggesting a relatively inelastic demand. Implementation of the aggregates tax in conjunction with other measures, e.g. the waste disposal tax, mandatory separate collection at source of CDW, generally helped to improve the supply of secondary aggregates in the Danish market (Söderholm, 2011[10]).
- In Sweden, a tax was introduced in 1996 on natural gravel extraction to protect groundwater sources. While the tax started with a low rate, an increase in 2003 resulted in a more pronounced reduction in virgin gravel consumption. However, this decline was also influenced by a rising demand for higher-quality crushed rock (Söderholm, 2011[10]).
- In the United Kingdom, an aggregates tax was introduced in 2002. Although there has been a decrease in aggregate extraction, this trend began before the introduction of the tax and was likely also influenced by such factors as a decrease in infrastructure investment and the landfill tax on CDW.
- Italy has not seen any substantial shifts in the demand for aggregates in reaction to the fees applied since the early 1990s. This indicates the relative inelasticity associated with the low tax rate and the industry’s limited preparation to assimilate recycled materials of similar quality to virgin products, combined with weak disincentives to landfilling (European Environmental Agency, 2008[8]).

The inelasticity in the demand for aggregates is explained by multiple factors (OECD, 2023[11]). Firstly, the low price of aggregates makes their medium-distance transport unprofitable. This significantly limits competition in the market and the possibility of importing these aggregates from other countries. Aggregates are generally consumed within a 50 km radius of their extraction (Mineral Products Association, n.d.[12]) because transportation over longer distances is unprofitable, resulting in limited competition in the sector. Secondly, the use of extracted aggregates, as an input by most productive sectors, has incomplete substitutes, as recycled aggregates are not yet available in sufficient quantity and quality to meet demand. Thirdly, the construction and infrastructure sector is a market that plans years in advance and, therefore, it is significantly slow to react. Additionally, the cost of aggregates typically represents a small percentage of the final price for buyers, so their demand is not greatly influenced by price fluctuations for these materials.

There are limits to the substitution rate from primary materials to secondary recycled materials due to insufficient quantities of recycled aggregates of appropriate quality currently available. Furthermore, even with the total recycling of all CDW, recycled aggregates would not cover the entire yearly demand for construction aggregates. Currently, the countries with the highest percentage of recycled aggregates impose a levy on virgin aggregates (e.g. the United Kingdom), or they have a shortage of available natural rocks (the Netherlands, Malta), or a shortage of CDW disposal space (Sweco, 2022[13]).

The elasticity of demand may increase in the medium to long term if the possibility of substituting virgin aggregates grows, or in the presence of technological advances in production processes. Measures to support markets for recycled aggregates are pivotal to increasing the availability and quality of substitutes.

8.3. Tax definition

This section describes key design characteristics for a proposed tax on construction aggregates.

8.3.1. Taxable event and tax base

The recommended taxable event is the affectation of ecosystem services and the environmental impact of the extractive activity of construction aggregates. Regarding the scope, it is recommended to impose taxes on all construction aggregates so as to prevent the risks of regrettable substitution and to encourage the use of recycled materials.[2]

The tax base depends on when the taxable event occurs (during extraction or consumption) and on the physical magnitude to be taxed (e.g. quantities extracted, affected areas, affected ecosystem services). Conversely, the taxation of extractive activities is generally preferred as it provides a clearer link to environmental impacts and is simpler to implement and enforce compared to taxing the consumption of construction aggregates. One drawback of this approach is that it could inadvertently promote imports, which could give materials imported to Italy a competitive edge, compared to domestic extractions. Given that this is not believed to be a concern in the Italian context, where the quantity of aggregates imported has been very low in recent years (according to EW-MFA data), taxing the extraction of aggregates appears to be the better option.

Virgin material taxes on construction aggregates may generally be implemented as *ad quantum* taxes based on a physical metric (e.g. quantities extracted, surface of the affected area), *ad valorem* taxes based on a monetary metric (e.g. sales price), or a combination of the two models. In principle, environmental taxes should be directly levied on the negative environmental externalities generated by polluters (or a close proxy), thereby aligning environmental damage with pricing and steering business and consumer choices towards a preferred direction. Generally, *ad quantum* taxes are more correctly aligned to environmental harm and are often simpler to administer than *ad valorem* taxes.

Within the *ad quantum* option, the tax is ideally based on both the affected area and the quantity extracted to provide closer links to environmental externalities. In practice, the choice of the physical magnitude on which to apply the tax often depends on the availability of the data: while information on the volume and weight of extracted materials is routinely reported by extraction operators, data concerning the exploited and restoration areas are not as readily available and requires constant updates to align with any variations in extraction operations or changes in land use.

8.3.2. Tax rate

The tax rate is a key factor that might determine environmental and economic outcomes of environmentally related taxes. A tax rate that is too low, although it may generate public revenues, will not be sufficient to drive behavioural change by firms or consumers. Conversely, a tax rate that is too high could lead to negative economic impacts, especially on the competitiveness of firms and the domestic economy.

Economic theory offers varied perspectives on the optimal way to define tax rates:

- **Negative externalities.** A Pigouvian approach sets the tax rate to reflect environmental damage, which is a clear implementation of the polluter pays principle. As such, it ensures that producers and consumers have a financial incentive to take those impacts into account in their decisions. While this is the preferred approach, the valuation process of environmental externalities can be difficult, especially where the damage is inflicted on something that does not have a clear market value, and policy makers might need to resort to a proxy for assessing pollution. The proxy should be as close as possible to pollution, thus minimising the risk of introducing distortions in production patterns.

- **Achievement of environmental objectives.** In some cases, tax rates can be adjusted to meet set environmental targets, such as reductions in GHG emissions or in municipal waste generation. Ecological economics advocates for determining the desired activity level as a technical and political decision. Consequently, environmental taxes would be set to curtail activity to these predetermined levels.
- **Revenue raising.** Funding public spending is one main reason why governments may levy explicit environmentally related taxes. This is often the case of taxes applied on goods with inelastic demand curves. These approaches are not aligned with the objectives of environmental taxes.

A common theme in the first two perspectives outlined above is the idea that the tax rate should reflect the environmental repercussions of the activity, allowing for potential variations based on the severity of the impact. Selected studies have delved into the environmental costs tied to aggregates extraction across various regions (Damigos and Kaliampakos, 2003[14]; Garrod and Willis, 2000[15]; Garrod and Willis, 2000[16]; London Economics, 1999[17]). However, to the best of the authors' knowledge, such investigations have yet to be conducted for Italy. In the absence of specific studies for Italy, which differentiate environmental impacts based on activity type, one approach would be to introduce a flat tax across all aggregates. While this method simplifies the process, cheaper materials could be disproportionately impacted by the relatively higher tax. An alternative strategy might be to differentiate tax rates based on the location of the extraction. For instance, extraction activities on sites situated in protected natural areas could incur a higher tax rate.

The feasibility of importing aggregates significantly influences demand elasticity, which in turn affects the effectiveness of the tax. Two main factors determine the decision to import: the proximity of available materials in neighbouring countries, especially as aggregates are usually used within a few kilometres, and the transportation costs from these countries. As outlined in section 8.2.3, Italy's current transport costs average around EUR 3.97/t (corresponding to EUR 8.37/m^3, assuming an average aggregates density of 2.11 t/m^3 and 50 km). To encourage the use of domestic recycled materials over imported raw materials, particularly in Italian regions bordering other countries, it is advisable to set average tax rates below these transportation costs. Alternatively, a tax on imports could be considered, although the additional administrative costs would need to be justified by the risk of expected large quantities of imports.

8.3.3. Revenue allocation

Revenue from environmentally related taxes may be paid into the general government budget and used in accordance with wider policy issues, or it may lower other taxes. Countries may decide to partially or totally earmark revenues for specific spending purposes, which are generally related to environmental policy objectives. The earmarking of taxes is usually not advised as it may lead to inefficient use of government revenues or even a violation of the polluter pays principle. However, earmarking can be helpful to improve the political acceptability of environmental taxes or to ensure a minimum level of targeted public expenditure on the environment.

Multiple options could be considered for earmarking tax revenues. One common option for earmarked environmental taxes is to offset the loss of ecosystem services in municipalities that are close to extraction sites. Resources channelled to municipalities could be used to initiate restoration efforts to counteract the environmental degradation from extraction activities or to develop recreational spaces for locals. Linking the expenditure of the tax revenue to the taxed sector and the affected municipalities could increase the transparency of the tax and its acceptance by economic agents. Additionally, as discussed in Chapter 7, a structure that partially earmarks funds to bolster the appeal and market competitiveness of recycled materials, for instance, with subsidies, could help promote a shift from virgin to secondary materials within the construction sector. Funds could also be earmarked for infrastructural improvements to improve the recycling of CDW, although there are risks of lock-in effects (as discussed in the case of the landfill tax in Chapter 6).

