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Modelling the macroeconomic impact of competition policy: 2023 update and further development

Prepared by

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Joint Research Centre

Directorate General Economic and Financial Affairs

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EXECUTIVE SUMMARY

This report models and analyses various aspects of the macroeconomic impact of competition policy interventions by the European Commission over the period 2012-2022. Based on information provided by the Directorate-General for Competition (DG COMP) on its merger interventions, cartel prohibitions and other antitrust interventions, the Joint Research Centre (JRC) has used two models to simulate the macroeconomic impact of such interventions: the QUEST III macro-model of the EU economy, which was developed by the Directorate-General for Economic and Financial Affairs (DG ECFIN) for assessing the impact of EU policies, and an EU-wide input-output model, which allows for an investigation of the sectoral differentiation and spill-over effects of competition policy interventions.

The simulation carried out in QUEST III allows to evaluate the impact of competition policy enforcement on economy-wide measures of performance such as GDP, employment, prices and productivity. The impact includes the direct price effects of the Commission's competition policy interventions (as captured by the annual customer savings calculations) as well as the indirect, deterrent effects of these interventions. This report updates the model simulation published in the previous edition (European Commission, 2023) by including the competition interventions by the Commission in the latest year for which data are available, 2022. Overall, the computation of the mark-up shock and the related macroeconomic impact does not significantly differ from the numbers obtained using the cohort of 2012-2021. This is in itself not surprising as the mark-up shock is computed on the basis of the average direct and indirect price effects of the Commission's competition policy interventions over the relevant time period, an average which becomes more and more stable with the increase of years of data on interventions.

The updated simulation results suggest a 1.16 percentage point reduction in markups (as measured by the Lerner index) resulting from the Commission's competition policy interventions. This reduction in mark-ups, applied to a (calibrated) mark-up level of 13.56 percent in the steady-state of the QUEST III model, triggers an increase of real GDP relative to the baseline in the range of 0.6% - 1.1% in the medium to long term (the equivalent of an uplift of EUR 100 - 180 billion in current GDP), as well as a 0.3% - 0.7% reduction in the price level. All the main components of aggregate demand increase. More specifically, after 5 years, the results suggest an increase in consumption (0.5%) and investment (1.1%) despite the decline in profits associated with the negative markup shock. Investment is increasing because the negative direct effect of markups on future profitability is more than offset by the positive effect of the increasing demand due to the lower prices.

In a similar way as competition policy interventions are mapped onto the QUEST III model, an input-output model can be used to assess the price effects of competition policy interventions throughout the economy. The input-output model analyses how these price effects are transmitted across sectors using information on economic interdependencies retrieved from an input-output table of the European Union. On average, the Commission's competition policy enforcement is estimated to lower prices by around 0.93%. Two thirds of the overall effect can be attributed to the "within-sector price-effect" including both the direct and deterrence effects of competition policy interventions with respect to that sector. The remaining part, i.e. the "spill-over price effect", results from amplification of this impact due to the transmission of price effects across sectors.

The report further considers three different (hypothetical) scenarios regarding the state of competition in the EU. The first one aims at describing the 'costs of non-competition' in the EU by assessing the additional real GDP growth that would have resulted if the increase in markup observed in the EU over the last 20 years had not occurred (abstracting away from other developments in the economy, such as changes in technology, which may also have had an impacted on observed markups). The two other scenarios seek to assess the ‘benefits of competition’ to the wider economy by simulating how GDP growth would be impacted if one were to move from the current state of the economy to hypothetical more competitive benchmarks (featuring lower mark-ups). Overall, the modelling results indicate that the corresponding reduction in markups (of around 8%) could deliver significant positive effects to the economy, with an estimated increase of GDP of in the range of 3,5 - 5% after 10 years. When the benchmark scenario also allows for a change in TFP (Total Factor Productivity), one can even observe amplified benefits of a more competitive environment to almost 4 - 6% after 10 years.

1. INTRODUCTION

Competition policy interventions by the European Commission and other relevant agencies generate large benefits for consumers by ensuring that businesses and companies compete fairly with each other. By preventing the continuation of harmful conduct or anti-competitive mergers, such market interventions help reduce prices, create a wider choice for consumers and improve quality and innovation.

Part of the savings for customers, which can be estimated in a rather straightforward manner, reflect the *direct* aggregate price effects of important interventions.[1] Nevertheless, these customer savings only reflect the “tip of the iceberg” in terms of positive effects of competition policy for society. Enforcement also generates (i) indirect deterrence effects and (ii) positive non-price effects on innovation, quality, and productivity in the markets concerned which are likely to be significantly larger, but also more difficult to estimate. Furthermore, the above-described benefits of competition enforcement at market level are likely to culminate in the improvement of economy-wide measures of performance such as GDP, employment, prices and aggregate productivity.

This report models and analyses various aspects of the macroeconomic impact of competition policy interventions by the European Commission over the period 2012-2022. Based on information provided by the Directorate-General for Competition (DG COMP) on its merger interventions, cartel prohibitions and other antitrust interventions, the Joint Research Centre (JRC) has used two models to simulate the macroeconomic impact of such interventions: the QUEST III macro-model of the EU economy, which was developed by the Directorate-General for Economic and Financial Affairs (DG ECFIN) for assessing the impact of EU policies, and an EU-wide input-output model, which allows for an investigation of the price effects by sector of competition policy interventions and their transmission to the rest of the economy, taking into account sectoral interdependences. These two modelling tools are complementary. The QUEST III model captures the impact of competition policy enforcement on economy-wide measures of performance such as GDP, employment, prices and productivity. The input-output model explores the price effects of competition policy interventions at the industry/sector level, by exploiting information on the sector distribution of such interventions and by tracking the interlinkages between industries.

The present report updates the macro-model and input-output model simulations published in the previous edition (European Commission, 2023) by including the competition interventions by the Commission in the latest year for which data are available, 2022. The report further considers three different (hypothetical) scenarios regarding the state of competition in the EU developed in a separate study by consultants Lear et al. (2023). The first one aims at describing the costs of non-competition in the EU by assessing the additional real GDP growth that would have been performed without the increase in markup observed in the EU over the last 20 years (hence abstracting away from other developments in the economy, such as changes in technology, which may also have had an impact on observed markups). The two other scenarios seek to assess the benefits of competition to the wider economy. This is

[1] For further background, see European Commission (2022a), *Competition Policy Brief:* Customer savings generated by the Commission's antitrust and merger enforcement, a 10-year perspective (1/10/2022). The sample of decisions (“interventions”) used for the customer savings calculations in this Report consists of decisions concerning anticompetitive mergers, cartels and non-cartel antitrust conduct and agreements. Merger interventions include phase II prohibitions, phase II clearances subject to remedies, phase II abandonments and phase I clearances with remedies. Cartel interventions consist of prohibition decisions under Article 7 of Reg. 1/2003. Antitrust interventions include prohibition decisions under Article 7 and commitment decisions under Article 9 of Reg. 1/2003, as well as “informal interventions”.

achieved by simulating how GDP growth would be impacted by moving from the current state of the economy to hypothetical more competitive markets (featuring lower mark-ups).

This year's annual report has the same format as the previous year's report. However, contrary to previous years, there are no technical annexes. The report has been kept relatively concise, focusing on the main methods used and results obtained. The report is a collaborative effort of two Directorates-General (DG COMP and the JRC), and has benefited from the support of DG ECFIN.

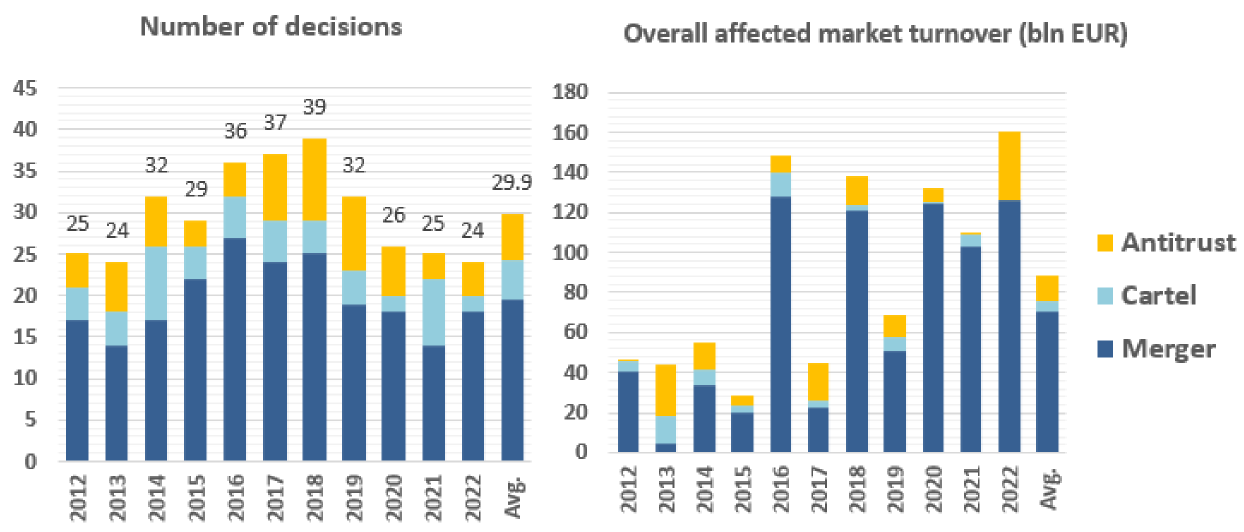
2. OVERVIEW OF COMPETITION POLICY INTERVENTIONS 2012-2022

In this report, we analyse the impact of competition policy interventions by the Commission in the 11-year period between 2012 and 2022. There are three types of cases: merger interventions, cartel prohibitions and antitrust interventions other than cartels.

