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Silvia Anna Maria Camussi

Bank of Italy: Banca d'Italia

Davide Dottori

`davide.dottori@bancaditalia.it`

Banca d'Italia <https://orcid.org/0000-0002-5376-4632>

Marco Mancinelli

Bank of Italy: Banca d'Italia

Anna Laura Mancini

Bank of Italy: Banca d'Italia

Francesca Modena

Bank of Italy: Banca d'Italia

Pasquale Recchia

Bank of Italy: Banca d'Italia

Emanuele Russo

Bank of Italy: Banca d'Italia

Giulia Martina Tanzi

Bank of Italy: Banca d'Italia

Research Article

Keywords: Employment, National Recovery and Resilience Plan, Labor Mobility, Regional Economies, Construction Sector, Demand Shock, Input-Output

Posted Date: November 7th, 2023

DOI: <https://doi.org/10.21203/rs.3.rs-3519605/v1>

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Version of Record: A version of this preprint was published at Journal of Industrial and Business Economics on April 1st, 2024. See the published version at <https://doi.org/10.1007/s40812-024-00301-8>.

The employment activated by the National Recovery and Resilience Plan in the construction sector at the regional level

Silvia Anna Maria Camussi*, Davide Dottori**,*, Marco Mancinelli**, Anna Laura Mancini*,
Francesca Modena***, Pasquale Recchia[◇], Emanuele Russo^{◇◇} e Giulia Martina Tanzi^{◇◇◇}

Abstract

This work estimates the regional employment generated by the National Recovery and Resilience Plan (NRRP) in the construction sector, based on the resources already assigned to new projects. These resources are associated with the creation of regional value added, estimated using a standard Leontief model applied to 2019 Input-Output tables. Then, the number of employees needed to reach the expected increase in production is derived. In the second part of the analysis, possible channels to satisfy the estimated labor demand are discussed, taking into account the regional heterogeneity in labor supply and workers' mobility.

JEL Classification: D57, J2, H50

Keywords: Employment, National Recovery and Resilience Plan, Labor Mobility, Regional Economies, Construction Sector, Demand Shock, Input-Output

* Bank of Italy, Torino branch, ** Bank of Italy, Ancona branch, *** Bank of Italy, Trento branch, [◇] Bank of Italy, Bari branch, ^{◇◇} Bank of Italy, Genova branch, ^{◇◇◇} Bank of Italy, Milano branch; * Corresponding author.

The views expressed in this paper are those of the authors and do not necessarily represent those of the Bank of Italy. We would like to thank Gaetano Basso and Andrea Petrella for sharing material and for suggestions at various stages of the work. We also thank Fabrizio Balassone, Fabrizio Colonna, Luigi Guiso, Andrea Lamorgese, Paola Rossi, Roberto Torrini for helpful comments and the participants at the 44th AISRe annual conference. All remaining errors are ours.

1. Introduction

Following the exceptional negative shock due to the pandemic crisis, the European Union introduced an unprecedented response in terms of resources: the Next Generation EU program, NGEU (European Commission 2021). The European Commission describes NGEU as “once in a lifetime chance to emerge stronger from the pandemic, transform our economies, create opportunities and jobs for the Europe where we want to live”; coupled with the EU’s long-term budget, it forms “the largest stimulus package ever financed in Europe”.¹ The program is aimed to accelerate green and digital transition and boost potential growth (Bańkowski et al., 2022). The centerpiece of NGEU is the Recovery and Resilience Facility (RRF), an instrument for supporting reforms and investments in the EU Member States through the provision of grants and loans. To apply for the resources, member states prepared national recovery and resilience plans, consisting in a package of reforms and investments to be carried out between 2021 and 2026 (Bank of Italy, 2021).

Italy’s National Recovery and Resilience Plan (henceforth NRRP) is the largest national plan in absolute figures (European Parliament, 2022). In addition to improving productivity and growth potential in the long run, the Plan is expected to be a remarkable demand shock to the national economy during its implementation, for the good and service markets but also for the labor market (Basso et al. 2023, D’Andrea et al. 2023, Di Bartolomeo and D’Imperio, 2022, CNEL 2022). However, less is known about the NRRP consequences at the local level, also due to difficulties in attributing in a reliable way resources to places and in estimating where the value added and the labor demand triggered by these resource are going to be actually created.²

Against this background, this paper provides a contribution by estimating at the regional level the NRRP impulse to the value added and labor demand in the construction sector. This sector, which includes both building construction and specialized engineering, is the main recipient of the Plan’s funds and it would record the highest change in employment in absolute terms at the national level (Basso et al., 2023). Moreover, much more than in other sectors, the activity in construction sector is likely to take place locally, thus enhancing the possibility to derive estimates at the local level with a higher accuracy and reliability.

The data are based on a careful examination of the resources that were effectively allocated, as of end of January 2023. This analysis relies on the scrutiny of NRRP’s implementation

¹ From the European Commission website: https://commission.europa.eu/strategy-and-policy/recovery-plan-europe_en (last consultation: October 24, 2023).

² For the case of Tuscany, see IRPET (2023). For an overview of the NRPP from the perspective of territorial gaps, see Corò et al. (2022).

decrees, thus providing us with a unique dataset grounded on the actual and relatively updated status of resource assignment to the construction sector. We focus on resources devoted to new projects (thus disregarding those intended to finance interventions already in place) and that can be regionalized, i.e.: for which it is possible to derive a territorial distribution with a sufficiently high degree of reliability.

In the next step of analysis, under the assumption that the Plan is implemented on schedule, given the resources allocated to the construction sector, we compute the associated value added generated in each region, estimated by applying a Leontief model to the 2019 Input-Output tables. We then quantify the number of employees needed to satisfy the correlated increase in output demand. We also go deeper into detail by deriving how the new labor demand is likely distributed across occupation types and sub-sectors.

In the second part of the paper, the estimated labor demand is related to the supply side of the labor market, by discussing the channels through which the increased demand can be met at regional level, taking into account local heterogeneity in terms of labor force's characteristics and mobility. This analysis leverages data from several sources, such as the Istat Labor force survey and administrative data provided by the National Social Security Institute (INPS) and the Ministry of Labor and Social Policies.

The results show that the boost to labor demand generated by the NRRP will be significant and heterogeneous in intensity over the Italian regions. On the basis of € 43.5 billion resources already allocated to the sector for the implementation of new projects the induced employment is estimated at approximately 62,000 persons on an annual basis in the average of the period 2023-26, that corresponds to 6.5% of the employees and 4.0% of the total construction employment in 2019, the baseline year of our exercise.³ The regions for which these incidences are the highest are located in the Southern Italy (Sicilia, Calabria, Basilicata and Campania). By taking into account the allocation of resources among the sub-sectors and the occupational distribution in each of them, one can expect stronger demand for blue-collar workers, particularly for the specialized ones; in the regions where civil engineering work is more important (such as Liguria, Abruzzo and Marche) technical and highly specialized occupations would instead be relatively more requested.

