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DAF/COMP/GF/WD(2015)33

Organisation de Coopération et de Développement Économiques  
Organisation for Economic Co-operation and Development

12-Oct-2015

English - Or. English

**DIRECTORATE FOR FINANCIAL AND ENTERPRISE AFFAIRS  
COMPETITION COMMITTEE**

## **Global Forum on Competition**

### **DOES COMPETITION KILL OR CREATE JOBS?**

#### **Contribution from European Commission**

-- Session I --

*This contribution is submitted by the European Commission under Session I of the Global Forum on Competition to be held on 29-30 October 2015.*

Ms. Ania Thiemann, Global Relations Manager, OECD Competition Division  
Tel: +33 1 45 24 98 87, Email: [ania.thiemann@oecd.org](mailto:ania.thiemann@oecd.org)

**JT03383685**

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**DISTRIBUTIONAL AND LABOUR MARKET EFFECTS OF  
EU COMPETITION POLICY – A GENERAL EQUILIBRIUM ANALYSIS\***

**-- European Commission<sup>1</sup>--**

**Abstract**

This paper proposes a novel methodology to assess distributional and labour market effects of important merger and cartel decisions by the European Commission. A unique database containing microeconomic estimates of customer savings resulting from avoided price increases associated with merger and cartel decisions are exploited to run macroeconomic policy simulations using a dynamic stochastic general equilibrium model. The model allows investigating the effects of EU competition policy interventions not only on standard macroeconomic variables such as GDP and employment, but also on distributional outcomes across households with different skill levels and across different types of income earners (capital owners, wage earners and benefit recipients). The policy simulations presented include both direct and indirect (deterrent) effects of competition policy interventions. They show that competition policy has a sizeable impact on GDP growth, job creation and the distribution of consumption across different types of households.

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\* Adriaan Dierx, Fabienne Ilzkovitz, Beatrice Pataracchia, Marco Ratto, Anna Thum-Thysen and Janos Varga (European Commission).

The authors would like to thank Alexander Italianer for his support to this study project. We would also like to acknowledge the comments and suggestions on earlier drafts of this paper by the participants of the 2015 conference on Competition Policy, Shared Prosperity and Inclusive Growth organised by the World Bank and the OECD and the CRESSE 2015 conference organised by the Athens University of Economics and Business. We would also like to thank Antonio Bosisio, Luisa Carrer, Jukka Heikkonen and Ronal Muresano Caceres for their contributions to the preparation of the paper. The paper has been written under the sole responsibility of the authors and does not present the views of the European Commission. Please do not cite or quote without permission from the authors.

<sup>1</sup> Directorate-General for Competition, Mado 3/28, European Commission, 1049 Brussels, Belgium, tel. +32 2 299 33 79, e-mail: fabienne.ilzkovitz@ec.europa.eu (corresponding author).

## 1. Introduction

1. Competition authorities use estimates of the macroeconomic effects of competition policy to illustrate the benefits of their activities and legitimise competition policy interventions towards the larger public. Recently, there has been an increasing interest in this type of analysis, both by competition authorities and academics (Ilzkovitz and Dierx, 2014 and 2015). This is partly in response to an increased scepticism about the benefits of competition policy, which became evident around the turn of the century (Kovacic, 2006). The Great Recession has reinforced the need to assess the effects of competition policy not only on economic growth but also on inequality.

2. Less empirical analysis has been done on the macroeconomic impact of competition policy in comparison with that of other EU policies affecting the conditions of competition, such as internal market or trade liberalisation policies. Similarly, while it is often argued that the poorest in society are more affected by higher prices and lower quality and choice resulting from a lack of competition, these effects have been little studied. This paper attempts to fill this gap and proposes a novel methodology to assess the distributional macroeconomic effects of important merger and cartel decisions taken by the European Commission.

3. The lack of empirical analysis on the distributional macroeconomic impact of competition policy may be explained by the difficulties associated with this type of work. First, it is not straightforward to find appropriate competition policy indicators. In this paper, we circumvent this difficulty by using a unique database containing microeconomic estimates of customer savings resulting from avoided price increases associated with important merger and cartel decisions. These estimates are calculated by multiplying the foreseen reduction in prices (in comparison with the counterfactual of no competition policy intervention) by the expected duration of such price reduction and the turnover in the market affected by the decision.

4. Second, it is difficult to establish empirically a causal relationship between competition policy and competition, which is commonly used to make the link with macroeconomic outcomes. The approach taken in the current paper is to use a unique database aimed at calculating microeconomic estimates of customer savings resulting from competition policy interventions to calibrate mark-up shocks, which are then applied to a Dynamic Stochastic General Equilibrium (DSGE) model, i.e. the QUEST model (see Ratto et al., 2009).

5. Third, it is harder to track the chain of events which may follow a competition policy intervention in the medium to long term and to attempt measuring its distributional macroeconomic impact than to look at the immediate microeconomic impact of a specific decision in a given market. However, a DSGE model which: (1) assumes that goods markets are imperfectly competitive; (2) disaggregates employment into various skills categories; and (3) considers different types of income earners (capital owners, wage earners and benefit recipients) is well-suited for this task and can be used to get an indication of the distributional macroeconomic effects of competition policy.

6. Finally, very often, the methods used to assess the aggregate effects of competition only look at the direct price effects and ignore the deterrent effects of competition policy. These deterrent effects, which discourage future anticompetitive behaviour, are difficult to assess because they are not felt immediately and cannot be measured directly. Nevertheless, there appears to be a consensus in the literature that these effects are considerable. This paper makes the assumption that, for each important merger and cartel decision taken by the European Commission, the avoided price increase covers not only the relevant market directly affected by the decision (direct effects) but also the whole subsector concerned by this decision (deterrent effects). However, the multiplying factor of the deterrent effects over the direct effects of a given decision is subjected to a maximum threshold reflecting results reported in the literature on the size of deterrent effects. In addition to such sectoral spill-over effects, the paper also considers

intertemporal deterrence effects, which arise from companies' expectations that the European Commission will continue its competition policy interventions at the same pace into the foreseeable future. The results of the simulations measuring the total (i.e. the direct plus the sectoral and intertemporal deterrent effects) of EU competition policy are then compared with those of other competition-friendly structural policies.

7. The paper is organised as follows. Section 1 presents the integrated framework used in this paper to move from the microeconomic estimates of the customer savings to the macroeconomic effects of competition policy. Section 2 describes how the customer savings are estimated and presents the results of these estimations. It makes a distinction between the direct and deterrent effects of competition policy enforcement actions and summarises what can be learnt from the literature on the deterrent effects. Section 3 contains a short description of the QUEST model used to run the simulations and explains how the macroeconomic and distributional effects of competition policy are derived in this model. Section 4 describes how the mark-up shocks have been derived reflecting both the direct and deterrent effects of the competition policy interventions. This section also presents the results of the model simulations. The final section concludes and offers some ideas for further research.

## 2. The integrated framework

8. Two main approaches may be used to assess the aggregate effect of competition policy, a bottom-up approach measuring the direct benefits of competition policy for consumers (the customer savings approach) and a macro-modelling approach analysing the impact of competition policy on competition and (directly and indirectly) on GDP growth or other macroeconomic variables (see Ilzkovitz and Dierx (2015) for a comprehensive survey of this latter literature, which is shortly summarised in Box 1 below).

### Box 1. Empirical work analysing the macroeconomic impact of competition policy

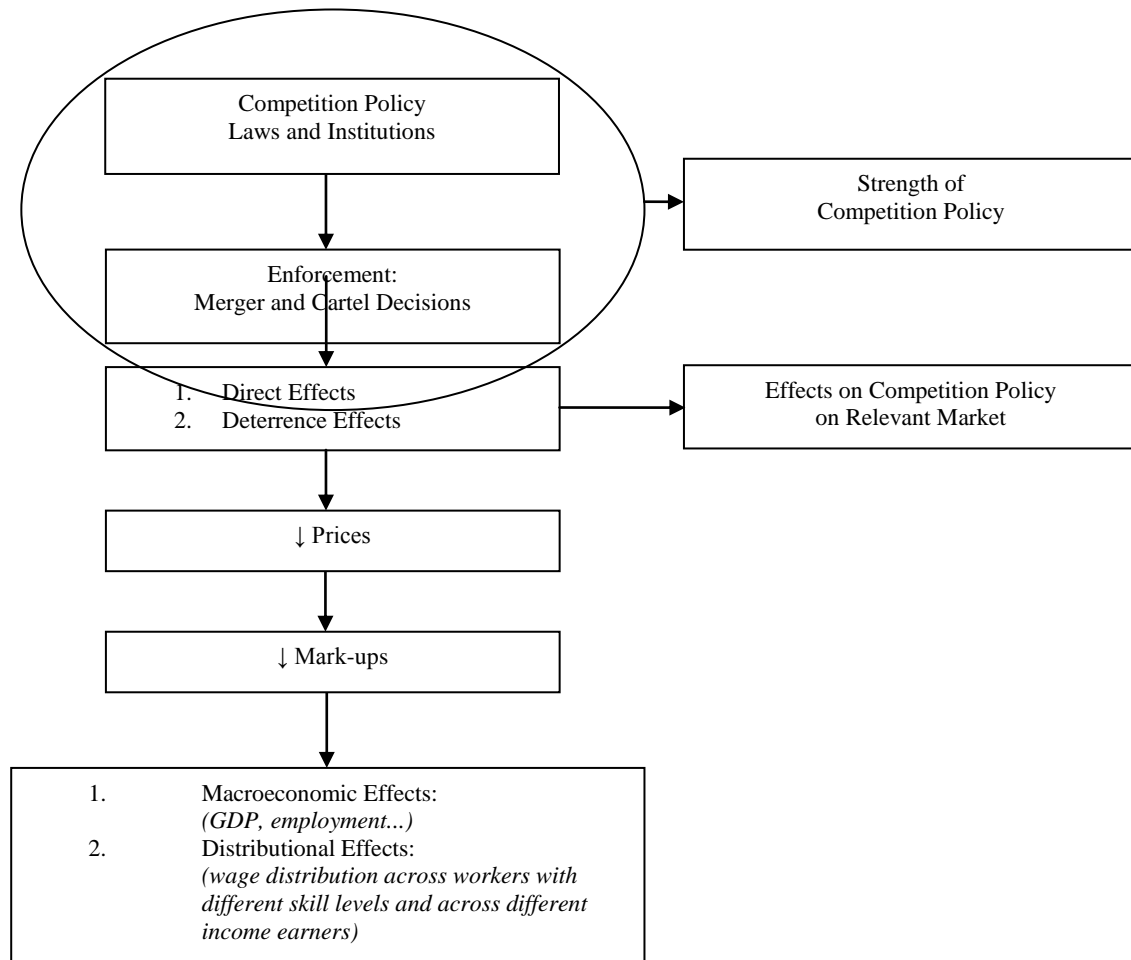
Ilzkovitz and Dierx (2015) make a distinction between: (i) studies analysing the impact of competition policy on the degree of competition; and (ii) studies analysing the impact of competition policy on economic performance at the national or sectoral level.