8.3.4. Tax definition scenarios

Table 8.2 summarizes the different tax scenarios used in the following sections to assess the expected environmental outcomes and economic implications of the tax. Differences relate to the tax base, the tax rate and the use of revenues, as well as the elasticity assumptions (0% and 10% price elasticity).

For scenarios with earmarked revenues, it is assumed that the tax revenue will be used to fund actions for the environmental restoration of the quarrying sites and to promote the production and use of recycled materials. While most regions currently have land restoration obligations linked to regional plans of extractive activities ("Piani Regionali delle Attività Estrattive") and permitting, compliance is not consistently achieved. Additional funding could therefore help to ensure nationwide coverage, especially to address priority sites that have the largest adverse impacts on local communities. The sectoral allocation of revenue is assumed to be as follows: forestry and use of forest areas (28%), waste treatment (28%), construction (28%), and education (6%). The remaining 10% would be retained by the public administration to support the administrative costs of the tax.

Table 8.2. Key aspects of the scenarios analysed for the tax on aggregates extraction in Italy

Scenarios	Tax base	Tax rate	Price elasticity	Earmarked tax
S1	ad quantum Quantity extracted in volume	Tax of EUR 2.5 /m³	0%	Yes
S2			10%	
S3		Tax of EUR 5 /m³	0%	
S4			10%	
S5	ad valorem Monetary value in EUR	Tax of 10% of the aggregate price	0%	
S6			10%	
S7	ad quantum Quantity extracted in volume	Tax of EUR 2.5 /m³	0%	No
S8			10%	
S9		Tax of EUR 5 /m³	0%	
S10			10%	
S11	ad valorem Monetary value in EUR	Tax of 10% of the aggregate price	0%	
S12			10%	

Source: Authors' own elaboration.

8.4. Environmental outcomes

Taxes are widely employed to influence consumption levels. Most governments of OECD countries impose excise taxes on fuel consumption or they differentiate value added taxes (VAT) on food products. Taxes on the extraction or use of primary aggregates are less common, but have been employed by some countries on construction aggregates, such as stone and gravel.

This section discusses the potential environmental outcomes of a tax on the use of primary construction aggregates, and the impact it would have in terms of demand for materials as well as the implications for GHG emissions and other environmental impacts. The environmental outcomes of introducing a virgin material tax on construction aggregates are assessed using two complementary approaches:

- The introduction of a tax on non-metallic minerals of EUR 4/tonne, modelled in ENV-Linkages with a similar methodology as presented in Chapter 7.
- Analysis performed using an input-output methodology to assess the implications of the tax on the switch from primary to secondary aggregates under different tax design options (i.e. for the different tax scenarios

described in Table 8.2). To facilitate the calculations and to provide a higher boundary estimate in this exercise, it is assumed that the tax does not affect total demand of construction aggregates, i.e. that any reduction in primary aggregates demand is compensated by a higher use of secondary materials.

8.4.1. Reduced demand for virgin construction aggregates

It is expected that the introduction of a tax on virgin construction aggregates will reduce the use of virgin aggregates, with gains in resource efficiency or a shift to recycled aggregates, resulting in associated reduced environmental impacts (e.g. extraction-related impacts, GHG emissions).

Policy simulations performed using the ENV-Linkages model indicate that a tax on primary non-metallic minerals of EUR 4/tonne would lead to a 5% reduction in overall demand for these materials in 2040 compared to the baseline. However, the introduction of the tax alone would only lead to modest savings in terms of GHG emissions.

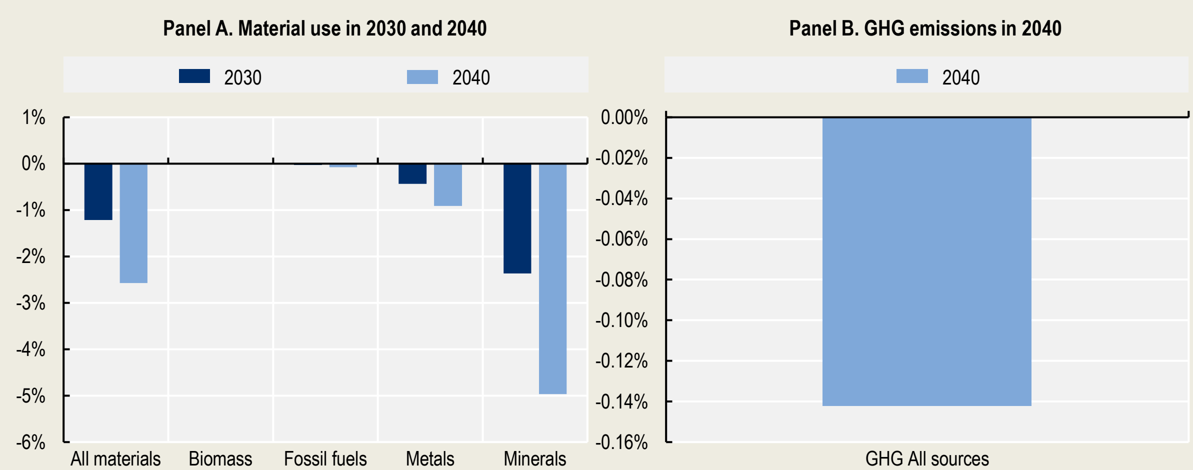
Box 8.1. Results from ENV-Linkages on the introduction of a tax on non-metallic minerals

The introduction of a tax on non-metallic minerals of EUR 4/tonne, modelled in ENV-Linkages with a similar methodology as presented in Chapter 7, is projected to lead to a 5% decrease in the overall use of non-metallic minerals compared to the baseline. Panel A in Figure 8.2 shows the impact of the tax described on the various material categories. In addition to reducing minerals use compared to the baseline, there is also a smaller reduction of metals use due to the impacts on activities that also use metals, as well as in the use of fossil fuels.

The reduction in material use caused by the introduction of a tax on non-metallic minerals would lead to GHG emissions savings of 0.14% compared to the baseline, as shown in Panel B in Figure 8.2. The main impact is on CO_2 emissions, which is linked to the process emissions and energy use in processing non-metallic minerals.

Figure 8.2. A tax on non-metallic minerals is expected to reduce material use

Variation in percentage compared to the baseline scenario



Source: OECD ENV-Linkages model.

As presented in Table 8.3, the results from the input-output methodology suggest that the virgin material tax could substantially shift demand from primary to secondary aggregates, and that the largest reductions in primary demand are expected with *ad quantum* taxes. Demand for all aggregates would decrease by 1.4% for the tax rate option of EUR 2.5/m^3 (S2 and S8), 2.8% with tax rates of EUR 5/m^3 (S4 and S10), and by 1.0% in the *ad valorem* option (S1 and S12). Within the *ad quantum* scenarios, limestone (43% of total reduction) and sand and gravel (28% of total reduction) contribute more than 50% to the total demand reduction, followed by clay (13%) and alluvial aggregates (11%). This largely reflects the current composition of aggregates demand in Italy. The *ad quantum* tax options impact more aggregates with higher extraction levels and lower prices. For instance, under scenarios S2 and S8, the tax rate of EUR 2.5/m^3 represents up to 25% of the price of the cheapest aggregate, which is clay, and only 2% of the price of granite. These proportions double with the tax rate at EUR 5/m^3.

Table 8.3. Demand variation in the scenarios with 10% demand elasticity

Variation in demand compared to current levels, thousand m^3 and % change

Scenario Tax rate	S2 and S8		S4 and S10		S6 and S12	
	ad quantum (EUR 2.5 per m^3)		*ad quantum* (EUR 5 per m^3)		*ad valorem* 10%	
	Thousand m^3	%	Thousand m^3	%	Thousand m^3	%
Clay (argilla)	125	2.5%	251	5.0%	51	1%
Limestone (calcare)	413	1.4%	826	2.8%	299	1%
Gypsum (gesso)	12	1.0%	23	1.9%	12	1%
Sandstone (arenaria)	2	0.5%	4	0.9%	4	1%
Sand and gravel (sabbia e ghiaia)	270	1.4%	541	2.8%	190	1%
Alluvial aggregates (inerti alluvionali)	103	1.2%	206	2.3%	88	1%
Silica sands (sabbie silicee)	16	1.1%	31	2.3%	14	1%
Granite (granito)	1	0.2%	1	0.4%	3	1%
Basalt (basalto)	25	0.9%	49	1.7%	29	1%
Total	**966**	**1.4%**	**1 931**	**2.8%**	**690**	**1%**

Note: numbers may not add up precisely due to rounding.
Source: Authors' own elaboration.

8.4.2. GHG emissions and other environmental savings

As emissions from the recycling process of CDW (mainly associated with energy consumption) tend to be lower than GHG emissions related to the extraction of natural aggregates and landfilling of CDW, the tax is likely to have a climate positive effect. Box 8.1 presents estimates for GHG emissions impacts derived from CGE simulations, suggesting that benefits in GHG emissions from the introduction of the virgin material tax alone (i.e. in the absence of additional climate mitigation policies) could be modest overall. This aligns with results obtained for OECD countries and, in particular, for Europe in a previous analysis (Bibas, Château and Lanzi, 2021[18]). Furthermore, considerable GHG emissions occur in the later stages of the life cycle of construction aggregates, such as cement production, but this is beyond the scope of the current analysis.

