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Abstract

This paper presents new estimates for service sector mark-ups in the EU. We extend a widely used mark-up estimation methodology by allowing mark-ups in service sectors to depend on strictness of product market regulation as measured by the OECD's sectoral Product Market Regulation index. The idea here is that less strict regulation of product markets fosters competition and hence reduces firms' mark-ups. Our empirical analysis broadly confirms this. Our findings indicate that mark-ups in most EU countries and most sectors have shown a declining trend over the past 15 years, due to competition-friendly product market reforms. Further, we find that in each of the sectors analysed in this paper, mark-up reduction is driven by one particular sub-group of product market regulations: in the communication sector regulations related to a more competitive market structure show a significant effect; in the energy public ownership appears to matter most; professional services mark-ups are most affected by entry regulations and in the retail sector mark-ups are most affected by registration and licensing regulations. We also find that product market regulations do not fully explain the mark-ups but that there is a significant country-specific component that can potentially be explained by other factors such as competition or labour market policies. We discuss potential extensions of this paper in order to explore the role of these additional factors. The estimates from this paper are used in DG ECFIN's QUEST model to analyse the macro-economic effects of product market reforms.

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1. INTRODUCTION

Mark-ups, i.e. the difference between the cost and the selling price of a good or service, are an important determinant of the producer and consumer surplus. Lower mark-ups increase purchasing power for consumers and downstream users and are generally seen as welfare enhancing. Indeed, many countries actively promote competition-friendly policies in order to promote social welfare. In particular, changes in product market regulations and competition in EU Member States (EU MS) are likely to have changed mark-ups. This paper aims to estimate mark-ups in the service sector in EU MS and update these by using information from recent reform indicators. We extend Roeger's (1995) mark-up estimation methodology by allowing for the mark-ups to depend on sectoral product market regulations. Roeger's (1995) methodology was previously used by ECFIN to compute constant mark-ups. With mark-ups depending on product market regulations they become time-dependent (insofar as product market regulations change over time in light of structural reforms).

Mark-ups are important indicators for measuring real frictions in goods markets and in capturing product market competition (Griffith and Harrison 2004). According to Aghion (2002) mark-ups are a robust measure of competition and to be preferred to other indicators such as the Herfindahl index of market concentration (Griffith and Harrison 2004). Country- and sector-specific mark-up estimates therefore provide valuable quantitative information about competition and rigidities in goods markets and changes in these mark-ups may be associated with reform measures (see also Blanchard and Giavazzi 2001 and Melitz 2003).

Structural reforms, such as changes in product market regulation or competition policies, may have a positive effect on growth via a decrease in mark-ups. Indeed, by increasing competition, such reforms can lead to firms decreasing their prices by lowering their mark-ups. Using ECFIN's DSGE model QUEST, this has been shown to raise output and increase demand for all factors of production (Varga and in't Veld 2013). Mark-up reductions can also reduce export prices and improve the trade balance. In this QUEST exercise, in the short to medium term, the trade balance improves, largely due to a decline of private consumption in the short term due to a fall in economic rents. In turn, workers' consumption rises more gradually. With higher consumption, the trade balance returns to baseline values (ibid.). In addition, growth can also be enhanced because 'allocative efficiency' can be increased when product market reforms lead to a decrease in mark-ups: a reduction of rents will bring prices closer to the marginal cost of production and will make the allocation of resources more efficient by allocating them to the production of goods that are valued more by consumers (Griffith and Harrison 2004, Schiantarelli 2008). In fact, Schiantarelli (2008) argues that a reduction in mark-ups may lead to lower productivity firms exiting the market, and thereby lead to a reallocation of resources to more productive firms and to a further increase in growth. Causa et al. (2014) provide evidence for a further positive effect of product market reforms: they show that – in addition to enhancing employment - relaxing stringent product market regulations can have an equalising effect on the income distribution in particular at the low end. They argue that even if higher competition on product markets may lead to lower bargaining power of the workers, on the whole competition-enhancing product market reforms can lead to better social outcomes as the positive employment and income equality effects of increased competition can offset the negative effects resulting from reduced bargaining power on the side of the workers.

Previous findings show indeed that less restrictive product market regulations can lead to decreasing mark-ups. Griffith and Harrison (2004) examine the effect of product market regulations on mark-ups in the aggregate business enterprise sector (and in the electricity sector) in 12 EU countries in the period 1985-2000 using OECD STAN and Eurostat data and compute a time-varying measure that can be related to the measure of the mark-up as used below (ibid., Roeger 1995, Klette 1998, 1999). Griffith and Harrison (2004) disaggregate the effects of different product market regulation sub-indicators and find a large variation in effects across the different measures. In particular they study the ease of starting a new business, price controls, time spent with government bureaucracy, tariff rates, regulatory trade barriers, state aid and public procurement. The authors find in their setting that mark-ups are lower when entry is easier and average tariffs are lower. Regulatory trade barriers and time with government bureaucracy are only significant when controlling for time and country effects according to the author's findings. Perhaps counterintuitively, less stringent price controls and less involvement of the government via the public

enterprise sector appear to increase mark-ups. The authors also test and control for the effects of labour and credit market regulation and still find that looser regulation is associated with lower mark-ups.

Hoj et al. (2007) study the effect of product market regulation on mark-ups. Sectoral mark-ups were calculated based on the methodology by Roeger (1995) (see below), using the OECD STAN database for 17 countries over the 1972-2002 period. They find a significant and positive correlation between product market regulations that can be characterized as less conducive to competition, such as removing trade barriers, facilitating market access or easing residency and nationality requirements for professional services, and mark-ups. They find this correlation to be particularly strong in the non-manufacturing sector.

Schiantarelli (2008) provides a critical analysis of recent micro and macro empirical studies of the effect of product market regulation on growth. He begins with acknowledging the fact that the effects of product market regulation on macroeconomic performance had been under-researched. Schiantarelli (2008) shows that product market reforms should be divided into those with short-run and those with long-run effects and that particularly reforms affecting entry have long-run effects. Indeed, citing Griffith and Harrison (2004), he stresses the finding that product market regulations raising barriers to entry can lead to higher mark-ups and vice versa.

Several authors study the effect of structural reforms within European Single Market (such as liberalisation reforms, less involvement of the public sector and privatisation programmes) on mark-ups. Evidence seems mixed. Badinger (2007), who bases his methodology on Roeger (1995), finds that mark-ups have decreased as a result of pro-competitive reforms in the manufacturing industry, but increased in the service industry. Bottaso and Sembenelli (2001) find that the European Single Market Program contributed to lower mark-ups (and higher productivity) for Italian firms which were more likely to be affected by abolishing external barriers. Bassanetti et al. (2009) study the effect of product and labour market reforms in the context of the European Single Market in ten EU countries in the 1990s. They find that mark-ups had a tendency to increase in the 1990s when not controlling for rent sharing. Controlling for rent sharing results in more or less constant mark-ups (see section 4). Gagnepain and Marin (2003) and Goldberg and Verboven (2001) also study the effect of liberalization policies within the European Single Market on mark-ups and productivity in the EU – in particular in the aviation and the car market, respectively. Gagnepain and Marin (2003) find an effect of reforms in the aviation industry only after 1993. Konings and Vandenbussche (2005) find that antidumping protection increases the market power of import-competing domestic firms measured in terms of mark-ups (calculated based on the Roeger-methodology).

The remainder of the paper is organized as follows: Section 2 outlines our methodology used to estimate mark-ups as a function of product market indicators. Section 3 analyses our estimation results and section 4 describes future research avenues. Section 5 concludes.

2. METHODOLOGY

In this section we briefly describe the underlying theory, outline the datasets used and explain our estimation strategy.

A. THEORY

To estimate time-varying mark-ups based on structural reform indicators we use a method developed by Roeger (1995), which extends methodologies proposed by Hall (1988) and Shapiro (1987). A well-known measure of mark-ups is the Lerner index (P-MC)/P, which relates prices to marginal costs. The difficulty with this direct measure of mark-ups is that marginal costs (MC) are not directly observable. Therefore, Hall (1988) came up with an indirect measure based on short-run fluctuations of production inputs and output on the macro level (Hall 1988; Roeger 1995).

The idea underlying this indirect measure of mark-ups is the following: under perfect competition, production input shares equal output elasticity. Under imperfect competition, however, production input shares are smaller than output elasticity because the monopolist collects rents and factors are consequently remunerated below their productivity. As a consequence the Solow Residual underestimates factor input contribution to output growth and this measurement error can be used to estimate a measure of a mark-up.

The measurement error in the Solow residual is captured in the following regression model:

$$SR_{it} = \mathrm{B}(\Delta y_{it} - \Delta k_{it}) + (1 - \mathrm{B})\Delta tfp_{it} \quad (1)$$

Where SR_{it} denotes the Solow Residual, Δy, Δk and Δtfp denote the growth in output, capital and total factor productivity (TFP) respectively and B denotes the mark-up. All variables are indexed with country and time sub-indices i and t respectively. When B = 0 we assume perfect competition and the Solow Residual equals TFP growth as originally noted by Solow (1957). There is no measurement error and no bias. When B ≠ 0 we assume imperfect competition and the measurement error is captured by B. Indeed, the Solow Residual equals weighted average of TFP growth and capital productivity.

When estimating B on the basis of equation (1), there is an endogeneity problem arising from the fact that the term Δtfp is part of the error term of the regression model and also correlated with (Δy-Δk). Hall (1988) proposes using instruments that are correlated with output but uncorrelated with technological change. Such instruments are hard to find and Roeger (1995) proposes an approach that does not require instruments. Roeger (1995) proposes using both the production function (primal productivity measure) and the (dual) cost function approach for estimating the Solow Residual. Using this approach he can derive an expression independent of Δtfp, which allows estimating B.

In Roeger's (1995) approach, under perfect competition, constant returns to scale, no labour hoarding and no under-utilization of production factors, both measures (the primal and the dual approach) should be highly correlated . Under imperfect competition however, weighting factor inputs with their revenue shares (the primal approach) underestimates their contribution to total revenue, and therefore the difference between changes in revenue and revenue weighted changes in factor inputs is systematically related to changes in (nominal) output minus changes in nominal capital[2].

The following equation expresses the difference between the two Solow residuals as specified in Roeger (1995), where B denotes the mark-up and $\Delta y_{it} + \Delta p_{it} - (\Delta k_{it} + \Delta r_{it})$ denotes nominal capital productivity:

$$SR_{it} - SRP_{it} = B\big(\Delta y_{it} + \Delta p_{it} - (\Delta k_{it} + \Delta r_{it})\big) \quad (2)$$

$\Delta y_{it}, \Delta p_{it}, \Delta k_{it}, \Delta r_{it}$ are the log differences of output, price of output, capital and price of capital. B is interpreted as the mark-up since it measures how production in terms of quantity and prices reacts to a change in capital productivity. Further, B is related to the mark-up of prices over marginal costs via the relationship $\mu = \frac{1}{1-B}$. Equation (2) can be tested empirically by regressing $(SRQ_{it} - SRP_{it})$ on $(\Delta y_{it} + \Delta p_{it} - (\Delta k_{it} + \Delta r_{it}))$.

Roeger (1995) assumes constant mark-ups. In order to estimate mark-ups as a function of time-varying structural reform indicators we need to relax this assumption and assume:

$$B_{it} = B(PMR_{it}) = b_{0i} + b_1 PMR_{it} \quad (3)$$

where PMR_{it} refers to product market regulation indicators.

Applying this assumption to Roeger's (1995) derivation of the difference in Solow residuals yields the following non-zero difference between the primal and the dual Solow residual measures:

$$SR_{it} - SRP_{it} = B(PMR_{it})\big(\Delta y_{it} + \Delta p_{it} - (\Delta k_{it} + \Delta r_{it})\big) + b_1 \Delta PMR_{it} \quad (4)$$

The term $b_1 \Delta PMR_{it}$ – appearing additionally compared to equation (2) – stems from an initial step in Roeger's (1995) derivation: taking derivatives of the relation $MC_t = (1 - B(PMR_t)P_t)$ yields $\Delta MC_t = (1 - B(PMR_t))\Delta P_t - \frac{dB}{dPMR_t}\Delta PMR_t P_t$. b_1 is defined as $\frac{dB}{dPMR_t}$. The subsequent steps of Roeger's (1995) derivation remain the same as in the case of a constant mark-up. The derivation of equation (4) is provided in the Appendix.

[2] Nominal capital growth $(\Delta k_{it} + \Delta r_{it})$ appears on the RHS because in the calculation of the Solow residual the capital contribution is measured as one minus the wage share.

This methodology has several advantages over other methods used in this context. An advantage of this methodology over Hall (1988) is that we do not need to find instruments reflecting pure demand shocks (and not a consequence of technological shocks) (Roeger 1995). Griffith and Harrison (2004) argue that Roeger's measure can also be related to a simple measure defined as value added over production costs.[3] We argue that our measure is advantageous to this simple measure as measurement error on capital costs, in particular the risk premium, may be reduced. Risk premia are typically expressed as consisting of a constant and a stochastic term and measurement error can occur through both these terms. Roeger's (1995) measure is expressed in growth rates, and therefore does not depend on the constant term. Sources of measurement error are therefore reduced to the stochastic part of capital costs. The simple mark-up measure of value added over capital and labour costs is expressed in levels and is therefore subject to measurement error both in the constant and in the stochastic term of the risk premium.

B. DATA

Mark-up estimation results are based on sectoral data (at the 2 digit level) which are available for 1995-2007 from the EU-KLEMS/WIOD 2012 database and from the OECD product market regulation (PMR) database, which is available for the years 1998, 2003, 2008 and 2013. Based on data availability of sectoral PMR indicators we include the retail, energy, communication, transport and professional service sector in our analysis.

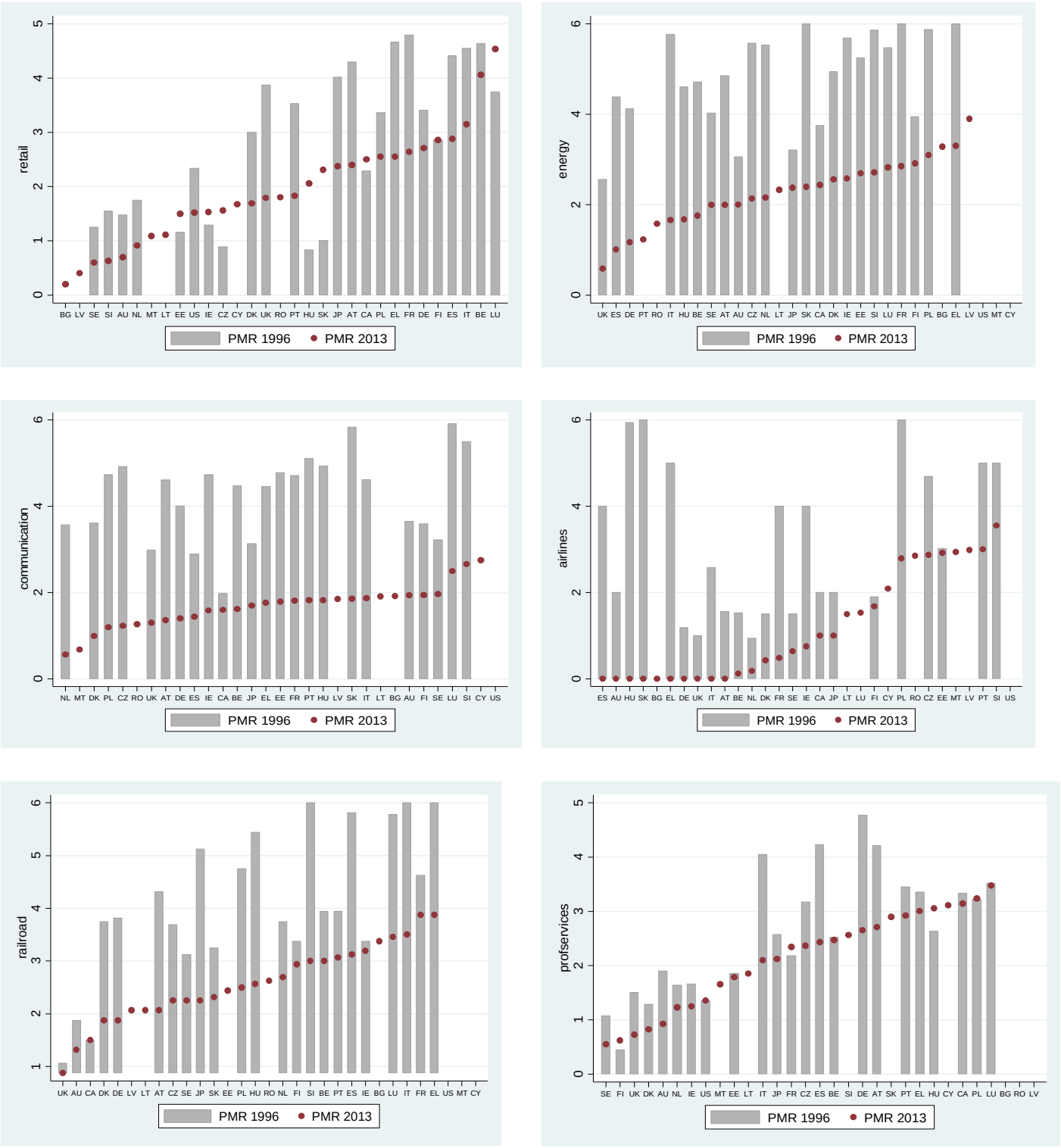
The EU-KLEMS/WIOD database includes measures of economic growth, productivity, employment creation, capital formation and technological change at the industry level for all European Union member states from 1970 onwards. For the method we use (Roeger 1995), we need only nominal series on gross output, wage costs, intermediate inputs and capital services. Capital services are however not directly observable, therefore capital costs have to be calculated using a standard capital cost formula.

