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Rising Child Poverty in Europe

Mitigating the Scarring from the COVID-19 Pandemic

Jean-Jacques Hallaert, Iglika Vassileva, and Tingyun Chen

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Rising Child Poverty in Europe - Mitigating the Scarring from the COVID-19 Pandemic

Prepared by Jean-Jacques Hallaert, Iglika Vassileva, and Tingyun Chen

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ABSTRACT: Child poverty increased dramatically during the COVID-19 pandemic. In 2020 alone, the number of children suffering from poverty in the EU increased by 19 percent, or close to 1 million. Left unaddressed, this would not only affect individuals' life prospects and well-being but also have long-term economic implications. This paper argues that, to limit this potential scarring effect of the pandemic, policies should be deployed to reduce rapidly the number of children affected by poverty and mitigate the long-term impact of poverty. Reducing the number of children affected by poverty can be achieved by (i) labor policies and reforms that increase parental work and the labor income of poor parents and (ii) fiscal spending on family and children that can have a powerful and immediate impact. These policies need to be complemented by public investment in education and childcare, health, and housing to mitigate the long-term impact of child poverty.

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Author's E-Mail Address:	jhallaert@imf.org; ivassileva@imf.org, Tchen2@imf.org

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WORKING PAPERS

Rising Child Poverty

Mitigating the Scarring from the COVID-19 Pandemic in Europe

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Executive Summary

During the COVID-19 pandemic, child poverty increased dramatically in the European Union. Child poverty declined in the aftermath of the Global Financial and Sovereign Debt Crises (GFC), but in 2020 alone, the number of children suffering from severe material deprivation increased by 19 percent (0.9 million) in the EU. Indirect evidence suggests that this number may have further increased in 2021 and the sharp increase in inflation in 2022 likely worsened the situation further as higher prices for energy and foodstuff increased difficulties of poor households to afford essential goods.

Large variations were observed among EU countries. In 2020, about half of EU countries experienced an increase in child poverty while the over half experienced a decline. The sharp increase in child poverty at the EU level was driven by the fact that the increase in child poverty was particularly dramatic in countries with a large children population. For example, the number of children affected by severe material deprivation almost tripled in Germany in 2020. The share of children suffering from poverty increased by 3.0 to 4.0 percentage points in Germany, Romania, and Spain. Together these three countries account for almost a third of EU children. The heterogeneity across EU countries in the impact of the pandemic on child points to the role of several factors such as differences in the severity of the economic shock of the pandemic, differences in policy response to the shock, differences in existing safety nets, and structural characteristics.

The increase in child poverty could be an important scarring effect of the pandemic. Pediatric and economic literatures highlight that poverty has severe consequences for children themself (negatively affecting skills developments, health, and educational achievement and, in turn, well-being and income prospects in adulthood) and for the economy as a whole, through high remediation costs and lower human capital accumulation with impact on productivity, potential growth, employability, inequality, and social mobility. The potential scarring effect of rising child poverty during the pandemic is compounded by the educational loss associated with the closure of school and childcare centers, which was more severe for poorest children.

The literature on the impact of poverty has important implications for policies aiming at limiting this scarring effect of the pandemic. First, policies should both aim at reducing as rapidly as possible the level of child poverty and at mitigating its long-term impact. Second, because the long-term consequences of child poverty increase with the duration of poverty, and because it is less costly to reduce poverty early than to implement remediation policies later on to mitigate its impact, the priority should be to reverse as soon as possible the increase in child poverty experienced during COVID. Third, as the impact of child poverty persists in adulthood, policies aiming at reducing the level of child poverty should be accompanied by policies mitigating its long-term impact. Fourth, the effort should be broad based. Child poverty is multidimensional and given the multiple and interrelated channels through which child poverty affects economic and personal prospects, policies cannot be limited to increasing parental income.

This paper's analysis suggests that both labor and fiscal policies have a role to play in reducing child poverty. An econometric analysis, exploiting heterogeneity across EU countries highlights that difference in child poverty dynamics across EU countries since the GFC is strongly associated with structural features (such as income inequality, average household size, share of children with single parenthood), the economic cycle notably via its impact on labor market, and the generosity and design of social protection spending on family and children.

Policy makers could deploy policies that increase parental work and the labor income of poor parents. Reforms that reduce the obstacles to work notably by increasing working hours flexibility, promoting work-life balance, reducing gender biases in employment, and increasing access to childcare for low-income parents would facilitate combining work and parental responsibilities. This would foster an increase in working hours and in labor market participation and would be particularly impactful for single parents. Adjusting the design of the tax-benefit system could also increase the financial incentives for parents to work (more) and women's labor force participation. These reforms would reduce child poverty, and, at the same time, help increase job stability that the literature shows mitigate the impact of child poverty. Policies could also be implemented to increase the net wage of poor parents. For example, a reduction in payroll taxes paid *by employees* at the low-end of the pay scale would increase low-earner parents net wage without increasing the labor cost for employers and thus avoid a potential reduction in low-skilled demand. A reduction in payroll tax paid *by employers* at the low end of the pay scale would increase job opportunities without reducing net wages.

While some of these policies and reforms may take time to implement and have an effect, social protection spending on family and children can have a powerful and immediate impact on child poverty. At a time when fiscal tightening is needed in most countries to reduce fiscal deficits and public debt inherited from the pandemic and to fight inflation, increasing social protection spending may be challenging. In navigating potential trade-offs, it is important to note that repeating the post-GFC approach of reducing social protection spending on family and children as part of a broader fiscal consolidation would delay the reduction in child poverty and increase the scarring effect of the pandemic. Moreover, the increased means-testing implemented to support the post-GFC fiscal consolidation does not appear to have increased the impact of spending on child poverty and, post-COVID-19, is unlikely to do so unless issues with the design and implementation of means-testing are addressed. Therefore, in the short-term, spending on family and children should be preserved or, when possible, increased, while initiating reforms that would increase their impact on child poverty such as: (i) introducing a universal child benefit taxed at a sufficiently progressive and broad-based personal income tax, or (ii) making cash transfers more conditional on caregivers taking action for the child's wellbeing (e.g., school attendance, health check), and (iii) increasing the amount of transfers to specific groups that tend to be more affected by child poverty such as single parents or parents of younger children.

Limiting the scarring effect of the pandemic also calls for policies to mitigate the long-term impact of child poverty. Increasing parents' income and employability can mitigate the scarring effect of child poverty but public investment is also needed. As EU initiatives increasingly help reduce the cost of childcare, they need to be complemented by investment to increase availability of childcare, notably in poor neighborhoods. This would help increase the relatively low usage of formal childcare services by poor parents and, thus, the policy impact on child poverty and women's labor force participation. Investment in education is needed to increase the inclusion of poor children in schools and alleviate the education loss from the pandemic. Policies to improve parents' skills would reinforce the impact of labor policies aiming at increasing poor parents employability and labor income. Given that child poverty is associated with poorer health, increased access to healthcare and medicine would have a positive long-term impact, including by magnifying the impact of investment in education and the impact of labor policies. Providing adequate nutrition to poor children and pregnant women has a rapid impact on children health thus efficiently mitigate the long-term effect of poverty. As poverty determines where and how people live, housing policies have an important role to play in reducing the impact of child poverty.

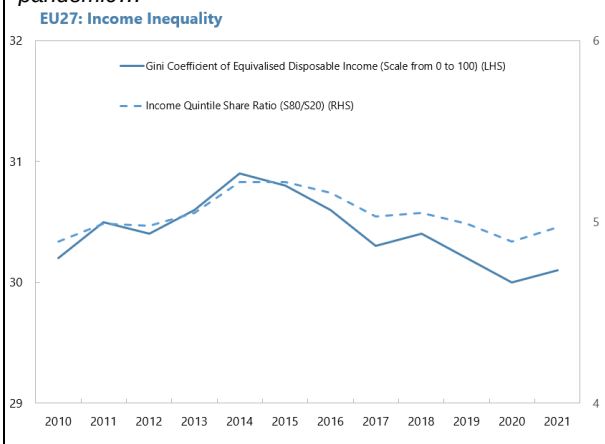
I. Introduction

The need to reduce child poverty has long been recognized in Europe. As early as 2004, the European Commission emphasized, in a report on social inclusion, that "material deprivation among children must be a matter of serious concern" and urged Member States to "focus on eliminating poverty and social exclusion among children" as one of six key priorities (EC 2004). Since then, child poverty has remained high on the European political agenda. Notably, in 2013, in the Recommendation "Investing in children: breaking the cycle of disadvantage" (EC 2013), the EC recommended addressing child poverty and social exclusion through multidimensional strategies. The most recent initiative is the adoption by the European Council, during the COVID-19 pandemic, of the "European Child Guarantee," whose objective is "to prevent and combat social exclusion by guaranteeing effective access of children in need to a set of key services" (UNICEF 2021).

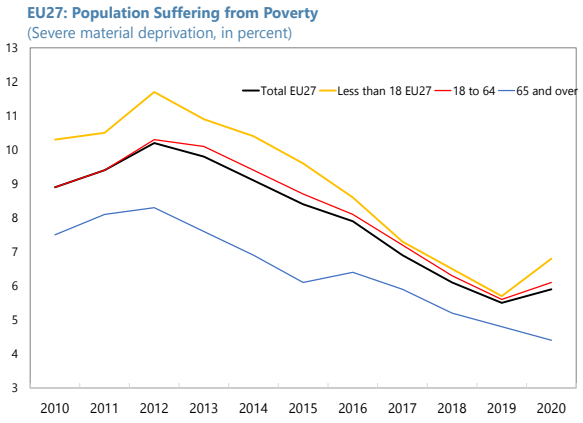
The COVID-19 pandemic has reinforced the urgency of tackling child poverty. The COVID-19 crisis has not increased income inequality in the EU.[1] However, poverty increased and it has disproportionately affected children. While the Global Financial and Sovereign Debt Crises (GFC) did not affect children more than other age groups (the share of children in total poor was broadly stable), the COVID-19 crisis did (Figures 1 and 2). In 2020 alone, the number of children suffering from severe material deprivation increased by 0.9 million in the EU. This represents a 19 percent increase, 3¼ times more than the increase in adult poverty. Moreover, school and nursery closure during the pandemic slowed the accumulation of human capital of children and the educational loss was stronger for poor children.

Figure 1. Inequality and Poverty in the EU (2010–21)

Inequality remained broadly stable during the COVID-19 pandemic…



…but severe material deprivation increased markedly with children more affected than the rest of the population



Source: Eurostat.

The increase in child poverty and in inequality in access to education could be a key channel of the scarring effect of the COVID-19 crisis. First, poverty affects children's life prospects: "Poor children have weaker language and memory than their peers, and these problems continue into adulthood. When they grow up, they have lower earnings and income, are more dependent on public assistance, have more health problems, and are more likely to commit crimes" (Hastings and Smeeding 2019). Second, it will have macro-economic implications

[1] EU (or EU27) covers the 27 current Members States of the European Union (therefore excludes the UK).

via lower productivity and potential growth, increased income inequality, reduced social mobility and social cohesion, and increased fiscal cost.

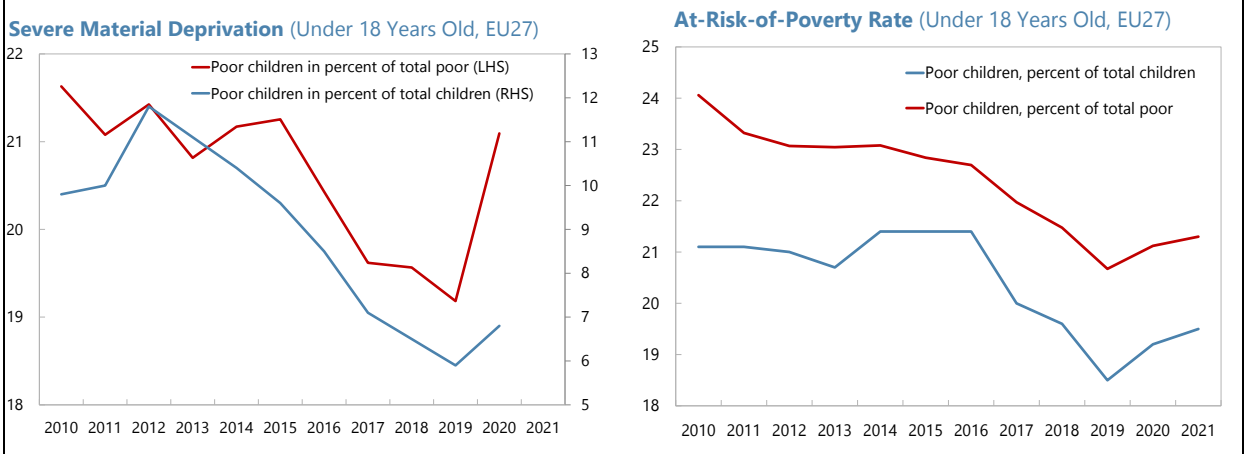
To limit the scarring effect of the pandemic from child poverty, policies should be deployed to reduce rapidly the number of children affected by poverty and to mitigate the long-term impact of child poverty. Labor and fiscal policies have a role to play in both cases. Considering the multidimensionality of poverty and the fact that various policies have substantial synergies and complementarities, labor and fiscal policies should be consistent and implemented as a package. However, required policies would need to be assessed in the context of other policy objectives and constraints, as difficult tradeoffs may arise because policy space has been considerably reduced by the series of shocks that affected the European economy since the pandemic. Moreover, some measures will have a rapid impact while others may require reforms and investments that would take time to implement and bear fruit.

The Working Paper is organized as follows. Section 2 describes trends in child poverty in the EU since 2010 with a particular focus on developments during the COVID-19 pandemic. Section 3 discusses how the rise in child poverty contributes to the scarring effect of the pandemic. Section 4 identifies policies that could reduce child poverty. The role of labor policies (Section 5) and fiscal policies (Section 6) on reducing the level of poverty and on mitigating its impact is then detailed. Section 7 concludes.

II. Child Poverty in the EU and Impact of the COVID-19 Pandemic

Child poverty declined in the last decade. Whether measured by at-risk-of poverty or by severe material deprivation,[2] the child poverty rate declined in the EU. Notably, the share of children suffering from severe material deprivation was cut by half between 2012 and 2019. This decline was faster than for adults, allowing to reduce the share of children in total poor (Figures 1 and 2).

Figure 2. Child Poverty in the EU (2010–21, in percent)



Sources: Eurostat and IMF staff calculations.

[2] See Annex I for a definition and a discussion of the key concepts used in this paper.

The pandemic ended this trend, as child poverty surged. In 2020 alone, the number of children suffering from severe material deprivation increased by 0.9 million in the EU, a 19 percent jump (Table 1).[3] The share of children suffering from severe material deprivation rose by 1.1 percentage point to 6.8 percent. As children fell more into poverty than adults,[4] their share in the population suffering from severe material deprivation increased markedly, erasing, in one year, all the reduction achieved in the second half of the 2010s (Figure 2). Partial evidence suggests that the number of children suffering from poverty is likely to have further increased in 2021. At time of writing, the data for severe material deprivation were not available for 2021, but the at-risk-of-poverty rate rose by 0.3 ppt on top of a 0.7 ppt increase in 2020 (Figure 2). Child poverty may have further increased in 2022 as more people may be unable to afford essential goods due to high inflation (notably of food and energy).[5]

Table 1. Child Poverty During the Pandemic[1/]

	Increase in children suffering from severe material deprivation (2019-20)		Increase in children at risk of poverty (2019-21)	
	Thousands	Percent	Thousands	Percent
EU27	882	19	784	5
EA19	822	27	840	7
Germany	543	186	601	36
Luxembourg	1	100	7	26
Spain	246	50	104	5
Austria	16	29	89	39
Slovenia	2	29	-1	-2
France	160	24	12	0
Romania	132	20	-48	-4
Czech Rep.	6	10	8	4
Latvia	2	10	11	21
Greece	30	9	41	11
Netherlands	7	9	1	0
Lithuania	3	8	-26	-23
Cyprus	0	0	-2	-7
Bulgaria	-3	-1	-40	-12
Sweden	-2	-3	-78	-16
Poland	-17	-10	109	12
Finland	-3	-12	-16	-15
Italy	-88	-14	101	4
Belgium	-20	-15	-85	-19
Hungary	-40	-18	6	3
Croatia	-8	-20	-3	-3
Ireland	-20	-23	-25	-6
Malta	-1	-25	-1	-6
Slovakia	-22	-26	-7	-4
Portugal	-28	-29	25	8
Denmark	-11	-31	-10	-8
Estonia	-3	-38	-4	-9

Sources: Eurostat and IMF staff calculations.
1/ Children under 18. Countries are ranked by the increase in the total number of children suffering from severe material deprivation.

Due to differences in the severity of the economic shock of the pandemic, in policy response, in existing safety nets, and in structural characteristics, not all EU members experienced an increase in child poverty. The number of children suffering from severe material deprivation rose in 12 EU countries in 2020 but decreased in 14 others. Similarly, between 2019 and 2021, the number of children at risk of poverty increased in 13 EU countries but declined in 14 others. The increase in the EU27 as a whole can be explained by a sharp increase in child poverty in most large EU members. The share of children suffering from severe material deprivation increased by 3 percentage points or more in a year in Germany, Romania, and Spain (which together account for almost one-third of EU child population). In Germany alone, the number of children suffering from severe material deprivation almost tripled (Tables 1 and 2).[6]

[3] Data do not allow to identify the dimensions driving the increase in children severe material deprivation in 2020. For the population as a whole, it was mostly due the inability to face unexpected expenses and the ability to eat meat or proteins regularly.

[4] This contrasts with the GFC when the increase in the severe material deprivation rate was similar for children and working age adults.

[5] For example, food banks report that, in France, the number of people receiving food aid increased by 10 percent in 2022, as much as in 2020 and 2021 combined (Ané 2023).

[6] Germany has a relatively large share of children living in households in which no adult is employed (Fuchs-Schündeln and others 2020). Child income poverty started to drift upward after the reunification. The increase in child poverty was, in part, driven by poverty of children headed by a non-citizen and single parenthood (Corak and others, 2005). Recent evidence points to the rising number of working poor and to the role of single parenthood (Schumacher 2023).

