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# NET OPERATING LOSS POLICIES IN POLAND – A TOOL FOR TAX NEUTRALITY AND A FIRM'S ANTIFRAGILITY

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**Abstract**

The purpose of the article is to check the impact of Net Operating Loss Policies (NOL) for firms. Net Operating Loss Policies (NOL) are a central fiscal tool because they enable firms to be taxed on their average profitability over time. A complete NOL policy has 4 dimensions: a NOL carry-forward (1), carry-back (2), unlimited in time (3) and with the time value of money (4) taken into account. No country applies a complete NOL policy. To evaluate the impact of all dimensions of NOL policies, Polish firm data from 41 sectors from the BACH database over ten years, from 2011 to 2020, are analysed. The results show that the change observed in the effective tax rate is positive with a complete NOL policy. In such case, firms pay less CIT in total, showing that the state will earn less, but should get more stability from firms which will hoard more cash. More investments or firms with more equity could be reached, strengthening the state's stability. The variance confirms such intuition, an earlier use of a full or almost full fiscal deficit logically means a higher effective tax rate in years to come (but less in gross terms).

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## Introduction

The accounting result and fiscal result could be very different. For the tax office, the fiscal result is the most important because it is the basis for corporate income tax (CIT).

A firm has a net operating loss (NOL) when its allowable tax deductions are higher than its taxable income. In such a case, the firm pays no CIT for the year and could take profit from the NOL for the following years. In such a case, NOL will be carried forward, and will be offset against the next available future profits. In this paper, the acronym NOLCF is used for this mechanism.

Some countries also recognize the possibility to carry back NOL. In such a case, a firm facing a deficit in the current year could use it to offset profits earned in preceding year(s) and thus generate a refund of CIT previously paid. In this paper, the acronym NOLCB is used for this mechanism.

Both mechanisms enable a firm to be taxed according to its average profitability and make the tax code more neutral over time. This is a quite popular mechanism among countries but is used in very different ways.

NOL Policies are complete when they integrate 4 dimensions: a NOL carry-forward (1), carry-back (2), unlimited in time (3) and with the time value of money (4) taken into account.

In Germany, NOLs are carried forward without a time limit. For corporate tax, there is an optional carry-back to the previous year of up to EUR 1 million. In the United-States, NOLs generated in tax years ending after 31 December 2017 generally may not be carried back and must instead be carried forward indefinitely. The NOL deduction is limited to 80% of taxable income (determined without regard to the deduction). In Poland, a tax loss reported in a tax year may be carried forward over the next five consecutive tax years; however, the taxpayer may not deduct more than 50% of the loss incurred in the year for which it was reported. As of January 2020, a taxpayer has an additional option and may make a deduction from the tax base once over the next five consecutive tax years up to PLN 5 million of the loss incurred. In Austria, tax losses can be carried forward without any time limit. However, they can be offset against taxable income only up to a maximum of 75% of the taxable income for any given year.

During the COVID-19 pandemic, several countries temporarily expanded their NOL Policies to provide relief for firms. For instance, in the United States, the United States, the corporate tax provisions in the Coronavirus Aid, Relief, and Economic Stimulus Act ("CARES"), which is the largest economic stimulus in U.S. history (Cochrane & Fandos, 2020), allowed firms to carry back losses that occurred in the 2020 tax year. In Poland, taxpayers could deduct a tax loss incurred in 2020 from their 2019 income for tax purposes. In Germany, the loss carry-back amount was increased from EUR 1 million to EUR 10 million for the fiscal years 2020 and 2021. Furthermore, a loss carry-back from 2020 could already be considered when calculating the 2019 prepayments or issuing the 2019 tax assessment before the 2020 assessment had been issued. In Austria, losses that could not be offset in 2020 could be carried back to 2019 up to an amount of EUR 5 million. If the loss carry-back could not be used in full in 2019, a further carry-back to 2018 was possible.

From NOL Policies implementation presented above, the following table could be constructed (see Table 1.