i) Krakowski (2005), Hylton and Deng (2007) and Sama (2013) come to the conclusion that the strength of competition policy (as perceived by business leaders or as measured by the quality of competition laws and institutions) has a positive impact on the perceived competition intensity. Other variables, such as the size of the economy, the population of the country, its degree of openness and GDP per capita also have a positive impact on competition, suggesting that having wealthy, large and open markets is as important for competition as good competition laws. However, these results are not always robust, in particular if corrected for endogeneity.

ii) Papers by Kee and Hoekman (2007), Clougherty (2010), Petersen (2013) and Buccirossi et al. (2013) aim to make a link between the strength of competition policy and various measures of economic growth. Kee and Hoekman, for example, find that the introduction of competition laws has had a high positive and long lasting effect on the number of firms in a sample of 28 industries in 42 countries. Clougherty uses the annual budget of competition authorities as a measure of a country's commitment of resources to competition policy and he finds a positive relation between this variable and real per capita GDP growth. Petersen, however, concludes that antitrust law has a significant positive effect after ten years only, as new institutions take time to run effectively and have a noticeable effect on the economy as a whole. Buccirossi et al. estimates the impact of competition policy on total factor productivity growth for 22 industries in twelve OECD countries over 1995 to 2005. He and his co-authors find a positive and significant relationship between competition policy indexes combining both input and output variables and TFP growth.

9. The macro-modelling approach analysing the impact of competition policy is less developed than the body of literature analysing the impact of competition and although there is a consensus that competition offers macroeconomic benefits, it is less clear cut from an empirical perspective that competition *policy* increases economic growth. In this paper, we propose a framework to integrate the bottom-up customer savings approach with a top-down macro-modelling approach. This framework is described in Graph 1.

**Figure 1: An integrated framework to assess the impact of competition policy**



10. An integrated macro-modelling of the impact of competition policy should first analyse the impact of competition policy on competition and second, the impact of competition on macroeconomic performance. This requires indicators of competition policy and of competition.

11. Competition policy is defined here as the enforcement of competition policy legislation covering the prohibition of cartels and the control of mergers. The strength of the European Commission's competition policy is measured by the number and importance of its interventions in these areas. Microeconomic estimates of the customer savings associated with important cartel and merger decisions are used as a proxy for this. Due to data limitations other aspects of competition policy such as the prohibition of abuse of dominant position or State aid control are not covered here.

12. Competition cannot be observed directly and therefore, indirect measures of competition are commonly used. Here, competition is measured by the mark-up of prices over marginal costs, an indicator often used in empirical work. The price effect of important merger and cartel decisions by the European Commission and the size of the market affected by such decisions are used to calculate mark-up shocks reflecting the impact of competition policy interventions. The deterrent effects of these interventions are taken into account as well. The QUEST model simulations are then used to assess the macroeconomic and distributional effects of these shocks.

### 3. Measuring the microeconomic effects of important merger and cartel decisions

#### 3.1 Customer savings

13. A relatively simple method is used by some competition authorities (in the EU, Netherlands, UK and US) to estimate the customer savings resulting from competition policy interventions, including in particular merger decisions and cartel prohibitions. This section starts by presenting the estimation method used by the European Commission and continues with a description and discussion of the results of the estimates obtained.

##### (i) Methodology

14. The European Commission started relatively recently (in 2008) to calculate the customer savings associated with important merger and cartel decisions. These customer savings are obtained by multiplying the estimated reduction in prices resulting from the competition policy enforcement in the market concerned by the estimated duration of the price reduction. A summary of the assumptions made regarding the market concerned, the price effect and the duration of this effect is presented in Table 1. These assumptions are based on the relevant literature and are rather conservative.

**Table 1: Overview of assumptions used by the European Commission**

<b>Competition policy intervention</b>	<b>Cartel prohibition</b>	<b>Merger decision</b>
<b>Affected turnover</b>	Turnover of cartel members	Size of relevant market
<b>Yearly price effect</b>	10-15%	1-3-5%
<b>Duration</b>	1/3/6 depending on the stability of cartel	2/3/5 depending on entry barriers

15. For cartels, only the turnover of the cartel members directly concerned is used as an estimate of the scope of the competition policy intervention. Regarding the duration of the effect, 1, 3 or 6 years are considered reflecting the European Commission's judgement of the future sustainability of the cartel at the date of detection. Cartels are judged to be either "unsustainable", "fairly sustainable" or "very sustainable", depending on a case-by-case analysis of market conditions, the lifespan of the cartel and the ease of reaching and renewing the agreements. Finally, a 10% price overcharge is generally applied to calculate customer savings from cartel decisions, although a 15% overcharge is sometimes used if it can be justified.

16. Mudde (2012) and Davies (see OECD, 2013) made an assessment of these assumptions. Mudde considers that the assumption of a 1-year duration of the price overcharge is too conservative as according to his dataset the average life-time of cartels detected by the European Commission is 8 years. For Davies, the European Commission's case-dependent approach is quite persuasive given that there are various

determinants of cartel duration, such as the severity of fines and leniency programmes, the type of industry or the ease of entry. However, this approach requires a significant judgemental input and if sufficient case-specific information is not available, Davies recommends using a single number, somewhere between 1 and 6 years. Regarding the cartel overcharge, the empirical evidence in the academic literature (see Bolotova and Connor, 2006 and Smuda, 2014) suggests that the median cartel overcharge lies between 17 and 30%, which makes the 10% assumption conservative.

17. The merger decisions included in the sample considered for the calculation of customer saving are important decisions, i.e. Phase 1 and Phase 2 merger decisions with remedies or Phase 2 merger prohibitions<sup>2</sup>. The affected turnover is defined as that of all firms in the relevant markets, using a broader definition of the affected turnover than in cartels. The reason is that the price effect of a merger is unlikely to be confined to just the parties involved as rivals will increase their price in response to an increase in price by the merging parties. This argument can also be made for cartels, indicating that the narrow definition of the affected turnover in cartels may lead to an underestimation of the customer savings. The duration of the price effects is generally 3 years, but sometimes an assumption of 2 or 5 years is made depending on the size of market entry barriers.

18. For the price effect, a default assumption of 3% has been made from 2012 on but assumptions of a 1% and 5% price overcharge are also used as sensitivity tests. Before 2012, the European Commission used PCAIDS (Proportionally Calibrated Almost Ideal Demand Systems) model simulations to calculate the price effects of merger decisions. PCAIDS models are simple representations of competitive interaction of firms, allowing the prediction of the price effects of merger decisions. The reason why the European Commission services decided to simplify the method used is that the sophistication of the PCAIDS methodology made the exercise quite costly and that, despite its sophistication, this methodology did have limitations (see European Commission, 2013). For example in some cases, model simulations were not feasible, either because the models could not adequately describe the nature of competition or because data required for the model calibration were not available and therefore, a default assumption of a 1% or 3% price overcharge was already made. Davies (see OECD, 2013a) considers that a 1% price overcharge is too low as assumption and quotes studies using default price overcharges from mergers ranging between 3 and 9%. He therefore suggests using a default price overcharge of 3%, which is baseline scenario used by the European Commission.

19. In the current paper, the price effect, its duration and the size of the market affected by cartels and mergers are used to calculate mark-up shocks applied to the QUEST model.

## (ii) Results

20. Table 2 presents the latest data on the reported customer savings (expressed as a percentage of GDP x 10<sup>-2</sup>) from four jurisdictions (i.e., the EU, Netherlands, UK and US) that regularly publish their estimates of customer savings. This table should not be used to compare the performances of the competition authorities in the four countries but rather to show the order of magnitude of the estimates, which vary widely over time and between jurisdiction. For example, over the period 2008-2013, the average yearly customer savings resulting from interventions by competition authorities ranges between 1.6 10<sup>-2</sup> % of GDP for the UK and 6.9 10<sup>-2</sup> % of GDP for the European Commission.

<sup>2</sup> A Phase 1 merger decision is a decision which is taken within 25 working days following the notification of the merger. If the merger raises competition concerns and cannot be resolved in Phase 1, a Phase 2 merger investigation is opened. Phase 2 is an **in-depth analysis of the merger's effects on competition** and requires more time (at least 90 working days from the opening of a Phase 2 investigation). Following the Phase 2 investigation, the Commission may either unconditionally clear the merger or approve the merger subject to remedies or prohibit the merger if no adequate remedies to the competition concerns have been proposed by the merging parties.