To capture structural reforms we use the OECD product market regulation (PMR) database, which has recently been updated (OECD 2013). In this database the OECD developed a set of indicators over time (Nicoletti et al. 1999, Conway et al. 2005 and 2006, Woelfl et al. 2009) which is now widely used both by the academia and policy makers. It contains information on regulatory structures and policies, which has been collected via questionnaires of over 1100 questions that were distributed to national governments. There is a separate economy-wide and sectoral set for the retail, professional service, transport, energy and communication sectors. Each indicator is sub-divided into various sub-indicators. The economy-wide indicator is subdivided into indicators for state control, barriers to entrepreneurship and barriers to foreign trade and investment (and further breakdowns of these sub-indicators are also available). The professional service sector-specific indicator is subdivided into entry and conduct regulations. Energy, transport and communication (ETCR) sector indicators are subdivided into entry regulation, public ownership, vertical integration and market structure. The retail sector indicator is subdivided into registration and licensing, special regulation of large outlets, protection of existing firms, regulation of shop opening hours, price controls and promotions and discounts. The OECD PMR database is updated on a five yearly basis and currently covers the years 1998, 2003, 2008 and 2013. In order to obtain yearly data we linearly interpolate the available PMR values. We linearly extrapolate those PMR series, which do not include the latest available years. The indicators take values from 0 (least restrictive) to 6 (most restrictive).

Graph 1 shows histograms for each sector in our sample showing PMR indicator values across countries for the initial (1996) and for the final (2013) year in our sample. The graphs show that in most countries and all sectors product market regulations were generally less strict in 2013 than they were in 1996. Indeed, the maximum value across countries has decreased in all sectors when comparing the 1996 distribution with the 2013 distribution. Countries that are situated in the lower half of the distribution in several sectors are the Netherlands, the United Kingdom, Sweden, Australia and the United States. It is less clear cut to identify countries situated systematically in the upper half of the distribution. Slovenia scores highest or second-highest among the sampled countries in the airline and communication sectors. Luxembourg displays high PMR values in the retail, communication and airline sector. Greece shows highest or second-highest PMR values in the energy and rail and road sectors. In several sectors the variability across countries seems to have decreased and countries seem to converge to more similar levels of product market regulation. This is in particular the case in the energy sector, the communication sector and the rail and road sector.

[3] Indeed, the mark-up (also called Lerner-index or price cost margin) is often calculated as (p-c)/c, where p is the price and c is the marginal cost. Following e.g. Boone (2008) and Schiersch and Schmidt-Ehmcke (2010), we can then obtain an estimate of the mark-up at the firm- or sector-level by calculating (turnover-total variable cost)/turnover, and defining total variable cost as the sum of costs of intermediate inputs and personnel costs.

Graph 1: PMR indicators by country and sector in 1996 and 2013



Note: Values above 6 are due to either splicing the new 2008 PMR method and the 2013 PMR method done by the OECD (OECD 2013a) or to our linear extrapolation.

A challenge for our analysis was to match the sectors available in the OECD PMR sectoral database with those available in the EU-KLEMS/WIOD database. For some sectors it was straightforward as for the retail, communication and transport sectors. The professional service sector exists in both databases but it is differently defined across the two datasets. In the OECD PMR database the sector includes professions in accounting, legal services, engineering and architecture whereas EU-KLEMS/WIOD contains an aggregate including renting of machinery, computer activities, R&D as well as other business activities.

Our sample based on a combination of the two databases contains data from 1995 to 2007. PMR indicators are available until 2013 and are used for an out-of-sample prediction of the mark-ups according to equation (3). The number of countries in the overlapping sample varies between 23 and 25 depending on the sector. The sample includes 21 EU countries and Australia, Canada, Japan and the United States.

C. ESTIMATION

To estimate equation (4) we apply a linear multi-level mixed model methodology (for methodological accounts see Searle et al. 1992, McCulloch et al. 2008, Verbeke and Molenberghs 2000, Raudenbusch and Byrk 2002, Demidenko 2004) with White (1980) corrected errors for heteroscedasticity or autocorrelation. In order to estimate the above-mentioned model, including in particular country-specific random coefficients, this estimation strategy appears to be suitable. Linear multi-level mixed models are a flexible framework in particular for hierarchical or panel data, characterized by being clustered. These models can include both random (varying across units) and fixed effects (constant across units). They allow for random intercepts but also random slopes. The fixed effects are computed as in the traditional ordinary least squares framework. The random effects are not directly estimated but are computed based on their estimated variances and co-variances (for the exact formulas see Bates and Pinheiro 1998). Variance components are estimated together with the fixed parameters based on a maximum likelihood methodology[4]. Traditional panel models used in econometrics are nested models of this broader class of models.

The estimation model is derived as follows. Plugging equation (3) in (4), defining $Y_{it} = SR_{it} - SRP_{it}$ and $X_{it} = (\Delta y_{it} + \Delta p_{it} - (\Delta k_{it} + \Delta r_{it})$ and adding an error term provides equation (4), which we estimate by sector in order to retrieve sectoral estimates of the parameters β_{0i} and β_1:

$$Y_{it} = \beta_{0i} X_{it} + \beta_1 (PMR_{it} X_{it} + \Delta PMR_{it}) + \varepsilon_{it} \quad (4)$$

Note that a main difference with traditional panel methods is that the country-specific term β_{0i} is a slope parameter rather than an intercept. We therefore interpret β_{0i} as a country-specific random coefficient (varying across countries) rather than a country-specific fixed or random effect[5]. This interpretation of β_{0i} entails assuming that β_{0i} is a random variable and must be independent of X_{it} and ε_{it} for its estimation to be unbiased. We argue that since β_{0i} is a level term whereas X_{it} is a cyclical term, independence may be likely. The independence assumption could be relaxed if we would treat β_{0i} as a "fixed effect" by specifying it as a coefficient of an interaction term $D_i X_{it}$. However, the random coefficient estimation method is advantageous as it is more efficient because both the within-unit and the across-unit variation are taken into account. This method generally generates more narrow confidence intervals and therefore is more likely to provide statistically significant results. Indeed, we care about efficiency of our estimates since we have a relatively small sample. Furthermore, we avoid a loss of degrees of freedom, which would arise from estimating around 20 additional β_{0i} coefficients for each country. Within the context of a sensitivity analysis, below (see Table 3) we report a Hausman test for β_1 specified under a fixed and a random effects model specification respectively. We find that the random coefficient model is not rejected in three sectors. Therefore we decided to proceed with the random coefficient model.

Finally, we propose an extra step for the computation of the mark-ups. PMR indicators are not the only factor that explains mark-ups; indeed competition or labour market policies may play a considerable role (see also section 5). Furthermore, we believe that country-specific factors such as capital costs - and in particular transfer pricing - may bias the estimation results for the country-specific effects and cause measurement errors[6]. These two facts could explain why in some countries (in particular Italy in the retail sector) despite comparably strict product market regulations, the mark-up calculated from equation (3) is low compared to countries with lose product market restrictions such as the United Kingdom (see Tables A2b). We therefore calculate a GDP[7]-weighted average of country-specific effects:

$$B_{it} = \beta_{0ave} + \beta_1 PMR_{it} \quad (5)$$

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[4] In fact, first the likelihood function is optimized w.r.t. the fixed parameter and the error variance for given variance components of the random effects. The likelihood function obtained from this first step is then maximized w.r.t. the variance components of the random effects.

[5] Estimating β_{0i} as a random slope in a GLS framework (in STATA using the command xtreg specifying the maximum likelihood estimation method) yields the same result as estimating β_{0i} as a random slope in the current setting (in STATA using xtmixed).

[6] In particular in Ireland efforts to avoid national taxation may lead to profits being relocated to other countries.

[7] In purchasing power standard; retrieved from AMECO.

In equation (5) cross-country variation stems only from the PMR indicators and cross-country variation coming from capital productivity is averaged out. This is why a mark-up measure as stated in equation (5) puts more weight on the PMR indicator in determining the mark-ups than if β_0 were allowed to vary across countries.

We compare mark-up estimates based on (3) and (5) respectively and group countries into those for which (3) and (5) both yield low or high mark-ups and those for which (3) and (5) would yield contradictory results (see Graphs A1).

3. RESULTS

In this section we present our results. We start by showing our findings for the effects of PMR indicators on mark-ups and our estimated mark-ups, and our findings for the effects of disaggregated PMR indicators on mark-ups. Finally we show results from a sensitivity analysis.

A. THE EFFECT OF PRODUCT MARKET REFORMS ON MARK-UPS

Table 1 and Table A1 show our results for the effect of product market regulations on mark-ups by sector (β_1) and for the country-specific effects β_{0i}, respectively.

We add a variable controlling for the business cycle, the growth rate of gross output, in order to control for macroeconomic variation. Coefficients of the cyclical component point to either pro-cyclical or countercyclical developments of mark-ups (see Romer 2001 for evidence on counter-cyclicality of mark-ups and Nekarda and Ramey 2013 for evidence on pro-cyclicality of mark-ups and Rotemberg and Woodford 1991 for a discussion of the relation between mark-ups and the business cycle).

A positive effect of the PMR indicators on the mark-up indicates that an increase in tightness of product market regulations increases the mark-up and vice versa a loosening of product market regulations would reduce the mark-ups. Table 1 shows that all sectors display a positive effect, in line with our expectations. The effect is insignificant for the communication and the airlines sector.

Table 1: Baseline model, linear multi-level mixed (random coefficients) regression: PMR coefficients β_1[8]

VARIABLES	(1) retail	(2) communication	(3) energy	(4) profservices	(5) airlines	(6) rail&road
X*PMR	0.0461***	0.0116	0.0306***	0.0511***	0.0171	0.0134*
	(0.00500)	(0.00731)	(0.00702)	(0.00684)	(0.0139)	(0.00769)
X*output growth	0.155***	-0.0472	-0.0615	-0.145	-0.165***	0.135***
	(0.0477)	(0.0436)	(0.0390)	(0.100)	(0.0247)	(0.0206)
Observations	252	241	240	240	241	232
Number of groups	25	24	24	23	24	23

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

A reason we see for the insignificance of the results in the airlines and communication sector is that public ownership regulation and barriers to entry are probably not the indicators that play the most important role in these sectors. Further, given international competition in the airline sector, a country's performance regarding entry regulations may not be a relevant measure for competition. Table 2 shows that we find significant results for the communication sector when examining the role of PMR sub-indicators, for airlines this is not the case.

The table also shows that the coefficient for output growth shows a mixed picture in the sense that it is significantly positive for retail and rail and road, significantly negative for airlines, and insignificant for the

[8] In the professional services data is missing for Slovenia and Slovakia. In the rail and road sector data is missing for the United States and Estonia. In the energy, airline and communication sectors data is missing for the United States.

other sectors included in the analysis. This illustrates the different findings in the literature mentioned above.

B. ESTIMATING MARK-UPS DETERMINED BY PRODUCT MARKET REFORM INDICATORS

As mentioned above, we base our estimation of the size of mark-ups on sectoral PMR indicators as we are interested in sectoral mark-ups[9].

As shown in Section 1, our results can be compared to several previous estimates of mark-ups in the service sector. The main econometric difference between these estimates and ours is that we estimate country-specific slope parameters for the relation between capital productivity and the difference in the Solow residuals, whereas other papers include country-specific (or sector-specific) intercepts. Apart from further differences in samples and data sources, another source for differences in results is that our calculation of mark-ups from equation (3) is based on PMR indicators.

Molnar and Bottini (2010) also use Roeger (1995) to estimate mark-ups using the time period 1993-2006 based on the Amadeus (firm level) database and OLS fixed effects regressions per country including year and sector dummies. Christopoulou and Vermeulen (2008) use the 2007 EU-KLEMS data for the period 1981-2004 to estimate mark-ups based on Roeger (1995) and OLS regressions per country and per sector. Griffiths and Harrison (2004) use a simplified version of Roeger (1995) and base their analysis on OECD STAN data and OLS fixed effects regressions for the aggregate business sector including country and year dummies. Hoj et al. (2007) estimate mark-ups based on the OECD STAN database for 17 countries based on the 1972-2002 period based equally on Roeger (1995) and OLS regressions per country and per sector. Martins et al. (1996b) look at the period 1970 to 1992, and use sectoral OECD STAN data and OLS regressions per country and per sector.

Graphs 2 and Tables A2 show our results for the mark-ups (as specified by equation (3)). Graphs 2 show mark-ups in the initial available year (1996) compared to the most recent year (2013). Tables A2 exhibit the estimated mark-ups for the whole available time-span 1996-2013 and Graphs A2 display the developments of PMR indicators and estimated mark-ups over time. In the remainder of this section we compare mark-ups across sectors, countries and time.

Cross-sectoral comparison

Graphs 2 show that on average mark-ups seem to be comparably high in the energy, professional services and communication sectors; with the highest mark-ups in the energy sector. It is likely that mark-ups are high in the energy sector as it is a sector characterized by comparably high fixed costs (Hoj et al. 2007). Mark-ups in the retail and transport sectors are comparably low with the lowest mark-ups in the retail sector. Molnar and Bottini (2010) attribute this latter finding to the fact that the number of players is increasing in the retail sector and that at the same time the market is - despite the growing number of players - becoming more concentrated with retail chains (WTO 1998). These chains may fiercely compete for market share, driving down mark-ups in the retail industry.

These findings are partly in line with findings by the OECD in Molnar and Bottini (2010), Hoj et al. (2007), Christopoulou and Vermeulen (2008) and Martins et al. (1996). Molnar and Bottini (2010) find that mark-ups are higher for professional services and lower for retail. Hoj et al. (2007) confirm low mark-ups in the retail sector but also in the transport and – in contrast to Molnar and Bottini (2010) – in the professional service sector. Christopoulou and Vermeulen (2008) find high mark-ups in the transport sector. Hoj et al. (2007) also find high mark-ups in the energy and communication sector (see also Martins et al. 1996b and Christopoulou and Vermeulen 2008). The high mark-ups in these industries are attributed to monopolies or quasi-monopolies or network effects (Christopoulou and Vermeulen 2008). However, as Tables A2 show, deregulation effects in these industries are apparent by a decrease in mark-ups in those sectors over time.

In summary, it seems that the previous literature finds an agreement on low mark-ups in the retail sector and high mark-ups in the electricity sector. More ambiguous results are found for the transport and professional service sectors.

[9] Next to the sectoral PMR indicators, the OECD also provides economy-wide PMR indicators. It should be noted that countries may score quite differently on economy-wide versus sectoral PMR indicators.

