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AGGREGATES EXTRACTION, ENVIRONMENTAL CHARGES AND REGIONAL PLANNING POLICIES EVIDENCE ON DELINKING AND POLICY EFFECTIVENESS IN ITALY

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Aggregates extraction, environmental charges and regional planning policies
Evidence on delinking and policy effectiveness in Italy

(Very preliminary version not to be quoted)

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Abstract

The present study focuses on delinking trends and policy effectiveness in the realm of aggregate extraction. It deals with the implementation of environmental taxes and environmental planning at regional level, as tools aimed at achieving weak sustainability for non renewable resources like aggregates, extracted for a diverse set of economic aims. The economic instrument in force in Italy is a charge per cubic meter of aggregates extracted. The application is very decentralised. There is not a common rate at the national level, and every region has the possibility to apply a different rate with different ways of application at the provincial and municipal level. The revenue from the charge accrues for the most part to municipalities and it should be earmarked to 'compensatory investments' in the localities of quarrying activity. The charge on aggregates is only one element of the very complex planning, authorisation, and regulation system on quarrying activities prevailing in Italy, so much so the analysis of aggregates charge effectiveness cannot be performed in isolation from the features and the working of such an administrative system. Probably because of the very decentralised administrative system for aggregates quarrying, there is a very limited recording of quantities extracted, industry turnover and production costs, market prices, international trade, breakdown of end-uses, and of other key economic variables at the national level. In contrast, there is very detailed information on single quarries number, location, and features, on planned and actual aggregates extraction, on charges and other variables at the local level (regions, provinces, municipalities). However, this information is not integrated in any country-level databases, regular reports, and general studies. Therefore, the case study has been performed by taking a general country-level perspective to the extent allowed by available information while developing some specific in-depth analyses for extraction activities and their administration at the regional/provincial level, including the specific role of extraction charges. In particular, a part of the study is focused on two large Northern regions, Lombardy and Emilia-Romagna, that together account for over 12 million inhabitants (21% of the national total) and more than 22% of national GDP in 2004. For these two regions, the quantity and quality of data provided by local administrations have been such to allow us to apply econometric techniques to test the role of charges and the demand/supply drivers in determining extractions. Information and interviews lead to the conclusion that the possible effects of extraction charges for the aggregate market development in Italy can be very limited. The level of charges is generally too low (around 0,41-0,57 €/m3) to be expected to have an effect on demand (through aggregate prices) and supply of aggregates. Also the stability of nominal charges over time contributes to their limited share of quarrying production costs. Extraction and supply of aggregates is mainly controlled by (regional/provincial) planning of quarrying activities and extraction quantities. Planned extraction tends to be in line with foreseen demand developments, and establishes supply ceilings accordingly. The environmental objectives of planning are, at least for the moment, other than reducing extraction, and they generally consist of minimising external impacts, to support sustainable management of landscapes, and to provide multi-value public goods within the local area. The still poor working of the recycling loop for C&D waste in Italy and the preference for virgin materials by the construction industry combines in making aggregate recycling still limited. Even in this case, the extraction charges, also due to their relatively low levels, do not work in favour of recycling in an apparent way. Landfill taxes and policies involving C&D and quarrying waste could have a relatively more significant role in favouring recycling. The econometric analysis on two large Italian regions (Lombardy and Emilia-Romagna) confirms these results, and in particular the dominant role of demand drivers and the limited role of tax/charges for extraction decisions. Even if 'decoupling' between extraction and GDP is taking place to some extent, it can be hardly attributed to extraction charges.

Keywords: Aggregates, environmental charges, regional planning, regional sustainability, ex post compensations

Introduction

The economic instrument in force in Italy is a charge per cubic metre of aggregate extracted. The application is highly decentralized. There is no common national rate, and every region can apply a different rate and in different ways at provincial and municipal levels. The revenue from the charges for the most part accrues to municipalities and should be earmarked for 'compensatory investments' in localities of quarrying activity. The charge on aggregates is only one element of the very complex planning, authorisation, and regulation system related to quarrying activities prevailing in Italy; thus analysis of the effectiveness of aggregate charges cannot be performed in isolation from the other features and working of the administrative system.

This country study on Italy is based on the original reconstruction of data and information from interviews with industrial and administrative actors involved in the aggregates industry. The very scant information available and the lack of previous country-wide studies is in sharp contrast to the significant size of the Italian aggregates industry - the fourth largest in Europe (UEPG countries) in terms of extraction after Germany, Spain, and France - and its major importance for the management of land resources in Italy. Probably because of the very decentralised administrative system related to the quarrying of aggregates, national level records of quantities extracted, industry turnover and production costs, market prices, international trade, breakdown of end-uses, and of other key economic variables are not comprehensive. In contrast, in terms of the number and location of individual quarries, and their features, planned and actual aggregates extraction, charges and other variables at the local level (regions, provinces, municipalities) information is extremely detailed. However, this detailed information has not been integrated into country-level databases, regular reports, or general studies.

Therefore, the current case study takes a general country-level perspective to the extent allowed by the information available and develops some specific in-depth analyses of extraction activities and their administration at the regional/provincial level, including the specific role of extraction charges. One part of the study focuses on two large Northern regions, Lombardy and Emilia-Romagna, which together accounted for over 12 million inhabitants (21% of the national total) and more than 22% of national GDP in 2004. For these two regions, the quantity and quality of data provided by local administrations allow us to apply econometric techniques to test the role of charges and the demand/supply drivers that determine extractions.

1. Extraction taxes on aggregates

1.1. The framework: definitions and scope

The economic instrument applied in Italy is a charge per cubic metre of aggregates extracted. There is neither a common rate nor a minimum/maximum rate established at the national level. Regions can apply different rates based on different features within the complex planning and authorisation framework described in Section 4[1].

Analysis of two major regions (Lombardy and Emilia-Romagna), which we take in this study as leading case studies (opening direction for future further researches), produced the results summarised below.

Lombardy. The right to exploit quarries belongs to the owner of the site, who is authorised by the Province to exploit it. The authorisation is conditional on the signing of an agreement between the applicant and the Municipality/Municipalities involved. The agreement *should* follow the guidelines prepared by the Regional Council[2]. Through the agreement, the applicant agrees to certain conditions.

a) To pay an annual extraction charge to the Municipality, in order to cover some of the costs of rehabilitation of the areas directly or indirectly affected by the exploiting activities.
b) These costs are in addition to the ones already charged to the holder of the authorization.

[1] A detailed analysis of the legislation on aggregates and quarrying in Italy, not presented here, was performed for the present study. It is available upon request.

[2] The agreement is a private law contract between two parties, wherein the municipality operates as an intermediary. It is a bargaining process wherein the municipality may play its part in order to maximise its benefits The inclusion in the bargaining of side payments that increase the total cost and are aimed at funding for compensatory local public goods may be in line with the weak sustainability rule implicit in the aggregate tax implementation. Even the funding of non environmental goods may be sustainable, if the ex post total stock of capital is at least equal to the ex ante one. An obvious problem arise if the municipality exploits its power in order to bargain extra benefits that are completely dis-joint from the process of environmental planning and environmental taxation (a typical example of non sustainability action is using the related funding for consumption instead of investments).

c) The fee is proportional to the type and amount of material extracted in a year, in compliance with the tariffs fixed by the Regional Council.
d) The Regional Council is required to fix: (i) the amount to be paid to cover the expenses related to the evaluation of the application; (ii) the charge for exploitation rights, which is based on the commodity sectors and the amount of extracted materials (except for ornamental stone, where the tariff applies to commercialised materials). Municipalities allocate 15% of the above-mentioned sums to the Province, which can use them for the rehabilitation and improvement of areas affected.
e) The charge for exploitation rights was introduced in 2001 (Decree of the RC VII/320 of 23rd October 2001) and later revised (see Table 1).

Table 1. Extraction charges in Lombardy

Category	*Tariff/fee per cubic metre of extracted material**	
	2001-2002	*2004-2005*
I Sand and gravel	0,387 €	0,41 €
II Clay	0,439 €	0,47 €
III Peat	1,34 €	1,42 €
IV Ornamental stone	3,10 €	3,28 €
V Limestone and dolomite used to make lime and cement	0,387 €	0,41 €
VI Crushed stone (including residual material)	0,387 €	0,41 €

* The tariff applies to the volume of extracted material except for ornamental stone, where it applies to tradable materials.

Sources: Decree of the Regional Council VII/320 of 23rd October 2001, as modified by in 2002 and Decree of the Regional Council VII/1090 of 27th October 2004.

f) If the extractive activities take place (even partially) within the boundaries of a regional park, a fee (not higher than 1/3 of the charge) must be paid to the park's managing body, in order to cover a part of the costs involved in rehabilitation of the areas surrounding the quarry.
g) The applicant must, at his own expense and before the closure of the quarry, carry out any rehabilitation work necessary to make the area suitable for the re-use foreseen in the provincial plan, according to the conditions specified in the agreement.

Emilia-Romagna. The mechanism in Emilia Romagna is also based on the rights of the site owner and the authorisation to excavate[3], which is conditional upon the signing of an agreement between the applicant and the appropriate Municipality. The agreement is based on the guidelines prepared by the Regional Council. In signing this agreement, the applicant commits: (a) to carry out any work that is necessary to connect the quarry to the public road; (b) to carry out any work that is necessary to prevent damage to other goods/activities; (c) to correctly implement the exploitation plan; (d) to carry out any work necessary for site rehabilitation; (e) to submit adequate financial guarantees; (f) to pay an annual charge to the Municipality, in proportion to the type and amount of material extracted and in compliance with the charges established by the Regional council. This charge is aimed at covering some of the costs arising from public works additional to those mentioned above. Municipalities must allocate 20% and 5% respectively of the fee to the relevant Province and Region[4]. The Regions and Provinces may use these sums for rehabilitation and improvements to add value to the areas affected by the quarrying activities and for planning, monitoring, and research related to extraction activities. In

[3] This lasts on average 5 years. It should be noted that the share of non extracted materials (residuals existing at the end of the licence period) needs further authorization (for new projects) from the municipalities, a process which is then also monitored by the provinces.

[4] The regional share of the tax revenue was 554.106€ in 2006, representing 5% of the total revenue derived from the aggregate tax. Total regional revenue was 11.082.120€ (compared with total regional tax revenues of around 21 billions €, thus roughly 0,5% of total tax revenues, and, as a term of reference, to the 21 millions € of water extraction rights public licensing). Its relevance would increase if we consider the share of this source of income in the municipality budgets.

practice, there is no binding law requirements; the revenues have generally be used to cover for additional administrative expenses including direct and indirect monitoring activities.

The level of the charge in Emilia Romagna since its introduction in 1991-1992 has been between 0,46€ and 0,57€ per cubic meter extracted (see Table 2a for more detail). The Municipality can add other costs within agreements to bring the total cost of exploitation to around 1€ per cubic metre. The amount of the charge is not subject to regular review and updating and has remained at the same level as when it was first introduced[5]. However, Emilia Romagna is now examining and revising charges and new levels should be set for 2007 (see below)[6]. According to regional level policy makers, there should be economic incentives which differentiate the tax levied according to the land's (ecological) value. This ecological value is already estimated as part of the planning procedures. A differentiated tax could integrate some recognition of the heterogeneity in land use and values, complementing a preliminary stage of (economic) evaluation with a consequential stage where even price mechanisms play a role.

Table 2a. Extraction charges in Emilia-Romagna (1991-2007)

Group I: extracting materials for constructions	**€/m3**
Sands and gravels from alluvial deposits	0,57
Extracting materials from the mountains	0,465
Other materials extracted from alluvial deposits	0,465
Extracting materials from "*marnoso–arenaced*" formations	0,258
Group II: extracting materials for industrial use	**€/m3**
limestones and marls	0,52
sands for industrial use	0,57
clays for bricks	0,465
Clays for ceramics	0,52
Gypsum	0,57
Group III: Ornamental stone	**€/m3**
Ornamental stone	0,258
Group IV: peats	**€/m3**
Peats	1,03

Table 2b. Examples of extraction charges in Italy (€/m3)

Materials	**Piedmont since 2006**	**Lombardia since 2004**	**Veneto since 1995**	**Tuscany since 2000**	**Marche since 2004**	**Umbria since 2000**	***ER (forecast revisions to charges)***
Sands and gravel (alluvial deposits)	0,75	0,41	0,62	0,46	0,59	0,25	*0,85*
Clay	0,50	0,47	0,52	0,21	0,35	0,25	*0,78*
Materials from mountains	0,50	0,41	0,36	0,46	0,70	0,35	*0,78*
Gypsum	0,50	Not available	0,36	0,39	0,29	Not available	*0,85*
Ornamental stones	Not available	Not available	0,26	0,28	0,35	0,30	*0,39*

[5] Further details on charges in Lombardy and ER are available upon request.

[6] 2007 should see the first updating of aggregate charges since their introduction in 1991. The revision is likely to be based on past inflation, in order to restore levels to 1991 real term values. See Table 2b - forecast charges.

1.2. Aggregate policies: main aims

In their present configuration, extraction and other charges are designed to cover the (presumed) direct and indirect costs of land resource modifications induced by quarrying. Additional costs for land restoration are levied on the exploiter when a quarry is closed down.

In principle, the charge is aimed at maintaining the 'natural capital' in the quarry location area. However: (a) the costs reflected in the fee are not established through a specific 'natural capital' calculation, and they are slow to come through because of the lengthy administrative processes; (b) while the results of the restoration charges (after closure) are visible, how the extraction charge revenues are used by local administrations requires monitoring. Available information also indicates that, in the contractual agreements with quarry owners, Municipalities often ask for finance for activities not linked to land preservation.

The charge is not aimed at controlling and regulating the quantities extracted; these are established by the Provincial quarrying plans. In both Emilia Romagna and Lombardy there is a trend towards limiting the opening of new quarries and exploiting existing ones more efficiently.

The fee also is not designed to create incentives for recycling and substitution of recycled aggregates or C&D waste for virgin aggregates. In Milan province's plan, it was proposed that a fixed share (25%) of the materials requirement estimated in planning should be covered by C&D waste recycling and materials from excavation (constructions), but this was rejected by the regions, which considered this share to be infeasible. In the Province of Bologna (Emilia Romagna) a voluntary agreement has been established related to recycling of C&D to substitute for virgin aggregates, but this does not involve provincial planning (see below).

According to the bill that introduced the tax, it must be earmarked for ex post compensation. Actually, compensation is paid through a "market" bargaining process and is effectively on top of the tax paid by municipalities and operators. The actual tax is constituted by a formal charge levied by provinces and municipalities, and an informal charge which is open to bargaining at local level, which is used to finance local public goods and compensate for full environmental externalities from quarrying activities. Tax revenues are used for general budget purposes. Thus, although the tax revenue does not completely fulfill its goal, the functioning of the system results in an outcome that is coherent with overall policy objectives.

1.3 Costs of and revenues from aggregates charge

Based on the charges per ton levied in the regions of Emilia Romagna and Lombardy (around 0,31 €/ton, or 0,46-0,57 €/m3), a total extracted quantity of 358 million tons of aggregate in Italy represents a total charge value of 110 million€[7]. The additional costs related to the compensatory investments demanded by municipalities are difficult to estimate. Information from interviews suggests that these extra charges can double the initial charge, thus suggesting total revenues of 220 million€. The estimated turnover of the aggregates industry in Italy is around 2,2 billion € (ANEPLA estimates)[8]. Extraction charges can represent around 5% of total turnover, and charges plus other costs can be as much as 10% of total turnover. Although these are very rough estimates, based on gross averages for widely varying situations across all Italian provinces, they suggest that charges and related costs are not a critical item in total production costs. Additional costs are also levied for rehabilitation of sites when quarries are exhausted, but it is not possible on current information to estimate these on a country-wide basis.

Even the distribution of charge revenue among the various institutions varies from region to region, making a country-wide picture impossible. In the province of Bologna (capital of Emilia-Romagna) the sharing of an estimated total revenue of 1,5 million/€ is: 75% to the Municipality, 20% to the Province (estimated amount 300.000€), 5% to the Region. This revenue is generally used for restoration of closed quarry sites (in the past many sites were not fully restored by the owners) and for general land conservation purposes. In a region such as Emilia-Romagna the total revenue can be around 10-15 million/€, which, for comparison, represents half of the revenue from water exploitation rights. In Emilia Romagna, the total budget in 2006 was 13.1 billion/€, of which 275 million/€ is current and capital expenditure on 'environment and landscape'. The limited revenue flows and the allocation across three administrative levels probably are part of the reason why amounts are not formally allocated to objectives.

[7] For comparison, the estimated revenue in France is around 50-60 million/€ (informal sources).