**Table 1: NOL Policy configurations (non-COVID) 2021**

| NOL CARRIED FORWARD | | | NOL CARRIED BACK | | |
|---|---|---|---|---|---|
| LIMITED | | NON LIMITED | LIMITED | | NON LIMITED |
| TIME | THRESHOLD | | TIME | THRESHOLD | |
| POLAND | UNITED STATES | GERMANY | | GERMANY | |
| | POLAND | | | | |
| | AUSTRIA | | | | |

*Source: Own elaboration.*

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From that chart, it appears that only Germany has the first 2 dimensions of NOL Policies, carry-forward (1) and carry-back (2). However, it shows that no country has complete NOL Policies.

## Literature review

Smith (1776) was the first to construct four maxims of taxation for public funding. For the purpose of this article, the most important is the ability-to-pay principle. Firms should pay taxes when they are able. It is what Atkinson and Stiglitz (1976) make explicit when they state that "the tax burden should always correspond to taxable capacity[2]". For the government, its aim should be to stay as neutral as possible. "The tax system should remain in the background, and business, investment, and consumption decisions should be made for non-tax reasons[3]". If it is not the case, the risk could be that firms make decisions only in order to pay less or no taxes. The "lack of simplicity and neutrality invites tax avoidance".

NOL policies play a central role in such a configuration. They enable firms to pay taxes according to their financial capacity over a length of time. Most governments have proportional CIT. A progressive tax system has an intrinsic counter-cyclical effect, while proportional CIT does not. NOL policies enable CIT symmetry and provide a stabilising effect of corporate taxation on cash-flow. Firms could pay less taxes in profitable years due to the use of previous tax losses. As a consequence, firms could have more cash and they could use it for investment purposes. That is why, as stated by Auerbach and Feenberg (2000), NOL Policies play the role of "automatic stabilizers" because without any explicit action from the government, they mitigate output fluctuations.

One important study on the stabilising effect of corporate tax was the one of Devereux and Fuest (2009). They find that tax in the UK has no automatic stabilizing impact when profit and losses are not treated symmetrically. When the authors integrate NOL policies, they observe a stabilizing impact. They estimate that 8% of a potential shock to corporate income would be offset by the tax system under that confirmation.

More recently, based on German manufacturers' data, Buettner and Fuest (2010) show that the stabilising role of the corporate tax system with limited NOL

policies has been stronger in downturns, approximately 13%, and weaker in upswings, around 3%. Interestingly, with a perfect loss offsetting system, the potential stabilisation effect of perfect loss offsets is especially high in downturns, reaching as much as 20%.

More recently, two studies have shown the positive impact of NOL policies on cash-flows. Heitzman and Lester (2021) estimate that firms will save an additional $0.12 to $0.17 for each dollar of tax benefits provided by NOLs. Heitzman and Lester (2021) get a lower amount. For the average profitable firm, a $1 increase in a firm's potential direct NOL benefit at the end of year t generates $0.07 in cash tax savings in year t + 1.

NOL policies give more cash to firms which they could use for new investments or as a buffer for the years to come. The positive impact of NOL policies for attracting investments is an old topic. In 2009, Ahsan and Tsigaris (2009) show that a more liberal tax code in terms of NOL policies could be an alternative to attract investments and to a reduction of the capital tax rate. Moreover, they quantify the difference in the absence of NOL policies. With no loss offset, efficiency costs[4] amount to twenty-five cents per dollar of tax revenue or some eight percent of savings. However, in the case of full loss offset, the efficiency cost is observed to be eight cents per dollar of revenue raised or two and half percent of savings. Of course, the positive impact of NOL policies on investments varies according to their limitation.

Dressler and Overesch (2013) use data of German multinationals taken from the Microdatabase Direct Investment of the German Central Bank (Deutsche Bundesbank) and analyse the investment behaviour of multinational subsidiaries in 41 host countries during the years 1996-2007. They start by showing that the tax rate has a negative impact on investment levels. A tax rate which is one percentage point higher is associated with 0.543 percent less investment in fixed assets. On the contrary, NOL policies have a positive impact. They find significant effects of the intertemporal loss offset provision. They estimate that a loss carry forward has an offsetting effect of about 0.073 for a country with a high CIT of about 30%. Moreover, in the case of a limitation of the maximum loss carry forward to five or less years, they note a detrimental effect on investments. That means that NOL policies should be complete to have their full positive impact on investments.