Cross-country comparison

In terms of cross-country variability, we find in the retail sector that Luxemburg, Belgium and Italy display particularly high and increasing mark-ups, whereas Sweden, Slovenia and the Netherlands display comparably low mark-ups. In our model, increasing mark-ups stem from tightening of product market regulations such as the "Plaza Stop Act" that came into force in Hungary in 2010[10].

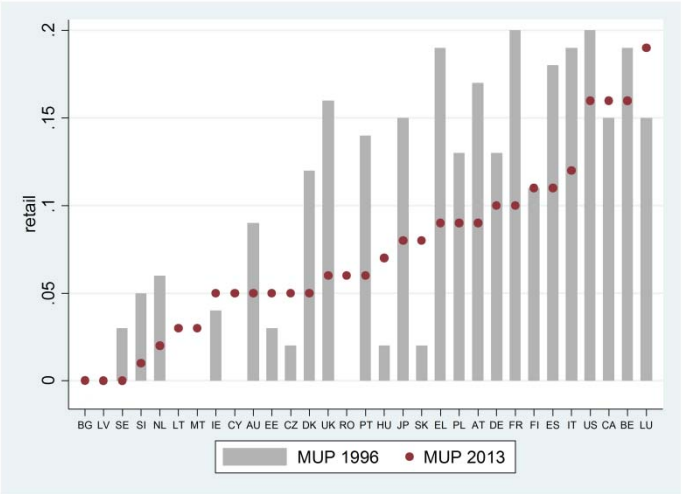
In the network industries Denmark, the Netherlands and the United Kingdom display comparably low mark-ups, which go hand in hand with PMR indicators in the lower half of the cross-country distribution. High mark-ups in the communication industries are found in Luxemburg and Slovenia. In the transport sectors we find high – but decreasing - mark-ups in Portugal and Luxembourg.

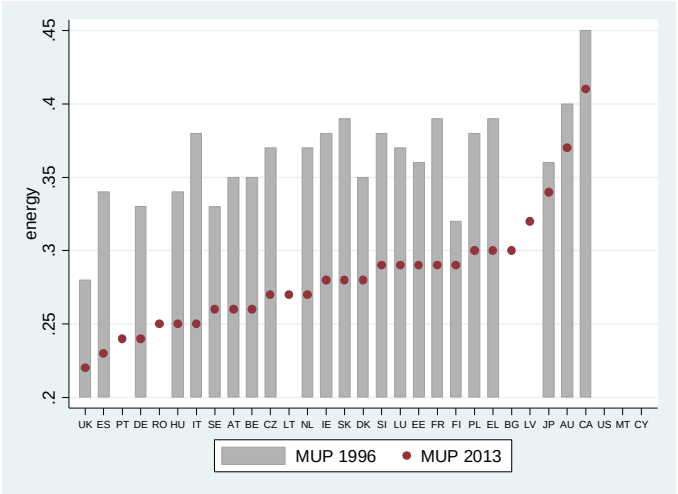
In the professional services sector, mark-ups are lowest in the Nordic countries and the United Kingdom. High mark-ups in the professional service sector are found in Hungary, Poland and Luxembourg.

Our cross-country findings confirm general findings of low mark-ups in the United Kingdom. Molnar and Bottini (2010) find that competitive pressures are generally lowest in Sweden and Central European countries and highest in the other Scandinavian countries and the United Kingdom. Hoj et al. (2007) confirm Molnar and Bottini's (2010) finding that among the sampled countries in the non-manufacturing sector the United Kingdom and the United States display the highest competitive pressures, but in contrast to Molnar and Bottini (2010), they also find low mark-ups in Sweden in the non-manufacturing sector. Potential reasons for these differences in results are outlined at the outset of this section. As mentioned there, we use a different sample as well as estimate the model with a country-specific slope rather than intercept.

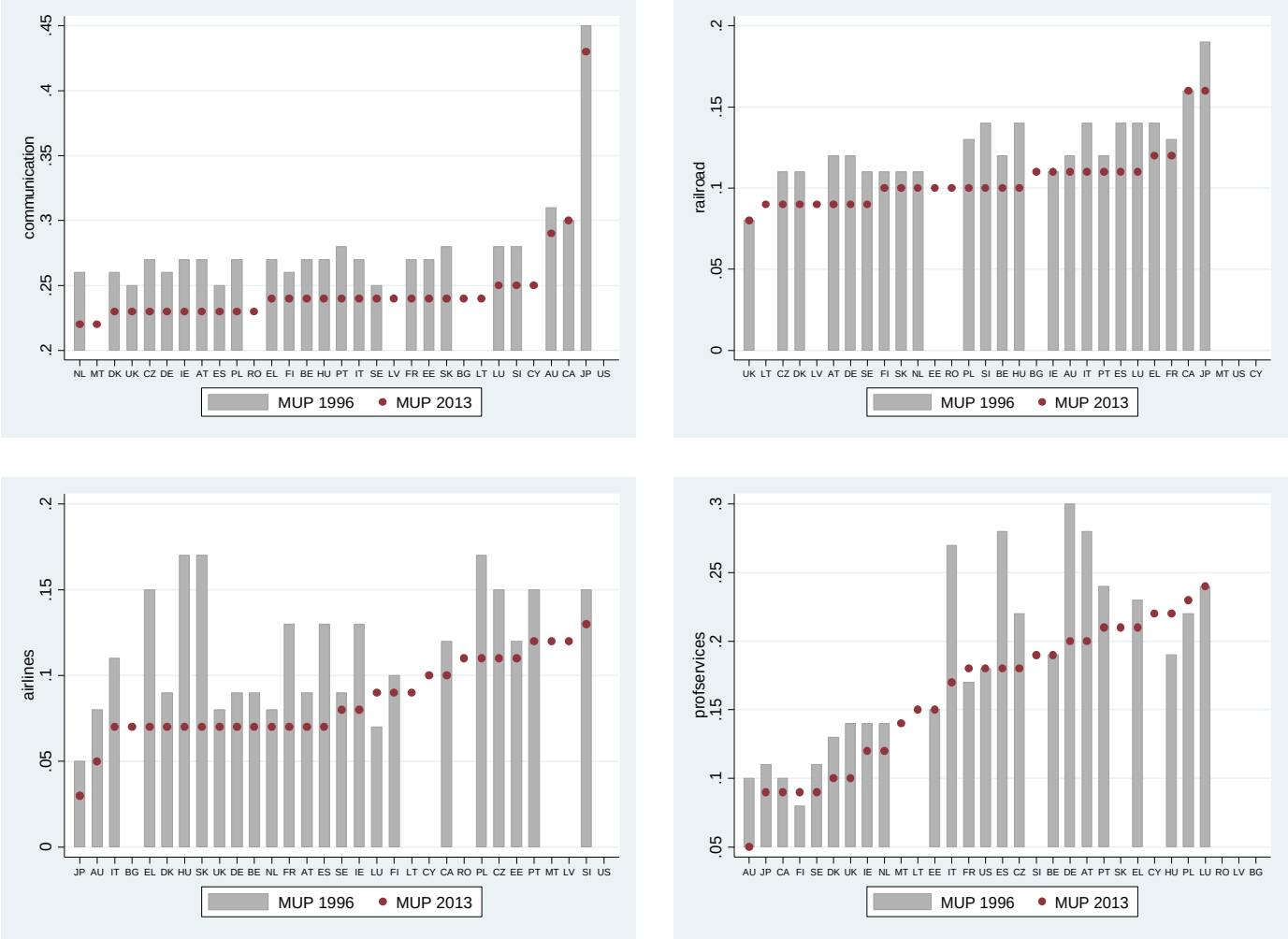
Varga et al. (2014a and b) report aggregate service sector mark-ups based on weighted averages of mark-ups obtained at a more disaggregated sectoral level. It should be noted that – depending on the weight of each respective subsector - countries may score quite differently on the aggregate service sector level versus the more disaggregated results presented in our paper.

Graphs 2: Mark-ups by country and sector in 1996 and 2013 – EU Countries (excluding airlines) $B_{it} = \beta_{0ave} + \beta_1 PMR_{it}$





[10] The "Plaza Stop Act" is a law that controls the construction of new retail outlets that are larger than 300 m^2.



Note: In the retail sector, PMRs are on average relatively low in particular for Bulgaria. Given that we impose the GDP-weighted average β_{0ave}, which is negative for the retail sector (see Table A1), the estimated mark-up for Bulgaria turns out to be slightly below zero in this sector. We normalize this value to zero. Note that negative β_{0i} indicates a negative relationship between capital productivity and the difference in the two Solow residuals given PMR indicators.

Comparison across time

Graphs A2 show the developments of the mark-ups and the PMR indicators over time. The graphs show clearly that both PMR and mark-ups have been generally declining with a few exceptions such as PMR and mark-ups in the retail sector in Canada, the Czech Republic, Estonia, Hungary, Ireland and Slovakia or in the professional services sector in Finland, Hungary and Poland.

C. MARK-UP ESTIMATES BASED ON COUNTRY-SPECIFIC EFFECTS

As mentioned in section 2, we compute mark-ups in two ways: first we estimate them based on equation (3) with conventional country-specific effects and then we estimate them based on an average country-specific effect as described in equation (5). We argued that for some countries, country-specific effects such as capital costs – in particular transfer pricing- may bias estimation results in particular in terms of the country-specific effects.

Graphs A1 compare mark-up estimates with country-specific effects by sector (vertical axis) with estimates with EU-average constant term for the year 2013. The red lines denote the mean values, so the plots are deviations from the mean values. In the north east and south west quadrant, we have countries for which the estimated mark-ups in the service sectors are both above respectively below the mean values. For example, both empirical estimates show relatively high mark-ups for the retail sector in Luxembourg, and relatively low mark-ups in Sweden and the Netherlands. In the North West and South East quadrant, we have countries for which the two methods yield different results. For example, in the professional services sector we found that the mark-up estimates with country-specific effects are relatively high in the UK and

IE, while the estimates with EU-average constant term yield relatively low mark-ups for UK and IE. Indeed, as shown in Graph 1, the UK and IE have relatively low values on the PMR indicator for professional services, corresponding with low intensity of regulation, which would be associated with stronger competition and lower mark-ups. Another example is the retail sector in Italy, with relatively low mark-up estimates based on country-specific effects but relatively high mark-ups when using the EU-average constant term. As Italy's retail sector is heavily regulated according to the PMR indicator, we would expect relatively high mark-ups in this sector. As discussed earlier, the country-specific term can be biased and this may create these counterintuitive results. When using the EU-average constant term the only source of variation in mark-ups across countries comes from differences in the PMR, and this method is in general yielding results more in line with intuition.

D. DISAGGREGATION OF PRODUCT MARKET REGULATION MEASURES

As mentioned in Section 2, the mark-up indicators are subdivided into different categories. In order to As mentioned in Section 2, the mark-up indicators are subdivided into different categories. In order to potentially obtain more targeted policy insights we examine the effect of the various sub-indicators. The trade-off we face is that when adding each indicator separately it can be argued that we are encountering an omitted variable bias due to not including the remaining indicators. However, when we have many sub-indicators we might encounter the problem of multi-collinearity and resulting insignificance of the parameters. When including all sub-indicators jointly, we did not find all sub-indicators to have an insignificant effect and therefore chose to include all indicators jointly.

We examine the sub-indicators entry regulation, conduct regulation, public ownership, market structure, vertical integration, and a range of indicators relevant for the retail sector. Entry regulations refer to the degree of regulation of a profession and exclusivity rights. The conduct regulations indicator is based on questions such as whether restrictions on cooperation are in place and which forms of businesses are allowed. Public ownership refers to the share of the industry owned by the government. The market structure indicator is based on questions on how many firms compete in the respective sector, how big the market share of the largest company is and how many operators work on a particular area. Vertical integration refers to integration of the network and the service provision in the network industries.

Table 2 shows our results for all sectors for which we have sector-specific PMR indicators.

Entry regulations seem to matter less in the communication, transport and energy sector but more so in the professional service sector, where an increase in tightness of entry regulations increases the mark-up. Public ownership appears to play a significant role in the energy sector but not so much in the communication and airline sectors. The market structure indicator appears to be an important indicator with significant effects in the communication sector. Vertical integration and conduct regulations do not seem to have a significant effect on mark-ups. In the retail sector, when controlling for all PMR sub-indicators, the strongest indicator seems to be regulations in registration and licensing. This indicator is based on questions whether licenses and registrations are needed for commercial activity and outlet siting. Tightening of regulation in this area corresponds with a significant increase in the mark-up in retail.

Graphs A3 shows on the vertical axis again the mark-up estimates with country-specific effects by sector and on the horizontal axis the mark-up estimates using PMR sub-indicators that appeared with significant regression coefficients in Table 2. We have decided to exclude the rail and road sector as there is only one common sub-indicator for the rail sector and the road sector in this case (i.e. entry regulation). The graphs show that the two estimates are highly correlated. An explanation for this is that there is in general a high correlation between the sectoral PMR indicator and the sub-indicators. This especially holds true for communication and professional services.

Table 2: Linear multi-level mixed (random coefficients) regression including PMR sub-indicators: PMR coefficients

	communication	airlines	rail&road	energy	prof services	retail
entry regulations	-0.00110	0.00627	0.00459	0.00589	0.0431***	
	(0.00635)	(0.00615)	(0.00493)	(0.00367)	(0.00714)	
public ownership	-0.00264	0.00986		0.0220***		
	(0.00640)	(0.00966)		(0.00806)		
market structure	0.0154***			0.00727		
	(0.00557)			(0.00620)		
vertical integration				-0.00980		
				(0.00612)		
conduct regulations					-0.00391	
					(0.0129)	
registration and licensing						0.0214***
						(0.00742)
special regulation large outlets						-0.00613
						(0.0105)
shop opening hours						-0.00385
						(0.00766)
protection of existing firms						0.00205
						(0.00616)
price controls						0.0178
						(0.0111)
promotions and discounts						0.0126
						(0.0110)
Observations	241	239	232	180	240	201
Number of countries	24	24	23	23	23	20

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4. SENSITIVITY ANALYSIS

As a first sensitivity test we estimate the model under a fixed effects model specification (specifically as a least squares dummy variable (LSDV) model). Based on the Hausman test we find that the random coefficient model is not rejected in three sectors (see Table 3).

Table 3: Fixed effects panel regression and linear multi-level mixed (random coefficients) regression: PMR coefficients β_1

Estimator of β_1	(1)	(2)	(3)	(4)	(5)	(6)
	retail	energy	communication	airlines	rail&road	professional services
LSDV	0.0352*	0.0271***	0.00331	0.0136	0.00834	0.00715
	(0.0182)	(0.00964)	(0.00662)	(0.0163)	(0.00613)	(0.0206)
Random coefficient	0.0461***	0.0306***	0.0116	0.0171	0.0134*	0.0511***
	(0.00500)	(0.00702)	(0.00731)	(0.0139)	(0.00769)	(0.00684)
P-value Hausman all covariates	0.000	-	-	0.7685[a]	0.2992[a]	0.3746[a]
Null Hypothesis of no systematic difference	rejected			accepted	accepted	accepted
Observations	252	240	241	241	232	240

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: The LSDV estimator is in theory unbiased but less efficient than the random coefficient estimator. The Hausman test is rejected if p<0.05. Hausman p-values are not reported for the energy and communication sector because the estimated variance-covariance matrix does not satisfy the asymptotic assumptions of the test. The test statistic is negative. This often occurs with relatively small samples. [a] The variance-covariance matrix is not positive definite, which can also occur in small samples.

Secondly, following Christopoulou and Vermeulen (2008), we add a constant, traditional country-specific effects (not only indirect effects through X_{it}) and time dummies to the regression model. Table 4 shows the results of these additional sensitivity analyses for the retail sector. The estimates in the alternative specifications are very similar to the one found for the baseline model. The same conclusion is drawn for the other sectors (results are not reported)[11].

Table 4: Linear multi-level mixed (random coefficients) regression – various specifications: PMR coefficients β_1

Retail sector	(1) baseline	(2) with constant	(3) with country effects	(4) with constant and country effects	(5) with time dummies
X*PMR	0.0461***	0.0461***	0.0461***	0.0461***	0.0466***
	(0.00500)	(0.00494)	(0.00500)	(0.00494)	(0.00512)
Observations	252	252	252	252	252
Number of groups	25	25	25	25	25

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

We exclude data for which we had less than three data points. This concerns the sectors retail and professional services. Table 5 shows that the coefficients do not change strongly.

