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The Employment Effects of Labor and Product Market Deregulation and Their Implications for Structural Reform

HELGE BERGER and STEPHAN DANNINGER*

This study explores the effects of labor and product market deregulation on employment growth. Our empirical results, based on an Organization for Economic Cooperation and Development country sample from 1990 to 2004, suggest that lower levels of product and labor market regulation foster employment growth, including through sizable interaction effects. Based on these findings, the paper discusses a theoretical framework for evaluating deregulation strategies in the presence of reform costs. Optimal deregulation takes various forms depending on the deregulation costs and the strength of reform interactions. Compared with the first-best policy, decentralized decision making can lead to excessive or insufficient deregulation. [JEL L51, E24, J50]
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Deregulation, despite its ample potential benefits, is not an easy feat. Policymakers often face formidable headwinds in implementing reform. In part, this resistance reflects the economic and political costs of

*Helge Berger is a professor of Monetary Economics in the Department of Economics, Free University Berlin. Stephan Danninger is an economist in the European Department of the IMF. The authors are indebted to Alfonso Arpaia, Jörg Decressin, Marcello Estevão, Andy Hughes-Hallet, Giuseppe Nicoletti, Werner Schule, Marcel Thum, Bob Traa, and participants at the European Commission's Workshop on Sequencing and Incentives of Reforms and the IMF European Department's research seminar for insightful comments. Jair Rodriguez provided excellent research assistance.

deregulation. Structural change in product and labor markets—while increasing output and employment growth (for example, OECD, 2001 and 2005; Blanchard, 2004)—invariably involves up-front costs, including frictional unemployment, and costs associated with scrapping or mobilizing fixed capital. Reforms often also entail some redistribution of income, generating political costs a social planner would ignore. As a result, policymakers tend to curtail or slow reforms, thereby forgoing economic gains.

Part of the difficulty in implementing structural reforms is that reforms are most effective if executed in a coordinated fashion. One recent example of a partial approach is Germany's labor market reform, which occurred against the backdrop of a highly regulated service sector—the largest economic sector in terms of employment. The reform has been criticized for its high implementation costs and apparent lack of early success.[1] But the benefit from partly liberalizing labor markets might have been (and might continue to be) small because extensive product market regulation constrains labor demand and, thus, dampens the positive employment effects. Ignoring this interaction biases policymakers' anticipated reform benefits downward, leading—in the worst case—to the absence of reform.

Spillovers between labor and product market reform have proved to be important in many countries. Using Italian microdata, Kugler and Pica (2004) show that the effects from changes in employment protection differ among industries, depending on the competitive conditions in product markets. Estevão (2005) finds that in the case of a sample of Organization for Economic Cooperation and Development (OECD) member countries the impact of lower labor costs on real GDP growth is larger in economies with lower levels of product market regulation. More recent studies focus on the labor market and also find evidence of interaction effects of market regulation (Nicoletti and Scarpetta, 2005; and Griffith, Harrison, and Macartney, 2006).

Based on the assumption that current levels of regulation are excessive, economists commonly endorse an unconditional elimination of regulatory barriers, because they act as a direct brake on economic activity.[2] However, this view tends to ignore reform spillovers on the benefit side. An implication of the model by Blanchard and Giavazzi (2003) is that sequential deregulation might have advantages. They show that greater competition in product markets reduces the rents available for redistribution in a union-

[1]See, for instance, Fertig and Kluve (2004) and Boss and Elender (2005) for an analysis of the economic impact of recent German reforms, including Hartz IV.

[2]A minimum amount of regulation is a prerequisite for growth and, more generally, economic welfare. However, beyond a certain level, regulation impedes efficiency and real economic activity. Recent research tends to support the view that labor and product market regulation are excessive in many advanced countries (Jean and Nicoletti, 2004; and Conway and others, 2006).

firm bargaining process. Thus, by reforming the product market first, opposition to (and the political costs of) labor market reforms would decline and prepare the ground for further reforms.[3] The more general question then becomes whether coordinated reform strategies are the best approach and, if so, under what circumstances.