This section complements the insights presented, with estimates specific to Italy provided from the academic literature. Borghi et al. (2018[19]) estimated that a shift to best recycling practices for CDW would reduce GHG emissions by 152%. Under current management, the impact is 3.40 kg CO_{2e} per tonne of CDW, while a shift from landfilling would have a net benefit of -1.78 kg CO_{2e} (saved) per tonne of CDW. The largest environmental burden associated with the current management comes from waste transportation, which is not compensated by the use of recycled aggregates. Based on the results of the study by Borghi et al., rough estimates predict that around 13.22 kg CO_{2e} could be saved for every tonne of CDW diverted from landfill to recycling, and thus avoiding the extraction of around one tonne of virgin aggregates (mainly sand and gravel).

According to the life cycle assessment carried out by Simion et al. (2013[20]), using primary data collected for Emilia-Romagna, the production of 1 tonne of aggregates from crushed natural inert quarries generates 103 kg of CO_{2e}, whereas the production of 1 tonne of recycled aggregates from CDW generates 15.5 kg of CO_{2e}. Using estimates by Simion et al. (2013[20]), around 87.5 kg CO_{2e} could be saved from producing and using recycled aggregates instead of virgin aggregates.

In practice, the implications of the tax for the embodied GHG emissions of buildings and infrastructure depend on the sector's response to the tax as well as advancements in the energy mix. A carbon footprint analysis would be needed to accurately estimate the implications on GHG emissions as a result of the tax, also taking into consideration specific features of the tax design and the local context. One aspect highlighted in the literature is the importance of facilitating transportation of CDW to recycling facilities (Borghi, Pantini and Rigamonti, 2018[19]; Cerchione et al., 2023[21]; Colangelo, Petrillo and Farina, 2021[22]). Borghi et al. (2018[19]) recommend localising recycling sites and promoting connections between recyclers and constructors, as well as improving the quality of recycled aggregates.

Beyond GHG emissions, slowing down demand for virgin construction aggregates could mitigate the range of environmental impacts caused by their extraction and consumption. Quarrying operations are often located in natural settings and significant landscape disruptions may occur. During the exploratory and extraction phases, the use of explosives and heavy machinery generates dust, gases and noise. Depending on the location of the activity, the contamination of groundwater and surface waters may occur, as well as disruptions to aquatic ecosystems and sediment transport patterns, potentially reducing water quality. Furthermore, as construction aggregates are a non-renewable resource, their extraction would be increasingly costly, both in economic and environmental terms, in the absence of measures to slow down extraction levels. In addition, quarrying significantly contributes to the generation of waste, including sludge, dust and other non-useful materials.

One indirect environmental benefit of the tax would be a drop in CDW landfilling if the decrease in demand of virgin materials is compensated by a greater demand for recycled alternatives. These impacts would be more likely with a higher landfill tax rate on CDW disposal. In addition, revenue earmarking could amplify the environmental benefits, for instance, if part of the revenues is destined for the restoration of old quarrying sites or to support the availability and quality of secondary materials.

8.5. Economic implications

Economic implications of the introduction of virgin material tax on construction aggregates are assessed using two main approaches.

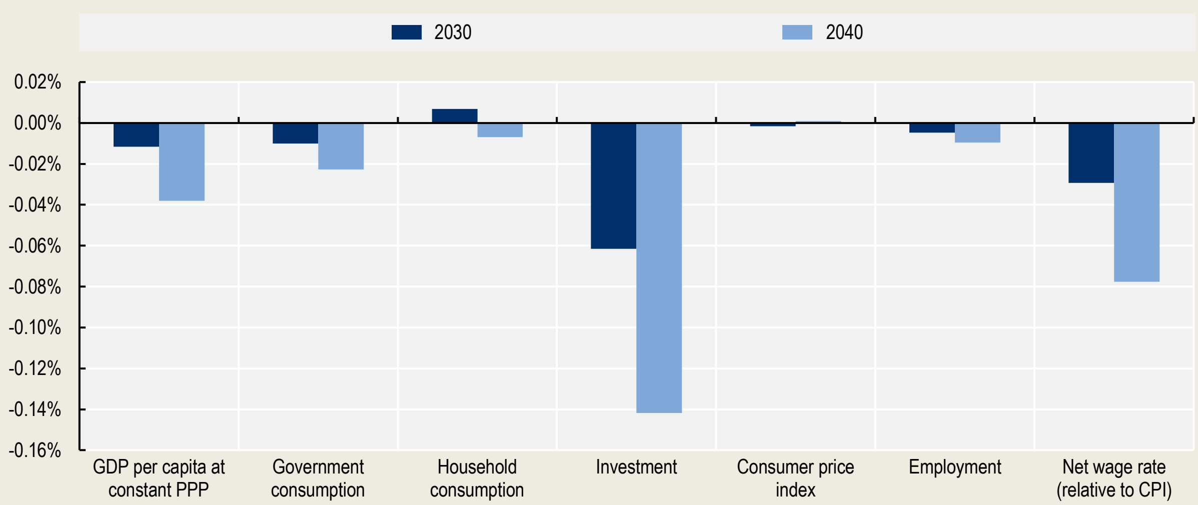
- Simulations performed with ENV-Linkages suggest that the introduction of a tax on construction aggregates is likely to lead to limited impacts on the main macroeconomic indicators, such as GDP and employment. Box 8.2 contains a more detailed description.
- Insights from the empirical literature and calculations performed using an input-output methodology are leveraged to assess the economic implications of different options in instrument design to estimate the economic implications of the different scenarios in terms of revenue generation, behavioural changes, distributional impacts and gross value added (GVA). To facilitate the calculations, and to provide a higher boundary estimate, it is assumed that the total demand of aggregates is not affected by the tax, i.e. that any reduction in virgin aggregates demand is compensated with an increase in the use of secondary aggregates. The estimation has been carried out using 2019 data.

Box 8.2. Results from ENV-Linkages on the introduction of a tax on non-metallic minerals: macroeconomic implications

The introduction of a tax on non-metallic minerals of EUR 4/tonne, modelled in ENV-Linkages with a similar methodology as presented in Chapter 7, would lead to limited macroeconomic implications. Figure 8.3 presents the variation in 2040 compared to the baseline scenario. The variation of GDP per capita is projected to remain below 0.04% in 2040. The principal reason is that the tax is targeting a small sector of the economy, mainly impacting the processing and extraction of non-metallic minerals and their main end-use sector: the construction industry. This explains why the impact on investment (of which construction is the main beneficiary) is greater than the impact on GDP. The impact on employment and wage rates remains limited.

Figure 8.3. The tax on non-metallic minerals would lead to minimal changes in macroeconomic indicators

Variation in percentage compared to the baseline scenario

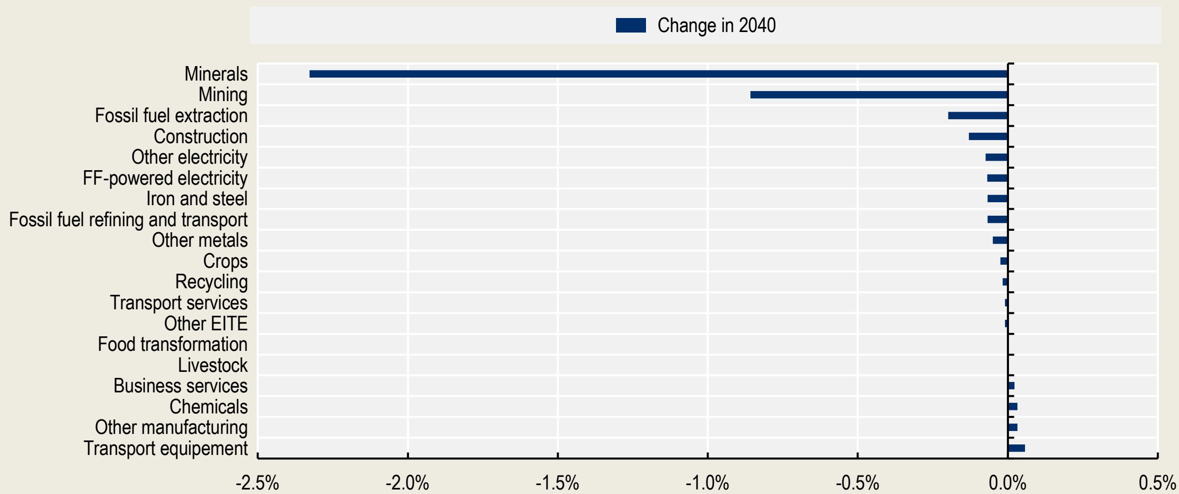


Source: OECD ENV-Linkages model.