Table 5: Linear multi-level mixed (random coefficients) regression – excluding countries with low data availability: PMR coefficients β_1

	(1) retail	(2) prof services
X*PMR	0.0436***	0.0486***
	(0.00457)	(0.00729)
Observations	227	209
Number of groups	22	20

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: In the retail sector we dropped Estonia, Slovenia and the United States; in the professional services sector we dropped Estonia, Portugal and the United States.

We also test for sensitivity towards not including the extrapolated years 1996 and 1997 in the sample. Results in Table 6 show that the estimated coefficients are similar to the ones reported in Table 1. Notice that in Table 6 we now also find a positive and statistically significant coefficient in case of the communication sector.

Table 6: Linear multi-level mixed (random coefficients) regression – excluding years 1996 and 1997: PMR coefficients β_1

	(1) retail	(2) energy	(3) communication	(4) airlines	(5) Rail and road	(6) prof services
X*PMR	0.0479***	0.0309***	0.0125*	0.0201	0.0138*	0.0507***
	(0.0057)	(0.0069)	(0.0069)	(0.015)	(0.0079)	(0.0072)
Observations	233	223	223	223	214	221
Number of groups	25	24	24	24	23	23

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

[11] The biggest difference can be observed in the communication sector: when adding a constant, the coefficient size decreases by about ½ to 0.005.

Finally we also test for sensitivity towards interpolation. To this end we pool sectors, countries and years. Results are shown in Table 7. In the "no interpolation" model we also find a positive and statistically significant coefficient, which is even somewhat larger in magnitude.

Table 7: Linear multi-level mixed (random coefficients) regression – with and without interpolation: PMR coefficients β_1

	(2) interpolation	(1) no interpolation
X*PMR	0.0348***	0.0470***
	(0.00573)	(0.0101)
Observations	732	128
Number of groups	72	72

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

5. FURTHER RESEARCH AGENDA

A. MICRO-DATA ANALYSIS: USING THE ORBIS DATA BASE

Using the 2012 release of the EU-KLEMS/WIOD data base bears the restriction of data availability only until 2007. Further releases through EUKLEMS' follow-up project WIOD may provide all necessary data (including capital data) until 2009. However, in order to include the most recent developments and also in order to conduct a more disaggregate analysis, it can be considered to redo our analysis using the Amadeus or Orbis[12] database (containing around 70 million firms in Europe). The advantage of the Orbis over the Amadeus database is that it does not suffer from the large-firm bias. In addition to the data availability, there would be several advantages of investigating at a micro-level analysis: we would be able to further disaggregate sectors and we would be able to analyse market structure and credit relation variables. Disadvantages of using the Orbis database as opposed to EUKLEMS or WIOD data would be coverage and representativeness issues. The Orbis database covers about 80 million firms. All OECD countries are covered and a large variety of non-OECD countries, including Slovenia, Estonia and the rest of Eastern Europe. Coverage rates across countries vary (see Ribeiro et al. 2010, Table 2).

B. FURTHER INDICATORS OF INTEREST

We propose to explore the role that additional **competition policy indicators** play in decreasing mark-ups. Buccirossi et al. (2013) assess the effects of competition policies on productivity growth, in particular institutional and enforcement features of the competition policy regime, antitrust measures and merger rules. They find that competition policy is positively correlated with total factor productivity growth in 22 industries in 12 OECD countries based on their own implemented questionnaire sent directly to competition authorities. Konings et al. (1999) study the link between the new 1993 competition policy and mark-ups in Belgium and the Netherlands but do not find a significant correlation with this particular policy change. Hoj et al. (2007) review the correlation between competition policy and competitive pressures using the OECD's Competition Law and Policy (CLP) indicators, which are available for 2003 and for 2013 (Alemani et al. 2013). Hoj et al. (2007) find that the deterrence of cartels appears to be the element of competition law and enforcement that increases competition pressure most in OECD countries. Improvement of merger control regimes, easing the possibility to sue for smaller firms and improving the coherence of competition policy were found to be other issues to be targeted when the aim is to increase competition pressures.

Another indicator of interest would be the **share of foreign companies and foreign direct investment** (see for instance Hoekman et al. 2001). The share of foreign companies and foreign direct investment is likely to be related with one of the economy-wide PMR indicators, which measures barriers to trade and investment. Openness to trade is an important determinant of competitive pressure on the domestic market.

[12] http://www.bvdinfo.com/en-gb/our-products/company-information/international/orbis-%281%29

Hoj et al. (2007) report, that openness to trade has increased and barriers to trade have been reduced. Implicit barriers, such as administrative burdens, have increased however according to the authors. Hoj et al. (2007) mention in particular the energy sector (in Italy, Sweden and the US), the telecom sector (in Denmark) and the retail sector (in France, Finland, Japan and Norway) as examples of recent changes in regulations that reflect increased openness to trade. Another measure potentially capturing the share of foreign activity in the service sector could be an indicator for the EU internal market for services (see for instance Pelkmans et al. 2014 for an overview of Single Market indicators). In this context **export shares per industry** could potentially be an interesting indicator. Martin and Rodriguez (2010) show on a micro level that non-exporting firms generally have lower margins.

In addition we would be interested in the effect of **market structure indices** such as average firm size, firm birth rates and firm death rates per sector. Martins and Scarpetta (1999) show, that these indicators have a significant effect on mark-ups. These measures would characterize the sectoral market and could be an indicator of the type of competition prevailing. In this context, the Herfindahl index of market concentration could also control for the type of competition in the respective sector. These indicators are already reflected to some degree in the PMR sub-indicator "market structure" (see Table 4). More detailed indicators could be built in an analysis based on firm-level data such as the Amadeus or the Orbis database (see below). In this exercise a two-step approach can be envisaged, where in the first step the impact of product market regulation on market structure (captured by for example the abovementioned indicators for business demography) is studied, and in the second step the impact of market structure on mark-ups is analysed.

A further additional control variable of interest would be **labour market regulations and reforms** (see Blanchard and Giavazzi 2001, Boulhol 2005, Bassanetti et al. 2009). Boulhol (2005), building on work by Blanchard and Giavazzi (2001), studies the link between pro-competitive policies, workers' bargaining power, capital market integration and price mark-ups in the manufacturing sector. He finds both an increase and a convergence of mark-ups both across countries and sectors. Increasing price-cost margins are counter-intuitive to an increase in competition. Boulhol (2005) attributes the increase in mark-ups despite an increase in competition to a deterioration of workers' bargaining power. According to the author this implies the importance of considering developments on the labour market such as rent sharing when assessing mark-ups and the impact of competition. Bassanetti et al. (2009) study the effects of simultaneous moves in mark-ups and rent sharing between capital and labour as a result of structural reforms in the context of the European Single Market. They find that mark-ups did not rise in the 1990s if one controls for efficient bargaining and that at the same time the workers' share of rents declined. Similarly to Boulhol (2005), they argue that mark-ups have not increased because of higher market power but rather because rent has been reallocated. Sectors with institutional changes and privatisation programmes were most affected. In particular the authors note that labour market reforms in Europe since the 1990s – notwithstanding their positive effect on job creation - affected wage setting mechanisms and types of jobs leading to higher shares of temporary jobs and nominal wage moderation. This in turn led to a reduced labour share and reduced bargaining power. In particular the network sector was affected by privatisation and resulting reductions in wage bargaining power according to the authors. Griffith and Harrison (2004) share the view that it would not capture the whole picture to exclusively study reforms in the goods market and that rent sharing is a crucial determinant of mark-ups, as they add labour market regulation measures to their mark-up regression.

A wage bargaining indicator and an indicator for labour market policies (such as union density) may be incorporated in equation (4) in the following way:

$$Y_{it} = \beta_{0i}X_{it} + \beta_{1i}BARG_{it} + \beta_2(PMR_{it}X_{it} + \Delta PMR_{it}) + \beta_3(LMR_{it}BARG_{it} + \Delta LMR_{it}) + \varepsilon_{it} \qquad (7)$$

As Bassanetti et al. (2009) note, papers studying simultaneous imperfections on the goods and on the labour market often combine the mark-up calculation by Hall (1988) with an efficient bargaining model. Bassanetti et al. (2009) follow the same approach but use the methodology put forward by Roeger (1995) rather than Hall (1988). They base their analysis on the EU-KLEMS 2008 database. Their calculations lead to an equation similar to Equation (4) but instead of including the PMR term they include a term measuring the change in labour to capital ratio, of which the coefficient can yield a measure of bargaining power[13]. In order to account for structural breaks resulting from the European Single Market in both the product and the labour market, the authors add interaction terms with dummy variables for the years 1993 or 1994.

[13] Another difference to our approach is that the coefficient on capital productivity does not vary across countries and is therefore not a random coefficient.

Including a control for an imperfect labour market (wage bargaining) raises the mark-up: mark-ups are higher before a share of them is deducted to the workers. The key result of Bassanetti et al.'s (2009) paper is that mark-ups have risen after 1993 or 1994 but when controlling for labour market imperfections the rise becomes insignificant. Moreover, rents for workers decrease significantly as a result of the structural reforms in 1993 and 1994. They interpret this finding as evidence for the fact that mark-ups increase as a result of the reforms, but rather due to a gain in profit due to rent allocation than due to a gain in market power. To incorporate the effects of labour market relations we would propose to add a control for bargaining power in equation (4). Alternatively we could include a measure for labour regulation (such as an index including measures of minimum wage legislation, hiring and firing, collective bargaining and unemployment insurance) as proposed by Griffith and Harrison (2004). Several authors argue that employment protection legislation and other labour market policies and product market regulation are highly correlated in OECD countries (see for instance Koeninger and Vindigni 2003).

Further interesting variables of interest – in the macroeconomic setting for estimating mark-ups - could include **credit market regulation**. Griffith and Harrison (2004) propose a measure including bank ownership, competition from foreign banks, credit given to the private sector and interest rate controls. Bottaso et al. (1997) argue that liquidity constrained firms are more likely to not cut prices in order to generate cash to pay a rising debt. This literature relates to papers explain countercyclical mark-ups through credit market imperfections and the business cycle (Chevalier and Scharfstein 1995)). More detailed indicators could be built in an analysis based on firm-level data such as the Amadeus or the Orbis database (see below). In particular, credit relations could be tested and it could be explored whether crisis-stricken countries were more strongly affected and whether the credit crunch has a significant effect on mark-ups. Further indicators could be **income taxation** (Wu and Zhang (1999) demonstrate in a theoretical model that income taxation decreases the number of firms, thereby decreases competition and increases mark-ups), **inflationary uncertainty** (Benabou and Gertner 1993), **government spending** (see for instance Monacelli and Perrotti 2008; Ravn et al. 2012) or **public procurement** (Griffiths and Harrison 2004).

C. COMPUTING COUNTRY-SPECIFIC EFFECTS: A NEW MEASURE OF CAPITAL COST

When computing mark-ups with country-specific effects as shown in tables A2b we find examples of country-sector combinations displaying both a high PMR indicator and a low mark-up, e.g. in Italy's retail sector. This is somewhat surprising as competitive pressures are typically considered to be low in Italy (Molnar and Bottini 2010, Christopoulou and Vermeulen 2010). Indeed, the OECD (2003) finds that mark-ups in Italy are highest among the OECD countries. Molnar and Bottini (2010), using the Roeger (1995) methodology, find however that Italy's mark-up lies in the middle of a distribution of 12 OECD countries with the UK, Austria, Sweden and Central European countries displaying higher mark-ups. One reason for the discrepancies could be that, as OECD (2003) notes, Italy's retail distribution sector is characterised by a high percentage of small firms and by low concentration. Some databases such as the Amadeus data do not include small firms and could therefore yield biased results. EU-KLEMS, the data used in this note, should not be characterized by such a bias as it is based on national accounts data. Another reason for the discrepancy could be the measure used for capital costs. In order to test this hypothesis we could re-estimate the model with a new indicator of capital cost based on the IMF's Composite Financing Cost Indicators (CFCI).

6. CONCLUSION

This paper presented new estimates for service sector mark-ups in the EU, investigating in particular the role of product market regulation. We have extended the methodology developed in Roeger (1995), allowing the mark-up to depend on OECD's Product Market Regulation indicator. Results are presented based on regressions with country-specific coefficients by sector and with GDP-weighted average country-specific coefficients by sector, with the latter approach producing the most intuitive results. Empirical results were presented for mark-up developments over time, across countries, and across sectors.

With some exceptions we found declining mark-ups over time, related with reduced strictness of product market regulations. For example, in the Austrian retail sector estimated mark-ups decreased from 17% in 1996 to 9% in 2013 (using GDP-weighted average country-specific coefficients). In the Spanish professional services sector, the mark-up declined from 28% in 1996 to 18% in 2013. Exceptions to this

general pattern include for example the Hungarian retail sector (increase in mark-up from 2% in 1996 to 7% in 2013). Secondly, with regard to the comparison across sectors, we have found comparably high mark-ups in energy, communication and professional services. This may to some extent be explained by sector-specific technological characteristics (such as high fixed costs in network sectors), but can also point at above-normal rents associated with sheltered competition and restrictive product market regulation. Relatively low mark-ups were found for the retail and transport sectors. In the cross-country comparison our estimations point at generally low to medium mark-up levels in UK, the Netherlands, and Denmark, and medium to high mark-ups for some sectors in Greece, Spain and France. We further found that in each of the sectors analysed in this paper, mark-up reduction is driven by one particular sub-group of product market regulations: in the communication sector regulations related to a more competitive market structure show a significant effect; in the energy public ownership appears to matter most; professional services mark-ups are most affected by entry regulations and in the retail sector mark-ups are most affected by registration and licensing regulations. Finally, we found that product market regulations do not fully explain the mark-ups but that there is a significant country-specific component that can potentially be explained by other factors such as competition or labour market policies.

These mark-up estimates have been introduced in DG ECFIN's QUEST model, and would allow for richer analysis on the impact of product market reforms in this DSGE model. Finally, various possible extensions have been discussed, including the analysis of firm-level data such as ORBIS to include firm-specific characteristics, and a variety of other potentially relevant determinants of mark-ups.

APPENDIX

A.1. DERIVATION OF EQUATION (1) [14]

In order to derive an expression for the measurement error in the Solow residual arising from the fact that output elasticities of the input factors are not equal to factor shares under perfect competition, we start from the definition of the Solow residual:

$$SR_t = \Delta y_t - \frac{F_L L_t}{Y_t}\Delta l_t - \left(1 - \frac{F_L L_t}{Y_t}\right)\Delta k_t \qquad \text{(A1)}$$

Note that (A1) is derived from the Taylor expansion of the production function $Y_t = F(K_t, L_t)TFP_t$.

First order conditions of (A1) under monopolistic competition yield:

$$(1-B)F_L = \frac{W_t}{P_t} \leftrightarrow (1-B)\frac{F_L L_t}{Y_t} = \frac{W_t L_t}{pY_t} \leftrightarrow \frac{F_L L_t}{Y_t} = \frac{W_t L_t}{P_t Y_t}\frac{1}{1-B} \qquad \text{(A2)}$$

Replacing $\frac{F_L L_t}{Y_t}$ in (A1) by (A2) and denoting $ws_t = \frac{W_t L_t}{P_t Y_t}$ yields:

$$\Delta y_t = \frac{ws_t}{1-B}\Delta l_t + \left(1 - \frac{ws_t}{1-B}\right)\Delta k_t + \Delta tfp_t$$

Multiplying by $(1-B)$ yields:

$$(1-B)\Delta y_t = ws_t \Delta l_t + (1 - B - ws_t)\Delta k_t + (1-B)\Delta tfp_t$$

From this it follows that

$$SR_t = B(\Delta y_t - \Delta k_t) + (1-B)\Delta tfp_t$$

SR_t is an exact measure of TFP growth only under perfect competition ($B = 0$). In general it measures both the contribution of TFP growth and market imperfection (measured by $B(\Delta y_t - \Delta k_t)$).