This paper adds to this discussion along two dimensions: first, by providing additional empirical evidence on the interaction between labor and product market reform with an emphasis on employment growth; and, second, by exploring some of the theoretical implications of deregulation spillovers for optimal policy design in the presence of reform costs.

With regard to labor market issues, our study is most closely related to two recent papers by Nicoletti and Scarpetta (2005) and Griffith, Harrison, and Macartney (2006).[4] Similar to these papers we focus on a panel of OECD countries, but examine employment growth, not employment rates; use aggregate and sectoral employment and regulation data during 1990–2004; and stress robustness in our empirical specification to test for the presence of interaction effects.[5]

Our empirical results suggest that reducing product and labor market regulation fosters employment growth, including through sizable interaction effects. The most promising reform strategy identified is one of simultaneous deregulation by coordinating labor and product market reforms. A country moving from median levels of regulation to a level on a par with the lowest decile of OECD countries stands to gain about 1 percentage point in annual employment growth. On average, the growth contribution from coordinating reforms (across markets) is 15 percent of the total growth boost, but doubles with a larger reform effort (from the 75th percentile of regulation to the lowest decile). Although they are subject to some data caveats, mostly because of a lack of broad-based regulatory measures with sufficient time variation, the econometric results are surprisingly robust across estimators, specifications, types of regulatory indicators, and data sources.

As do Nicoletti and Scarpetta (2005) and Griffith, Harrison, and Macartney (2006), we find that product and labor market regulations interact negatively, but our results point to a decreasing intensity of spillovers as levels of regulation increase. Empirically, the employment effect of a marginal

[3]However, the theoretical relationship underlying the complementarities between labor and product market reforms may be more involved than Blanchard and Giavazzi (2003) let on. For instance, Kauppi, Koskela, and Stenbacka (2004) analyze the effects of simultaneous labor and product market imperfections on equilibrium unemployment under exogenous as well as endogenous capital intensity and find that the long-term equilibrium unemployment is an increasing function of the relative bargaining power of labor unions, whereas there is a nonmonotonic relationship between long-term unemployment and the intensity of product market competition.

[4]Much of this work was done at approximately the same time. See, for instance, the working paper version of our paper (Berger and Danninger, 2005). For examples of earlier work see Boeri, Nicoletti, and Scarpetta (2000); and Nicoletti and Scarpetta (2005).

[5]See the next section for details.

increase in, for instance, labor market regulation is a negative function of the level of product market regulation. That is, increasing labor market regulation is less harmful when product market regulation is high than when it is low—and vice versa.[6] Deregulation has the reverse effect: benefits from deregulating one market increase as the level of regulation decreases in the other market. As a result, our findings imply, joint deregulation is more effective in creating employment than partial or sequential deregulation.

To explain why joint regulation is not observed more frequently, we develop a simple theoretical framework for analyzing deregulation decisions in an environment where implementing reforms is costly. The analysis suggests that a partial market perspective by market regulators leads to suboptimal deregulation outcomes, with the possibility of "too much" or "too little" reform depending on the decision process. The analysis draws on standard game theory results in order to illustrate welfare implications. An important assumption is that the costs of reform are fixed and not controlled by the decision maker. Allowing one regulator to commit ex ante to a deregulation policy eliminates the possibility of excessive deregulation, but it also amplifies the negative consequences of a partial perspective on the effects of a reform.

I. Empirical Evidence: Employment Effects of Regulation

The availability of new cross-country data on regulatory activity initiated a flurry of quantitative research on its economic effects (Nicoletti and Scarpetta, 2003; Alesina and others, 2005; Conway, Janod, and Nicoletti, 2005; and OECD, 2005). The general tenor of this literature is that excessive product market regulation has a measurable negative effect on economic activity and is at least partly responsible for divergences in economic performance among industrial countries. High levels of regulation are associated with lower investment and multifactor productivity growth. Market regulation is also associated with high wage premiums and rigid labor markets (Jean and Nicoletti, 2004). The evidence regarding the impact of labor market regulation is somewhat more mixed—but a number of studies suggest a negative impact on real activity (Young, 2003; OECD, 2004a; and Nickell, Nunziata, and Ochel, 2005).