**Table 2: Estimates of annual customer savings (% of GDP x 10<sup>-2</sup>)**

	2008	2009	2010	2011	2012	2013	2014
<b>European Commission</b>	<b>8.7</b>	<b>7.6</b>	<b>8.9-13.1</b>	<b>4.4-6.4</b>	<b>2.6-5.7</b>	<b>3.8-4.7</b>	<b>2.7-5.5</b>
<b>US (DoJ + FTC)</b>	<b>0.7</b>	<b>2.0</b>	<b>0.9</b>	<b>1.7</b>	<b>6.4</b>	<b>1.3</b>	<b>N.A.</b>
<b>UK (CC+OFT)</b>	<b>2.6</b>	<b>2.7</b>	<b>1.3</b>	<b>1.0</b>	<b>1.0</b>	<b>1.0</b>	<b>N.A.</b>
<b>NL (NMa/ ACM)</b>	<b>0.7</b>	<b>0.1</b>	<b>1.5</b>	<b>6.1</b>	<b>3.7</b>	<b>10.8*</b>	<b>N.A.</b>

Source: Own calculations based on national and EU sources

\* Not comparable with the figures for 2008-2012 due to a change in methodology

21. Such variation in annual customer savings can be attributed to the fact that the sizes of the markets in which the competition authorities intervene, the scope and the number of cases can vary significantly from one year to another and across jurisdictions. Another reason for such variation is that the assumptions and methodologies<sup>3</sup> used for estimating customer savings, for example, regarding the price effect, its duration and the size of the affected market, vary from one jurisdiction to another<sup>4</sup>, making it hard to compare the results of the different authorities. This is the reason why the OECD has made some proposals aimed at an increased convergence of assumptions used by different competition authorities (see Box 2).

#### **Box 2. Guiding principles and methodology suggested by the OECD to calculate the customer savings**

The following principles have been endorsed by the Competition Committee of the OECD:

- Whenever possible use case specific information.
- Assume that no intervention will have a negative impact.
- Estimate static consumer benefits and when possible also include dynamic ones.
- Calculate and publish the estimates regularly.
- Present the results both as an annual figure and as an annual moving average over three years.
- Present the results by type of decisions (for example, separate the estimated impact of cartel decisions from that of merger decisions).

The OECD also suggests using a simple and easily-applicable methodology: the static consumer benefits resulting from each decision is the product of the size of the affected turnover, the price increase avoided and the expected duration of the price effect. When case-specific information is available on these three elements, this information should be used.

<sup>3</sup> See OECD (2013a) for a summary of the assumptions made in the three jurisdictions.

<sup>4</sup> For example, the ACM and the DoJ assume that the duration of the effect of a cartel decision is one year, while the CMA assumes a duration of six years.



When such information is not available, the OECD suggests using the following assumptions:

	<b>Cartel cases</b>	<b>Merger cases</b>
Affected turnover	Ex-ante turnover of the companies under investigation in the affected market(s)	Ex-ante turnover of all firms in the affected market(s)
Yearly price effect	Overcharge of 10%	Price increase of 3%
Duration	3-year	2-year

Source: OECD (2014a)

22. A strength of the customer savings approach is that its bottom-up estimates are closely linked to the important decisions taken by the competition authorities. However, its main disadvantage is that customer savings only measure the direct price effects of competition policy interventions. Therefore, these estimates are very small when expressed as a percentage of GDP. Moreover, the total effects extend beyond prices and include effects on quality, choice and innovation. The customer savings estimates also ignore the indirect consequences of the price reduction for the economy as a whole. Most importantly though, they do not consider the deterrent effects of competition policy which can be very significant (see Section 2.2). For these various reasons, not all competition authorities in OECD jurisdictions calculate the customer savings resulting from their interventions. Some of them have expressed concern that these estimates over-simplify matters, giving external stakeholders a partial or distorted view of the value and purpose of competition law enforcement. This would argue in favour of using a more comprehensive approach such as the one adopted by the current paper.

### **3.2 Deterrent effects**

#### **(i) Definition and determinants of deterrent effects**

23. A primary goal of competition policy enforcement is to deter anticompetitive behaviour by enterprises, thereby maintaining a level playing field in product markets to the benefit of the end consumer. The deterrent effect of a cartel prohibition, for example, depends on the impact of the decision by the competition authority on the perceived likelihood of getting caught and on size of the expected fines. For a punishment to be effective in deterring anticompetitive behaviour it needs to be transparent and be imposed on the undertakings that committed the infringements.

24. Cartel prohibitions and fines are supposed to deter new cartel formation, limit overcharges and reduce the stability of undetected cartels. A number of papers have attempted to address the question whether current fines are sufficient to deter companies from joining cartels and most researchers consider that EU antitrust fines are insufficient for cartel deterrence. Motta (2008), however, considers that fines set according to the relevant EU Guidelines are not necessarily inadequate to achieve deterrence. There are other ways to increase deterrence that should be further explored. A system of private rights of action, for example, possibly combined with greater attention to fostering a culture of competition would be more suited to increase cartel deterrence.

25. Looking at developments over time, Hyytinen et al. (2010) find that at the end of a period during which cartels in Finland were legal (1951-1990) almost all manufacturing industries had become cartelised. Similarly, Baker (2003) provides evidence that periods of lax antitrust enforcement in the US

were invariably followed by an increase in anticompetitive behaviour. Therefore, stricter enforcement (in whatever form) should also contribute to greater cartel deterrence.

26. The literature on the deterrent effects of merger control is more limited than that of cartels. In the area of mergers, the deterrent effect is defined as the extent to which companies modify or abandon their merger plans in order to take out anticompetitive elements. However, this is very difficult to measure as this implies observing the number of mergers deterred by the merger control regime and assessing whether the deterred mergers would have had anticompetitive effects. On the one hand, a strict application of merger control rules may be welfare enhancing because it deters future anticompetitive mergers (see Nocke and Whinston (2011) and Sørsgard (2009 and 2014)). On the other hand, companies may decide not to go ahead with a pro-competitive merger if merger control rules are applied too strictly. In the end, an appropriate balance needs to be found. The presumption of the literature is that notified mergers are anti-competitive and that therefore a reduction in the number of notified mergers is an indication of a positive deterrent effect of the merger control, which appears to be a strong assumption.

27. In addition, there is a debate regarding the type of actions (Phase 1 remedies, Phase 2 remedies or prohibitions) having the greatest deterrent effects. Buccirossi et al. (2008) consider that the most common reasons for abandoning a merger are the risk that it would not be approved and the high cost of remedies. Seldeslachts, Clougherty and Barros (2009) however consider that blocked mergers have significant deterrent effects while there is no impact from merger settlements or ongoing monitoring. Duso, Gugler and Szucs (2013) consider that since the 2004 EU merger control reform prohibitions have had no deterrent effects while aborted mergers in either Phase 1 or Phase 2 have had such effects. In a more recent paper, Clougherty et al. (2014) find that of the various EU merger control actions, only Phase 1 remedies have a deterrent effect. These diverging results show that further work is necessary before drawing robust conclusions on the type of actions having the strongest deterrent effects on anticompetitive mergers.

## **(ii) Measurement of deterrent effects**

28. The deterrent effects of a competition policy intervention are difficult to measure because they are not felt immediately and cannot be measured directly. Therefore, there is more work on optimal deterrence from a theoretical perspective than work which tackles the problem of measuring deterrent effects. Nevertheless, attempts have been made to get rough estimates of the deterrent effects of merger control and cartel punishment. These estimates are very often based on surveys directly asking businesses and legal advisors about the deterrent effects of competition authorities' work across different areas (such as cartel policy enforcement or merger control). These surveys have limitations: there is no certainty about the reliability of the information provided by the respondents and the surveys may be biased. However, this is the only way to obtain direct information on deterrent effects. A summary of the results of recent EU surveys is given in Table 3.

**Table 3: Summary of the results of surveys on deterrent effects**

Source	Method	Conclusion	Number of cases deterred per case investigated/detected
<b>Twynstra Gudde (2005)</b>	Interviews with 16 competition lawyers and companies in the healthcare, energy and publishing industries about the follow-up of 475 merger proposals during the period 2000-2003.	6% of notified mergers are abandoned and 12% modified.	For every merger blocked or remedied, 7.5 are abandoned or modified.
<b>Deloitte (2007)</b>	30 interviews with competition lawyers, economists and companies & questionnaire completed by 234 competition lawyers and 202 large firms (200+ employees). Period 2004-2006.	According to lawyers, 8% of qualified <sup>5</sup> mergers are abandoned and 7% modified. According to companies, 8% are abandoned and 4% modified.	For every merger blocked or remedied, 5 are abandoned or modified according to lawyers. For every cartel detected, 5 are deterred according to lawyers and 16 are deterred according to companies.
<b>London economics (2011)</b>	27 interviews of professionals from legal firms & survey based on questionnaire completed by 501 large firms (200+ employees) and 308 small firms (under 200 employees). Period 2003-2011.	18% of qualified mergers are abandoned and 15% modified (based on a small sample).	For every merger blocked or remedied, 1.8 are abandoned (based on a small sample). For every cartel detected, 28 are deterred (but only 20% of cartels are detected).
<b>SEO survey (2011)</b>	Online survey completed by 512 companies and 97 advisers on competition law (mainly lawyers) over the period from 2005 to mid-2010.	13% of notified mergers are abandoned and 5% modified.	For every cartel detected, 5 are deterred (but only one third of cartels are detected).

Source: Baarsma et al. (2012) and CMA (2014)

29. Surveys of competition lawyers have been used in a number of studies commissioned by competition authorities to evaluate the deterrence effect of their merger decisions. The Twynstra Gudde (2005) study asked competition lawyers in the Netherlands about their follow-up of 475 merger proposals in the period 2000–2003. Around 6% of such proposals were abandoned due to concerns about possible infringements of competition rules, while another 12% were modified. For each merger enforcement action by the Dutch competition authority, 7.5 mergers are deterred. According to UK competition lawyers four out five harmful mergers in the UK are deterred as a result of competition policy enforcement (Deloitte, 2007). Many 2-to-1 market consolidations are never even considered, because the authorities would certainly be opposed. Moreover, a survey of companies also conducted by Deloitte shows that for each merger enforcement action by the OFT, 5 mergers are deterred. A more recent survey made by London

<sup>5</sup> A qualified merger is a merger over which the UK competition authority could take jurisdiction.