[8] This represents an average value of 5,7 €/ton, which seems to be low relative to market prices.

In short, the economic and financial burden of the extraction charges seems to be a relatively small, although not negligible, as a component of the industry production costs. It is unlikely that quantity decisions are taken based on savings on extraction charges. Even demand for new quarries seems to be barely influenced by these charges. The levels of the charges are revised very infrequently, with no regularity, in most regions/provinces. Their real value, taking into account inflation, aggregate materials prices, or the value of production, may be declining in some phases.

On the revenue side, the value of extraction charges is significant only for municipalities, which receive the highest share and also enjoy the additional revenues levied in contractual agreements. The actual allocation of these revenues is very uncertain in both economic and environmental terms. Therefore, not only is the ex ante correspondence between the level of the charge (and other costs) and the external costs of quarrying very loose, but also the actual compensation of such external costs through appropriate revenue allocations by the municipalities is very uncertain.

Another critical issue for social costs and conservation of natural capital is site restoration after quarry closures. Although progress is being made, it is difficult to get an overall picture of the quality of the rehabilitation that takes place. Various public officials and environmental managers that were interviewed felt strongly that the quality of site restorations must now be a key priority. However, the available figures on site restoration do not show clear evidence of innovative trends. Table 3 shows the mix of after-closure restoration categories in the Province of Bologna for 1990-2005. In fact, agricultural exploitation of former quarries, generally associated with lower environmental value, tends to dominate over other options which could perhaps provide wider public good benefits. According to policy makers in the sector, options such as forestation, creation of wetlands, lakes and reservoirs should be prioritised in planning scenarios. The aim is to increase the compensation in total value terms as far as possible, even perhaps over-compensating for the damage resulting from quarrying activities.

Table. 3- Province of Bologna: Site restorations categories

Typology of quarry site restoration/ex post use of the site	1990	1995	2000	2005
Partial site covering with agricultural use	15%	14%	15%	15%
Total site covering with agricultural use	33%	33%	30%	33%
Lake creation for recreation use	1%	1%	0%	1%
Lake creation for multiple uses	5%	5%	9%	5%
Restoration with agricultural use and vegetation setting	23%	20%	12%	23%
Forestry	22%	25%	27%	22%
Total site covering with forestry	0%	1%	2%	0%
Total site covering with functional restoration	0%	0%	2%	0%
River water basin expansion	0%	0%	0%	0%
Wetland creation	2%	2%	4%	2%
Total number of site restoration in the Province	131	117	124	117

Source: Province of Bologna.

1.4 The legislation on quarries and aggregates

The administrative, legislative, and planning system for quarrying in Italy is rather complex[9]. Unlike other sectors, it reflects a significant decentralisation of responsibilities and procedures, including the definition and management of extraction charges (see Section 1 and 3). Here we summarise the national legal and administrative system and the systems that apply to our two regions, Lombardy and ER.

The reference national law on mines and quarries is Royal Decree 1443 of 1927. It states that exploration/exploitation mining concessions are the responsibility of the Ministry of Industry. Exploitation

[9] Full details are available upon request.

concessions are charged on a per hectare basis. In the case of quarries, exploitation rights belong to the owner of the land on which the quarry is situated.

In the system for quarries, the Italian Constitution (art.117) explicitly recognises the legislative responsibility of the Region. Decrees 2/1972 and 616/1977 award the Regions legislative power for all quarrying activities, including extractions from rivers, lakes, and shores. Many regions have delegated most of these competencies to the Provinces and Municipalities.

In Lombardy, the legislation in force is Regional Law 14/1998. It includes regulation on planning, exploitation, monitoring and fines, information and data. Planning is based on a regional plan, which in turn is based on the provincial plans approved by the Region. Provincial plans include the identification of exploitable sites, quantity and quality of materials to be extracted, allowable exploitation techniques, and the final designation of the site when the materials are exhausted. Exploitation by site owners must be authorised by the Province, based on an agreement between the owner and the Municipality in which the site is located. These agreements include guaranteed payment of the annual charge to the Municipality (see Section 1), commitment to carry out restoration to, and pay for, restoration of the site when activity ceases, the possibility that, in the case that an owner does not want to continue to exploit the quarry, the Province can give the concession to another party. There are also provisions in the plans for consortia to be set up to exploit adjacent quarries.

The institutional setting in ER is different. The legislation in force is Regional Law 17/1991. It provides guidelines for Regional territorial plans. The Regional Plan for Extraction Activities is formulated, and adopted by Provincial administrations. This plan includes the identification of inter-municipal 'extractive poles' and defines the criteria for identification of municipal extractive sites. The 'Municipal extraction plans', which represent variants of the urban planning instruments, establish which sites can be exploited, the criteria for and methods of exploitation, and the conditions relating to restoration of the area after closure of the quarry. Quarrying activities are authorised by the Municipal mayors, based on an agreement between the owner and the Municipality levying the charges (see Section 3) and the commitment to post-closure restoration. The information system relating to quarries and mines is the responsibility of the Regions.

In general, although the four main actors, i.e. the Region, the Province, the Municipality, and the site owner, are similar across the whole of Italy (20 regions in all) they have institutional settings that differ in to greater or lesser extents on some issues, including the levels of extraction charges, and what they are used for and how they are distributed, and the requirements for site restoration. Furthermore, not all regions (particularly those in the South) have well developed systems for planning, charging, inventory, etc. In some areas in the South of Italy, quarries, like landfills, become embroiled in illegal activities involving criminal organisations.

The local administrators interviewed suggested that a common national framework would be preferred and that the ongoing process in Italy of administrative decentralisation would further exacerbate the existing differences.

There is a problem in Italy regarding the long licence authorization procedure (2-5 years): this (inefficiency) burden may on the one hand favour conservation of land and materials; however, private agents would prefer policy instruments such taxes if this made the authorization procedures less burdensome. In this regard, Kellett (1995) notes that although "it (a five year period) may produce the illusion of sustainability in the short term; it is unlikely to have any lasting impact on demand for aggregates. It may however have the short term effect of increasing the price of aggregates, thus enhancing the competitiveness of super quarries". The latter factor actually characterizes and is consistent with Emilia Romagna, which is trying to provide incentives for big quarries within new planning schemes to mitigate transport costs and soil excavation (deeper excavations are preferred to higher numbers of shallow sites as in the past). The key role of planning is again highlighted. Planning aims at minimizing total social costs by allocating quarries in the territory and deciding which depths of quarries will be permitted[10].

2. The aggregate market

2.1. Drivers of demand

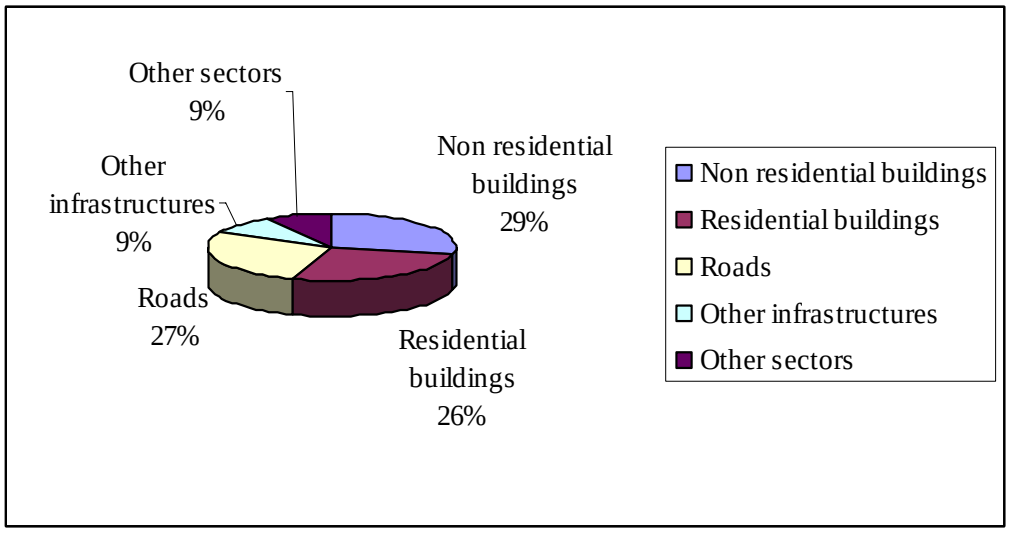
The construction industry's activities constitute the main driver of aggregates demand. The sectors that consume aggregates extracted in Italy are summarised in Figure 1. Residential and non-residential constructions represent 55% of end usage. The other important sector is road construction (27%). Infrastructures account for less than

[10] Further comments on legislations regarding related issues like C&D waste and protected areas are available upon request, and omitted for brevity reasons .

10% of the total. These shares are influenced by the different phases of the business and public investment cycles, as the implementation of the ambitious plans for infrastructural investments in Italy (*Piano per le grandi opere*) could work to increase total demand and also to shift the relative share in favour of infrastructures and roads. However, very large projects usually lead to the opening of so called 'temporary quarries', which are specific to the project and supply most of its demand[11]

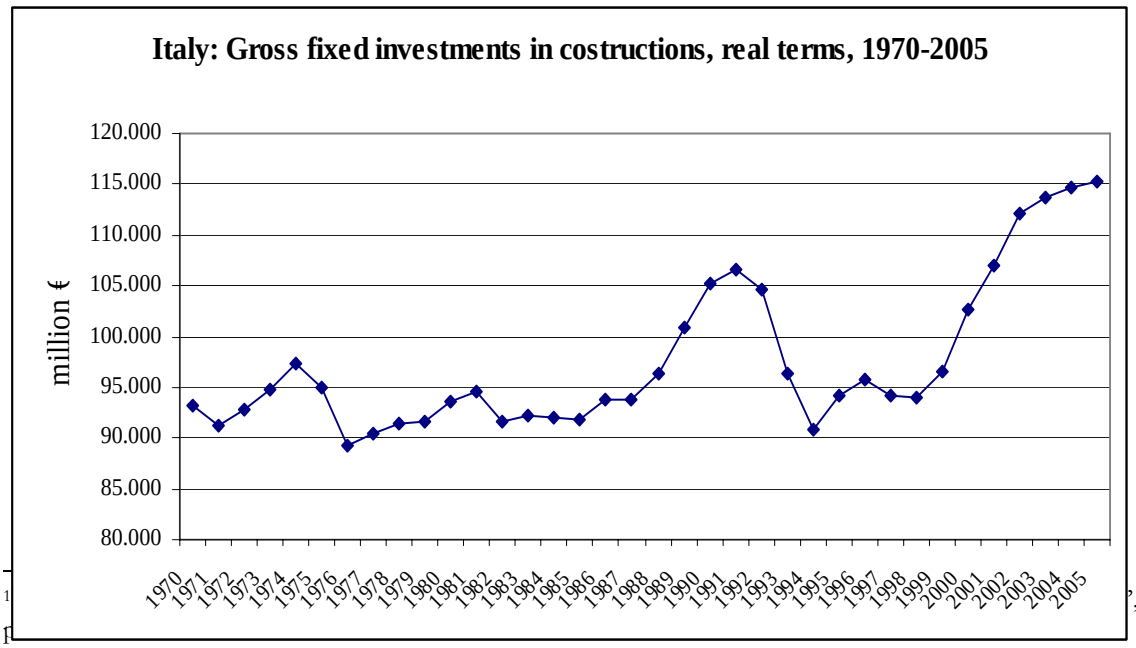
Since 1997-98, Italy has experienced a very significant and extensive cycle of construction activity, both residential and non residential (Figure 2). Gross fixed investments in construction increased from around 95 billion/€ per year to around 115 billion/€ per year (at constant 2000 prices). Also the value added of the construction industry increased significantly in the same period, up to 60 billion/€ at 2000 prices (Figure 3).

Figure 1. Main sectors of aggregates demand in Italy



Source: ANEPLA

Figure 2. Gross investments in the construction sector in Italy



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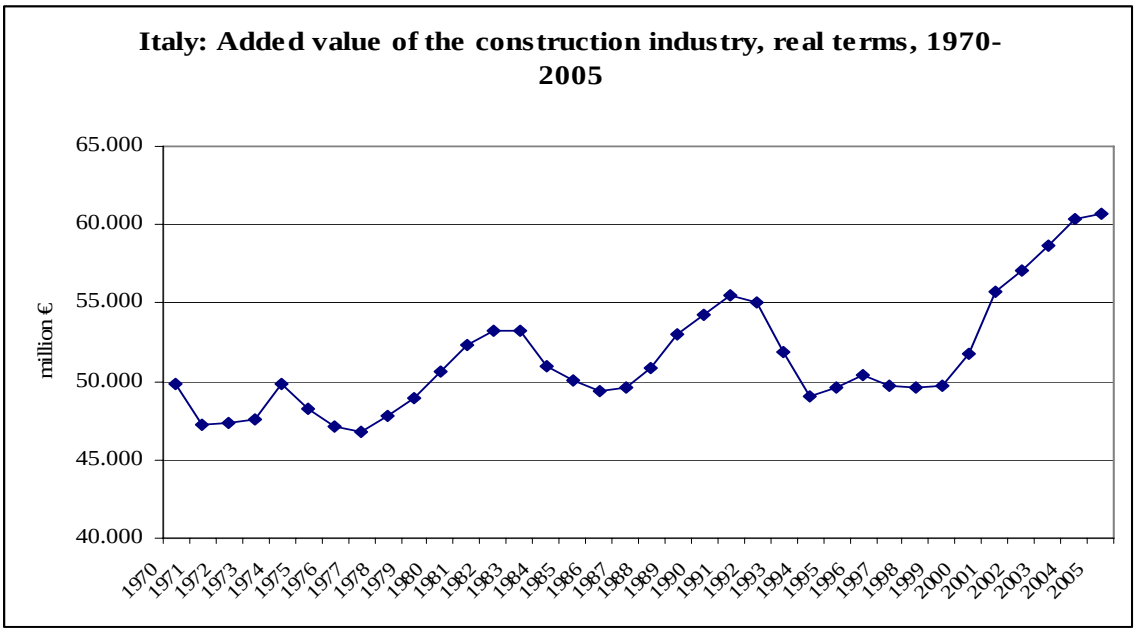
Source: Elaborations of ISTAT national account statistics

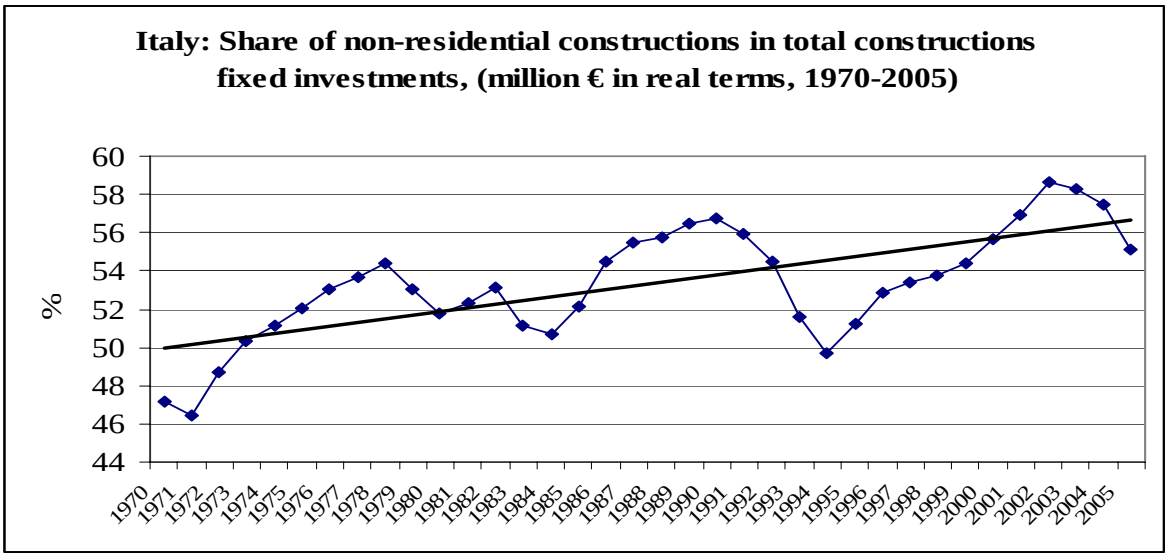
Figure 3. Value added of the construction industry in Italy



Source: Elaboration of ISTAT national account statistics

Although time series on the production of aggregates are not available on a country-wide basis (see below), the relatively stable coefficient of aggregates input in the construction activities implies a substantial increase in the demand for aggregates. This increase is confirmed by direct information from the industry (ANEPLA). A medium term trend is under way, which favours non-residential investments, resulting in the share of residential to non-residential investments decreasing (Figure 4). This change in favour of non-residential investments has not affected the trend for residential investment being the main driver of aggregate use.