This study extends this research in two directions. First, it focuses on employment effects. Excessive regulation has ambiguous theoretical effects on employment. Standard static models with monopolistic markets show that deregulation increases output, but these results can be reversed in a dynamic setting (Ebell and Haefke, 2003 and 2004).[7] The second aspect of the study is

[6]A helpful analogy for interpreting the positive interaction term is that of a regulation threshold. In a hypothetical high/low regulation world, increasing regulation in a low-regulation environment would create high costs in terms of job growth. However if regulation in one market is already above the low-regulation threshold, the added negative employment effect of higher product market regulation would have a comparatively smaller added effect.

[7]Using a dynamic general equilibrium model, Ebell and Haefke show that centralized wage bargaining regulation can lead to overhiring and hence deregulation induces labor shedding.

its focus on interaction effects between product and labor market regulation, which are the subject of an emerging literature (Kugler and Pica, 2004; Annett and Debrun 2004; and Estevão, 2005).[8]

The two papers most closely related to our study are Griffith, Harrison, and Macartney (2006) and Nicoletti and Scarpetta (2005). The former assesses the unemployment effect of product and labor market regulations and institutions in a panel of OECD countries and applies a two-stage estimation approach: the authors first estimate the effect of product market regulation on competitiveness, measured by profitability, and in stage two include profitability in an unemployment rate equation that controls for labor market regulations and institutions and tests for interaction effects. Their findings confirm that regulation decreases competition and lowers labor market performance. They also find that improvements in competitiveness (through lower product market regulation) have a stronger positive effect on unemployment when the bargaining power of labor markets is stronger. The paper by Nicoletti and Scarpetta (2005) uses a sectoral regulation indicator for a sample of OECD countries and also explores direct and interaction effects of product and labor market regulations. They find that the negative employment effect of product market regulations is magnified in labor markets with higher insider bargaining power.

Our approach extends and complements these studies along three important dimensions. For one, we use employment growth rates as a dependent variable. Similar to employment rates, this variable is stationary, but it is not influenced by changes in labor force participation and hence focuses on labor demand. Second, we use aggregate and sectoral regulation and employment data to confirm our results. Finally, we enter the regulation parameters directly and jointly into our empirical employment model when testing for the interaction effect. The direct approach has the advantage of avoiding a possible omitted variable bias arising from the positive correlation between product and labor market regulation (OECD, 2005).

Data

A host of new data on regulatory activity offer new ways to quantify the economic effects of regulation by comparing regulatory activity across

[8]Kugler and Pica (2004) find that labor market liberalization leads to larger positive employment responses in less regulated product markets. Estevão (2005) shows that wage moderation—measured by the productivity and unemployment level adjusted wage change—is more effective in stimulating growth if it occurs in countries with more deregulated product markets. Annett and Debrun (2004) explore indirect evidence for the advantages of sequencing of reforms like Blanchard (2004) and find that within the euro area, product market reforms Granger-cause labor market reforms, suggesting sequential effects and one-directional spillovers. Burda (2000) discusses some of the earlier literature. See Daveri and Tabellini (2000) for an instructive discussion of the impact of taxation (in particular labor taxes) on unemployment and real growth in Europe.

sectors and countries, and over time. To implement the proposed empirical strategy, we develop a panel data set of OECD countries by matching aggregate employment growth data with data on regulation indices and other control variables. The analysis covers the years 1980–2004, with most regressions starting in 1990, in line with the availability of the regulation data.