A.2. DERIVATION OF EQUATION (4)

In order to derive an expression for the difference between the Solow residuals based on the primal (production function) and the dual (cost function) approach respectively, we start from the relation between prices P_t and marginal costs MC_t:

$$(1-B)P_t = MC_t$$

Where B depends on product market reform indicators PMR_t as defined as in (3):

$$\big(1 - B(PMR_t)\big)P_t = MC_t \qquad \text{(A3)}$$

Taking derivatives yields:

$$\big(1 - B(Z_t)\big)\Delta P_t - \frac{dB}{dZ_t}\Delta Z_t P_t = \big(1 - B(Z_t)\big)\Delta P_t - b_1 \Delta Z_t P_t = \Delta MC_t$$

Dividing by (A3) yields:

$$\frac{\Delta P_t}{P_t} - \frac{b_1 \Delta Z_t}{\big(1 - B(PMR_t)\big)} = \frac{\Delta MC_t}{MC_t} \qquad \text{(A4)}$$

The difference in log marginal costs - Δmc_t - can be expressed as (see Roeger 1995:320)

[14] For simplicity we drop the country subindex i in section A.1. and A.2. We adopt the following convention: Δx_t denotes the log difference of the variable X_t.

$$\Delta mc_t = \left[\frac{W_t N_t}{C(.)}\right]\Delta w_t + \left[1 - \frac{W_t N_t}{C(.)}\right]\Delta r_t + \Delta e_t \quad \text{(A5)}$$

Where $C(.)$ designates a cost function:

$$C(.) = C(W_t, R_t Y_t) = \frac{\partial C_t}{\partial Y_t} Y_t = MC_t Y_t = \big(1 - B(PMR_t)\big) P_t Y_t \quad \text{(A6)}$$

Combining equations (A4), (A5) and (A6) yields:

$$\frac{\Delta P_t}{P_t} - \frac{b_1 \Delta Z_t}{\big(1 - B(PMR_t)\big)} = \left[\frac{W_t N_t}{\big(1 - B(PMR_t)\big) P_t Y_t}\right]\frac{\Delta w_t}{w_t} + \left[1 - \frac{W_t N_t}{\big(1 - B(PMR_t)\big) P_t Y_t}\right]\frac{\Delta r_t}{r_t} + \frac{\Delta e_t}{e_t}$$

Multiplying with $\big(1 - B(PMR_t)\big)$ and writing $\frac{\Delta X_t}{X_t} = \Delta x_t$ yields:

$$\big(1 - B(PMR_t)\big)\Delta p_t - b_1 \Delta PMR_t = \frac{W_t N_t}{P_t Y_t}\Delta w_t + \left[\big(1 - B(PMR_t)\big) - \frac{W_t N_t}{P_t Y_t}\right]\Delta r_t + \big(1 - B(PMR_t)\big)\Delta e_t \quad \text{(A7)}$$

Define

$$SRP_t = \frac{W_t N_t}{P_t Y_t}\Delta w_t + \left[1 - \frac{W_t N_t}{P_t Y_t}\right]\Delta r_t + \Delta p_t \quad \text{(A8)}$$

SRP_t can be interpreted as the price-cost - or dual approach - Solow residual.

Using (A8) to rewrite (A7) yields:

$$SRP_t = -B(PMR_t)(\Delta p_t - \Delta r_t) + b_1 \Delta PMR_t + \big(1 - B(PMR_t)\big)\Delta e_t \quad \text{(A9)}$$

Subtracting equation (A9) from equation (1) yields:

$$SR_t - SRP_t = -B(PMR_t)\big(\Delta y_t + \Delta p_t - (\Delta k_t + \Delta r_t)\big) + b_1 \Delta PMR_t$$

A.3. TABLES AND FIGURES

Table A1: Country-specific coefficients (β_{0i}) by sector and EU GDP-weighted average country-specific coefficients (β_{0ave})

	Retail		Energy		Communication		Airlines		Rail and Road		Professional Services		GDP in PPS
	RC	**FE**	**RC**	**FE**	**RC**	**FE**	**RC**	**FE**	**RC**	**FE**	**RC**	**FE**	207.08
AT	-0.02	0.00693	0.05	0.0673	-0.06	-0.0555	0.15	0.159***	0.10	0.121***	-0.01	0.116*	-
AU	0.02	0.0455	0.30	0.322***	0.27	0.292***	0.05	0.129***	0.10	0.109***	0.00	0.0455	251.88
BE	-0.04	-0.0168	0.25	0.275***	0.16	0.185***	-0.02	-0.0210	0.06	0.0771***	0.01	0.129*	50.76
BG													-
CA	0.05	0.0761*	0.33	0.415***	0.28	0.298***	0.08	0.0943***	0.14	0.148***	-0.07	0.0749	12.73
CY													155.90
CZ	0.06	0.0792***	0.11	0.118***	0.36	0.375***	0.10	0.117**	0.17	0.181***	0.00	0.121*	1929.81
DE	-0.09	-0.0869	0.32	0.360***	0.26	0.278***	0.11	0.115***	0.02	0.0374*	0.09	0.255***	136.20
DK	-0.05	-0.0236	0.32	0.328***	0.17	0.185***	0.00	0.00483	0.08	0.0909***	-0.04	-0.0153	14.29
EE	0.13	0.161***	0.21	0.222***	0.21	0.237**	0.07	0.140**			0.07	0.154***	191.88
EL	0.04	0.122	0.26	0.281***	0.41	0.437***	-0.07	-0.0626	-0.55	-0.518***	-0.04	0.0871	826.92
ES	0.04	0.101	0.26	0.269***	0.29	0.313***	0.02	0.0335	0.07	0.0973***	0.00	0.130*	118.30
FI	0.01	0.0389	0.25	0.260***	0.18	0.194***	0.20	0.225***	0.14	0.155***	0.04	0.0688***	1377.44
FR	0.00	0.0445	0.10	0.122***	0.13	0.159***	0.12	0.130***	0.08	0.105***	0.01	0.125**	47.71
HR													118.69
HU	0.11	0.126***	-0.01	0.00458	0.26	0.317***	-0.12	-0.109*	0.03	0.0419**	0.07	0.198***	106.72
IE	0.02	0.0482	0.05	0.0619	0.11	0.125***	0.05	0.0729	0.08	0.0954***	0.30	0.396***	1290.59
IT	-0.11	-0.106	0.09	0.104	0.26	0.306***	0.01	0.0169	0.09	0.123***	-0.05	0.0975	-
JP	-0.03	-0.0583	0.27	0.296***	0.41	0.433***	0.01	0.253***	0.13	0.183***	-0.02	0.0824	32.15
LT													21.91
LU	0.04	0.0970	0.15	0.163***	0.56	0.615***	0.09	0.138***	0.12	0.139***	-0.08	0.0644	19.80
LV													6.42
MT													417.56
NL	0.02	0.0439	0.15	0.158***	0.30	0.310***	0.01	0.00675	0.12	0.135***	0.03	0.0931**	375.63
PL	0.07	0.153**	0.17	0.216***	0.37	0.410***	-0.06	-0.108	0.13	0.155***	0.12	0.322***	163.51
PT	-0.05	-0.0100	0.18	0.194***	0.33	0.351***	-0.05	-0.0359	-0.03	-0.0100	-0.02	0.121*	140.14
RO													221.21
SE	0.03	0.0543*	0.42	0.444***	0.15	0.170***	0.06	0.0669***	0.13	0.154***	0.07	0.136***	33.02
SI	0.09	0.101***	0.16	0.179***	0.27	0.296***	0.04	0.0544	-0.01	0.0183			60.09
SK	0.13	0.332*	0.16	0.195*	0.34	0.442**	0.34	0.341***	0.24	0.306***			1431.74
UK	0.01	0.0444	0.24	0.246***	0.10	0.121***	0.10	0.127***	0.09	0.103***	0.24	0.333***	-
US	0.09	0.189***									0.11	0.278***	
Weighted average	-0.02		0.20		0.22		0.07		0.06		0.06		
LM test*	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	0.00	-	

Notes: * H0 rejected indicates that the model with random slopes is preferred to the linear model. Note that this test needs to be run on non-robust estimations. (1) Random coefficient (RC) estimates are estimates of the country-specific effect β_{0i} using the mixed model estimator. (2) Fixed effect estimates are estimates of the country-specific effect β_{0i} using a least-squares dummy variable procedure. (3) The EU weighted average effect is computed as the GDP-weighted average of the country-specific effects β_{0ave}. GDP is measured in PPS and is retrieved from AMECO database.

Tables A2a: Constant mark-ups by sector – EU countries

	Retail Trade	Inland Transport	Air Transport	Post and Communication	Electricity, Gas and Water Supply
AT	0.13	0.15	0.15	-0.03	0.18
BE	0.13	0.11	-0.03	0.2	0.36
BG	0.16	0.22	0.22	0.24	0.18
CY	0.18	-0.23	0.22	0.29	0.41
CZ	0.13	0.21	0.17	0.38	0.21
DE	0.03	0.06	0.1	0.32	0.4
DK	0.08	0.11	0.02	0.18	0.41
EE	0.22	0.17	-0.06	0.21	0.32
EL	0.44	-0.47	0.04	0.44	0.42
ES	0.24	0.13	0.07	0.31	0.3
FI	0.15	0.18	0.24	0.2	0.35
FR	0.19	0.14	0.15	0.15	0.21
HU	0.16	0.08	-0.1	0.32	0.07
IE	0.11	0.14	0.11	0.09	0.18
IT	0.05	0.17	0.07	0.3	0.19
LT	0.34	0.4	-0.09	0.51	0.33
LU	0.26	0.18	0.13	0.6	0.23
LV	0.3	0.2	0.1	0.3	0.19
MT	0.32	0.35	-0.04	0.25	0.07
NL	0.09	0.16	0.01	0.31	0.22
PL	0.24	0.22	-0.07	0.38	0.3
PT	0.12	0.03	0.01	0.35	0.28
RO	0.33	0.25	0.14	0.42	0.13
SE	0.09	0.18	0.08	0.18	0.51
SI	0.14	0.07	0.11	0.3	0.31
SK	0.49	0.37	0.25	0.43	0.34
UK	0.16	0.12	0.12	0.12	0.26
AU	0.10	0.13	0.14	0.30	0.39
CA	0.16	0.17	0.10	0.30	0.53
JP	0.04	0.19	0.29	0.42	0.34
US	0.26	0.15	0.11	0.31	0.32

Tables A2b: Mark-ups with country-specific effects by sector $B_{it} = b_{0i} + b_1 PMR_{it}$

Retail	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
AT	0.18	0.17	0.17	0.16	0.16	0.15	0.15	0.14	0.14	0.14	0.14	0.14	0.13	0.13	0.12	0.11	0.10	0.09
AU	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.06	0.05
BE	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.16	0.16	0.15	0.15	0.15
BG																		
CA	0.15	0.15	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
CY																		
CZ	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.13
DE	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.03	0.03	0.03
DK	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.06	0.05	0.04	0.03	0.03	0.03	0.03	0.02	0.02
EE	0.18	0.18	0.18	0.18	0.18	0.18	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.20
EL	0.25	0.25	0.25	0.25	0.25	0.25	0.24	0.24	0.24	0.23	0.23	0.22	0.21	0.20	0.19	0.18	0.17	0.15
ES	0.25	0.24	0.24	0.23	0.23	0.22	0.22	0.21	0.21	0.21	0.21	0.21	0.20	0.20	0.19	0.19	0.18	0.18
FI	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
FR	0.22	0.21	0.21	0.20	0.19	0.19	0.18	0.17	0.17	0.17	0.17	0.18	0.18	0.16	0.15	0.14	0.13	0.12
HU	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.16	0.16	0.17	0.18	0.18	0.19	0.19	0.20	0.21
IE	0.08	0.08	0.07	0.07	0.07	0.07	0.06	0.06	0.07	0.07	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09
IT	0.10	0.10	0.09	0.09	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.07	0.06	0.05	0.04	0.04
JP	0.15	0.14	0.13	0.12	0.11	0.10	0.09	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08
LT																		
LU	0.22	0.22	0.22	0.22	0.23	0.23	0.23	0.23	0.24	0.24	0.24	0.25	0.25	0.25	0.25	0.25	0.25	0.25
LV																		
MT																		
NL	0.11	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07
PL	0.22	0.22	0.21	0.21	0.20	0.20	0.19	0.19	0.19	0.18	0.18	0.18	0.18	0.18	0.18	0.19	0.19	0.19
PT	0.11	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.11	0.11	0.12	0.13	0.13	0.11	0.09	0.07	0.05	0.03
RO																		
SE	0.09	0.08	0.08	0.08	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
SI	0.16	0.16	0.15	0.15	0.15	0.15	0.14	0.14	0.14	0.14	0.13	0.13	0.13	0.13	0.12	0.12	0.12	0.12
SK	0.18	0.18	0.18	0.18	0.18	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.18	0.20	0.21	0.22	0.24
UK	0.18	0.17	0.16	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.09	0.09
US	0.20	0.20	0.20	0.19	0.19	0.19	0.19	0.19	0.18	0.18	0.18	0.18	0.17	0.17	0.17	0.17	0.17	0.16

Energy	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
AT	0.20	0.20	0.20	0.19	0.17	0.15	0.13	0.13	0.12	0.13	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.11
AU	0.40	0.40	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37
BE	0.40	0.40	0.39	0.39	0.37	0.37	0.37	0.36	0.36	0.35	0.34	0.33	0.33	0.32	0.31	0.31	0.31	0.31
BG																		
CA	0.45	0.45	0.44	0.42	0.41	0.41	0.40	0.40	0.40	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41
CY																		
CZ	0.28	0.28	0.27	0.27	0.26	0.23	0.21	0.20	0.20	0.19	0.19	0.19	0.19	0.19	0.17	0.17	0.17	0.17
DE	0.45	0.45	0.39	0.38	0.38	0.38	0.38	0.38	0.38	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36
DK	0.47	0.47	0.47	0.45	0.44	0.43	0.43	0.41	0.41	0.41	0.40	0.39	0.39	0.39	0.39	0.39	0.40	0.40
EE	0.37	0.37	0.35	0.35	0.35	0.35	0.35	0.32	0.32	0.32	0.32	0.31	0.31	0.31	0.30	0.29	0.29	0.29
EL	0.44	0.44	0.44	0.44	0.44	0.43	0.41	0.41	0.41	0.37	0.37	0.37	0.37	0.37	0.36	0.36	0.36	0.36
ES	0.39	0.37	0.33	0.32	0.32	0.31	0.31	0.30	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
FI	0.37	0.36	0.36	0.36	0.36	0.35	0.35	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34
FR	0.29	0.29	0.29	0.28	0.27	0.27	0.25	0.24	0.23	0.22	0.21	0.21	0.21	0.20	0.20	0.19	0.19	0.19
HU	0.13	0.13	0.12	0.12	0.12	0.11	0.08	0.07	0.06	0.06	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.04
IE	0.22	0.22	0.22	0.22	0.19	0.18	0.17	0.16	0.16	0.16	0.16	0.15	0.15	0.15	0.12	0.12	0.12	0.12
IT	0.26	0.26	0.25	0.23	0.21	0.20	0.18	0.17	0.16	0.15	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
JP	0.36	0.36	0.36	0.36	0.35	0.34	0.34	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.34	0.34
LT																		
LU	0.32	0.32	0.31	0.31	0.28	0.26	0.26	0.25	0.25	0.25	0.24	0.23	0.23	0.24	0.24	0.24	0.24	0.24
LV																		
MT																		
NL	0.32	0.32	0.32	0.26	0.25	0.24	0.24	0.24	0.23	0.23	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22
PL	0.35	0.35	0.35	0.34	0.33	0.33	0.33	0.31	0.31	0.30	0.29	0.29	0.29	0.28	0.28	0.27	0.27	0.27
PT		0.35	0.35	0.34	0.32	0.32	0.31	0.29	0.29	0.28	0.25	0.25	0.25	0.25	0.24	0.23	0.23	0.22
RO																		
SE	0.54	0.54	0.54	0.54	0.53	0.51	0.50	0.50	0.50	0.50	0.49	0.49	0.49	0.49	0.48	0.48	0.48	0.48
SI	0.34	0.34	0.34	0.33	0.33	0.33	0.33	0.33	0.32	0.31	0.30	0.26	0.26	0.25	0.25	0.25	0.25	0.24
SK	0.34	0.34	0.34	0.34	0.34	0.34	0.30	0.30	0.28	0.28	0.28	0.25	0.25	0.25	0.23	0.23	0.23	0.23
UK	0.32	0.31	0.30	0.29	0.29	0.29	0.28	0.28	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26
US																		