Figure 4. Share of non-residential to residential investments in Italy



2.2. The aggregate industry

In 2004, the Italian aggregates industry was composed of around 1.796 companies, representing around 12% of the total for the UEPG countries. They operated across 2.460 sites, 9% of the European total. Data suggest that the average size of companies is smaller than the European average. Total estimated production is 358 million tons, 12,5% of the European total. This share shows that average production per site and per company in Italy is higher than the European average. Unlike in other UEPG countries, the greater part of production is represented by sand and gravel (220 million tons) not crushed rocks (135 million tons). Italy accounts for 16% of total sand and gravel produced in the UEPG countries, which suggest its relative specialisation in these products. The amount of recycled aggregates produced is extremely low, 3 million tons, which represents only 2% of the UEPG total. Other national estimates for 2004 indicate 3,7 million/tons (see text)

Table 2. Italy's position in the European aggregates industry, 2004, million tons

			Production million tons			
	Companies	Sites	Sand & gravel	Crushed rocks	Recycled	Total
Total UEPG countries	15.121	27.065	1354,2	1360,2	145,6	2860
Italy	1.796	2.460	220	135	3	358
Italy share	11,8%	9,0%	16,2%	9,9%	2,0%	12,5%

Source: Elaborations of UEPG (2005) data.

According to data from ANEPLA, between the intermediate industrial census of 1996 and the official census of 2001, the aggregate industry underwent a process of concentration. The number of firms decreased from 1.876 to 1.796, while production increased as did employee numbers, which went from 12.562 to 14.010[12]. The number of firms in the 10-20 and 20-50 employee size classes increased, while the number of firms with less than five employees decreased. Although 597 firms are still classified as 'craft firms', the number of incorporated firms has increased. This structural improvement was favoured by the good business cycle of the construction industry, and probably also by a 'wave' of extraction of authorisations by provinces at the end of the 1990s.

The main problems faced by industries are those related to the exploitation of natural resources because of the increasing legislation on environmental and regulatory requirements of land planning (see below).

Quarries in Italy

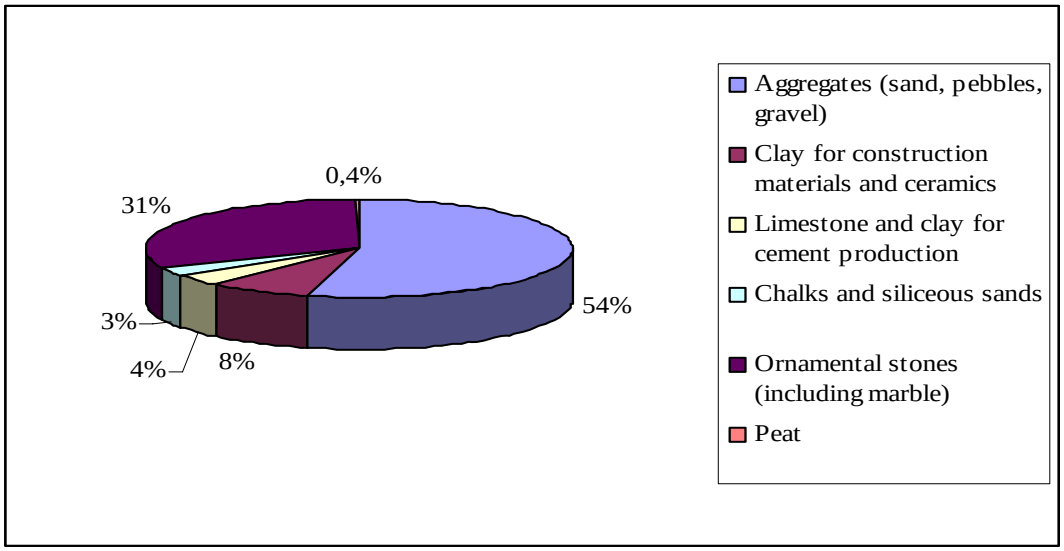
Aggregates represent around 54% of total quarrying activity in Italy (Figure 5). The next most important component, around 31%, is ornamental stone, and in particular marble, of which Italy is one of the world's major producers and exporters. The third major component (8%) is for clay, especially for the production of ceramic tiles of which Italy again is a major world producer and exporter.

The aggregates industry has very limited economic relationships to the marble industry, apart from some extraction residuals from marble and stones, which are delivered to aggregates producers to be crushed and commercialised. There are no commercial relationships at all with either the clay quarries or the ceramic tiles industry.

There are many issues related to the three main non-metallic mineral extraction industries that are cross sector, in terms of their similar environmental and land use issues. Some land use regulations involve all three sectors in rather similar ways. The marble industry, however, is subject to the mining industry regulations, which differ greatly in terms of legal rights and administrative procedures from those that apply to aggregates quarrying.

[12] The concentration of firms in the market is highly heterogeneous in Italy across regions and even across provinces within the same region. The tax has helped to reduce the number of firms by cutting off less innovative and less well performing ones. There are several cartels in existence and the market is often rent intensive, with high mark ups on costs. This is one reason why operators in Italy are not very bothered about the tax and monitoring activities.

Figure 5. Breakdown of total number of quarries in Italy by type of materials



2.3. supply and price trends

There are no national data series for virgin aggregates extraction/production in Italy. The available data, sometimes very detailed (see Section 5), are mainly local level (provinces, regions) reflecting the profile of administrative competencies (planning and authorisation) with no central authority collecting country-level data. ANEPLA, the association of the aggregates industry, produces annual estimates of production/extraction by the associated firms but does not have a specific recording system for all of the industry economic variables. There are many firms involved, spread all over the country making data building on a country-wide basis very difficult. ISTAT, the Italian central statistical institute, recently made an attempt to estimate the extraction of non metallic minerals (an aggregation of 'Marbles and stones' and 'Materials for the construction industry and other manufacturing industry', including aggregates). The results are reported in Annex I.

In order to describe a general trend, we present below some indirect estimates of extraction trends based on information available from the Italian NAMEA. NAMEA is available for Italy from 1990 to 2002. It includes economic and environmental data on the ATECO sector CB, which includes branch 13, 'Metallic minerals', and 14, 'Other extractive industries'. The latter includes quarries producing aggregates.

1992 is the only year for which a breakdown between 'Metallic minerals' and 'Other extractive industries' is available. In 1992, from a total of 454.533.913 tons extracted, 'Metallic minerals' represented just 98.231 tons and 'Other extractive industries' represented 454.435.682 tons. The metallic minerals industry in Italy is very small, most activities having been closed down during the 1980s. Also considering that the estimated amount of aggregates in Italy is 358 million tons (ANEPLA, 2003; UEPG, 2005) compared to 534 million/tons for 2001 (NAMEA), data for the whole 'Non-energy extraction industry' can be considered to be a good approximation of the general trend of extractions from quarries, including aggregates, which represents the largest share in the total (the other major components being marble and clay for ceramics).

Table 3 summarises available data on the value of production, intermediate consumption, and value added, in constant 1995 prices, along with employment, main air emissions, and quantities extracted. Figure 6 shows the trend in quantities extracted, which has been increasing from 1997/98, in line with the favourable trend in construction investment. However, this trend slowed in 2000-2001, and data for the most recent years are not available to enable us to confirm a correlation with the construction investment cycle. A closer analysis of this correlation for Lombardia and ER is made in Section 5.2.

Table 3. Non-energy minerals extraction quantities, economic data, and atmospheric emissions in Italy based on NAMEA, 1990-2002

(ATECO Classification: CB, 13- 'metallic minerals' + 14-'other extractive industries'; million €, thousands employees, tons of emissions and materials)

	Economic data (million € constant 1995 prices)				Extraction (tons) *	Atmospheric emissions (tons)			
	Value of production	Value added	Intermediate consumption	Employees (000)	Minerals	CO2	CH4	NOx	SOx
1990	3.223	1.521	1.702	46	456.760.933	421.116,2	32,0	4.338,0	807,2
1991	3.084	1.450	1.634	41	450.192.209	415.853,8	32,0	4.292,0	795,2
1992	3.144	1.474	1.670	39	454.533.913	421.567,8	32,7	4.319,8	800,2
1993	2.819	1.353	1.466	38	391.049.309	361.319,4	30,8	3.195,6	683,5
1994	2.674	1.286	1.388	35	378.311.974	339.095,8	30,7	3.055,3	626,1
1995	2.881	1.383	1.498	34	402.936.675	357.995,0	32,3	3.162,3	445,7
1996	2.979	1.448	1.532	33	400.620.301	381.219,9	33,4	3.646,4	474,3
1997	3.190	1.511	1.679	33	390.610.510	378.509,7	34,7	3.256,7	136,0
1998	3.433	1.529	1.904	34	460.861.249	454.251,0	38,8	3.987,5	146,2
1999	3.349	1.493	1.856	34	604.148.776	535.519,6	42,7	4.838,8	172,3
2000	3.215	1.434	1.781	33	583.244.212	556.008,5	43,2	4.990,5	102,9
2001	3.291	1.499	1.792	33	534.198.802	603.605,4	45,8	5.273,3	111,0
2002	2.880	1.314	1.566	33	NA	538.513,2	37,8	4.739,3	103,5

Figure 6. Non-energy minerals extraction Italy, 1990-2002

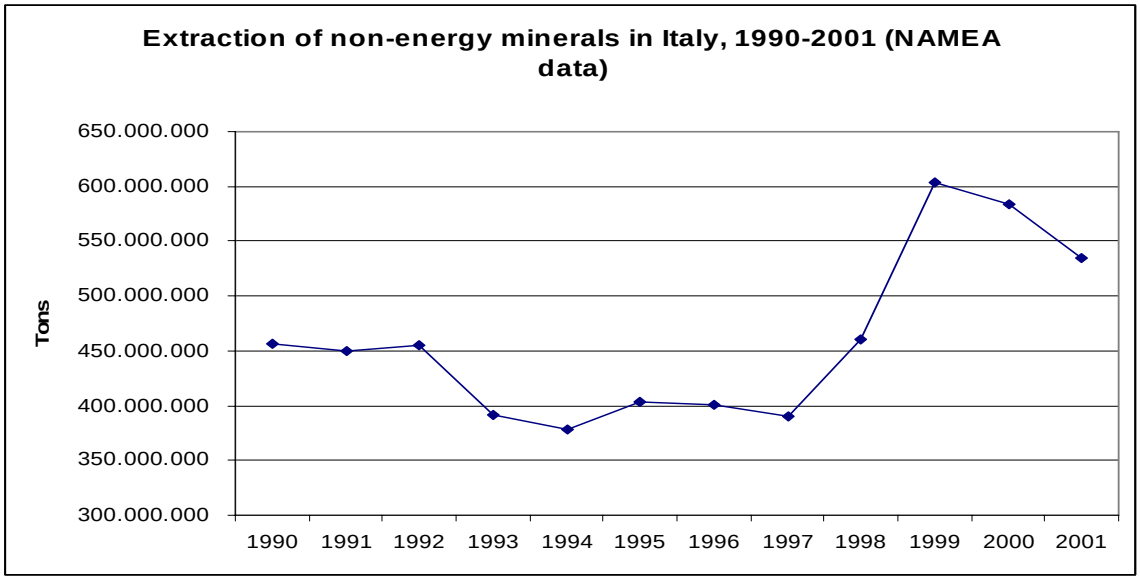
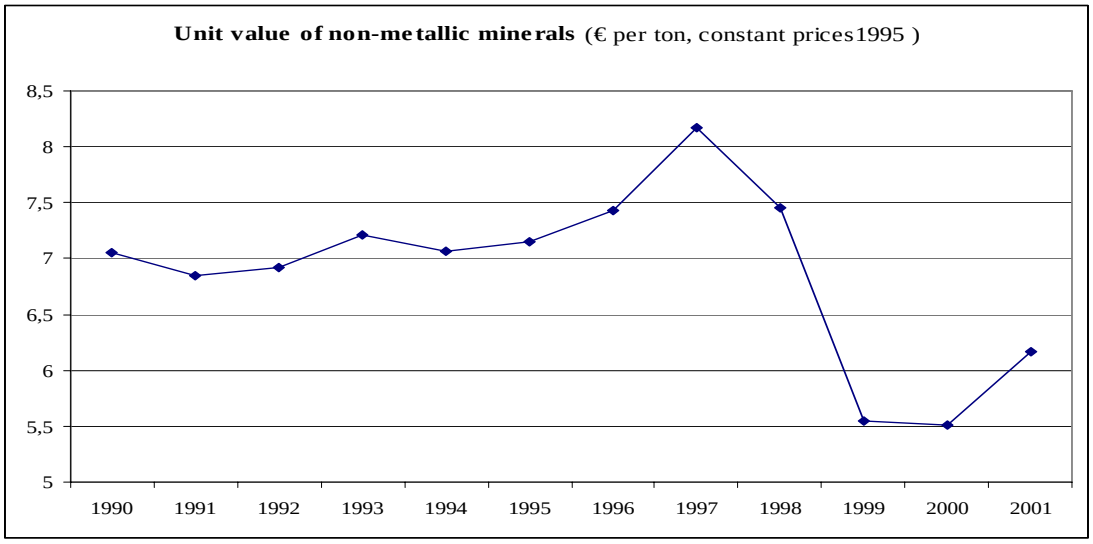


Figure 7 shows the average unit value of the minerals extracted at constant 1995 prices based on NAMEA data, and show a peak at the very beginning of a favourable business cycle, followed by a slowdown in the early phase of increasing supply, and a recovery during the early 2000s. The unit value went from around 7 €/ton to around 6 €/ton in the course of a decade. A tentative interpretation is that in the late 1990s, and related to the start of the favourable construction cycle, a great number of provincial plans for extraction (that had been awaiting approval for a long time) were passed, leading to a huge increase in extraction levels and a decrease in unit prices for materials.

Figure 7. Average unit value of non-energy minerals extracted in Italy (value of production at constant prices divided by quantities), 1990-2001



Taking into account that these are average unit values of production (and not market prices) for all non-energy minerals, and are in constant 1995 prices (not nominal prices), and only go to 2001, the interpretation of this (expected) inverse relationship between supply and prices cannot be taken as being completely representative of aggregate price behaviour during the last few years.

There are no time series on prices of aggregates in Italy. According to the industry, the prices published by Chambers of Commerce cannot be considered to be representative of the market, which is made up of many small direct private transactions, with highly variable conditions. For example, the opening of a new construction site can suddenly raise the price of aggregates in the local area (around 30/50 km) and negatively affect prices for other quarries. Interviews with industry suggests that the average price for aggregate materials had increased during the last few years and, at present, is in the range 8/9 €/ton in Lombardy and around 15 €/ton in ER[13].

As has emerged from the analysis of these two regions (see also other sections), extraction charges have not contributed much to the price increase as these charges are relatively low and very stable. The market continues to be the main driver of prices for aggregates. In these circumstances, it should be noted that the real value of stable extraction charges also has tended to decrease, thus reducing even further the role of these charges in production costs and in decisions about the quantities to be extracted.

2.4. Waste production and recycling of extractive industries and C&D waste

The waste produced by extractive industries is important in terms of the environment and their recycling potential; some could possibly substitute for aggregates in certain applications.

Non-hazardous waste generated by the Italian non-metallic, non-energy extraction industry (code 14), which includes aggregates, marble and other materials from quarries, amounted to 417.611 tons in 2002 (APAT, 2005). This represents a relatively small share of the waste produced by the sub-system related to construction/housing/infrastructures activities. Hazardous waste from this industry was just 6.761 tons. Most hazardous and non-hazardous waste production is concentrated in the Northern and Central regions, where most activities are located.

The manufacture of non-metallic minerals (code 26, mainly ceramics tiles) produces much more non-hazardous and hazardous waste, around 5,4 million tons and 38.000 tons respectively. The largest part is concentrated in the Northern regions where the ceramic tiles industry is located.

[13] However, some sand/gravel derived products are sold in the market at prices of up to 150€ per tonne.

The construction industry (code 45) produced around 518.500 tons of non-hazardous waste and a relatively significant amount of hazardous waste, 234.260 tons. A large part is produced in the Northern regions.

These figures can be compared with the enormous amount of waste classified as C&D waste, around 40 million tons, produced in 2002, mostly in the Northern regions. These data suggest that there is an enormous potential of recycling of C&D.