The main dependent variable, employment growth, is measured by the number of people employed during a given year in the business sector. The data source is the OECD STAN database.[9] A preferable measure would have been total hours worked per year to capture movements between full- and part-time employment, but this level of detail was not available for a sufficiently large number of countries.

Two types of regulation indicators are examined: product market regulation and employment protection legislation. The broad-based indicators used in the main part of the study (published in OECD, 2005) have the advantage of covering a variety of aspects of regulation, but have the disadvantage of being available only for a selected few years. Specifically, we use broad-based indicators for the labor market for 1988, 1998, and 2003 and for product markets for 1998 and 2003. Available data points are mapped forward annually until a new regulation data point was available. In addition, product market regulation during 1990–98 is assumed to be at the 1998 level. An alternative set of indicators of regulation developed by Nicoletti, Scarpetta, and Boylaud (2000) contains annual data, but refers to a small set of nonmanufacturing industries. We use these data to cross-check our results.

An additional advantage of using broad-based indicators of regulation is that they allow for exploration of which aspects of regulation are more important than others.[10] For product market regulation, five different dimensions are discussed: administrative regulation, economic regulation, barriers to entrepreneurship, degree of state control, and barriers to trade and investment. For employment protection regulation, we assess, in addition to the overall effect, the regulation of regular employment, temporary employment, and collective dismissals.[11] All regulation indicators take values between zero and six, with six indicating severe restrictions or limits on competition and zero no restrictions or no barriers to competition.

[9]The following OECD member countries are covered: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Mexico, Netherlands, New Zealand, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States.

[10]The OECD indicators were developed to illustrate broad differences in product market policies and are described in detail in Conway, Janod, and Nicoletti (2005).

[11]Although both the OECD's Employment Protection Legislation (EPL) and product market measure work with a zero–six scale, this does not mean that the intensity of regulation at a given level, say four, is directly comparable nor that—as a result of the rank-basing of some variables—the scale remains the same over time. We return to this issue in the empirical application.

Data sources for other control variables—tax wedge on labor, union density, population size and growth, and coverage of collective bargaining—are the OECD "Taxing Wages" (various issues), Nickell (2003, Tables 8 and 9), and the IMF World Economic Outlook and International Financial Statistics databases.

Empirical Results

The baseline results are derived from an unrestricted dynamic model of employment growth. Special attention was given to interaction effects between product and labor market regulation:

$$\Delta E_{it} = \alpha + \alpha_1 \Delta E_{it-p} + \alpha_2 R_{PMit} + \alpha_3 R_{LMit} + \gamma R_{PMit} x R_{LMit} + \delta X_{it} + \varepsilon_{it}, \quad (1)$$

where Δ is a general growth rate operator, p indicates the lag length chosen, and X_{it} refers to control variables, including, in our baseline specification, population level, population growth, and the tax wedge on labor. We will comment on extensions, adding other institutional controls and regional country groupings below.

To exploit the existing (if limited) time variation of our broad-based regulatory indicators while safeguarding against spurious results, we make use of standard time-series panel techniques employing fixed or random-effect estimators.[12] But because there is little reason not to make use of the information contained in the within-country changes in regulatory activity, we report the panel results using fixed and random effects to prevent the slow-moving regulatory indicators from picking up country effects.

The main findings are reported in Table 1. The empirical models differentiate between two definitions of the dependent variable: the models in the first two columns and column 5 measure employment growth as the average annual growth rate over a five-year span to remove business cycle variations. The models in columns 3, 4, and 6 refer to the annual employment growth rate. Only the estimates for the regulation variables are shown. All models have a dynamic specification and include population size, population growth, the tax wedge on labor, and a constant as additional control variables.[13] Models 1 and 3 are estimated with fixed effects and models 2 and 4 use random effects.[14] Model 5 presents the results

[12]An alternative approach would be to collapse the data set into one cross-country section, which produces comparable results. Results are available on request.