During the analysed period, the Commission intervened in the market 329 times: 215 merger, 51 cartel and 63 antitrust decisions were adopted. Taken together, the size of the markets directly affected by these interventions is worth a total of approximately EUR 977 billion.[2] The distribution of competition policy enforcement over time can be seen in Figure 2.1. The left-hand panel of the figure displays the number of decisions by type. In the right-hand panel, the overall turnover in the markets affected by those decisions is presented.

The smallest number of decisions in a given year is 24 (in 2013 and 2022) and the maximum number is 39 (in 2018). The total size of the markets affected by decisions may change remarkably from one year to another because cases differ widely in terms of associated market turnover. In 2016, for example, the total affected market size was more than five times larger than the value for 2015 despite the difference in case count being relatively modest. The year 2022 is characterized by a low number of interventions but the largest overall affected market size. This is because of the presence of a few large cases. In 2022, the five largest interventions (three merger cases and two antitrust cases)[3] account for more than 80% of the overall affected market size.

Figure 2.1: European Commission interventions 2012-2022 (Descriptive statistics)



2 Specifically, for the purpose of calculating turnover, the annual turnover of all firms in the affected market(s) is used in the case of merger interventions, while the annual turnover of the companies under investigation in the affected market(s) is used for cartel and antitrust cases.

3 The three merger cases are M.9987 - Nvidia/Arm, M.9343 - Hyundai Heavy Industries Holdings / Daewoo Shipbuilding & Marine Engineering, and M.10638 - ALD / LeasePlan. The antitrust cases are AT.40462 - Amazon Marketplace and AT.40703 - Amazon Buy Box.

Over the period of analysis (2012-2022), the average number of interventions per year is around 30, with merger cases being most frequent (65% of the total number of interventions), followed by cartels (16%), restrictive agreements and concerted practices under Article 101 (11%) and abuse of dominant positions under Article 102 (7%). In 4 cases, (1%), interventions were performed under Articles 101 and 102 together, and/or in combination with Article 106 (exclusive right).

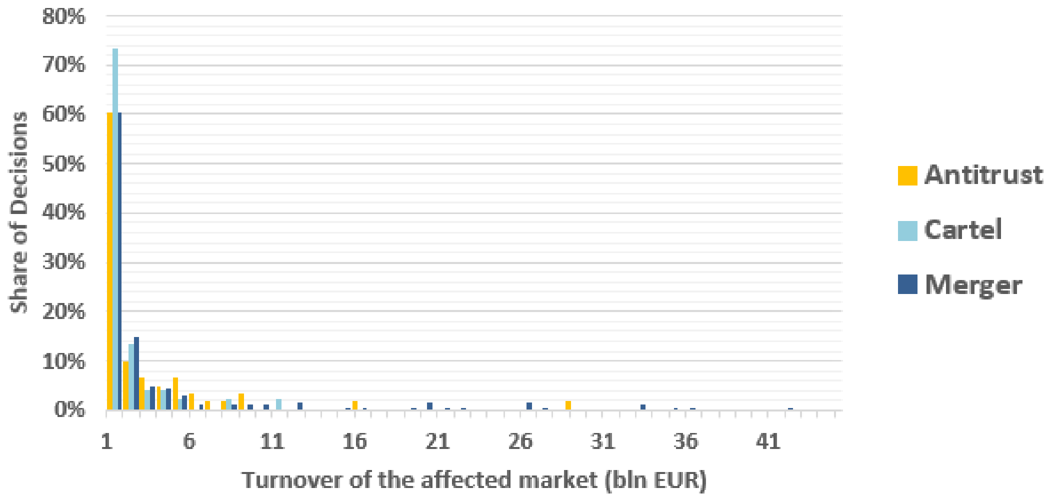
In most years, mergers are also leading in terms of the share of affected market turnover, constituting about 79% of the total on average.[4]

As measured by market turnover affected by the decisions, merger cases have a larger average size (EUR 3.6 billion) than antitrust (EUR 2.2 billion) and cartel cases (EUR 1.2 billion). These results are mostly due to a handful of important merger interventions made in the years 2016, 2018, 2020 and 2022. As can be seen from Figure 2.2 below, such large decisions are relatively uncommon.[5] The overwhelming majority of cases – whether concerning merger interventions, cartel prohibitions or antitrust interventions – affect relatively small markets. Indeed, more than 60% of merger and antitrust interventions and more than 70% of cartel prohibitions concern affected markets with a total turnover lower than EUR 1 billion. This also explains why for all competition policy instruments the average size of the affected markets is substantially greater than the median size with median values of EUR 0.58 billion for mergers, EUR 0.54 billion for cartels and EUR 0.69 billion for antitrust cases.

[4] An exception to the pattern, however, is the year 2013, in which antitrust and cartel cases accounted for 59% and 30% of the total affected turnover, respectively.

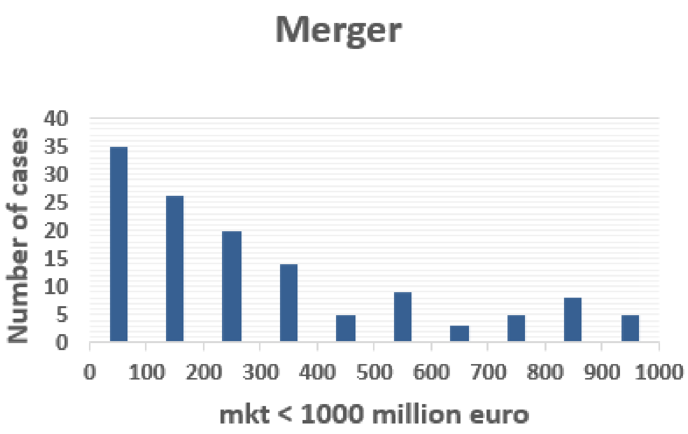
[5] Visually, distributions of affected market turnover presented in Figure 2.2 resemble heavy-tailed distributions. In case of a distribution with very heavy tails with an undefined or infinite mean, the arithmetic average of affected market turnovers could be meaningless. Therefore, in order to ensure eligibility of the prior considerations we tested if affected market turnover comes from a distribution with a finite mean. Bootstrap test for finite moments (Fedotenkov 2013) does not reject the null assumption that the affected market turnovers come from distributions with finite mean (the corresponding p-values for cartels, mergers and antitrust are 0.294, 0.241 and 0.349). Hill estimator (Hill 1975) provides the following estimates of the Pareto-like tail index: 1.231 for cartels, 2.347 for mergers and 1.640 for antitrust. In all cases, the estimates are greater than one, indicating that the samples come from distributions with a finite mean. Therefore, our previous discussion is mathematically correct.

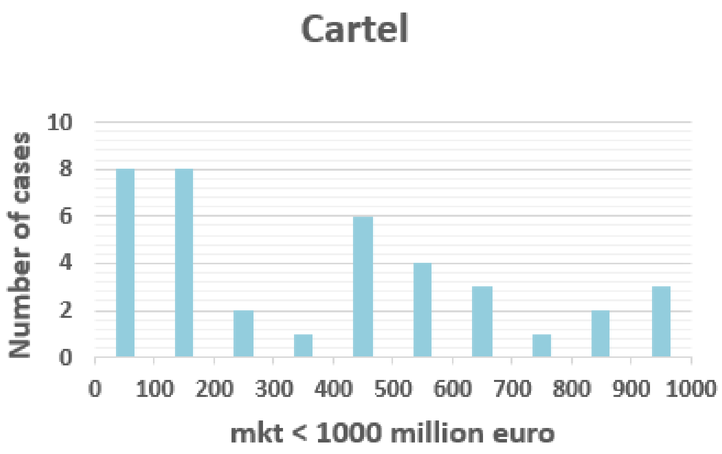
Figure 2.2: Distribution of affected market turnover by competition policy instrument



As most of the observations presented in Figure 2.2 have a relatively small turnover, we present in Figure 2.3 a histogram of cases for which the affected turnover is less than EUR 1 billion. Again, most observations concentrate on the left-hand side of the charts, indicating that interventions in affected markets with a relatively low total turnover are the more frequent, especially for merger and antitrust.

Figure 2.3: Distribution of affected market turnover by competition policy instrument (<1 EUR bn.)