Economics (2011) finds a lower deterrent effect of 1.8 mergers deterred for each merger enforcement action. Finally, a study carried out for the Dutch competition authority by SEO (2011) reports that 5% of notified mergers are modified prior to notification and that 13% are deterred in anticipation of a possible intervention by the Dutch competition authority. To sum-up, according to these surveys, between 12% and 33% of notified/qualified mergers are either abandoned or modified due to concerns about possible infringements of competition rules and between 1.8 and 7.5 mergers are deterred per merger enforcement action by the competition authorities.

30. Various methods have been used to measure the deterrence effects of cartel policy enforcement actions. The aim of this research is to determine the effects of enforcement on the observable population of cartels and ultimately to make an inference on how this might affect the whole population of cartels (including the number of undetected cartels). The validity of this approach depends on the robustness of the established link between the number of detected cartels and the whole population of cartels. For example, Ormosi (2014) uses methods similar to those applied to make inferences about wildlife population characteristics in ecology to determine whether an observed change in the number of detected cartels is caused by a change in the detection rate or by a change in the rate of deterrence. On the basis of this approach, he finds that less than a fifth of EU cartels between 1985 and 2005 were detected. This result is similar to the survey result reported by London Economics (2011). The survey by SEO (2011), however, obtains a detection rate of one third. The surveys by London Economics (2011) and SEO (2011) have also been used to estimate the ratio of cartels deterred over cartels detected. They find that there are between 5 and 28 cartels deterred per cartel detected.

31. Using the above survey information to determine the deterrent effects of competition policy enforcement is not straightforward. As highlighted by Ormosi (2014) in the case of cartels, even if the ratio of deterred cartels over detected cartels is 5 to 1, we cannot deduce that the harms from the deterred cartel are five times greater than the competition authorities' estimates of the savings achieved from the detection of cartels. The reason is that the observed sample of cartels detected may not be representative of the full population of cartels. Davies and Ormosi (2013) consider that this sample selection bias is likely to be substantial because the unobserved cases could well be those which are the most harmful. In particular, undetected cartels are likely to be more harmful than the detected ones, because the latter are less sustainable or more prone to whistle-blowers. Similarly, mergers with clear anticompetitive effects are more likely to be discouraged by merger control. Davies and Ormosi estimate that the deterred cartel harms would be between 10 and 30 times what is detected and recorded by competition authorities. For mergers, this multiplying factor ranges between 6 and 17.

32. In the calculation of the mark-up shocks including the deterrent effects of competition authorities' interventions, we have used another, sector-based approach to estimate the deterrent effects (see Section 4.1(i)b below). However, we have applied a multiplying factor of 30 as an upper bound for the deterrent effects of cartel decisions and a multiplying factor of 15 as an upper bound for the deterrent effects of merger decisions, taking into account that mergers and cartels with important anticompetitive effects are more likely to be deterred by competition policy enforcement.

## **4. QUEST model**

### **4.1 Short description of the QUEST model**

33. The macroeconomic assessment presented in this paper is based on an extended version of the European Commission's QUEST III model (see Ratto et al. 2009), which we adapted for analysing the potential distributional effects of competition policy. Standard modern macroeconomic models, so called Dynamic Stochastic General Equilibrium models, go in the direction of meeting the requirement of rigorous micro foundations and they also include imperfections in goods and labour markets by modelling

these markets as imperfectly competitive. Nevertheless, these models typically lack sufficient detail to make a link between product market reforms and their distributional consequences. We overcome this limitation by introducing two skill-groups, low- and high-skilled into the the DSGE model of Ratto et al. (2009).

34. The model version used here is a two-region open-economy setup calibrated for the European Union and the rest of the world. For each region, the model economy is populated by households, final goods producing firms and there is a monetary and fiscal authority, both following rule-based stabilisation policies. The domestic and foreign firms produce a continuum of differentiated goods. The goods produced in the home country are imperfect substitutes for goods produced abroad. The level of competition among firms is captured by the inverse elasticity of substitution between the goods varieties which can be directly linked to the mark-up that firms charge over the marginal cost of production. Competition policy in the model acts as an instrument to decrease these mark-ups and therefore increase competition among the firms.

35. From the consumers' side, we distinguish between households which are liquidity constrained and consume their disposable income and non-liquidity constrained (so-called Ricardian) households who have full access to financial markets. The latter group of households make decisions on financial and real capital investments. The model is a fully forward-looking dynamic model in which all investment decisions are based on the expected future stream of income. Households also differ in terms of their skills and wages. In standard DSGE models liquidity and non-liquidity constrained households earn the same wage which makes these models less suitable for the purpose of the paper. In order to measure the distributional consequences of competition policies we introduce two skill groups into our model with different wages. Additionally, we identify the liquidity constrained households as low-skilled and the non-liquidity constrained households as high-skilled. By using the ISCED education classification, we define the share of population with up to lower secondary education (ISCED 2) as low-skilled and the rest of the population as high-skilled. Particularly, in our calibration for the European Union this means that around 25% of the population is classified as low-skilled and liquidity constrained while the remaining share is considered high-skilled and non-liquidity constrained at the same time.

36. We calibrate our model by selecting behavioural and technological parameters so that the model can replicate important empirical ratios such as labour productivity, investment, consumption to GDP ratios, the wage share, the employment rate, given a set of structural indicators describing market frictions in goods and labour markets, tax wedges and skill endowments. Most of the variables and parameters are taken from available statistical or empirical sources from the literature and the remaining parameters are tied down by the mathematical relationship of the model equations.

37. The model closely follows Ratto et al. (2009). Therefore the following two subsections will focus on those parts of the model which are crucial for understanding the transmission mechanism of mark-up shocks (Section 3.2) and their distributional consequences (Section 3.3). In order to focus on the main transmission mechanism, for illustration purposes we present a slightly simplified set of equations from the model in these sections.

#### **4.2 *Modelling the macroeconomic effects of mark-up shocks***

38. Competition policy measures are translated into the model as mark-up shocks which are interpreted as resulting from interventions made by the competition authority to increase the level of competition among domestic firms. We assume that final goods producers work under monopolistic competition setting and each firm produces a variety of the domestic good which is an imperfect substitute

for varieties produced by other firms. Final output of firm  $j$  at time  $t$  ( $Y_t^j$ ) is produced using capital  $K_t^j$  and a labour aggregate ( $L_t^j$ ) in a Cobb-Douglas technology, subject to a fixed cost  $FC_{Y,t}^j$

$$Y_t^j = \left( L_t^j - FC_L^j \right)^\alpha \left( u_t^j K_t^j \right)^{1-\alpha} - FC_Y^j \quad (1)$$

with

$$L_t^j = \left( \Lambda_L^\mu \left( \chi_L L_{L,t}^j \right)^{\frac{\mu-1}{\mu}} + \Lambda_H^\mu \left( \chi_H L_{H,t}^j \right)^{\frac{\mu-1}{\mu}} \right)^{\frac{\mu}{\mu-1}}, \quad (2)$$

where  $L_{L,t}^j$  and  $L_{H,t}^j$  denote the employment of low and high-skilled by firm  $j$  respectively. Parameter  $\Lambda_s$  is the corresponding share parameter ( $s \in \{L, H\}$ ),  $\chi_s$  is the efficiency unit, and  $\mu$  is the elasticity of substitution between different labour types.<sup>6</sup> The term  $FC_L^j$  represents overhead labour and  $u_t^j$  is the measure of capacity utilisation.

The objective of the firm is to maximise the present discounted value of profits:

$$PR_t^j = P_t^j Y_t^j - W_{L,t}^j L_{L,t}^j - W_{H,t}^j L_{H,t}^j - i_t^K P_t^j K_t^j \quad (3)$$

where  $i_t^K$  denotes the rental rate of capital.<sup>7</sup>

It can be shown that in a symmetric equilibrium, when  $P_t^j = P_t$ ,  $\forall j$ , firms charge a mark-up over the marginal cost of production (MC):

$$P_t^j = (1 + \tau_t^j) MC_t^j \quad (4)$$

where  $\tau_t^j$  is the price mark-up which is defined as a function of the elasticity of substitution  $\sigma^d$ , and a mark-up shock  $\varepsilon_{mkp,t}$ :

$$\tau_t^j = 1 / \left( \sigma^d - 1 \right) + \varepsilon_{mkp,t}. \quad (5)$$

39. In the subsequent analysis we will simulate the effect of competition policies as negative shocks to the price mark-up via the mark-up shock component ( $\varepsilon_{mkp,t}$ ) in Equation 5.

<sup>6</sup> Data on skill-specific population shares, participation rates and wages are obtained from the Labour Force Survey (EUROSTAT). The elasticity of substitution between different labour types ( $\mu$ ) is one of the major parameters addressed in the labour-economics literature. We rely on the seminal reference for this elasticity parameter by Katz and Murphy (1992). We use their estimated elasticity of substitution between skilled and unskilled labour which is about 1.4.

<sup>7</sup> Note, that following Ratto et al. (2009), we assume that economic agents (firms and households) face technological constraints which restrict their price and wage setting, investment, employment and capacity utilisation decisions. These constraints are captured by the corresponding adjustment costs but for easier tractability we omit these terms in the following sections.

40. Skill-specific labour demand can be obtained from the first order condition of the firm's cost minimisation problem<sup>8</sup> with respect to labour:

$$P_t^j \frac{\partial Y_t^j}{\partial L_{s,t}} \frac{1}{1 + \tau_t^j} = W_{s,t}, \quad s \in \{L, H\}, \quad (6)$$

where the marginal product of labour and the mark-up will jointly determine the optimally chosen level of low- and high-skilled employment level.