As regards the labor supply side, the regions where the NRRP is expected to create a greater boost to labor demand (Sicilia, Calabria, Basilicata and Campania) also show a large pool of unemployed workers that previously worked in the construction sector. However, in some regions for which a significant employment impact is estimated (such as Abruzzo and Marche),

³ This estimate is lower than the one provided in Basso et al. (2023), Table 1, of about 95,600 persons (see also Bank of Italy, 2022a). The difference is mainly due to the use, in this exercise, of already allocated resources (about 60 per cent of those assigned).

the number of unemployed with previous experience in the sector is lower than the number of workers required by the NRRP. A softening of the push provided by the tax incentives for the redevelopment of residential buildings could facilitate the recruitment of the workforce needed for the NRRP projects, as it would allow to employ some of the workers already hired for these interventions.⁴

The recruitment of workers from other regions or from abroad, which is more widespread in construction than in manufacturing, could help to cope with demand's peaks. Moreover, in the construction sector, within-firm mobility of workers across regions occurs more frequently than in other industries.

The match between demand and potential supply could be more difficult where the latter has been unemployed for longer or lacks the required skills. In addition to the recourse to territorial mobility, training interventions aimed at acquiring the most demanded or the most rapidly assimilated operational skills could be useful.

The work is structured as follows. In section 2, the criteria according to which the resources of the NRRP were allocated to the construction sector and regions are described and the resulting evidence is reported. In the third section, the value added generated by these in each region is estimated, while the fourth section provides a quantification of the corresponding change in employment required to meet this expansion in business activity. Finally, in the fifth section, some considerations are made regarding the labor supply potentially available to meet the new demand of workers, analyzing the characteristics of unemployed individuals and the mobility of workers between sectors and regions.

2. The regional distribution of NRRP resources for the construction sector

The analysis is conducted under the assumption that the implementation of the NRRP interventions will be carried out on schedule and it considers only the resources already allocated, for which the distribution can be estimated with accuracy. In the exercise we both consider the resources allocated by NRRP and by the Complementary National Plan (CNP⁵). The two Plans are analyzed jointly because the NRRP expressly recalls its integration with the CNP, through common implementation tools and a unified monitoring system. The funds allocated to already ongoing projects are excluded, as the purpose of the analysis is to quantify the additional activity generated by the Plan. Using the classification defined by the *Ragioneria*

⁴ According to ISTAT national accounts data, in 2022 the total employment in the construction was 15.3% higher than in 2019 (+235,000 employees).

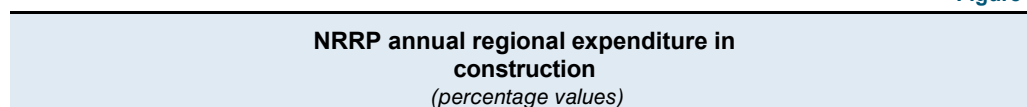
⁵ For brevity, unless otherwise specified, in the following the term NRRP will refer to both the whole of the NRRP in the strict sense and the CNP. For more details on the lines of action and the state of implementation of the Plan and for further details, see Corte dei Conti (2023).

Generale dello Stato (RGS) - to which we applied some modifications to resolve few ambiguities⁶ – we identify the beneficiary sectors⁷ of each measure of the NRRP and of the CNP.

The allocation of the resources between regions was carried out by analyzing the implementation decrees, available at January 2023. At the regional level, there is no time schedule for the use of the resources.⁸ Therefore, in order to allocate the interventions over the period of operation of the Plans, we apply to the regional resources the same time frame of the expenditure at a national level.⁹

Overall, at the end January 2023, €126.5 billion have been allocated (about €110 billion of the NRRP, compared to the initial allocation of €191.5 billion, and about €16.5 billion of the CNP, out of the initial 30.6). Out of these €126.5 billion, about €77 billion are estimated to involve the construction sector.¹⁰ The resources devoted to new projects in the sector amount to €44.4 billion¹¹, €0.9 billion of these refer to interventions that cannot be territorialized because they are managed by central authorities and for which it was not possible to unambiguously identify the resources pertaining to each region. Considering the remaining €43.5 billion, we observe that almost half of this amount is concentrated in five major regions: Campania, Sicilia, Lombardia, Lazio and Puglia (Figure 1, panel a).

Figure 1



⁶ This classification follows the same approach used at national level in Basso et al. (2023). To clarify the type of reclassifications made, we provide two examples. For the “Scuola 4.0” measure, the RGS’ classification allocated all the resources to the computer and electronic and optical products manufacturing sector; in our classification, instead, the funds are equally divided equally with the construction sector, which is also largely involved in the implementation of the planned measures. Also for the “Piano Italia a 1Gbs measure”, the RGS’ classification attributed the resources exclusively to the computer and electronic and optical products manufacturing sector; in our classification, the resources are divided equally with the construction sector.

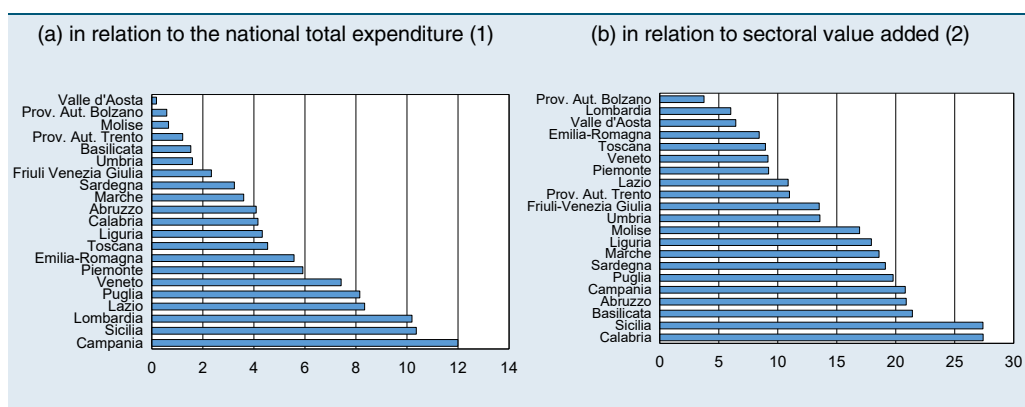
⁷ The sectors of activity are identified according to the two-digit Ateco 2007 classification.

⁸ For homogeneity, we give to the CNP the same time frame as for NRRP interventions. However, the CNP does not have a formal deadline in 2026 and its interventions may therefore continue even after that date. The assumption of an equal temporal distribution of resources may therefore lead to an overestimation of the resources deployed over the NRRP’s period of operation, with a consequent overestimation of the employment impacts, as well.

⁹ This approach assumes a homogeneous implementation capacity of interventions across the country. First evidence on disbursements shows that there could be significant differences in the time profiles of expenditure between macro areas. In the regions of Southern Italy, there could be a time distribution of expenditure more concentrated at the end of the period than the average national profile, with possible congestion effects of the interventions in that period and consequent implementation difficulties.

¹⁰ This number is lower than that estimated by the National Association of Building Constructors (ANCE) in January 2022 (approximately 87 billions), but considering the progress of the resource allocation process, it appears reasonably in line with it. The regional distribution of these resources is also similar to that predicted by ANCE.

¹¹ Since the purpose of this exercise is to quantify the additional activity generated by the Plans, funds allocated to projects already in existence have been excluded.



Source: elaborations based on official allocation documents and Istat, Regional Accounts.
 (1) Average annual resources allocated to each region over the total annual resources allocated to the construction industry. - (2) Average annual resources allocated to each region over the sectoral value added registered in 2019.