[13]The left-hand-side variables exhibit significant autocorrelation. Alternative specifications that more directly test for cyclical effects found a positive association with lagged and current GDP growth. However, because GDP growth becomes insignificant in the presence of lagged dependent variables, and to avoid multicollinearity and endogeneity problems, GDP growth was subsequently dropped from the baseline specification.

[14]The Hausman specification tests tend to reject random in favor of fixed effects, but there is a potential conflict between using fixed effects and the inclusion of regulatory indicators with limited time variation.

Table 1. Employment Growth and Regulation: Annualized Five-Year Growth, 1990–2003[1]

	Employment Growth					
	(1) $\Delta^5 E_t$	(2) $\Delta^5 E_t$	(3) ΔE_t	(4) ΔE_t	(5) $\Delta^5 E_t$	(6) ΔE_t
R_{PM}	–0.007	–0.007	0.0003	–0.004	–0.005	–0.0004
	(2.17)**	(2.84)***	–0.1	(2.13)**	–1.52	–0.1
R_{LM}	–0.009	–0.007	–0.008	–0.003	–0.01	–0.008
	(4.35)***	(4.43)***	(2.37)**	(2.04)**	(4.67)***	(2.31)**
$R_{PM} \times R_{LM}{}^2$	0.014	0.015	0.01	0.008	0.014	0.01
	(4.12)***	(5.61)***	(1.19)*	(2.67)***	(4.29)***	(1.91)*
Estimation[3]	FE	RE	FE	RE	IV	AB
Observations	319	319	343	343	319	375
Countries	27	27	28	28	28	28
R^2 (within)	0.36	0.34	0.32	0.29	0.55[5]	…
R^2 (between)	0.01	0.22	0.1	0.87	0.55[5]	…
Wald-test[4]	15.6***	56.8***	2.5*	15.9***	15.9***	…

Source: Organization for Economic Cooperation and Development and authors' estimates.

Note: Absolute value of t or z statistics in parentheses; */**/*** significant at the 10/5/1 percent level.

[1]The dependent variable in models 1, 2, and 5 is the annualized employment growth rate (persons) averaged over five years. In models 3, 4, and 6 it is the annual growth rate. Models 1, 2, and 5 also include the five-year lag of the average growth rate; models 3 and 5 also include the first to the fifth lag of the annual employment growth rate (results not shown). Model 5 is an instrumental variable estimation using the lagged annualized real GDP growth rate averaged over five years as an instrument on the lagged dependent variable. The specification includes country dummies equivalent to a FE specification. Model 6 presents Arellano-Bond estimates based on a four-lag structure and covers the period 1988–2004. All models include a constant, and population size, population growth, and the tax wedge on labor as additional control variables. Lagged dependent variables in all models are significant.

[2]Dummy interaction effect; 1 if both labor and product market regulation are at or above the average level of the sample of OECD countries, and 0 otherwise.

[3]FE = fixed effects, RE = random effects, IV = instrumental variables, AB = Arellano-Bond.

[4]Test of joint significance of regulation variables.

[5]Adjusted R^2.

instrumenting the lagged dependent variable. The final model applies the General Methods of Moments estimator proposed by Arellano and Bond (1991).

The first aspect worth noting in Table 1 is the consistent sign pattern of the estimated coefficients across models, where significant. The direct effect of market regulation is negative, whereas the interaction term has an offsetting positive effect in all specifications except model 3, where the coefficient is insignificant. Although product market regulation is not always

statistically significant,[15] Wald-tests indicate joint significance of all three regulation variables at least at the 10 percent level in all specifications. The interaction term is a dummy variable set to be equal to one if a country has above-average product and labor market regulation and zero otherwise. The dummy specification avoids potential compatibility problems with the metric of the two indicators and generally provides a better fit than simple multiplicative interaction terms. Note that the interaction result is robust to nonlinear (quadratic) specifications of the regulation indicators and hence does not pick up a nonlinear direct effect from the regulation indicators.