41. To sum up the transmission channel from the firms' (supply) side, the interventions of the competition authority resulting in an increase in competition and a decrease in mark-ups will lead to lower prices (Equation 4). Since firms are forward-looking, their demand for labour and capital is based on the expected future stream of profits taking into account the effect of mark-ups both on prices and demand. They take into account the direct effect of mark-ups on future profitability, which is negative due to lower mark-ups, and at the same time they also take into account the increase in future demand for their products due to the lower prices. In order to satisfy the higher demand, firms require more labour and capital. However, the decline of firms' future profitability partly mitigates the increase of demand for input factors as increased production costs and lower prices can result in shrinking profits accrued by the firms (Equation 3).

### 4.3 Modelling the distributional effects

42. The model allows investigating the effects of EU merger control and cartel policy interventions not only on standard macroeconomic variables such as GDP and employment, but also on distributional outcomes and second-order effects through examining employment and the wage-distribution across households (1) with different socio-economic characteristics - in particular skill levels - and (2) across different income sources (capital ownership, wage earners and benefit recipients).

43. We assume that there are two types of households characterized by a skill-income type combination:

- High skilled non-liquidity constrained (NLC) households whose income sources are wages, transfers, benefits and additionally income from capital ownership and the financial market.
- Low skilled liquidity constrained (LC) households whose income sources are only wages, transfers and benefits. These households earn lower wages which is captured by their lower efficiency level in the labour aggregate (eq. 2). These households cannot rely on additional income from holding assets (e.g. government bonds, physical capital) nor from the firms' profits as opposed to the non-liquidity constrained high-skilled households who can benefit from accessing both financial and physical capital markets.

44. This setup allows assessing the effects of competition policy on employment and wages across skill-income levels and across income sources by comparing the effect on wages with the effect on profits.

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<sup>8</sup> Note that the term  $\frac{1}{1 + \tau_t^j}$  represents the Lagrange multiplier, which in a cost minimisation problem can be interpreted as the effect on the objective (i.e. costs) of relaxing the constraint by 1 unit (i.e. producing one extra unit). This interpretation implies that the Lagrange multiplier equals real marginal cost  $\frac{MC_t^j}{P_t^j} = \frac{1}{1 + \tau_t^j}$ .

45. Formally, the household sector consists of a continuum of households  $h \in [0, 1]$ . A share  $(1-\varepsilon)$  of these households is not liquidity constrained and high-skilled. They have access to financial markets where they can buy and sell domestic assets (government bonds) and they accumulate physical capital which they rent out to the final good sector. The remaining share  $\varepsilon$  of households is liquidity constrained and low-skilled. These households cannot trade in financial and physical assets and consume their disposable income each period. For each skill group we assume that households supply differentiated labour services to their trade unions which act as wage setters in monopolistically competitive labour markets for each skill-group separately. The unions pool wage income and distribute it in equal proportions among their members within each skill-group. Nominal rigidity in wage setting is introduced by assuming that the households face adjustment costs for changing wages.

46. The utility function of households is additively separable in consumption ( $C_{h,t}$ ) and leisure ( $1-L_{h,s,t}$ ). We assume log-utility for consumption and allow for habit persistence (as measured by the parameter  $habc$ ).

$$U(C_{h,t}) = (1-habc)\log(C_{h,t} - habc\bar{C}_{t-1}) \quad (11)$$

Preferences for leisure are given by

$$V(1-L_{h,s,t}) = \frac{\omega_s}{1-\kappa}(1-L_{h,s,t})^{1-\kappa}, \text{ for } s \in \{L, H\} \quad (12)$$

47. Parameters  $\kappa$  ( $\kappa > 0$ ) and  $\omega_s$  are used to calibrate the corresponding Frisch labour supply elasticities.<sup>9</sup> We assume a skill specific weight ( $\omega_s$ ) on leisure which is necessary in order to capture differences in labour supply elasticities across skill groups (higher for low-skilled and lower for high-skilled).

#### ***a. Non-liquidity constrained (high-skilled) households***

48. Non-liquidity constrained households maximise an intertemporal utility function in consumption and leisure subject to a budget constraint. These households make decisions about consumption ( $C_{h,t}$ ), and labour supply ( $L_{h,t}$ ), the purchases of investment good ( $I_{h,t}$ ) and government bonds ( $B_{h,t}$ ), the renting of physical capital stock ( $K_{h,t}$ ), and receive wage income ( $W_{H,t}$ ), unemployment benefits<sup>10</sup> ( $bW_{H,t}$ ), transfer income from the government ( $TR_{h,t}$ ), and interest income ( $i_b, i_{K,t}$ ). Hence, non-liquidity constrained households face the following Lagrangian

<sup>9</sup> The Frisch labour supply elasticity is defined as the elasticity of hours worked to the wage rate. In other words, it measures the substitution effect of a change in the wage rate on the supply of labour.

<sup>10</sup> Note that  $b$  is defined as the benefit replacement rate. Households only make a decision about the level of employment but there is no distinction on the part of households between unemployment and non-participation. It is assumed that the government makes a decision how to classify the non-working part of the population into unemployed and non-participants. The non-participation rate (NPART) must therefore be seen as a policy variable characterising the generosity of the benefit system.



$$\begin{aligned}
& \max_{\left\{ \begin{array}{l} C_{h,t}, L_{h,H,t}, B_{h,t}, \\ I_{h,t}, K_{h,t} \end{array} \right\}_{t=0}^{\infty}} V_{i,0} = E_0 \sum_{t=0}^{\infty} \beta^t \left( U(C_{h,t}) + V(1 - L_{h,H,t}) \right) \\
& - E_0 \sum_{t=0}^{\infty} \lambda_{h,t} \frac{\beta^t}{P_t} \left( \begin{array}{l} (1+t_{C,t})P_{C,t}C_{h,t} + B_{h,t} + P_{I,t}(I_{h,t}) - (1+i_{t-1})B_{h,t-1} \\ - (1-t_{w,H,t})W_{H,t}L_{h,H,t} - bW_{H,t}(1-NPART_{h,t} - L_{h,H,t}) - TR_{h,t} \\ - (1-t_K)(i_{K,t-1} - rp_K)P_{I,t-1}K_{h,t-1} - t_K\delta_K P_{I,t-1}K_{h,t-1} - \sum_{j=1}^J PR_{j,h,t} \end{array} \right) \\
& - E_0 \sum_{t=0}^{\infty} \lambda_{h,t} \xi_{h,t} \beta^t (K_{h,t} - I_{h,t} - (1-\delta_K)K_{h,t-1})
\end{aligned} \tag{13}$$

49. The budget constraints are written in real terms with the price for consumption, investment ( $P_{C,t}$ ,  $P_{I,t}$ ) and wages ( $W_{H,t}$ ) divided by GDP deflator ( $P_t$ ). All firms of the economy are owned by non-liquidity constrained households who share the firms' total profits,  $\sum_{j=1}^J PR_{j,h,t}$ , where  $J$  denotes the number of firms. NPART denotes the non-participation rate and  $b$  is the benefit replacement rate. As shown by the budget constraints, the households pay consumption taxes ( $t_{C,t}$ ), wage income taxes ( $t_{w,H,t}$ ) and  $t_K$  capital income taxes and depreciation allowances ( $t_K\delta_K$ ) after their earnings on physical capital. When investing into tangible capital the household requires premium  $rp_K$  in order to cover the increased risk on the return related to these assets. The final term in Equation 13 reflects the technological constraint with respect to the accumulation of capital over time.

### ***b. Liquidity constrained (low-skilled) households***

50. Liquidity constrained households do not optimize but simply consume their current income at each date. The consumption of household  $h$  is thus determined by the net wage income plus benefits and net transfers:

$$(1+t_{C,t})P_{C,t}C_{h,t} = (1-t_{w,L,t})W_{L,t}L_{h,L,t} + bW_{L,t}(1-NPART_{h,L,t} - L_{h,L,t}) + TR_{h,t} \tag{14}$$

### ***c. Wage setting***

51. Within each skill group a variety of labour services are supplied which are imperfect substitutes to each other. Thus, trade unions can charge a wage mark-up ( $\mu_{s,t}^w$ ) over the reservation wage<sup>11</sup>. The reservation wage is given as the marginal utility of leisure divided by the corresponding marginal utility of consumption. The relevant net real wage to which the mark up adjusted reservation wage is equated is the gross wage adjusted for labour taxes, consumption taxes and unemployment benefits, which act as a subsidy to leisure. Thus, the wage equation is given as

$$\frac{U_{1-L,h,s,t}}{U_{C,h,s,t}} (1 + \mu_{s,t}^w) = \frac{W_{s,t}(1-t_{w,s,t} - b)}{P_{C,t}(1+t_{C,t})} \text{ for } s \in \{L, H\} \tag{15}$$

Finally, to sum up the transmission channels from the households (demand) side, low-skilled, liquidity constrained households, which consume their income every period, can increase their

<sup>11</sup> The wage mark-up depends on the intratemporal elasticity of substitution between differentiated labour services within each skill groups and fluctuations in the mark-up arise because of wage adjustment costs following Ratto et al. (2009).

consumption thanks to declining prices and increasing wage income (as firms' labour demand increases, see previous section). High-skilled, non-liquidity constrained households rely on additional income from holding assets (e.g. government bonds, physical capital) and from the firms' profits. Depending on the magnitude of the decline in firms' profits resulting from the lower mark-ups, these households may have smaller increase in their consumption relative to the liquidity constrained households.