Table 4. Italy: Waste production of non-energy, non-metallic mineral industries, and C&D waste, 2002, tons

		Italy	***Northern regions***	***Central regions***	***Southern regions***
Construction & demolition waste		37.345.630	23.404.835	7.010.052	6.930.143
Non-hazardous waste	Industry Code	Italy	***Northern regions***	***Central regions***	***Southern regions***
Extraction industry (non-energy, non metallic)	14	417.611	149.116	229.336	39.159
Manufacturing of non metallic minerals	26	5.445.544	3.466.345	1.190.625	788.574
Construction	45	518.596	415116	69.366	34.114
Hazardous waste	Industry Code	Italy	***Northern regions***	***Central regions***	***Southern regions***
Extraction industry (non-energy, non metallic)	14	6.761	2.847	3.090	824
Manufacturing of non metallic minerals	26	38.035	31.916	3.423	2.696
Construction	45	234.260	160.577	56.599	17.084

Source: calculations from APAT (2005)

The potential for recycling is largely under-exploited. In particular, in Italy a very small amount of recycled aggregates are produced. The take off of recycling for mining, aggregates and C&D waste is constrained by economic, regulatory and organisational factors.

From the economic point of view, recycled aggregates, mostly due to the presently poor recycling market organisation, are not competitive with virgin materials in terms of either cost *and/or* quality. The Italian construction industry has a clear preference for virgin materials and still largely distrusts recycled materials, except for specific uses, such as filling. The virgin aggregate producers would be in a very good position to develop recycling because they know the market, they have the infrastructure and the equipment required for crushing. There is a good economic rationale for construction companies to deliver demolition waste and pick up virgin aggregate materials at the same quarry sites (which would also simplify the regulatory requirements). However, aggregate producing firms that have tried to develop a recycling activity have not found it economically viable due to lack of demand and poor prices for recycled materials[14].

Also the regulation framework, in particular (i) a (still) somewhat ambiguous and moreover modifiable waste definition (across materials), and (ii) the rules for storage and transport of such waste, have so far not much favoured recycling developments. Even the development in Italy of 'green public procurement' policies during the early 2000s, and in particular the provisions for compulsory shares of recycled materials in the procurements of public administrations have not catalysed the recycling market in practice.

Notwithstanding this, a certain interest in and development of recycling activity is now developing, as represented by the establishment in 2000, of ANPAR (Italian association of recycled aggregate producers). There are around 50 producers/plants in Italy. The estimated amount of recycled C&D in 2004 is 3,7 million/tons, or

[14] Over recent years, some good examples of recycling specialised companies have emerged in connection to the construction sector instead, probably exploiting some favourable (but randomly distributed) local situations (in terms of local voluntary agreements, low transport costs, public institution's support, etc..) and niche markets for certain materials depending on the features of material demand in some contexts.

around 10% of C&D estimated production (ANPAR 2005)[15]. Even though this share is increasing, this amount is clearly very low compared to the amounts of virgin aggregates produced and consumed in Italy[16].

An interesting initiative related to C&D waste recycling is the Agreement signed in February 2004 between ANPAR and UPI (National Union of Italian Provinces). The parties to the agreement have committed: (a) to encourage the demolition of buildings according to techniques that allow the selection of construction/demolition waste and the separate collection especially of hazardous waste; (b) to select at source construction/demolition wastes, separating dangerous from non-dangerous wastes and non-dangerous waste from similar categories of materials, as well as separating non-hazardous waste into homogeneous material categories; (c) to use design and building techniques based on materials that have a reduced environmental impact in terms of qualitative and quantitative waste production; (d) to promote measures aimed at increasing the amount of waste brought to recycling; (e) to foster the reuse of those residues that can serve as material/components of new construction processes; (f) to improve the quality of recycled materials; (g) to introduce technical requirements and contractual clauses that provide for the use of recycled materials; (h) to identify new markets for recycled materials; (i) to monitor the construction/demolition waste flow; and (l) to promote the implementation of Ministerial Decree 203/2003[17] (see below section 4.6.2 on the law framework).

Regions and provinces may innovate in this area. Though there is currently a ban on free commercial trade of materials coming from non-extractive production sites (i.e. road and transport infrastructures works, construction sites, etc.), Emilia Romagna legislation has introduced the possibility of selling such materials in the market, provided that agents pay the same charges as are imposed on aggregate materials produced by quarries. The payment 'frees' C&D materials, opening the way to their re-use for specified and monitored destinations, such as underground infrastructure replenishment, natural sites restoration/replenishment (lakes, wetlands, etc.).

In the opinion of some regional officers, it is reasonable to assume that a 10-25% (25 being the maximum ceiling according to experts in the field) of materials supply could stem from 're-use' of secondary low value materials, primarily originating from the construction sector. There are some examples of quite high value reuse, such as cement[18] production[19]. Innovation could play a role in this respect[20].

Geography also matters: in mountainous areas some materials may come from excavation of tunnels for infrastructures, which are then reused. This happens less frequently in non-mountainous regions where to construct infrastructures new materials are needed. Nevertheless, the opposite may be true, highlighting the high complexity of planning in front of heterogeneous geological and economic factors. Some materials deriving from tunnel excavation can be of low quality, while materials arising out of some plain areas (e.g. the Po area in Northern Italy) is of high value; as examples the works for the Milan Metro and airport have produced, according to ANEPLA, a positive net supply of materials (production higher than use in such works).

All in all, the current value of most recyclable materials is not high, with those sending material for recycling receiving nothing or next to nothing in return (despite it avoiding the costs of landfill), allowing the agents operating the processing and recycling businesses to receive a mark up.

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15 ANPAR (2006), based on a direct survey, estimates recycling of 4,2 million/tons of inert materials, which represents 10% of the 42 million/tons of C&D waste estimated by APAT (2005).

16 The current maximum feasible share is 10-15%, not more. Reasons are many: small size of the market, operators perceive medium-high risks in increasing recycling reuse shares in their business due to unstable prices and materials quality and cost differentials between primary and secondary materials, and the lock in investments effects (thus fixed and variable costs of processing materials), are not large.

17 It may be noted that according to both public and private agents the agreement has not generated the expected amount of effective implementation, which is highly dependant on local features. One good practice to flag out we are aware of is the attempted implementation by the Province of Bologna, which signed a practical set of objectives with operators in the sector, exploiting the framework agreement.

18 It is worth noting that a possible trade off may exist between using more recycled aggregates as inputs (cement) and the additional energy this requires. Trade offs should be carefully examined by means of cost benefit analyses.

19 For example, during the excavation for building TAV (high speed train infrastructures) train tracks, some firms began to mix secondary materials (sand & gravel, etc..) with lime, in order to produce a material which is legally ready for use in the same work, by passing waste legislation which bans the reuse of non-inert materials. It should be noted, on the other hand, that new quality standards in construction may not be conducive to recycling (e.g that relating to housing) since they create incentives for the use of mixed materials, which then produce mixed waste flows, which are difficult to separate out.

20 Regarding innovation dynamics in the sector, some key questions arise that might constitute the subjects for further research. These are: are aggregate firms innovative or interested in developing their brand in the market? Do they opt for EMS and auditing schemes and innovation in a more general sense?

It is worth noting that a "label" on secondary material (e.g. CE type label), originating from market behaviour or regulatory forces, could increase the price of secondary material, giving rise to a convergence to the virgin material market price. Actually, this is one of the main promising dynamic in Italy. On the basis of DM 203/2004, recycled aggregates may concur to the 30%[21] recycling objective of public institutions, but only if registered to a proper inventory. Quality has increased compared to the past and secondary aggregates must be CE labelled, simplifying the registration, in addition to the requirement of a minimum amount of 3000 m3[22]. Those factors help the transition form a small scale voluntary level of activity to a larger scale of production associated with higher quality, driven by higher technical standards, and processes of registration/certification which help recycling markets to improve their performances. Supply and demand are favoured in their matching by such dynamics reducing uncertainty on quality; prices can increase and stabilise.

It is to be highlighted that the aggregate charge plays a minor if not absent role in those market evolution. It is the legal framework that create a more stable, valuable scenario for recycling, not an extra price imposed by a tax per tonne of virgin aggregate materials; prices go up driven by the factors "quality and certainty". Regulatory efforts are not absent, but not in the "tax" form. The role of public administrations is important to crate scale economies and a start up to the market. Given the relevancy of public expenditures in the sector, this may really constitute a pivotal role in the current and future development of such secondary markets[23].

Problems still remain. The main problem to tackle, notwithstanding the aforementioned positive developments, is the still very poor market, the perceptions of risk, the locks in effects in agent's behavior, and poor demand for recycled material. In the field of recovery/recycling, only very high value options, such as road foundations are being exploited. High added value is necessary to create sufficient rent for it to be shared by suppliers and those using secondary materials. The quality of material is crucial and very important with respect to relative costs[24].

It is claimed by experts in the sector that the highest marginal value for the reuse of recycling opportunities is in road construction with respect to buildings, which have already reached high efficiency standards. Currently, too much material is being used in road building (the height of the road infrastructure could be reduced by reducing the number of pavement layers).

In general, the aggregate extraction charge, while being considered a potential factor favouring recycling even, is not effective in achieving this result in Italy (and, we stress, it was not designed in its origin to achieve this objective).

2.5. Import-export of aggregates

In 2005, Italy imported 5.737.014 tons of aggregates (sand, gravel, crushed rock), to a total value of 163,1 million/USD[25]. Total imported quantities represents only 1,6% of total estimated extraction (358 million/tons in 2004). Italy also exported 1.757.137 tons of aggregates, to a total value of 91,2 million/$, which brings the contribution of net imports to just 3.979.877 tons, or 1,1% of estimated domestic extraction.

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[21] Important to be noticed, the rule 5205/2005 adds that post-consumption waste may be mixed with "excavated" waste (aggregates), with a minimum share of the former type defined in 60%, declared in the registration to the inventory.

[22] This is a sort of identity card of the product/material, impacting on the perceived and effective quality.

[23] Also industrial operators of the virgin aggregates market (ANEPLA) claim that economic instruments are relatively less effective in favouring the development of secondary material markets (recycling of aggregates), if compared to a clearer technical regulation and a new framework of "quality" parameters in public works, which may act as a driver in the market. Publicly funded works should create a favourable environment both by boosting demand and by establishing a new perception on the real quality of recycled materials.

[24] There may be problems in matching supply and demand for high value uses. There is often insufficient supply due to technical but also lock in effects based on the way buildings and infrastructures are constructed. Supply is dependent on past technological standards, demand is driven by current and future expectations in relation to standard and prices. The incorrect matching is partly a result of this diachronic factor.

[25] All data in this section are elaborated from the United Nations Statistical Division COMTRADE database (http://unstats.un.org/unsd/comtrade). Aggregates are identified according to the four-digits SICT Rev. 3 classification and include the following items: No. 2373: Name: 'Sands, natrl. not mtl.brng'; Description: 'Natural sands of all kinds, whether or not coloured (other than metal-bearing sands of division 28)'; No. 2374: Name: 'Pebbles, gravel, broken or crushed stone, of a kind commonly used for con'; Description: 'Pebbles, gravel, broken or crushed stone, of a kind commonly used for concrete aggregates, for road metalling or for railway or other ballast, shingle and flint, whether or not heat-treated; macadam of slag, dross or similar industrial waste, whether or not incorporating materials cited in the first part of the heading; tarred macadam; granules, chippings and powder, of stones of heading 273.12 or 273.13, whether or not heat-treated'.

While transportation costs remain a basic constraint to an extensive trade in aggregates, it seems that Italian trade includes small flows (of both imports and exports) from and to other countries. This can be due to the demand for specific materials (quality, features) and/or to the opportunities provided by low freight charges, i.e. the very low charges for freight on what would otherwise-be empty ships. This is probably the explanation for the huge variation in the average unit values of imported and exported aggregates, which are sometimes very low and sometimes very high.

Tables 5 and 6 present the geographical breakdown of imports and exports in 2005 for 'sand' and 'gravel and crushed stone' (SITC 2374).

For sand (SITC 2373), the major import flows are from France, Egypt, Spain, Bulgaria, Portugal, Switzerland, Slovenia and Tunisia, i.e. from Alpine and Mediterranean countries, over relatively small distances transported by sea or by land. Total export is dominated by flows to Switzerland.

Table 5. Italian imports and exports of sand by destination and origin ranked by value, for transactions over 100 tons in 2005

Export to	Trade Value 000 $	Net Weight (tons)	Import from	Trade Value 000 $	Net Weight (tons)
World	10.060	187.515	World	74.980	1.564.582
Switzerland	1.605	145.841	France	20.594	355.661
Germany	1.119	3.727	Egypt	20.037	559.586
Egypt	812	972	Spain	9.109	203.464
France	717	5.943	Bulgaria	5.772	164.748
Spain	556	4.349	Germany	5.232	73.234
Morocco	54	9.786	Switzerland	2.270	13.367
Hungary	374	1.042	Norway	1.574	14.728
Russian Federation	334	610	Portugal	1.564	39.296
Bosnia Herzegovina	299	1.012	Austria	1.440	21.405
Romania	250	669	Australia	1.387	7.513
Croatia	215	1.975	India	1.013	8.988
Sweden	20	283	China	761	1.469
Czech Rep.	198	972	Slovenia	683	59.986
Slovenia	194	3.578	Canada	531	1.911
Belgium	139	612	USA	500	574
Serbia and Montenegro	74	229	Tunisia	456	16.629
Latvia	74	307	Jordan	334	6.847
Greece	72	205	Belgium	312	6.373
Ethiopia	33	137	United Kingdom	185	270
Slovakia	23	145	Rep. of Korea	134	2.994
			Russian Federation	96	3.200

Source: elaboration on COMTRADE, SICT Rev. 3, item 2373: 'Sands, natural, excluding metal-bearing sands'.

For gravel and crushed stone (SITC 2374), which represent the major component of total aggregate trade in terms of both weight and value (but are very low unit value compared to sands), import is dominated by Croatia, which supplies more than half of the total for Serbia-Montenegro, Norway, Austria, Switzerland and Slovenia. Also, with the exception of the flow from Norway, trade is dominated by the Alpine and Mediterranean origins. Exports, on the other hand, with the exception of the flow towards Tunisia, are mainly directed to Central and Northern Europe, in particular Germany, Belgium, United Kingdom, Switzerland and Sweden.

Table 6. Import and export of gravel and crushed stones in Italy, by destination and origin ranked by value, transaction over 2.000 tons for export and 100 tons for import, 2005

Export to	Trade Value 000 $	NetWeight (tons)	Import from	Trade Value 000 $	NetWeight (tons)
World	81.145	1.569.622	World	88.132	4.172.432
Germany	22.132	358.626	Croatia	37.420	2.615.316
Belgium	7.486	169.056	France	16.841	94.934
United Kingdom	7.345	161.642	Serbia Montenegro	10.377	811.459
Switzerland	7.214	274.443	Austria	9.283	136.002
Sweden	6.983	143.829	Norway	7.251	335.239
Tunisia	6.115	156.448	Germany	1.433	3.800
France	5.512	59.345	Switzerland	1.358	67.859
Austria	3.999	38.389	Spain	1.082	10.894
Netherlands	2.132	28.302	Turkey	1.063	7.887
Morocco	1.340	15.046	Slovenia	489	59.702
Russian Federation	1.285	7.391	China	293	672
Israel	1.046	36.259	United Kingdom	199	1.108
Hungary	827	10.812	India	190	1.057
Slovenia	82	8.416	Argentina	161	.617
Libya	82	23.915	Ukraine	134	13.900
Brazil	615	21.342	Egypt	81	1.284
Greece	45	11.009	Albania	60	7.091
Spain	430	4.492	Netherlands	52	142
Poland	400	3.441	Mexico	42	2.900
Denmark	356	3.352			
Algeria	327	3.504			
Croatia	285	3.457			
Slovakia	145	2.276			
Lebanon	111	3.699			
Palestinian Terr.	87	2.850			

Source: elaboration of COMTRADE, SICT Rev. 3, item 2374: 'Pebbles, gravel, broken or crushed stone, of a kind commonly used for constructions'.

Despite its still low level, import of aggregates has been increasing during the last decade. Figure 9 illustrates the evolution of imported and exported quantities of total aggregates (sand, gravel, crushed rock) in 1988-2005. While export has remained around the same level during this period, imports have increased from about 1,5 million/tons in the mid-1990s to 5,7 million/tons in 2005. Similar to production, this acceleration in imports was particularly strong after 1998, the start of the favourable construction investment cycle. It is interesting to note that, in terms of value, imports and exports have followed parallel paths (Figure 10). This suggests that increasing imports commanded decreasing prices while exports enjoyed favourable prices in foreign markets.