Table 2. Heterogeneity in the Impact of the Pandemic on Severe Material Deprivation

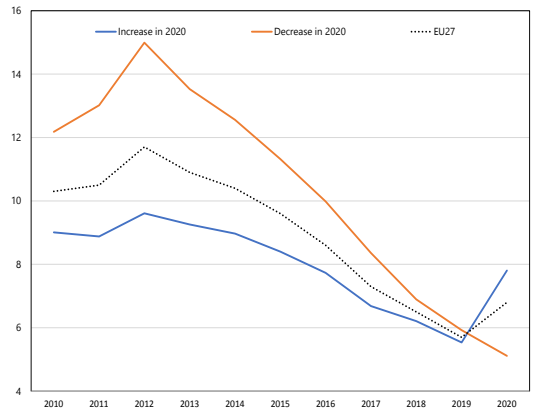
	Severe Material Deprivation increased in 2020					Severe Material Deprivation decreased in 2020			
	Children population		Poverty rate			Children population		Poverty rate	
	Number	In percent of EU total	In 2020 (percent)	Change 2019-20 (ppt)		Number	In percent of EU total	In 2020 (percent)	Change 2019-20 (ppt)
Germany	13,677,902	16.8	5.9	3.8	Sweden	2,155,379	2.6	3.0	-0.1
Romania	3,644,619	4.5	21.4	3.7	Bulgaria	1,189,680	1.5	20.0	-0.2
Spain	8,325,756	10.2	9.0	3.0	Finland	1,058,091	1.3	2.2	-0.2
Greece	1,854,378	2.3	19.4	1.8	Poland	6,913,237	8.5	2.3	-0.3
France	14,540,168	17.9	6.3	1.2	Belgium	2,320,244	2.9	4.6	-0.8
Austria	1,542,621	1.9	4.5	1.0	Italy	9,433,159	11.6	5.7	-0.8
Slovenia	371,395	0.5	2.4	0.5	Denmark	1,156,138	1.4	2.2	-0.9
Lithuania	498,821	0.6	8.6	0.4	Malta	81,948	0.1	3.9	-0.9
Latvia	359,457	0.4	6.3	0.3	Croatia	697,325	0.9	4.7	-1.0
Netherlands	3,337,245	4.1	2.7	0.3	Estonia	257,044	0.3	1.9	-1.2
Czech Rep.	1,999,465	2.5	3.1	0.2	Ireland	1,201,635	1.5	5.4	-1.5
Cyprus	170,553	0.2	11.8	0.1	Portugal	1,717,050	2.1	3.9	-1.7
					Hungary	1,709,048	2.1	11.0	-2.1
					Slovakia	1,011,959	1.2	6.4	-2.3
Total	50,322,380	61.8	7.8	2.3	Total	30,901,937	38.0	5.1	-0.8
Severe Material Deprivation remained unchanged									
Luxembourg	119,539	0.1	1.3	0					

Sources: Eurostat and IMF staff calculations.

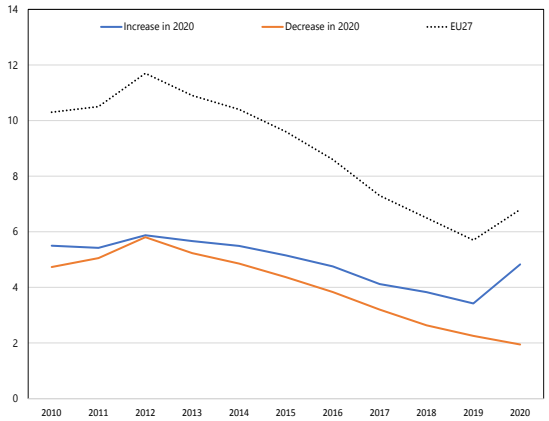
Countries experiencing a decrease in child poverty in 2020 exhibit a different dynamic in the last decade than countries experiencing an increase in child poverty. Possibly reflecting structural differences and differences in policies, the countries experiencing a decline in child poverty during the pandemic are also the countries that had the fastest decline in child poverty post-GFC (Figure 3).

Figure 3. Heterogeneity in Child Poverty Dynamic (2010–20, in percent) [1/]

Severe material deprivation rate of each group



Contribution to EU severe material deprivation rate



Sources: Eurostat and IMF staff calculations.
1/ "Increase (decrease) in 2020" reports the contribution to EU27 Severe material deprivation rate of countries that experienced a increase (decrease) in their national child severe material deprivation rate in 2020. See Table 2 for the country groups. Luxembourg is excluded as the rate of severe material deprivation was unchanged.

Severe material deprivation and at risk of poverty provide a different picture of the pandemic impact of child poverty. The magnitude of the increase in the number of poor children differs significantly depending on the indicator selected (Figure 2). Moreover, severe material deprivation and at risk of poverty point to contrasting developments in some countries (Table 1). For example, Romania experienced one of the largest increases in the share of children suffering from severe material deprivation (+ 3.7 ppt in 2020) but the share of children at risk of poverty declined (- 0.7 ppt in 2020 and - 2.0 ppt if the poverty line is anchored at its 2008 level). Also, the increase in the severe material deprivation rate appears similar across age groups but the at-risk-of-poverty rate increased significantly more for younger children than for older ones (Table 3).

Table 3. Change in Child Poverty Rate During the Pandemic by Age
(EU27, in percentage points)

	Less than 18	Less than 6	6 to 11	12-17
Severe material Deprivation (2019-20)	1.1	1.1	1.0	1.2
At Risk of Poverty (2019-21)	1.0	1.9	0.9	0.0

Sources: Eurostat and IMF staff calculations.

Severe material deprivation is our primary measure of poverty. Severe material deprivation is better suited for a cross-country analysis of poverty than at risk of poverty as it is not sensitive to differences in income levels across EU countries. Whatever the income level of the EU country he/she lives in, a person not being able to eat meat or proteins regularly (in combination with other deprivation indicators—see Annex I) can be considered poor. In contrast, the at-risk-of-poverty measure is sensitive to differences in income levels across EU countries as it counts people below a certain threshold (the poverty line) defined as a percent of each country's equivalized median income (Annex I). To put it simply, as the median income differs across EU countries (and other time),[7] a person with an income of X euros can be considered at risk of poverty in one country but not in another. Moreover, an income-based measure of poverty is insufficient. Poverty is multidimensional (Aaberge and Bandolini 2015; UNICEF 2016) and "must be seen as the deprivation of basic capabilities rather than merely as lowness of income" (Sen 1999). Therefore "a poverty analysis that concentrates only on income can be quite remote from the main motivation behind our concern with poverty (viz. the limitations of the lives that some people are forced to live)" (Sen 1992) as well as its social and economic impact. It is also insufficient from a policy viewpoint. As the next sections will argue, fighting child poverty requires policies that go beyond increasing parental income. For these reasons, as material deprivation measures the enforced inability (rather than the choice not to do so) to afford some goods considered as essential, it constitutes, for our purpose, a better measure of poverty, though, due to its focus on material wellbeing, severe material deprivation may underestimate the importance of services (e.g., access to education, healthcare, etc.) that are emphasized in this Working Paper as crucial to mitigate the impact of poverty. Nonetheless, at risk of poverty will be used to provide to complement data and provide additional insights.

III. The Long-Term Impact of Child Poverty

The long-term impact of child poverty could be a channel through which the pandemic has a scarring effect. Falling into poverty has an immediate impact on the well-being of children. But there is more: the long-term

[7] The "anchored at-risk-of-poverty rate" allows to eliminate the problem of the change in poverty line across time notably its decline in times of economic crisis (see Annex I).

impact of child poverty is large both for the child affected and for economic performance. This section summarizes the evidence of the long-term impact of child poverty.

The Impact of Child Poverty on Affected Individuals

Literature provides overwhelming evidence that a child growing up in poverty experiences worst outcomes throughout his/her life than a child that did not suffer from poverty. Poverty impedes the formation of the "abilities that are so powerfully predictive of adult success and failure" (Heckman 2008). It is associated with lower educational achievements, lower physical and mental health, and behavioral issues.

Poverty affects brain and language development. "Children in poor families have […] been documented to have reduced volumes in the cerebral cortex and hippocampus […]. These areas are associated with executive function, language development, and memory" (National Academies of Sciences, Engineering, and Medicine 2019).[8] The reason is that critical neurological development happens early in life and is extremely responsive to the environment; an environment that poverty affects considerably (Berlin and Gale 2022; Delorme 2022; Dreyer 2022, Heckman 2008, National Academies of Sciences, Engineering, and Medicine 2019). A key mechanism is that poverty is associated by chronically elevated level of stress[9] and anxiety that can lead to permanent changes in brain structure and function (National Academies of Sciences, Engineering, and Medicine 2019; Shonkoff and others 2012; World Bank 2015). Another crucial element of the environment is the caregiver's level of speech. The difference in language between poor and non-poor children emerges as early as 15 or 16 months of age, and by age three, the vocabulary of a child living in poverty is less than half the size of vocabulary of a child from a professional family (Hart and Risley 1995; Heckman 2014; Hoff 2003; National Academies of Sciences, Engineering, and Medicine 2019).

This early impact of poverty contributes to lower educational attainment. Because child poverty affects areas of the brain that are essential for school readiness and leads early to inequality in language and in memory, it contributes to differences in cognitive (and non-cognitive) skills and educational outcomes. Educational outcome and skill acquisition may also be affected by lower quality education and environment in poor neighborhood. Thus, unsurprisingly, socio-economically advantaged students perform better in PISA tests than disadvantaged students (OECD 2019).

The COVID-19 pandemic will magnify the impact of poverty on skill acquisition. The long-term impact of the increase in child poverty during the pandemic is likely to be larger than during a typical economic crisis. The reason is that the pandemic had a significant impact on children's accumulation of human capital because of the widespread school and nursery closure.[10] Evidence shows that the educational loss due to childcare and school closure was more severe for the poorest children. Though there is some preliminary indication that academic performance of children recovers with time when schools reopen, the pace and the magnitude of the recovery remains unclear and it remains to be seen how it differs between disadvantaged and richer students (Agostinelli and others 2022; Andrew and others 2020; Asakawa and Ohtake 2022; Burgess and Sieversten 2020; Carlana and others 2023, Engzell and others 2021; Grewenig and others 2021; Hanushek and Woessmann 2020; Huber

[8] See also, among others, Hair and others (2015) and Heckmam (2008).

[9] Chronically elevated level of parental stress (due to material hardship) affects their relationship and the quality of parenting. This can result in children stress and harm their cognitive and socioemotional development. Blanchflower and Clark (2019) shows that financial difficulties explain the lower self-reported happiness of parents compared to non-parents.

[10] Evidence suggest that the impact is on the acquisition of both cognitive and non-cognitive skills.

and Helm 2020; IMF 2022; Stantcheva 2022; Werner and Woessmann 2021; Schady and others 2023; Strunk and others, 2023).

Child poverty is also associated with health issues. Children living in low-income families have more health issues than other children. They are more likely to be admitted to a hospital, have poor nutrition, and become disabled (Haskings and Smeeding 2019; McLaughlin and Rank 2018). This has several causes. First, low-income parents have less resources to invest in their children and engage less in healthy behaviors (Hoynes, and others 2015). Second, poor children experience higher stress levels (Evans and Garthwaite 2014; Aizer, and others 2016) that affect health. Third, material hardships including food insecurity, poor housing and homelessness, and exposure to toxic substances are also associated with childhood poverty and have health consequences (Almond and Currie 2011; OECD 2018). Finally, not only poor children have more health problems, they also often have a lower access to healthcare. In 2019, financial cost was the main reason for unmet medical needs in the EU. This was ten times more frequent for those in the lowest income quintile than for those in the richest income quintile (Hallaert and Primus 2022). Health issues and poor nutrition may also affect poor children's education attainment.

Literature consistently shows that the childhood poverty is likely to persist throughout life and result in lower economic prospects and inequality. Lower levels of cognitive and behavioral skills as well as lower educational achievement are difficult to overcome. They affect prospects in life and notably labor earnings and capacity to find stable jobs (Berlin and Gale 2022; Haskins and Smeeding 2019; Heckman 2008 and 2014; McLaughlin and Rank 2018; World Bank 2015). Heckman (2008) estimates that "about 50 percent of the variance in inequality in lifetime earnings is determined by age 18." Moreover, the stress associated with child poverty does not only affect brain development but is also associated with diseases in adulthood. For example, Kelly-Irving and others (2013) documents that exposure to stressful conditions and events early on in life increase risk of cancer in adulthood. Health inequalities persist across generations and "a growing number of studies suggest that differences in early life health environments may causally contribute to these disparities" (East and others 2023). Finally, poverty in early childhood, prolonged poverty, and deep poverty are particularly damaging and are all associated with worse child and adult outcomes (Duncan and others 2010; Dreyer 2022; Francesconi and Heckman 2016; Heckman 2008 and 2014; National Academies of Sciences, Engineering, and Medicine 2019).

The Macroeconomic and Social Impact of Child Poverty

"The investments we make today in disadvantaged young children promote social mobility, create opportunity and foster a vibrant, healthy and inclusive society and economy […] It fosters social inclusion and the productivity of the […] workforce and creates a healthier society for all"
James J. Heckman (2014)
Nobel Laureate in Economics

Reduced productivity is an important element of the macro-economic cost of poverty. Holzer and others (2008) estimates that, in the United States, the economic cost of child poverty due to reduced productivity, crimes associated with child poverty, and increased health expenditure reaches 4 percent of GDP. McLaughlin and Rank (2018) adopt a broader coverage of the cost of child poverty to include, among others, the costs associated with child homelessness (such as the shelter system) and the costs associated with increased childhood maltreatment in poor families (such as the costs of the foster care and child welfare systems). They estimate the cost of child poverty to 5.4 percent of GDP. These studies estimate that reduced productivity accounts for about 30 percent of the estimated total cost of child poverty.

Through its impact on productivity, the rise in child poverty during the COVID-19 pandemic is likely to be a channel of scarring. "Scarring—defined as diminished longer-term output relative to pre-pandemic projections—may occur due to pandemic-induced damage to capital, labor, and productivity" (IMF 2022). The rise in the number of children suffering from poverty during the pandemic will contribute to this scarring for two reasons. First, a rise in the level of child poverty means that more children would see their productivity reduced when they reach working age. Second, due to school and nursery closure, the impact of poverty on human capital accumulation and thus on productivity is likely to be larger than in typical crisis.[11]

Another long-term consequence of the rise in child poverty during the pandemic is its impact on social mobility. Child poverty is associated with lower social mobility. Bolt and others (2021) show that intergenerational earnings persistence is mainly explained by differences in investments received during childhood. Chetty and Hendren (2022) document that "policies that directly expand investment in children—especially low-income children—are often the most cost-effective way to reduce intergenerational inequality."

Implications for Policy Priorities

Reducing the scarring effect from the rise in child poverty calls for policies that would reduce the level of child poverty and policies aiming at mitigating the long-term consequences of child poverty.

1) Because the long-term consequences of child poverty increase with the duration in poverty, the priority is to reverse as soon as possible the increase in child poverty experienced during the pandemic. Policy action on this front is important as severe material deprivation is likely to persist beyond the pandemic. Notably, due to high inflation experienced in 2022–23, more people are likely to be unable to afford basic goods such as food.

2) As the impact of child poverty persists in adulthood and thus have a long-term macroeconomic impact, policies aiming at reducing poverty should be complemented by policies mitigating the long-term consequences of child poverty. Policies to boost long-term productivity and aiming at the largest efficiency of fiscal spending should pay particular attention to younger children (from birth to age 5) because early childhood is a critical time to shape abilities and early interventions have a large positive impact on health, individual productivity, future labor earnings, and education. For example, randomized-controlled experiments show spending on birth-to-five quality education programs for disadvantaged children programs produce a 7–13% annual return on investment through increased productivity and lower social cost (Heckman 2008 and 2014; Garcia, Heckman and others 2016). Moreover, early childhood policies are less costly and more efficient than remediation policies at a later stage in life, including during teenage years (Almond and Currie 2011; Chetty and Hendren, 2022; Heckman 2008).

3) Efforts should be broad based. Given the multiple and interrelated channels through which child poverty affects economic prospects, policies cannot be limited to increasing parental income. It is also crucial to support education, access to health, and adequate housing and nutrition. As the pandemic is likely to affect skills accumulation more than typical economic crisis, public investment in children education is crucial.

[11] Drozd and others (2022) argue that the drop in female employment during the pandemic (Figure 7) will reduce less-educated women's future human capital and earnings, which in turn may affect their children' prospects.

IV. The Drivers of Child Poverty: An Econometric Investigation

This section aims at identifying econometrically policies that could reduce the level of child poverty. Policies that mitigate the long-term consequences of child poverty will be discussed in the following sections. Table 4 presents the results. They are robust to different specifications and estimation methods (Annex II and Table 6). As expected, level of child poverty is associated with structural features (notably demographics and income inequality),[12] economic cycle (notably via changes in labor market conditions), and social protection spending.

Child poverty is associated with demographic features such as household size and the prevalence of single parenthood.[13] This is consistent with existing literature (Guio and others 2020; Heckman 2008; McLanahan 2004; OECD 2018) and with the fact that children in single-parent families constitute a growing share of poor children in advanced economies (OECD 2018; Thévenon and others 2018).[14] Importantly for the design of policies, single parenthood is associated with child poverty because single parents' households have lower income and are more at risk of monetary poverty than other households with children. The reason is that Single parents have more difficulties joining the labor market on a stable and full-time basis in part due to the difficulties to combine work with childcare obligations (notably for children below mandatory school age).[15] Their employment rate is lower, their unemployment rate is higher, they rely more on temporary contracts and part-time jobs (Figure 4). When they work, they face a higher in-work risk of poverty. In 2021, 19 percent of working single parents were at risk of poverty. This was twice the rate for other households with children. As discussed in more details in the next section, these constraints highlight that, in the fight against child poverty, policies that improve the single parents' ability to work (more) are important (EC 2018; Heine 2016; Jordan and others 2019; Nieuwenhuis 2017 and 2021; OECD 2014 and 2018; Ruggeri and Bird 2014; Stantcheva 2022).

The impact of the business cycle is significant. Regression results suggest that change in the business cycle affect poverty mostly through its impact on the labor market.[16] Notably, changes in the unemployment rate is strongly associated with child poverty. The dummy for the GFC, which is also highly significant, captures other transmission channels of the crisis. Among the various variables tested to capture the distinctive features of the COVID-19 crisis (i.e., closure of schools and nurseries, containment measures and social distancing—Annex II, Table II.1), the stringency of containment measures performs best. It is (moderately) associated with child poverty but is significant only for younger children, suggesting a possible impact of the closure of childcare centers on parents' capacity to work.

[12] Consistent with other econometric works (Guio and others 2020), income inequality is associated with child poverty.

[13] Even if working parent(s)' labor income is not low, it can be insufficient to avoid poverty if household is size is large.

[14] The prevalence of single parenthood has increased over time in Europe: in 2021, single parent's households accounted for 12.5 percent of households with dependent children. This was a 1.1 percentage point increase in a decade. The shares range from 3.3 percent in Slovenia and Greece to 29.3 percent in Estonia.

[15] Table 4 shows that single parenthood is more strongly and more significantly associated with younger child poverty than with poverty of all children.

[16] The results are robust to another measure of the business cycle: the output gap (Annex II).