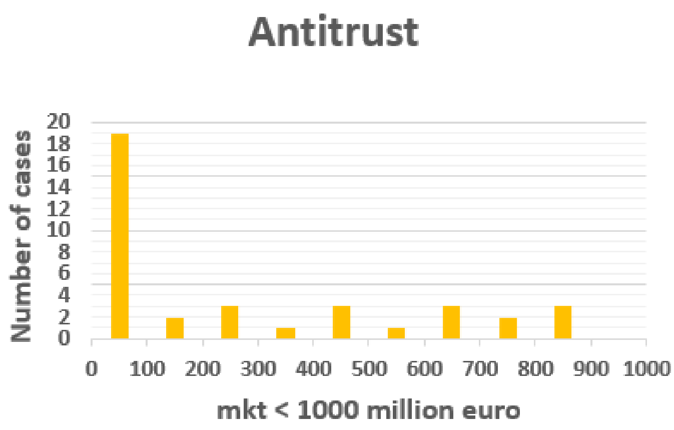
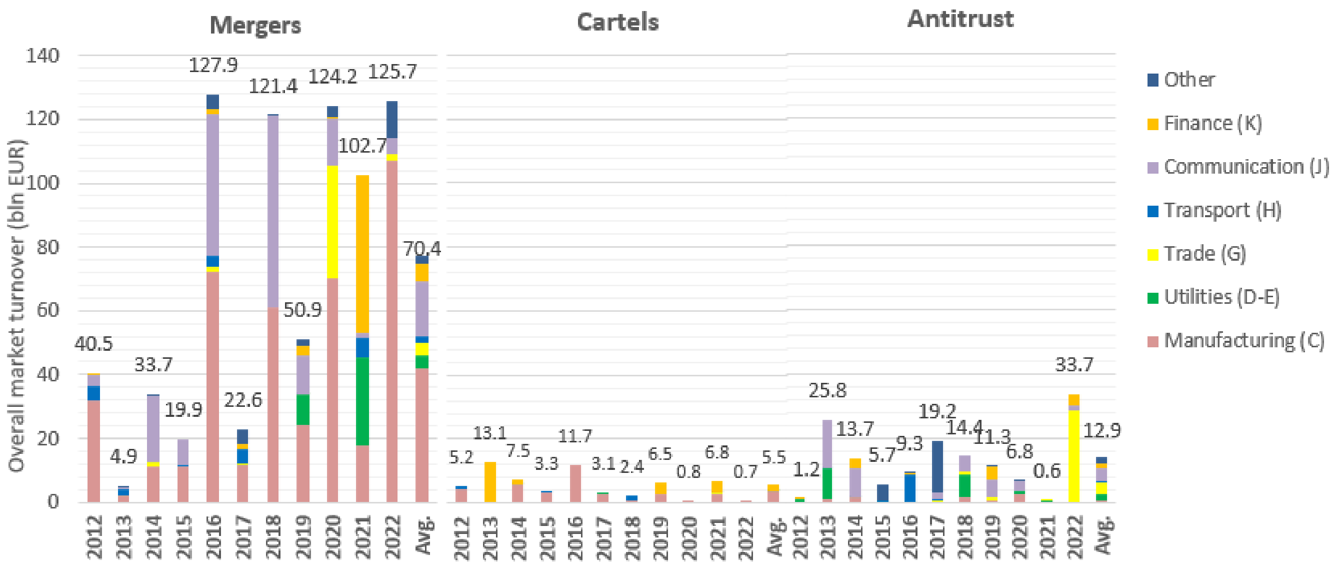


Figure 2.4 below presents the affected turnover of cartel, merger and antitrust interventions, by year and by sector. It emerges that to a very considerable degree, the Commission's cartel prohibitions and merger interventions occurred in the manufacturing sector. In case of cartels, several important decisions, especially in the year 2013, are found in the financial sector. Regarding mergers and antitrust, a significant share of the overall affected turnover is further accounted for by cases in the communication sector. In 2022, the turnover affected by antitrust interventions is dominated by the trade sector due to one large case.

Figure 2.4: Affected turnover of cartel, merger and antitrust interventions, by NACE Rev. 2 sector



3. THE DIRECT EFFECTS OF COMPETITION POLICY INTERVENTIONS

As set out in the introduction, competition policy interventions generate large benefits for consumers by ensuring that businesses and companies compete fairly with each other. By preventing the continuation of harmful conducts or ant-competitive mergers, market interventions help reduce prices, create a wider choice for consumers, improve quality and foster innovation. Part of the savings for customers, namely those reflecting the direct aggregate price effects, can be estimated in a rather straightforward manner. Following OECD guidance[6], these savings are typically obtained for a given decision by multiplying the estimated reduction in prices (or avoided increases in price) resulting from the intervention by the size of the market concerned and the expected duration of the price reduction. The annual aggregate customer savings correspond to the sum of customer savings from all interventions in a given year.[7]

It is worth noting that the customer savings estimated only reflect the "tip of the iceberg" in terms of positive effects of competition policy for society. Enforcement also generates: (i) indirect deterrence effects; and (ii) positive non-price effects on innovation, quality, and productivity which are likely to be significantly larger, but also more difficult to estimate. It is further worth bearing in mind that the customer savings estimations, as a general rule, may disregard special features of individual interventions, and assume the correctness of the decisions concerned (i.e., no Type I nor Type II errors are committed). Therefore, they complement, but do not substitute for proper ex-post evaluation of interventions.

Since 2012, the direct price effects of interventions have been estimated using the customer savings approach. This was initially done for cartel and merger cases only but, starting last year, customer savings for non-cartel antitrust decisions have also been considered (retroactively for the full period). The current figures are based on data obtained from case teams over the eleven-year period 2012-2022.

Table 3.1 and Figure 3.1 below summarise the main conclusions drawn from the calculation of an upper bound and lower bound for the direct customer savings. For the eleven-year period under consideration, the estimated total customer savings from all competition policy interventions by the European Commission are in the range of EUR 146 billion to EUR 248 billion (depending on lower or upper bound assumptions made for the price effects of the different interventions) or, on average, EUR 13 to 23 billion per annum.

Table 3.1: Customer savings (2012-2022) in billion EUR

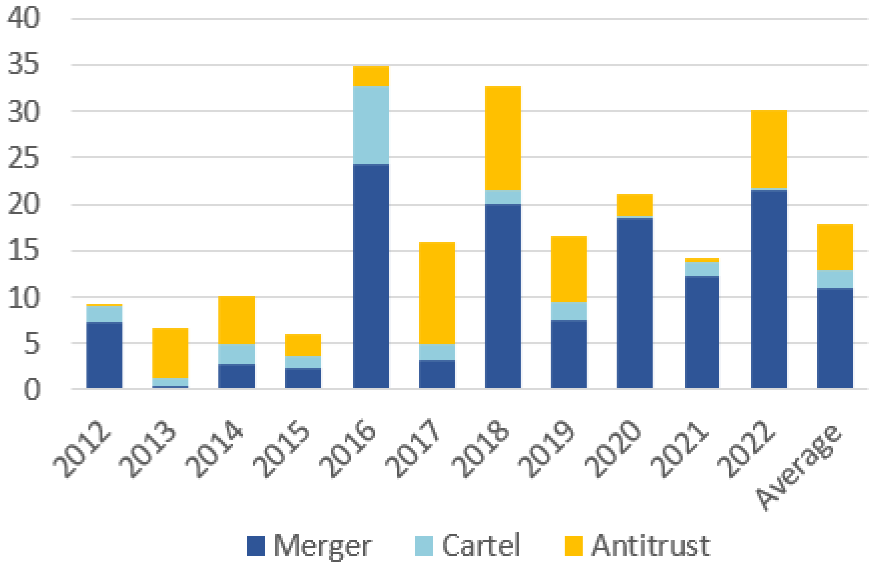
Year	Merger	Cartel	Antitrust	Total customer savings
2012	5.5 – 9.1	1.4 – 2.0	0.1 – 0.2	7.0 – 11.3
2013	0.4 – 0.6	0.6 – 0.9	4.3 – 6.6	5.3 – 8.1
2014	2.1 – 3.6	1.7 – 2.6	2.4 – 7.7	6.2 – 13.9
2015	1.7 – 2.9	1.0 – 1.5	1.6 – 3.3	4.3 – 7.7

6 OECD (2014), Guide for helping competition authorities assess the expected impact of their activities, available at https://www.oecd.org/daf/competition/Guide-competition-impact-assessmentEN.pdf.

7 Details of the calculation by the Commission can be found in European Commission (2022a).

2016	18.3 – 30.4	6.7 – 10.0	1.4 – 2.9	26.4 – 43.3
2017	2.4 – 4.1	1.4 – 2.1	7.8 – 14.3	11.6 – 20.5
2018	15.0 – 25.0	1.3 – 1.9	7.4 – 14.9	23.7 – 41.8
2019	5.7 – 9.4	1.5 – 2.3	6.4 – 7.7	13.6 – 19.4
2020	13.8 – 23.0	0.2 – 0.3	1.6 – 3.3	15.6 – 26.6
2021	9.2 – 15.3	1.3 – 1.9	0.2– 0.3	10.7 – 17.5
2022	16.1 – 26.8	0.2 – 0.3	5.6 – 11.2	21.9 – 38.3
Average per year	**8.2 – 13.6**	**1.5 – 2.4**	**3.5 – 6.5**	**13.3 – 22.5**
Average per case	0.4 – 0.7	0.3 – 0.5	0.6 – 1.1	0.4 – 0.8

Figure 3.1: Customer savings (2012-2022) in billion EUR



There is a significant variation in customer savings from one year to the next, which suggests the need to consider long time series. Such variations can be attributed to several factors, such as the size of markets in which the Commission intervenes, the scope of the interventions and the number of cases investigated. Customer savings were particularly high in 2016, 2018 and 2022, with annual amounts of over EUR 30 billion. In 2016, this was due to important merger interventions and cartel prohibitions, while in 2018, merger and antitrust interventions (specifically Art. 102) contributed to the high level of customer savings in that year. In 2022, the total customer savings amounted to EUR 30.1 billion with merger interventions playing a dominant role.

Overall, aggregate customer savings from merger interventions are larger (EUR 90 - 150 billion in total for the period considered) than those from antitrust interventions (EUR 39 - 72 billion) and cartel prohibitions (EUR 17 - 26 billion). This difference, in large part, reflects differences in the number of interventions over the 2012-2022 period with 215 interventions for mergers, 51 for cartels and 63 for antitrust (Art. 101 and Art. 102).

In addition, the range of customer savings associated with an average antitrust intervention (EUR 0.6 - 1.1 billion) lies above the ranges recorded for an average cartel prohibition (EUR 0.3 - 0.5 billion) or merger intervention (EUR 0.4 - 0.7 billion).