Looking at the evolution of trade for the two main groups of materials, gravel and crushed rock show the most significant changes (Figure 11 and 12). While imports and exports of sand have remained almost stable over 1998-2005 (with a structural situation of net import), imports of gravel and crushed rock have increased rapidly during the last decade, and Italy has gone from being a net exporter to being a net importer. Once again, the acceleration in net imports occurred in 1998 in parallel with construction investment recovery. It can be seen (Figure 13) that imports of gravel and crushed rocks were at declining unit values, while export unit values have remained rather stable over time, suggesting increased competitiveness of imported materials, which, however, are not traded at low prices.

Figure 9. Total import-export of aggregates (sand, gravel, crushed rocks) for Italy, 1988-2005 (tons)

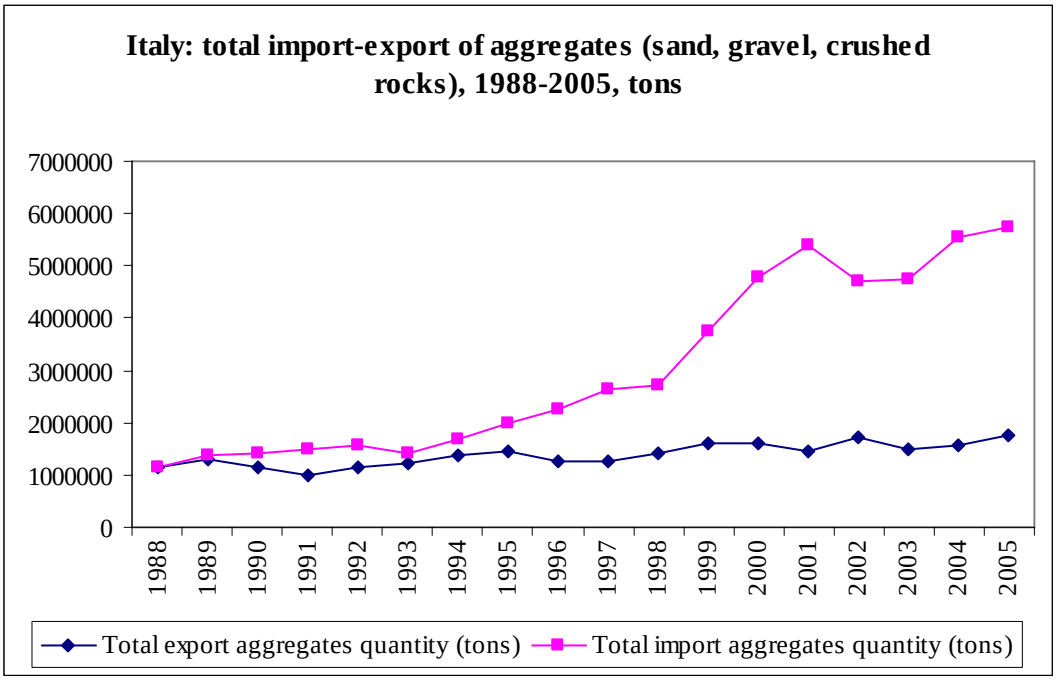


Figure 10. Value of import-export of aggregates (sand, gravel, crushed rocks) for Italy, 1988-2005 (000$)

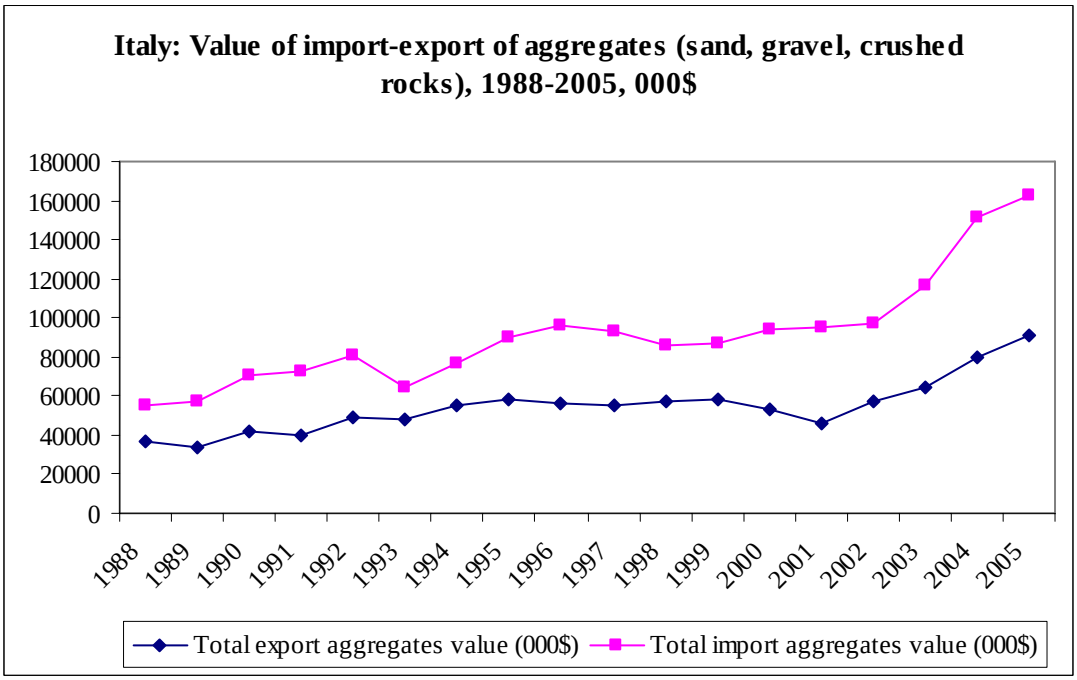


Figure 11. import-export of sand for Italy, 1988-2005 (tons)

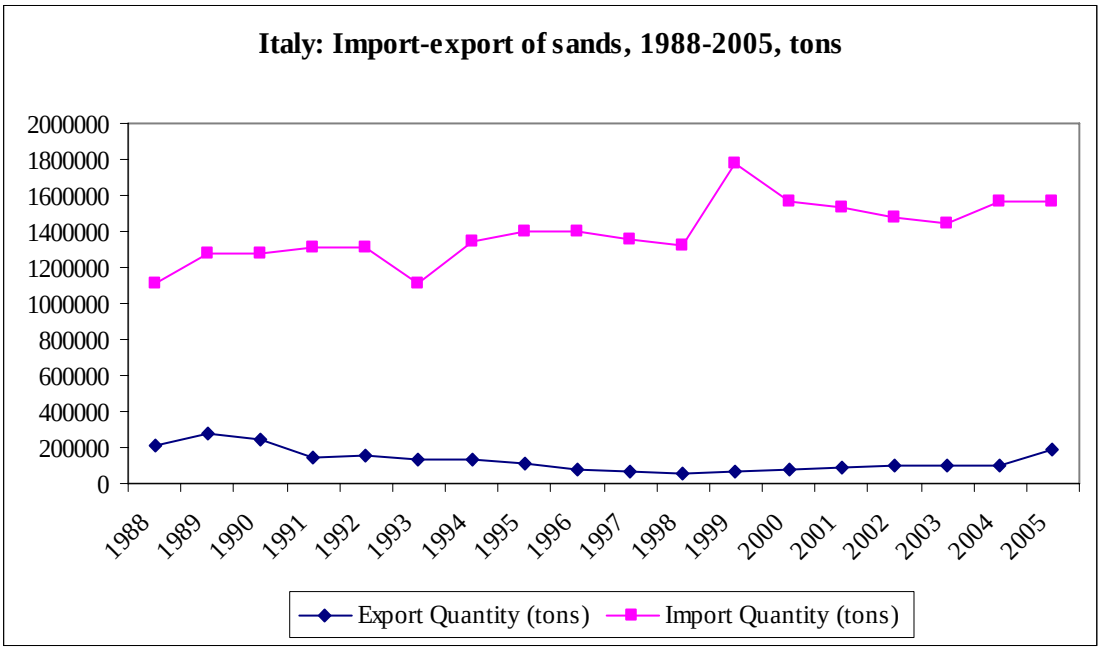


Figure 12. Import-export of gravel and crushed rocks for Italy, 1988-2005 (tons)

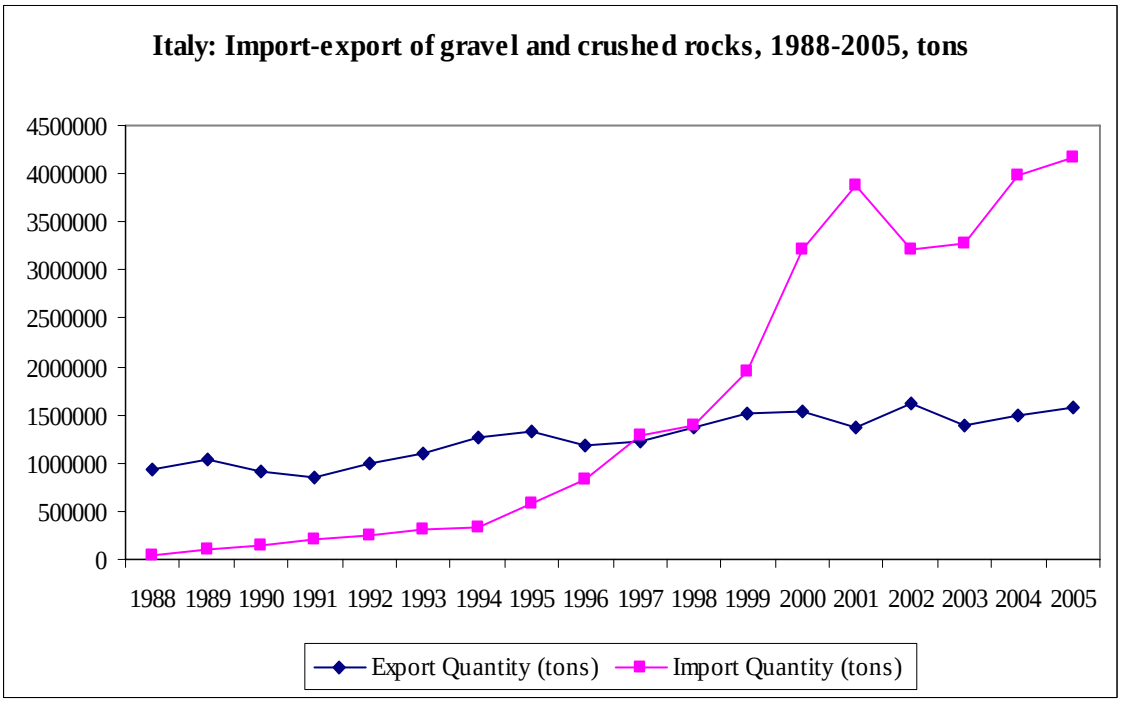
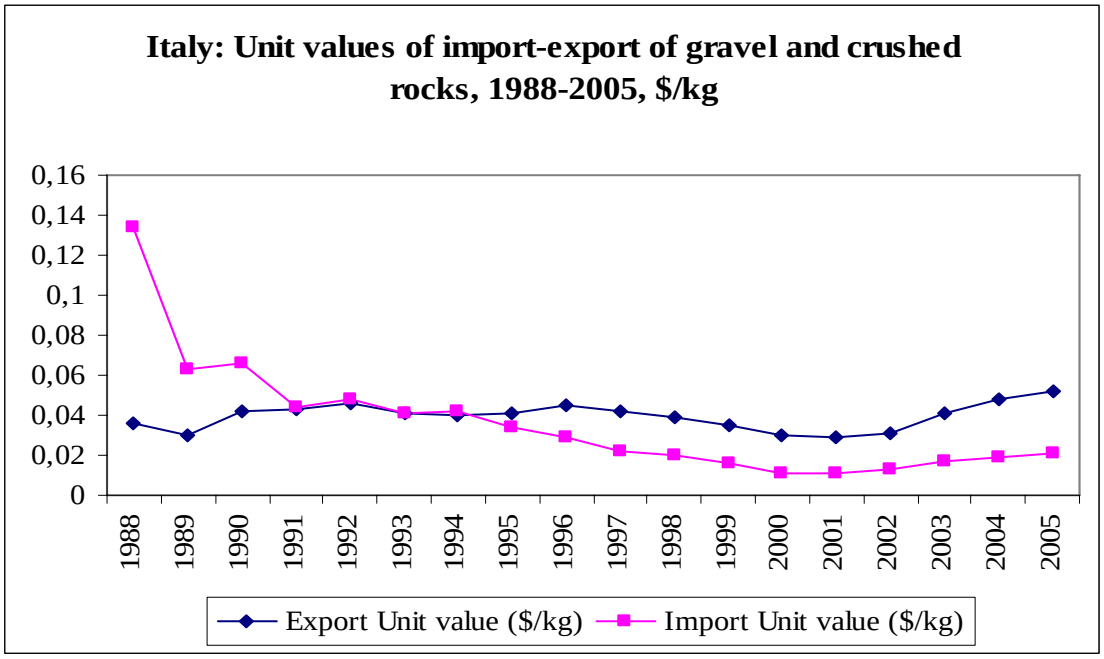


Figure 13. Unit values of import-export of gravel and crushed rocks for Italy



In general, it can be claimed that the still limited importance of international trade in aggregates in Italy is due to the high ratio of transportation costs to value of materials. The possibility of international trade flows is thus linked to geographical proximity, specific favourable conditions in the freight market and, in the case of some import flows, low production costs in countries of origin (availability of materials, less strict environmental and land-use regulations, low labour cost, etc.). This is confirmed by the geographical structure of Italian trade and the relatively high unit value of traded flows. Notwithstanding this, import flows of aggregates, particularly gravel and crushed rocks, significantly increased during the last decade, although still remaining very low compared to domestic production. The increased imports did not violate the conditions of geographical proximity and occurred in parallel with increased domestic demand driven by the favourable construction cycle. Increasing imports cannot be attributed to the aggregates charges prevailing in Italy or to the constraints in the extraction planning system. This was confirmed by interviews with industrial operators.

It can be concluded, therefore, that in Italy, a higher aggregate tax would probably increase imports from eastern EU countries and the Italian alpine regions. A higher tax would further shift the comparative advantages from (i) relative scarcity (abundance) in different countries, (ii) different regulations in the sector, (iii) lower transport costs, which are slowly but surely, changing the structural comparative advantages in aggregates production[26].

In addition, a region based state, such as Italy, would be unlikely to have very different taxes even within a country perspective, i.e. markedly different tax levels in neighboring regions, since trade flows arising from any existing differences are a major component of externalities (mainly transport). Thus, regional policies, if not controlled top down, could be detrimental. Currently, Regions cooperate in order to ensure that there are no huge differences in their tax levels; there are no formal top down mechanisms in Italy. The central state level is not concerned with regulation. It can be argued that the regional level is effective and coherent since it avoids any national level legislation which by definition would not differentiate taxes according to specific local and territorial socio-economic and geological situations. It is also preferable to an extreme province- or municipality-

[26] According to experts in the field, Croatia will be the main source for Italy in the future. Rail infrastructures could be used to help reducing transport costs in the future and also would be a more efficient and cost effect way of transporting material at the present time based on international trade (cost) advantages and specialization reasoning. Some operators claim, for instance, that based on cost advantages and asset availability cement should be produced in Croatia, Macedonia and Greece rather than Italy. Nevertheless, lock in effects (capital investment) may prevent any short run re-organisation of production, which also could have severe social impacts in terms of employment.

based tax system, which could fuel detrimental fiscal competition between local entities[27]. In addition, the regional level is one where the public agent can allocate effectively and efficiently the extraction of aggregates in a homogenous territory.

To sum up, regions play a key role in setting taxes and monitoring their implementation in the preliminary planning and evaluation of projects and quarries. They should coordinate in order to avoid wide differences between regions, and coordinate the actions taken by provinces and municipalities at a lower level to ensure coherence[28]. The provinces should plan and monitor actions taken by municipalities. It can be said that the three levels play complementary roles, with coordination and general policy target setting actions biased towards the more centralised regional level and effective policy/planning of quarries being more the responsibility of provinces and municipalities. The latter set and manage the contractual obligations of the parties in the market, and provide compensation for external costs from taxes and other sources of revenues.

3. Effectiveness analysis. Extraction charges vs other policies, planning and market factors

3.1. A preliminary assessment

The two cornerstones of policy on aggregates in Italy are: (a) planning/regulation of quarrying activities, and (b) extraction charges. The latter do not have the explicit aim of either reducing the quantities extracted or increasing the amounts of aggregates and C&D waste that is recycled. Extraction charges are mainly intended to 'compensate' for external land use costs arising from quarrying activities. In addition to extraction charges other costs may arise as a result of the agreements between site owners and municipalities, which could be up to double the amount of the basic extraction charge. A relatively small extraction charge thus renders these additional costs more economically sustainable.