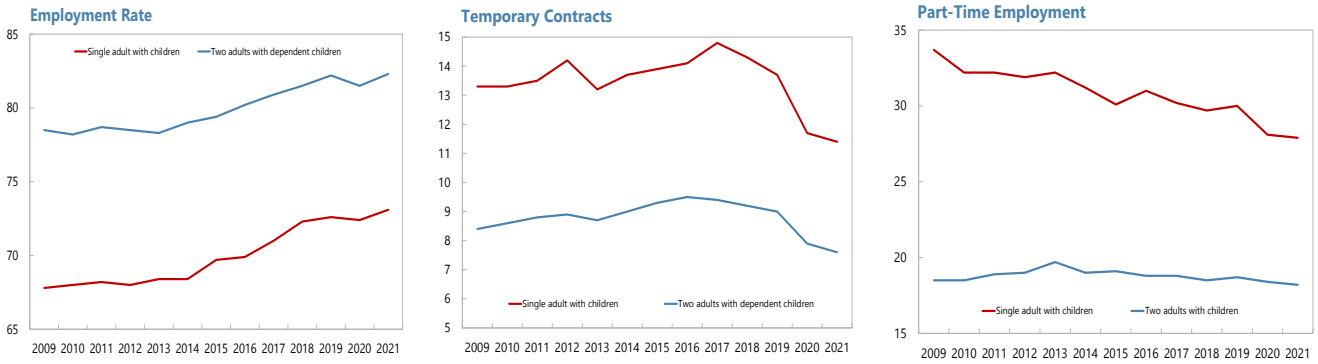
Table 4. Severe Material Deprivation—Panel Regressions (EU27, 2009–20)[1/]

	All Children (Less than 18)		Younger Children (Less than 6)	
	Baseline	(1)	Baseline	(1)
Stringency of containment during the pandemic		0.033 (0.024)		0.061** (0.026)
GFC dummy	0.161**** (0.043)	0.203**** (0.051)	0.188**** (0.054)	0.247**** (0.063)
Gini coefficient	0.101* (0.055)	0.126** (0.060)	0.156* (0.080)	0.186** (0.092)
Average household size	0.354**** (0.058)	0.379**** (0.076)	0.356**** (0.059)	0.429**** (0.053)
Share of children with single parent [2/]	0.203** (0.080)	0.220*** (0.072)	0.285*** (0.108)	0.316**** (0.094)
Unemployment rate	0.229**** (0.043)	0.237**** (0.046)	0.236**** (0.048)	0.256**** (0.040)
Share of children living in households with very low work Intensity [2/]	0.174*** (0.062)	0.194*** (0.066)	0.160**** (0.082)	0.178**** (0.050)
Temporary employment share	0.173* (0.090)	0.211** (0.102)	0.194 (0.126)	0.268* (0.139)
Family and children spending	-0.309**** (0.061)	-0.282**** (0.062)	-0.311**** (0.082)	-0.276**** (0.081)
Other working age spending		-0.147 (0.119)		-0.216 (0.137)
Observations	322	310	322	310
R-Squared	0.623	0.627	0.533	0.539
Adjusted R-Squared	0.582	0.579	0.478	0.481
F-Statistic	60.15****	45.96****	41.03****	32.08****

Source: IMF staff calculations.

Note: Robust standard errors in parentheses, **** p<0.001, *** p<0.01, ** p<0.05, * p<0.10.
1/ See Annex II for details.
2/ For parents of the respective children age group.

Figure 4. Parents' Employment by Household Type (EU27, in percent)



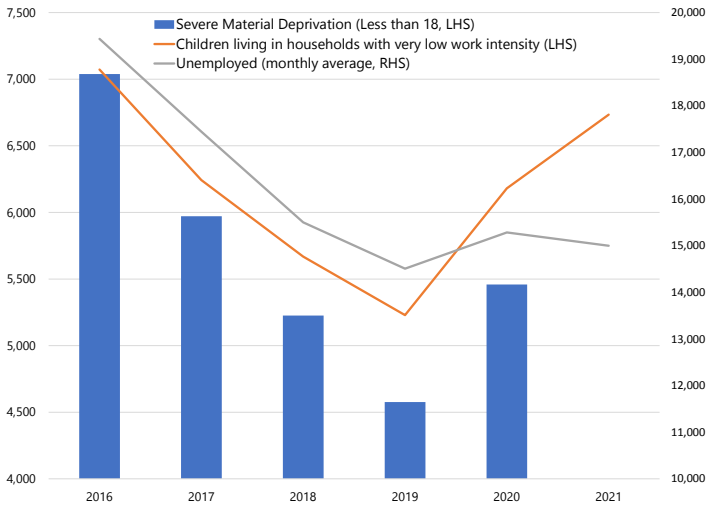
Source: Eurostat.

Labor market participation is associated with child poverty. Parents' difficulties in participating in the labor force on a stable and full-time basis limit their capacity to secure a sufficient and stable labor earning. These difficulties may contribute to child poverty. This mechanism is captured, in Table 4, by the share of households with very low work intensity and the prevalence of temporary employment. It is particularly important during crises:

- During the GFC, on the basis of 11 case studies, Cantillon and others (2017) conclude that "the labor market has been central to the transmission of the impact of the crisis to households with children. In many of the countries studied, increasing child poverty was closely linked to an increase in the proportion of low work-intensity households. In many countries, this meant that the crisis disproportionately increased poverty among specific risk groups that already faced exceptionally high rates of poverty and low attachment to the labor market: notably those with low levels of education, single parents, and those of migrant background."

- During the COVID-19 pandemic, the rapid and forceful deployment of job retention schemes across Europe prevented a surge in unemployment and a sharp decline in employment (Ando and others 2022). The strong link between unemployment rate and child poverty suggests that this policy helped mitigate the increase in child poverty. However, nonstandard workers (such as workers with temporary contracts), who accounted for a large share of the employment in the sectors most affected by the pandemic and were typically not eligible to job retention schemes (Ando and others 2022; OECD 2020a) experienced a stronger decline in employment than other workers. Econometric results suggest that this may have contributed to an increase in child poverty because (i)

Figure 5. Labor Market Development and Child Poverty (EU27, in thousands)



Source: Eurostat.

single parents rely more than other parents on nonstandard forms of work (Figure 4) and (ii) the share of children living in households with very low-work intensity increased during the pandemic (Figure 5).[17]

Finally, the generosity of social protection is negatively associated with child poverty. Table 4 shows that a higher social protection spending on family and children (as a share of GDP) is strongly associated with a lower prevalence of child poverty. Other types of social protection spending benefiting the working age population (proxied by social protection spending excluding old age spending and family and children) increase parents' income and can improve housing and nutrition conditions.[18] As such, they could affect child poverty. Such spending is indeed negatively associated with lower child poverty, but its economic impact is much smaller than the one of family and children spending and it is not statistically significant.

This section has set the stage for the policy discussion. Based on these results, the next sections will discuss how labor market and fiscal policies can reverse the increase in child poverty experienced during the pandemic. They will also discuss policies that would mitigate the long-term impact of child poverty notably.

V. Labor Policies

By increasing parent's income, labor policies can reduce child poverty and mitigate its long-term impact. The rationale is that increasing parents' labor income reduces monetary poverty but also increases parents' capacity to purchase essential goods, thus reducing the whole household material deprivation. If labor policies manage to increase parents' income on a stable basis, they would help mitigate long-term impact of child poverty as a sustained increase in income improves the child environment and allows parent to invest more in children (Section III). This section discusses three ways through which labor policies could increase parental income: (i) increasing the employment rate (or working hours) of parents, (ii) increasing net wage and labor income predictability, and (iii) improving skills.

Increasing Parents' Employment Rate and Working Time

Fostering parents' labor force participation has been increasingly at the core of policies to reduce child poverty in advanced countries. Limiting ourselves to Europe, at the Barcelona Summit of 2002, childcare enrollment targets were set for EU countries (EC 2018). These targets were increased in 2022 (Official Journal of the European Union 2022).[19] The primary objective (and the primary objective of the "Strategic engagement for gender equality 2016–2019") is to increase female labor participation (EC 2016; Heine 2016).[20] Increasing enrollment in quality formal childhood education and care (ECEC) would also foster child development by providing, at a critical age, a nurturing environment essential for future success and productivity. Notably, quality childcare improves school achievement (Borowsky and others 2022; Currie 2001; Duncan and others 2009;

[17] At time of writing, data for severe material deprivation were not available for 2021 but the increase in the number of children living in households with low work intensity in 2021 is one of the reasons to expect that the severe material deprivation has increased further that year, even if unemployment declined. The change in the share of children living with adults with a temporary contract should not play a significant role in 2021 as it was broadly similar as in 2020 (9.8 percent versus 9.8 percent).

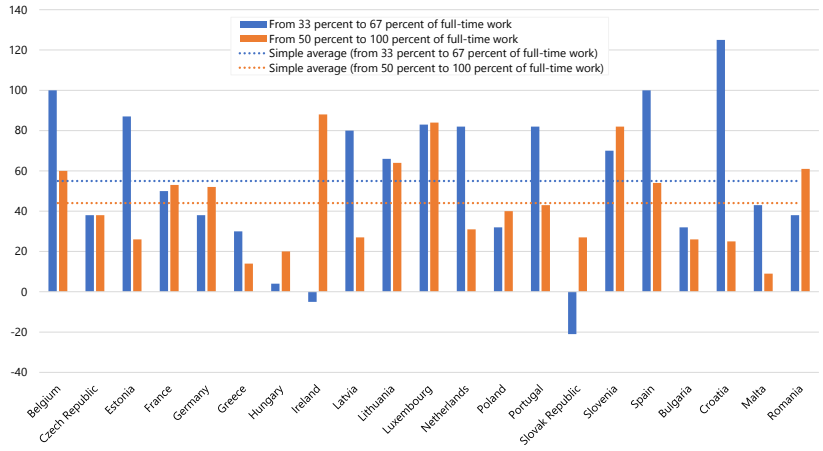
[18] This includes unemployment benefits that mitigate the income shock due to a loss of parental employment.

[19] Initial targets were to provide early childhood education and care to 33 percent of children under 3 and 90 percent of children between 3 and mandatory school age. Revised targets are to reach 45 percent and 96 percent respectively by 2030.

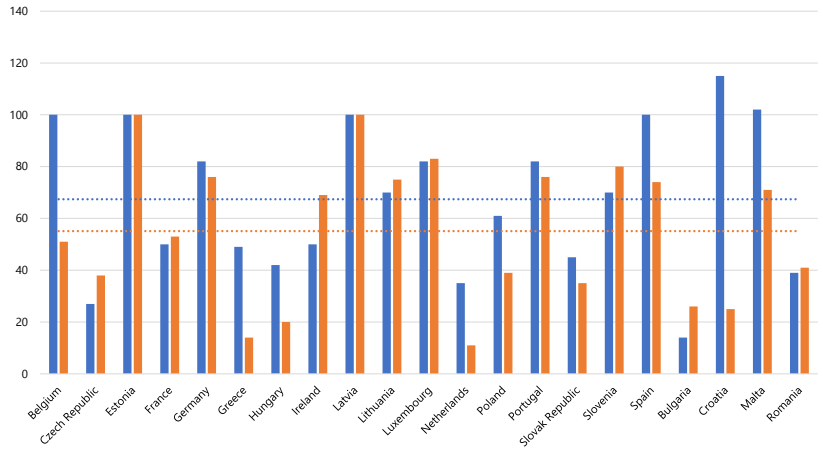
[20] In 2019, 32.6 percent of women outside the labor force indicated that looking after children or adults in need of care was their main reason for not seeking employment. This share declined to 27.9 percent in 2021 and is much higher than for men (7.6 percent in 2019 and 8 percent in 2021). For a broader review of evidence see Morrisey (2017).

Figure 6. Marginal Effective Tax Rates for Parents with Two Children (2021, in percent)[1]

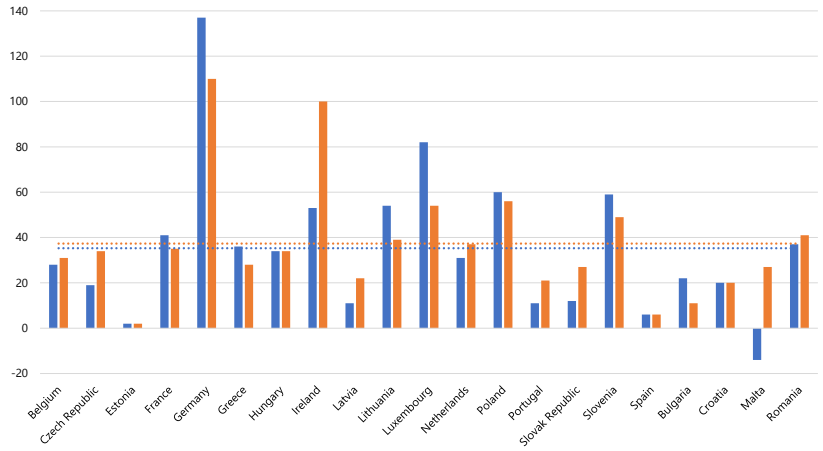
A. Single parents



B. Couples with one working parent



C. Couples with two working parents



Source: OECD (Database on Effective tax rate on increasing working hours).

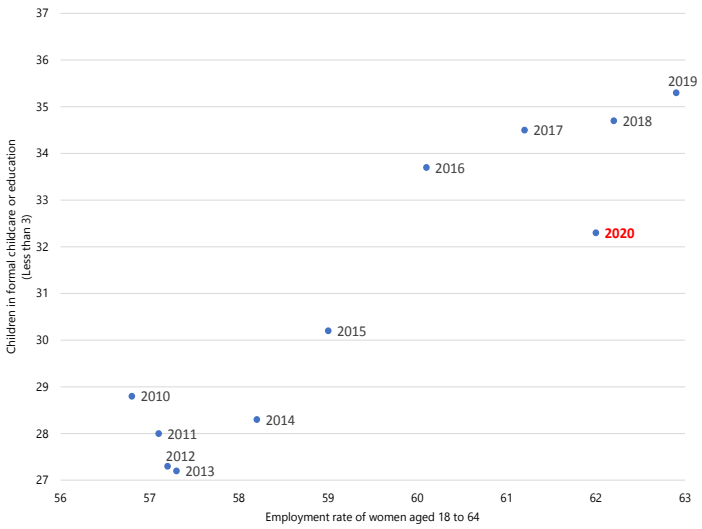
1/ Fraction of any additional earnings lost to either higher taxes or lower benefits when an employed person increases their working hours from 33 percent to 67 percent of full-time work / 50 percent to 100 percent of full-time work. The income includes social assistance benefits and housing benefits. All working parents are assumed to earn the minimum wages. Children are aged 4 and 6.

Duncan and Magnuson 2013; Heckman 2014; Hufkens and others 2019; Morissey 2017). In 2013, the European Commission also recommended member states to implement policies to address child poverty and promoting children's well-being (EC 2013). Though multidimensional, "an important first element of the strategy is to gain access to adequate resources, amongst others by parents' participation in the labor market" (Hufkens and others 2019).

Adjusting the design of the tax and social benefits system could provide additional incentives for parents to work (more) and favor women's labor force participation. Figure 6 reports the fraction of any additional earning lost to either higher taxes or lower benefits when an employed person increases his/her working hours. It shows that the financial incentives for low-wage parents to work more are often low.[21] Notably, in several countries, the total income of a household does not increase (or even declines) if a parent works longer hours (the marginal effective tax rate is 100 percent or higher). However, Figure 6 also shows that it is possible to design a tax and social protection system that reinforces the financial incentives to work more. For example, if a Slovak or an Irish low earner single parent with two children increases its working time from 1/3 of full-time to 2/3 of full time, his/her total income increases by more than the additional labor earning (the marginal effective tax rate is negative). In addition, the tax system can create disincentives for second earner to participate in the labor market. As second earners are often women, eliminating such disincentives would help reduce poverty, foster female labor participation, and eliminate a gender bias. There is evidence that these policies would also have an impact on child development. In the case of the United States, Morris and others (2001) and Morris, Gennetian, and Knox (2002) find that programs that increase both parental employment and family income have positive effects on children's school test scores and child behavior but programs with work requirements that increase employment but not family income (because participants lose benefits) show mostly null effects on child outcomes.

Increasing parent's work intensity also requires policies that remove obstacles to work. Some parents have material difficulties to work more, which can be alleviated by reforms that increase flexibility concerning working hours (to facilitate combining work and parental responsibilities), adequate work-life balance (e.g., sufficient parental leave including paternity leave, possibility of leaves in case of child sickness, facilitating return to work after parental leave, etc.),[22] prevent gender biases in employment, and increase access to childcare.

Figure 7. Employment Rate of Women and Childcare Enrollment Rate of Young Children (EU27, Children less than 3 spending at least 1 hour a week in childcare, in percent)



Source: Eurostat.

[21] Figure 6 presents three scenarios as the marginal effective tax rate is sensitive to assumptions and coverage.

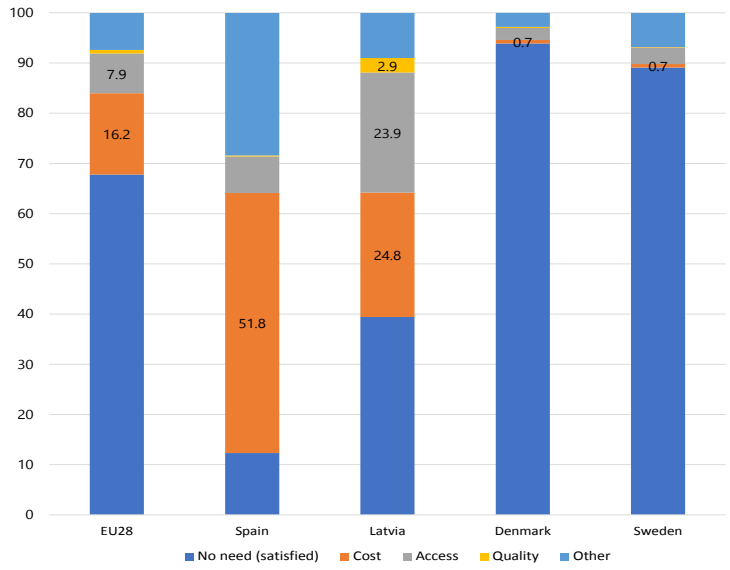
[22] See EC (2017) for details on the legislative and non-legislative initiatives related to work-life put forward by the European Commission.

EU policy to increase the use of childcare highlights the impact of removing obstacle to work. Over the 2010s, the enrollment of younger children enrollment of younger children increased by about 6 percentage points in the EU and was accompanied by a similar increase in female employment rate (Figure 7, EC 2018).[23]

Reducing the cost of childcare has been instrumental in increasing its use. There are several reasons why parents do not use (or use more) formal childcare. In the EU, the main impediment is financial cost (Figure 8). Through tax cuts and benefits, the cost of childcare paid by parents is much reduced and has declined substantially in recent years (Figure 9). This reduced the cost of employment and, in turn, increased the use of childcare and parents' employment and work hours. [24]

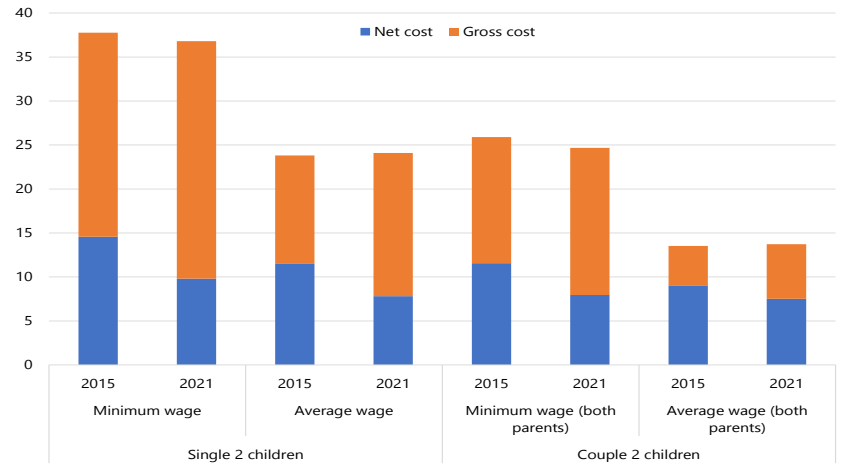
Despite the reduction in cost, childcare remains an obstacle to low-income parents' work. Access to childcare remain relatively more expensive for parents earning minimum wage than for parents earning average wage, though the gap is narrower in 2021 than in 2015 (Figure 9). Moreover, the OECD (2020b) estimates that in almost all 22 EU countries for which data are available the effective tax rate on entering full-time employment increases when childcare cost is accounted for (Figure 10). This suggests, again, that there is scope to adjust the design of the

Figure 8. Main Reasons for not Using (More) Formal Childcare (2016, in percent of households with at least one child aged 12 or less)[1]



Sources: EU-SILC ad-hoc module on services 2016 and IMF staff calculations.
1/ Access aggregates "Distance," "No place available," and "Opening hours" as reasons for not using (more) formal childcare services.