4. MODELLING THE DETERRENT EFFECTS OF COMPETITION POLICY INTERVENTIONS

As described in the previous section, the direct effects of competition policy interventions are often measured by the direct customer savings from such interventions. These direct effects provide, however, only a partial view of the benefits of competition policy since they do not consider the deterrent effects.

The deterrent effects consist in preventing and reducing in severity future anticompetitive behaviour of market participants. According to the economic literature, these deterrent effects are much larger than the observed effects of competition policy interventions on the markets directly affected (See Nelson and Sun, 2001; Clougherty et al., 2016). However, such deterrent effects cannot be easily measured because one needs to make inferences about changes in future behaviour by market players as a result of the interventions by competition authorities. Different methods have been applied in the past to estimate the deterrent effects of competition policy interventions (For an overview, see Dierx et al., 2020). The most commonly used estimation approach relies on surveys which have directly asked companies and their legal advisors to estimate the number of anticompetitive actions deterred for every anticompetitive action detected.[8]

This section presents an alternative approach to modelling the deterrent effects of competition policy, based on models used to describe the diffusion of information.[9] The primary purpose of this approach is to model the impact of competition policy interventions as (downward) markup shocks, reflecting both the direct effects and the deterrent effects of the competition policy intervention in the different competition policy areas.

4.1 Main principles underlying the modelling of the deterrent effects

The approach used in this report assumes that by detecting anticompetitive behaviour and intervening against anticompetitive mergers, the competition authority (i.e. the European Commission in this case) sends a signal as regards its enforcement actions that is diffused amongst market participants and amplified by interactions between them. This discourages market players from infringing competition law. This framework reflects the role of both the competition authority and the market players in the process of diffusion of information about competition policy interventions. Note that the mere existence of a competition authority can have deterrent effects depending on its reputation.[10]

The intensity of the signal sent by the competition authority to market players is captured by the strength of competition enforcement within a sector. More precisely, the strength of the

8 The ratio of the number of “deterred” cases over the number of “detected” cases is often referred to as the “multiplier” ratio. Alternatively, the multiplier can be related to the ratio of “deterred” harm over “detected” harm. However, it can be misleading to use the ratio of the number of deterred merger/cartel/ antitrust cases over the number of detected merger/cartel/ antitrust cases as a proxy of the corresponding ratio of deterred harm over detected harm (as the harm may differ from case to case).

9 For a more detailed description of this approach and a technical explanation of the model used, see Dierx, A., Ilzkovitz, F., Pataracchia, B. and Pericoli, F. (2023), “Modelling the diffusion of the deterrent effects of competition policy”, Journal of Competition Law & Economics, 19(2), 277-311.

10 This framework allows integrating the main determinants of deterrence identified by the literature: (i) the perceived probability for a company of being caught and convicted of anticompetitive behaviour by the competition authority; and (ii) the expected cost of being detected (e.g. fines being imposed or other adverse consequences). Both aspects depend, in large part, on the reputation of the competition authority, which in turn may again depend on its past enforcement record resulting from its detection and investigation activity, its (current) capacity to stop and punish anticompetitive behaviour and other characteristics of the competition policy regime.

signal is captured by the size of the market directly affected by the competition policy intervention relative to the sector to which this market belongs. This is in line with the results of business surveys showing that anticompetitive behaviour is more likely to be halted in sectors where the authorities have conducted cartel or other antitrust interventions or where they have recently prohibited or imposed severe remedies on a merger.[11]

The diffusion of this signal is modelled by the Bass or mixed-influence model (Bass, 1969), which assumes that there is a positive (non-linear) relation between detection activity (the competition policy interventions) and deterrence. In this model, the marginal effect of an increase in detection activity is not constant: for small cases, the marginal effect is increasing (convex relation between case detection and deterrence) while for large cases, the marginal effect is decreasing (concave relation). Taken together, this gives rise to an 'S-shaped' relationship between detection and deterrence.

According to the mixed-influence model, the information diffusion can be described by the following differential equation:

$$\frac{d\omega}{d\sigma} = (\alpha + \beta * \omega(\sigma)) * \{1 - \omega(\sigma)\} \qquad (4.1)$$

with the independent variable σ representing the signal sent by the competition authority to market players in the sector directly affected by the competition policy interventions and the dependent variable ω representing the deterrent effects of such detection activity.

The solution of this differential equation is:

$$\omega(\sigma) = \frac{1 - \frac{\alpha(1-\omega_0)}{\alpha+\beta\omega_0} * exp(-(\alpha+\beta) * \sigma)}{1 + \frac{\beta(1-\omega_0)}{\alpha+\beta\omega_0} * exp(-(\alpha+\beta) * \sigma)} \qquad (4.2)$$

Equation (4.2) shows that the deterrent effects of a given intervention ($\omega(\sigma)$) depend on ω_0, i.e. the initial level of deterrence which reflects the reputation of the competition authority; α, the sensitivity of market players to the external signals sent by the competition authority; and β, which is the strength of the interactions between market participants.

4.2 Measurement of model variables and calibration of parameter values

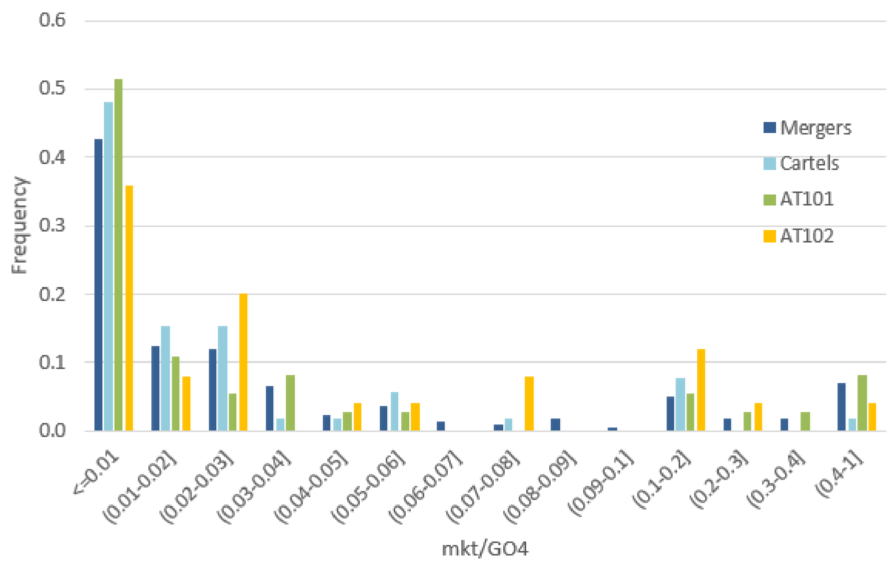
The strength of the signal sent (σ) is measured based on actual interventions made by the Commission over the period 2012-2022. More precisely, the strength of the signal sent is estimated by the size of the markets directly affected by the Commission's competition policy interventions (mkt) over gross output in the corresponding NACE four-digit sector (GO4). Accordingly, σ = mkt / GO4. The deterrent effects ω of a given intervention are defined as the share of deterred markets in the sector (mkt^D) over gross output in the corresponding NACE four-digit sector, not considering the markets directly affected by the intervention (GO4 – mkt). Accordingly, ($\omega(\sigma)$ = mkt^D / (GO4 – mkt)). On this basis, a deterrence multiplier associated with a specific competition policy intervention can be calculated as $\mathrm{mkt}^D / \mathrm{mkt} = \omega\,(1 - \sigma) / \sigma$.

Figure 4.1 below shows the frequency distribution of the variable σ for each of the f competition policy instruments considered in the analysis: merger interventions, cartel prohibitions and

[11] This assumption, while consistent with some findings in the literature, simplifies reality as the deterrent effects of important competition policy interventions can be diffused beyond the sector in which the direct effect is felt and affect a large part of the industry.

antitrust interventions under Articles 101 and 102 TFEU.[12] For all the instruments, the distribution is skewed with a long right tail. This implies that for most of the interventions, the size of the market directly affected by the intervention is very small relative to that of the corresponding sector. In almost 50% of all cases, the market size represents less than 1% of the size of the sector concerned and a large majority of the interventions have a market size corresponding to less than 5% of the sector concerned.

Figure 4.1: Frequency distribution of detection activity by policy instrument (in percentage of total, 2012-2022)



The parameters α and β used to model the diffusion of information about competition policy interventions are calibrated in such a way that the weighted average of deterrence multipliers is in line with evidence from surveys of market participants. These surveys provide evidence in support of our assumption to fix the weighted average deterrence multiplier at 10 for merger interventions, 20 for cartel prohibitions, 20 for antitrust interventions under Article 101, and 10 for antitrust interventions under Article 102. The ratio of β/α is set at 5 for all cases as this yields an S-shaped relationship between detection and deterrence, in line with the non-linear relation described in the literature.[13] Furthermore, as the reputation of the competition authority depends on its past enforcement record, the parameters ω_0 for the different competition policy instruments are set equal to the average annual intervention rates of the Commission over the period 2012-2022.