It can be claimed that the Italian approach is based on a mix between keeping a stable level of 'natural capital' and compensating the local community for any disturbance or loss of amenities by investing in the area surrounding of quarrying activities. Also, the legal obligation of rehabilitating the areas around closed down quarries is coherent with the principle of maintaining an 'almost' constant natural capital ('weak sustainability' rule). Unlike other countries, Italy does not see the quantities of materials extracted as themselves being the source of environmental damage. In addition, quarrying policy does not reflect the principles of optimal consumption of scarce non-renewable resources, in which pricing plays a key role by preventing inter-temporal negative externalities. Externalities are seen mainly in terms of changes to the local environment and landscape, and the economic instrument is mainly compensatory in nature.

From an environmental point of view, however, the actual process of earmarking the revenue from charges and other payments provided for in the agreements between municipalities and quarry owners, is far from transparent and is not well documented, and relies on the 'good administration' of individual municipalities. Under current conditions, the main aim of these charges is to provide revenue for the municipality.

Furthermore, in most Italian regions rehabilitation works following quarry closures are not well documented. This, however, should improve in future as the late 1990s' regulations require a rehabilitation programme to exist when a quarry is opened, Thus, recent trends are to shift from low-value rehabilitation projects (landfills, low-value agricultural lands) to higher value projects, e.g. afforestation, recreational areas, biodiversity, bird watching, etc., which will create a higher value for local communities[29].

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[27] There are some possible negative side effects specifically: if responsibility remains at level of municipalities, a tax might provide the incentive for the authorisation of more new quarries in order to raise money to finance local public expenses. Thus, coherent planning from top down from Region to Province is needed to maximise the social benefits (and minimise social costs).

[28] As Kellett (1995) notes, in the case of the UK, sharp differences in policies and demand across regions can induce trade flows and increase the pressures on environmental conservation in exporting areas, driven by the importing regions. This does not, at present, seem to be as important an issue in Italy as it is in the UK. Nevertheless, differences in Regional socio-economic policies could produce distortions and inefficient allocation of economic (transport) and environmental costs. Kellett (1995: 572) also notes that "interregional trade, which implies massive use of transport, fuel an consequent pollution, as well as an uneven spread of environmental impacts from extraction sites, is also questionable in the light of the sustainability concept. Alternative sources of material, such as recycled aggregates or waste products from other processes should also be examined as a possible component of a sustainable policy".

[29] Creation of biodiversity hot spots in the post quarry scenario, in newly created parks or alongside rivers, may be of higher value (Ticino example), although this will require some exploitation of these new sites in order to maximise their value

In general, the planning of quarrying activities seems to be based on the same principles as land conservation and minimisation of natural capital losses. Extraction is allowed to keep pace with demand, and the scarcity of aggregates is not prioritised; however, resource exploitation should fulfil sustainability rules[30]. Planning has generally addresses the preventive side to these sustainability objectives, but the approach is changing. During the last few years, the approach of planners has shifted from allowing small and shallow extraction for short period over large areas of land, to allowing a few deeper sites involving less surface areas. In short, a few deeper, better managed mines are considered preferable to several shallower, less well exploited mines. This confirm the idea that the 'surface externalities' related to quarrying sites, including the transportation networks, are considered to be more important than those associated with intensive exploitation[31]. Furthermore, the development of aggregates and C&D waste recycling has, so far, not been a priority in planning.

Given the information available, it seems that the quantities extracted and the value of the materials have been influenced by the 'authorisation wave' that occurred at the end of the 1990s, which followed a period when there were few authorisations issued and coincided with a recovery in construction investment.

Planning does have an influence on quarrying activity (quantities) that is: (a) linked to the development of demand but is lagging behind it due to the slowness of the planning process; (b) based on caps on total quantities extracted that are related to the sustainability of local land resources and conservation; and (c) the imposition of higher rehabilitation costs.

The specific role of aggregates extraction planning is complemented by a very complex set of legislation/regulation on (a) land use and (b) waste.

The first area of legislation (land use and planning) contributes to limiting the quantitative development of quarrying activity and to increasing its explicit and implicit costs. However, the very 'local' nature of the activity gives Municipalities a significant and arbitrary role in the actual development of aggregates quarrying, including the nature of the 'compensatory' investments required of quarry owners, the actual earmarking of the revenue from the extraction charges, and the land rehabilitation operations when the quarry is abandoned.

The second area (waste) acts instead in a more complex way. On the one hand, it works as an indirect support for quarrying activity by limiting the development of recycling for mining/quarrying and C&D waste. Although the application of some provisions (e.g 'green public procurements) could lead to significant developments, current recycling developments are very poor. On the other hand, the increasing limitations on waste landfills, including the enormous amount of C&D waste, and the application of a landfill tax since the mid-1990s, could drive the development of recycling to produce substitute for virgin aggregates. Even in this case, however, the evidence suggests that these effects would be very limited in the short term.

In other words, planning in terms of quantities, seems clearly to be more important than extraction charges for shaping the development of aggregates supplies in Italy. From the information available and the interviews with stakeholders it is clear that material extraction is inelastic to prices, and taxes/charges, and that extraction charges are low relative to the total value of the materials extracted: 1 cubic metre has a market value of 8-9€, compared to a charge of 0,31 €/m3. Even it the other payments to municipalities are included the cost rises only to a maximum of 0,6 €/m3. On the other hand, demand for aggregates seems to be inelastic to price and also to extraction charges when translated into the market price of aggregates.

In one of the regions we examined (Emilia-Romagna), when the charge was established in 1991 its level was relatively high, probably the highest in Italy at the time. The idea was to implement a real fiscal environmental tool aimed at making an impact on materials extraction through prices. Policy makers later recognised that price instruments were less effective than planning mechanisms, which are now at the heart of policy relating to the aggregates sector. In Emilia Romagna, the new charge, to be introduced in 2006/2007, is just an update of the old one, taking account of inflation over the past decade or so.

Officers claim that according to some evaluation studies carried out by technical experts, the tax should have been tripled. However, this would be neither feasible in political terms, nor effective based on the reasoning

[30] This view is consistent with Kellett (1995) who stresses that potential resources are massive and prices are low compared to other minerals. The real issue is not scarcity per se, but the environmental costs linked with extraction, within a wide geographical perspective that takes account of interregional and inter country spillovers through the trading if aggregates: "it is not resource depletion which is the key issue but the environmental impact of resource exploitation" (Kellett, 1995, p. 575).

[31] In ER, authorisations for extractions usually apply to a period of 5 years. 4 of these are to be devoted to mining and the fifth to rehabilitation of the site (i.e. creation of grassland, wetland, tree planting). In practice, some rehabilitation (i.e. tree planting) begins in parallel with excavation activity (i.e. tree planting).

behind the relative importance of price and non-price (economic) mechanisms based on compensation investments. Higher taxes might even lead to more illegal extractions[32], and/or more imports from neighbouring regions or abroad (see Section 4.5).

3.2. Econometric analysis on aggregate trends and delinking in two regions

3.2.1. Introduction

The data analysis suggests that extraction charges play a limited role in shaping industry decisions about aggregates production in Italy, and that market drivers (construction investments) coupled with the planning of quarrying activities could explain a large part of the aggregate market and its dynamics.

In order to test this hypothesis, this section presents an econometric exercise of aggregate production/extraction, mainly sand and gravel, for the Northern Italian regions of Lombardia and Emilia-Romagna. We are aware that the quantitative econometric exercise is constrained by data availability. Thus, it is only meant to provide complementary evidence to qualitative and descriptive findings commented above, and to suggest future applied research directions that may exploit more longer time series and larger datasets regarding more regions.

A large dataset on the aggregate sectors in these two regions (and their provinces) was provided by the local authorities. These data, merged with GDP and value added data elaborated from other sources, allow us to conduct econometric tests for the importance of demand drivers, extraction charges, and other factors in explaining the aggregate production.

For Lombardia, we exploit a panel dataset covering 10 provinces, over a period of 9 years (1995-2003). Data on aggregates are available from 1991 (we use aggregate data for sand and gravel, which are more reliable and relevant in quantitative terms), but provincial value added (VA) are only available from 1995. As drivers we use the VA for the province and the construction sector. We include in the explanatory variables, the aggregates charge introduced in the early 1990s and updated to match inflation every two years. Finally, we test the importance of provincial contiguity by including some proxies: (i) the VA for nearby provinces; (ii) a dummy variable capturing whether a province is contiguous with the Province of Milan, the latter being a possible geographical driver of extractions in other areas.

For Emilia-Romagna, as it was not possible to collect data for all provinces, we decided to focus on the Province of Bologna, the main city/province in that region. This province is considered to be representative of the average regional situation. The dataset was built on aggregates extraction time series for 1980-2004. Data and elaborations were provided by the Extractions and Mining Office, which is part of the Landscape Planning Service (Servizio Pianificazione Paesistica) in the Bologna Province, and referred to all aggregates, although sand and gravel represent the larger part proportion of the material extracted in this region. In order not to lose the power of the time series data, we took regional GDP and the construction VA at regional level as our explanatory variables. The final time series dataset covers the period 1984 to 2004. For Emilia-Romagna, aggregates charges are not introduced as drivers given that, although the tax was introduced in 1992, it has not been revised since. It is an atypical case of decreasing 'real' tax over time. In 2007 the tax will be updated for the first time in 15 years.

Table 7 presents the descriptive statistics for the two datasets. All econometric specifications are estimated in logarithmic terms to smooth the data series and, where significant, to elicit elasticity values.

[32] This claim is supported by the aggregate industry, which highlights the risk, in absence of a rule that obliges the building sector agents to present a proof of legal disposal in order for the construction operations to be approved.

Table 7. The datasets: Descriptive statistics

Variable	mean	max	min	
Lombardy (N=90: 9 Years, 10 Provinces)				
Extraction of sand and gravel (tons)	3.123.463	1.213.2259	8.870	
Extraction of sand and gravel (per capita)	4,039738	10,84167	0,050131	
Provincial Construction added value (€1995 Millions)	19.888	3.424	177.200	
Provincial added value (€1995 Millions)	85.621	112.190	2.663	
Aggregate tax (€/m3)	0,321	0,387	0,285	
Emilia-Romagna (Bologna)				
Extraction of aggregates (tons)	2.918.889	4.090.470	1.502.413	
Authorised quantity of extraction material by Province (tons)	42.651.698	53.498.005	26.498.164	
Regional Construction value added (€1995, Millions)	3.798	5.178	2.867	
Regional GDP (€1995 Millions)	75.024	91.562	59.711	

Source: Own calculations based on data provided by the two regions.

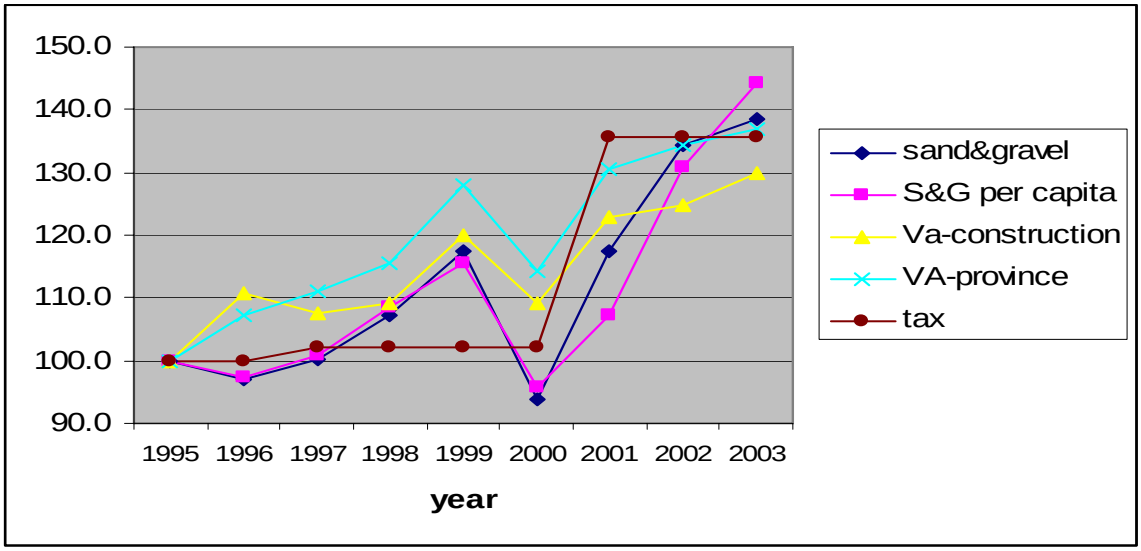
3.2.2 Descriptive findings

Figure 14 shows that for Lombardy, during the 10 year period considered, extraction and the two selected drivers were not affected by structural breaks[33]. Apart from a short-lived slump in extraction activity at the end of the 1990s, all factors increased more or less incrementally. In terms of the aggregates charge, its moderate increase over the period (which probably converges to zero in real terms) did not apparently affect extraction rates. The sudden increase that occurred in 2001 seems to follow, rather than anticipate, the economic cycle of the extraction and construction sectors. We cannot assess whether the introduction in 1993-1994 of a charge changed the long run extraction path given the unavailability of data before 1991.

The changes in the variables over the whole period considered are: 38% increase for extraction (44% in per capita terms), 30% for construction sector VA, 37% for provincial average VA and 36% (nominal) for the aggregates charge on sand and gravel.

[33] For Italy as a whole, and for most regions, a peak in extraction activity occurred in 1989. After the 1991-1992 recession, the crisis in the constructions sector during 1993-1996 led to a slump in extractions followed by a recovery to a 'normal' economic cycle in the late 1990s.

Figure 14. Lombardy: Sand & gravel, added value, aggregate tax



Source: Own calculations based on data provided by the two regions.

Table 8 shows that the correlation between extraction and drivers is close to one. This means that all trends, at least in the observed period, are extremely interdependent. Even the evolution of the aggregate charge seems 'to follow' the trend.

Tab. 8 Correlation matrix for Lombardy

	Sand & gravel	*Sand & gravel per capita*	*VA construction*	*VA province*	*Population*	*Aggregate charge*
Sand & gravel	1.000					
Sand & gravel per capita	0.964	1.000				
VA construction	0.901	0.840	1.000			
VA province	0.903	0.831	0.972	1.000		
Population	0.587	0.536	0.501	0.484	1.000	
Aggregate charge	0.851	0.747	0.848	0.834	0.224	1.000

Source: Own calculations based on data provided.

For the Province of Bologna, the longer time series does not lead to different conclusions (Figure 15). The trends for extraction, VA and GDP are correlated. The aggregates charge introduced in 1992 (relatively high in monetary value, compared to the charge currently being applied in Lombardy) with the specific aim of providing new incentives to increasing recycling, seems unrelated to any structural change in extraction trends. In addition, the authorised quantities increased in response to demand.

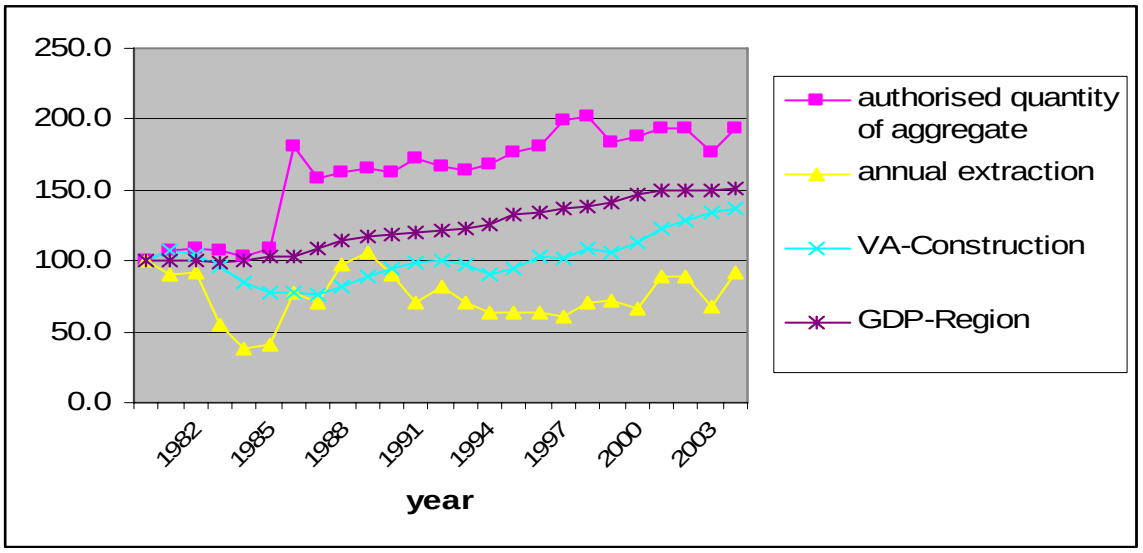
Figure 16 shows that the surface amount of authorised quarrying was stable over the period (since 1986), which is consistent with the focus on policy aimed at reducing (stabilising) the extent of the areas being excavated. The amounts of extraction may increase, but based on more intensive excavation at each site (i.e. higher productivity per site). According to policy makers, this was the main objective of planning policies in the aggregates area, and represented a sharp difference from former policy orientation. This confirms that the aim of policy is not to reduce the amounts extracted but to reduce the environmental impacts of excavation

In looking at the changes over time, we can see that in terms of authorised area, authorised quantities and annual extractions respectively, the changes (from 1980 to 2004) are 126%, 93%, and -7%, while VA and GDP respectively have increased by 38% and 50% (in real terms). If we compare 2004 and 1990, the figures are more similar to those for Lombardy. In the 15 years considered in our analysis, the economic drivers have increased more than the physical aggregates figures.