The positive interaction effect implies that joint deregulation creates employment growth effects that are larger than the sum of the effects from partial deregulation. This can be seen by comparing the employment effects of partial deregulation and joint regulation. The full impact of a partial reduction in regulation is the sum of the direct impact and the offsetting effects from the interaction term. The model parameters imply that the (marginal) employment effect from deregulating one market increases as the level of regulation decreases in the other market, thus reflecting positive synergies from joint deregulation.

Although less effective than coordinated reform, partial reform tends to have positive employment growth effects as well. Across all models, the estimated average net effect of deregulation is positive; that is, lower levels of regulation in the other market are associated with higher employment growth. In a few cases and at very high levels of regulation, the individual marginal effects of deregulation become negative. But the result is reversed as the level of regulation in the other market falls and is not relevant in most plausible deregulation scenarios (see Table 5).

Several modifications to the baseline model were examined to assess the robustness of the results. In a first step, additional control variables commonly associated with employment activity were added to examine the scope of an omitted-variable bias (see, for example, Nicoletti and Scarpetta, 2005). In particular, including union density or the coverage of collective bargaining—although significant in some specifications—has no significant effect on the sign pattern, standard error, or size of the reported coefficients in the baseline results presented in Table 1. Note that including the variables considerably shortens the available sample. We also test for heterogeneity across regional country groupings but do not detect a country cluster effect (for example, transition economies).[16]

It is also worthwhile to stress the robustness of the baseline results with regard to the dynamic specification. Model 5 in Table 1 controls for the

[15]A possible explanation is inflated standard errors because of the positive correlation of the regulation variables. Product market regulation is statistically significant in models that exclude labor market regulation and the interaction term. See Nicoletti and Scarpetta (2005) for a discussion of multicollinearity and an attempt to limit the issue by generating synthetic regulatory indicators.

[16]Results are available from the authors on request.

potential endogeneity of the lagged five-year growth averages using an instrumental variable (IV) approach with lagged GDP growth as an instrument. As discussed, the IV model produces the same sign and significance patterns of the regulation effects as in the baseline model. In addition, the annual model was reestimated in model 6 using the procedure proposed by Arellano and Bond (1991). Again the sign pattern of the regulation effects remained intact, although the coefficients came out somewhat weaker in terms of their statistical significance, compared with the IV approach.[17]

Finally, note that our empirical results are in line with findings by Griffith, Harrison, and Macartney (2006) and Nicoletti and Scarpetta (2005). High regulation impedes labor market performance, and sizable interaction effects are at work—albeit not necessarily pointing in the same direction. Although their studies find that marginal interaction effects of product and labor market regulation increase at higher levels of market regulation, our findings imply a gradually decreasing interaction effect as the general level of regulation decreases. The remaining differences with the other studies may be a result of alternative empirical specifications and the use of different labor market indicators, with the other studies focusing less on labor market regulation and more on institutions (for example, bargaining).

An intuitive explanation for the underlying economic mechanics can be derived, for instance, from a simple static framework with monopolistic competition and a labor supply that is sensitive to the level of labor market regulation (Berger and Danninger, 2005). In this model, lower product market regulation increases competition and also raises the elasticity of labor demand with respect to real wages. Plausibly, labor market deregulation will increase labor supply and make labor supply more wage-elastic. If this is the case, product market deregulation will have a larger overall effect on employment at lower levels of labor market regulation. In other words, product and labor market deregulation reinforce each other. The positive sign of the estimated parameter for the interaction terms is consistent with this interpretation.

Effects of Regulation Subindices

In a next step and to better understand which regulation channels in particular affect employment growth, we explore the relative importance of different subcomponents of the regulation indices. The results are reported in Tables 2 and 3. To assess the effects of labor market regulation, we estimate the effects of three subindices measuring the degree of employment protection of regular employment, temporary employment, and large-scale dismissals. Columns 1 through 4 in Table 2 compare the estimates for the

[17]Given that this procedure was developed for large microdata panels, and in view of the limited time variation of the current sample, the applicability of the dynamic panel estimator is doubtful.