Figure 9. Childcare Cost by Type of Household in the EU (in percent of net household income)[1]

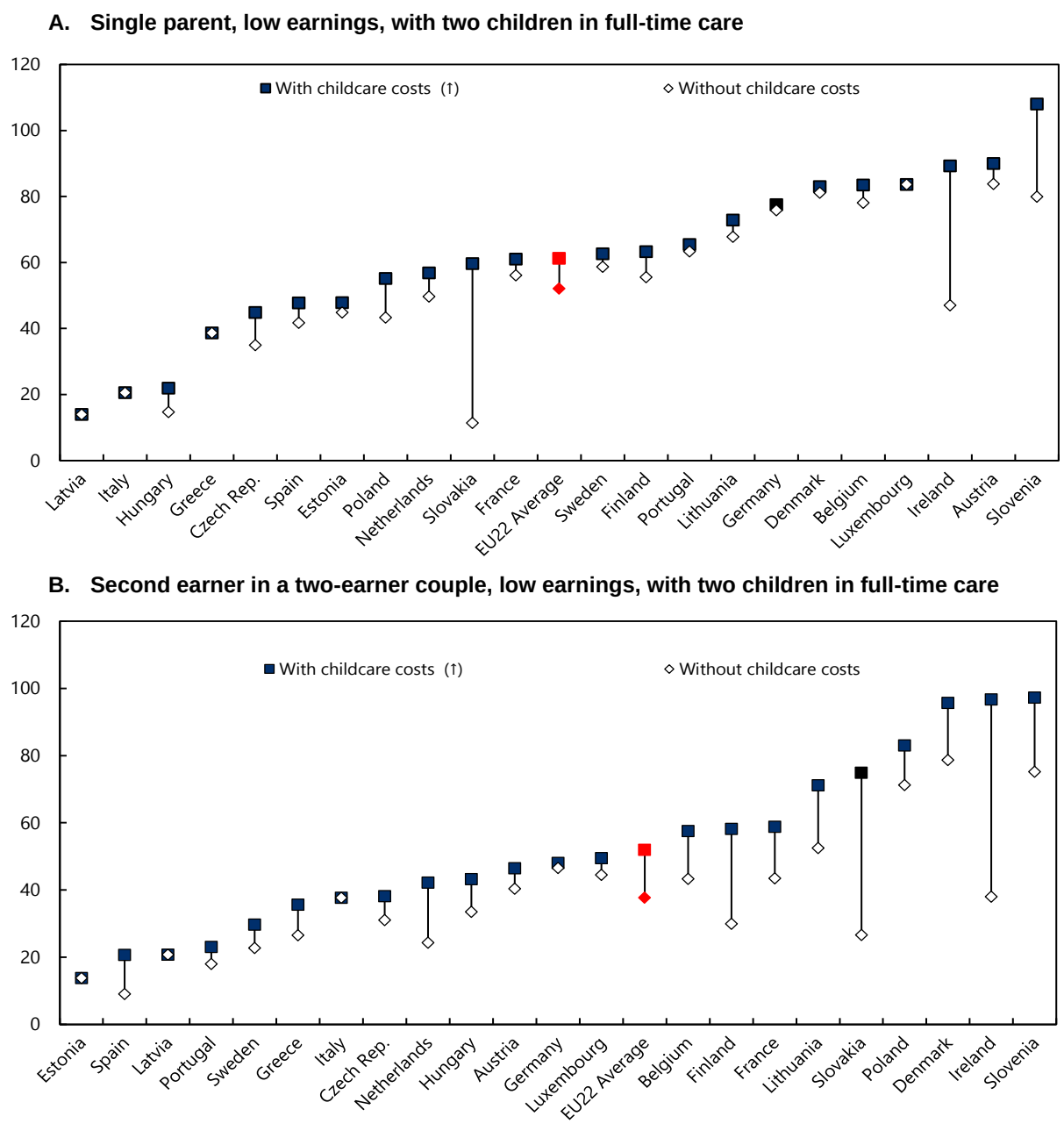


Sources: OECD and IMF staff calculations.
1/ Simple average of cost for 21 EU member states. The cost is for full-time center-based childcare for parents working full time. The difference between gross and net cost reflects the impact of support through taxes and benefits. Net household income includes social assistance.

[23] A positive association is also found for children aged 3 to the minimum school age that spend at least 30 hours in childcare per week. However, if they spend between 1 and 29 hours in childcare, the association is negative. This highlights that to foster parental work, childcare is more important for parents with young children and needs to be available for a sufficient duration.
[24] See Morrissey (2007) for a review of theory and evidence.

tax and benefits system to reduce poor parents' disincentives to work. The European Child Guarantee, which aims to provide free ECEC for disadvantaged children, should further reduce childcare cost for the poorest.

Figure 10. Effective Tax Rates on Entering Full-time Employment for Low Earners With and Without Childcare Costs (2019, in percent)[1]



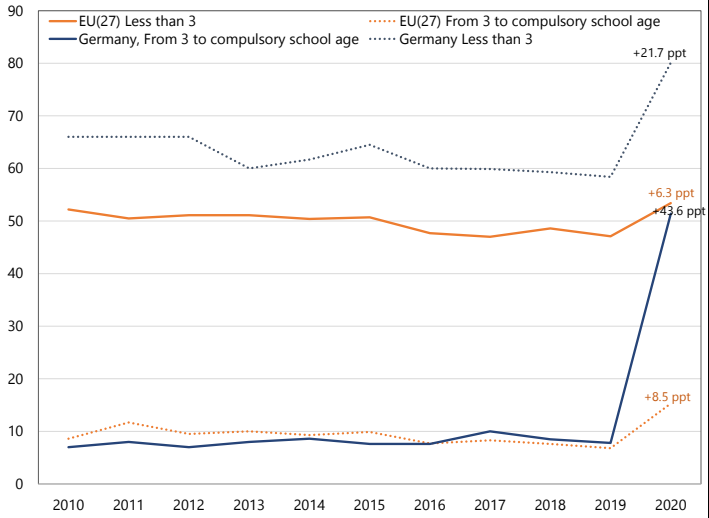
Source: OECD (2020b).

1/ Data reflects the net cost of full-time care in a typical childcare center. Children are aged 2 and 3. 'Full-time' care is defined as care for at least 40 hours per week. Family has no childcare costs if one parent is not in paid work. Low earnings refer to 20th percentile on the full-time gender-specific earnings distribution. Two earners are assumed for couples, male and female, with the female partner as the second earner. For single parents, women's earnings distribution is assumed. In countries where local authorities regulate childcare fees, childcare settings for a specific sub-national jurisdiction are assumed.

Though increasing access to childcare has promoted women's' labor market participation, its impact on child poverty is muted. Due to the complexity of the enrollment process (Hermes and others 2023) and the financial cost (directly and through the effective tax rate), parents that benefit most of childcare services are not the poorest. In the EU, children under three enrolled in childcare centers are overrepresented in higher income quintiles (Hufkens and others 2019). In the case of France, Boone and Goujard (2019) find that "only 30 percent of children in the least well-off third of the population benefit from 'formal' childcare services […] compared with nearly 60 percent for the population as a whole."[25] Given the beneficial impact of ECEC for child development, this unequal use of childcare services may entrench social disadvantages and reduce social mobility. Again, this suggests that fostering parents' employment to reduce child poverty requires a stronger focus on the obstacles to work faced by the poorest.

Lockdowns and social distancing during the COVID-19 pandemic increased obstacles to work. Both the employment rate of women and in the enrollment rate of children in formal ECEC dropped (Figure 7). The proportion of children taken care only by parents increased (Figure 11). However, the causality between ECEC closure and women's employment rate is unclear. On the one hand ECEC closure and social distancing may have reduced some women's work capacity and their labor force participation.[26] However, the decline in the employment rate of women is proportionally similar to the decline in the employment rate of men of the same age. On the other hand, the demand for childcare may have declined because women tended to work heavily in sectors most affected by lockdowns.[27]

Figure 11. Share of Children Cared Only by Parents
(EU27, in percent)



Source: Eurostat.

Increasing Net Wage and Labor-Income Stability

In addition to reforms that would reduce the marginal effective tax rate, several policies can boost poor parents' take-home wage, and thus, incentives to work. A first option is to increase the minimum wage. Though this can help reduce child poverty, it may also reduce employment opportunities for low-skilled poor parents. Another option is to reduce payroll taxes at the low end of the pay scale. If contributions paid by employees are cut, they increase the net wage of low-earner parents without increasing the labor cost for employers. If contributions paid by employers are cuts, evidence shows that it could significantly increase job opportunities through a significant creation of low-skilled jobs without reducing the level of the minimum wage

[25] These findings are consistent with a large body of literature (Förster and Verbist 2012; Hufkens and others 2019; Van Lancker 2013 and 2018; Van Lancker and Ghysels 2012).

[26] Mothers, as the main care takers, are the ones who mainly adapt their working hours (Misra and others 2007).

[27] Moreover, the decline in the employment rate of single parents (whose capacity to work depends more on childcare availability) was proportionally smaller than for parents in couple (Figure 4).

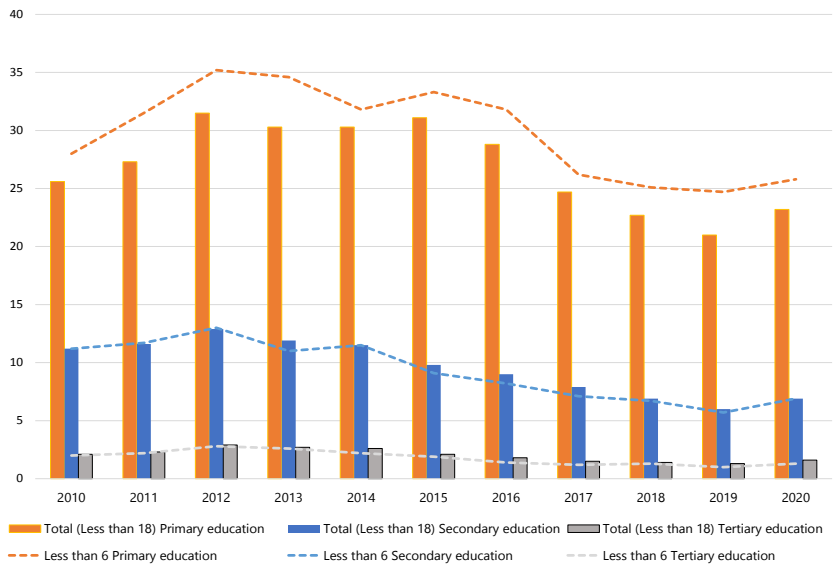
(L'Horty and others 2019; Orliac et Nouveau 2012). Finally, a tax credit similar to the U.S. Earned Income Tax Credit can be considered. Evidence shows that it increased labor supply (notably encouraging single parents to work) and has been successful at reducing poverty. It is also linked to improvement in the health and human capital of children in families benefiting from it. (National Academies of Sciences, Engineering, and Medicines 2019; Berlin and Gale 2022; Pulliam and Reeves 2021).

Not only a stable and predictable income reduces the level child poverty (Section III), but it also mitigates its long-term impact. It reduces mental stress and improves parenting behavior (Blair 2010; World Bank 2015) and, in a randomized-controlled trial, has a positive impact on infant brain activity (Troller-Renfree and others 2022). Moreover, children attend school longer when parents have a stable level of income across early childhood and adolescence (Carneiro and others 2021). Finally, a stable income provides a better social protection. An unstable job is a disadvantage in European countries where social protection is tied to stable employment contracts. It was particularly a disadvantage during the COVID-19 pandemic as, in most European countries, the job retention schemes protected only stable workers (Ando and others 2022; OECD 2020a). The active labor market policies and structural and legal reforms that help increasing poor parents' employment can also help increasing job stability. Affordable childcare with adequate opening hours can also help. Finally, improving the skills of parents increase chances of finding a stable job.

Improving Skills

Better skills provide access to better jobs, more job opportunities, and higher wage. The link between parents' educational attainment level and children severe material deprivation is very strong (Figure 12 and Annex II). This points to the need to provide adequate and subsidized training to parents with the lowest educational level. In the long term, educational policies have a role to play to reduce as much as possible drop-out rate and provide adequate work skills (see below). This will also reduce the intergenerational transmission of poverty.

Figure 12. Child Poverty by Parental Educational Achievement
(EU27, in percent)



Source: Eurostat.

Since the mid-1990s, the focus of policies aiming at reducing poverty has increasingly been put, in advanced economies, on fostering work,[28] but labor policies need to be complemented with fiscal policies. This section has described how labor policies can alleviate child poverty. In doing so, it showed that they

[28] This was part of a broader change in the design of and ideas about the welfare state (Mounk 2017; Van Lancker 2013).

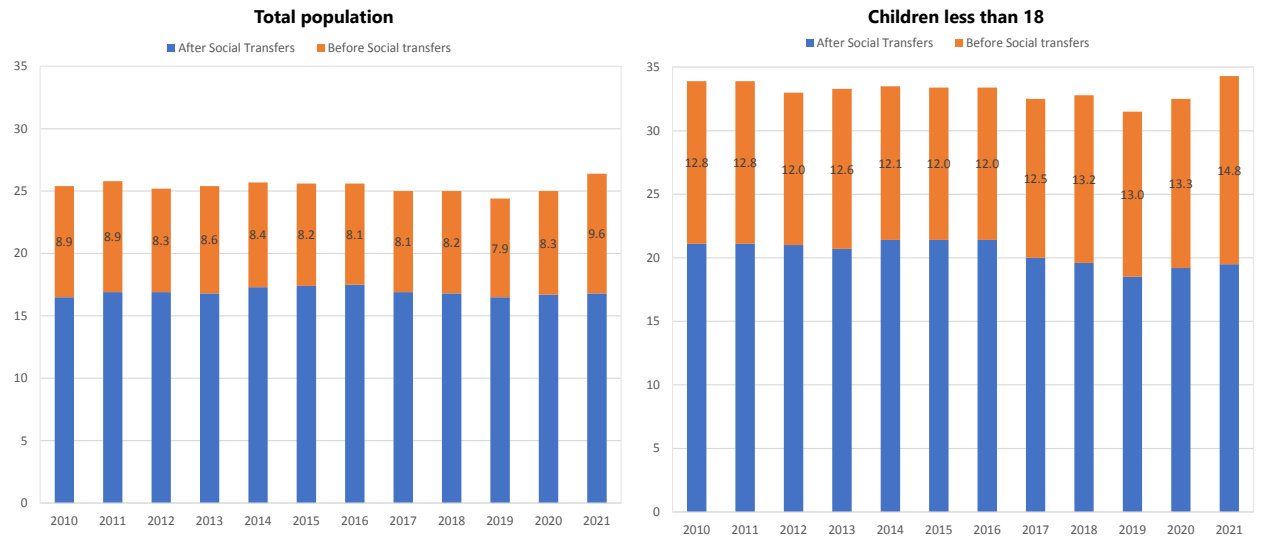
need to be consistent with and complemented by other policies notably fiscal policies. Moreover, as their impact will take time to materialize, reducing child poverty rapidly post-COVID-19 will depend crucially on fiscal policies.

VI. Fiscal policies

Fiscal spending has a critical role to play in reducing rapidly child poverty post COVID-19.[29] The level of social protection spending on family and children is strongly associated with the level of children's severe material deprivation (Table 4). Moreover, social transfers significantly reduce the number of people suffering from monetary poverty, and their impact on children is larger than for the rest of the population (Figure 13). Crucially, unlike labor policies, the impact of fiscal spending is rapid. The first part of this section draws the lessons of the post-GFC policies to guide post-pandemic spending on family and children.[30]

Fiscal spending has also a role to play in mitigating the long-term impact of child poverty. Although there is evidence that family and child benefits have a positive impact on poor children's brain activity, health, educational achievement, and future earnings, the literature points that it is not sufficient nor the most efficient way to mitigate long-term impact of child poverty (Barr and others 2022; Copeland and others 2022; Francesconi and Heckman 2016; Heckman 2014; Pulliam and Reeves 2021; Troller-Renfree and others 2022).[31] Therefore, the second part of this section discusses how public investment in physical infrastructures and human capital can mitigate the scarring effect of the rise of child poverty during the pandemic.

Figure 13. Reduction in the At-Risk-of-Poverty Rate Due to Social Transfers (EU27, in percentage points)[1, 2]



Source: Eurostat.

1/ The at-risk-of-poverty threshold is set at 60 percent of the national median equivalized disposable income after social transfers.

2/ Data labels report the reduction of the at-risk-of-poverty rate achieved by social transfers. Pensions are counted as income (before social transfers) and not as social transfers.

[29] Moreover, this policy has the support of the population. Surveys report a strong demand from the population for governments to reduce child poverty and to provide childcare support to working parents (Annex III).

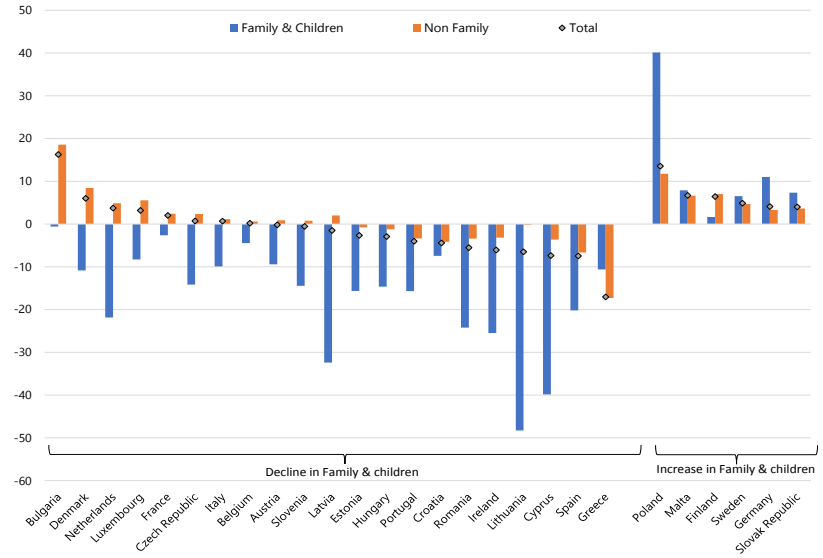
[30] Unless otherwise specified, spending on children and family refers to social protection spending on children and family.