The small change in overall employment hides a larger disparity in sector-specific employment. Figure 8.4 shows the evolution of employment compared to the baseline scenario in 2040. As expected, the largest impact is projected to occur in sectors linked to non-metallic minerals: processing and extraction, and construction. The energy sectors (fossil fuel extraction and power generation) are impacted because of the (small) macroeconomic impacts and because of the fall in output in the sectors linked to metals and minerals.

Figure 8.4. The tax on non-metallic minerals is expected to negatively affect employment in the targeted sectors

Variation of employment by sector w.r.t the baseline scenario, in 2040



Source: OECD ENV-Linkages model.

8.5.1. Revenue generation

The revenue generated by a virgin material tax would be one order of magnitude higher than the revenues generated by existing fees, which, in 2021, amounted to approximately EUR 50 million at the national level for all construction aggregates, including ornamental stones (see Chapter 5).

Table 8.4 reports expected tax revenues by type of aggregates for scenarios S1-S12 (see Table 8.2.). The potential revenues are higher for *ad quantum* taxes (than for *ad valorem*). For the *ad quantum* taxes, revenues would amount to EUR 170-172 million at a tax rate of EUR 2.5 per m^3 (S1 and S2), and to EUR 335-344 million at a tax rate of EUR 5 per m^3 (S3 and S4). Revenues would amount to EUR 131-132 million for the *ad valorem* tax of 10% of the aggregates price (S5 and S6). The effect of demand elasticity on revenue is limited overall. For the 12 scenarios, limestone is the aggregate contributing the most to the total revenue of the tax (at 40-41%), followed by sand and gravel (at 25-27%), and alluvial aggregates (at 12-13%).

Table 8.4. Aggregates tax revenue per scenario

Tax revenues by scenario, EUR millions

	S1 and S7	S2 and S8	S3 and S9	S4 and S10	S5 and S11	S6 and S12
Scenario Tax rate	***ad quantum* (EUR 2.5/m^3)**		***ad quantum* (EUR 5/m^3)**		***ad valorem* 10%**	
Scenario Elasticity	**0%**	**10%**	**0%**	**10%**	**0%**	**10%**
Clay	12.7	12.4	25.3	24.1	5.1	5.1
Limestone	74.7	73.7	149.4	145.3	54.1	53.6
Gypsum	3.0	3.0	6.0	5.9	3.2	3.1
Sandstone	1.0	1.0	2.0	2.0	2.2	2.2
Sand and gravel	47.6	46.9	95.2	92.5	33.5	33.2
Alluvial aggregates	22.1	21.9	44.2	43.2	19.0	18.8
Silica sands	3.4	3.4	6.8	6.7	3.0	3.0
Granite	0.8	0.8	1.6	1.6	4.1	4.1
Basalt	7.2	7.1	14.3	14.1	8.3	8.2
Total	**172.5**	**170.0**	**344.9**	**335.3**	**132.5**	**131.2**

Note: numbers may not add up precisely due to rounding. As the revenue generation does not depend on whether the tax is earmarked or non-earmarked, the scenarios with the same tax characteristics and elasticity (e.g. scenarios S1 and S7) are reported together. These calculations assume that the virgin material tax would not affect overall materials use in the short term. However, in practice, revenues would be lower once the tax is effective, i.e. it effectively reduces the extraction of construction aggregates.
Source: Authors' own elaboration.

8.5.2. Behavioural and distributional implications

The construction sector could respond to the tax implementation through any combination of possible scenarios that affect the demand of virgin construction aggregates: i) keeping constant levels of material extraction, with the tax mostly passed on to the final price (paid by the end consumer); ii) reducing extraction, shifting towards alternative raw materials, such as wood, which is only feasible in specific cases; and iii) reducing extraction, transitioning to secondary materials, contingent on the ability of recycled aggregates markets to meet the required quantities and quality standards at a competitive price.[3]

Monitoring and controls are crucial to ensure a satisfactory level of tax compliance within the extractive and construction sectors. Firms, particularly those with environmental tax liabilities, tend to engage in evasion practices, unless there is a strong likelihood of an audit. As discussed in the previous sections, an earmarked tax could enjoy a more positive reception among economic actors, potentially contributing to higher compliance rates while promoting the use of recycled materials.

The readiness of the market and the industry's response will ultimately influence who bears the burden of the tax and to what degree. When the demand for materials is more elastic than supply, producers shoulder most of the tax cost. However, if demand is more inelastic than supply, the tax would have a minimal effect on extraction levels in the short term, with the greatest impacts of the tax affecting consumers. The latter scenario is more likely for construction aggregates, given that extraction rates can, to a certain extent, be adjusted, whereas demand for construction aggregates is typically inelastic in the short and medium term (as already discussed in section 8.2.4). The risk of distributional impacts is expected to be minor overall because the aggregates contribution to the total cost paid by the construction sector is small. Hence, corrective measures to adjust for disproportionate impacts on low-income consumers may only be required under specific circumstances. However, this scenario highlights the importance of complementary measures to amplify the potential of the tax.

8.5.3. Gross value added and employment implications

This section estimates the direct and indirect implications for each scenario in terms of GVA and the effects on employment associated with the variation in demand and the distribution of tax revenues allocated to public spending. This estimate has been made using the input-output methodology and information from the Italian input-output (I-O) tables for the year 2019. The input-output methodology is described in more detail in Annex 8.C. The calculations have been performed using the 63 productive sectors disaggregated in the Italian I-O tables, but which are presented in aggregate form within 12 sectors for better readability.

Direct effects are generated within a specific production sector and result from expenditures on the final demand within that sector. These effects are therefore directly linked to final demand in that particular branch of production. Indirect effects are generated across all production sectors because the demand originates from a specific sector's production processes. As this demand ripples through the economy, various sectors need to purchase inputs from one another. Collectively, these cascading impacts comprise the indirect effects associated with the final demand originating from the production sector which initiated this chain reaction. Detailed GVA and employment impacts of the proposed tax, disaggregated by productive sector, are available in Annex 8.D. It is important to consider that the implications on GVA and estimated jobs, in this section, relate exclusively to reduced demand of virgin aggregates; any effects of this tax on the variation in the demand of recycled aggregates is beyond the scope of this study.

Economic implications of reduced demand

While the modelling insights suggest that the economic impacts of the tax would be small overall, there are likely to be significant variations depending on tax design. GVA and employment would be affected by variations in the demand for virgin aggregates (as summarised in Table 8.5). The scenarios with EUR 5/m^3 (S4 and S10) get approximately twice the demand reduction obtained by the other tax options (EUR 2.5/m^3 and *ad valorem*).[4]

Table 8.5. Variations in the demand for virgin aggregates in the scenarios with (10%) demand elasticity

EUR thousands

	S2 and S8	S4 and S10	S6 and S12
Scenario Tax rate	**ad quantum (EUR 2.5 /m^3)**	**ad quantum (EUR 5 /m^3)**	**ad valorem 10%**
Scenario Elasticity		10%	
Clay	1 267	2 534	512
Limestone	7 471	14 942	5 409
Gypsum	302	604	316
Sandstone	101	203	223
Sand and gravel	4 758	9 517	3 350
Alluvial aggregates	2 211	4 422	1 902
Silica sands	341	681	298
Granite	79	157	409
Basalt	717	1 433	831
Total	**17 245**	**34 491**	**13 249**

Note: no results are presented for odd scenarios with zero demand elasticity, as there is no demand variation.
Source: Authors' own elaboration.

While effects on GVA and employment are expected to be small overall, they vary across scenarios (see Table 8.6 and Table 8.7). The scenarios with EUR 5/m³ tax rate have around twice the effects associated with the other two options. Indirect effects are highly important as they account for 68% of employment and 46% of GVA effects (in all the scenarios). With respect to the impact on productive sectors, the most significant direct effects occur in the "mining and quarrying" sector. Indirect effects, i.e. the impacts of reduced demand in the extractive industry sectors on the rest of the economy due to reduced sales, are present in the sectors of "transportation and business services", "wholesale and retail trade" and "energy, water and waste treatment". According to the Italian I-O tables, these relationships are not very relevant.

Table 8.6. Impact on employment in the scenarios with 10% demand elasticity

Number of people in full-time employment

Scenarios	S2 and S8			S4 and S10			S6 and S12		
Scenario tax rate	***ad quantum*** **(EUR 2.5 per m³)**			***ad quantum*** **(EUR 5 per m³)**			***ad valorem*** **10%**		
Economic activities	**Direct**	**Indirect**	**Total**	**Direct**	**Indirect**	**Total**	**Direct**	**Indirect**	**Total**
Agriculture, forestry, fishing	0	0	0	0	-1	-1	0	0	0
Mining and quarrying	-8	0	-8	-16	0	-16	-6	0	-6
Manufacture of food products, beverages and tobacco products	0	0	0	0	0	0	0	0	0
Manufacture of textiles, wood and paper	0	0	0	0	0	0	0	0	0
Manufacture of coke and chemicals	0	0	0	0	0	0	0	0	0
Other manufacturing	0	-1	-1	0	-2	-2	0	-1	-1
Energy, water and waste treatment	0	-1	-1	0	-2	-2	0	-1	-1
Construction	0	-1	-1	0	-1	-1	0	0	0
Wholesale and retail trade	0	-2	-2	0	-5	-5	0	-2	-2
Transportation and business services	0	-9	-9	0	-19	-19	0	-7	-7
Public administration and collective services	0	-1	-1	0	-2	-2	0	-1	-1
Other services	0	0	0	0	-1	-1	0	0	0
Total	**-8**	**-17**	**-25**	**-16**	**-35**	**-51**	**-6**	**-13**	**-19**

Source: Authors' own elaboration.