Compared with the regional value added of the construction sector, the new resources allocated by the NRRP are larger in the regions of southern Italy (Figure 1, panel b). The projects involving the largest shares of resources are related to the development of the railway network (in Abruzzo, Basilicata, Calabria, Campania, Marche, Umbria and Sicilia), the development of the port system (Friuli Venezia Giulia and Liguria), the energetic efficiency of the public and private buildings (Basilicata, Calabria, Trentino and Sardegna), urban regeneration (Calabria and Sicilia) and interventions for areas hit by earthquakes (Abruzzo and Marche). In terms of timing, less than half of the expenditure will be concentrated in the two-year period 2025-26 (Table 1).

Table 1

Time profile of the resources allocated in construction (millions)							
	2021	2022	2023	2024	2025	2026	Total
Abruzzo	27.0	203.2	261.6	426.0	462.5	397.6	1,778.0
Basilicata	7.4	72.5	105.0	160.9	179.2	139.8	664.7
Calabria	29.4	234.8	339.6	396.9	455.4	352.3	1,808.5
Campania	75.3	602.9	769.8	1,130.2	1,357.7	1,277.6	5,213.5
Emilia-Romagna	33.7	329.7	444.0	534.6	600.1	480.9	2,422.9
Friuli Venezia Giulia	25.0	173.7	190.0	202.8	239.4	184.2	1,015.2
Lazio	51.0	430.5	664.2	824.0	919.7	735.8	3,625.0
Liguria	31.6	293.9	404.9	413.4	387.9	350.1	1,881.8
Lombardia	58.3	655.0	891.1	1,000.5	1,030.0	796.8	4,431.7
Marche	23.2	177.5	251.5	376.4	396.2	340.8	1,565.5
Molise	4.2	37.6	55.6	64.0	71.1	51.8	284.3
Piemonte	23.9	329.7	526.2	597.3	601.0	494.9	2,573.0
Prov. Aut. Bolzano	4.7	42.6	49.4	55.5	62.3	40.6	255.0
Prov. Aut. Trento	4.9	88.9	133.3	125.7	99.2	74.4	526.4
Puglia	39.6	354.2	557.5	792.8	932.5	866.1	3,542.7
Sardegna	21.7	183.7	250.0	304.6	356.2	291.0	1,407.2
Sicilia	50.9	476.4	663.0	991.8	1,172.5	1,150.8	4,505.4
Toscana	24.1	246.2	353.8	443.1	494.9	411.0	1,973.2
Umbria	9.3	80.7	117.4	148.4	183.0	154.2	693.0

Val d'Aosta	1.1	11.1	15.9	17.6	20.3	13.6	79.5
Veneto	41.3	505.5	690.2	730.7	704.5	552.5	3,224.7
Total	587.5	5,530.3	7,733.9	9,737.2	10,725.7	9,156.5	43,471.0

Source: our elaborations based on data contained in official allocation documents (January 2023).

As regard the kind of interventions (Table 2), the majority of resources are concentrated in specialized construction activities (55.3% at a national level), followed by the civil engineering and the construction of residential and non-residential buildings (36.7 and 8.1%, respectively).¹² Compared to the size of these activities within the construction sector (measured in terms of employees¹³), the allocation of resources is more oriented towards civil engineering works, in connection with the infrastructural purpose of many planned interventions.

Table 2

Resources allocated to the construction sector by sub-industries (millions)			
	Construction of residential and non- residential buildings (ateco 41)	Civil engineering (ateco 42)	Specialized construction activities (ateco 43)
Abruzzo	98.3	1,116.4	563.3
Basilicata	38.9	286.5	339.4
Calabria	210.0	468.4	1,130.1
Campania	295.3	2,554.2	2,364.0
Emilia-Romagna	193.2	526.5	1,703.2
Friuli Venezia Giulia	78.3	516.9	419.9
Lazio	659.8	712.0	2,253.3
Liguria	136.3	1,166.2	579.3
Lombardia	354.9	931.2	3,145.5
Marche	155.7	899.7	510.2
Molise	60.9	60.4	163.0
Piemonte	186.1	816.7	1,570.2
Prov. Aut. Bolzano	17.5	27.5	209.9
Prov. Aut. Trento	17.9	288.5	220.0
Puglia	314.8	1,436.8	1,791.1
Sardegna	65.1	498.8	843.3
Sicilia	227.5	1,854.3	2,423.6
Toscana	167.9	318.0	1,487.3
Umbria	58.3	305.9	328.8
Val d'Aosta	18.9	15.5	45.2
Veneto	153.0	1,137.5	1,934.2
Total	3,508.6	15,937.9	24,024.5

Source: elaborations on data contained in official allocation documents.

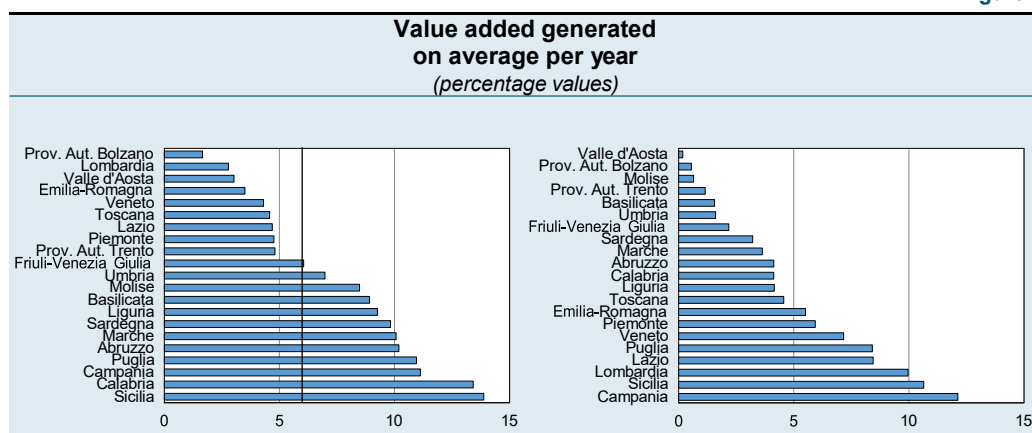
3. The regional effects on value added fostered by the NRRP

¹² The only exception is Campania, where the resources allocated for civil engineering works exceed those for specialized construction works.

¹³ In qualitative terms, this evidence is confirmed by measuring the weight of the branches based on both the data of the employed in the Asia database of Istat and the data of the employed in the Labor Force Survey of Istat.

The resources allocated to the construction sector in each region are associated with the generation of value added spurred both by the direct effects on production within the sector (i.e. what is directly fostered by the resources allocated to it) and by the indirect effects, according to what feeds back through supply and demand linkages with other sectors (i.e. the impact that activity in other sectors, stimulated by the resources allocated to the construction industry, has in turn on the construction sector itself). Instead, the estimates do not include the effects on the construction sector due to the resources allocated to the other productive sectors because only a part of them is attributable to specific regions and, even when they can be territorialized, compared to construction activities, it is less likely that their employment effects will materialize locally.¹⁴ To estimate the overall impact, we apply a standard Leontief model to the 2019 ISTAT Input-Output tables, thus assuming linear and inelastic relationships between factors (cf. the Methodological Appendix).¹⁵

Figure 2



Source: elaborations on data from ISTAT, Territorial Accounts, and *Ragioneria Generale dello Stato*. See the Methodological Appendix.
 (1) The share of value added activated by the NRRP (average years 2023-2026) is expressed in relation to the regional value added of the construction sector in 2019. The vertical black line refers to the Italian average value.