[31] Glass and others (2016) also argue that differences in state-provided family support explain differences in parent happiness across countries. Reduced parental stress is conducive to a more nurturing environment which affects child development.

Structural Changes in Spending on Family and Children Post-GFC

Spending on family and children contributed more than other social protection areas to the post-GFC fiscal consolidation. Due to freezing or under indexation, tightening of eligibility conditions (e.g., in Greece, Hungary, the Netherlands), cuts and caps on social protection spending and parental leave policies (e.g., Czech Republic, Ireland, Estonia) (OECD 2014; Bargain and others 2017), spending on family and children declined in real terms in most EU countries. In contrast, spending on other social protection areas increased in the majority of EU countries or were cut less than family and children (Figure 14 and Table 5). Notably spending on old age and survivors were protected from cuts. As a result, the share in family and children in total social protection spending declined from 2009 to 2013 (Figure 15 and Table 5) fueling concerns with the consequences of underinvestment in children. The "unequal distribution of the austerity burden" (Cantillon and others 2017) also increased inequality across generations. This prompted calls to rebalance the social protection system (Chen and others 2018; Gibson-Davis and Percheski 2018; Hammer and others 2018; Hüttl and others 2015). Concerns with the distribution of spending across generations are not new. They date back at least to the 1980s when Preston (1984) argued that, by prioritizing the elderly over children, future generations would have insufficient resources to thrive.

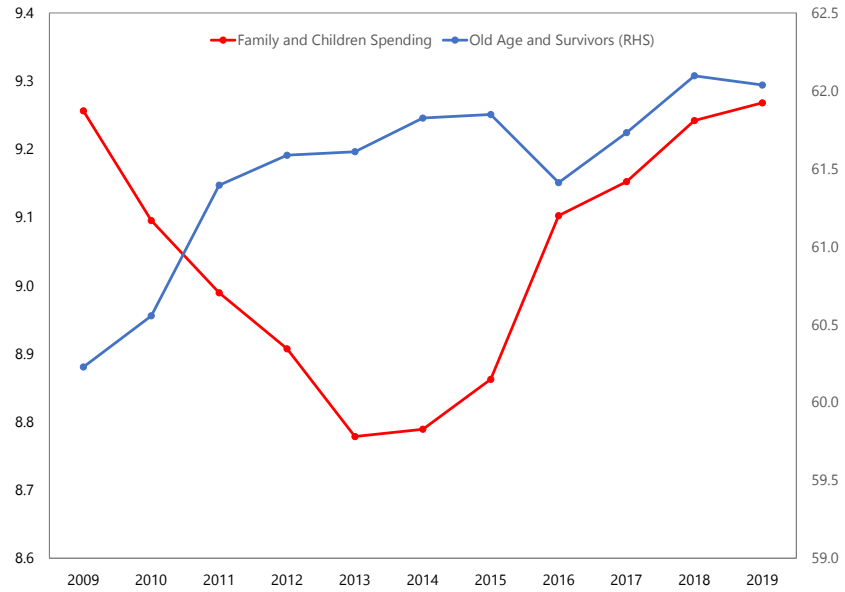
Figure 14. Post-GFC Consolidation: Impact on Social Protection Spending (Changes in percent, EU27, per inhabitant at constant 2010 prices)[1/]



Sources: Eurostat and IMF staff calculations.

1/ Change between the peak in family spending during the GFC and the trough post-GFC (no later than 2015). If no peak (no cut in family spending): Changes over 2009-2013. See Table 5 for precise dates.

Figure 15. Family and Children Versus Old Age and Survivors Spending (EU27, in percent of social protection spending)



Sources: Eurostat and IMF staff calculations.

Table 5. Impact of the Post-GFC Fiscal Consolidation on Social Expenditure of EU countries
(Change in percent, in nominal terms, in local currency)[1]

	Family and Children		Non-Family and Children		Total Social Expenditures	
	Pre-GFC 1/	Post-GFC Consolidation 2/	Pre-GFC 1/	Post-GFC Consolidation	Pre-GFC 1/	Post-GFC Consolidation 2/
Lithuania	157.6 (2005-09)	-35.4 (2009-13)	96.9	-2.6	104.5	-7.8
Latvia	173.8 (2005-08)	-24.6 (2008-12)	80.8	11.5	90.2	6.2
Ireland	44.1 (2005-09)	-19.3 (2009-14)	51.2	0.1	50.2	-2.6
Portugal	35.4 (2005-09)	-17.9 (2009-12)	21.0	-3.2	21.8	-4.1
Spain	48.0 (2005-09)	-17.2 (2009-14)	44.0	-3.6	44.2	-4.4
Slovenia	41.9 (2005-11)	-12.3 (2011-15)	38.3	2.7	38.6	1.3
Netherlands	16.1 (2005-09)	-11.1 (2009-13)	-4.4	14.6	-2.8	12.3
Italy	31.1 (2005-09)	-8.5 (2009-10)	17.7	2.7	18.4	2.1
Greece	46.0 (2005-09)	-8.3 (2009-11)	45.9	-5.1	45.9	-5.3
Czech Rep.	42.0 (2005-09)	-7.2 (2009-12)	33.0	3.9	34.0	2.5
Estonia	91.1 (2005-10)	-4.0 (2010-13)	82.5	13.3	83.7	10.9
Hungary	36.5 (2005-10)	-3.9 (2010-12)	25.7	5.3	27.2	4.0
Luxembourg	46.5 (2005-10)	-3.9 (2010-11)	33.5	-1.1	35.6	-1.6
Austria	19.1 (2005-10)	-3.6 (2010-12)	24.3	7.1	23.7	5.9
Belgium	23.0 (2005-09)	13.4 (2009-13)	27.4	15.3	27.0	15.1
Denmark	26.0 (2005-09)	3.0 (2009-13)	26.2	16.2	26.2	14.4
Finland	21.6 (2005-09)	15.1 (2009-13)	24.4	23.9	24.1	22.9
France	13.0 (2005-09)	8.6 (2009-13)	18.6	12.1	18.0	11.7
Germany	13.4 (2005-09)	16.7 (2009-13)	8.2	5.6	8.6	6.5
Poland	47.6 (2005-09)	32.0 (2009-13)	40.9	15.0	41.2	16.1
Slovakia	31.4 (2005-09)	25.5 (2009-13)	48.4	14.0	46.7	15.1
Sweden	26.8 (2005-09)	17.3 (2009-13)	12.9	12.8	14.5	13.4

Sources: OECD (Social Expenditure Database) and IMF staff calculations.
1/ Change 2005 to peak in total family spending during the GFC. If no peak, up to 2009.
2/ Consolidation took place over different periods across the EU. The column reports change in spending in total family spending form its GFC peak (or 2009 if no peak) to its trough post-GFC (or 2013 if there is no trough).

During the pandemic, the social protection system again shielded better the elderly than children. Though the impact of the post-GFC fiscal consolidation on the level of spending on family and children was soon reversed,[32] it remains small and much smaller than spending on old age and survivors (Figure 15). This difference in the size of transfers may explain why (and despite a sharp increase in spending on family and children in 2020),[33] the share of elderly suffering from severe material deprivation decreased during the pandemic, while it increased for children and the working age population (Figure 1). Another contributing factor may be the change in the way family and children benefits are delivered.

Unlike other social protection areas, spending on family and children has been increasingly provided in-kind and means-tested (Figure 16).[34] In real terms, total social protection benefits for family and children per

[32] Starting in 2014, the nominal social protection spending on family and children grew faster than total government spending or total social protection spending. As a share of GDP, family and children spending were back in 2019 to their level of 2008-09.

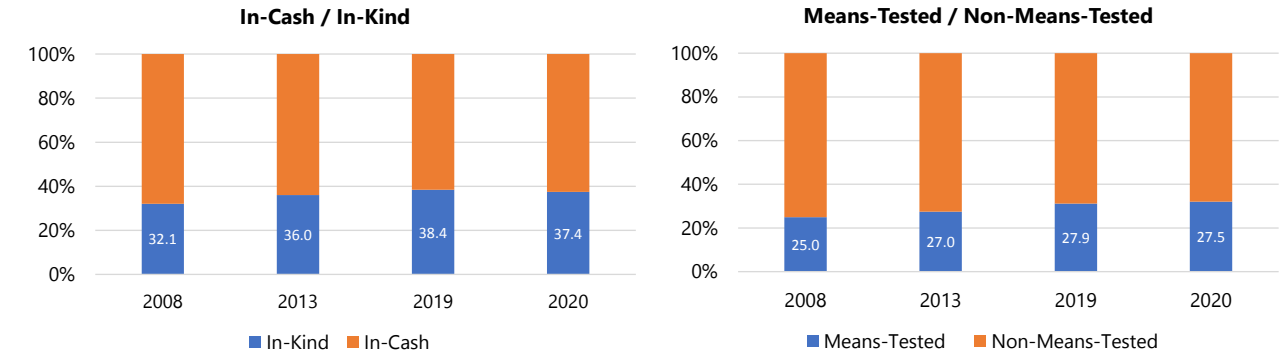
[33] In 2020, for the EU27 as a whole, social protection spending on family and children increased at the same rhythm (9.2 percent) than total social protection spending (8.8 percent) or total general government spending (9.2 percent).

[34] The share of social protection spending excluding family and children that is means-tested was at 9 percent in both 2008 and 2019. The share that is provided in kind stood, in both years, at 34 percent.

inhabitant increased by 1.8 percent a year on average between 2008 and 2019. The benefits provided in kind grew by 3.5 percent, much more than the 0.9 percent annual increase for in-cash benefits. Similarly means-tested benefits increased faster (2.9 percent per year) than non-means-tested benefits (1.5 percent). More specifically:

- The increase in family and children expenditure by 0.2 percent of GDP between 2008 and 2019 in the EU was entirely due to in-kind spending. This is driven by the increase of spending on childcare. It has grown steadily over the past two decades and was protected from cuts during the post-GFC consolidation (Figure 17). In other terms, the post-GFC cuts in family and children spending are due to cuts on in-cash spending, which in some countries were significant in real terms (Figure 14).
- Most of the increase in the share of means-tested family and children spending took place during the post-GFC fiscal consolidation but continued at a slower space afterwards.

Figure 16. Changes in the Delivery of Family and Children Social Protection Benefits (EU27, in percent, Euro per inhabitant at constant 2010 prices)

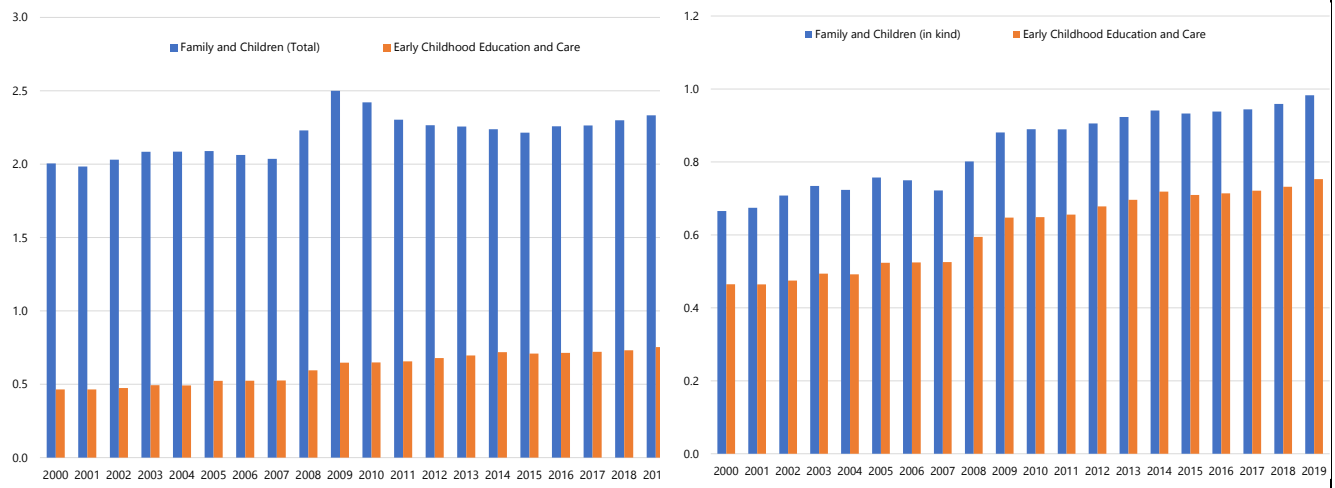


Sources: Eurostat and IMF staff calculations.

Figure 17. Evolution in In-kind Family and Children Social Protection Benefits (In percent of GDP)[1/]

ECE and total spending on family and children

ECE and in-kind spending on family and children



Sources: OECD and IMF staff calculations.

1/ Simple average for the 22 EU countries that are members of the OECD.

The COVID-19 pandemic reversed the post-GFC trends (Figure 16). Despite the forceful deployment of job retention schemes, the labor income of parents declined during the pandemic. The drop in the use of childcare affected in-kind spending (Figures 7 and 11). Thus, support during the pandemic relied on in-cash support. In real terms, in-cash family and children spending per inhabitant grew by 7.2 percent, much more than any time since the GFC (less than 1 percent per year on average). For the first time since the GFC, it also grew faster than in-kind spending.[35]

Increasing the Efficiency of Spending on Family and Children Post-Pandemic

To reduce the scarring effect of the COVID-19 crisis, post-pandemic fiscal consolidation should spare spending on family and children. Post-pandemic, government budgets have had to accommodate increased spending demands to mitigate the impact of rising food and energy prices and to strengthen external security, while a tighter fiscal stance is needed to fight inflation and rebuild fiscal buffers. Therefore, despite its importance, an increase in fiscal spending to reduce rapidly child poverty may not be perceived as a priority. In Germany, for instance, increasing spending to tackle the sharp increase in child poverty faces difficult tradeoffs. As part of the preparation of the 2024 budget, the German government discusses a possible "Basic Child Security" plan that would bundle various benefits and allowances and would simplify the application process by moving it online. This is expected to help the application of vulnerable groups such as single parents and immigrant families and reduce the stigma for applying for support. However, in large part because of its cost (estimated at about EUR 12 billion), the plan has been met with some resistance within the ruling coalition (Schumacher 2023). If, increasing family and children spending is not an option, cutting them for fiscal consolidation purposes, as was done post-GFC, would delay the decline in child poverty and, thus, increase the scarring effect of the pandemic and ultimately lead to higher fiscal cost due to the need for mitigation policies.

In this context, policies should aim to, at least, maintain current level of social protection spending on family and children, while increasing their efficiency. Table 5 breaks down the "family and children spending" variable of the baseline regression into four categories to identify the relative efficiency of in-cash and in-kind benefits as well as means-tested and non-means-tested transfers. The results suggest that:

1) Relying more on in-kind spending would increase the efficiency of family and children spending on poverty of younger children but would reduce its impact on poverty of older children. The combined impact of in-kind spending on young children's poverty is stronger than the combined impact of in-cash spending (-0.49 vs. -0.34). In contrast, for all children, the combined impact of in-cash spending on poverty is stronger than the impact of in-kind spending (-0.38 vs. -0.24). This difference can be explained by the fact that spending on early childhood education and care accounts for the bulk of in-kind spending, and, by design, benefits younger children and their parents.

2) Non-means-tested spending have a larger impact on child poverty than means-tested spending. This is true for both in-cash and in-kind spending. Notably, means-tested in-kind spending has no statistically significant association with child poverty (and is not associated with a reduction in child poverty) suggesting that the means-testing of ECEC may not be sufficient to increase the use of childcare by poorer parents. The relatively smaller impact of means-tested spending is likely to relate to pitfalls related to the design of means-testing: (i) eligibility criteria might be too tight and prevent support to those in need, or might be too generous and provide support to parents who do not need it, (iii) a proportion of recipients are neither poor nor entitled to

[35] At 2.9 percent, the growth of in-kind spending in 2020, was also lower than the annual average of 3.8 percent over 2008-19.

receive the benefits, and (iii) some poor parents do not apply to benefits they are eligible to because of stigma, complex and invasive procedures, or unawareness. Moreover, the means-testing needs to be well designed so

Table 6. Severe Material Deprivation—Panel Regressions Breaking Down Social Benefits (EU27, 2009-20)[1/]

	All Children (Less than 18)		Younger Children (Less than 6)	
	Baseline	Breakdown	Baseline	Breakdown
GFC dummy	0.161****	0.206****	0.188****	0.222****
	(0.043)	(0.036)	(0.054)	(0.043)
Gini coefficient	0.101*	0.058	0.156*	0.081
	(0.055)	(0.057)	(0.080)	(0.069)
Average household size	0.354****	0.374****	0.356****	0.352****
	(0.058)	(0.065)	(0.059)	(0.045)
Share of children with single parent [2/]	0.203**	0.188***	0.285***	0.291****
	(0.080)	(0.070)	(0.108)	(0.088)
Unemployment rate	0.229****	0.219****	0.236****	0.241****
	(0.043)	(0.042)	(0.048)	(0.042)
Share of children living in households with very low work Intensity [2/]	0.174***	0.188****	0.160****	0.164****
	(0.062)	(0.057)	(0.082)	(0.041)
Temporary employment share	0.173*	0.210***	0.194	0.249***
	(0.090)	(0.073)	(0.126)	(0.092)
Family and children spending:				
1) Total	-0.309****		-0.311****	
	(0.061)		(0.082)	
2) In cash (Means tested)		-0.124***		-0.099**
		(0.041)		(0.049)
3) In cash (Not means tested)		-0.258****		-0.239****
		(0.043)		(0.048)
4) In kind (Means tested)		0.011		0.035
		(0.102)		(0.124)
5) In kind (Not means tested)		-0.255**		-0.526***
		(0.099)		(0.174)
Observations	322	310	322	310
R-Squared	0.623	0.657	0.533	0.573
Adjusted R-Squared	0.582	0.612	0.478	0.517
F-Statistic	60.15****	47.51****	41.03****	33.33****

Source: IMF staff calculations.
Note: Robust standard errors in parentheses, **** p<0.001, *** p<0.01, ** p<0.05, * p<0.10.
1/ See Annex II.
2/ For parents of the respective children age group.

that the withdrawal of the benefits does not provide disincentives to work and does not undermine the use of labor policies to reduce child poverty (Atkinson 2015; Brady and Burroway 2012; Gugushvili and Hirsch 2014; Van Lacker and Ghysels 2012).[36]

To increase the efficiency of spending on family and children, policy makers may consider other options:

Introducing a universal child benefit taxed at a sufficiently progressive and broad-based personal income tax. This would make the benefit larger for low-income parents. Proponents of this approach argue that it could be fiscally neutral and would be simpler and less costly to administer than means-tested benefits. It would also be socially and politically more sustainable, eliminating both fraud incentives and stigma, and would minimize disincentives to work. This benefit would also prevent falling into poverty rather than treating poverty when it occurs (Atkinson 2015; Berkowitz and others 2022; Clements and others 2015; Krishna 2017; National Academies of Sciences, Engineering, and Medicines 2019). If a universal child benefit is not favored, policy makers can consider making cash transfers more conditional and increasing the targeting on some vulnerable groups.