NOL policies could even play a decisive role for firms when they have to choose the countries for their

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[2]League of Nations Fiscal Committee, (1939). Report to the Council on the work of the ninth session of the Committee: held at Geneva from June 12th to 21st, 1939. Series of League of Nations publications, II, Economic and financial 1939. II.A. 13, ref. no. C.181.M.110.1939.II.A.[F./Fiscal.102.] (Geneva: League of Nations).
[3]Doernberg, R.L., (2008). International taxation. 8th edition. Thomson-West.

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[4]The authors give the following definition: "Thus the efficiency cost (in cents) of raising a dollar of revenue through distortionary taxation beyond that of the dollar being raised".

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activities. For instance, Sharma et al. (2021) show that the well-known strategy of multinational companies is to reduce theirs worldwide tax liability by selling an intangible asset to an affiliate in a low-tax country. Such a strategy could be also profitable even at an arm's-length price, as long as the NOL policies in the home country is imperfect. NOL policies could be in that way the adjustment variable in determining the localisation of an intangible asset. It still is beneficial to transfer the IP offshore to a country with an identical or higher tax rate, as long as the NOL policies offshore are sufficiently more generous than the one in the home country.

The last paper worth mentioning is the one from Hanappi (2018). He provides new empirical evidence on the potential effects of carryover provisions. He uses data of 34 OECD and non-OECD countries to illustrate the effects that specific carryover provisions have on a firm's ability to recoup its tax losses. However, his work is not based on firm-level data, as he uses a simulation approach in his analysis on hypothetical investment projects as a benchmark: "we cannot reproduce observed levels of unused or expiring tax losses in any particular country. Instead, our analysis focuses on evaluating the impact of specific provisions on a firm's ability to recoup tax losses on the basis of a predefined investment project". He takes an example of 20 years' investment. In the normal case, the pre-tax net income is 1.33 and a post-tax cash-flow reaches 0.60. With a revenue shock of 5% and no intertemporal loss off-sets, the pre-tax net income is reduced by 49% to 0.68 and post-tax cash-flow by 83% to 0.10. In the same environment but with perfect intertemporal loss off-sets, the pre-tax net income is reduced by 49% to 0.68 and post-tax cash-flow by 83% to 0.10. In the same environment but with perfect intertemporal loss off-sets, the pre-tax net income is the same at 0.68 but the post-tax cash-flow is higher by 40% because it reaches 0.14. However, as he mentions, the NOL policies are not complete in the countries he analyses. If it was the case, he states that the tax-induced distortions towards less risky projects would have been removed and the stabilisation effects of corporate taxation would have been increased.

The aim of the following article is to confirm such a statement with the use of firm-level data in Poland.

## Research method

The BACH database is used for empirical observations. The period analysed is ten years, from 2011 to 2020. As stated on the website, "the data are based on the annual statistical financial statements collected by the Central Statistical Office. The survey comprises enterprises of more than 9 employees". A comparison between sectors according to the NACE classification of economic activities based on Regulation (EC) No 1893/2006 of the European Parliament and of the Council, 20 December 2006 is used. NACE is the "statistical classification of economic activities in the European Community" and it is the acronym for "nomenclature statistique des activités économiques dans la Communauté européenne". The following 41 sectors are analysed.

**Table 2: Sectors selected for the analysis**

| No. | Sectors |
|-----|---------|
| 1 | Agriculture, forestry and fishing |
| 2 | Crop and animal production, hunting and related service activities |
| 3 | Mining and quarrying |
| 4 | B8 - Other mining and quarrying |
| 5 | Manufacture of beverages |
| 6 | Printing and reproduction of recorded media |
| 7 | Manufacture of coke and refined petroleum products |
| 8 | Manufacture of chemicals and chemical products |
| 9 | Manufacture of basic pharmaceutical products and pharmaceutical preparations |
| 10 | Manufacture of basic metals |
| 11 | Manufacture of motor vehicles, trailers and semi-trailers |
| 12 | Manufacture of other transport equipment |
| 13 | Other manufacturing |
| 14 | Electricity, gas, steam and air conditioning supply (D) |
| 16 | Water collection, treatment and supply |
| 17 | Waste collection, treatment and disposal activities; materials recovery |
| 18 | Construction |
| 19 | Construction of buildings |
| 20 | Civil engineering |