Communication	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
AT	-0.01	-0.01	-0.01	-0.02	-0.03	-0.03	-0.03	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.05
AU	0.31	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.29	0.29	0.29
BE	0.22	0.21	0.21	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
BG																		
CA	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
CY																		
CZ	0.41	0.41	0.40	0.40	0.40	0.39	0.39	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.37	0.37	0.37
DE	0.30	0.30	0.29	0.29	0.29	0.28	0.28	0.28	0.28	0.28	0.28	0.27	0.27	0.27	0.27	0.27	0.27	0.27
DK	0.21	0.21	0.20	0.20	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.18	0.18	0.18	0.18	0.18	0.18
EE	0.26	0.26	0.26	0.25	0.25	0.25	0.25	0.25	0.24	0.24	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.23
EL	0.46	0.46	0.45	0.45	0.45	0.44	0.44	0.44	0.44	0.44	0.44	0.43	0.43	0.43	0.43	0.43	0.43	0.43
ES	0.32	0.32	0.32	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.30	0.30	0.30
FI	0.22	0.22	0.22	0.21	0.21	0.21	0.21	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
FR	0.19	0.18	0.17	0.17	0.17	0.17	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
HU	0.32	0.32	0.31	0.31	0.31	0.30	0.29	0.29	0.29	0.29	0.29	0.28	0.28	0.28	0.28	0.28	0.28	0.28
IE	0.16	0.16	0.16	0.16	0.14	0.14	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
IT	0.32	0.31	0.31	0.30	0.30	0.30	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.28	0.28	0.28
JP	0.45	0.45	0.44	0.45	0.45	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43
LT																		
LU	0.63	0.63	0.61	0.60	0.60	0.60	0.60	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59
LV																		
MT																		
NL	0.34	0.33	0.33	0.32	0.32	0.32	0.32	0.31	0.31	0.31	0.31	0.31	0.31	0.30	0.30	0.30	0.30	0.30
PL	0.43	0.43	0.42	0.42	0.41	0.40	0.40	0.40	0.40	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
PT	0.38	0.38	0.38	0.37	0.37	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
RO																		
SE	0.19	0.19	0.19	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.17	0.17	0.17	0.17	0.17
SI	0.33	0.33	0.33	0.32	0.32	0.32	0.31	0.31	0.31	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
SK	0.41	0.41	0.40	0.40	0.40	0.39	0.39	0.38	0.38	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.36	0.36
UK	0.14	0.14	0.14	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.12	0.12	0.12
US																		

Airlines	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
AT	0.18	0.18	0.18	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.15	0.15	0.15	0.15	0.15
AU	0.08	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05
BE	0.00	0.00	-0.01	-0.01	-0.01	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
BG																		
CA	0.12	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
CY																		
CZ	0.18	0.18	0.18	0.18	0.18	0.16	0.16	0.16	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
DE	0.13	0.13	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
DK	0.03	0.03	0.03	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
EE	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.10	0.10	0.10	0.10	0.09	0.12	0.12	0.12	0.12
EL	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.02	-0.07	-0.07	-0.07	-0.07	-0.07
ES	0.09	0.09	0.09	0.09	0.09	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.02	0.02	0.02	0.02	0.02	0.02
FI	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
FR	0.19	0.19	0.19	0.17	0.17	0.17	0.15	0.15	0.14	0.14	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
HU	-0.02	-0.02	-0.02	-0.02	-0.02	-0.04	-0.04	-0.04	-0.05	-0.05	-0.05	-0.10	-0.12	-0.12	-0.07	-0.07	-0.12	-0.12
IE	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.11	0.08	0.07	0.07	0.07	0.07	0.07	0.07
IT	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.01	0.01	0.01	0.01	0.01
JP	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.03	0.03	0.03
LT																		
LU	0.09	0.09	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
LV																		
MT																		
NL	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
PL	0.04	0.04	0.04	0.03	0.03	0.00	0.00	0.00	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
PT	0.04	0.04	0.04	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RO																		
SE	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
SI	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.10	0.10	0.10	0.10	0.10
SK	0.44	0.44	0.42	0.42	0.41	0.39	0.39	0.38	0.38	0.36	0.36	0.34	0.34	0.34	0.34	0.34	0.34	0.34
UK	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.10	0.10	0.10	0.10	0.10	0.10
US																		

Rail and Road	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
AT	0.16	0.16	0.15	0.15	0.15	0.15	0.15	0.15	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
AU	0.12	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
BE	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
BG																		
CA	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
CY																		
CZ	0.22	0.22	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
DE	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
DK	0.13	0.13	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
EE																		
EL	-0.47	-0.47	-0.47	-0.47	-0.47	-0.47	-0.47	-0.47	-0.47	-0.48	-0.48	-0.50	-0.50	-0.50	-0.50	-0.50	-0.50	-0.50
ES	0.15	0.15	0.15	0.15	0.14	0.14	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.11
FI	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
FR	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
HU	0.10	0.10	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.06
IE	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.12	0.12	0.12	0.12	0.12	0.12	0.12
IT	0.17	0.17	0.17	0.17	0.17	0.15	0.15	0.15	0.15	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
JP	0.19	0.19	0.17	0.17	0.17	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
LT																		
LU	0.20	0.20	0.17	0.17	0.17	0.17	0.17	0.16	0.16	0.16	0.16	0.16	0.17	0.17	0.17	0.17	0.17	0.17
LV																		
MT																		
NL	0.17	0.17	0.16	0.16	0.16	0.16	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
PL	0.19	0.19	0.17	0.17	0.17	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
PT	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01
RO																		
SE	0.18	0.18	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.16
SI	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.04	0.03	0.03	0.03	0.03	0.03
SK	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27
UK	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
US																		

Prof Services	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
AT	0.20	0.20	0.19	0.18	0.17	0.17	0.16	0.15	0.15	0.15	0.15	0.15	0.14	0.14	0.14	0.13	0.13	0.13
AU	0.10	0.09	0.08	0.07	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05
BE	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
BG																		
CA	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09
CY																		
CZ	0.16	0.16	0.16	0.15	0.15	0.15	0.15	0.14	0.14	0.14	0.13	0.13	0.13	0.13	0.13	0.12	0.12	0.12
DE	0.33	0.32	0.30	0.29	0.28	0.27	0.25	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.23	0.22	0.22	0.22
DK	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EE	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
EL	0.13	0.13	0.13	0.13	0.13	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.11	0.11
ES	0.21	0.21	0.20	0.19	0.18	0.17	0.16	0.15	0.15	0.14	0.14	0.14	0.14	0.14	0.13	0.13	0.13	0.12
FI	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.07	0.07	0.07	0.07	0.07
FR	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.14	0.14	0.14	0.14	0.13	0.13	0.13
HU	0.20	0.20	0.20	0.21	0.21	0.21	0.21	0.21	0.21	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22
IE	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.38	0.38	0.38	0.37	0.37	0.37	0.37	0.37	0.37	0.37
IT	0.16	0.16	0.15	0.15	0.15	0.14	0.14	0.13	0.13	0.12	0.12	0.11	0.11	0.10	0.09	0.08	0.07	0.06
JP	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.09	0.09	0.09	0.09
LT																		
LU	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
LV																		
MT																		
NL	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09
PL	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
PT	0.16	0.16	0.16	0.16	0.15	0.15	0.15	0.15	0.15	0.15	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.13
RO																		
SE	0.12	0.12	0.12	0.12	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
SI																		
SK																		
UK	0.31	0.31	0.30	0.30	0.30	0.29	0.29	0.28	0.28	0.28	0.28	0.28	0.27	0.27	0.27	0.27	0.27	0.27
US	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18

Tables A2c Mark-ups with average country-specific effects by sector $B_{it} = \beta_{0ave} + \beta_1 PMR_{it}$

Retail	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
AT	0.17	0.17	0.16	0.16	0.15	0.15	0.14	0.14	0.14	0.13	0.13	0.13	0.13	0.12	0.11	0.10	0.10	0.09
AU	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.06	0.05
BE	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.18	0.18	0.17	0.17	0.16
BG																		-0.01
CA	0.15	0.15	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
CY																		0.05
CZ	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.05
DE	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.12	0.12	0.11	0.11	0.11	0.11	0.10	0.10	0.10
DK	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.10	0.09	0.08	0.07	0.06	0.06	0.06	0.06	0.06	0.05
EE	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.05
EL	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.18	0.18	0.17	0.17	0.16	0.15	0.14	0.13	0.12	0.11	0.09
ES	0.18	0.18	0.17	0.17	0.16	0.16	0.15	0.15	0.14	0.14	0.14	0.14	0.14	0.13	0.13	0.12	0.12	0.11
FI	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
FR	0.20	0.19	0.18	0.18	0.17	0.16	0.16	0.15	0.15	0.15	0.15	0.15	0.15	0.14	0.13	0.12	0.11	0.10
HU	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.07	0.07
IE	0.04	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.03	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05
IT	0.19	0.18	0.18	0.17	0.17	0.16	0.16	0.15	0.16	0.16	0.16	0.16	0.16	0.16	0.15	0.14	0.13	0.12
JP	0.15	0.14	0.13	0.12	0.11	0.10	0.09	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08
LT																		0.03
LU	0.15	0.15	0.16	0.16	0.16	0.16	0.17	0.17	0.17	0.17	0.18	0.18	0.18	0.18	0.18	0.18	0.19	0.19
LV																		0.00
MT																		0.03
NL	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02
PL	0.13	0.13	0.12	0.12	0.11	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
PT	0.14	0.14	0.14	0.13	0.13	0.13	0.13	0.13	0.13	0.14	0.15	0.15	0.16	0.14	0.12	0.10	0.08	0.06
RO																		0.06
SE	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
SI	0.05	0.05	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01
SK	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.04	0.05	0.07	0.08
UK	0.16	0.14	0.13	0.12	0.11	0.10	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.06	0.06
US	0.20	0.20	0.20	0.19	0.19	0.19	0.19	0.19	0.18	0.18	0.18	0.18	0.17	0.17	0.17	0.17	0.17	0.16

Energy	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
AT	0.35	0.35	0.35	0.34	0.33	0.30	0.29	0.28	0.28	0.28	0.27	0.27	0.27	0.27	0.27	0.27	0.26	0.26
AU	0.40	0.40	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37
BE	0.35	0.35	0.34	0.34	0.32	0.32	0.32	0.32	0.31	0.30	0.29	0.28	0.28	0.27	0.27	0.26	0.26	0.26
BG																		0.30
CA	0.45	0.45	0.44	0.42	0.41	0.41	0.40	0.40	0.40	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41
CY																		
CZ	0.37	0.37	0.37	0.37	0.35	0.33	0.30	0.30	0.30	0.29	0.29	0.29	0.29	0.29	0.27	0.27	0.27	0.27
DE	0.33	0.33	0.27	0.26	0.26	0.26	0.26	0.26	0.26	0.25	0.25	0.25	0.25	0.25	0.25	0.24	0.24	0.24
DK	0.35	0.35	0.35	0.33	0.33	0.31	0.31	0.30	0.29	0.29	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
EE	0.36	0.36	0.35	0.35	0.35	0.35	0.35	0.32	0.32	0.32	0.32	0.31	0.30	0.30	0.30	0.29	0.29	0.29
EL	0.39	0.39	0.39	0.38	0.38	0.37	0.35	0.35	0.35	0.32	0.32	0.32	0.31	0.31	0.31	0.31	0.30	0.30
ES	0.34	0.32	0.28	0.26	0.26	0.26	0.26	0.25	0.24	0.24	0.24	0.23	0.23	0.23	0.24	0.24	0.23	0.23
FI	0.32	0.32	0.32	0.32	0.31	0.31	0.31	0.30	0.30	0.30	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
FR	0.39	0.39	0.39	0.38	0.37	0.37	0.35	0.34	0.33	0.32	0.31	0.31	0.31	0.30	0.30	0.29	0.29	0.29
HU	0.34	0.34	0.33	0.33	0.33	0.32	0.29	0.29	0.27	0.27	0.27	0.26	0.26	0.26	0.25	0.25	0.25	0.25
IE	0.38	0.38	0.38	0.38	0.35	0.34	0.32	0.32	0.32	0.32	0.32	0.31	0.31	0.31	0.28	0.28	0.28	0.28
IT	0.38	0.38	0.37	0.35	0.33	0.31	0.30	0.29	0.28	0.27	0.26	0.26	0.26	0.26	0.25	0.25	0.25	0.25
JP	0.36	0.36	0.36	0.36	0.35	0.34	0.34	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.34	0.34
LT																		0.27
LU	0.37	0.37	0.37	0.37	0.34	0.31	0.31	0.31	0.31	0.30	0.29	0.29	0.28	0.29	0.30	0.29	0.29	0.29
LV																		0.32
MT																		
NL	0.37	0.37	0.37	0.31	0.30	0.30	0.30	0.30	0.29	0.28	0.28	0.28	0.28	0.27	0.27	0.27	0.27	0.27
PL	0.38	0.38	0.38	0.37	0.36	0.36	0.36	0.34	0.34	0.33	0.32	0.32	0.32	0.31	0.31	0.30	0.30	0.30
PT		0.37	0.37	0.36	0.34	0.34	0.33	0.31	0.31	0.30	0.28	0.27	0.27	0.27	0.26	0.26	0.26	0.24
RO																		0.25
SE	0.33	0.33	0.32	0.32	0.31	0.30	0.29	0.29	0.29	0.28	0.28	0.28	0.28	0.28	0.26	0.26	0.26	0.26
SI	0.38	0.38	0.38	0.38	0.38	0.37	0.37	0.37	0.36	0.35	0.34	0.31	0.30	0.29	0.29	0.29	0.29	0.29
SK	0.39	0.39	0.39	0.39	0.39	0.38	0.35	0.34	0.33	0.32	0.32	0.30	0.30	0.29	0.28	0.28	0.28	0.28
UK	0.28	0.28	0.26	0.26	0.25	0.25	0.25	0.24	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22
US																		

For Cyprus and Malta only data for the electricity sector is available in 2013 (not for electricity).
In PT we have no PMR data for the gas sector in 1996.