According to our estimates, the growth in value added in the construction sector generated by the NRRP, relative to the level recorded in 2019, would show significant regional heterogeneity, correlated with the amount of resources available. The impact would be particularly high in the regions of Southern Italy (Figure 2, panel a). As compared to a 6% average per year for Italy as a whole, the growth in value added would be almost double for Campania and Puglia, and more than double for Sicilia and Calabria; it would instead be below

¹⁴ Consider, for instance, interventions that stimulate the demand for digital business services: the associated increase in employment could materialize outside the region, by workers from contracting companies who could work remotely from the location of the client. The activity generated in the construction sector, on the other hand, is more likely to take place in the territory to which the resources are allocated, although not necessarily using exclusively local labor (see *below*).

¹⁵ The assumption of fixed factor relationships coefficients implies that there is no possibility of substitution between production factors, e.g. in response to changes in relative prices. The assumption of linearity also implies that there are no diminishing returns in the use of resources. Finally, the analysis is carried out without taking into account possible general economic equilibrium effects, which could either increase final additional employment (e.g. through an expansion of aggregate demand resulting from increased incomes) or decrease it (e.g. through indirect displacement effects with respect to possible alternative uses of resources). An application of the Leontief model to estimate the effects of an exogenous increase in resources assigned to the construction sector is also carried out by ANCE (2015).

or in line with the national average for almost all the northern regions, which are characterized by lower levels of allocated resources compared to the regional value added of the sector. Among the central regions, Lazio and Toscana would be in line with the northern ones, while the impact would be above the average for Umbria and especially for Marche, also in relation to the resources allocated for the development of the railway network and for post-earthquake reconstruction.

In absolute terms, however, about half of the overall effect can be attributed to five regions: Campania, Sicilia, Lombardia, Lazio and Puglia (Figure 2, panel b), i.e. those in which the resources allocated, in absolute terms, are larger.

4. Employment effects of the NRRP

Having estimated the value added spurred by the NRRP, it is possible to quantify the number of employees¹⁶ needed to meet the increased production needs generated by the NRRP.¹⁷

The resources already allocated by the NRRP would generate in the Italian construction sector an estimated labor demand of about 62,000 units on an annual basis in the average of the period 2023-2026. This amounts to 6.5% of the 2019 sectoral employment. In the projected peak year of 2025, labor demand would reach more than 71,000 workers.¹⁸ However, this masks a significant heterogeneity at the regional level: the absolute values (reported in the first column of Table 3) entail very different incidences of the stimulated employment (over the 2019 sectoral levels; cf. third column of Table 3), ranging from less than 2% to almost 14%.

Table 3

Employment generated in the construction sector
(absolute values and percentage values)

¹⁶ In this analysis the expected change in employment is estimated by focusing on employees. Although the share of the self-employed in the construction sector is structurally high (34%, according to the most recent national accounts data), the occupational expansion between 2019 and 2022, related to the increase in business activity over the period, mainly affected employees, who grew by 22%, compared to a change of less than 4 among the self-employed.

¹⁷ Following the methodology of Basso et al. (2023), on the basis of the territorial accounts data referring to 2019, we first compute the share of compensation of employees over the value of production in the construction sector; subsequently, this share is multiplied by the estimated change in production due to the NRRP in order to quantify the expected increase in wages. Dividing this amount by the average wage in the sector, again measured on the basis of territorial accounting data on the same date, we obtain the estimated change in the number of employed persons (see the Methodological Appendix). Since for a given change in the wage bill this estimate is inversely proportional to the average wage level considered, the employment impact would be slightly reduced if wage revaluation dynamics increases were incorporated.

¹⁸ This amount is lower than previous estimates at the Italian level for the peak year 2025, reported in Basso et al. (2023). For this year they estimate an additional labor demand of about 95,600 persons (Table 1 in Basso et al., 2023). The difference is mainly due to the use, in this exercise, of the resources already allocated (about 60% of the total assigned). There are also differences due to the different updates in the financial planning considered and to the non-inclusion of the indirect effects on the construction sector stemming from of the NRRP resources allocated to the other sectors. These dimensions would, however, contribute to a lesser extent to the size of the deviation from previous estimates.

	Change in Employment due to NRRP (1)	Employed in 2019	Change in NRRP/employe es in 2019 (2)	Variation 14-19	Variation 19-21
Abruzzo	2,924	28,600	10.2	-200	4,700
Basilicata	1,066	10,100	10.6	-700	2,900
Calabria	3,236	24,500	13.2	-1,200	8,200
Campania	9,313	91,400	10.2	15,100	7,700
Emilia-Romagna	2,749	68,200	4.0	500	8,400
Friuli Venezia Giulia	1,092	17,700	6.2	0	-500
Lazio	5,617	105,300	5.3	9,900	15,900
Liguria	2,097	25,100	8.4	1,400	1,400
Lombardia	4,933	173,600	2.8	5,500	28,500
Marche	1,864	20,500	9.1	500	3,600
Molise	456	5,600	8.1	100	1,800
Piemonte	2,678	60,100	4.5	300	3,900
Prov. Aut. Bolzano	278	16,200	1.7	2,100	900
Prov. Aut. Trento	569	11,300	5.0	-200	-600
Puglia	6,000	60,900	9.9	3,300	8,400
Sardegna	2,137	23,300	9.2	600	3,200
Sicilia	7,588	55,900	13.6	-1,400	15,800
Toscana	2,457	56,500	4.3	1,800	-600
Umbria	941	14,200	6.6	-600	2,700
Val d'Aosta	86	2,800	3.1	-600	100
Veneto	3,563	83,200	4.3	3,100	2,800
Total	61,644	955,000	6.5	39,300	119,200

Source: elaborations on data from ISTAT, Regional Accounts, and Ragioneria Generale dello Stato. Cf. the Methodological Appendix.

(1) The Employment Change due to NRRP is computed as the annual average of additional employment generated by the NRRP in the construction sector for the period 2023-26. The data in the other columns are taken from ISTAT's Regional Accounts, with reference to employment in the construction sector. (2) Percentage values.

In line with what has been noted above regarding the amount of resources allocated and the consequent effect on value added, the impact on employment is larger in percentage terms for regions in Southern Italy (and in particular in Sicily, Calabria and Basilicata), while those exhibiting the smallest effects would be the Autonomous Province of Bolzano, Lombardia, Val d'Aosta, Emilia-Romagna and Veneto.¹⁹

For the regions where the impact is expected to be larger, it can be observed that the construction sector has already experienced a strong expansion of employment in recent years (the fifth column shows the change between 2019 and 2021, the last year available in the Regional Accounts), also due to the effect of the tax incentives for the requalification of residential buildings. For regions such as Sicilia, Basilicata and Calabria, the average annual increase in employment estimated to meet the stimulus provided by the NRRP would be about half of that observed in the two-year period 2019-21, which followed a phase of employment decline in the years 2014-19. Only Campania experienced a strong expansion in

¹⁹ In general, the regions maintain the same positions when sorted by resources allocated over value added (Figure 1, panel b), impact on value added (Figure 2, panel a) and employment activated generated (Table 2).

the number of employed persons also in the five-year period 2014-2019, and the annual employment increase fostered by the NRRP would be comparable to the one observed in 2019-21.

The actual additional demand for new workers in the construction sector will also depend on the evolution of the policy interventions related to tax incentives for the renovation of residential buildings, which have driven the sector's dynamic in the last two years. If the extent of tax incentives will be revised downward, the incremental employment generated by the NRRP will also be reduced, since part of the activity generated by it could be carried out by workers already hired or through the re-employment of fixed-term workers whose contracts have ended in the meantime.