Overall, it seems that Emilia-Romagna could have experienced a stronger 'relative delinking' between GDP and extraction than Lombardy.

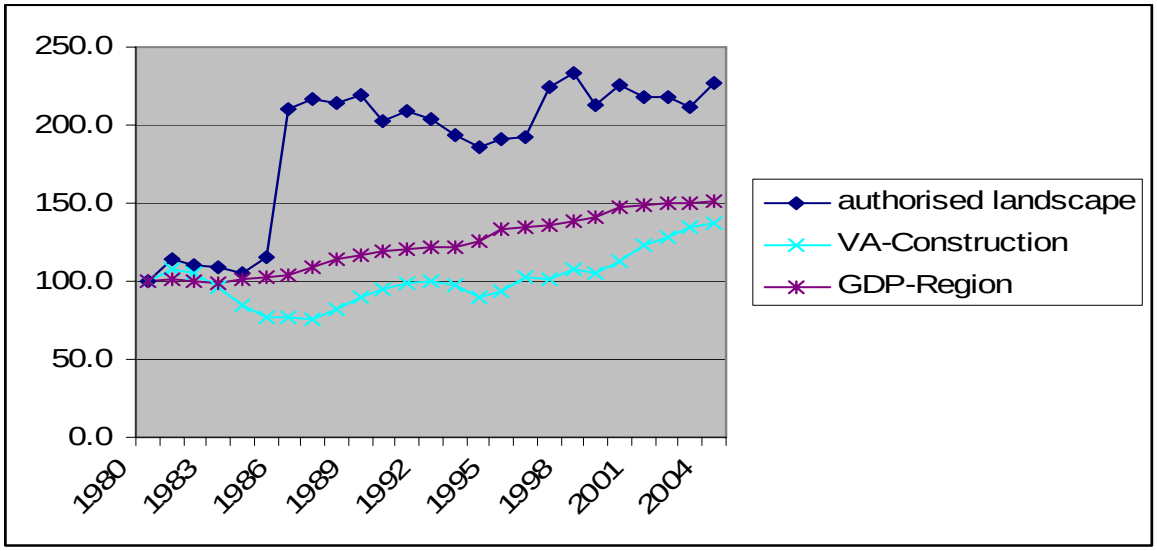
Finally the correlation matrix presented in Table 9 shows that, though significant (higher than 0,20) the correlations between the figures for extraction and VA are lower than for Lombardy. It would seem that while GDP as a driver is highly correlated with trends in aggregates related to planning authorisation, it is the VA from construction that most forcibly determines annual extraction levels. Population is also a driver of aggregate extractions. However, as expected, it is highly correlated to the VA for construction.

Fig. 15- Province of Bologna: Aggregate extraction and drivers



Source: Own calculations based on data provided.

Fig. 16- Province of Bologna: Authorised surface and drivers



Source: Own calculations based on data provided.

Tab. 9 – Correlation matrix. Province of Bologna (1980-2004)

	Authorised landscape	Authorised quantity	Annual extraction	VA-C	*GDP*
Authorised landscape	1.00				
Authorised quantity	0.96	1.00			
Annual extraction	0.22	0.12	1.00		
VA	0.27	0.39	0.28	1.00	
GDP	0.74	0.84	0.06	0.73	1.00
Population	0.23	0.29	0.18	0.83	0.60

Source: Own calculations based on data provided.

3.3.3 Panel data econometric analysis for Lombardy (provincial level)

We analysed the Lombardy panel dataset[34] by estimating logarithmic specifications in both absolute level and per capita terms. The usual Hausman test was conducted to select between the 'random effects model' (REM) and 'the fixed effects model' (FEM) (least square with dummy variables, or fixed effects, LSDV). The results are presented in Table 10.

The specification (in absolute values), which includes the VA for construction shows that the latter is significant in both models (but REM is preferable). FEM elasticity is 0.75 (significant at 5%), while the REM value is higher, 1.03: thus, unitary elasticity prevails a general evidence. If provincial VA is included, the elasticities for both models are instead higher, 1.47 and 1.29, with standard errors indicating that elasticity values are higher than 1.

Considering the additional possible drivers, the construction VA for neighbouring provinces emerges as significant (at the 1% level) in the FEM model, with an elasticity of 1.17. The REM model would present the reverse results (but the Hausman test is clear in rejecting it). The VA for provincial level is significant if we include this geographically related factor, with a 1.33 elasticity in the REM model. The dummy capturing adjacence to Milan shows the expected positive sign. Nevertheless, it does not impact on VA elasticity, and its significance is only at the 20% statistical level.

[34] We consider 10 Provinces: Milan, Como, Varese, Lodi, Mantova, Bergamo, Brescia, Pavia, Sondrio, Cremona over the periodo 1995-2003.

The inclusion of aggregate charges proves this is not a significant driver. The elasticity for the construction VA (REM) is 0.89, for provincial VA it is 1.32, both not very different from unity.

If we consider the model specifications that include per capita variables, we observe an elasticity of 0.63 for construction VA (standard errors 0.35, 1%) in the base specification, and a specification for provincial VA which is insignificant.

The effect of adjacent provinces' VA is positive and significant. This suggests that spatial proximity analysis could be a fruitful research development. The Milan dummy is not significant.

If we insert charge-related variables into the specifications, the VA terms are driven to insignificant coefficients, while the aggregate charge is positively significant at 10%. We can claim that the dynamic correlation between VA and the charge (around 0.29) is responsible of this outcome. All in all, the charge proves not to impact negatively on extraction, contrary to what the theory and policy might predict, and its positive correlation with VA creates problems for statistical analysis.

Although limited in terms of the number of available observation, our panel dataset shows some interesting results which are worthy of further exploration. Confirming the descriptive analysis, econometric outcomes show the relevant role of VA drivers, with estimated elasticity not very different from 1, or even higher. It nevertheless should be noted that, as expected, the construction VA for neighbour provinces could represent an important driver. At the same time, but also as expected, the role of aggregate taxes as implemented confirms to be not significant in influencing the main dynamics of the system.[35]

Tab. 10- Regression for panel data analysis on Lombardia

Drivers/dependent variable (sand and gravel extraction)	Extraction	Extraction	Extraction	Extraction	Extraction (per capita)	Extraction (per capita)	Extraction (per capita)	Extraction (per capita)
VA-construction	1.03*** [0.24]		Not significant		0.64*** [0.36]		Not significant	
VA-province		1.29*** [0.23]		1.33*** [0.27]		Not significant		Not significant
VA-construction contiguous-provinces			1.17*** [0.51]	Not significant			1.26** [0.49]	0.94*** [0.35]
Tax	Not significant				Correlated with VA			
Dummy-Milan-contiguity	Positive coefficient, 20% significance				Positive coefficient, 20% significance (only with VA construction)			
Model	REM	REM	FEM	REM	REM	REM	FEM	REM
F test prob	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Cells show coefficients (elasticities): significant at 10, 5, and 1% (*, **, ***). Square brackets denote standard errors.

3.3.4 Time series analysis for Emilia-Romagna (Bologna Province)

From the data investigation and interviews it emerged that there was sufficient data reliability from 1984-1985, and good data reliability from 1990-1991, i.e. a period shorter than the available data series. In fact, the introduction of taxes and charges created side effect incentives for better surveying and data collection.

If we limit our econometric analysis to 1985-2004, and use a linear specification, insignificant outcomes emerge[36]. By observing the N shape of the relationship between extraction and GDP, non-linear specifications can be seen to provide a better fit with the data (see fit values in Figure 18). Some cubic specifications (not shown here) prove that all three elements are significant at the 1% level, with adjusted R2 between 0.40 and 0.50 across models[37]. As a final exercise, we attempted a time series analysis on the 1990-2004 series. Although this does not allow full econometric analysis of the structural break that eventually occurred as a consequence of the introduction of the charge, we can compare the results of this analysis with the empirical assessments for Lombardy.

35 The possibly prominent role of construction activity for aggregate extraction in Lombardy during the last 20 years also emerges from the data and evidence presented in IReR (2005).

36 It should be noted that a time series analysis over 20 years is considered as complementing the descriptive analysis.

37 Regarding GDP, the three elements are significant with signs that recall the N shape. For VA, the linear and squared terms are associated with a positive sign, while the cubic term has a negative sign, which may indicate a tendency towards 'delinking'. All terms are statistically significant.

GDP is insignificant as a driver in the linear specification, though if we add the squared term the R-squared increases to 0.55 and both linear and squared elements become significant at 1%, with negative and positive coefficients.

It emerges that VA is significant at 10%, with a coefficient of 0.49, which is associated to evidence of 'relative delinking'. This is consistent with the results of the descriptive analysis[38]. Non linear specifications are insignificant. We note that R-squared values are case quite low, probably signalling the need for additional explanatory variables.

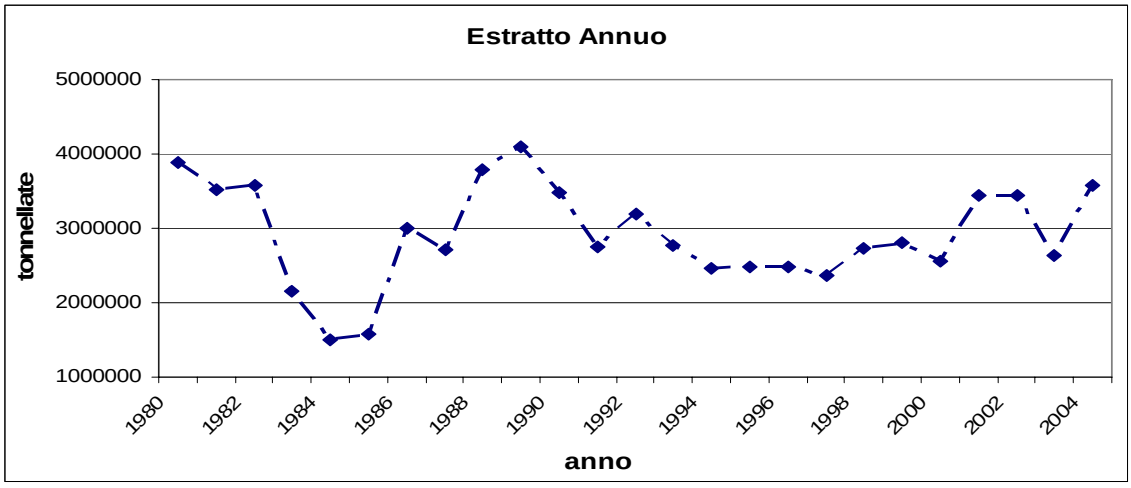
To sum up, an N shaped trend fits with the data for 1985-2004, at least in terms of GDP. There is, then, no delinking associated with the introduction of the charge in 1991 or with other exogenous structural factors. Focusing on the more recent period, 1990-2004, a 'relative delinking' emerges with respect to VA for construction. Nevertheless, although the overall evidence is confirmed as favouring a delinking, both for VA and GDP, there is a positive and significant correlation in the post-aggregates charge period.

Tab. 11- Regressions for time series analysis of Emilia-Romagna (Bologna)

	Extraction	Extraction
VA-construction	0.49* [0.26]	/
GDP-region	/	0.22
R-squared	0.21	0.15
F test prob	0.000	0.000

Cells show coefficients (elasticities): significances at 10, 5, 1% (*, **, ***). Square brackets indicate standard errors.

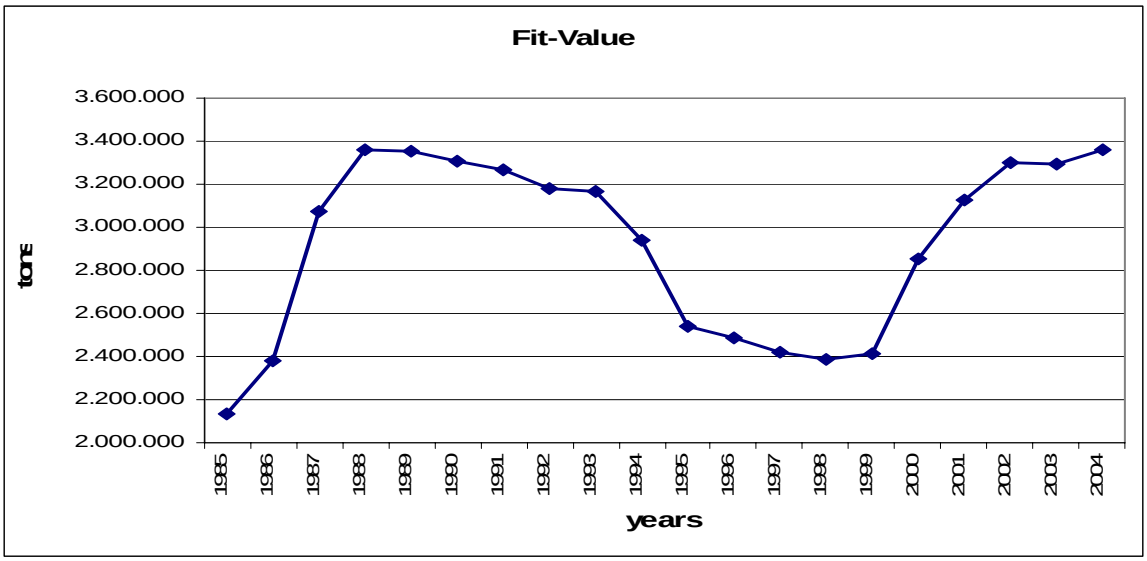
Fig. 17 – Province of Bologna: extraction vs VA and GDP (1980-2004)



Source: Own calculations based on data provided.

[38] The VA for construction is significant at ***, when correcting for first order autocorrelation using the Prais-Weinstein and Cochrane Orchutt procedures. These estimators may lead to efficiency losses in small sample data. However, the Durbin Watson statistic of 1.63 supports the fact that the null hypothesis of zero first order serial correlation (upper bound with T=15 and K=2, 1.252), should not be rejected.

Fig. 18- Province of Bologna: Fit values extraction- GDP (1985-2004)



Source: Own calculations based on data provided.

4. Main findings

We here list the main findings of the research.

1. In 2004, the Italian aggregates industry was composed of around 1.796 companies operating at 2.460 sites. The average size of these companies is smaller than the European average. Total estimated production is 358 million/tons, 12,5% of the European total (UEPG countries). Most of the production is sand and gravel (220 million tons) followed by crushed rock (135 million tons). The amount of recycled aggregates produced is very low, from 3,0 million tons (UEPG data) to 3,7-4,2 million/tons (ANPAR estimates), which is only about 2% of the total for the UEPG countries and around 10% of the C&D (Construction & Demolition) waste produced in Italy.
2. The activities of the construction industry are the main driver of demand. Since the late 1990s, Italy has experienced a significant expansion in construction investments. The domestic supply of aggregates has expanded correspondingly and average prices have increased during the last few years. Also net imports of aggregates, particularly gravel and crushed rock, have been increasing since the late-1990s; however, the total (3,9 million/tons) is still only 1,1% of domestic extraction.
3. The economic instrument that has been in use in Italy for several years (since the early 1990s) is a charge per cubic metre of aggregates extracted. There is no common national rate[39] and every region is free to apply its own rate in the framework of its competencies and the complex planning and authorization framework that prevails.
4. Extraction charges are not primarily aimed at reducing the quantity extracted or at promoting recycling of extraction/mining and C&D waste. Rather, their purpose is to contribute to compensate for the external costs associated with quarrying activities through financing land conservation investments

[39] The Italian National Law on extractive and mining activities (Royal Decree 1443/1927) classifies aggregates and other materials required for construction in a category of secondary relevance, where the ownership of subsoil materials belongs to the owner of surface land, and to extract it is sufficient to have "authorisation" and not the "concession" that is necessary for extraction of other minerals such as oil, natural gas, gold, etc.. The latter are in the 1st relevance category, and which belong to the State. According to this vision, aggregate tax revenues go towards public studies, research, territorial and sector based planning, controls, monitoring works, but not explicitly to compensate for environmental costs and exploitation of materials and resources, as is the case for 1st category materials

implemented by municipalities and other institutions that share the revenues (which mostly accrues to municipalities).