Communication	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
AT	0.27	0.27	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
AU	0.31	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.29	0.29	0.29
BE	0.27	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
BG																		0.24
CA	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
CY																		0.25
CZ	0.27	0.27	0.26	0.26	0.26	0.25	0.25	0.25	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.23	0.23	0.23
DE	0.26	0.26	0.25	0.25	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.23	0.23	0.23
DK	0.26	0.26	0.25	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.23	0.23
EE	0.27	0.27	0.27	0.26	0.26	0.26	0.25	0.25	0.25	0.25	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.24
EL	0.27	0.27	0.26	0.26	0.25	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
ES	0.25	0.25	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.23	0.23	0.23
FI	0.26	0.26	0.26	0.25	0.25	0.25	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
FR	0.27	0.27	0.26	0.26	0.25	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
HU	0.27	0.27	0.27	0.27	0.27	0.25	0.25	0.25	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
IE	0.27	0.27	0.27	0.27	0.25	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.23	0.24	0.23	0.23	0.23
IT	0.27	0.27	0.26	0.25	0.25	0.25	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
JP	0.45	0.45	0.44	0.45	0.45	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43
LT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24
LU	0.28	0.28	0.27	0.26	0.26	0.26	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
LV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24
MT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22
NL	0.26	0.25	0.25	0.24	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.23	0.23	0.22	0.22	0.22	0.22	0.22
PL	0.27	0.27	0.27	0.26	0.25	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.23	0.23	0.23
PT	0.28	0.27	0.27	0.26	0.26	0.25	0.25	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
RO																		0.23
SE	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.24	0.24	0.24	0.24	0.24
SI	0.28	0.28	0.28	0.27	0.27	0.27	0.26	0.26	0.26	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
SK	0.28	0.28	0.27	0.27	0.27	0.27	0.27	0.25	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
UK	0.25	0.25	0.25	0.25	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.23	0.23	0.23
US																		

Airlines	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
AT	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.07	0.07	0.07	0.07	0.07
AU	0.08	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05
BE	0.09	0.09	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
BG																		0.07
CA	0.12	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
CY																		0.10
CZ	0.15	0.15	0.15	0.15	0.15	0.13	0.13	0.13	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
DE	0.09	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
DK	0.09	0.09	0.09	0.09	0.09	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
EE	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.10	0.10	0.10	0.10	0.08	0.11	0.11	0.11	0.11
EL	0.15	0.15	0.15	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.12	0.07	0.07	0.07	0.07	0.07
ES	0.13	0.13	0.13	0.13	0.13	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.07	0.07	0.07	0.07	0.07	0.07
FI	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
FR	0.13	0.13	0.13	0.11	0.11	0.11	0.09	0.09	0.09	0.09	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07
HU	0.17	0.17	0.17	0.17	0.17	0.15	0.15	0.15	0.13	0.13	0.13	0.08	0.07	0.07	0.11	0.11	0.07	0.07
IE	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.10	0.08	0.08	0.08	0.08	0.08	0.08
IT	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.07	0.07	0.07	0.07	0.07
JP	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.03	0.03	0.03
LT																		0.09
LU	0.07	0.07	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
LV																		0.12
MT																		0.12
NL	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
PL	0.17	0.17	0.17	0.16	0.16	0.13	0.13	0.13	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
PT	0.15	0.15	0.15	0.15	0.13	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
RO																		0.11
SE	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
SI	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.13	0.13	0.13	0.13	0.13
SK	0.17	0.17	0.15	0.15	0.13	0.12	0.12	0.11	0.11	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07
UK	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.07
US																		

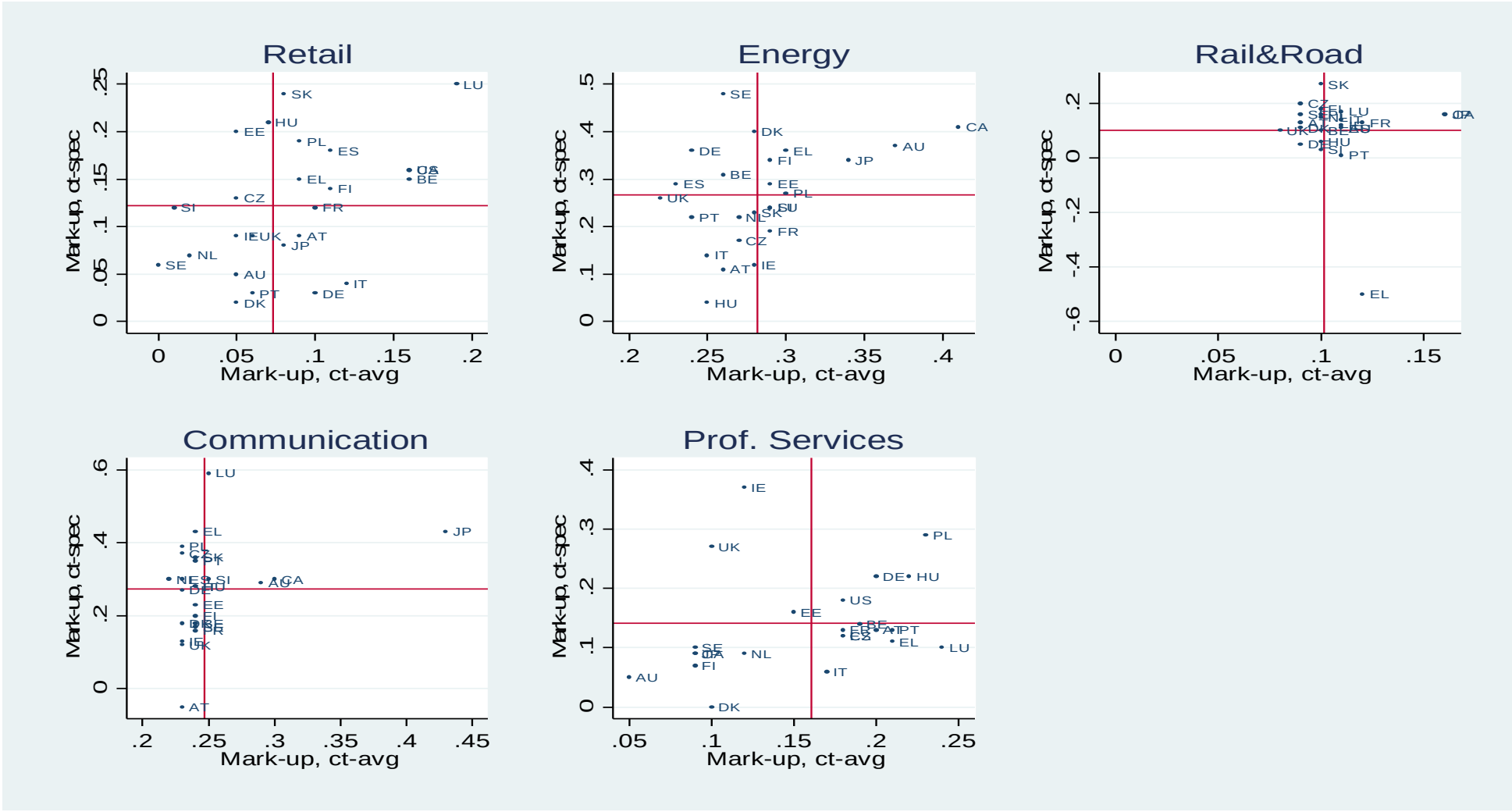
Values are equal for the UK and SK in the latest years since the PMR indicator takes the value zero.

Rail and Road	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
AT	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
AU	0.12	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
BE	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
BG																		0.11
CA	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
CY																		
CZ	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.09
DE	0.12	0.12	0.12	0.11	0.11	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
DK	0.11	0.11	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
EE												0.10	0.10	0.10	0.10	0.10	0.10	0.10
EL	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.13	0.13	0.12	0.12	0.12	0.12	0.12	0.12	0.12
ES	0.14	0.14	0.14	0.14	0.14	0.14	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
FI	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.10	0.10
FR	0.13	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
HU	0.14	0.14	0.12	0.12	0.12	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
IE	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
IT	0.14	0.14	0.14	0.14	0.14	0.12	0.12	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
JP	0.19	0.19	0.17	0.17	0.17	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
LT																		0.09
LU	0.14	0.14	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
LV																		0.09
MT																		0.00
NL	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
PL	0.13	0.13	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
PT	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
RO																		0.10
SE	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.09
SI	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.13	0.13	0.13	0.13	0.11	0.11	0.11	0.11	0.10	0.10
SK	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
UK	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
US																		

For Cyprus and Malta only data for the road sector is available in 2013 (not for rail); Rail data for Estonia is not available before 2007.

Prof Services	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
AT	0.28	0.27	0.26	0.25	0.25	0.24	0.23	0.22	0.22	0.22	0.22	0.22	0.22	0.21	0.21	0.21	0.20	0.20
AU	0.10	0.09	0.08	0.07	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05
BE	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
BG																		
CA	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09
CY																		0.22
CZ	0.22	0.22	0.22	0.21	0.21	0.21	0.20	0.20	0.20	0.20	0.19	0.19	0.19	0.19	0.18	0.18	0.18	0.18
DE	0.30	0.29	0.28	0.27	0.25	0.24	0.23	0.21	0.21	0.21	0.21	0.21	0.20	0.20	0.20	0.20	0.20	0.20
DK	0.13	0.12	0.12	0.12	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
EE	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
EL	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.22	0.22	0.22	0.22	0.21
ES	0.28	0.27	0.26	0.25	0.24	0.23	0.22	0.21	0.21	0.21	0.20	0.20	0.20	0.20	0.19	0.19	0.19	0.18
FI	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.09	0.09	0.09	0.09
FR	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.18	0.18	0.18	0.19	0.18	0.18	0.18	0.18	0.18
HU	0.19	0.20	0.20	0.20	0.20	0.20	0.20	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.22	0.22	0.22	0.22
IE	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.13	0.13	0.13	0.12	0.12	0.12	0.12	0.12	0.12
IT	0.27	0.26	0.26	0.26	0.25	0.25	0.25	0.24	0.24	0.23	0.23	0.22	0.21	0.20	0.20	0.19	0.18	0.17
JP	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.09	0.09	0.09	0.09
LT																		0.15
LU	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
LV																		
MT																		0.14
NL	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.13	0.13	0.13	0.13	0.12	0.12	0.12	0.12	0.12
PL	0.22	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
PT	0.24	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.22	0.22	0.22	0.22	0.22	0.22	0.21	0.21	0.21	0.21
RO																		
SE	0.11	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
SI																		0.19
SK																		0.21
UK	0.14	0.13	0.13	0.12	0.12	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
US	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18

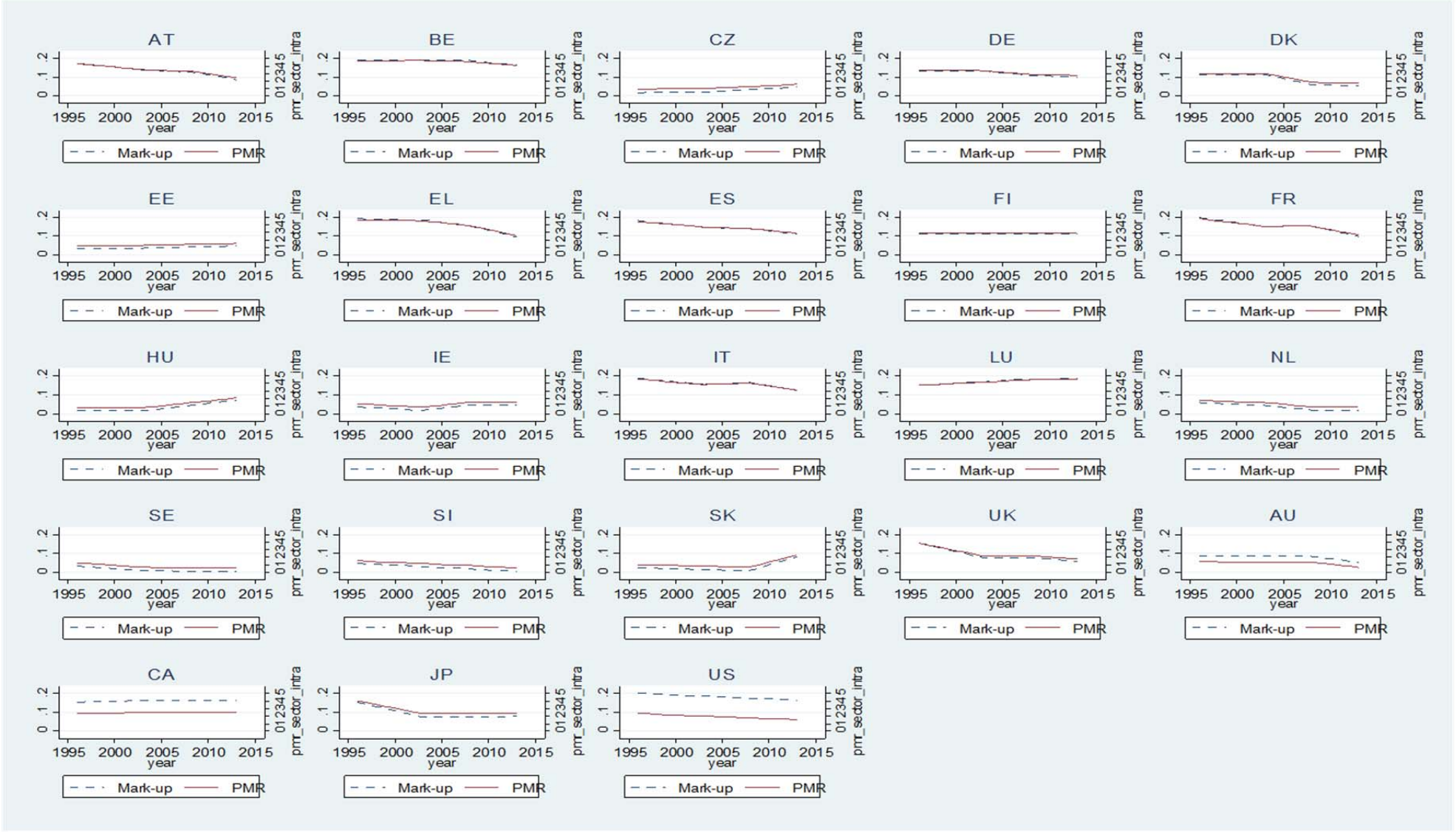
Graphs A1: Comparison of mark-up estimates for 2013 - $B_{it} = \beta_{0ave} + \beta_1 PMR_{it}$ versus $B_{it} = \beta_{0it} + \beta_1 PMR_{it}$



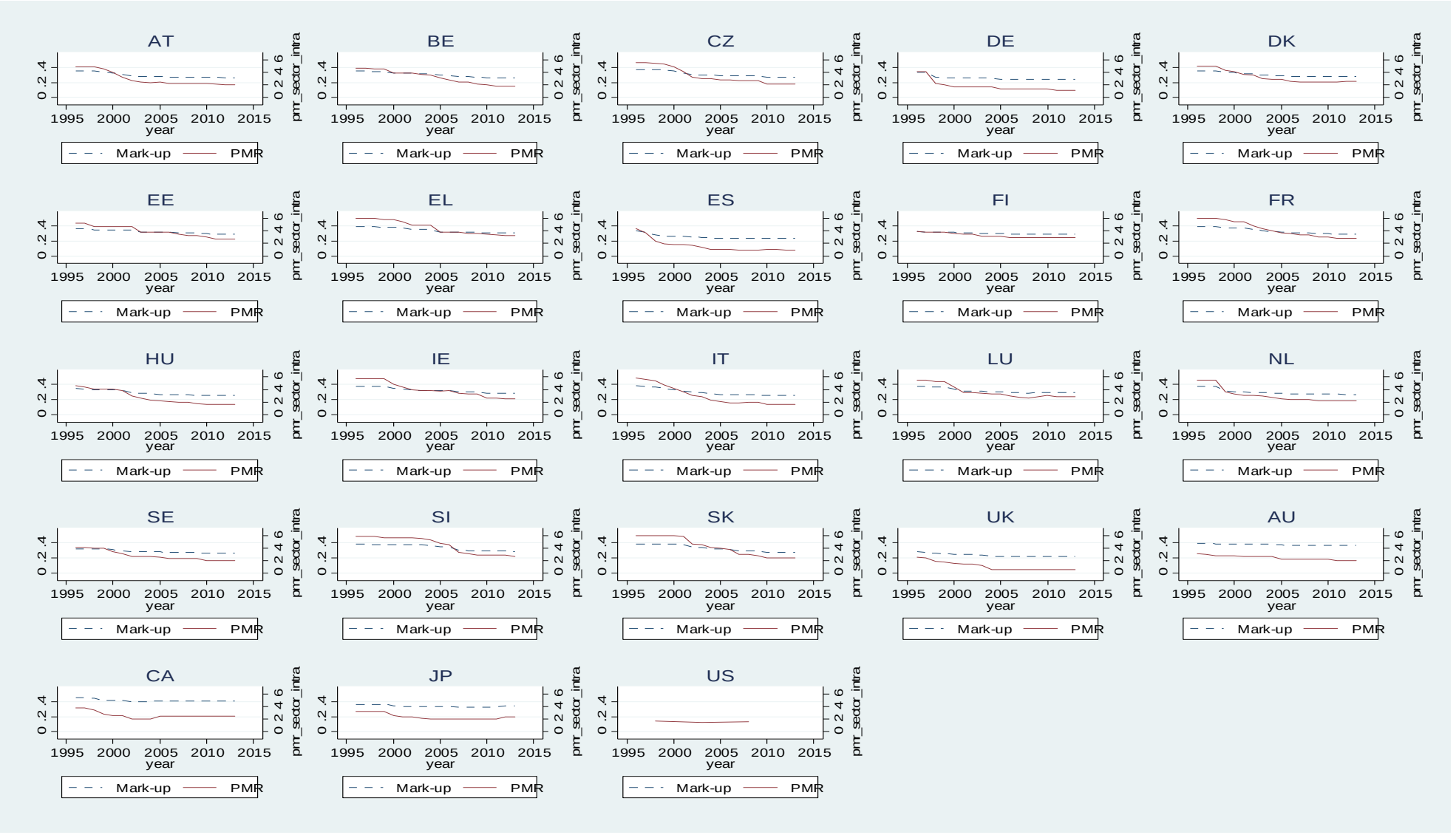
Note: The mark-ups for the non-EU countries are calculated on the basis of $B_{it} = \beta_{0i} + \beta_1 PMR_{it}$.