4.1 Estimated labor demand by occupational groups

Combining data on the distribution of resources among the three construction sub-industries with information from ISTAT's *Labor Force Survey* (LFS), it is possible to provide an assessment of the employment effects of NRRP in different occupational categories (cf. the Methodological Appendix). We consider four occupational classes in the analysis: technical or highly specialized professions, administrative or commercial professions, specialized workers (e.g. bricklayers, electricians, plumbers, carpenters, etc.) and low skilled workers (e.g. manual laborers and truck and lorry drivers).²⁰ The distribution of these occupations within the three sub-sectors is shown in Table 4.

Table 4

Distribution of occupations by construction sub-industries (1) <i>(percentage values)</i>			
	Construction of residential and non-residential buildings (ateco 41)	Civil engineering (ateco 42)	Specialized construction activities (ateco 43)
Technical and highly specialized professions	10.3	21.6	9.1
Administrative or commercial professions	8.7	9.1	9.4
Skilled workers	69.0	26.1	70.3
Low skilled workers	12.0	43.2	11.2

Source: elaborations on Istat's, *Labor Force Survey*. Cf. the Methodological Appendix.
(1) Data referring to 2021.

Specialized blue-collar workers account for approximately 70% of employment in the construction of building and in specialized construction activities, whereas each of the other

²⁰ The classification is obtained by reclassifying the *one-digit* occupational codes in the Istat's *Labor Force Survey* into four classes. Cf. the Methodological Appendix.

three categories account for approximately 10% of employment. In contrast, when considering civil engineering, the distribution of occupational groups is less concentrated, with an increase in the share of both low-skilled workers and technical-specialist occupations.

Therefore, by jointly considering the distribution of professional categories among construction sub-sectors and the resources allocated at a regional level in each of them, we estimate that the additional demand would be particularly high for specialized workers, followed by that for unspecialized workers (Table 5). In all the regions the demand for these two professional figures would account for more than 70% of total additional employment, with slight differences in the relative weight of the two (for example, Toscana, Lombardia and Bolzano would present a particularly high demand for specialized workers). In relative terms, the demand for highly specialized and technical professionals would be higher in regions such as Liguria, Abruzzo and Marche, which are affected by important civil engineering projects (railway network and port system development; see Section 2).

Analyzing the socio-demographic characteristics of individuals working in the professional categories considered, it can be noticed that the larger presence of high school graduates among specialized workers vis-à-vis low-skilled ones (at the national level, about 40% of specialized workers have at least a high school diploma, compared to 27% for workers in non-specialized occupations) as well as the higher incidence of immigrants (23%, compared to 16% among low-skilled workers and to very low values for the other two professional classes). The presence of immigrants among skilled workers is also very heterogeneous across the territory, with higher levels in northern regions and significantly lower levels in southern regions. Skilled *blue-collar* workers are also on average younger than other *blue-collar* workers in construction (the share of those under 50 years of age is 68 and 62% respectively), while both occupational classes share the fact that they are almost entirely made up of men, against a female incidence of over 70% for white-collar occupations and 19% for technical and specialized professionals.

Table 5

Labor demand generated by NRRP in construction, by occupational groups (1) (percentage values)				
	Technical and highly specialized professions	Administrative or commercial professions	Skilled workers	Low skilled workers
Abruzzo	16.7	9.2	43.4	30.7
Basilicata	14.1	9.3	52.8	23.8
Calabria	12.9	9.3	57.2	20.6
Campania	15.1	9.2	49.1	26.5
Emilia-Romagna	12.0	9.3	60.3	18.4
Friuli Venezia Giulia	15.8	9.2	46.6	28.3
Lazio	12.0	9.3	60.4	18.3
Liguria	17.3	9.2	41.6	31.9
Lombardia	11.5	9.3	62.0	17.2

Marche	16.4	9.2	44.7	29.7
Molise	11.8	9.2	61.3	17.7
Piemonte	12.5	9.3	58.2	19.9
Prov. Aut. Bolzano	11.6	9.3	61.8	17.3
Prov. Aut. Trento	13.7	9.3	54.1	22.9
Puglia	13.9	9.3	53.5	23.4
Sardegna	13.9	9.3	53.3	23.5
Sicilia	14.1	9.3	52.9	23.8
Toscana	11.0	9.3	63.6	16.0
Umbria	14.6	9.2	51.2	25.0
Val d'Aosta	12.0	9.2	60.5	18.3
Veneto	13.2	9.3	56.0	21.5

Source: elaborations on Istat data.

(1) The demand by occupational categories is calculated by weighting the share of each category in each of the three sub-sectors, measured at national level, by the weight of the sub-sector in terms of resources allocated for each region.

5. Labor supply and mobility of workers in the construction sector

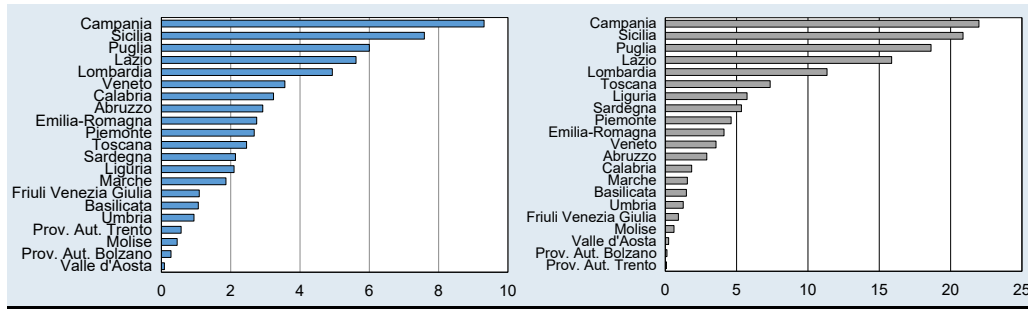
In the absence of detailed labor supply information, in this section we discuss possible channels for recruiting the new workforce needed for the increase in activities.

5.1 Unemployment in the Italian regions

The new regional demand of workers will likely be met first from the pool of unemployed individuals. In 2021, the regions where NRRP would generate more employment are those characterized by a large number of unemployed individuals with previous experience in the construction sector (Figure 3). In some regions, however, the number of job-seekers previously employed in the sector is small compared to the magnitude of the demand generated by the NRRP: Marche and Friuli (where the unemployed individuals would cover more than four-fifths of the new labor demand), Abruzzo (around two-thirds) and the two Autonomous Provinces (around 40% and 15% in Bolzano and Trento, respectively) due to the very low number of unemployed individuals.

Figure 3

Demand and supply of workers (thousands)	
(a) demand generated by the NRRP (1)	(b) unemployed persons with previous experience in the sector (2)



Source: Istat, Regional Accounts and Istat's *Labor Force Survey*.
 (1) Estimate of the change in employment due to NRRP; annual average for the period 2023-26. - (2) Labor supply refers to jobseekers in 2021 with previous experience in construction.