Table 8.7. Impact on GVA in the scenarios with 10% demand elasticity

EUR millions

Scenarios	S2 and S8			S4 and S10			S6 and S12		
Scenario tax rate	ad quantum (EUR 2.5 per m^3)			*ad quantum* (EUR 5 per m^3)			*ad valorem* 10%		
Economic activities	**Direct**	**Indirect**	**Total**	**Direct**	**Indirect**	**Total**	**Direct**	**Indirect**	**Total**
Agriculture, forestry, fishing	0	0	0	0	0	0	0	0	0
Mining and quarrying	-1	0	-1	-3	0	-3	-1	0	-1
Manufacture of food products, beverages and tobacco products	0	0	0	0	0	0	0	0	0
Manufacture of textiles, wood and paper	0	0	0	0	0	0	0	0	0
Manufacture of coke and chemicals	0	0	0	0	0	0	0	0	0
Other manufacturing	0	0	0	0	0	0	0	0	0
Energy, water and waste treatment	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0
Wholesale and retail trade	0	0	-1	0	0	0	0	0	0
Transportation and business services	0	-1	-1	0	-1	-1	0	-1	-1
Public administration and collective services	0	0	0	0	0	0	0	0	0
Other services	0	0	0	0	0	0	0	0	0
Total	**-1**	**-1**	**-3**	**-3**	**-2**	**-5**	**-1**	**-1**	**-2**

Source: Authors' own elaboration.

Economic implications of the use of tax revenue

Tax revenues used by sub-national levels of government as public expenditure will generate direct economic benefits on specific productive sectors, and subsequent indirect effects on the rest of the economy. Based on the assumptions made with respect to the use of tax revenues, the economic impact would be greatest with the highest tax rate. The direct economic impact (both on employment and GVA) will be concentrated in the productive sectors of agriculture, forestry and fishing, construction, public administration, and waste treatment, whereas the main indirect effects will be observed in the transportation and business services and in other manufacturing sectors. The economic implications of the earmarked taxes (S1-S6) are detailed in Annex 8.D (in terms of employment and GVA generation).

For the estimate of "annual economic impact" of the non-earmarked tax, it is assumed that generated tax revenue will be used in the public administration sector. In terms of both job creation and GVA, the direct economic impact is concentrated in the productive sector of public administration, whereas indirect effects are generated in activities related to transportation and business services, public administration and collective services, and energy, water and waste treatment. In Annex 8.D, Annex Table 8.D.3 and Annex Table 8.D.4 detail the results for the non-earmarked tax options.

The "public spending impact" columns in Table 8.8 report on the estimated annual employment and GVA associated with the tax revenue for all the scenarios.

8.5.4. Total economic implications

As illustrated in Table 8.8, the economic benefits associated with tax revenues are significantly greater than the losses caused by the reduction in demand. Based on the assumptions of the proposed scenario, the total economic impact of the tax would be positive in terms of both employment generation and GVA. In addition, Table 8.9 shows the main sectors affected, distinguishing between direct and indirect sectoral effects.

Table 8.8. Total economic impacts, by scenario

Scenarios	Potential revenue (EUR millions)	Job impact (annual employment)			GVA impact (EUR millions)		
		Demand-related impact	Public spending impact	Total	Demand-related impact	Public spending impact	Total
S1	173	0	2 553	**2 553**	0	144	**144**
S2	170	-25	2 517	**2 492**	-3	142	**139**
S3	345	0	5 106	**5 106**	0	288	**288**
S4	335	-51	4 963	**4 913**	-5	280	**275**
S5	132	0	1 962	**1 962**	0	110	**110**
S6	131	-19	1 942	**1 922**	-2	109	**107**
S7	172	0	1 870	**1 870**	0	156	**156**
S8	170	-25	1 844	**1 819**	-3	154	**151**
S9	345	0	2 470	**2 470**	0	312	**312**
S10	335	-51	3 636	**3 585**	-5	303	**298**
S11	132	0	1 437	**1 437**	0	120	**120**
S12	172	-25	1 423	**1 397**	-3	118	**116**

Note: In terms of employment, an earmarked tax (S1-S6) results in a greater impact than the non-earmarked one. This is because sectors, where the impact of the earmarked tax option is concentrated, generate higher employment per product. Conversely, in terms of generated GVA, the non-earmarked tax option (S7-S12) has a greater impact because sectors where the impact of this tax option is concentrated have a higher potential for generating GVA per product.
Source: Authors' own elaboration.

Table 8.9. Main sectors affected by the different tax options

	Earmarked tax S1-S6		Non-earmarked tax S7-S12	
Effects	Demand-related impact	Public spending impact	Demand-related impact	Public spending impact
Direct Job Impacts	Mining and quarrying	Agriculture, forestry, fishing Construction Public administration and collective services Energy, water and waste treatment	Mining and quarrying	Public administration and collective services
Indirect Job Impacts	Transportation and business services Wholesale and retail trade	Transportation and business services Other manufacturing	Transportation and business services Wholesale and retail trade	Transportation and business services Public administration and collective services Energy, water and waste treatment

	Earmarked tax S1-S6		Non-earmarked tax S7-S12	
Effects	Demand-related impact	Public spending impact	Demand-related impact	Public spending impact
Direct GVA impacts	Mining and quarrying	Agriculture, forestry, fishing Construction Public administration and collective services Energy, water and waste treatment	Mining and quarrying	Public administration and collective services
Indirect GVA impacts	Transportation and business services Wholesale and retail trade Energy, water and waste treatment	Transportation and business services Other manufacturing	Transportation and business services Wholesale and retail trade Energy, water and waste treatment	Transportation and business services Public administration and collective services Energy, water and waste treatment

Note: In the indirect effects, the "energy, water and waste treatment" sector is more significant in terms of GVA than in terms of employment because this sector has a greater capacity to generate GVA per unit of production.
Source: Authors' own elaboration

8.6. Implications for policy design and implementation

While virgin material taxes are more challenging to implement than fees, taxes may contribute to the reduction of virgin materials demand. Experience from selected OECD countries suggests that taxation on virgin materials can have an impact despite the relatively low price elasticity of aggregates, especially when implemented in combination with landfill taxes and other supporting measures. Furthermore, revenues have been used to finance initiatives with community or environmental aims, such as recovering abandoned quarries. Revenues could also be used to potentially finance incentive mechanisms aligned with higher circularity and sustainability, such as support for secondary materials.

This ex-ante assessment can provide a useful guide for the design and implementation of virgin material taxes in Italy.[5] The next section summarises the key considerations for such policy design and implementation in the Italian context.

8.6.1. Possible key characteristics of a national legislative framework on extractive activities

> *Introduction at the national level for a harmonised approach across regions*

In the Italian context, the majority of decisions concerning the design and implementation of a virgin material tax on construction aggregates would be made at sub-national levels of government. However, the establishment of a national legislative framework could help to harmonise the implementation of the tax instrument. For instance, minimum tax rates set at the national level could be pivotal in ensuring an increase in the level of taxation across the country, while allowing for some flexibility across regions to adapt to local circumstances.

> *Taxable event and tax base: extraction of all quarried non-energy minerals.*

It is recommended that the tax applies to the extraction of all categories of quarried construction aggregates. While the analysis here did not include ornamental stones (due to limited data availability), in principle, there would be no environmental or economic reason to exclude these materials from the tax.

> *Tax rates:* ad quantum *taxes are preferable, ideally combining a measure of both the areas affected and the extracted volumes.*

The assessment carried out suggests that *ad quantum* taxes are preferred, as they represent a closer proxy to the environmental impact associated with extraction than *ad valorem* taxes. *Ad quantum* taxes should ideally combine both a measure of the areas affected (e.g. extraction surface areas) and the extracted volumes (in tonnes or m^3), where data is available. In specific local contexts, a combination of *ad valorem* and *ad quantum* taxes could also be considered. With *ad quantum* options, it is suggested to start with a lower tax rate that gradually increases over time. Taxes that are introduced progressively are often better received by the affected parties and, as they provide more long-term visibility, they may allow economic actors to mitigate economic impacts. Hence, the national framework could allow for *ad quantum* taxes (via volumes and/or extraction surface areas) as well as minimum tax rates for each material type that progressively increase over time.