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| 21 | Specialised construction activities |
| 22 | Transportation and storage |
| 23 | Warehousing and support activities for transportation |
| 24 | Accommodation and food service activities |
| 25 | Food and beverage service activities |
| 26 | Publishing activities |
| 27 | Programming and broadcasting activities |
| 28 | Telecommunications |
| 29 | Information service activities |
| 30 | Real estate activities (L) |
| 31 | Real estate activities (L48) |
| 32 | Architectural and engineering activities; technical testing and analysis |
| 33 | Advertising and market research |
| 34 | Professional, scientific and technical activities |
| 35 | Rental and leasing activities |
| 36 | Employment activities |
| 37 | Travel agency, tour operator and other reservation service and related activities |
| 38 | Security and investigation activities |
| 39 | Human health and social work services |
| 40 | Human health activities |
| 41 | Arts, entertainment and recreation |

*Source: Own elaboration.*

The analysis is narrowed by firms' size. Small firms (turnover < 10 million €) are distinguished from medium-sized firms (10 million € ≤ turnover < 50 million €) and from large firms (turnover ≥ 50 million €). SMEs cover firms with turnover < 50 million €.

The research method is based on real firms' data according to their sector and their size to get more precise observations.

In Poland, the standard rule is that a NOLCF is limited to five years and capped at 50% of total loss per year. NOL policies in Poland are not complete.

In the database, tax/loss on profit is presented. The amount is corrected by the change in deferred tax to get "only" the corporate income tax of the year. The starting year is 2011, and the postulate is: from that date no previous fiscal deficit exists. Then, only sectors and companies with CIT paid are kept, which means when CIT > 0 in at least one year. Two cases are distinguished: CIT = 0 or CIT > 0.

To compute the fiscal loss, Earning Before Tax (EBT) is used. When EBT < 0, the amount is considered a fiscal loss and no CIT is paid. Such simplification is used because unfortunately the "real" fiscal result reported by firms to the tax office is not known. The standard CIT rate in Poland is 19%. All the data are considered raw.

The starting point of the research method is the non-complete NOL policies in Poland described as the raw case. Then the impact of four cases on the raw case is tested to evaluate the consequences of more developed and complete NOL Policies.

The following four hypotheses are tested:

Case 1a: the limits of five years and 50% per year is cancelled. Case 1 = ∞ NOLCF. When EBT < 0 in year N and CIT = 0, 100% of the loss in the following years (N+1, N+2…) could be used and it is cumulative. The hypothesis that 50% has already been used as established in the fiscal law is adopted. This means that the CIT in N+1 is corrected with the use of 100% of the loss in N. At the same time, the following years are corrected because the fiscal deficit is used in full before that time. This means that N+2 or N+3 will have more CIT because the loss of N is already used in full at N+1 or N+2. Finally, the change in the effective tax rate (CIT / EBT) between the raw case and case 1a is analysed.

Case 1b: data in case 1a are used but the impact of the time value of money is added. A deduction in later years is not valuable in real terms as a deduction made today. For this reason the impact of inflation is added. When EBT < 0 in year N and CIT = 0, 100% of the loss in the following year (N+1, N+2…) is used and it is cumulative. However, in that case, the value of the loss in the following year (N+1, N+2…) is increased by the inflation rate registered in the following year (N+1, N+2…). Next, the change in the effective tax rate (CIT / EBT) between the raw case and case 1b is analysed.

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Case 2a: a full NOLCB is used. Case 2 = fiscal loss in year N is 100% used in year N-1 or N-2. At the same time, the following years are corrected because the fiscal deficit is used in full before that time. That means that N+1 or N+2 will have more CIT because the loss of N is already used in full at N-1 or N-2. If a deficit to be used in N+1 or N+2 is still present, it is then used in full as in case 1. That means that if the loss of N is not already used at in full at N-1 or N-2, the remaining amount is used in N+1 or N+2. Finally, the change in the effective tax rate (CIT / EBT) between the raw case and case 2a is analysed.