Table 2. Employment Growth and Regulation: Employment Protection Legislation Subindices, 1990–2004[1]

	Change in Employment			
	(1) $\Delta^5 E_t$	(2) $\Delta^5 E_t$	(3) $\Delta^5 E_t$	(4) $\Delta^5 E_t$
R_{LM}	–0.007 (2.17)***			
Regular employment		–0.014 (4.31)***		
Temporary employment			–0.003 (2.66)***	
Collective dismissal				–0.014 (2.92)***
Observations	319	319	319	167
Countries	27	27	27	27
Estimation[2]	FE	FE	FE	FE
R^2 (within)	0.36	0.34	0.31	0.6

Source: OECD and authors' estimates.

Note: Absolute value of t statistics in parentheses; *** significant at the 1 percent level.

[1]The dependent variable is the annualized employment growth rate average over five years. Regulation subindices measure regulation of regular employment contracts, regulation of temporary employment contracts, and regulation of collective dismissals. In addition to R_{PM} and an appropriately defined interaction variable, models include a five-year lagged dependent variable, population size, population growth, tax wedge on labor, fixed effects, and a constant.

[2]FE = fixed effects.

overall index with its subcomponents. The largest negative employment effects stem from employment protection of full-time employment and large-scale dismissals. Regulations affecting temporary employment seem to play a smaller role. These results suggest that employment protection interferes with job growth primarily by raising the cost of regular full-time employment contracts.

Analysis of product market subindices hints at increased costs for creating new jobs. Columns 1 through 6 in Table 3 present the overall index compared with five subcomponents. Employment growth is mostly hampered by a high administrative burden and barriers to entrepreneurship, trade, and investment. Comparatively less important and insignificant at conventional levels are economic regulations—for instance, through price ceilings or quotas—and excessive state control in the form of public ownership. Although still based on fairly general indicators, the findings suggest that regulation hampers job creation especially in start-ups or small firms, because they are most sensitive to administrative burdens and barriers to entry of entrepreneurship and investment. This interpretation is consistent with large

Table 3. Employment Growth and Regulation: Product Market Regulation Subindices, 1990–2004[1]

	Change in Employment					
	(1) $\Delta^5 E_t$	(2) $\Delta^5 E_t$	(3) ΔE_t	(4) ΔE_t	(5) $\Delta^5 E_t$	(6) $\Delta^5 E_t$
R_{PM}	−0.007 (2.17)**					
Administrative regulation		−0.009 (3.26)***				
Economic regulation			−0.001 −0.45			
Barriers to trade and investment				−0.007 (2.30)**		
Extent of state control					−0.003 −1.15	
Barriers to entrepreneurship						−0.009 (2.51)**
Observations	319	319	319	319	319	319
Countries	27	27	27	27	27	27
R^2 (within)	0.36	0.34	0.36	0.33	0.41	0.33

Source: OECD and authors' estimates.

Note: Absolute value of *t* statistics in parentheses; **/*** significant at the 5/1 percent level.

[1]The dependent variable is the annualized employment growth rate average over five years. Regulation subindices measure the level of administrative regulation, level of economic regulation, barriers to trade and investment, extent of state control, and barriers to entrepreneurship. In addition to R_{LM} and an appropriately defined interaction variable, models include a five-year lagged dependent variable, population size, population growth, tax wedge on labor, fixed effects, and a constant.

competitive barriers in the service sector in several European countries, where most small enterprises are concentrated (Berger and Danninger, 2006).

Results from Sectoral Data

Next, we explore whether the qualitative results from the cross-country panel hold up in an industry-level data set. The main benefit of the alternative panel is more frequent data on product and labor market regulation, but with the drawback that it covers an earlier time period (1980–98), includes fewer countries (six), and restricts the analysis to just four nonmanufacturing sectors.[18] Annual product markets regulation data come from Nicoletti, Scarpetta, and Boylaud (2000) and have been used in explaining relative economic performance (for example, Alesina and others, 2005). Data on

[18]Electricity production, telecommunications, transportation, and postal services.