5. Our information and that gleaned from interviews lead us to conclude that the effects of extraction charges on aggregate market development in Italy are very limited. The level of charges is generally too low (around 0,41-0,57 €/m3) to have any effect on demand (through aggregate prices) or supply of aggregates. Moreover, the stability in these nominal charges over time has contributed to their limited effect on quarrying costs. Although there are regional variations, the value of these charges at national level can be estimated at €110 million, which is around 5% of the estimated turnover of the aggregate industry.
6. Extraction and supply of aggregates is mainly controlled by (regional/provincial) planning of quarrying and extraction quantities. Planned extraction tends to be in line with forecast demand, and supply ceilings are set accordingly. The present environmental objectives of planning are generally aimed at minimizing external impacts, supporting sustainable management of landscapes, and providing multi-value public goods within the local area. Planning is the first main level of regulatory processes. Environment oriented planning and evaluation was in place before the aggregate taxes were introduced. Planning includes social evaluations of projected quarry locations and sizes, which often have to be used in the case of protests, especially in response to 'NIMBY' (not in my backyard) type of objections.
7. The use of recycled aggregates is low level due to the still poor working of the recycling loop for C&D waste in Italy and the preference of the construction industry for virgin materials. In addition, the low level of extraction charges does not encourage recycling. Reformed Landfill taxes and policies related to C&D and quarrying waste could be significant in promoting recycling.
8. The econometric analysis of two large Italian regions (Lombardy and Emilia-Romagna) confirms these results, and particularly the dominant role of demand drivers and the limited role of taxes/charges on extraction decisions. Although the 'decoupling' of extraction and GDP is happening to a certain extent and on a relative basis, this is not due to extraction charges.
9. The possibility of evaluating local administrations' actual exploitation of charges in compensatory investments is limited. There is no country-wide information on the use made by Italian municipalities of such revenue. However, the available data suggest that these monies are not invested in land resource conservation as much as might be expected. If the external (social and environmental) costs associated with quarrying exist, extraction charge policies can be said to be ineffective; however, more extensive information will be needed to support this conclusion.
10. Nevertheless, indirect effects should be taken into consideration when evaluating the overall effects of the introduction of aggregate taxes. The most important effect of charges on extraction activities is linked to monitoring, because following their introduction, new issues have emerged[40]:
11. Monitoring and control which previously was based on qualitative methods, now must be quantitative. The need for the Public Administration to know exactly how much is extracted per year in order to calculate the tax, make it necessary to have a very organized monitoring of activities at quarry level (whereas previously checking was rather arbitrary or non-existent). This has necessitated major changes in extraction activities management requiring:
12. better knowledge and understanding of the activity, mainly in relation to construction of datasets, which have increased in quality and quantity since the mid nineties, to accurately record and elaborate the quarry data;
13. the extractive firm to assume legal responsibility for declaring actual annual quantities extracted, primarily in order to monitor the extent to which excavation operations are coherent with the planning authorisations in terms of quantity, depth, distances form other sites, etc.. As a consequence, this creates the possibility for taxes to be properly calculated on exact figures. The presence of taxes have increased the effectiveness and quality of such monitoring activities;
14. the administrative authorities to take legal responsibility for checking the accuracy of firms' declarations. The Public Administrations sees the aggregate tax as a way of collecting tax revenues at the local level, which is another reason for this increased attention on this sector.

[40] The following considerations mainly apply to Emilia Romagna, though many apply to the current evolution of the Northern Italian aggregate sector.

15. illegal and badly managed excavations, before the introduction of the aggregate tax, were classed "only" in terms of environmental damage; now they represent a loss of public revenue;
16. firms whose market behaviour is good have begun to collaborate with the Public Administration to identify illegal excavations, since the latter's avoidance of tax produces unfair competition in the market.
17. there has been a small reduction in the amounts of aggregate extracted, but in other respects there have been real improvements in the sector, both on the side of the public authorities and the market including a reduction in the number of operating quarries, major improvements in the use of materials, higher aggregate prices and better use being made of it (gravel can no longer be used for road embankments; its primary use is in cement and bitumen conglomerates, etc.).
18. As a consequence of the legal rules being enforced and the public authorities operating more efficiently, aggregate taxes, combined with good planning procedures, good project evaluation and serious monitoring, there has been a positive evolution in the field of aggregate extraction. There are also indirect effects stemming from the tax that influence the direct effects on demand and supply through market prices. Overall, the combination of direct and indirect effects linked to planning, monitoring and agent behaviour described above have generated multiple improvements in the way the system works in terms of efficiency, environmental performance, and quality of operators.

5. Evaluating the results and main conclusions

The application of extraction charges to aggregates in Italy is not primarily aimed at reducing the quantity extracted nor at promoting the recycling of extractive/mining and C&D waste. It is instead aimed at contributing to reducing the external costs of quarrying activities by financing local land conservation investments by municipalities and other institutions that receive a share of the charge revenues, the bulk of which goes to the municipalities.

Therefore, the effect of the charge on quantities extracted, or conservation of the resource in the ground, can*not be used as a direct dimension for evaluating this policy*. However, extraction charges could affect the aggregates market, and this effect could be an important dimension of policy evaluation, which, however, is about *an 'unintended effect' on reducing extraction and developing recycling*. Instead, given the objective of the charge, *the most direct and appropriate dimension for evaluation of extraction charges in Italy is the actual use of the revenue by local administrations*. In particular, the key 'effectiveness question' refers to the actual use of the revenue for compensation of landscape alterations, destruction of amenities, and other local impacts of quarrying activity.

In terms of the role of charges in the aggregate market, our information and the interviews lead us to conclude that the effects are very limited. Despite the variety of situations caused by the very decentralised management of the charge across provinces/municipalities, the level of charges is generally too low to be expected to have an effect on demand (through aggregate prices) and supply of aggregates. Also the stability of nominal charges over time contributes to their limited efficacy in the production costs of the aggregates quarrying industry.

Markets mechanisms, and in particular construction investments, are actually the main drivers of demand for extraction/production. On the supply side, production is mainly controlled by provincial level planning of quarrying and extraction. Quantity extraction planning tends to be in line with forecast demand, and defines supply ceilings accordingly. In addition, the true objectives of current planning are generally sustainable management of landscapes and multi value public goods. The planning processes, however, are also largely conditioned by local (regional, provincial, and municipal) administrative processes and political cycles, which are often rather unclear. Furthermore, three are many other land use legislations that have an influence on quarrying openings and exploitation.

The result is that the elasticity of aggregate supply to demand can be limited at the local level, in particular in times of favourable business cycles for constructions. This general rigidity, however, is compensated for by flexibility in procurements inside the economically feasible area (about 30-50 km), by flexibility in the timing of extractions within the total capacity of single quarries (extraction anticipations and delays within allowed limits), by some limited import flow from nearby countries, and by price increases (even if elasticity of demand to prices is low which means that the quantities demanded are hardly affected).

The still poor working of the recycling loop for C&D waste in Italy despite recent favourable developments, and the preference for virgin materials by the construction industry, combine to make aggregates recycling marginal

and not a true alternative to virgin aggregates. Also, the relatively low extraction charges, do not work in favour of recycling. Specially designed policies and taxes on landfill would do more to promote recycling.

The econometric analysis on two large Italian regions largely confirms these results. The panel dataset analysis for Lombardy highlights that the correlation (elasticities) between aggregate extraction and economic drivers is substantial. Elasticities are estimated as close to unity. The role of construction value added deriving from neighbouring provinces emerges as an element that demands further investigation. Although the available data are not long enough to carry out a sound structural-break analysis, the tax/charge elements in aggregates seem to be ineffective in terms of impacting on the dependent variable (extraction of aggregates).

The evidence for Emilia-Romagna (Bologna) differs slightly, but points to the same conclusion. A 'relative delinking' between GDP and extraction seems to have emerged during the past 15 years, though results support a robust and direct correlation between economic drivers (GDP and construction value added) and extraction. It can be claimed that, even in this case, the aggregates charge imposed in 1991 has not influenced extraction trends.

In terms of the second dimension of the evaluation, i.e. the actual use of charge revenues for intended land restoration activities by local administrations, a thorough assessment is not possible. There are no country-wide data on how municipalities use this revenue. A direct analysis would imply an investigation of hundreds of specific local examples. However, the available information suggests that, in many local situations, specific allocation of revenue is not in line with the compensatory charges made for land resources improvement. Social and environmental costs associated with aggregates quarries will continue, and industry itself would favour a more transparent and targeted use of the charge revenue. From this point of view, the extraction charge policy can be considered to be ineffective, but a more extended information base is needed to support this conclusion.

The above discussion should not lead to the absolute conclusion that charges on aggregates are ineffective in regions in Italy because they are not directly targeted to efficiency and improvements in aggregate extraction and use. A key result of this study is that that the combined effect of many factors such as landscaping and sectoral planning, project evaluation, good quantitative monitoring, careful public administration checks on procedures with a stronger effort carried out "on site", and the charges levied, has improved the performance of the entire system[41]. To sum up, the tax has indirectly and positively affected the policy and market environment through institutional improvements. A key factor is the monitoring and quantification of flows that followed the introduction of the tax before which there was only qualitative evaluation of quarries. Thus, we would argue that a 'medium level tax', not 'too low' and not 'too high' (compared to other EU experiences), may contribute to better environmental performance through indirect effects and complementarity with other policy/economic factors, such as planning and ex post compensation schemes[42]. The tax should be of course complemented by a less uncertain institutional framework, that is higher certainty regarding regulations and authorization procedures. In addition, shorter evaluation (of the permit/authorization) periods and longer licence/authorization periods may increase the agent's incentives towards higher investments, stricter liability, even on the environmental side[43]. More specifically, we would suggest that the dynamic interplay between taxes and planning can be described as follows. If taxes reduce extraction levels through direct and indirect effects at time T, then future

[41] All these new factors have increased the cost per cubic metre of aggregates in direct and indirect ways and are contributing to driving the market to a more sustainable use of natural primary materials through preservation and re-use, with the objective of increasing both the value and the efficiency of quarry exploitation.

[42] Our conclusions are generally consistent with the following statements: "the lack of recognition that high quality restoration is a positive element of a sustainable policy and as such should be distinguished from, day to day issues such as control over noise, dust and vibration plays down a genuinely credible sustainable aspect of the latest policy advice", and " local plan policies on aggregates need to be written specifically with sustainability issues in mind. Thus the central issue should be the balance between environmental quality before working commences and after restoration is complete. Issues of demand management and the localization of supply may be relevant to the realization of policies. Control over working to protect local populations form nuisance will remain a central theme in mineral plans bit it is not directly related to sustainability. Finally resource depletion issues and the questions related to the economics of recycling of aggregates are best left to the market" (Kellett, 1995, pp. 576-577).

[43] Italian industry claim that Italian excavation permit periods are generally too short: it may happen that some years are need to obtain a 18/24 months licence of excavation. In any case, licence rarely are longer than 5 years, compared, in their view, to 40 years licensing or even more, in other countries (Spain, France, UK). We may point out that, although it is quite clear that too a short time may hamper investments and liability, economic theory and evidence does not generally support "infinite" contract as more efficient and effective, the pros of certainty may be balanced by cons, like reduced incentives in (environmental) innovations, including recycling, deriving from the lack of pressure from new entrants (potentially higher innovative and performing) operating in the area for excavation.

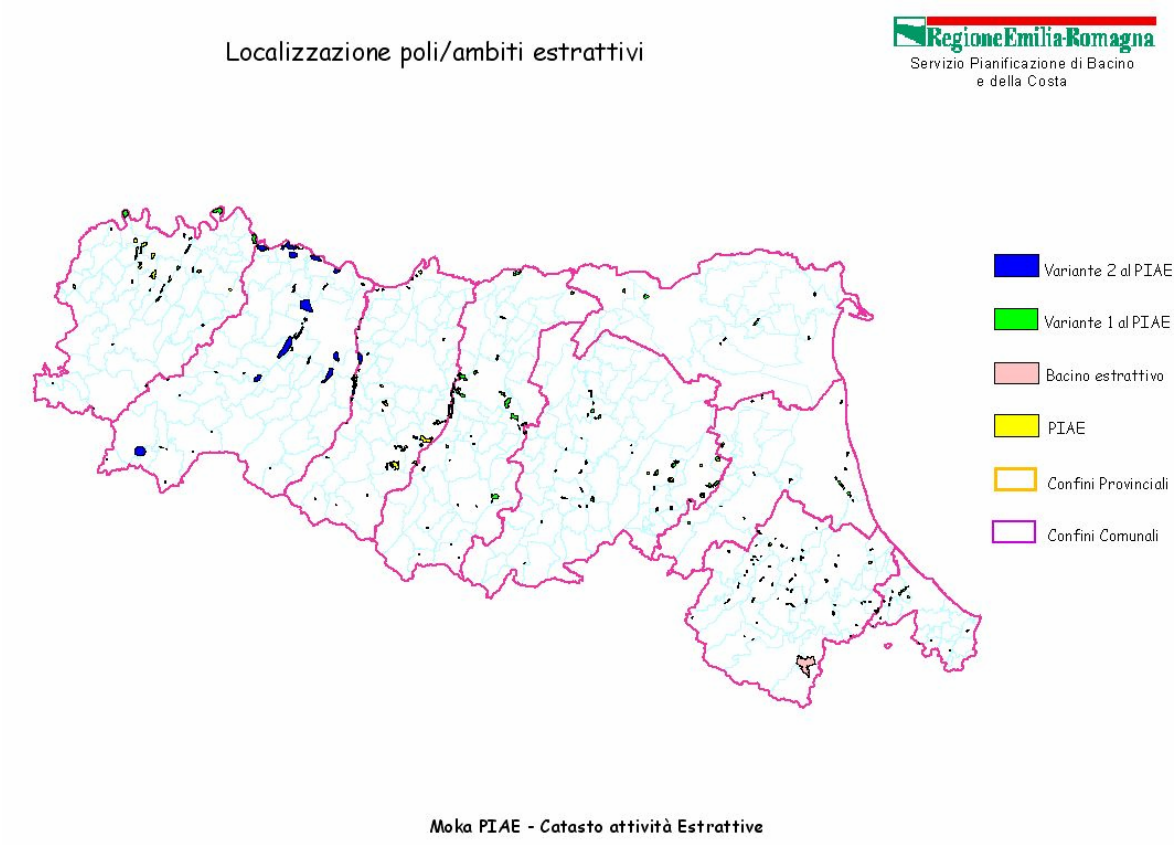
planning rounds at times T+1,2.. may take this into account and reduce authorized extracted material per value added (more efficiency overall should be the aim of future planning). Thus, a dynamic interplay between tax and planning could emerge, with a tax effect operating both in the short run and perhaps becoming even more relevant in the long run. Planning must always play a key role. Taxes are important, but their effects need to be integrated within a complementarity framework, with other instruments[44].

Table 19. Preliminary assessment of the causality hypothesis on the instruments

Instrument	*Intended effects*	*Evidence*	*Unintended effects*	*Evidence*
Charge ⇒	Revenue for investments compensating for 'external costs'	Limited, mixed about earmarking of revenues and quality of investments	Dispersion of financial resources out of the land resource sectors	Limited
Charge ⇒			- ΔExtraction	Strong: No effects
Charge ⇒			+ Δ Recycling	Strong: No effects
Charge ⇒			+ Δ Substitutes	Strong: No effects
Charge ⇒			+ Δ Import	Strong: Limited effects
Planning ⇒	Limitation of extracted quantities	Strong: Significant effects	Arbitrariness of local-level decisions	Limited
Planning ⇒	Limitation of quarrying areas	Strong: Significant effects	Arbitrariness of local-level decisions	Limited
Planning ⇒	Minimum impact on land resources	Limited, depending on local administrations (see charge)		
Planning ⇒	Remediation/restoration after closure	Limited, mixed about quality of remediation works		

[44] Table 19 provides a preliminary summary of the causality relationships between charge, planning and intended/unintended effects of aggregates quarrying policy.

Figure 19. Map of quarries in Emilia Romagna following the Regional planning



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