## 5. Model simulations

### 5.1 Calculation of mark-up shocks

#### (i) Method

52. A database, which was created to calculate customer savings estimates from important merger and cartel decisions by the European Commission, has been used to calibrate the mark-up shocks applied to the QUEST model. As explained in Section 2.1, customer savings are obtained by multiplying the estimated reduction in prices resulting from competition policy enforcement decisions in the market concerned by the estimated duration of the price reduction and the size of the market.

53. The aggregate change in mark-up ( $\Delta MUP$ ) due to a set N of important competition policy enforcement decisions can be defined as follows<sup>12</sup>:

$$\varepsilon_{mpk} = \Delta MUP_N = \sum_{k \in \{K_N\}} \left[ \frac{\Delta P}{P}_k (1 + MUP_k) \right] \frac{GO_k}{GO} \quad (16)$$

where  $K_N$  is the set of sectors  $k$  in which these decisions led to a change in customer prices,  $\frac{\Delta P}{P}_k$ .

54. Mark-ups levels are calibrated for the available sectors on the basis of Thum-Thysen and Canton (2015), which extends Roeger's (1995) mark-up calculation method by including the effects of product market reforms. Equation 16 illustrates that the aggregate mark-up shock moves in line with price shocks in the sectors affected by the European Commission's decisions. However, they are weighted by the relative gross mark-up in the sector concerned,  $(1 + MUP_k)$ , and by the share of gross output in sector  $k$  in the EU economy as a whole,  $\frac{GO_k}{GO}$ . In our simulations the sectors  $k$  are defined at the ISIC3 2-digit level.

#### a. Direct effects of merger and cartel decisions

55. A distinction is made between mark-up shocks reflecting only the direct effects of merger and cartel decisions and shocks including the deterrent effects as well. In the former case, the price change in each sector  $k$  is computed as a weighted average of the price changes in the set of markets affected by European Commission merger and cartel decisions  $n$ :

$$\frac{\Delta P}{P}_k = \sum_{n \in M_k} \frac{\Delta P}{P}_n MS_{nk} + \sum_{n \in C_k} \frac{\Delta P}{P}_n MS_{nk} \quad (17)$$

where  $M_k$  and  $C_k$  are the sets of merger and cartel decisions respectively affecting sector  $k$ . For each merger and cartel decision, the European Commission defines a relevant market directly

<sup>12</sup> Note that from Equation 4, we can express the percentage price change in sector  $k$  as  $\Delta P_k/P_k = (\Delta(1+MUP_k))/(1+MUP_k) + \Delta MC_k/MC_k$ , where  $MUP_k$  is the mark-up ( $\tau_t^k$ ). Assuming that  $\Delta MC_k/MC_k = 0$  and  $\Delta(1+MUP_k) \approx \Delta MUP_k$ , we obtain that  $\Delta MUP_k = \Delta P_k/P_k (1+MUP_k)$ . Equation 16 aggregates the relevant mark-up changes using the corresponding market-shares as weights.

concerned by the decision. In our simulations, the weights  $MS_{nk}$  used to calculate the price change at the sector level are defined as the share of the affected turnover in the relevant market of decision  $n$  in sector  $k$  ( $mkt_{nk}mkt_{ji}$ ) over gross output in the sector at the 2-digit level ( $GO_k$ ):

$$MS_{nk} = \frac{mkt_{nk}}{GO_k} \quad (18)$$

56. As already mentioned in Section 2.1, we adopt the default assumption that merger and cartel decisions entail price reductions of 3% and 10%, respectively, in comparison with the counterfactual of no intervention. Equation 17 can therefore be reformulated as:

$$\frac{\Delta P}{P}_k = -0.03 \sum_{n \in M_k} MS_{nk} - 0.1 \sum_{n \in C_k} MS_{nk} \quad (19)$$

Substituting back Equations 18 and 19 in Equation 16, the mark-up change associated with the direct effects of merger and cartel decisions can be calculated as follows:

$$\Delta MUP_N = -\frac{1}{GO} \sum_{k \in \{K_N\}} \left[ (0.03 \sum_{n \in M_k} mkt_{nk} + 0.1 \sum_{n \in C_k} mkt_{nk}) (1 + MUP_k) \right] \quad (20)$$

### ***b. Deterrent effects of merger and cartel decisions***

57. As shown in Section 2.2, the direct price effects of competition policy decisions ignore the deterrent effects of such decisions. To take into account these deterrent effects, we make the assumption that, for each important decision by the European Commission, the price reduction covers not only the relevant market directly affected by the decision (the direct effects described above) but also the whole subsector defined at the NACE rev2 4-digit level to which the relevant market belongs. For example, an important airline merger decision with competition concerns covering specific routes only is supposed to have deterrent effects on the whole air passenger transport sector, meaning that other airline companies will be induced to abandon likely anti-competitive mergers. This assumption rests on the idea that the deterrent effects of competition policy interventions are more likely to have spill-overs on the companies belonging to the same sector. The assumption has some empirical support: a survey by Deloitte suggests that mergers in the UK are more likely to be abandoned or modified if there has been a recent inquiry by the UK competition authority in the sector (Deloitte, 2007 and Gordon and Squires, 2008).

58. In the calculation of the mark-up shocks including deterrent effects, we assume that the deterrent effects will spill-over to the whole sub-sector defined at the NACE rev2 4-digit level to which the market concerned by the competition policy intervention belongs. When taking an important merger or cartel decision, the European Commission tends to indicate the NACE rev2 sectors concerned. In order to reflect the deterrent effects in our simulation, the weights  $MS_{nk}$  used to calculate the price change in sector  $k$  resulting from decisions  $n$  are defined as the share of output at the NACE rev2 4-digit level of sector  $k$  concerned by decisions  $n$  in total output of sector  $k$  (defined at NACE rev2 2-digit level). However, due to a lack of information on gross output at NACE rev2 4-digit level, we use the share of value added at the NACE rev2 4-digit level in total value added at the NACE rev2 2-digit level instead:

$$k_{ji} = \frac{VA_{4ji}}{VA_{2i}} \quad (21)$$

59. In order to avoid implausible multiplication effects for specific small cases, we assume that this value cannot exceed the original value of the affected market by a certain threshold,  $T \in \{T_M, T_C\}$ , which may differ between merger and cartel decisions:

$$MS_{nk} = \begin{cases} \frac{VA4_{nk}}{VA2_k} \text{ if } \frac{VA4_{nk}}{VA2_k} GO_k < T \text{ mkt}_{nk} \\ \frac{T \text{ mkt}_{nk}}{GO_k} \text{ if } \frac{VA4_{nk}}{VA2_k} GO_k \geq T \text{ mkt}_{nk} \end{cases} \quad (22)$$

where  $VA2_k$  denotes the value added of the 2-digit NACE rev2 sectors corresponding to the ISIC3 sectors used in the model simulations<sup>13</sup> (see Sections 4.2 and 4.3). The thresholds  $T_M$  for merger decisions and  $T_C$  for cartel decisions have been set at 15 and 30, respectively, in order to be broadly in line with the literature which shows that the deterred harm could reach up to 17 times the direct harm of a merger decision and 30 times the direct harm of a cartel decision (see Section 2.2(ii)).

60. The application of the weights  $MS_{nk}$  defined in Equation 22 permits the calculation of mark-up shock including deterrent effects:

$$\Delta MUP_N^{det} = -\frac{1}{GO} \sum_{k \in \{K_N\}} \left[ (0.03 \sum_{n \in M_k} MS_{nk} GO_k + 0.1 \sum_{n \in C_k} MS_{nk} GO_k) (1 + MUP_k) \right] \quad (23)$$

**(ii) Magnitude and duration of the shock**

61. The direct impact of the European Commission's competition policies can be assessed by aggregating the changes in mark-up directly resulting for its merger and cartel decisions. Since the price effects following decisions by the European Commission are assumed to last three years, we consider that every year customers will benefit not only from the interventions in that same year, but also from interventions made in the two previous years.

62. In the current exercise we look at decisions having had an impact in 2014, i.e. decisions taken in 2012, 2013 and 2014. The decrease in mark-up ( $-\Delta MUP_N$ ) associated with decisions by the European Commission in each of these three years is computed using Equation 20 and then summed to arrive at a total effect in 2014 of 0.03 percentage points. This figure includes the direct effects of the European Commission's merger and cartel decisions only.

63. However, the simulations presented in the present paper consider not only the direct but also the deterrent effects of merger and cartel decisions. Using Equation 22 the decrease in mark-up ( $-\Delta MUP_N^{det}$ ) resulting from the European Commission's decisions in 2012, 2013 and 2014 can be derived: the mark-up reduction equals 0.09 percentage points in 2012, 0.47 percentage points in 2013 and 0.23 percentage points in 2014, which adds up to an aggregate negative mark-up shock of 0.79 percentage points, which corresponds to a 6.06 percent reduction in the mark-up level.

64. The magnitude of this shock appears to be reasonable in comparison with the mark-up shocks reported by simulation studies aimed at assessing the impact of a wider set of competition-friendly structural reforms. For instance, in Varga and in 't Veld (2014) structural reforms aimed at narrowing the gap vis-à-vis the average of the three best EU performers in terms of market functioning correspond to an average mark-up decline across the EU of around 1.5 percentage points.

65. With respect to the duration of the shock, the assumption is that the effects of important merger and cartel decisions by the European Commission last three years (see above) and that the European

<sup>13</sup> The conversion from NACE rev2 classification to ISIC3 is based on the Eurostat RAMON correspondence tables (from NACE rev2 to NACE1.1 and from ISIC3.1 to ISIC3), available at [http://ec.europa.eu/eurostat/ramon/reactions/index.cfm?TargetUrl=LST\\_REL](http://ec.europa.eu/eurostat/ramon/reactions/index.cfm?TargetUrl=LST_REL) as well as the United Nations conversion tables: <http://unstats.un.org/unsd/cr/registry/regdnld.asp?Lg=1> (from NACE1.1 to ISIC3.1)

Commission will continue its competition policy interventions at the same pace into the foreseeable future. Such a 'permanent' mark-up shock can then be applied to a baseline scenario under which the European Commission would take no merger or cartel decision. The assumption of a permanent shock reflects the idea that a single competition intervention by the Commission will have little or no enduring effects on company behaviour. The deterrent effects of such interventions come from companies' awareness of the existence of a competition authority and the expectation that the authority will continue to act if infringements of competition law occur.