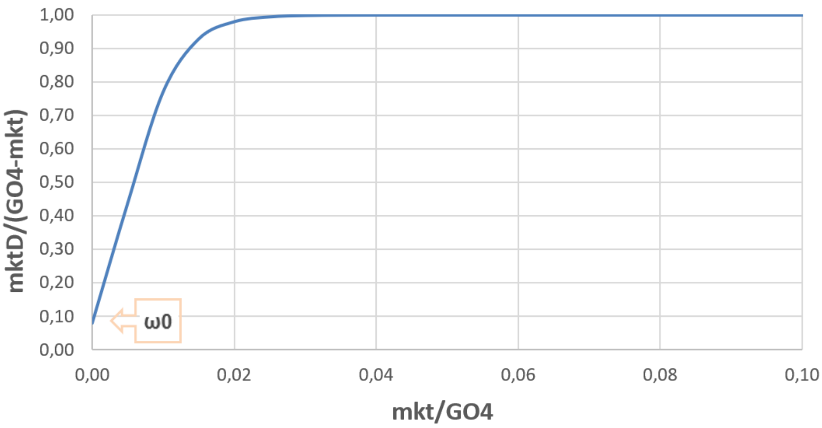
We report below the calibrated Bass function describing the relation between the signal sent by competition authorities based on their detection activity and deterrence for the Commission's merger interventions under the assumptions described above. Figure 4.2 illustrates that, in this model simulation, almost all anticompetitive mergers in the sector are deterred (i.e. not notified) following a merger intervention for which the affected market size

12 X-axis in Fig. 4.1 follows the mathematical convention of including interval end point with square bracket and excluding it with round parenthesis.

13 Dierx et al. (2023) provide a more detailed explanation of the calibration of the mixed-influence model used including an extended sensitivity analysis.

exceeds 3% of the sector size. Data on the market size of merger interventions over the period 2012-2022 show that around one quarter of merger interventions fall in this category and that such merger interventions have occurred in sectors such as mobile telecommunications, energy, steel and metals and beer.

Figure 4.2: Illustration of the relationship between detection and deterrence in a mixed-influence model (mergers)



5. ASSESSING THE EFFECTS OF INTERVENTIONS USING THE QUEST MACRO-MODEL

Competition policy serves as an instrument to increase competition amongst companies and thereby contributes to a decrease in the level of markups. By assessing the extent of changes in markups due to the European Commission's policy interventions, it becomes possible to model and simulate the effects of these competition policy interventions using the QUEST III macro-model.[14] In this section, we outline the main features of the simulation analysis with the QUEST III model and present the main results.

The logic of the simulations is as follows: for each merger intervention, cartel prohibition and antitrust intervention, DG COMP computes the annual value of sales in the affected market(s) in millions of euros at current prices. By making assumptions on the avoided price increase, its duration and the importance of deterrent effects, we convert these values into annual markup shocks (here: changes in the Lerner index[15]) at the two-digit sector level. The markup shock at the NACE two-digit sector level is the difference between the *observed* markup at the sector level, as impacted by the Commission's competition policy interventions, and the *counterfactual* markup computed in a macroeconomic scenario without competition policy interventions.

Subsequently, we aggregate these sector specific shocks into a single EU economy-wide markup shock (see European Commission, 2023). Specifically, we compute a time-invariant, permanent markup shock generated by the Commission's competition policy interventions[16], and we use this shock to simulate the macroeconomic impact through QUEST III.

More specifically, in QUEST III, the aggregate change in markup ΔMUP_K due to merger interventions, cartel prohibitions and other antitrust interventions can be defined as follows:

$$\Delta MUP_K = \sum_{i \in \{I_K\}} \left[\frac{\Delta P_i}{P_i} (1 + MUP_i) \right] \frac{GO_i}{GO} \qquad (5.1)$$

where I_K is the set of NACE two-digit sectors i in which competition policy interventions k have led to a change in customer prices.

Equation (5.1) shows that the aggregate markup shock depends on: (i) the price shocks ($\Delta P_i / P_i$) in the sectors affected by the Commission's competition policy interventions; (ii) the gross markup level (MUP_i) in the NACE two-digit sectors concerned;[17] as well as (iii) the gross output (GO_i) of the sectors affected by the Commission's competition policy interventions as a share of total gross output within the EU business economy (see European Commission, 2022b).

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[14] QUEST III belongs to the class of New-Keynesian Dynamic Stochastic General Equilibrium (DSGE) models widely used by international institutions and central banks. For more information about the features of QUEST and its applications the reader may refer to https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/economic-research/macroeconomic-models_en.

[15] To apply the markup shocks to the QUEST III model, the markups are expressed in terms of the Lerner index (L), which is defined as the difference between price (P) and marginal costs (MC) over price (P). The markup shock is obtained as an absolute variation of the Lerner markup, i.e., the difference in the level of markup.

[16] The permanence of the markup shock reflects companies' expectations that in the foreseeable future the European Commission will continue to enforce EU competition policy rules at the same average pace as the one observed over the period 2012-2021.

[17] Markup levels are calibrated according to the method proposed by Thum-Thysen and Canton (2015), which extends Roeger's (1995) markup calculation method by including the effects of product market reforms (see European Commission (2022b), Annex A.1).

The price shock in each two-digit sector (or industry) i, in turn, is computed as the weighted sum of the price changes caused by competition policy interventions in that sector:

$$\frac{\Delta P_i}{P_i} = \sum_{k \in M_i} \frac{\Delta P_k}{P_k} MS_{ik} + \sum_{k \in C_i} \frac{\Delta P_k}{P_k} MS_{ik} + \sum_{k \in A_i} \frac{\Delta P_k}{P_k} MS_{ik} \qquad (5.2)$$

where the sets M_i, C_i and A_i are comprised of merger interventions, cartel prohibitions and antitrust interventions, respectively, affecting markets in industry *i*. The market weights MS_{ik} depend on the size of the sectors directly or indirectly affected by competition policy interventions k in industry i.

When deterrence is taken into account, the total weights MS_{ik}^T include both the direct effects and the indirect deterrent effects of competition policy interventions. The total market affected includes both the markets directly affected by intervention *k* (mkt_{ik}) and the markets affected indirectly through sectoral deterrence (mkt_{ik}^D):

$$mkt_{ik}^T = mkt_{ik} + mkt_{ik}^D \qquad (5.3)$$

Finally, we also take into account information about the duration of the price increases avoided because of the Commission's competition policy interventions. This implies that the markup shock in a given year is the sum of the effects of competition policy interventions in that year and of interventions from previous years, which continue to have an effect in the current year.

Table 5.1 summarises the default assumptions underlying the permanent markup shock under the baseline scenario: the avoided price increase equals 3% for merger interventions, 15% for cartel prohibitions and 5% for antitrust interventions both under Articles 101 and 102 TFEU. These assumptions are broadly in line with the assumptions made for the direct customer savings calculations presented in Section 3, with some exceptions.[18]

Table 5.1: Baseline scenario under the Bass approach to deterrence

<table>
<tr><th></th><th>Merger</th><th>Cartel</th><th>Antitrust Art. 101</th><th>Antitrust Art. 102</th></tr>
<tr><td>Avoided price increase associated with direct and deterred effects</td><td>3%</td><td>15%</td><td colspan="2">5%

(unless case-specific information is available)</td></tr>
<tr><td>Weighted average of deterrence multipliers</td><td>10</td><td colspan="2">20</td><td>10</td></tr>
</table>

18 For certain specific cases we have adopted a number of assumptions for the direct and deterrence effect. First, we consider cases where the investigation started more than three years after the end of the anticompetitive behaviour of concern (as sometimes may apply to e.g. leniency cases) as having no direct price effects but only deterrence effects. Indeed, the main objective of such interventions is typically to deter companies from engaging in anticompetitive behaviour, because of the fines imposed on the companies having participated in the cartel. For a number of cases concerning the manufacture of basic pharmaceutical products (two cases in 2013 and one case in 2014, 2020 and 2021), we have applied the case-specific avoided price increase for the estimation of the direct price effects while using the standard 5% avoided price increase as a basis for the calculation of the indirect, deterrent effects. For such cases, the application of the specific avoided price increase would have excessively large effects in the analysis of the deterrence.

The simulation exercises presented below have been developed under the assumption that the economy is hit by a markup shock while being in the steady-state. Therefore, these simulations do not take into account possible nonlinear responses of the economy generated by sharp business cycle fluctuations such as those caused by the COVID-19 pandemic or the Russia's attack on Ukraine. Under the baseline scenario, the steady-state markup (here expressed by the Lerner index) decreases by 1.164 percentage points, compared to an initial (calibrated) level of 13.56 percent.

Table 5.2 illustrates the macroeconomic impact of competition policy enforcement under the baseline. We observe that the 1.164 percentage point reduction in markup resulting from the Commission's competition policy interventions triggers an increase of real GDP to the baseline equal to 0.56% and a 0.32% reduction in inflation as measured by the GDP deflator after five years. All the main components of aggregate demand increase. More specifically, after 5 years we simulate substantial increases in consumption (0.48%) and investment (1.09%) in spite of the decline in profits associated with the negative markup shock. Evaluated over a longer horizon, the interventions trigger an uplift in real GDP relative to the baseline equal to 1.07% after 50 years (the equivalent of an uplift of EUR 100 - 180 billion in current GDP terms).

It is worthwhile to observe that the computation of the mark-up shock and the related macroeconomic impact does not significantly differ from the numbers obtained using 2012-2021 data, as described in European Commission (2023). This is not surprising in the absence of an outlier year or a change in the methodology used: the mark-up shock is computed on the basis of the average direct and indirect price effects of Commission's competition policy interventions over the relevant time period, an average which becomes more and more stable with the increase of years of data.[19]

Table 5.2: Macroeconomic impact of permanent markup shock to the steady state (in %)

	1	5	10	50
GDP	**0.32**	**0.56**	**0.75**	**1.07**
GDP deflator	-0.24	-0.32	-0.44	-0.70
Employment	0.26	0.40	0.48	0.47
Labour productivity	0.07	0.16	0.27	0.59
Consumption	0.33	0.48	0.66	0.96
Investment	0.52	1.09	1.32	1.71
Profits	-8.45	-11.47	-10.84	-9.5

Numbers are expressed as percentage deviation from the initial equilibrium values. Columns report the impact after 1, 5, 10, 20 and 50 years.