> *Use of revenues: sub-national governments are best placed to allocate revenues according to local circumstances. Requirements for partial earmarking could be considered to support environmental restoration.*

The earmarking of tax revenues is usually not advised as it may lead to inefficient use of government revenues, even though it can be helpful in specific instances, for example, to improve the political acceptability of environmental taxes or to ensure a minimum level of targeted public expenditure on the environment. Earmarked revenues could be used for the environmental restoration of quarries, as well as the transition of the construction sector towards a circular economy, for instance, with measures that enable material recovery and reuse. In Italy, the regions also have the authority to make decisions on the use of revenues. It may not be advisable to be prescriptive on the use of revenues at the sub-national level as, in general, local governments may be better placed to identify the most efficient use of revenues (e.g. paid into the general government budget, contributions to wider policy issues, reduction in other taxes). However, national legislation may be helpful in establishing minimum requirements on environmental restoration. The institution of specific funds for restoration may be considered. Currently, regional plans on extractive activities provide a key tool to regulate the sector. This includes planning obligations for environmental permits and provisions for quarry restoration after closure. National legislation could also include specific provisions to support the municipalities that are directly affected by quarrying activities.

8.6.2. ***Considerations on the policy mix***

The scenarios considered in this section suggest that both the economic implications and environmental outcomes of the proposed aggregates tax appear to be relatively modest, mainly because of assumptions of a high degree of inelasticity in the demand for virgin aggregates. While this suggests limited economic impacts on firms and stakeholders, it also implies limited environmental benefits. Additional efforts would therefore be required to amplify the benefits of the tax. Efforts should be directed towards increasing elasticity in the demand for virgin aggregates, for instance, by increasing the substitution options of virgin aggregates or supporting investments in greater resource efficiency in the sector.

The literature recommends implementing aggregates taxes or fees in combination with additional policies aimed at increasing the demand for and supply of recycled materials in order to enhance the positive impacts of the tax on the use of secondary raw materials (Söderholm, 2011[10]). Virgin material taxes alone may not provide sufficient incentives for operators to improve their environmental performance and substantially increase the supply of recycled materials (Söderholm, 2011[10]), whereas the outcomes can be significant when combined with other policies. The following complementary measures could be considered.

Furthering the development of **End-of-Waste (EoW) criteria for CDW, as well as the classification of industrial by-products, will enhance the market for recycled aggregates.** Italy has already developed EoW criteria for CDW for paving roads. In addition, green public procurement (GPP) criteria are forthcoming for inert CDW.[6] Given that common regulatory frameworks are not being developed at the EU level, the Recycling Task Force of the European Aggregates Association has developed a “Guidance on End of Waste Criteria for Recycled Aggregates from Construction & Demolition Waste” to set key common requirements that should enable recycled aggregates to meet the relevant product standards (European Aggregates Association, 2022[23]).

It is also pivotal to strengthen obligations for on-site sorting and selective demolition. Other non-economic policy interventions also remain crucial. Support for **selective demolition** and the sorting of waste by type, where it is generated to facilitate reuse and recovery (on-site sorting), are critical and could be improved by setting requirements in construction permits. Improved **quality standards** for CDW, **enhanced monitoring of generated CDW** and better enforcement of **measures to prevent illegal disposal**[7] also remain crucial.

Italy could consider the introduction of requirements for a minimum content of recycled aggregates in all construction works. Italy was the first EU country to implement mandatory GPP criteria, including minimum certified recycled content in major construction materials and products for all types of public construction contracts, not only for new buildings and infrastructure but also in the renovation of existing ones (see Chapter 5). It is possible that the extension of these obligations could be expanded to all construction works, including the construction and renovation of private buildings. As an example, Catalonia established an obligation to use at least 5% of recycled aggregates in all new construction works (ITeC, 2021). Subsidies and fiscal incentives to use recycled materials are also an option, as discussed in the following chapters for the example of reduced VAT rates and corporate tax credits.

As discussed in Chapter 6, it is crucial to consider a gradual yet substantial increase in **landfill tax rates** across regions to divert CDW from landfills and towards recycling. As the potential of recycling materials depends on the market for these products, policies would have to favour the use of recycled materials in complementarity to the tax on the extraction of aggregates. As presented in Chapter 4, the introduction of virgin aggregates taxes in combination with economic disincentives for landfilling in Denmark (in the form of a waste disposal tax differentiated for landfilling) and in the United Kingdom (in the form of a landfill tax) were effective at improving the recycling of CDW, creating a market for secondary materials and reducing the use of primary aggregates (Söderholm, 2011[10]; Ettlinger, 2017[24]).

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Notes

[1] https://ozinga.com/blog/recycled-vs-virgin-aggregates/

[2] Although not entirely included in the calculations in this chapter, due to limited available data, it is recommended to also tax ornamental stones (e.g. marble) given their significant level of extraction in Italy and the considerable environmental impacts of extraction.

[3] In addition, the construction sector could respond by increasing material productivity, i.e. implementing actions that reduce materials input while maintaining the same level of output. Although not discussed in this section, this is the outcome that is most likely to generate environmental benefits, as overall materials consumption is reduced.

[4] In addition to the reduction in demand for virgin aggregates, the implementation of the tax has other effects, such as the costs of substitution with recycled aggregates, variations in prices, or changes in final production. Analysing these effects on sectors like construction requires the development of other models, such as the Ghosh supply input-output model or general equilibrium models.

[5] This analysis was constrained by some data limitations present at the time of writing. Future efforts, aimed at better informing the design and implementation of such taxes, could focus on estimating aggregates' price elasticities for Italy and using extraction data cross-checked between EW-MFA and the mining and quarries survey. Future efforts could also include ornamental stones, as well as more detailed regional insights on the impacts of tax measures.

[6] http://anpar.org/wp-content/uploads/2023/12/schema_regolamento_eowinerti.pdf

[7] Italy is currently establishing the National Electronic Register for Waste Traceability (RENTRI) system, which will support authorities in preventing and combating illegal waste management.

Annex 8.A. Annual extraction levels per region, 2016-2020

Annex Table 8.A.1. Extraction levels of clay, limestone and gypsum in Italian regions

Thousands of m³ extracted, 2016-2020

	Clay (argilla)					Limestone (calcare)					Gypsum (gesso)				
	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Italia	4 289	3 935	4 056	5 067	3 444	28 132	28 066	26 325	29 883	29 172	1 166	1 030	1 423	1 207	1 387
Piemonte	319	358	362	333	347	1 160	1 225	1 273	1 470	1 348	261	NA	264	253	0
Valle d'Aosta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Liguria	0	0	0	0	0	625	656	663	657	611	0	0	0	0	0
Lombardia	123	154	182	128	91	2 411	2 904	2 856	3 268	2 579	27	NA	44	46	0
A.P. Bolzano	63	50	63	76	56	0	0	0	0	0	0	0	0	0	0
A.P. Trento	0	0	0	0	0	NA	NA	NA	NA	NA	0	0	0	0	0
Veneto	105	153	173	203	144	995	987	1 014	1 017	1 175	0	NA	NA	NA	NA
Friuli-Venezia Giulia	41	61	74	66	56	932	1 112	1 183	1 091	1 005	0	NA	NA	NA	NA
Emilia-Romagna	780	774	523	1 045	693	NA	NA	NA	NA	348	76	79	99	91	NA
Toscana	288	232	210	125	169	2 499	2 265	2 276	2 279	1 785	NA	NA	NA	NA	NA
Umbria	586	519	363	558	509	1 532	1 867	1 727	1 545	1 463	0	0	0	0	0
Marche	30	0	0	0	0	844	793	782	854	688	NA	NA	NA	NA	NA
Lazio	375	380	873	873	46	2 925	2 169	1 665	1 665	2 852	0	0	0	0	0
Abruzzo	182	101	72	105	76	423	453	439	433	680	NA	NA	70	NA	78
Molise	113	180	146	146	146	811	910	863	979	901	404	NA	599	527	0
Campania	163	126	10	0	0	2 162	2 734	2 214	2 704	3 431	0	0	0	0	0
Puglia	376	299	373	447	223	5 482	4 402	4 189	5 848	5 085	NA	NA	NA	NA	NA
Basilicata	194	160	350	358	367	1 020	1 285	1 552	1 399	1 489	0	0	0	0	0
Calabria	68	42	49	49	65	351	240	209	209	253	0	0	0	0	0
Sicilia	435	290	190	375	394	2 830	2 854	2 492	3 286	2 574	62	28	43	26	50
Sardegna	48	55	44	178	63	810	866	618	793	896	0	0	0	0	0

Note: NA stands for “not available” as ISTAT does not report these amounts to respect statistical confidentiality.
Source: Authors' elaboration of (ISTAT, 2023[2]).