## 5.2 Simulations of macroeconomic effects

66. The simulations presented below are based on an aggregate negative mark-up shock of  $\varepsilon_{mpk,t} = 0.79$  percentage points (see Equation 5) to the QUEST model. The magnitude of the shock reflects both the direct and deterrent effects of the European Commission's merger and cartel decisions. Table 4 shows the precise magnitude of the shock considered, both in absolute and relative terms. As motivated above, we take into account the cumulative "permanent" effects of Commission's competition policy interventions.

**Table 4: Magnitude of the mark-up shock**

$\Delta\varepsilon_{mpk}(pp)$	<i>mpk</i> level	$\Delta\varepsilon_{mpk}(\%)$
-0.787	0.130	-6.064

67. Table 5 reports the percentage change of GDP and of selected macroeconomic variables of interest resulting from the above mark-up shock. The figures reported are in percentage point difference from the un-shocked values. Columns report different number of years after the shock.

**Table 5: Macroeconomic effects of the mark-up shock**

	$\Delta$ (pp) after <i>n</i> years				
	1	5	10	20	50
<i>GDP</i>	0.215	0.371	0.494	0.647	0.711
<i>GDP deflator</i>	-0.162	-0.212	-0.285	-0.406	-0.452
<i>Employment</i>	0.170	0.263	0.314	0.340	0.312
<i>Consumption</i>	0.222	0.329	0.451	0.593	0.651
<i>Investment</i>	0.347	0.719	0.878	1.064	1.149
<i>Labour productivity</i>	0.045	0.108	0.180	0.306	0.400

68. Table 5 illustrates that competition policy interventions increase output and raise demand for the factors of productions (capital, labour). The combination of price decline and the higher wages associated with increased labour demand and higher labour productivity yields an increase in consumption. Investment is also increasing because the negative direct effect of mark-ups on future profitability is dominated by the positive effect of increasing demand due to lower prices. In terms of GDP we can observe an increase of 0.21% after one year. After five years, the effect on GDP almost doubles, increasing to 0.37%. This result is in line with Van Sinderen and Kemp (2008), who estimate that the policies of the Dutch competition authority over the 1998-2007 period had a positive GDP effect of 0.3% after five years and 0.4% after ten years.

69. Alternatively, the magnitude of the effects on GDP of the European Commission's merger and cartel decisions in 2012 can be put into perspective by comparing the GDP effects with similar studies having looked at other pro-competitive policies. Monteagudo et al. (2012) estimate the economic impact of the implementation of the Services Directive across the EU Member States. It concludes that Member States may achieve around 0.7% higher GDP from the Directive if they continue their reform efforts after 10 years and a 0.8% GDP increase in the long-run at the EU level. The same study estimates that the introduction of Points of Single Contact in the Member States, a measure which facilitates cross-border service provision, could bring around 0.13% GDP increase after 10 years and up to 0.2% increase in the long-run at the aggregate EU level. These results are broadly of the same order of magnitude as the GDP effects reported here. The European Commission (2012) estimates that the European Union's ambitious Single Market initiative should result in an 1.8% increase in EU GDP and a 1.3% increase in employment after 15 years. Although these studies rely on different methodologies, they can help us to compare our results with other actual competition policy friendly measures. Varga and in 't Veld (2014) find that structural reforms aimed at narrowing the gap vis-à-vis the average of the three best EU performers in terms of market functioning would boost EU GDP by 1.1% after 10 years.

### 5.3 *Robustness of the macroeconomic effects*

70. Alternative simulations have been carried out to test the robustness of the macroeconomic results presented above. Table 6 illustrates the sensitivity of the results to different assumptions made regarding the magnitude of the overcharges and of the deterrent effects. The first row presents the five-year GDP effect of a mark-up shock under the baseline scenario.

**Table 6: GDP effect after five years under different scenarios**

<i>Scenario</i>	<i>Merger overcharge</i>	<i>Cartel overcharge</i>	<i>Sector spill-over</i>	<i>Merger deterrence threshold</i>	<i>Cartel deterrence threshold</i>	<i>GDP effect after five years</i>
<i>Baseline</i>	3%	10%	Yes	15x	30x	+0.37%
<i>Lower bound overcharge</i>	1%	10%	Yes	15x	30x	+0.35%
<i>Upper bound overcharge</i>	5%	20%	Yes	15x	30x	+0.73%
<i>Lower bound deterrence threshold</i>	3%	10%	Yes	5x	10x	+0.13%
<i>Literature based deterrence</i>	3%	10%	No	15x	30x	+0.38%
<i>No deterrence threshold</i>	3%	10%	Yes	No threshold	No threshold	+0.98%

71. The second and third rows describe the outcome of a lower bound and an upper bound overcharge scenario, respectively. The price increase avoided with merger control is fixed at 1% in the former and 5% in the latter, while the price overcharge of cartels varies between 10 and 20%. These figures are based on assumptions used by competition authorities to calculate the direct customer savings resulting from their interventions or from the results of the literature on the price effects of mergers and cartels. The upper bound scenario is still relatively cautious. For example, there are studies showing that mergers can lead to price increases of up to 7% and that cartel overcharges may reach 50%.

72. An interesting conclusion resulting from the comparison of simulation results in the lower bound and upper bound overcharge scenario is that competition authorities can multiply the positive effects of

their interventions on GDP growth by two if they intervene in markets with more significant anti-competitive effects. The table shows that the GDP effect after five years increases from 0.35% to 0.73% if we move from the lower bound to the upper bound overcharge scenario. This would plead in favour of competition interventions in markets where the anti-competitive behaviour of companies has the biggest impact in terms of overcharges (for example, highly concentrated markets).

73. However, the assumptions concerning deterrent effects have an even bigger impact on the simulations results. Three scenarios concerning the deterrent effects are defined in the final three rows of Table 6. In the lower bound deterrence scenario, it is assumed that the avoided price increase resulting from a competition decision covers the whole subsector to which the relevant market of the decision belongs, with thresholds  $T_M = 5$  for merger decisions and  $T_C = 10$  for cartel decisions. In the literature based deterrence scenario, there are no sector spill-overs and the deterrent effects are obtained by multiplying the direct price effects by 15 for mergers and 30 for cartels. Finally, in the no deterrence threshold scenario, the price effects are supposed to affect the whole sub-sector at the four-digit level concerned by the decision. This last scenario is an upper bound scenario for the deterrent effects.

74. A first conclusion resulting from comparison of the results under the different deterrence scenarios is that the results under the literature based deterrence are very similar to those in the baseline, showing that the thresholds  $T_M = 15$  for merger decisions and  $T_C = 30$  for cartel decisions are very often reached in the baseline scenario. Another conclusion is that there is a greater sensitivity of the results to the different assumptions concerning the deterrent effects than to those concerning the price overcharges. The GDP effects after five years vary by a factor of 1 to 10 between the lower bound and the higher bound deterrence scenario: reaching 0.13% in the former case and 0.98% in the latter. This means that it would be very misleading for competition authorities to define priorities only on the basis of the likely direct effects of their interventions. Pursuing cases with limited anti-competitive effects but with significant deterrent effects is worthwhile. However, this also shows how important it is to be able to better estimate the magnitude of the deterrent effects of competition policy interventions.

#### 5.4 *Simulations of distributional effects*

75. In this section we focus on the distributional effects of the European Commission's merger and cartel decisions. As explained in Section 3.3, we make a distinction between different types of households. Non-liquidity constrained, high skilled households work, receive wages, transfers and benefits, consume and save, own capital and invest in financial markets. Liquidity constrained, low skilled households, whose only sources of income are wages, transfers and benefits, consume all their resources in each period. Making a distinction between these two types of household permits analysing the distributional effects of interventions by competition authorities such as the European Commission.

76. Table 7 reports the percentage change of the main macroeconomic variables describing the relative performance of non-liquidity constrained, high skilled households (*NLC*) and liquidity constrained, low skilled households (*LC*). Variables which refer to a specific household type are expressed in per-household terms. It appears that the mark-up shock leads to an increased demand for both non-liquidity constrained and liquidity constrained labour. Consequently, the wage increase for both types of households is comparable as well, but slightly higher for non-liquidity constrained households.

**Table 7: Distributional effects of the mark-up shock**

	<i>Δ (pp) after n years</i>				
	1	5	10	20	50
<i>Agg. Employment</i>	0.170	0.263	0.314	0.340	0.312
- <i>NLC</i>	0.169	0.265	0.319	0.344	0.315
- <i>LC</i>	0.172	0.255	0.290	0.323	0.299
<i>Agg. Consumption</i>	0.222	0.329	0.451	0.593	0.651
- <i>NLC</i>	0.189	0.217	0.325	0.462	0.530
- <i>LC</i>	0.378	0.850	1.036	1.201	1.210
<i>Wage income NLC</i>	0.670	1.475	1.822	2.078	2.028
<i>Wage income LC</i>	0.608	1.383	1.667	1.899	1.873
<i>Benefits NLC</i>	-1.646	-2.566	-3.195	-3.406	-2.954
<i>Benefits LC</i>	-0.389	-0.423	-0.538	-0.594	-0.399
<i>Transfers NLC</i>	0.215	0.371	0.494	0.647	0.711
<i>Transfers LC</i>	0.215	0.371	0.494	0.647	0.711
<i>Profits NLC</i>	-5.626	-7.593	-7.175	-6.623	-6.262
<i>Capital income NLC</i>	1.162	1.491	1.596	1.705	1.714
<i>Bonds interests NLC</i>	-0.491	-0.440	-0.631	-0.163	0.511

77. We also observe a substantial deterioration in profits due to lower mark-ups (a peak deterioration of 7.6% after five years), and a decrease in income from financial assets due to lower interest rates on bonds, driven by an accommodating monetary policy responding to decreasing prices. The latter two negative effects are only borne by the non-liquidity constrained households, who however, can benefit of an increase in capital income due to a higher demand for production factors.