Case 2b: data in case 2a are used but the impact of the time value of money is added. A deduction in later years is not valuable in real terms as a deduction made today. For this reason, the impact of the inflation is added. Finally, the change in the effective tax rate (CIT / EBT) between the raw case and case 2b is analysed.

The aim of the research method is to show that in all previous four cases where NOL policies are used at all previous four cases where NOL policies are used at their full potential (backward, forward, in both ways and with the use of the time value of money), such fiscal tool helps to make a firm more robust with a better adjusted CIT paid to its financial capacity over a length of time.

In Anti-fragility: Things that Gain from Disorder, Nassim Nicholas Taleb (2012) defines a convex or anti-fragile system as one that gains strength from downturns and volatility. NOLs are the fiscal tool which enables such gain.

To estimate such effect, the research method integrates the gross impact in terms of CIT reduction to be paid as a benchmark.

## Research results

Applying the previous cases described to the sample, the number of sectors covered in the analysis is reduced. Out of 41 sectors, only 29 sectors have responded positively by the conditions described in the raw case.

**Table 3: Summary of sectors used in the analysis**

| No. | Sectors |
| --- | --- |
| 1 | Accommodation and food service activities |
| 2 | Advertising and market research |
| 3 | Architectural and engineering activities; technical testing and analysis |
| 4 | B8 - Other mining and quarrying |
| 5 | Construction |
| 6 | Construction of buildings |
| 7 | Crop and animal production, hunting and related service activities |
| 8 | Electricity, gas, steam and air conditioning supply |
| 9 | Employment activities |
| 10 | Food and beverage service activities |
| 11 | Human health activities |
| 12 | Human health and social work services |
| 13 | Information service activities |
| 14 | Manufacture of basic metals |
| 15 | Manufacture of basic pharmaceutical products and pharmaceutical preparations |
| 16 | Manufacture of coke and refined petroleum products |
| 17 | Manufacture of motor vehicles, trailers and semi-trailers |
| 18 | Manufacture of other transport equipment |
| 19 | Mining and quarrying |
| 20 | Other manufacturing |
| 21 | Programming and broadcasting activities |
| 22 | Security and investigation activities |
| 23 | Specialised construction activities |
| 24 | Telecommunications |
| 25 | Total M (without M701) |
| 26 | Travel agency, tour operator and other reservation service and related activities |
| 27 | Warehousing and support activities for transportation |
| 28 | Waste collection, treatment and disposal activities; materials recovery |
| 29 | Water collection, treatment and supply |

*Source: Own elaboration.*

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In each case, the change in the effective tax rate (CIT / EBT) over a period of five years is computed.

Then, the average of the effective tax rate and the variance to appreciate the change are calculated.

**Table 4: Summary of the impact of each case**

| Row Labels | Average | Variance |
|---|---|---|
| 1a | 52.41% | 2.04 |
| 1b | 52.99% | 2.07 |
| 2a | 54.49% | 2.26 |
| 2b | 54.75% | 2.27 |
| Raw case | 54.61% | 2.18 |

*Source: Own elaboration.*

As shown above, the effective tax rate is on average higher "only" in case 2b. In the other cases, the NOL policies are more favourable for firms. Concerning the case 2b, it is the case mainly for large firms.

**Table 5: Case 2b and the raw case, from the perspective of the size of the firm**

| No. | Average | Difference versus the raw case |
|---|---|---|
| Large | 44.67% | NA |
| 2b | 45.84% | 5.3% |
| Raw case | 43.54% | |
| Medium | 68.45% | NA |
| 2b | 68.73% | 0.8% |
| Raw case | 68.17% | |
| Small | 66.32% | NA |
| 2b | 64.56% | -5.1% |
| Raw case | 68.07% | |
| SME | 39.82% | NA |
| Raw case | 39.34% | -2.4% |
| 2b | 40.31% | |

*Source: Own elaboration.*

Looking in details for large firms, it appears that it concerns only 4 sectors over 22 sectors. Without those 4 sectors (Architectural and engineering activities; Technical testing and analysis / Crop and animal pro-

Hunting and related service activities / Travel agency, Tour operator and other reservation service and related activities), a reduction of the effective tax rate is observed.