Annex Table 8.A.2. Extraction levels of sandstone, sand and gravel, and alluvial aggregates in Italian regions

Thousands of m³ extracted, 2016-2020

	Sandstone (arenaria)**					Sand and gravel (sabbia e ghiaia)					Alluvial aggregates (inerti alluvionali)*				
	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Italia	412	377	431	405	570	18 738	16 334	19 498	19 033	17 494	7 726	8 002	7 848	8 844	8 513
Piemonte	NA	NA	NA	NA	NA	0	0	0	0	0	5 045	4 960	4 206	4 751	4 440
Valle d'Aosta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Liguria	NA	NA	NA	NA	NA	0	0	0	0	0	0	0	0	0	0
Lombardia	78	85	NA	NA	NA	7 690	6 832	8 033	7 959	8 311	0	0	0	0	0
A.P. Bolzano	0	0	NA	0	0	775	973	829	916	775	0	0	0	0	0
A.P. Trento	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Veneto	0	0	0	0	0	3 267	3 097	3 570	4 248	3 977	0	0	0	0	0
Friuli-Venezia Giulia	0	0	0	0	NA	128	332	749	251	404	401	392	441	338	223
Emilia-Romagna	28	10	NA	NA	NA	1 466	1 152	559	180	118	1 951	2 100	2 864	3 371	3 487
Toscana	NA	NA	NA	214	NA	792	743	695	680	638	0	0	0	0	0
Umbria	0	0	0	0	NA	570	365	507	334	378	0	0	0	0	0
Marche	0	0	0	0	0	583	463	716	591	590	0	0	0	0	0
Lazio	NA	NA	NA	36	0	961	506	1 199	1 199	181	0	0	0	0	0
Abruzzo	0	0	0	0	0	707	429	967	1 156	765	0	0	0	0	0
Molise	0	0	0	0	0	68	22	71	65	72	0	0	0	0	0
Campania	NA	NA	NA	NA	NA	NA	0	0	0	0	0	0	0	0	0
Puglia	0	0	0	0	0	NA	80	42	54	63	111	257	80	57	75
Basilicata	NA	NA	NA	NA	NA	0	0	0	0	0	0	0	0	0	0
Calabria	0	0	0	0	0	932	711	845	845	708	0	0	0	0	0
Sicilia	NA	NA	NA	NA	NA	302	190	189	147	106	NA	NA	0	NA	NA
Sardegna	NA	NA	NA	NA	NA	470	438	528	409	407	NA	NA	257	NA	NA

Note: NA stands for "not available" as ISTAT does not report these amounts to respect statistical confidentiality.
Source: Authors' elaboration of (ISTAT, 2023[2]).

Annex Table 8.A.3. Extraction levels of silica, granite and basalt in Italian regions

Thousands of m³ extracted, 2016-2020

	Silica sands (sabbie silice)					Granite (granito)					Basalt (basalto)				
	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Italia	1 565	1 598	1 694	1 362	1 267	381	422	404	314	520	2 319	2 359	2 493	2 866	3 789
Piemonte	892	856	911	870	NA	23	NA	22	16	NA	0	0	0	0	0
Valle d'Aosta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Liguria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lombardia	60	NA	NA	0	NA	3	NA	1	1	NA	0	0	0	0	0
A.P. Bolzano	0	0	0	0	0	6	6	10	NA	NA	0	0	0	0	0
A.P. Trento	0	0	0	0	0	0	NA	NA	NA	NA	NA	NA	NA	0	NA
Veneto	0	0	0	0	0	0	0	0	0	0	NA	179	118	NA	83
Friuli-Venezia Giulia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Emilia-Romagna	523	696	770	461	426	0	0	0	0	0	0	0	0	0	0
Toscana	0	0	0	0	0	NA	NA	NA	0	0	0	NA	NA	NA	NA
Umbria	0	0	0	0	0	0	0	0	0	0	NA	NA	NA	NA	NA
Marche	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lazio	NA	0	0	0	0	0	0	0	0	0	450	648	593	593	1,230
Abruzzo	NA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Molise	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Campania	0	0	0	0	0	0	0	0	0	0	NA	NA	NA	NA	NA
Puglia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Basilicata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Calabria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sicilia	NA	0	NA	0	75	0	0	0	0	0	607	601	665	801	963
Sardegna	0	NA	0	0	0	346	404	369	279	476	491	335	252	286	395

Note: NA stands for “not available” as ISTAT does not report these amounts to respect statistical confidentiality.
Source: Authors’ elaboration of (ISTAT, 2023[2]).

Annex 8.B. Aggregates taxes in OECD countries

Annex Table 8.B.1. Taxes on aggregates extraction in OECD and other countries

Country	Year	Material	*ad quantum*	*ad valorem*		Earmarked	Funds destination
			(EUR/m^3)	(% benefit)	(% market price)		
Estonia	1991	Clay-cement	0.79			Yes (partly)	Natural regeneration of resources, preserving the environment and repairing environmental damage. In 2014, 44% of the collection went to the general state funds.
		Clay-ceramic	0.75				
		Clay-Infusible	1.42				
		Dolomite-fill	0.94				
		Dolomite-high quality	2.36				
		Dolomite-low quality	1.40				
		Dolomite-technology	3.34				
		Gravel-construction	2.43				
		Gravel-fill	0.60				
		Limestone-fill	0.98				
		Limestone-finish	2.94				
		Limestone-high quality	2.36				
		Limestone-low quality	1.49				
		Limestone-technology	2.49				
		Sand-construction	1.55				
		Sand-fill	0.42				
		Sand-tech	1.64				
Lithuania	1991	Clay, Devonian period	0.86			Yes (partly)	20% of the revenue is transferred to the municipalities where the material is extracted. The funds are used by the municipality to finance the Environment Protection Support Program.
		Clay, others	0.51				
		Clay, Triassic	0.84				
		Dolomite	0.99				
		Limestone	0.84				
		Quartz sand	1.59				
		Sand	0.38				
		Construction sand	0.48				
		Sand used for silicone	0.44				
		Land used for construction	0.26				
Sweden	1996	Natural gravel	1.58 (2007)			No	State general fund.
Croatia	1959	Materials (without specifications)		2.6% (5% in protected areas) (2003)		Yes	Investments associated with economic development and environmental protection measures.
Cyprus	1990	Materials (without specifications)	0.26 (1999)			Yes	75% of the funds are used to regenerate the environmental damage in municipalities affected by extractive activity. The remaining 25% is destined for projects to restore abandoned quarries.

Country	Year	Material	*ad quantum*	*ad valorem*		Earmarked	Funds destination
			(EUR/m³)	(% benefit)	(% market price)		
Czech Republic	1991	Materials (without specifications)	3.00(2011)		Up to 10%	Yes	25% allocated to projects for the restoration of abandoned quarries. Economic compensation for damages due to mining activity.
Denmark	2006	Materials (without specifications)	0.7 (2009)				
France	1999	Materials (without specifications)	0.20*				
United Kingdom	2002		2.50*				
Italy**	1998		Vary by region		Up to 10.5% in Toscana	Yes	50% goes to environmental recovery and remediation of disused quarries and degraded areas.
Colombia	1995-1996	Minerals (mining royalties)			3% of production value		
United States**		Sand (Kansas: sand royalty)	0,25				
		Minerals (Nevada: minerals tax)		5% of net proceeds			
		Sand, gravel, sandstone and other mineral products (West Virginia: severance tax)		5% of gross receipts attributable to natural resource production			

Notes: In the OECD database, these taxes appear as mining charges, mineral extraction charges, natural gravel tax, quarrying charge, aggregates tax, and a general tax on pollution. The taxes of the United Kingdom and Italy were not found in the OECD database.
* Tax per tonne of material.
** Sub-national tax.
Source: Authors' elaboration based on the (OECD, 2017[25]) Database on Policy Instruments for the Environment (PINE). Available at: https://pinedatabase.oecd.org/ (Accessed: 18 March 2022).

Annex 8.C. Input-output analysis

The input-output (I-O) methodology helps analyse the impacts of public policies, among many other possibilities, while considering the existing intersectoral relationships, i.e. the economic structure of the country. This methodology determines the direct and indirect impacts of such variables as production, job creation and gross value added (GVA) by productive sector. In this regard, to the extent that a tax policy generates changes in production and demand decisions, this methodology can be used to estimate the resulting economic effects.

For this analysis, employment data in the Italian I-O tables (expressed in terms of hours) were converted into number of jobs, assuming 1 720 hours per annum for persons working full time (European Commission funded project standard). These models produce a multiplier index that measures the total (direct and indirect) effect or impact of a "variation in demand" on employment, VAT, income, and other variables.

The input-output method is based on the Leontief model (1942), which uses equation (1) to assess how a variation in demand impacts production:

$$x = (I - A)^{-1}y = Ly \qquad (1)$$

where x is the vector *(nx1)* that represents the total production in the economy for each of the *n* production sectors, y is the vector (*nx1*) of final demand, I is the (*nxn*) identity matrix, and A is the (*nxn*) matrix of technical coefficients, with each column indicating the percentage of each input used by each sector in its total production. Consequently, L is the Leontief inverse matrix (*nxn*) that illustrates the direct and indirect impacts on production in all sectors.