78. Following the increase in disposable incomes, households increase consumption by 0.33% after five years. The increase in consumption of liquidity constrained households is particularly prominent due to the fact that in the QUEST model liquidity-constrained households consume all the available income sources and do not save or invest. In the long run non-liquidity constrained households slowly recuperate their consumption relative to the liquidity constrained households as their losses from profits and interests on bonds are decreasing.

79. Unemployment benefits paid to non-liquidity constrained households is decreasing because they experience a proportionally larger decline in their unemployment rate<sup>14</sup>. As transfer incomes are not linked to unemployment or wages, they increase proportionally at the same rate for both households.

80. Overall, we can observe that pro-competitive policies have important redistributive effects because while they boost the demand for all types of workers, they significantly reduce profits which are destined to non-liquidity constrained households.

<sup>14</sup> Although the employment effect is the same for each skill group – as the firms require a similar increase of labour input from both of them – the same increase in employment means a much larger decrease in the unemployment of high-skilled because their unemployment is much smaller initially.



81. The distributional consequences of competition friendly interventions and product market reforms are not addressed in the previously mentioned studies of Monteagudo et al. (2012), the European Commission (2012) and Varga and in 't Veld (2014). Structural reforms, in particular tax, labour market and welfare reforms have been more frequently analysed in terms of their distributional effects. Burgert and Roeger (2014) for instance, simulate the macroeconomic impact of tax shifts in the European Commission's QUEST model and show that a tax shift from labour income to consumption redistributes disposable income from capital owners to wage earners. They find that the tax shift is regressive in the short run, but progressive in the long run, if it is enacted by reducing employers' social security contributions, and is progressive already in the short run if it is enacted by reducing personal income taxes. In contrast, our results show that competition friendly measures can favour poorer households already in the short run.

82. Ahrend et al. (2011) present model-based evidence about how the short-term impact of selected macroeconomic shocks is shared across different groups of agents. Unsurprisingly, the authors find that individuals with low incomes, and especially young people, seem in general to lose most from adverse macroeconomic shocks (fiscal consolidation reforms). Stricter product market regulation (e.g. stronger entry barriers, less competition friendly environment) is found to amplify the negative effects of certain shocks for youths and the poorer segments of society. Additionally, more rigid market regulations also had negative income effects on the poor following devaluations and commodity price decreases, and adversely affected poverty in the aftermath of financial crises and fiscal expansion shocks. This evidence is very much in line with the results presented in the current paper, which illustrates how pro-competitive policy actions and reforms benefit the poorer segments of society.

### 5.5 *A focus on the labour market: does competition policy create jobs?*

83. Concerning labour market effects, our results indicate that employment will be higher by around 0.3% after 10 years on average across the two household types (Tables 5 and 7). This increase is due to positive reinforcing effects from both the labour demand and the labour supply side. From the *labour demand* perspective, firms require more labour (and capital) in order to ensure that production keeps up with the increased demand for the now lower priced products. However, as explained in Section 3.2, the decline in the firms' future profitability somewhat mitigates the labour demand channel because higher production costs (associated with the increased wage levels) and lower prices can result in shrinking profits for firms, which in turn may have a negative effect on employment in the short run. In our case however the net effect on employment in the short-run is positive (+0.2%). In the medium and long-run, increasing employment and wage income stimulate consumption by both types of households, which further reinforces the demand channel. From the *labour supply* side, households are willing to offer more labour services as declining prices lead to higher real wages for both types of labour services (unskilled and skilled).

84. This positive employment effect both in the short run and in the long run is also supported in the literature. Spector (2004) sets up a theoretical general equilibrium model to assess distributional effects of the intensity of product market competition. Based on comparative statics in the theoretical model he finds that employment increases in both the short and long run under two different wage-bargaining schemes (the 'right-to-manage' model and the efficient bargaining model)<sup>15</sup>. The effect on wages in his model depends on labour demand elasticity, the reservation wage and workers' bargaining power. Blanchard and Giavazzi (2003) also study the macro-economic effects of competition in labour and product markets based on a theoretical macroeconomic general equilibrium model. Based on comparative statics, they show that

<sup>15</sup> In the 'right-to-manage' model the bargaining parties – a trade union and a firm - bargain over the wage and the firm sets the employment level. In the efficient bargaining model the trade union and the firm bargain over wage and employment simultaneously, which theoretically leads to Pareto-efficient contracts.

an increase in competition (modelled as product market deregulation) leads to lower mark-ups, lower unemployment and higher real wages in the short run. They show that this favourable effect disappears in the long run if entry costs are held constant. With the additional assumption of decreasing entry costs the long run effect is just as favourable as the short run effect.

85. It could be argued that the short-run effects of competition policy on employment may be negative rather than positive. The OECD (2014b) points out that productivity gains caused by competition can result in firms laying off workers and thereby reduce employment at least in the short-run (citing Bloom et al., 2011 and Schmitz, 2005). In this same line, Cacciatore et al. (2012) find a negative short-run employment effect (but positive wage effect) from more competition if more competition is modelled via lower entry costs (stemming from a decline in barriers to entry). This way of modelling competition policy differs from our model where prices decrease immediately as we model competition policy as a decrease in the price mark-up.

86. However, the OECD (2014b) argues that a productivity gain through more competition is likely to not be stronger than the effect stemming from technological progress. The OECD also points to research that shows that this supply-side effect can also increase employment: they cite that Griffith et al. (2007) find a contemporaneous unemployment effect of -1.3% of product market deregulation based on regression results of a reduced form model and Fiori et al. (2012), who find an employment effect of 1.1% in the short run and 3.5% in the long run.

87. Finally, it can be argued that if competition leads to the less productive firms exiting the market (rather than the layoffs within existing firms) - with flexible labour markets, reallocation of workers to the more productive firms can occur rapidly and thereby reduce the likelihood of increased unemployment in the short run. However, in less flexible labour markets this mechanism could lead to employment losses in the short run. In the medium to long-term, however, the employment effects of EU competition policy are unambiguously positive.

## **6. Conclusion**

88. This paper tries to bridge the gap between the microeconomic estimates of the customer savings associated with important merger and cartel interventions and the longer term macroeconomic effects of these interventions. It also attempts to measure not only the direct effects of competition policy interventions but also their deterrent effects. Finally, it sheds some light on the distributional and labour market impact of competition policy.

89. The macroeconomic effects of competition policy interventions are assessed by applying mark-up shocks to a DSGE model, the QUEST model. The mark-ups shocks are calibrated on the basis of the microeconomic customer savings from cartel and merger decisions of the European Commission in 2012, 2013 and 2014. These shocks reflect both direct and deterrent effects of competition policy interventions. These deterrent effects are assessed by assuming that the price effects of the Commission's decisions affect not only the relevant market cited in the decision but also the whole subsector to which this market belongs (subject to thresholds defined in line with the literature on the size of deterrent effects of merger and cartel decisions, respectively). In the QUEST model simulations the mark-up shock brings about a reduction in prices, which in turn results in higher demand, employment and GDP growth. Profits are negatively affected.

90. The results of the simulations show that the total effects (including the deterrent effects) of competition policy interventions on GDP are sizeable: a 0.4% increase after five years and a 0.7% increase in the long term. This result is very similar to the one obtained in the one other study on the macroeconomic impact of competition policy that we are aware of. Van Sinderen and Kemp (2008) report

increases of 0.3% and 0.4% in GDP after five and ten years, respectively. The competition policy effects are slightly lower than the estimated impact of the implementation of the Services Directive.

91. Alternative assumptions concerning the size of the overcharges and the importance of the deterrent effects may be used to calculate mark-ups shocks, which can then be applied to the DSGE model in order to determine the possible range of effects. This is important as there is still a high degree of uncertainty regarding the magnitude of deterrent effects in particular. The robustness analysis carried out shows that the GDP effects are quite sensitive to the assumptions made with respect to the deterrent effects. Under the assumption that deterrent effects of merger or cartel decisions spill-over to the whole sub-sector concerned by such decisions, the GDP increase after five year may reach 1%.

92. The QUEST model also allows assessing the distributional effects of the EU competition policy interventions across households, differentiating between non-liquidity constrained households (savers and high-skilled) and liquidity constrained households (low skilled and consuming all their resources in each period). The simulations show that competition policy has important redistributive effects, with liquidity constrained households increasing proportionally more their consumption than non-liquidity constrained households: the liquidity-constrained households increase their consumption four times more than the non-liquidity constrained households after 5 years (by 0.85 and 0.22% respectively). This supports the view that competition policy interventions, by lowering prices and – as studied in other work also by increasing the quality and variety of products - are particularly beneficial for the poorest in the society.

93. This work can be further refined in different ways. In particular, it would be worthwhile to consider the differential effects of competition policy decisions affecting different sectors, which would require the use of a macroeconomic model that is disaggregated by sector. In addition, one may want to include an assessment of the macroeconomic effects of other competition policy interventions in the areas of antitrust and State aid control, which have not yet be covered in the current paper.

94. To conclude, this paper is a first contribution to a more comprehensive analysis of the impact of competition policy, going beyond the direct price effects and integrating deterrent and longer term effects. This objective is ambitious and the simulations are reliant on a chain of assumptions, going from the calculation of customer savings and the approximation of the deterrent effects to the specification and calibration of the general equilibrium model. However, these assumptions do not undermine the usefulness of the analysis in getting a better understanding of the role of competition policy in society.

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