Graphs A2: Developments of time-varying mark-ups $B_{it} = \beta_{0ave} + \beta_1 PMR_{it}$ and PMR indicators by sector and country – EU countries

Retail



Energy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Mark-up
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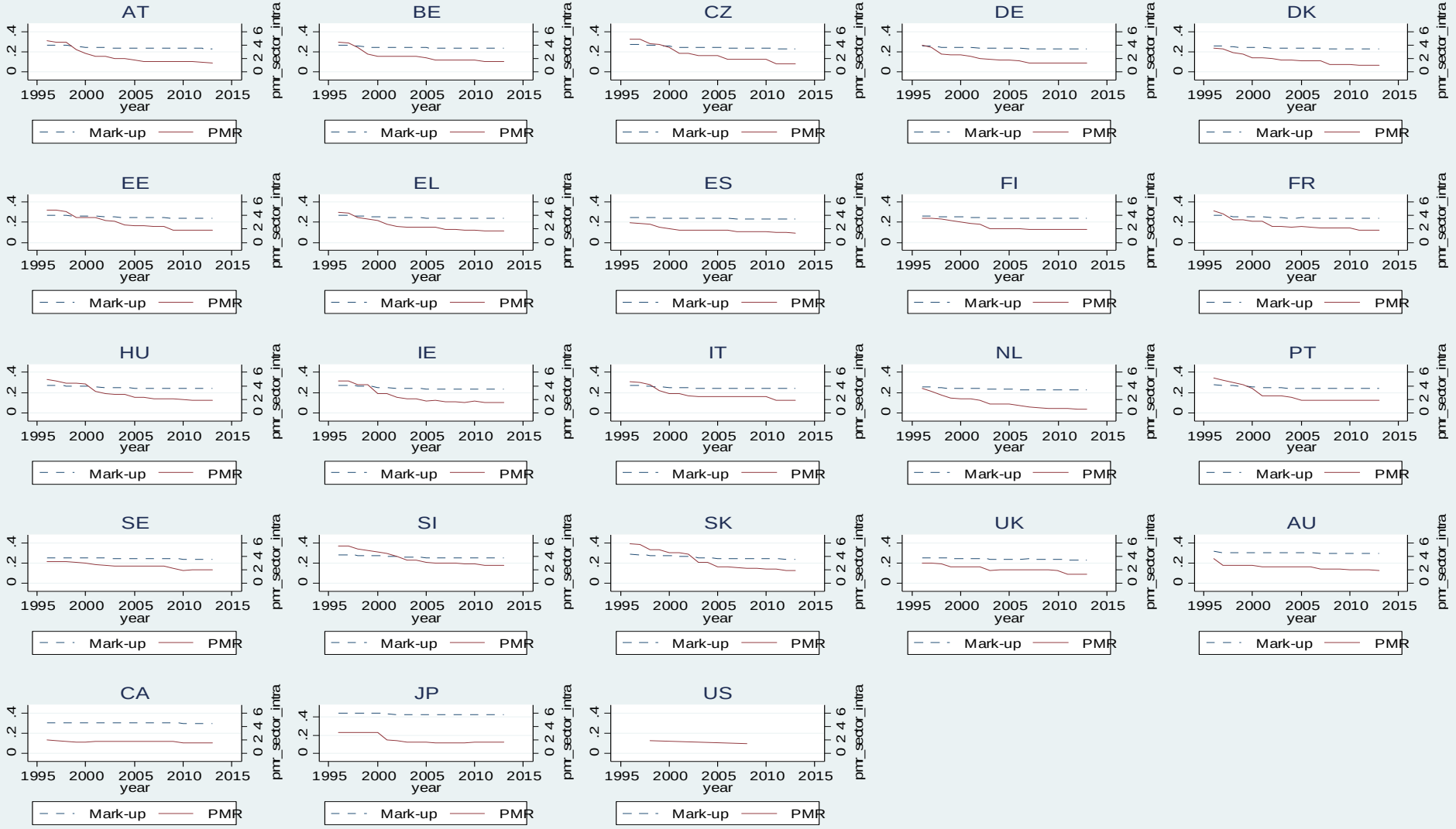
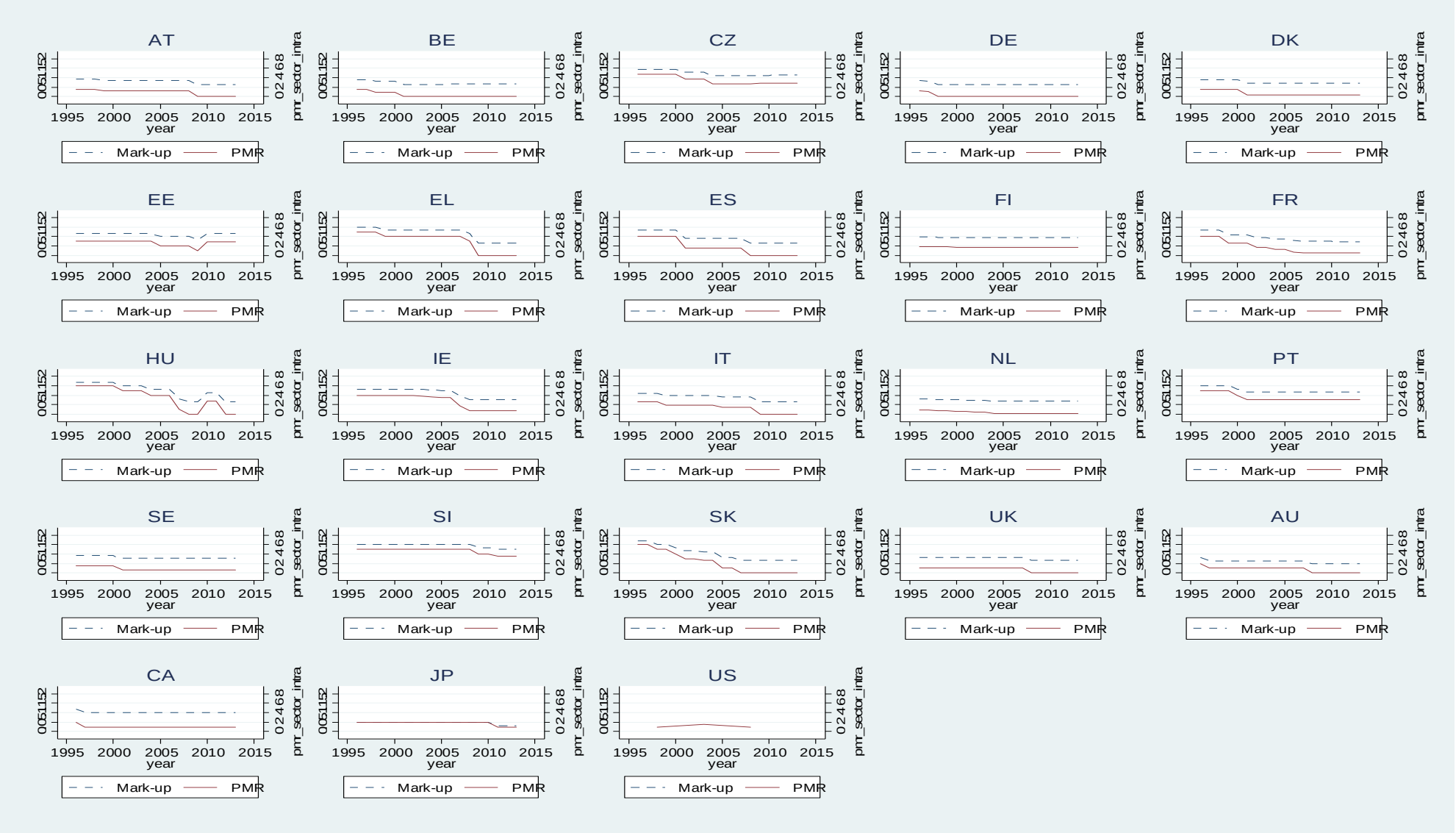
Communication



Airlines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year
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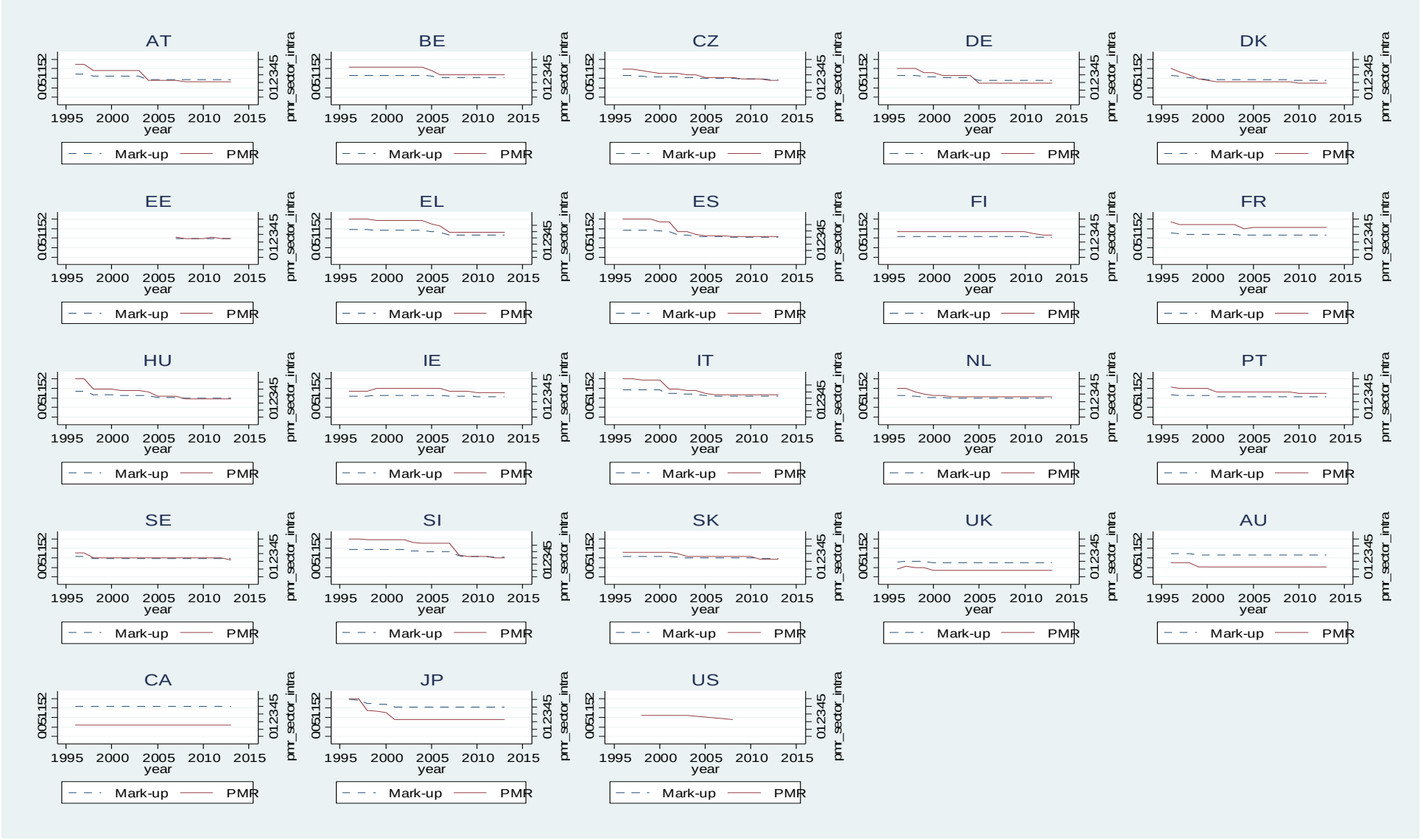
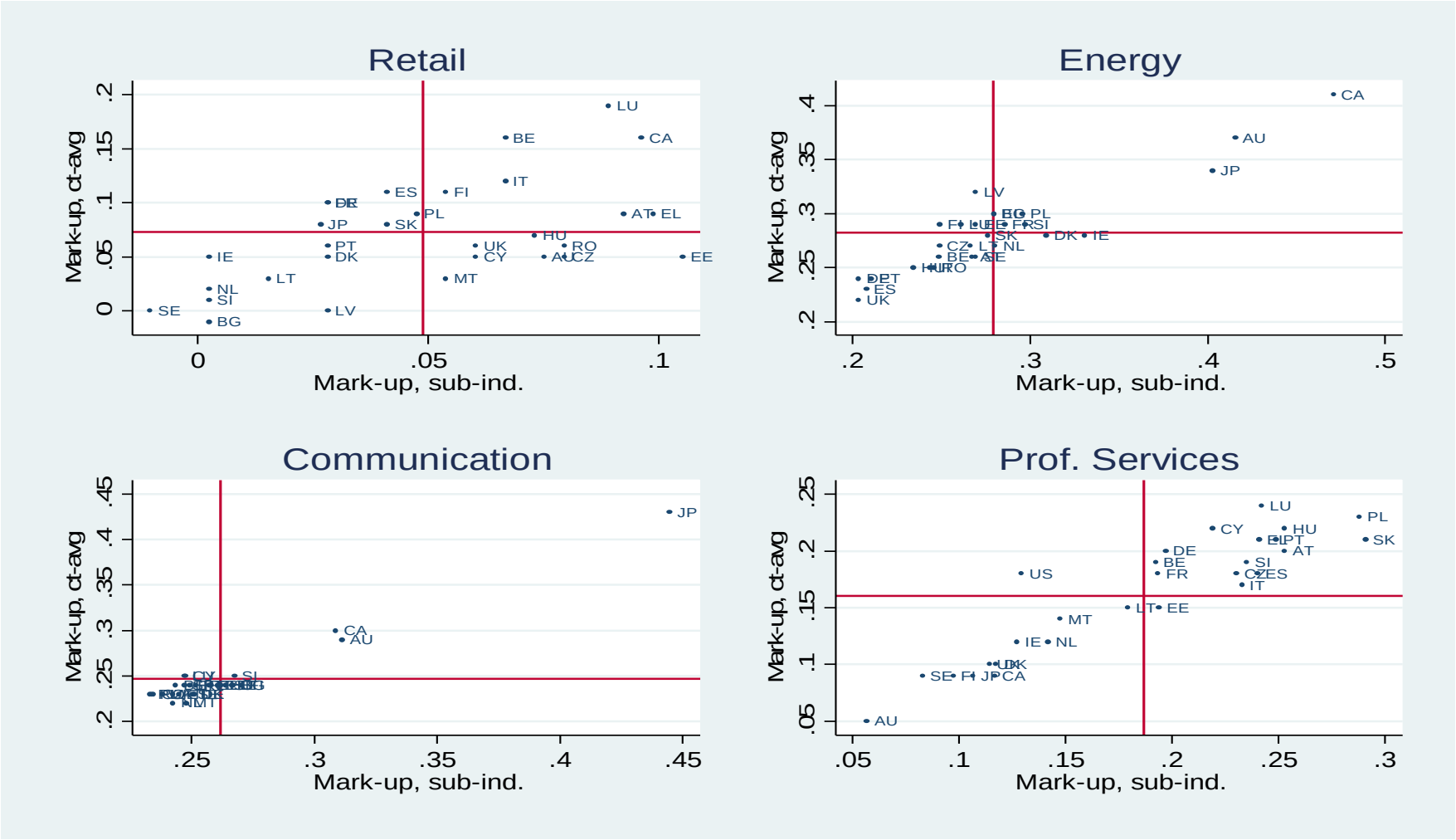
Mark-up
PMR

Rail and Road



Professional Services

Graphs A.3: Comparison of mark-up estimates for 2013 - $B_{it} = \beta_{0ave} + \beta_1 PMR_{it}$ versus $B_{it} = \beta_{0ave} + \beta_1 PMR_SUB_{it}$



Note: The mark-ups for the non-EU countries are calculated on the basis of $B_{it} = \beta_{0i} + \beta_1 PMR_{it}$.

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