Using equation (2), it is possible to estimate the effects resulting from changes in the final demand of one or more branches of production:

$$\Delta x = L\Delta y \qquad (2)$$

Consequently, this allows for assessing the impacts on production resulting from changes in final demand, while considering the entirety of the existing intersectoral relationships, i.e. the economic structure of the given territory.

From the demand model (equation 1), the impact of changes in the final demand on various economic variables, such as GVA and employment, can be analysed and are examined in this study. To do this, it is first necessary to obtain the vector for sectoral coefficients of GVA and work using equations (3) and (4):

$$v_j = g_j / x_j \qquad (3)$$

$$e_j = Emp_j / x_j \qquad (4)$$

Where g_j and Emp_j are GVA and employment, respectively, in sector j; and x_j is production in the same sector. Accordingly, v_i and e_j are the coefficients, respectively, for GVA and jobs created per production unit in sector *j*. Pre-multiplying the demand model (equation 1) by the vector of value added or employment coefficients transforms the model into units of those variables, enabling the estimation of the impact on value added and employment using equations (5) and (6):

$$V = vLy \qquad (5)$$

$$E = eLy \qquad (6)$$

Where V and E indicate, respectively, the amount of GVA and jobs generated, both directly and indirectly due to variations in final demand.

Annex 8.D. Detailed economic impacts of the Italian aggregates tax

Annex Table 8.D.1. Impact on employment associated with earmarked tax revenue, disaggregated into direct and indirect effects

Scenarios	S1			S2			S3			S4			S5			S6		
Economic activities	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
Agriculture, forestry, fishing	710	59	769	700	58	758	1 420	118	1 538	1 380	115	1 495	545	45	591	540	45	585
Mining and quarrying	0	1	1	0	1	1	0	2	2	0	2	2	0	1	1	0	1	1
Manufacture of food products, beverages and tobacco products	0	3	3	0	3	3	0	7	7	0	6	6	0	3	3	0	3	3
Manufacture of textiles, wood and paper	0	17	17	0	17	17	0	34	34	0	33	33	0	13	13	0	13	13
Manufacture of coke and chemicals	0	4	4	0	4	4	0	9	9	0	8	8	0	3	3	0	3	3
Other manufacturing	0	89	89	0	88	88	0	178	178	0	173	173	0	68	68	0	68	68
Energy, water and waste treatment	253	51	304	250	50	300	507	101	608	492	98	591	195	39	233	193	38	231
Construction	406	112	519	401	111	512	813	225	1 038	790	219	1 009	312	86	399	309	86	395
Wholesale and retail trade	0	72	72	0	71	71	0	144	144	0	140	140	0	55	55	0	55	55
Transportation and business services	0	434	434	0	428	428	0	868	868	0	844	844	0	334	334	0	330	330
Public administration and collective services	263	52	315	259	51	310	526	104	629	511	101	612	202	40	242	200	39	239
Other services	0	25	25	0	25	25	0	50	50	0	49	49	0	19	19	0	19	19
Total	**1 633**	**920**	**2 553**	**1 610**	**908**	**2 517**	**3 265**	**1 841**	**5 106**	**3 174**	**1 789**	**4 963**	**1 254**	**707**	**1 962**	**1 242**	**700**	**1 942**

Note: numbers may not add up precisely due to rounding.
Source: Authors' own elaboration.

Annex Table 8.D.2. Economic impact on GVA associated with earmarked tax revenue, disaggregated into direct and indirect effects (EUR millions)

Scenarios	S1			S2			S3			S4			S5			S6		
Economic activities	**Direct**	**Indirect**	**Total**	**Direct**	**Indirect**	**Total**	**Direct**	**Indirect**	**Total**	**Direct**	**Indirect**	**Total**	**Direct**	**Indirect**	**Total**	**Direct**	**Indirect**	**Total**
Agriculture, forestry, fishing	35	3	37	34	3	37	70	5	75	68	5	73	27	2	29	27	2	29
Mining and quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of food products, beverages and tobacco products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of textiles, wood and paper	0	1	1	0	1	1	0	2	2	0	12	2	0	1	1	0	1	1
Manufacture of coke and chemicals	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0
Other manufacturing	0	6	56	0	6	6	0	12	12	0	11	11	0	4	5	0	4	4
Energy, water and waste treatment	16	4	20	16	4	20	32	9	40	31	9	40	12	3	16	12	3	15
Construction	17	5	22	17	5	22	34	10	44	33	9	43	13	4	17	13	4	17
Wholesale and retail trade	0	4	4	0	4	4	0	8	8	0	8	8	0	3	3	0	3	3
Transportation and business services	0	27	27	0	27	27	0	54	54	0	53	53	0	21	21	0	21	21
Public administration and collective services	20	4	24	20	4	24	41	8	49	40	8	47	16	3	19	15	3	18
Other services	0	1	1	0	1	1	0	2	2	0	2	2	0	1	1	0	1	1
Total	**88**	**56**	**144**	**87**	**55**	**142**	**177**	**111**	**288**	**172**	**108**	**280**	**68**	**43**	**110**	**67**	**42**	**109**

Note: numbers may not add up precisely due to rounding.

Source: Authors' own elaboration.

Annex Table 8.D.3. Impact on employment associated with non-earmarked tax revenue, disaggregated by direct and indirect effects

Scenarios	S7			S8			S9			S10			S11			S12		
Economic activities	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
Agriculture, forestry, fishing	0	13	13	0	13	13	0	26	26	0	25	25	0	10	10	0	10	10
Mining and quarrying	0	1	1	0	1	1	0	1	1	0	1	1	0	0	0	0	0	0
Manufacture of food products, beverages and tobacco products	0	2	2	0	2	2	0	4	4	0	4	4	0	2	2	0	2	2
Manufacture of textiles, wood and paper	0	12	12	0	12	12	0	25	25	0	24	24	0	10	10	0	10	10
Manufacture of coke and chemicals	0	1	1	0	1	1	0	3	3	0	3	3	0	1	1	0	1	1
Other manufacturing	0	30	30	0	30	30	0	61	61	0	59	59	0	23	23	0	23	23
Energy, water and waste treatment	0	44	44	0	44	44	0	89	89	0	86	86	0	34	34	0	34	34
Construction	0	34	34	0	33	33	0	67	67	0	65	65	0	26	26	0	26	26
Wholesale and retail trade	0	35	35	0	34	34	0	70	70	0	68	68	0	27	27	0	27	27
Transportation and business services	0	354	354	0	349	349	0	708	708	0	689	689	0	272	272	0	269	269
Public administration and collective services	1 271	49	1 320	1 253	48	1 301	2 541	98	2 639	2 470	95	2 565	976	38	1 014	967	37	1 004
Other services	0	24	24	0	24	24	0	48	48	0	46	46	0	18	18	0	18	18
Total	**1 271**	**600**	**1,870**	**1253**	**591**	**1 844**	**2 541**	**1 199**	**3 741**	**2 470**	**1 166**	**3 636**	**976**	**461**	**1 437**	**967**	**456**	**1 423**

Note: numbers may not add up precisely due to rounding.

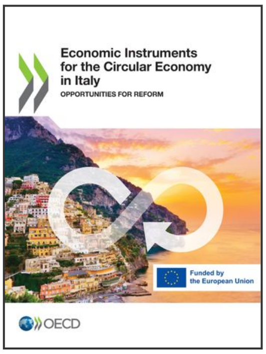
Source: Authors' own elaboration.

Annex Table 8.D.4. Economic impact on GVA associated with non-earmarked tax revenue, disaggregated by direct and indirect effects (EUR thousands)

	S7			S8			S9			S10			S11			S12		
Economic activities	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
Agriculture, forestry, fishing	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0
Mining and quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of food products, beverages and tobacco products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of textiles, wood and paper	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1
Manufacture of coke and chemicals	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other manufacturing	0	2	2	0	2	2	0	4	4	0	4	4	0	2	2	0	2	2
Energy, water and waste treatment	0	4	4	0	4	4	0	9	9	0	8	8	0	3	3	0	3	3
Construction	0	1	1	0	1	1	0	3	3	0	3	3	0	1	1	0	1	1
Wholesale and retail trade	0	2	2	0	2	2	0	4	4	0	4	4	0	1	1	0	1	1
Transportation and business services	0	23	23	0	22	22	0	45	45	0	44	44	0	17	17	0	17	17
Public administration and collective services	118	4	121	116	4	120	235	8	243	229	7	236	90	3	93	89	3	92
Other services	0	1	1	0	1	1	0	2	2	0	2	2	0	1	1	0	1	1
Total	**118**	**38**	**155.8**	**116**	**38**	**154**	**235**	**77**	**312**	**229**	**74**	**303**	**90**	**29**	**120**	**89**	**29**	**119**

Note: numbers may not add up precisely due to rounding.

Source: Authors' own elaboration.



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