**Table 6: Large firms in the case 2b. compared to the raw case without 4 sectors**

| Large | Average |
|---|---|
| 2b | 41.25% |
| Accommodation and food service activities | 12.77% |
| Advertising and market research | 18.55% |
| B8 - Other mining and quarrying | 66.38% |
| Construction | 79.08% |
| Construction of buildings | 81.38% |
| Electricity, gas, steam and air conditioning supply | 10.63% |
| Employment activities | 137.49% |
| Human health activities | 0.56% |
| Human health and social work services | 1.46% |
| Manufacture of basic metals | 17.22% |
| Mining and quarrying | 17.54% |
| Programming and broadcasting activities | 22.39% |
| Specialised construction activities | 180.52% |

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| | |
|---|---|
| Telecommunications | 39.74% |
| Total M (without M701) | 21.63% |
| Warehousing and support activities for transportation | 0.00% |
| Waste collection, treatment and disposal activities; materials recovery | 12.73% |
| Water collection, treatment and supply | 22.42% |
| Raw case | 41.60% |
| Accommodation and food service activities | 12.77% |
| Advertising and market research | 18.51% |
| B8 - Other mining and quarrying | 66.38% |
| Construction | 78.02% |
| Construction of buildings | 79.07% |
| Electricity, gas, steam and air conditioning supply | 10.63% |
| Employment activities | 138.61% |
| Human health activities | 3.30% |
| Human health and social work services | 3.30% |
| Manufacture of basic metals | 17.06% |
| Mining and quarrying | 17.54% |
| Programming and broadcasting activities | 23.59% |
| Specialised construction activities | 182.59% |
| Telecommunications | 39.74% |
| Total M (without M701) | 22.53% |
| Warehousing and support activities for transportation | 0.00% |
| Waste collection, treatment and disposal activities; materials recovery | 12.73% |
| Water collection, treatment and supply | 22.42% |

*Source: Own elaboration.*

The results show that for mainly all firms in all sectors, applying more developed NOL policies means a lower effective tax rate.

The variance is higher in case 2a and 2b compared to the raw case, meaning that earlier use of a complete or almost complete fiscal deficit logically means higher CIT in years to come. When NOL policies are stronger or complete, firms tend to use it earlier, when they have of course years with profit. They should have also more cash earlier due to a lower CIT amount to be paid.

To assess the antifragility, the amount of CIT to be paid in each case is measured.

In all cases, there is a lower amount. A higher impact in terms of CIT reduction could be observed in case 2b, when NOL policies are complete. In both cases, taking into account the time value of money (1b and 2b), less CIT to be paid is obtained.

**Table 7: Impact of each case in terms of CIT**

| Row Labels | Sum | Difference versus the raw case |
|---|---|---|
| 1a | 1 008 225 | -0.61% |
| 1b | 1 007 713 | -0.66% |
| 2a | 1 004 350 | -0.99% |
| 2b | 1 004 154 | -1.01% |
| Raw case | 1 014 362 | 0.00% |

*Source: Own elaboration.*

In terms of firms' size, for large firms, case 1a is the most interesting in terms of reduction of the effective tax rate. It is better for them to use the fiscal deficit in full when it appears. The possibility to carry back NOL means for them a higher effective tax rate in the following years. Large firms have possibility to manage their tax liabilities and such observation illustrates this.

The impact on the amount of CIT to be paid is not as strong as for firms of other sizes. This could be explained by the greater number of solutions they have to influence the amount of CIT to be paid. They know how to fully use a CIT reduction.

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**Table 8: Summary of the impact for large firms**

| Large | Average | Variance | CIT | Difference versus the raw case |
|-------|---------|----------|-----|-------------------------------|
| 1a | 41.47% | 1.35 | 728 663 | -0.42% |
| 1b | 42.57% | 1.41 | 728 346 | -0.47% |
| 2a | 45.47% | 1.58 | 731 731 | 0.00% |
| 2b | 45.84% | 1.60 | 731 651 | -0.01% |
| Raw case | 43.54% | 1.42 | 731 759 | 0.00% |

*Source: Own elaboration.*

For medium-sized firms, there is no impact of each case in terms of reduction of the effective tax rate. The case two does a bit better than case one. The difference in the amount of CIT to be paid is important for the cases that are case two compared to the raw case.