Going beyond the aggregate macroeconomic impact of competition policies, one can also examine the impact of the different competition tools. Figures 5.1 and 5.2 provide a graphical representation of the relative importance of the various instruments considered. Cartels and Antitrust represent approximately 30% of the total impact in terms of markup reduction each (30% for cartels, 31% for antitrust). The remaining 40% is attributable to merger cases. Table 5.3 decomposes the GDP impact of competition policy enforcement by the different competition instruments, again for different horizons.

19 For additional details on the currently employed methodology, the reader is invited to consult Box Comparison between current and 2021 methodology, page 19, European Commission (2023).

Figure 5.1: The markup level reductions associated with different competition tools (2012-2022)

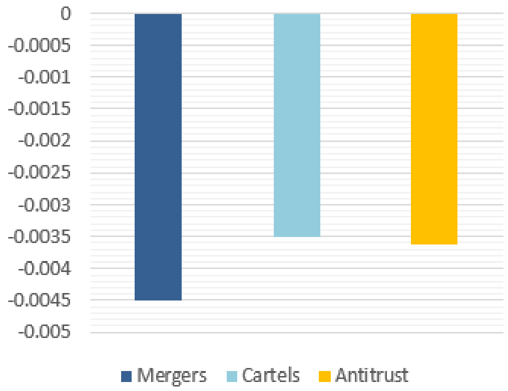


Figure 5.2: The relative markup level reductions associated with different competition tools (2012-2022).

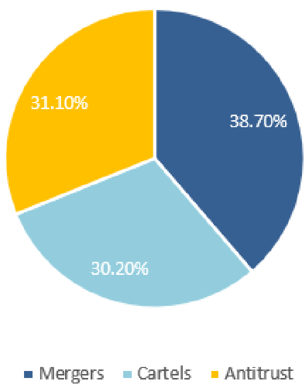


Table 5.3: GDP impact of different competition instruments on GDP.

	1	**5**	**10**	**50**
Merger	0.12	0.22	0.29	0.41
Cartel	0.10	0.17	0.23	0.32
Antitrust	0.10	0.17	0.23	0.34

Numbers are expressed as percentage deviation from the initial equilibrium values. Columns report the impact after 1, 5, 10 and 50 years.

6. ASSESSING THE EFFECTS OF INTERVENTIONS ON THE PRICE LEVEL USING AN EU-WIDE INPUT-OUTPUT MODEL

In a similar way as competition policy interventions are mapped onto the QUEST III model, an input-output model can be used to assess the price effects of competition policy interventions in the overall economy. Interventions of the European Commission to sanction anticompetitive behaviour reduce prices in the relevant markets (or prevent them from increasing). This effect is then transmitted to other markets via the interlinkages in the economy because firms downstream in the supply chain will face lower input prices. It is reasonable to expect that these firms will reduce the price of their own products. To analyse how the effects of competition policy interventions are transmitted across markets, we use information on economic interdependencies retrieved from the input-output table of the European Union. Specifically, the EU27 input-output table used is based on the results of the Figaro project (Rémond-Tiedrez, Rueda-Cantuche 2019), which constitutes the official input-output framework of the EU and is produced by Eurostat with the support of the JRC.[20]

The input-output table used in our analysis contains 64 branches of economic activities (or "industries" for short) based on the NACE Rev 2 statistical classification. In any given industry, competition policy interventions lead to a "within-industry price-effect" (encapsulating both the direct and deterrence effects with respect to that industry) and a "spill-over price effect", which arises via the input-output interlinkages with other sectors. The total price reduction resulting from competition policy interventions in this industry is the sum of these two effects.[21]

The within-industry effect reflects the repercussions of merger interventions, cartel prohibitions and antitrust interventions on the markets directly affected by these interventions. In a manner consistent with the analysis conducted with the QUEST macro-model (Section 5), the within-industry effect is computed according to Equation (5.1). However, in this case, the relative price drop computed through Equation (5.2) represents only one component of the overall price change in the sector (the other one being the spill-over effect). Deterrent effects are incorporated into the analysis as described in Equations (5.1) and (5.3).

The spill-over effect captures the ripple effects caused by the Commission's competition policy interventions. As price drops, this reduction is passed downstream along the supply chain. Spill-overs are computed from the within-industry effects using a standard input-output price model. The within-industry change of price represents the exogenous shock in this analysis. When an input becomes relatively cheaper as a result of a negative price shock, it is assumed that producers will entirely pass on the ensuing cost savings to their customers. In other words, the cost pass-through is assumed to be complete (one to one).[22] Consequently, the prices of the products are expected to decrease. The overall price reduction in industry i (including the deterrent effects) is given by the sum of the within and spill-over effects. It should be noted that, as in all input-output models, our analysis assumes a relatively simple cross-industry price

[20] See https://ec.europa.eu/eurostat/web/esa-supply-use-input-tables/figaro

[21] The methodology underlying these calculations, including all equations used in input-output simulations are discussed in detail in Cai et al. (2019, Part III) and Archanskaia et al. (2022, section 4.3). The similar input-output structure was also used for developing the *Fidelio* model (Rocchi et al. 2019, 2023).

[22] If one were to assume that producers partly pass on the cost savings to their customers, 50% for instance, the spillover effects will decline, however, the amount could differ from 50%. Suppose that outputs produced in sector A are used as inputs in sector B, the outputs of sector B are used as inputs in sector C, and goods produced in sector C are used as inputs in sector D. Assume that prices in sector A decline due to a competition policy intervention. This is the direct effect and the spillovers in sector B do not change. However, the spillovers faced by sector C become 50% lower, because part of the cost savings in sector B are arrogated by producers from this sector. Spillovers in sector D become 4 times lower because one half ends up in sector B, and one quarter in sector C.

transmission mechanism. In this framework, for example, firms' use of inputs is not affected by changing prices.

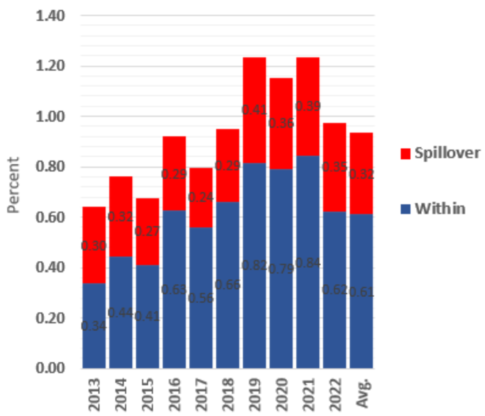
In line with the economic literature, in the estimation of customer savings, we assume that the price reducing effects of merger interventions, cartel prohibitions and antitrust interventions last for more than one year, absent case-specific information. Therefore, in the spirit of the QUEST simulations, we take into consideration the fact that decisions by the Commission can produce effects over several years. Thus, interventions used for the computation of, for instance, the 2022 within-industry effect include not only the cases for which a decision was reached in 2022, but also those from earlier years that are deemed to be still producing their effects in 2022. However, due to the unavailability of data, the impact of decisions taken prior to 2012 is not taken into account. As a result, the analysis may somewhat understate the price reduction effects in the earlier years of the sample. This particularly affects the measured impact of competition policy decisions in 2012, which is not comparable to the impact of following years and is therefore excluded from the figures.

While this input-output analysis is performed at the 64-industry level, aggregating the results into a single economy-wide figure is a useful summary measure of the price impact of competition policy interventions. To this end, the industry-specific results are averaged using weights that reflect industry size (as measured by gross output).

The key results of the input-output modelling are outlined below. In all cases, we take deterrence effects into consideration. All price changes, in absolute terms, must be regarded as price reductions. In Figure 6.1, we provide an overview of the effect of merger interventions, cartel prohibitions and antitrust interventions on the overall price level in the EU.

On average, competition policy enforcement is estimated to lower prices by around 0.93% over the full eleven-year period. Two thirds of the overall effect can be attributed to the within-sector impact of the Commission's competition policy interventions (WITHIN). The remaining part results from amplification of this impact between sectors (SPILLOVER) due to the input-output channels. The results vary from one year to another. The variations can be explained not only by the number of interventions, but also by their type; for instance, cartel prohibitions imply larger price decreases than other types of interventions. In addition, the analysis may somewhat understate the price reduction effects in the earlier years of the sample, as discussed earlier.

Figure 6.1: Impact of competition policy enforcement on the overall price level



Furthermore, taking duration effects into account, the 2022 WITHIN effect also includes the 2021 cases with an avoided price increase that lasts two or more years, the 2020 cases with duration of three or more years, etc. This carry-over from one year to the next not only increases the estimated impacts on prices, but also tend to smooth the dynamics over time. Moreover, the impact of competition policy on EU price levels tends to increase over time. This is because more recent cases in the sample have longer durations than older cases. It is important to keep in mind that in the early years of the series, the results are underestimated due to the lack of data on cases before 2012.

Even though the market turnover affected by the decisions in 2022 is the largest (Figure 1.1), the total price effects are lower than in 2019-2022. This is because in 2022 there are relatively few cartels (2 cases), which induce the largest price reductions.