Taking into account both the unemployed individuals and the inactive people who are available for work (always with previous experience in construction), in all regions, except the Autonomous Province of Trento, the potential labor supply pool would be much larger than new demand (Table 6). However, it must be taken into consideration that these estimates are still provisional, since not all the resources have been allocated yet. Looking at the quality of the workforce, in Italy 75% of the unemployed individuals or inactive people available for work, who had previous employment in construction, were specialized workers and 17% were low-skilled workers. However, the shares of specialized workers are particularly low in some regions, such as in Friuli, Molise, Basilicata and Valle d'Aosta, where low-skilled workers are more frequent among the unemployed and inactive individuals.

For individuals who have been unemployed for a long time or who specialize in different operational areas, training interventions may be necessary aimed at getting the operational skills that can be more readily acquirable among the most requested ones.²¹

Table 6

Unemployed individuals and potential labor force (1) (absolute values, 2021)					
	Estimated employment generated by NRRP	Unemployed individuals	of which: with previous construction experience	Inactive people available for work	of which: with previous experience in construction
Abruzzo	2,924	49,769	1,849	67,534	3,420
Basilicata	1,066	16,999	1,481	44,579	1,690
Calabria	3,236	113,908	7,351	204,229	11,164
Campania	9,313	381,076	20,872	588,149	26,926
Emilia-Romagna	2,749	113,688	2,907	115,993	2,914
Friuli Venezia Giulia	1,092	30,756	916	34,604	1,003
Lazio	5,617	251,363	18,630	285,943	11,039

²¹ For example, in the civil engineering sector, which has a limited weight on the employment figures but to which a significant portion of the resources are allocated, specialized workers such as paving workers, telecommunications equipment installers and railway track welders, among others, are very common, whereas they are scarcely represented in the other sub-sectors and therefore presumably also less widespread among the unemployed and inactive previously employed in construction.

Liguria	2,097	53,906	3,558	48,929	1,577
Lombardia	4,933	269,879	11,338	296,463	10,995
Marche	1,864	47,112	1,546	53,070	1,594
Molise	456	12,279	609	22,925	633
Piemonte	2,678	139,122	5,338	141,106	3,471
Prov. Aut. Bolzano	278	9,904	118	13,644	301
Prov. Aut. Trento	569	11,944	81	15,938	438
Puglia	6,000	205,459	15,867	329,707	15,439
Sardegna	2,137	87,693	5,732	119,821	6,104
Sicilia	7,588	301,579	21,989	537,627	25,500
Toscana	2,457	125,603	4,617	127,903	5,548
Umbria	941	25,017	1,259	30,414	228
Val d'Aosta	86	4,114	232	3,749	164
Veneto	3,563	115,636	4,119	130,269	4,773

Source: elaborations on Istat data, RFL.

(1) Inactive persons available for work are persons who are available for work in two weeks after the reference week, but who have not looked for a job in the four weeks preceding the reference week. The estimate of the change in employed employment generated by the NRRP is reported as an annual average for the period 2023-26.

5.2 Workers mobility across regions

In addition to the workforce available in the region, in order to find workers firms could make use of the mobility channel, which is higher in the construction sector than in manufacturing. To provide information on the geographical mobility of workers in the construction sector we use data from CICO (*Campione Integrato delle Comunicazioni Obbligatorie*), an administrative system that collects mandatory notifications that employers submit to the Italian Ministry of Labor when they activate or terminate a contract. In particular, we consider construction workers in each year and each region and we identify those with an employment contract in a different region in the last twelve months (Table 7). As shown in the table, which considers the inflows of workers from other regions by occupational type, mobility mainly concerns specialized workers and low-skilled workers, probably due to the higher incidence in these occupations of demographic groups that are characterised by greater territorial mobility (such as foreigners and young people). As highlighted above, these professional figures would also be the most demanded ones: it is, therefore, likely that their greater mobility could be exploited to satisfy part of the demand generated by the NRRP, especially during local demand peaks. In this regard, Table 7 also shows that the use of the mobility channel could be more difficult for island regions, which are recipients of many resources.

Table 7

Incoming workers in the region, by occupation (1) (percentage values, 2015-19 average)					
	Technical and highly specialized prof.	Administrative and commercial prof.	Specialized workers	Simple and unskilled workers	Total
Abruzzo	3.8	3.0	6.9	9.3	7.2
Basilicata	7.3	4.5	12.3	14.4	12.0
Calabria	4.2	2.4	6.1	6.4	5.7
Campania	4.1	1.3	8.2	8.0	7.1
Emilia-Romagna	4.3	2.8	7.9	11.9	8.0
Friuli Venezia Giulia	4.6	3.2	10.1	15.0	9.6
Lazio	3.6	2.3	6.7	7.8	6.2
Liguria	4.4	3.0	9.6	10.2	8.7
Lombardia	4.2	2.2	6.2	7.5	6.0
Marche	3.2	1.9	8.7	12.0	8.5
Molise	4.6	3.6	9.5	12.8	9.8
Piemonte	5.7	1.7	5.8	8.5	6.1
Prov. Aut. Bolzano	6.7	1.6	8.8	16.1	9.8
Prov. Aut. Trento	2.9	1.4	6.7	12.7	7.5
Puglia	5.0	1.5	6.2	6.8	5.9
Sardegna	3.1	0.9	2.8	3.1	2.8
Sicilia	3.4	1.4	4.4	4.5	4.1
Toscana	4.1	1.9	6.4	9.2	6.7
Umbria	3.8	1.6	6.8	11.0	7.5
Val d'Aosta	12.4	2.9	4.2	8.5	5.9
Veneto	5.2	1.6	6.9	13.0	7.5
Italy	4.3	2.0	6.8	8.6	6.6

Source: elaborations on CICO data.

(1) Share of workers who 12 months earlier had a contract of employment in the construction sector in another region in the total number of workers with an active contract.

Table 8 shows the workers' inflows for the construction sub-sectors. There is a higher flow of workers from other regions for civil engineering activities, which tend to include interventions involving several regions (construction of roads, motorways, railways, public utilities for transporting energy or fluids, telecommunications and other infrastructure). In contrast, geographical mobility is generally lower for the specialized construction sector, which tends to use local workers.²²

Table 8

Incoming workers in the region, by sector (1) (percentage values, 2015-19 average)			
	Construction of residential and non-residential buildings (ateco 41)	Civil engineering works (ateco 42)	Specialized construction activities (ateco 43)
Abruzzo	7.2	11.6	6.4

²² The activities included in this segment include electrical and plumbing installation, demolition and site preparation, and other building completion and finishing work.

Basilicata	11.6	13.3	12.0
Calabria	4.5	9.4	5.8
Campania	5.9	11.4	7.4
Emilia-Romagna	11.2	9.9	6.4
Friuli Venezia Giulia	7.3	12.5	10.1
Lazio	7.8	9.4	4.7
Liguria	8.5	15.8	7.6
Lombardia	6.9	7.6	5.2
Marche	9.5	14.7	7.1
Molise	11.8	9.7	7.8
Piemonte	5.0	14.1	5.6
Prov. Aut. Bolzano	12.0	25.4	6.6
Prov. Aut. Trento	7.0	14.5	6.7
Puglia	6.3	7.0	5.5
Sardegna	2.0	4.5	3.2
Sicilia	2.7	5.4	5.0
Toscana	7.5	12.3	5.8
Umbria	7.6	11.5	6.8
Val d'Aosta	6.3	4.3	5.8
Veneto	10.0	10.5	6.0
Italy	7.0	10.3	5.9

Source: elaborations on CICO data.

(1) Share of workers who 12 months earlier had a contract of employment in construction in another region in the total number of workers with an active contract.