It looks more interesting for them to use the fiscal deficit in advance. The cases that are case one have almost no impact. If one sector ("Mining and quarrying") is not taken into account, the reduction of the effective tax rate is observed in all cases.

**Table 9: Summary of the impact for medium firms**

| Medium | Average | Variance | CIT | Difference versus the raw case |
|--------|---------|----------|-----|-------------------------------|
| 1a | 68.86% | 2.11 | 113 220 | 0.06% |
| 1b | 68.86% | 2.11 | 113 184 | 0.03% |
| 2a | 68.73% | 2.50 | 107 108 | -5.34% |
| 2b | 68.73% | 2.50 | 107 068 | -5.38% |
| Raw case | 68.17% | 2.26 | 113 154 | 0.00% |

*Source: Own elaboration.*

**Table 10: Summary of the impact for medium firms without mining and quarrying sector**

| Medium 2 | Average | Variance |
|----------|---------|----------|
| 1a | 67.97% | 2.12 |
| 1b | 67.94% | 2.12 |
| 2a | 68.60% | 2.57 |
| 2b | 68.60% | 2.57 |
| Raw case | 69.13% | 2.33 |

*Source: Own elaboration.*

For small firms, the impact is strong in all cases. They do better than the raw cases in terms of reduction of the effective tax rate.

In the amount of CIT to be paid, all cases have an impact. Here also, the cases that are case two have a more important impact.

**Table 11: Summary of the impact for small firms**

| Small | Average | Variance | CIT | Difference versus the raw case |
|-------|---------|----------|-----|-------------------------------|
| 1a | 61.94% | 3.86 | 60 370 | -0.38% |
| 1b | 61.91% | 3.86 | 60 321 | -0.46% |
| 2a | 64.62% | 3.97 | 59 513 | -1.79% |
| 2b | 64.56% | 3.97 | 59 499 | -1.81% |
| Raw case | 68.07% | 4.13 | 60 597 | 0.00% |

*Source: Own elaboration.*

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For SMEs, the impact is real for all cases as it gathers small and medium-sized firms. Here, case two is stronger than case one.

In the amount of CIT to be paid, all cases have a huge impact on CIT.

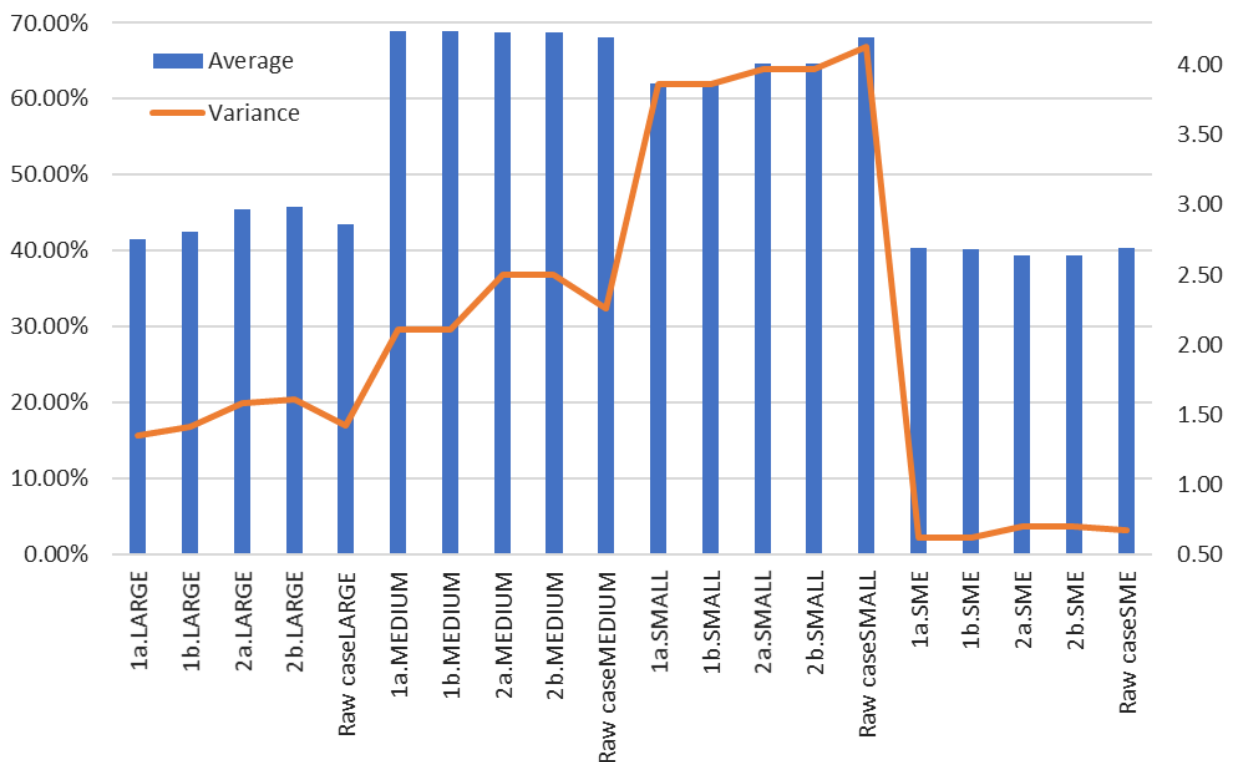**Table 12: Summary of the impact for SME**