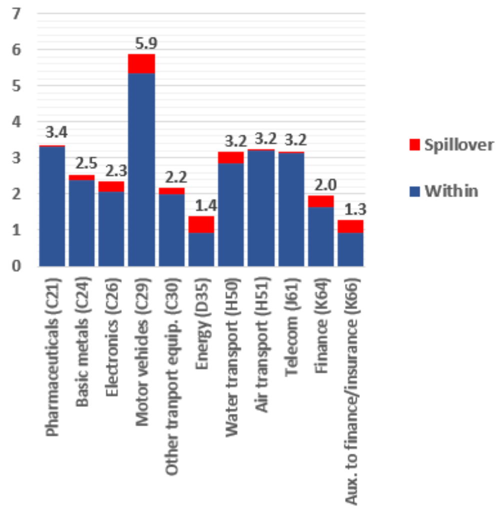
Table 6.1 below presents the relative significance of price spill-overs vis-à-vis the within-sector effects and total effects, respectively. Depending on the year, the spill-over effects account for 30 - 47% of the total impact on prices. The SPILLOVER/TOTAL ratio (and correspondingly the SPILLOVER/WITHIN ratio) is essentially determined by the distribution of the merger, cartel and antitrust cases across industries. Industries with many important downstream links (i.e., those that are located higher in supply chains) tend to produce stronger spill-overs than those with few downstream connections (i.e., those that sell a large share of their output to final users). Examples of activities with large spill-overs include finance, insurance and business services, resource extraction, the energy sector, basic manufacturing, and certain components of the transport network. As a result, the SPILLOVER/TOTAL ratio tends to be higher in years when the Commission's competition policy interventions are concentrated in high-spill-over industries. In 2022, spill-over ratios are close to the average. In fact, in 2022, few of the most significant cases were found in retail trade, rental and leasing of cars and light motor vehicles, which are industries with comparatively low spill-overs (Dierx et al. 2020). But, a few cases were also detected in sectors with relatively large spill-overs, such as manufacture of electronic components and building of ships and floating structures.

Table 6.1: Relative significance of price spill-overs

Year	Spill-over/Within	Spill-over/Total
2013	0.9	0.47
2014	0.71	0.42
2015	0.65	0.4
2016	0.47	0.32
2017	0.42	0.3
2018	0.44	0.3
2019	0.51	0.34
2020	0.45	0.31
2021	0.47	0.32
2022	0.57	0.36
Avg.	0.56	0.35

Figure 6.2 presents the average (%) price changes over the entire period of analysis in the sectors with the largest total price effects. We distinguish between within-industry and spill-over effects, which arise through the input-output mechanism. The largest price reductions are found in the industries in which the European Commission made its most significant interventions (motor vehicles, air transport, water transport, telecommunications and pharmaceuticals). The spill-over effects presented in Figure 6.2 may seem relatively low in comparison with those presented in Table 6.1. This is because in the sectors where the most important interventions were made, the "within" effects are dominant. In comparison, in the sectors where no interventions were made the spill-over effect constitutes 100 percent of the total price effect.

Figure 6.2: Industry-level price changes, 2013-2022 average, selected industries



7. FURTHER DEVELOPMENTS IN DATA ANALYSIS AND MODELLING

In parallel with the present study on the macroeconomic impact of competition policies, DG COMP has commissioned a study from a consortium comprising consultants Lear (consortium leader), E.CA Economics, Fideres, Kantar, Prometeia and the University of East Anglia to provide factual evidence on certain aspects of the state of competition in the EU.[23] Three different scenarios are considered in this study. The first one aims at describing the costs of non-competition in the EU by assessing the additional EU real GDP growth that would have been performed without the increase in markup observed in the EU over the last 20 years. The two other scenarios seek to assess the benefits of competition to the wider economy. This is achieved by simulating how GDP growth, would be impacted if one were to move from the current state of the economy to hypothetical, more competitive markets (featuring lower mark-ups). In the study of Lear et al. (2023), the simulations are performed with the MATER model, which is a multi-country, general equilibrium model, designed by Prometeia for macroeconomic scenario analysis. The framework is a network of two large-scale models, an Overlapping generation Model (OLG) and a Dynamic Stochastic General Equilibrium Model (DSGE), integrated in a top-down procedure.[24]

In this Section, we first define the three scenarios considered in the study of Lear et al. (2023). Then we report the impact on GDP and other macroeconomic variables of the transmission of the mark-ups changes contemplated in these three scenarios on the basis of simulations performed with the QUEST model used to compute the macroeconomic impact of competition policy enforcements in Section 5.

7.1 Benchmarking scenarios

The definition of the scenarios considered by Lear et al. (2023) relies on two different approaches. In the first, backward-looking approach, results from the literature on historical developments in markups are used to construct a counterfactual competition scenario describing the additional real GDP growth that would have resulted if the increase in markup observed in the EU over the last 20 years had not occurred (abstracting away from other developments in the economy, such as changes in technology, which may also have had an impacted on observed markups). In the second, forward-looking approach, alternative values of markups are built, either by confronting the estimated empirical distribution of markups with a counterfactual distribution in which all markups above the 97th percentile (i.e. the firms with the highest degree of market power) are replaced by the level of markup at that percentile or by allowing for partial convergence in markups across European countries, in the spirit of Pfeiffer et al. (2023).

Scenario 1: Counterfactual markup shocks based on historical markup developments

This backward-looking scenario aims at evaluating what would be the benefit of undoing the observed 7.54% markup[25] increase starting from the year 2000, which was empirically estimated by the papers in the literature selected by Lear et al. (2023). In

[23] Lear et al (2023).

[24] See Catalano (2023) for a technical description of the model.

[25] According to IMF (2019), there is an estimated 7.7% increase in markups between 2000 and 2015. Diez et al. (2021) report a 5.7% increase between 2000 and 2015. Calligaris et al. (2022) indicate an 8% increase between 2001 and 2014. The overall average derived from these individual estimates is 7.54% over 15 years. See Lear et al. (2023) for more details.

terms of Lerner index ((p-c)/p), this scenario can be translated into a 6.52 p.p absolute decrease from its steady-state value of 0.1356 or 13.56 p.p.

Scenario 2: Counterfactual markup based on topping-off of the highest mark-ups

The percentage difference between the average markup in the actual distribution and the average markup in the distribution where all markups above the 97th percentile have been replaced by the level of markup at that percentile, is equal to -8.45%. This difference can be translated into a 7.97 p.p. decrease in the Lerner index. The resulting impact on GDP and other variables could potentially be interpreted as benefits from addressing and avoiding any anticompetitive behaviour by (*in casu*) the highest-markup firms.

Scenario 3: Counterfactual markup shock based on country convergence.

This scenario is constructed in the spirit of Pfeiffer et al. (2023), allowing for partial convergence in markups across European countries. In this scenario, countries with markups higher than the EU average introduce procompetitive reforms aimed at reducing their country-level markups (computed as country-level turnover-weighted averages of materials-based markups estimated in Lear et al (2023)). This yields to a markup reduction of -8.38%. The decrease in Lerner index is computed as 7.9 p.p.

Markup impact on productivity

As discussed in Lear et al. (2023) as well in European Commission (2022b, 2023), there are various channels through which changes in competition affect economic performance, both at the microeconomic and at the macroeconomic level. At the microeconomic level, competition can affect productivity through its impact on: (i) allocative efficiency, i.e., reallocating sales to more productive firms; (ii) productive efficiency, i.e., increasing firm productivity; and (iii) dynamic efficiency, i.e., providing the incentive for firms to innovate. In a competitive environment, these efficiencies may be associated with better outcomes for consumers, in that they are passed on by competing firms to their customers through lower prices or better quality. The positive impact of competition on productivity results in better growth performance for the economy as a whole.

In order to assess this indirect positive effect of competition at the macroeconomic level, it is necessary to estimate the link between markup and productivity (TFP). Although several studies have investigated this link, finding a positive effect, it is not straightforward to extrapolate an elasticity from the literature, because existing studies are quite heterogeneous in terms of geography, timespan, level of aggregation considered, methodology, and results. Nonetheless, an attempt has been made by Lear et al. (2023), resulting in a conservative estimated TFP-to-markup elasticity of -0.13.

Table 7.1 summarises the markup shocks (defined in terms of absolute changes in the Lerner Index) and the corresponding TFP shocks which have been applied to the QUEST model.

Table 7.1 Computed markup and TFP shocks for the three scenarios

	Lear et al. (2023) markup change (%)	**Change in Lerner Index (p.p.)**	**TFP shock (p.p.)**
Scenario 1 – counterfactual based on the literature	-7.54	**-6.5**	**0.98**
Scenario 2 – counterfactual based on empirical distribution	-8.45	**-8.0**	**1.1**
Scenario 3 – counterfactual based on country convergence	-8.38	**-7.9**	**1.09**

The numbers for the impact on the Lerner index are expressed as percentage point (p.p.) absolute deviation from the steady-state value of 13.56 pp. The TFP shock is expressed as an absolute deviation in p.p.

7.2 Results

In order to provide more realistic results, the simulations have been implemented with a gradual phase-in, reflecting the historical development observed in markups and the time required for competition-enhancing reforms and potential gradual market entry of competitors, in line with similar macroeconomic simulations (Pfeiffer et al. 2023, Varga and In ’t Veld 2014). In the backward-looking scenario, we assume a 10 years’ phase-in, reflecting the observed historical dynamics in the increase of markup, while for the two forward looking scenarios, a gradual phase-in of 5 years is adopted. In the three scenarios, the TFP shock is also gradually phased-in at the same speed as the related markup shock. For this TFP shock, we also consider that the shock starts in the 5th quarter of the simulation (after one year of delay) to mirror the fact that adoption and diffusion of new technology is not immediate.

Scenario 1: Counterfactual markup shocks based on historical markup developments

Table 7.2 reports the macroeconomic impact for the backward-looking scenario based on the historical developments of markup. Table 7.3 shows results when TFP shock is also considered.