***Making cash transfers more conditional*.** Making part of in-cash transfers conditional to meeting some "performance criteria" (such as school attendance or health check) may increase the efficiency of spending by altering parents' behavior and providing incentives for a more nurturing environment and to invest more in child development (typically health and education). However, randomized clinical trials in the United States found only marginal improvements in children's health and educational outcomes and no impacts on the employment or earnings of parents (National Academies of Sciences, Engineering, and Medicines 2019). As for means-testing, the design of the program is crucial. The conditions and the impact on household income when the child grows, and the program ends, should be well designed. The administrative costs of the programs and risk that invasive procedures lead to a low take up should be considered (Del Bocca and others 2016; Francesconi and Heckman 2016; Heckman 2014; IMF 2015; National Academies of Sciences, Engineering, and Medicines 2019; World Bank 2015).

Increasing the transfers to some specific groups. This could be parents of younger children as it is below the age of 6 that the impact of poverty is the most severe over the long term and where the return of public intervention is the largest. This could also be single parents that "most welfare states were not built and may be ill equipped to manage" (Esping Andersen 1999). For example, the experience of Sweden suggests that providing a stable minimum income to single parents through a minimum child support benefit could have positive impact. This system may need to be reinforced by a stronger enforcement of payment of child alimony as it may reduce the incentive of non-resident parent to pay it (Heine 2016; National Academies of Sciences, Engineering, and Medicines 2019).

In the post-COVID fiscal environment, reducing rapidly child poverty may call for a focus on the most efficient form of spending but, in the long-run, complementarity of different approaches and sustaining the support are crucial. In-kind support and cash transfers are complementary. They both foster child development but through different mechanisms. In-kind benefit target specific needs. Unconditional and predictable cash transfers to low-income family reduce parental stress, improve parental involvement and, as a result, have a positive impact on children well into their adulthood. Notably, infants whose families received unconditional cash transfers exhibit change in brain activity that has been associated with the development of

[36] Brady and Burroway (2012) note that reducing incentives to work is also blamed on universal approach by those who advocate a well-designed targeting.

better cognitive skills. Importantly, the transfers deployed post-COVID should not be short-lived in order to mitigate the impact of poverty. Literature provides evidence that children whose families received cash transfers for longest periods had, in adulthood, better health outcome (e.g., lower level of anxiety and depressive symptoms), social behavior (fewer risky or illegal behaviors), as well as improved educational outcome and financial well-being (Blair 2010; Copeland and others 2022; Dreyer 2022; National Academies of Sciences, Engineering, and Medicines 2019; Troller-Renfree and others 2022; World Bank 2015).

The Role of Public Investment in Limiting the Scarring Effect of Child Poverty

Reducing the long-term impact of child poverty, and thus the scarring effect of the COVID-19 pandemic, requires policies that go beyond increasing parental income. The main role of family and children spending is to increase income to reduce the level of poverty. As a result of a lower level of poverty, they also mitigate the long-term impact of child poverty. However, public investment has an important complementary role to play. In this context, the European Child Guarantee, adopted by the European Council in 2021, will help by investing in human capital. It aims at providing every EU child at risk of poverty or social exclusion with access to a set of key services (free early childhood education and care, free education, free healthcare, healthy nutrition, and adequate housing). This could markedly reduce material deprivation. EU member states where at-risk-of-poverty or social-exclusion rate is above the EU average will have to allocate at least 5 percent of their European social fund resources to fight child poverty. Beyond this initiative, investment in four complementary and mutually reinforcing areas would magnify the impact of labor and fiscal policies on the long-term consequences of child poverty:

***Public investment in childcare infrastructure*.** The European policy to improve access to childcare focuses on reducing the cost borne by parents. Though this approach tackles the main reason for not using ECEC and there remains scope to reduce the ECEC cost for the poorest (Figures 9 and 10), this policy needs to be accompanied by investments to increase availability of formal ECEC, notably in poorest areas, and to ensure the quality of services.[37]

Public investment in education. One of the key channels through which child poverty has a long-term impact is educational outcome. Measures to boost poor children enrollment in ECEC needs to be accompanied by measures for school age children, as the socio-economic status of students is a strong predictor of educational achievement (PISA 2018 results). Though, as contemplated by the European Child Guarantee, providing free education may help the poorest access to education, financial cost is not the only issue. For example, poor neighborhoods and regions tend to have lower quality schools and teachers.[38] As a result, if adequate financing of education remains a priority,[39] it needs to be better distributed and accompanied by measures to increase inclusiveness notably reducing the isolation of disadvantaged students countries (Figure 18) and to recoup the educational losses associated with the lockdown during the pandemic. Improving poor children educational attainment would also reduce persistence in poverty (Figure 12) and increase equality and social mobility (Blanchard and Rodrik 2021; Bruroni and others 2013; Corak 2013;

[37] The benefit of childcare on child development depends crucially on its quality as low-quality childcare service can be harmful (Van Lancker, 2013).

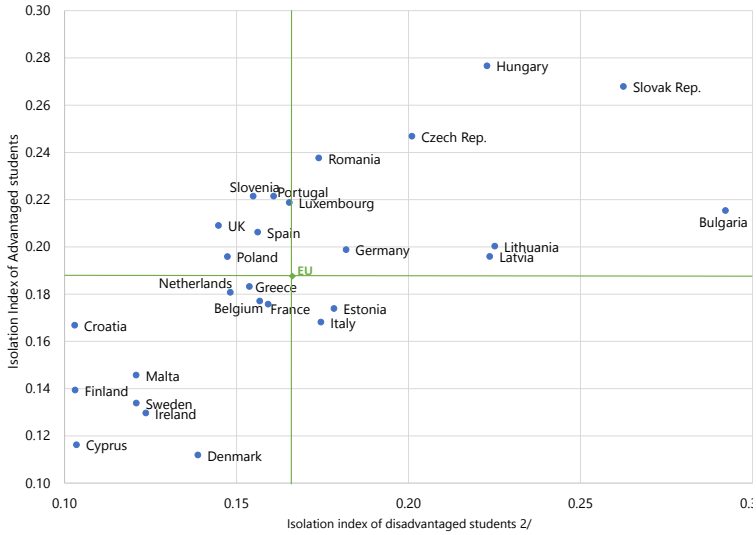
[38] Chetty and Hendren (2022) documents that children who moved to more upwardly mobile neighborhoods—those with higher-quality schools, for instance—tended to have better outcomes as adults.

[39] Between 2010 and 2019 education spending at the EU level has declined by 0.4 percentage points of GDP to 4.7 percent of GDP. Capital spending on education accounted for 0.4 percent on average during the period (Hallaert and Primus 2022).

Doepke and others 2022; Hallaert and Primus 2022; IMF 2021; Rodrik and Stantcheva 2021; Schady and others 2023).

Public investment in health and nutrition. As children with poorer health also spend less time in school and have fewer years of education, especially if they live in families with lower income (Currie 2009; Case and others 2002), "at least part of the intergenerational transmission of poverty may be due to the impact of family income on children's health" (National Academies of Sciences, Engineering, and Medicines 2019).[40] Therefore, increasing access to healthcare and medicine for poor children (but also poor pregnant women as health at birth is critical),[41] would have a positive impact on health and educational outcomes. It is an investment that would complement the use of labor policies to reduce poverty.[42] One policy that would increase health outcome is to provide adequate nutrition to poor children and pregnant women. There is evidence that nutrition support increases health of children right away, while adult health improves in the longer term (National Academies of Sciences, Engineering, and Medicines 2019). Nutrition support is an area where the EU (through the Fund for European Aid to the Most Deprived—FEAD) supplements EU countries' own spending. As part of the FEAD, EU Member States can choose between food and/or other basic material assistance or social inclusion activities, but FEAD is primarily a food aid scheme with 80 percent of its budget devoted to food (Lecerf 2019) and children are important beneficiaries (Table 7).

Figure 18. Isolation of Advantaged and Disadvantaged Students in the EU (2018)[1/, 2/]



Sources: OECD (PISA) and IMF staff calculation.
1/ A disadvantaged student is a student in the bottom quarter of the ESCS in his or her own country. An advantaged student is a student in the top quarter of the ESCS in his or her own country.
2/ The isolation index measures whether (advantaged or disadvantaged) students are more concentrated in some schools. It ranges from 0 to 1, with 0 corresponding to no isolation and 1 to full isolation.

Public investment in housing. Ensuring, though social housing or financial support, that poor households can afford adequate housing would directly reduce material deprivation. These policies should avoid creating isolated "poor neighborhood" as this would have negative impact on child development. Indeed, poor neighborhood have a "peer" effect that negatively affects skills acquisition and are associated with lower

[40] See also East and others (2023) who found evidence that the expansion of Medicaid in the United States leads not only to "large improvements in child health and declining health inequality" (as documented among other by Aizer and Currie 2014; Currie and Schwandt 2016a, 2016b) but also "persistent impacts on later generations' health." Echoing the conclusions of Heckman (2014) on early childhood education, they conclude "early life health investments have payoffs that extend well beyond those that social policymakers usually consider."

[41] See National Academies of Sciences, Engineering, and Medicines (2019) for the importance of fetal health and health at birth.

[42] Currie and Madrian (1999) conclude a review of empirical literature on the link between health, health insurance, and the labor market that "access to health insurance has important effects on both labor force participation and job choice; the link between health insurance and wages is less clear."

quality of school and healthcare (Agostinelli and others 2021; Chetty and Hendren 2022; Werner and Woessmann 2021).

Table 7. EU Assistance to Alleviate Material Deprivation Through FEAD (2018)

	Amount (in percent of GDP)	Beneficiaries by type of support in percent of total population			Share of Children in beneficiaries (in percent) [1/]
		Food	Material assistance	Social inclusion	
Belgium	0.002	0.1			34
Bulgaria	0.051	7.7			26
Estonia	0.005	1.7			28
Finland	0.002	5.1			12
France	0.003	6.5			35
Italy	0.003	4.4			19
Latvia	0.019	3.6			29
Lithuania	0.018	7.0			26
Malta	0.005	2.2			63
Poland	0.019	3.6			28
Portugal	0.009	0.8			27
Spain	0.007	2.8			31
Romania (2016) [2/]	…	16.7			20
Slovenia	0.008	7.6			19
Croatia (2017)	0.015	5.0	1.7		…
Cyprus	0.005	0.2	0.1		94
Czech Rep. (2017)	0.002	1.0	0.9		46
Greece	0.019	4.2	4.2		19
Ireland	0.002	3.1	0.8		44
Luxembourg	0.001	2.2	…		30
Slovakia	0.012	3.5	2.0		36
Austria	0.001		0.5		93
Denmark	0.002			0.0	…
Germany	0.000			0.0	11
Netherlands	0.001			0.0	…
Sweden	0.000			0.0	1
Hungary	…	…	…		…

Sources: FEAD (https://ec.europa.eu/social/main.jsp?catId=1239&langId=en&intPageId=3604), Eurostat, and IMF staff calculations.

1/ Children fifteen and below.

2/ No food or basic material assistance provided in 2017 and 2018, due to problems encountered with public procurement and the distribution of purchased items.

VII. Conclusion

During the COVID-19 pandemic, child poverty increased dramatically in the Europe. In 2020 alone, the number of children suffering from severe material deprivation increased by 19 percent (0.9 million) in the EU. Indirect evidence suggests that this number may have further increased in 2021 and the sharp increase in inflation in 2022 likely worsened the situation further as higher prices for energy and foodstuff increased difficulties of poor households to afford essential goods.

The increase in child poverty could be an important scarring effect of the pandemic. Pediatric and economic literatures highlight that poverty has severe consequences for children themself (negatively affecting skills developments, health, and educational achievement and, in turn, the well-being and income prospects in adulthood) and for the economy as a whole, through high remediation costs and lower human capital accumulation with impact on productivity, employability, potential growth, inequality, and social mobility. The

potential scarring effect of rising child poverty during the pandemic is compounded by the educational loss associated with the closure of school and childcare centers, which was more severe for poorest children.

Limiting the scarring effect of the pandemic calls for policies to reduce rapidly the number of children suffering from poverty. Reducing child poverty as early as possible is the most effective approach. Besides its importance for poor children's well-being and life prospects, evidence shows it is less costly to reduce poverty early than to implement remediation policies later on to mitigate its impact. Two types of policies can help:

- First, deploy labor policies to increase parental work and the labor income of poor parents, notably single parents. This paper presents policies and reforms that would increase parent's employment rate and working hours as well as increase their net wage and labor income stability. However, some of the proposed measures may take time to have an impact.
- Second, use social protection spending on family and children that can have a powerful and immediate impact. At a time when fiscal tightening is needed to reduce fiscal deficits and public debt inherited from the pandemic and to fight inflation, it is important to note an important trade off: repeating the post-GFC approach of reducing social protection spending on family and children as part of a broader fiscal consolidation would delay the reduction in child poverty and increase the scarring effect of the pandemic. Moreover, the increased means-testing implemented to support the post-GFC fiscal consolidation does not appear to have increased the impact of spending on child poverty and, post-COVID-19, is unlikely to do so unless issues with the design and implementation of means-testing are addressed. Therefore, in the short-term, spending on family and children should be preserved or, when possible, increased, while initiating reforms that would increase their impact on child poverty such as: (i) introducing a universal child benefit taxed at a sufficiently progressive and broad-based personal income tax, or (ii) making cash transfers more conditional on caregivers taking action for the child's well-being (e.g., health check, school attendance), and (iii) increasing the amount of transfers to specific groups that tend to be more affected by child poverty, such as parents of younger children or single parents.

Limiting the scarring effect of the pandemic also calls for policies to mitigate the long-term impact of child poverty. Increasing parents' income and employability can mitigate the scarring effect of child poverty but this is not enough. Public investment is also needed:

- As EU initiatives increasingly reduce the cost of childcare, they need to be complemented by investment to increase availability of childcare, notably in poor neighborhoods. This would help increase the relatively low usage by poor parents of formal childcare services and, thus, the policy impact on child poverty and women's labor force participation.
- Investment in education is needed to increase the inclusion of poor children in schools and to alleviate the education loss from the pandemic. Policies to improve parents' skills would reinforce the impact of labor policies aiming at increasing poor parents employability and labor income.
- Given that child poverty is associated with poorer health, increased access to healthcare and medicine would have a positive impact in the long term, including by magnifying the impact of investment in education and the impact of labor policies. Providing adequate nutrition to poor children and pregnant women has a rapid impact on children health thus efficiently mitigate the long-term effect of poverty.
- As poverty determines where and how people live, housing policies have an important role to play in reducing the impact of child poverty.

Annex I. Definition of Concepts

A. Survey Data

European Union Statistics on Income and Living Conditions (EU-SILC)

The EU-SILC is a panel survey conducted in EU and other European countries whose micro-household data underpin both the Eurostat *Income and Living Conditions* (ILC) database as well as the OECD *Income Distribution Database*. The survey provides both cross-sectional data pertaining to a given time or time-period as well as longitudinal data pertaining to individual-level changes over time, observed periodically or over a four-year period (Statistics on Income and Living Conditions (SILC) - Microdata). It has been noted that the comparability issues posed by differences in data collection across countries (for example, including reliance on household surveys as opposed to 'register' data) as well as the allowance for different concepts of self-employment income are addressed in the survey by conceptual harmonization of target variables and the so called "ex ante output harmonization model" employed by Eurostat (Eurostat 2007). Limitations still exist, including the exclusion of social transfers in kind from disposable income, the exclusion of capital gains, and the restriction of the data to the population living in private households.

Labor Force Survey (LFS)

LFS data in the time period relevant to this working paper are considered highly comparable across countries and time given the EU-LFS use of output harmonization. Increased content stability and frequency of surveys have also been implemented from 1998 to counterbalance allowances for country-specific surveys. Further information regarding data methodology as well as the underlying microdata can be found at the Eurostat EU LFS webpage (European Union Labor Force Survey).

European Social Survey (ESS)

The ESS subjects itself to extremely stringent sampling and collection design, data processing, and quality assessment checks, recognizing that quantifying such concepts as preference or attitude are particularly prone to survey design error, non-representative sampling errors, or timing and national context biases. To this end, the ESS employs periodic reports on measurement quality and equivalence of survey responses vis-à-vis the concept of interest, frequent nonresponse bias analyses, response rate floors, and monitoring and recording of contextual data taken from national media (Monitoring National Contexts).

B. Measuring Inequality

Equivalized Disposable Income

Statistics on disposable income refer to the total income of a household available for spending or saving, divided by the number of household members converted into equivalized adults by Eurostat. People with missing values for equivalized disposable income as well as those living in collective households and in institutions are excluded from calculations. The equivalence scale considers:

- the first household member aged 14 years or older as 1 person
- each other household member aged 14 years or older as 0.5 person
- each household member aged 13 years or younger as 0.3 person (Eurostat 2014).

For the purposes of regional time-series analysis, these data are converted into 2013 prices by deflating by national consumer price indices, indexed to 100, then weighted by PPP before aggregation into their respective regions.

Gini Coefficient

One of the most common measures of inequality, the Gini coefficient is advantageous in that it is independent of the sample mean and population size, symmetrical, and sensitive to transfers of income from the top to the bottom of a distribution. Gini coefficients in this note refer to the Gini of equivalized disposable income. Unfortunately, because this index is not decomposable or additive across subgroups like age, it is not sufficient when a more granular analysis of the population is desired.

C. Measuring Poverty

Material Deprivation

Material Deprivation is a broad approach to poverty measurement which aggregates various dimensions of non-monetary well-being into a single measure. This sort of asset-based poverty measurement is critical in capturing an individual's "command over resources"; something that income measures alone cannot communicate (Boarini and others 2006; Sen 1999).

Severe material deprivation rate, which is defined as the enforced inability (rather than the *choice* not to do so) to pay for at least four of the following nine items considered by most people to be desirable or even necessary to lead an adequate life (Glossary: Material deprivation):

1. to pay their rent, mortgage or utility bills;
2. to keep their home adequately warm;
3. to face unexpected expenses;
4. to eat meat or proteins regularly;
5. to go on holiday (a week's annual holiday away from home);
6. a television set;
7. a washing machine;
8. a car;
9. a telephone.

At-Risk-of-Poverty Thresholds and Rates

Unless otherwise indicated, the relative *at-risk-of-poverty threshold* is defined as 60 percent of the national median equivalized disposable income after social transfers. The *at-risk-of-poverty rate* is then calculated as the proportion of persons with an equivalized disposable income below that threshold. Where figures for subgroups exist, they are calculated based on the poverty threshold for the entire population. The *persistent* at-risk-of-poverty rate shows the percentage of the population living in households where the equivalized disposable income was below the at-risk-of-poverty threshold for the current year and at least two out of three of the preceding years.

These measures of poverty fall under the category of relative poverty, or the proportion of people earning less than a set proportion of a country's median income. When examining poverty over time, however, it is important to note that these relative measures obscure the effects of changes to the poverty threshold that occur when the living standards of the entire population change. This was certainly the case after the financial crisis, when countries saw an overall decline in national income which led to a decrease in the median income, allowing relative poverty to remain somewhat stable and masking the absolute deterioration of living conditions.

More conceptual concerns regarding the sole use of income as a proxy for living standards and poverty point out that the omission of other assets and wealth from the calculus, while understandable given the scarcity of data on wealth, presents an incomplete picture of economic well-being (Förster and others 2013).