| SME | Average | Variance | CIT | Difference versus the raw case |
|---|---|---|---|---|
| 1a | 40.31% | 0.62 | 105 972 | -2.65% |
| 1b | 40.24% | 0.62 | 105 861 | -2.75% |
| 2a | 39.37% | 0.70 | 105 997 | -2.62% |
| 2b | 39.34% | 0.70 | 105 936 | -2.68% |
| Raw case | 40.31% | 0.68 | 108 851 | 0.00% |

*Source: Own elaboration.*

In conclusion, in terms of effective tax rate reduction, case one is most important for large firms, unlike case two for SME firms. This supports the idea that SMEs have less possibility to influence their CIT, and this mechanism could play a real role in their cash-flow management. In terms of CIT to be paid, a reduction is observed. Taking into account the time value of money increases the reduction implied by NOL policies.

**Chart 1: Impact of each case by firms' size**



*Source: Own elaboration.*

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## Discussion

Taking a specific country, Poland, and firms' data, four cases are tested from the raw case based on a standard NOLCF limited in its length and not linked to the time value of money to a complete NOL policy. The results are the following.

1) Applying more developed NOL policies implies a lower effective tax rate;

2) In our model, firms use an earlier fiscal deficit. The variance confirms the intuition, that earlier use of a full or almost full fiscal deficit logically means higher CIT in years to come;

3) Over the period, applying more developed NOL policies implies less CIT to be paid in gross terms and firms have a higher level of cash ;

4) In terms of firms' size, the impact of applying more developed NOL policies is stronger on the effective tax reduction the smaller the companies are. Case 1 is most important for large firms, unlike case 2 for SME firms.

5) In terms of CIT to be paid, the firms' size show also a reduction in all cases.

NOL policies play a part in building an anti-fragility fiscal system. They enable firms to gain strength from downturns by increasing their cash-flows in optimizing the amount of CIT to be paid taking into account their fiscal result over the period. The observations in terms of firms' size are decisive for the state according to the share of firms it has inside its boundaries.

### Fiscal implications and further studies

NOL policies appear to play a part in an anti-fragility fiscal system. This ensures that businesses are taxed on their average profitability over time, which enables the firm to take all dimensions of the volatility of its businesses and better take into account the risky nature of investment projects. They have also a liquidity-enhancing effect, which could be decisive during economic shocks.

For future research, it would be good to specify the analysis by building some tests based on the declared fiscal result registered by the state and also compensation for the impact of loss of CIT due to the expansion of NOL policies. If firms could invest more, eventually firms will be more profitable and potentially have higher CIT in the future. Moreover, such initial loss could generate a profit when a crisis occurs if they enable the necessary aid from the state to be lowered. That could be also a topic for future research.

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