However, the CICO data may not fully capture the phenomenon of non-local labor, as they only capture mobility in the case of a contractual change of the worker. It is possible, however, that workers move to other regions while keeping the same employer. Table 9, based on INPS data, shows the shares of workers in construction who, while remaining employees of the same firm, changed their region of employment twelve months later. As shown above, indicators of geographical mobility are higher in the civil engineering sector, while specialized construction activities exhibit a lower level of employee mobility.

Table 9

Inter-regional movements within the same firm (1) (percentage values, average 2017-19)				
	Construction of residential and non-residential buildings (ateco 41)	Civil engineering works (ateco 42)	Specialized construction activities (ateco 43)	Total
Abruzzo	3.1	6.4	2.4	2.9
Basilicata	5.3	5.5	2.6	4.0
Calabria	2.1	2.2	0.6	1.5
Campania	2.4	3.4	2.1	2.3
Emilia-Romagna	2.3	4.2	0.9	1.6
Friuli Venezia Giulia	3.8	1.5	1.8	2.4
Lazio	2.4	2.4	1.6	1.9
Liguria	3.6	2.3	0.9	1.9
Lombardia	1.6	1.8	0.7	1.1
Marche	4.1	1.9	1.7	2.6
Molise	7.2	2.5	2.9	5.4
Piemonte	2.1	1.6	1.0	1.4

Prov. Aut. Bolzano	2.9	1.3	0.4	1.4
Prov. Aut. Trento	2.7	1.6	0.1	1.0
Puglia	2.1	1.6	0.7	1.4
Sardegna	0.9	0.7	0.7	0.8
Sicilia	0.8	1.2	0.8	0.9
Toscana	3.1	2.2	0.8	1.8
Umbria	4.3	1.2	1.5	2.8
Val d'Aosta	2.2	1.2	1.1	1.6
Veneto	1.4	3.0	0.9	1.2
Italy	2.2	2.3	1.1	1.6

Source: elaborations on INPS data.

(1) Share of construction workers who changed region, within the same firm, over the total number of workers in the region in construction who did not change employer, Average 2017-2019.

So far, we have only considered geographical mobility within Italy. It is also important to take into account the employment of foreign workers as an addition channel of recruitment. Although this is not directly observable in the available databases, one can attempt to quantify the phenomenon as a first approximation by measuring the share of foreign workers who have activated a contract in the construction sector without having had any type of employment contract in Italy in the previous 24 months (Table 10).²³

Table 10

Incoming workers from abroad (1) <i>(percentage values, average 2017-19)</i>				
	Construction of residential and non-residential buildings (ateco 41)	Civil engineering (ateco 42)	Specialized construction activities (ateco 43)	Total
Abruzzo	2.3	1.4	2.0	2.1
Basilicata	0.6	0.8	1.0	0.8
Calabria	1.7	0.8	1.9	1.7
Campania	1.4	0.6	1.4	1.3
Emilia-Romagna	4.4	2.4	4.3	4.2
Friuli Venezia Giulia	4.8	1.3	4.5	4.4
Lazio	3.9	1.5	3.8	3.6
Liguria	6.6	2.5	5.3	5.3
Lombardia	5.4	2.5	4.2	4.5
Marche	3.9	1.9	3.7	3.6
Molise	0.7	0.9	1.1	0.9
Piemonte	4.2	2.5	3.9	3.9
Prov. Aut. Bolzano	3.6	2.2	3.7	3.5
Prov. Aut. Trento	2.4	1.2	3.1	2.7
Puglia	1.5	1.2	1.0	1.2
Sardegna	1.0	0.0	0.8	0.8
Sicilia	0.9	0.3	0.8	0.8

²³ This is an approximate measurement because foreigners who remained in Italy although unemployed for 24 months are also included. Considering the relatively long time window, it is likely that this factor does not alter the substance of the results shown in the text.

Toscana	4.0	1.1	4.6	4.2
Umbria	3.2	1.1	2.8	2.8
Val d'Aosta	2.1	4.2	2.7	2.7
Veneto	4.3	2.1	4.0	3.9
Italy	3.2	1.5	3.3	3.1

Source: elaborations on CICO data.

(1) Share of construction workers who have not worked in Italy in the previous 24 months, over the total number of construction workers with an active contract.

The share of foreign workers employed in construction is higher than in manufacturing; however, the phenomenon appears less relevant in civil engineering, where technical or highly specialized professionals are highly demanded, whereas foreign workers tend to work in less skilled occupations. The use of the foreign workers seems to be more common in the central and northern regions, as previously mentioned. The indicator is lower for the southern regions, especially for the Islands, which already had a limited capacity to attract workers from other domestic regions (Table 9).

5.3 Workers mobility across sectors

The required labor force could also be found through inter-sectoral mobility, hiring workers switching from another sector to construction. According to our elaborations on CICO data, the phenomenon of sectoral mobility in construction is not negligible: on average, in the years 2015-19, in Italy about 10% of the construction employees worked in another sector 12 months earlier, often in manufacturing or private services other than trade and tourism (Table 11). The sectoral mobility indicator is generally higher in some regions in the Center (Toscana, Lazio, Marche) and the North East (Friuli and Trento).

Table 11

Construction workers from other sectors (1) (percentage values. 2015-19 average)							
	agriculture	manufacturing	trade	tourism	public sector	other services	total
Abruzzo	1.1	2.1	0.7	0.7	0.1	2.5	7.3
Basilicata	2.2	4.1	0.9	0.8	0.3	2.3	10.6
Calabria	1.2	3.0	1.7	1.2	0.3	2.6	10.1
Campania	2.4	2.4	1.1	0.8	0.3	2.1	9.2
Emilia-Romagna	0.6	3.4	1.0	0.6	0.2	2.7	8.6
Friuli Venezia Giulia	1.6	3.7	1.2	1.0	0.2	3.7	11.3
Lazio	0.8	7.1	1.0	1.1	0.2	2.4	12.6
Liguria	0.6	2.1	0.8	0.6	0.1	4.0	8.2
Lombardia	0.6	3.3	0.9	0.9	0.3	3.0	9.0
Marche	0.7	3.9	1.0	0.7	0.2	4.7	11.2
Molise	1.4	4.2	0.9	0.8	0.2	2.4	9.9
Piemonte	1.1	2.5	0.9	0.5	0.3	2.7	8.0
Prov. Aut. Bolzano	1.0	3.1	0.9	0.6	0.2	3.7	9.5
Prov. Aut. Trento	3.0	3.5	1.2	0.9	0.1	2.8	11.4

Puglia	0.9	2.5	0.8	1.3	0.3	3.2	9.1
Sardegna	1.6	3.5	1.0	0.7	0.3	2.4	9.5
Sicilia	1.4	2.9	0.9	0.9	0.1	3.1	9.4
Toscana	2.1	3.1	1.6	1.8	0.6	3.8	13.0
Umbria	1.5	2.6	0.9	0.5	0.2	2.4	8.1
Val d'Aosta	0.8	1.3	1.5	1.9	0.3	3.1	8.8
Veneto	1.2	3.8	1.0	0.8	0.2	3.2	10.2
Total	1.2	3.3	1.0	0.8	0.2	3.4	9.9

Source: elaborations on CICO data.

(1) Share of construction workers who were employed in other sectors in the previous 12 months, by employment sector in the total number of workers with an active contract.