To isolate the development of poverty over time from the effects of changing poverty lines, some measure of absolute poverty is required. This can be accomplished by fixing the cutoff level of the poverty threshold even in the face of economic distress or growth, as is the case with measures of *anchored at-risk-of-poverty rate*. Here, the indirect effects of changing standards of living are held constant (except for inflation adjustments).

At the European level, initiatives to reduce poverty rely on the *at risk of poverty and social exclusion.* This indicator sums up persons who are either at risk of poverty, severely materially and socially deprived, or living in a household with a very low work intensity. People are included only once even if they are in more than one of these three situations. (Glossary: At risk of poverty or social exclusion).

Annex II. Technical Annex

For the econometric analysis, we compiled an unbalanced dataset for the 27 EU countries for the period 2009-2020. Both pooling, fixed effects, and random effects specifications have been tested. The pooling and Hausman tests led us to select the fixed effects model. As heteroscedasticity was established, a heteroscedasticity-consistent estimation of the covariance matrix was performed. We also checked for serial correlation, unit roots, and multicollinearity.

A. Data Definitions and Sources

Results presented in Tables 4 and 6 are the outcome of a general to specific approach using variables listed in the below. Variables used are underlined in Table II.1.

We have used publicly available data mainly from Eurostat with the exception of the variables measuring the impact of the recent COVID-19 crisis, which are either taken from databases for recent IMF reports or from other publicly available sources. The period covered is 2009–2020. The cutoff date for the data is November 22, 2022.

Table II.1 Variables—Description and Sources

Abbreviation	Eurostat Code	Description
	A. Dependent Variables	
sevmatdepr18	ilc_mddd11	Severe material deprivation rate of population below 18 measured as proportion of the children below 18 years of age
sevmatdepr6	ilc_mddd11	Severe material deprivation rate of children below 6 measured as proportion of the children below 6 years of age
rop18pc	ilc_li02	Proportion of children below 18 years of age at risk of poverty
rop6pc	ilc_li02	Proportion of children below 6 years of age at risk of poverty
anrop18pc	ilc_li22	At-risk-of-poverty rate anchored at a fixed moment in time (2005) for children below 18 years
	B. Explanatory Variables	
Structural indicators		
gini	ilc_di12	Gini coefficient of equivalized disposable income - EU-SILC survey
hhdsize	ilc_lvph01	Average household size - EU-SILC survey
singlech2	ilc_lvps20	Share of children (aged less than 18) living with a single parent - EU-SILC survey
childcare3	ilc_caindformal	Share of children below 3 years of age not in any form of formal childcare or education - EU-SILC survey
childcare3toschool	ilc_caindformal	Share of children between 3 years of age and school age not in any form of formal childcare or education - EU-SILC survey

childcareschool	ilc_caindformal	Share of children between school age and 12 years of age not in any form of formal childcare or education - EU-SILC survey
eduatt02parents18	lfst_hhacednc	Share of children below 18 years of age, whose parents are with less than primary, primary and lower secondary education (ISCED11 levels 0-2)
eduatt02parents6	lfst_hhacednc	Share of children below 6 years of age, whose parents are with less than primary, primary and lower secondary education (ISCED11 levels 0-2)
gdpppspc	nama_10_pc	GDP in current prices, purchasing power standard (PPS, EU27 from 2020) per capita
Labor market indicators		
unempl	une_rt_a	Unemployment rate
tempempl	lfsa_etgar	Temporary employment (percent in total employment)
parttime	ilc_lvhl04	Share of part-time employed in the population aged 18 and over
lowworkint18	ilc_lvhl11	Children below 18 years of age living in households with very low work intensity (percent of total population aged less than 60)
lowworkint6	ilc_lvhl11	Children below 6 years of age living in households with very low work intensity (percent of total population aged less than 60)
Social protection indicators		
familyben1	gov_10a_exp	Social protection expenditures of the general government for "family and children" in percent of GDP
socben_workage_nofamily	gov_10a_exp	Other working age benefits in percent of GDP – total expenditures of the general government for "social protection," excluding "old age and survivors" and "family and children"
Crisis indicators		
gfc		Dummy for Global financial crisis and sovereign debt crisis (2009-13)
stringency		Stringency of containment during the pandemic – Oxford COVID-19 Government Response Tracker (https://github.com/OxCGRT)
covid_cases_pa_pmln		Number of COVID-19 cases per annum per million of population (https://ourworldindata.org/covid-cases)
covid		Number of days either in partial opening or full closure of schools due to COVID-19 (UNESCO - https://covid19.uis.unesco.org/global-monitoring-school-closures-covid19/regional-dashboard/)
fiscalsupportgdp		Fiscal support during COVID-19 (percent of GDP) – IMF October 2020 Fiscal Monitor Report database (https://www.imf.org/-/media/Files/Publications/fiscal-monitor/2020/October/Data/FiscalMonitorDatabase-October2020.ashx)

onbudgetgdp		On-budget fiscal support during COVID-19 (percent of GDP) – IMF October 2020 Fiscal Monitor Report database (https://www.imf.org/-/media/Files/Publications/fiscal-monitor/2020/October/Data/FiscalMonitorDatabase-October2020.ashx)
outputgap		Output gap (WEO database – Extracted on September 28, 2022)
	C. Additional Breakdowns of Social Benefits Variables	
non_meantest_ben	spr_exp_ffa	Non-means-tested benefits for family and children (percent of GDP)
meantest_ben	spr_exp_ffa	Means-tested benefits for family and children (percent of GDP)
cash_ben	spr_exp_ffa	Cash benefits for family and children (percent of GDP)
cash_non_meantest_ben	spr_exp_ffa	Cash non-means-tested benefits for family and children (percent of GDP)
cash_meantest_ben	spr_exp_ffa	Cash means-tested benefits for family and children (percent of GDP)
ben_in_kind	spr_exp_ffa	Benefits for family and children in kind (percent of GDP)
ben_in_kind_non_meantest	spr_exp_ffa	Non-means-tested benefits for family and children in kind (percent of GDP)
ben_in_kind_meantest	spr_exp_ffa	Means-tested benefits for family and children in kind (percent of GDP)

B. Data Transformations

In order to ensure comparability across countries and avoid non-stationarities of the data all indicators (with the exception of the dummy variables) are taken in relative terms—either in percent of GDP, percent of the total population, etc. Additionally, all data (with the exception of the dummy variables) has been standardized by subtracting the mean and dividing by the standard deviation. This transformation is made in order to put all variables on the same scale. Finally, a logistic transformation of the dependent variable has been applied ($ln[y/(1-y)]$, as all indicators of child poverty that we are trying to explain are defined in terms of proportions and $\in [0,1]$.

C. Robustness Tests

The panel regression results presented in the main text are robust to alternative specifications and methods (machine learning) as well as to a different measure of poverty (at-risk-of-poverty rate rather instead of severe material deprivation).

Alternative Specification and Coverage

A streamlined specification (Table II.2) illustrates two points made in the main text. When cyclical conditions are measured by output gap instead of unemployment rate, they remain significant. In the baseline regressions, we chose to capture the effect of the business cycle with the unemployment rate as it is through that unemployment that cyclical conditions affect child poverty. This choice is also motivated by the fact that, during the COVID-19

pandemic, the impact of the crisis on child poverty may have been muted by labor policies. Ando and others (2022) estimate that without the deployment of job retention schemes, the unemployment rate in the euro area would have been more than 2.5 percentage points higher than the level observed. Over the period considered, the unemployment rate and the output gap are strongly correlated (-0.68). Educational level of parents is significantly associated with child poverty. This variable is not included in Tables 4 and 6 because when added to the baseline variables it becomes insignificant presumably because its impact is captured by other variables. Machine learning results confirm their importance.

Table II.2 Streamlined Specification—Severe Material Deprivation

	All Children (Less than 18)	Younger Children (Less than 6)
Output gap	-0.085****	-0.112****
	(0.043)	(0.028)
Share of parents with less than secondary education 2/	0.377***	0.219**
	(0.130)	(0.100)
Average household size	0.413****	0.492****
	(0.076)	(0.080)
Share of children with single parent 2/	0.234**	0.340***
	(0.098)	(0.127)
Share of children living in households with very low work Intensity 2/	0.313****	0.270***
	(0.046)	(0.049)
Family and children spending	-0.410****	-0.425****
	(0.095)	(0.117)
Observations	320	320
R-Squared	0.552	0.439
Adjusted R-Squared	0.502	0.376
F-Statistic	58.90****	37.40****

Source: IMF staff calculations.
Note: Robust standard errors in parentheses, **** p<0.001, *** p<0.01, ** p<0.05, * p<0.10.
1/ For parents of the respective children age group.

Rising child poverty is a global problem. However, data limitations prevent us to conduct the analysis beyond the EU. Baseline regressions appear also robust to a larger of European countries. This is the case when one considers 38 European countries (EU27 and eleven countries from EFTA, Western Balkans, Turkey, and the United Kingdom). The results are not presented because missing data for some of the added countries.

Alternative Definitions of Poverty

We test the robustness of baseline specification by using monetary measures of poverty rather than material deprivation (Table II.3). As in Table 4, this is done for children less than 18 and for younger children (less than 6) except for the anchored at-risk-of-poverty rate for which data are not available.

In large part because of the sensitivity of the threshold to the business cycle, it is not surprising that the baseline specification performs not as well as for the at-risk-of poverty rates than for the severe material deprivation rate.

As the anchored at-risk-of poverty rate deals with the issue of a moving threshold, the baseline specification performs well. All the variables have the correct sign results and all key variables associated with severe material deprivation (except single parenthood) are also statistically significantly associated with the anchored at-risk-of poverty. Strikingly, the coefficient value of several variables is very close to those in the baseline regression presented in Table 4 (average household size, unemployment rate, family and children benefit). As expected, a monetary measure of poverty shows a stronger association with variables capturing labor income (temporary employment rate and low work intensity) and income inequality.

Table II.3 At Risk of Poverty—Panel Regressions

	Dependent variable:		
	Anchored at-risk-of-poverty rate (Less than 18)	At-risk-of-poverty rate (Less than 18)	At-risk-of-poverty rate (Less than 6)
GFC dummy	0.114 (0.087)	0.069 (0.061)	0.089 (0.083)
Gini coefficient	0.275** (0.134)		
Average household size	0.366** (0.153)	0.081 (0.116)	0.044 (0.134)
Share of children with single parent 1/	0.134 (0.100)	0.135** (0.064)	0.065 (0.116)
Unemployment rate	0.217*** (0.068)	0.061 (0.060)	-0.040 (0.084)
Share of children living in households with very low work intensity 1/	0.383**** (0.072)	0.310*** (0.095)	0.504**** (0.099)
Temporary employment share	0.389** (0.163)	0.340** (0.133)	0.269** (0.166)
Family and children spending	-0.308*** (0.117)	-0.256*** (0.094)	-0.207 (0.165)
Observations	275	323	323
R^2	0.666	0.459	0.354
Adjusted R^2	0.625	0.398	0.281
F Statistic	60.77****	35.09****	22.65****

Source: IMF staff calculations.
Note: Robust standard errors in parentheses, **** p<0.001, *** p<0.01, ** p<0.05, * p<0.10.
1/ For parents of the respective children age group.

Alternative Estimation Method: Machine Learning

Machine learning (ML) consists of a multitude of computationally intensive algorithms, which aim is to extract patterns from a dataset, where the relationships might be complex and difficult to model explicitly[43]. Six models (described below) have been used to identify the drivers of severe material deprivation for children below 18 (SMD18) and for children below 6 (SMD6). Table II.4 provides summary statistics of their performance. For both

[43] Müller and Guido (2016) provide a good overview of the machine learning methods and their implementation in Python.

age groups, all models show good generalization and prediction outcomes when run on the test subset of the dataset with coefficients of determination around 0.9 and higher.

Table II.4. Comparison of Machine Learning Models' Performance

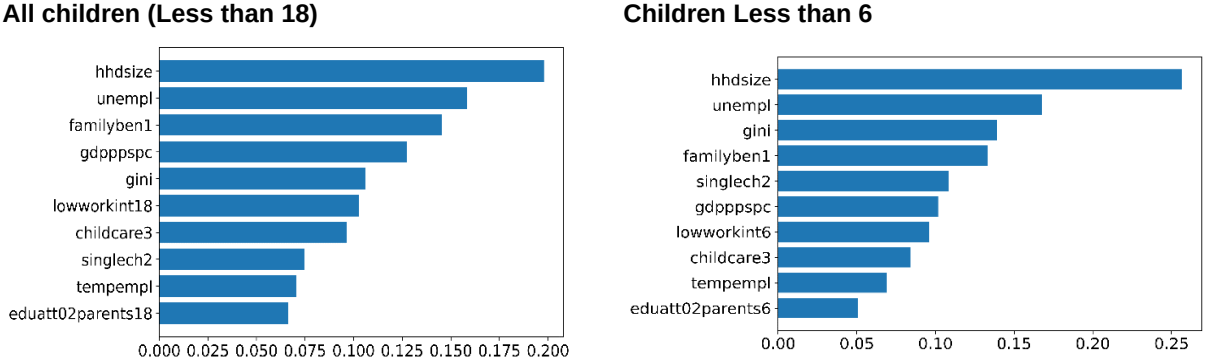
	All children		Small children	
Model	**Mean Squared Error**	**R^2**	**Mean Squared Error**	**R^2**
Linear regression	0.068	0.919	0.115	0.863
Elastic net	0.063	0.926	0.102	0.879
K-nearest neighbors	0.047	**0.945**	0.084	0.900
Support vector regression	0.051	0.939	0.095	0.887
Random forest	0.054	0.937	0.082	**0.902**
Extreme Gradient Boosting	0.056	0.934	0.095	0.887

Source: IMF staff calculations.

a. Main Results

Figure II.1 reports the contributions of explanatory variables to the prediction of the child poverty outcome (averaged, based on the results of all models). Results confirm that role of the variables used in the baseline specification (Table 4). Indicators related to the households' characteristics and income as well as participation in the labor market have the highest impact. Family and children benefits are also an important determinant of child poverty. Finally, results highlight the role of two other variables highlighted in the text but not in the baseline: low childcare enrollment and low level of parental education.

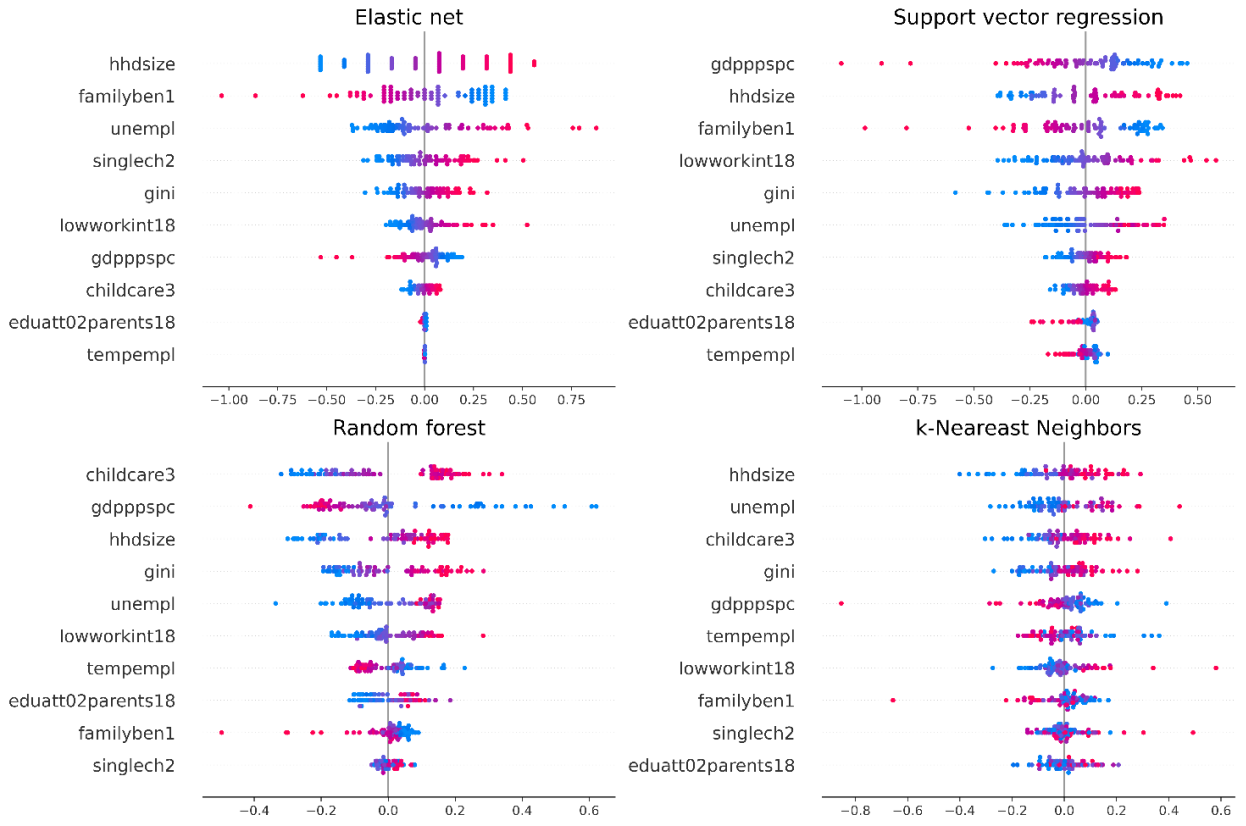
Figure II.1. Average Absolute Shapley Values



Source: IMF staff calculations.

Error! Reference source not found. provides more details on the contribution of the determinants of child poverty for all children[44] in four model,[45] as well as the direction of their impact. The explanatory variables are ordered according to their contribution to the explanation of child poverty in a descending order, i.e. that average household size has the highest contribution in the elastic net and k-nearest neighbors models, while GDP per capita PPS is the main determinant of child poverty according to the support vector machine model. Finally, the random forest model identifies the share of children below 3 years of age not in any form of formal childcare or education as the most important factor for child poverty.

Figure II.2. Summary Plot of Estimated Shapley Values for SMD18 with Various Machine Learning Models[1]



Source: IMF staff calculations.

1/ Red dots indicate that a higher value of an explanatory variable is associated with a higher level of child poverty, while blue dots indicate that a lower the value of the indicator the higher is child poverty.