The simulated decrease in markup would trigger an increase in real GDP of 3.43% after 10 years and 5.1% after 20 years. This could be considered as the costs of non-competition in the EU, i.e. the GDP lost due to the historical increase in mark-ups observed. This suggests that a 5.1 % of GDP loss (or avoided GDP gain) resulting from 20 years of increase in mark-ups could, in principle, be mostly recouped if pro-competitive reforms in the area of competition policy and other related policy areas (e.g. Single Market, Product Market Regulation, Trade) were implemented which would undo the mark-up increase.

The (missed) positive GDP impact results from an increase of all the main components of demand. More specifically, aggregate consumption increases by 2.7% and 4.2% after 10 and 20 years, respectively. The increase in aggregate investment is also remarkable, almost 7% after 10 years and 8.8% after 20 years. Also, labour productivity is positively affected by the increase in competition, due to labour market frictions in the economy implying that the labour market adjusts more slowly than GDP: the economy is able to produce a larger amount of output with a relatively lower intensity of labour (lower labour share). In the medium term, we also observe the deflationary effect of decreasing markups, which further sustains aggregate consumption after 10 years. When we bring in the TFP shock into the macroeconomic scenario, we observe an overall wider reaction of the economy, as expected, as it amplifies the positive benefits of a more competitive outlook.

Table 7.2 Impact of scenario 1 with gradual phase-in of 10 years.

	1	5	10	20	50
GDP	0.51	1.71	3.43	5.06	5.87
GDP deflator	0.46	0.73	-0.46	-2.34	-3.46
Agg. Employment	0.38	1.06	2.02	2.57	2.56
Labor productivity	0.13	0.64	1.38	2.43	3.22
Agg. Consumption	0.2	1.14	2.67	4.17	4.93
Investment	1.73	4.42	6.87	8.76	9.74

Numbers are expressed as percentage deviation from the initial equilibrium values. Columns report the impact after 1, 5, 10, 20 and 50 years.

Table 7.3 Impact of scenario 1 with TFP and a gradual phase-in of 10 years.

	1	5	10	20	50
GDP	0.56	1.91	3.95	5.75	6.64
GDP deflator	0.75	1.25	-0.04	-2.19	-3.50
Agg. Employment	0.38	0.99	1.93	2.55	2.55
Labor productivity	0.18	0.92	1.98	3.12	3.99
Agg. Consumption	0.5	1.66	3.43	5.07	5.91
Investment	1.58	4.43	7.25	9.31	10.39

Numbers are expressed as percentage deviation from the initial equilibrium values. Columns report the impact after 1, 5, 10, 20 and 50 years.

Scenario 2 Counterfactual markup based on topping-off of the highest mark-ups

The qualitative macroeconomic response of the counterfactual scenario in which the 97th percentile of the distribution is trimmed is similar to the scenario described above. However, the stronger markup decrease associated with a shorter phase-in delivers a more reactive economy and an amplified macroeconomic impact in the short term. The scenario shows an increase in GDP of 3.28% after 5 years and 4.74% after 10 years, associated to a deflationary outcome of 0.61% and 1.89%, respectively. When associated with a positive TFP shock, the GDP increase is amplified and reaches 4.14% after 5 years and 5.63% after 10 years.

Table 7.4 Impact of scenario 2 with gradual phase-in of 5 years

	1	5	10	20	50
GDP	0.87	3.28	4.74	6.50	7.35
GDP deflator	0.47	-0.61	-1.89	-3.80	-4.81
Agg. Employment	0.71	2.18	2.81	3.21	3.09
Labor productivity	0.16	1.08	1.88	3.18	4.13
Agg. Consumption	0.49	2.44	3.71	5.34	6.13
Investment	2.28	7.25	9.14	11.22	12.27

Numbers are expressed as percentage deviation from the initial equilibrium values. Columns report the impact after 1, 5, 10, 20 and 50 years.

Table 7.5 Impact of scenario 2 with TFP and gradual phase-in of 5 years

	1	5	10	20	50
GDP	1.46	4.14	5.63	7.44	8.31
GDP deflator	0.98	-0.54	-1.92	-3.99	-5.10
Agg. Employment	1.07	2.24	2.84	3.21	3.08
Labor productivity	0.39	1.86	2.72	4.10	5.08
Agg. Consumption	1.23	3.58	4.84	6.51	7.33
Investment	3.53	8.09	9.92	12.03	13.12

Numbers are expressed as percentage deviation from the initial equilibrium values. Columns report the impact after 1, 5, 10, 20 and 50 years.

Scenario 3: Counterfactual markup shock based on country convergence.

The scenario based on a counterfactual country convergence delivers, as expected, very similar macroeconomic impact as the scenario based on the trimmed distribution. This is not surprising given that the magnitudes of the markup shocks in the two simulations are very similar and they are performed with identical assumptions on gradual phase-in. In this case, we observe that the decrease in markup delivers an increase of GDP of 3.25% after 5 years and 4.69% after 10 years, as shown in table 6.5. When the scenario allows markup shock to be combined with TFP shock, the scenario delivers an increase of GDP of more than 4% after 5 years and 5.58% after ten years (table 6.6).

Table 7.6 Impact of scenario 3 with gradual phase-in of 5 years

	1	5	10	20	50
GDP	0.86	3.25	4.69	6.44	7.28
GDP deflator	0.47	-0.6	-1.88	-3.76	-4.77
Agg. Employment	0.7	2.16	2.78	3.19	3.07
Labor productivity	0.15	1.07	1.86	3.15	4.09
Agg. Consumption	0.49	2.42	3.68	5.29	6.08
Investment	2.26	7.17	9.05	11.11	12.15

Numbers are expressed as percentage deviation from the initial equilibrium values. Columns report the impact after 1, 5, 10, 20 and 50 years.

Table 7.7 Impact of scenario 3 with TFP and gradual phase-in of 5 years

	1	5	10	20	50
GDP	1.44	4.1	5.58	7.37	8.24
GDP deflator	0.97	-0.53	-1.9	-3.95	-5.06
Agg. Employment	1.06	2.22	2.81	3.18	3.05
Labor productivity	0.38	1.85	2.7	4.06	5.03
Agg. Consumption	1.22	3.55	4.8	6.45	7.27
Investment	3.5	8.01	9.82	11.91	12.99

Numbers are expressed as percentage deviation from the initial equilibrium values. Columns report the impact after 1, 5, 10, 20 and 50 years.

Overall, the modelling results indicate that a substantial reduction in markup (of around 8%) could deliver significant positive effects into the economy, with an increase of all demand components and of GDP (from 2 - 3% after 5 years and around 3,5 - 5% after 10 years). When the scenario also allows a TFP shock, the overall benefits of a more competitive environment are amplified and one observes a GDP increase to around 4% after 5 years and to almost 4 - 6% after 10 years.

8. CONCLUSION

This report updates the model simulations published in the previous edition (European Commission, 2023) by including the competition interventions by the Commission in the latest year for which data are available, 2022. Overall, the computation of the mark-up shock and the related macroeconomic impact does not significantly differ from the numbers obtained using the cohort of 2012-2021. This is in itself not surprising as the mark-up shock is computed on the basis of the average direct and indirect price effects of Commission's competition policy interventions over the relevant time period, an average which becomes more and more stable with the increase of years of data on interventions.

The simulation results suggest a 1.16 percentage point reduction in markups (as measured by the Lerner index) resulting from the Commission's competition policy interventions. This reduction triggers an increase in real GDP relative to the baseline in the range of 0.6% to 1.1% in the medium to long term, the equivalent of an uplift of EUR 100 – 180 billion. All the main components of aggregate demand increase. More specifically, after 5 years we simulate increases in consumption (0.5%) and investment (1.1%) despite the decline in profits associated with the negative markup shock. Investment is increasing because the negative direct effect of markups on future profitability is more than offset by the positive effect of the increasing demand due to lower prices.

The main report also explores how the price effects of competition policy interventions are transmitted across sectors using information on economic interdependencies retrieved from an input-output table of the European Union. On average, the Commission's competition policy enforcement is estimated to lower prices by around 0.88%. Two-thirds of the overall effect can be attributed to the "within-sector price effect" including both the direct and deterrence effects of competition policy interventions with respect to that sector. The remaining part, i.e. the "spill-over price effect", results from amplification of this impact due to the input-output channels between sectors.

The report finally explores different avenues to model "the cost of non-competition", defined here as the macroeconomic gains associated with moving from the current state of the economy to other, more competitive benchmarks (featuring lower mark-ups). Overall, the modelling results indicate that the corresponding reduction in markups (of around 8%) could deliver significant positive effects into the economy, with an estimated increase of GDP of in the range of 3,5 - 5% after 10 years. When the benchmark scenario also allows for a change in TFP (Total Factor Productivity), one can even observe amplified benefits of a more competitive environment to almost 4 - 6% after 10 years.

The macro-simulation exercises would merit further research to improve it in several dimensions. In particular, the calibration of the model of deterrent effects would benefit from further work to collect evidence on the size and determinants of the deterrent effects of competition policy interventions. The model is currently calibrated based on simple measurements (called multipliers) derived from surveys of companies and their legal advisors, which are scarce and limited in terms of time and geographical coverage. In this regard, DG Competition has commissioned a study[26] to improve the knowledge of the deterrent effects by providing an update of the existing survey-based evidence of the deterrent effects of EU competition policy.

26 Survey of Practitioners on the Deterrent Effects of EU Competition Enforcement. Study contract nr. COMP2023OP0002.

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