It is important to note, however, that the NRRP will also stimulate labor demand in other sectors, albeit to a lesser extent, which could compete with construction for absorbing unemployed and inactive workers.

6. Conclusions

The boost to labor demand in the construction sector generated by the NRRP and the CNP will be significant and of heterogeneous intensity across the Italian regions.

The regions where the impact of the NRRP on employment would be relatively greater, in relation to employment in 2019, are predominantly located in the South. In these regions there is generally a large pool of unemployed or inactive people available for work with previous experience in the sector. In the regions with a smaller number of unemployed individual or inactive workers compared to the demand generated by the NRRP - Abruzzo, Marche, Friuli and the Autonomous Provinces -the recruitment of workers from other regions could play a more important role, since these regions are characterized by relatively higher than average inflows, also from abroad. In all regions, moreover, part of the workforce hired for residential building activities spurred by tax incentives could be employed – in case of a mitigation of this impulse - in the new activities required by the NRRP.

In order to facilitate the re-employment of people who have been unemployed for a long time or lack the required operational skills, targeted training policies could be useful. In addition, given the expected strong expansion of the sector, it is important that controls on occupational safety aspects are adequate.

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Methodological Appendix

The estimation of employment generated by the National Recovery and Resilience Plan NRRP is based on the methodology developed in Basso et al. (2023) but developing the analysis at the regional level and focusing exclusively on the construction industry, without considering general economic equilibrium effects on the components of final demand.

Assuming that the NRRP will be implemented on schedule, the analysis is based on the resources already allocated and for which a territorial distribution can be made with a reasonable degree of reliability, including those of the Complementary Investment National Plan (CNP). For the sake of brevity, the term NRRP is henceforth used to refer to all the resources of both the NRRP in the strict sense and the CNP. For more details about the methodology used for resource allocation, see the item *Resources of the NRRP and CNP* in Bank of Italy (2022b).

In this paper, we exclude funds allocated to ongoing projects as the aim is to quantify the additional activity generated by the NRRP. Using the breakdown elaborated by the *Ragioneria Generale dello Stato* (RGS) - to which, as in Basso et al. (2023), changes have been made to solve some ambiguities - the beneficiary industries of the interventions are identified for each measure of the NRRP. At the sub-national level, there is no time frame for the use of resources. Therefore, in order to distribute the interventions over the period of operation of the NRRP, the same timing of the expenditure forecast at the national level was applied to the regional resources.

Using Input-Output tables computed by the Italian National Statistics Institute (Istat) and applying the Leontief's model, it is possible to estimate the additional demand triggered by the NRRP construction spending shock as:

$$\widehat{dD}_{r,t} = (I - D)^{-1} dS_{r,t}$$

given n industries, A represents the matrix of technical coefficients and I the identity matrix (both of dimension $n \times n$), while dS e \widehat{dD} are $1 \times n$ vectors indicating, respectively, the estimated expenditure shocks and the changes in total demand (for both intermediate and final goods) for region r in year t . Since we use national input-output tables, the estimates implicitly incorporate the simplifying assumption that output coefficients are uniform across regions. The Leontief model is applied for the years 2021 to 2026 to account for the distribution of NRRP expenditure over time. As the analysis focuses exclusively on the construction industry, the components of dS associated to other sectors are set to zero. In other terms, we do not consider NRRP spending shocks directed towards industries other than construction. Similarly, only the change in total demand for the construction industry is estimated. The latter can in turn be broken down into two parts:

- (i) a direct effect (dS) related to the additional demand directly allocated to the construction industry;
- (ii) an indirect effect ($\widehat{dD} - dS$) related to the inter-industry propagation of the same demand shock.

For each region, the new level of demand in the construction industry is determined by adding the estimated change to the demand values observed in 2019. The latter have been calculated by distributing the national total value among the regions on the basis of shares obtained from the regional Input-Output tables provided by the Regional Institute for Economic Planning of Tuscany (IRPET). In addition, since IRPET tables report the overall demand at the product level, the demand for product F (Construction and civil building works) has been transposed to the activity branch F (Construction) on the basis of shares, specific to each region, calculated from the supply tables; for Trentino-Alto Adige,

the overall demand was divided between the Autonomous Provinces of Trento and Bolzano considering their production shares obtained from Istat's regional accounts.

The employment needed to meet the new level of demand is calculated on the basis of the employment shares (α), again taken from Istat's regional account data as of 2019:

$$\alpha_r = \frac{wl_r}{py_r}$$

The terms wl e py indicate the value of, respectively, labor incomes and total production in the construction industry for region r . The value of production (py) is, however, available only at the national level, whereas the regional account only report data for value added. In order to estimate the value of production in the construction industry, for each region we multiplied the value added by a coefficient equal to the ratio between the national value of production and the corresponding value added. Multiplying $\widehat{dD}_{r,t}$ by the coefficient α_r , we obtained the expected change in the wage bill. Finally, dividing the latter term by the average wages in the industry (w_r), we get the change in employment required to meet the new demand levels in construction:

$$\widehat{dE}_{r,t} = \frac{\widehat{dD}_{r,t} \times \alpha_r}{w_r}$$

In order to calculate the distribution of demand among occupational categories, using data from Istat's Labor Force Survey (LFS) averaged over the year 2021, we first computed the distribution of employees among four macro occupational classes obtained by aggregating one-digit codes of the *profl* variable. In particular, the first class includes the first three categories (legislators, entrepreneurs and senior management; intellectual, scientific and highly specialized professions; technical professions), the second class considers categories 4 and 5 (executive professions in office work; qualified professions in trade and services), in the third class we put the category 6 (artisans and specialized workers) and categories 7 and 8 are included in the fourth class (plant operators, fixed and mobile machine operators and vehicle drivers; unskilled professions). Then, in order to obtain the distribution of total labor demand between occupational classes, for each region and year, we computed the average of the occupational shares in each construction sub-industry weighted by the proportion of the resources allocated to the sub-industry in the region.

The calculations on jobseekers and inactive persons available to work are also made on the basis of LFS data in the average of 2021. Inactive persons available to work are persons who are available to work within two weeks after the reference week, but who have not looked for a job in the four weeks preceding the reference week. For both jobseekers and inactive persons available to work, the number of individuals with previous experience in construction industry is calculated on the basis of those who indicated this industry as that of their last work experience.

For the analysis of worker mobility between regions and industries we use data from the *Campione Integrato delle Comunicazioni Obbligatorie* (CICO) which tracks the employment history of a representative sample of individuals drawn from the *Comunicazioni Obbligatorie*. The latter is an administrative system that collects mandatory notifications that employers submit to the Italian Ministry of Labor when they activate or terminate a contract. We assembled a panel database for the period 2015-2019 by following the workers over time. To observe incoming (outgoing) spatial mobility, we focused on individuals employed in the region in the construction industry at time t ($t-1$ for outgoing mobility) and observed the region of employment at time $t-1$ (t). For analyzing sectoral mobility, we focused on individuals employed in the region in the construction industry and look at the sector of work in the previous year. To measure mobility across regions but within-employer, we use a database from the National

Social Security Institute (INPS) consisting of the employment history of employees born on two dates of the month; in particular, by conditioning on being an employee of the same company, we calculate the share of workers who worked in another region in the previous year. For incoming mobility from abroad, we again use the panel dataset from CICO and calculate the incidence of foreign employees who did not have any employment relationship in Italy in the 24 months preceding the observation month.