Results are consistent with expectations: the level of the income level (GDP) and social benefits is negatively associated with child poverty while household size, unemployment, income inequalities, share of households with very low work intensity, and lower enrollment rate in childcare are associated with more child poverty. Figure II.2 also visually shows the lower contributions for some of the factors by the concentration of the dots, representing

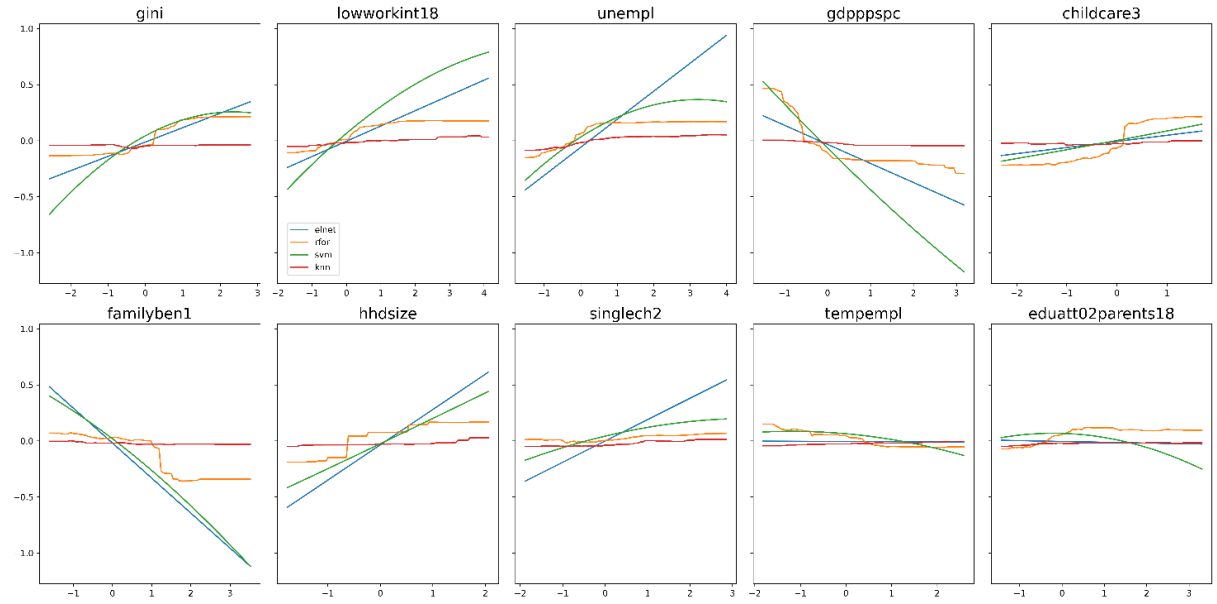
[44] Results for younger children are broadly similar.

[45] We present only four of the six methods for simplicity and because linear regression and elastic net on the one hand and random forest and xgboost on the other hand have very similar approaches and results.

the Shapley values for each specific instance (observation) around the zero line. This is the case of lower education of the parents, share of temporary employment in all models and the share of children with single parents and family and children benefits in the random forest and k-nearest neighbors models.

The partial dependence plots from four ML models are depicted on Figure II.3 below. This shows how the predicted value of the child poverty for all children changes with the variation of each of the included features in the models. It also allows to see the direction of the relationships with the explanatory variables as well as the strength of this relationship. Figure II.3 confirms that income level, social benefits and labor market status have the highest impact on child poverty. Interestingly, the random forest model indicates threshold levels above which the relationship between the explanatory variables and the child poverty changes. For example, for child poverty declines until GDP per capita above 28,000 PPS but at that point increase in income has little effect. A significant reduction of child poverty is also achieved if family and children benefits reach levels of around 3% of GDP.

Figure II.3. Partial Dependence Plots Based on Shapley Values for SMD18 with Various Machine Learning Models



Source: IMF staff calculations.

b. Technical Notes

As for the panel regression analysis the data has been standardized in order to put all variables on the same scale. Additionally, as child poverty is measured in share, a logistic transformation has been applied to ensure that the transformed variable will be over the entire interval $(-\infty, +\infty)$

After this transformation the data as indicated, the dataset has been split into two parts—train and test subsamples. The model parameters are estimated based on the train data and then the model performance is tested based on the test data. Following standard practices, we have reserved 75 percent of the sample for training and validated the models on the remaining 25 percent.

The main models' hyperparameters (or parameters of the ML methods) have been set using a cross-validated grid-search over a predefined parameter grid. The cross validation is a resampling procedure, where the dataset is split into 'k' subsamples. One subsample is treated as test data and the rest—as train data. This procedure is repeated a number of times and then the average outcome is reported.

As results differ across models, it is worth summarizing their methods, benefits, and limitations and then how to interpret each model results

Description of Models

1. Linear regression

Linear regression in machine learning is applied by fitting a straight line to the data points in the dataset that is close as possible to the observations. In machine learning the dataset is split into two parts—training (used for the fitting of the model) and test (for checking the performance of the model). By design, the linear regression assumes a linear relationship in the data. Furthermore, linear regression is more subject to overfitting (especially if the number of features is high compared to the number of observations) and sensitive to outliers.

2. Elastic Net

The elastic net is an extension of the linear regression. The ordinary least squares estimation of the coefficients of a linear regression minimizes the sum of the squares of the errors in the model, defined as the differences between observed and estimated values of the output variable ($\sum_{i=1}^{n}(y_i - \hat{y}_i)^2$). The elastic net imposes two penalties on this model, which are each given a different weight, depending on the value of the hyperparameter $\alpha \in [0,1]$:

L1 penalty	$\sum_{j=1}^{p}\lvert\beta_j\rvert$	$Elastic\ net\ penalty = \alpha * \mathrm{L1} + (1-\alpha) * \mathrm{L2} = \alpha\sum_{j=1}^{p}\beta_j^2 + (1-\alpha)\sum_{j=1}^{p}\lvert\beta_j\rvert$	$Loss\ function\ of\ the\ elastic\ net\ model = \sum_{i=1}^{n}(y_i - \hat{y}_i)^2 + \lambda\left[\alpha\sum_{j=1}^{p}\beta_j^2 + (1-\alpha)\sum_{j=1}^{p}\lvert\beta_j\rvert\right]$
L2 penalty	$\sum_{j=1}^{p}\beta_j^2$		

3. Random Forest Regression

The random forest method is an ensemble method. It aggregates multiple decision trees to improve their joint performance. The decision tree are classifiers, organized hierarchically with a root, branches, internal and leaf nodes, etc. When used separately, they are prone to bias and overfitting, but if a random forest is constructed (preferably from unrelated decision trees), it can address these issues. Random Forest models can capture well complex models and due to their (tree) structure allow for straightforward interpretation.

4. Extreme Gradient Boosting

XGBoost stands for eXtreme Gradient (Chen and Guestrin 2016) builds on the random forest method by adding new trees one by one to correct for the prediction errors made by the existing ones. In addition to that the XGBoost has built-in algorithms, which allow for faster execution by parallelization and other techniques.

5. Support Vector Regression

The support vector machine maps the observations (usually in higher dimensions) through a specific transformation, using a kernel. The idea is to be able to divide the observations into different categories, divided by a gap, which is as wide as possible. When used for regression analysis, the SVM fits the best line within a within a threshold value (the distance between the hyperplane and the boundary line). The support vector regression usually has a good generalization capacity and therefore high prediction accuracy and is robust to outlier. However, it is reported to be less effective for large datasets and does not perform well when the dataset has more noise.

6. K-Nearest Neighbors

K-Nearest Neighbors is used in classification and regression cases. It uses proximity as a criterion for classification or prediction. The training of the model is performed on the entire dataset and whenever a prediction has to be made, the mean or median of the k-most similar observations are used. In order to identify the k-nearest neighbors a distance measure needs to be identified. For a continuous variable, the most popular distance measures are Euclidean, Manhattan or Minkowski distance. The choice of *k* is also important for setting up the model. Typically, the larger the k, the more accurate is the model. The method is prone to overfitting scaling-related issues.

Interpretation of Results

Few machine learning methods are straightforward to interpret. They used to be regarded as black boxes that perform well for prediction purposes, but a number of methods have been developed recently to facilitate the interpretation of the results. These techniques fall into two categories – summary-based (providing insights about the average contribution of the included features for the explanation of the outcome variable) and instance-based (focusing on a breakdown of a specific observation). We summarize the main explanatory methods.[46,47]

1. Permutation Feature Importance

In the linear or elastic net models, the estimated value of the outcome is a weighted sum of the values of the features in the model. Thus, the estimated coefficients in the model can serve as a measure of the relative importance of each explanatory variable. However, this is not the case in more complex models, such as the support vector machine. In that case, the permutation feature importance estimates the impact of a random permutation of the values of a single variable on the model score, independent of the model used. This provides implications about the importance of the respective variable for the model performance. The permutation is performed in order to break the relationship between the feature and the outcome variable. Algorithmically, the method consists in:

(i) Calculation of the original score of the model (i.e. R^2 or mean squared error)
(ii) Permutation of the values of each feature in the model and calculation of the model score, based on the permutated values of this variable. This step might be repeated multiple times and an average score might be calculated.
(iii) Comparison of the values of the model scores, based on the original and permutated dataset. The worse the model score after permutation, the more important the respective feature is.

In case of high correlation between some of the features, the importance of each of these features will appear lower. This is due to the fact that even if the relationship of the outcome with one of the variables is broken, the other feature still provides a good explanation for the outcome.

The permutation feature importance can be calculated, based on either of the subsamples of the data—on the training dataset or on the one reserved for testing. We have used the latter in order to assess to what extent each of the explanatory variables contributes to the generalization power of the model (i.e., check if there is overfitting in case the feature appears to be important based on the training data and not important when assessed based on the test dataset).

*2. Partial Dependence Plots (PDP)*PDPs provide an intuitive interpretation of the model results: they estimate the average prediction of the outcome, based on different values of one or more selected explanatory variables,

[46] All the described methods are independent of the ML model used.

[47] Molnar (2018) reviews the various techniques for interpretability of machine learning models, while Ivanov and others (2022) provide a useful example of the application of these approaches for identification of the drivers of the labor market participation in Bulgaria.

conditional on the rest of the features. However, these plots depict only the average marginal effects, which might potentially hide heterogeneous relationships due to interactions between the variables. PDPs estimates the average effect of the different values of a specific feature on the outcome. In doing so, it takes the average of the values of the other variables. Thus, it explicitly assumes that there is no correlation between the explanatory variables. The value added of the PDPs is that they provide a visualization of the type of relationship between the outcome and the selected feature – whether it is linear or monotone, whether there are any discrete jumps, etc.

3. Local InterpreTable Model-agnostic Explanations (LIME)

LIME are derived by approximating the prediction of a complex (black box) model locally by an interpreTable model (linear regression or a decision tree). More specifically, the original model is used to generate samples for the interpreTable model, where the samples are weighted according to their proximity to the point. Algorithmically, this method consists in:

(i) Selection of a specific observation.
(ii) Perturbation of the dataset and calculation of predictions for the new data points.
(iii) Assignment of weights according to the proximity of the datasets to selected observation.
(iv) Training of a weighted interpreTable model on the new dataset.
(v) Interpretation of the new locally approximating model.

The LIME method provides only local explanations (of specific instances) and depends highly on the adopted definition of a for the specific instance and other parameter values used in the application of the method.

4. SHapley Additive exPlanations (SHAP)

SHAP is a concept from coalition game theory, which provides a method to calculate the contribution of each feature value ('player' in game theoretic terms) to the outcome prediction minus the average prediction for all instances ('gain' in game theoretic terms). The Shapley values are calculated as the average marginal contribution of a feature value, taken at all possible coalitions (i.e. for all possible values of the other features)[48]. They are widely preferred for explanation of machine learning models as they are based on solid theoretical foundations and satisfy the following important properties:

(i) *Efficiency*—the sum of the feature contributions adds up to the difference of the prediction for the feature value at this instance and the average.
(ii) *Symmetry*—if two features contribute equally to all possible coalitions, their Shapley values would be the same.
(iii) *Dummy*—if a does not change the predicted value in all possible coalitions, it has a Shapley value of 0.
(iv) *Additivity*—for the Shapley value for an aggregated object is the sum of the Shapley values of its components.

The main disadvantages of the Shapley values lie mainly in their computational intensity and the need to have access to all features and all data even after estimating the model.

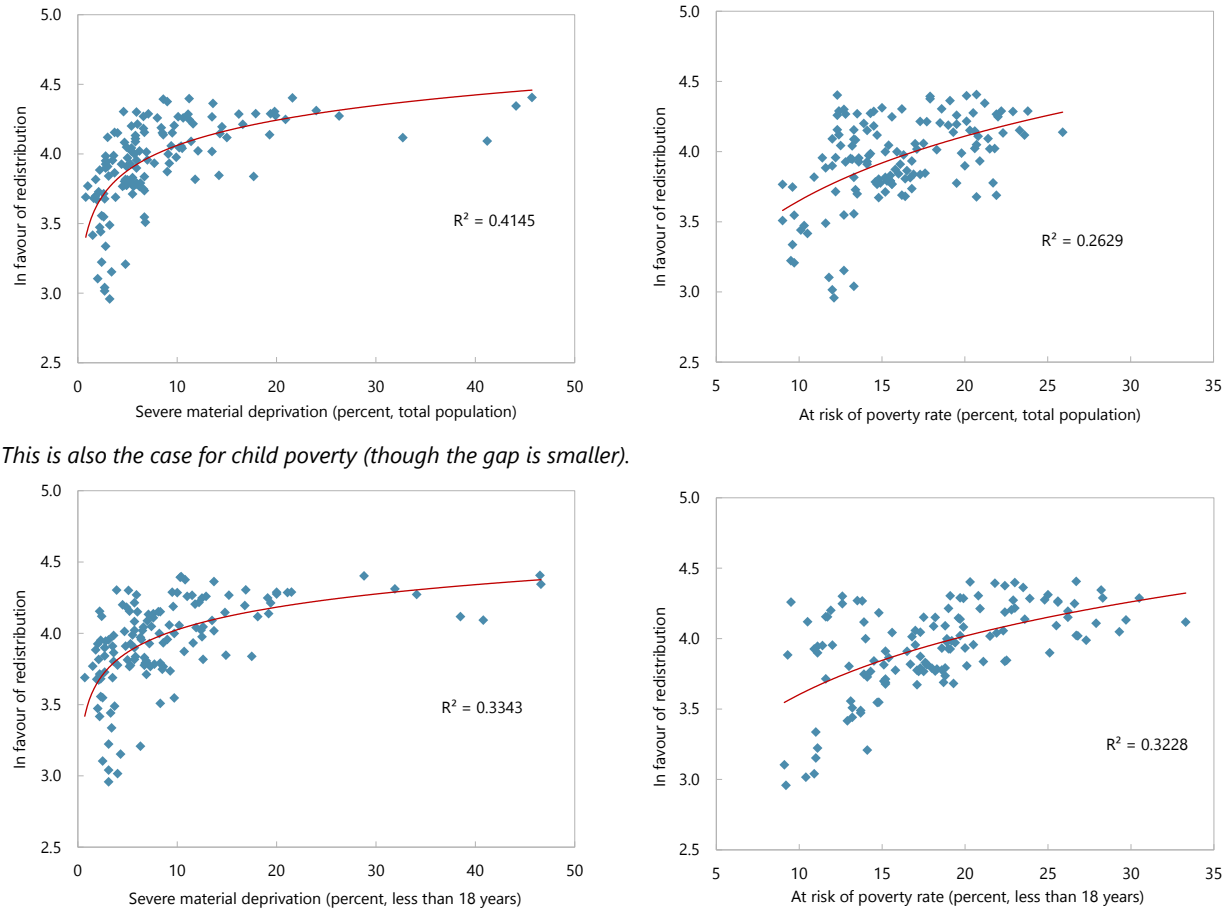
SHapley Additive exPlanations (SHAP) were developed by Lundberg and Lee (2017), based on the Shapley values. They provide both local (related to a specific observation in the dataset) and global (summary for the model) breakdowns by feature contributions. We have chosen to display a summary plot, where all features and observations are displayed and (in python) the features are ordered according to their importance.

[48] The contribution of the feature value is calculated by estimating the average outcome when replacing the specific value with a random other value of the same feature.

Annex III. Demand for Public Intervention

Public surveys report that demand for fiscal redistribution is strongly associated with the level of poverty. The link between demand for redistribution and poverty is stronger for severe material deprivation than for income poverty.

Figure III.1. Poverty and Demand for Redistribution in the EU27 (2008–20)[1]

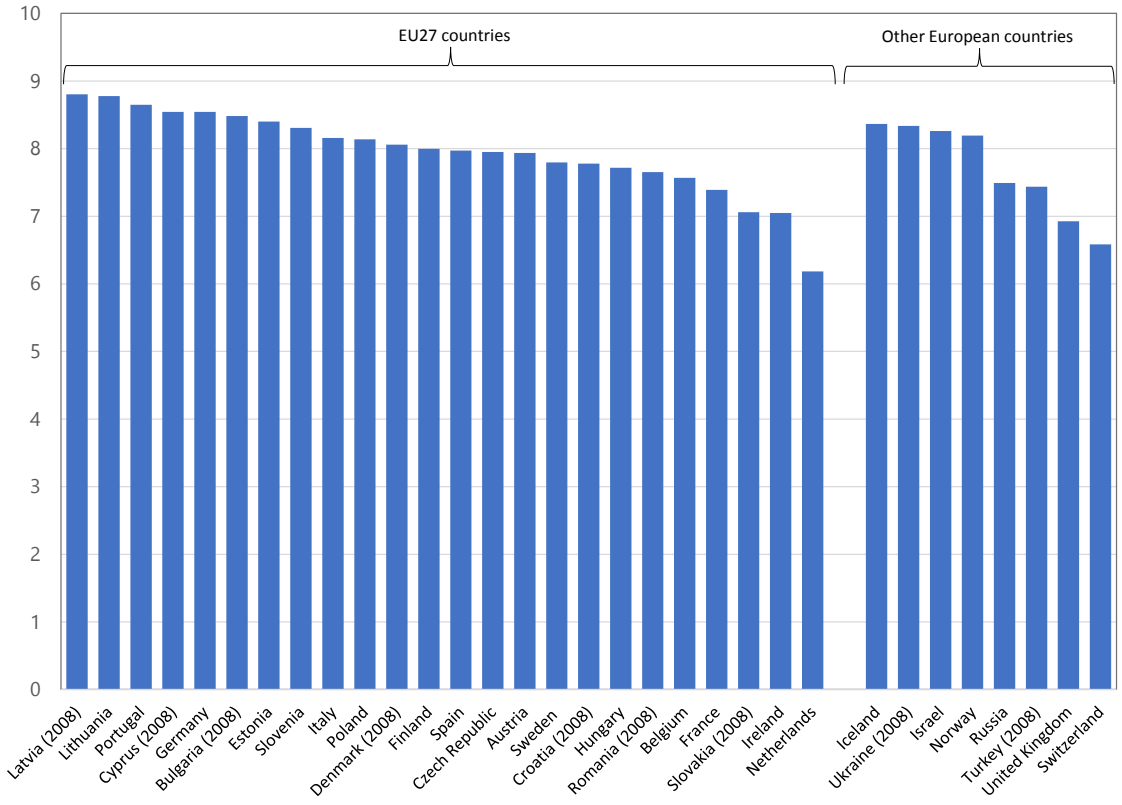


Sources: European Social Survey, Eurostat, and IMF staff calculations.

1/ Agreement with the statement "Government should take measures to reduce differences in income levels." Answers range from 1 to 5 with 5 indicating the strongest agreement.

They also report a strong support for public provision of childcare for working parents. Table III.2 provides answer by the whole population. When only answers of working age population are considered, the differences are only marginally higher on aggregate.

Figure III.2. Demand for Public Childcare Services for Working Parents
(2016 unless otherwise indicated)[1/]



Source: European Social Survey .
1/ Answer the question "how much responsibility governments should have to ensure sufficient childcare services for working parents?" Answers range from 0 (not governments' responsibility at all) to 10 (entirely governments' responsibility).

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