Table 4. Employment Growth and Regulation: Industry Level Data, 1980–98[1]

Degree of Regulation	(1) $\Delta^5 E_t$	(2) ΔE_t
R_{PM}	–0.006	–0.527
	(2.69)**	–1.47
R_{LM}	–0.023	–1.715
	(3.48)**	(1.81)*
$R_{PM} \times R_{LM}$	0.005	0.367
	(3.13)**	–1.44
Estimation[2]	RE	RE
Observations	103	183
Countries	6	6
Sectors	4	4
R^2	0.62	0.32
Wald-test[3]	7.1**	4.7

Source: OECD and authors' estimates.

Note: Absolute value of z statistics in parentheses; */** significant at the 10/5 percent level.

[1]Sectoral employment growth (persons) in four nonmanufacturing industries (electricity production, telecommunications, transportation, and postal services) covering the years 1980–88 sourced from the OECD STAN database. Market regulation indicators are taken from Nicoletti and Scarpetta (2005)and Nickell (2003, Table 12). Baseline regressions include sectoral dummy variables and in model 1 a five-year lag of the dependent variable and in model 2 the first to the fifth lag. Lagged dependent variables are significant. The interaction term is the product of the market regulation indicators.

[2]RE = random effects.

[3]Test of joint significance of regulation variables.

employment protection legislation are taken from Table 12 in Nickell (2003) to obtain an elongated time series. All other industry data come from the OECD STAN database.

Results from baseline regressions on this panel confirm the presence of negative regulation effects with cross-market interactions. Table 4 presents the sectoral regulation effects for two model specifications using five-year and annual employment growth rates. The model specifications are the same as in Table 1, but also include industry dummies. The Hausman specification test suggests random effects to be the preferable model. In both the five-year average and the annual specification, the same regulation pattern emerges. The sign pattern is the same as in the cross-country panel and, at least in the case of the five-year growth rates, the estimated effects are statistically significant.

The Economic Impact of Deregulation

Estimates of the employment growth effects of deregulation are presented in Table 5. The calculations are based on two different reform strategies

(comprehensive and partial) and two levels of the deregulation effort (small and large). A comprehensive reform is defined as coordinated deregulation in both the product and labor markets (that is, a decline of the regulation index in both markets). A partial reform is a unilateral decrease of the regulation index in only one market. A large deregulation effort represents movement from the 75th to the 10th percentile in the OECD distribution of the respective regulation index. A small reform effort is defined as a decline in the regulation level from the median to the 10th percentile. When conducting a partial reform experiment, we assume that the level of regulation in the nonreforming market remains at the prereform level.

The economic effects appear to be large in all reform scenarios, regardless of which empirical model is applied. The random-effects model produces a quantitatively smaller effect, but from a statistical point of view the fixed-effect model is preferable (see above). To avoid overstating our result we chose to present the result for the average effect. The first six columns in Table 5 report the annual employment growth effect based on different empirical models (see Table 1). The average effect across models is reported in the last column. Partial reforms lead on average to additional employment growth of between 0.5 and 0.6 percentage point across all models. The size of

Table 5. Employment Effects of Partial and Comprehensive Deregulation[1]

Model[2]	A	A	B	B	A	B	
Technique[3]	FE	RE	FE	RE	IV	AB	Mean
				Partial reform[4]			
75% → 10%							
Average growth effect	1.1	0.6	0.6	0.1	1.1	0.4	0.6
Median → 10%							
Average growth effect	0.8	0.4	0.5	0.2	0.8	0.3	0.5
				Comprehensive reform[4]			
75% → 10%							
Overall effect	2.9	1.5	1.5	0.7	2.9	0.8	1.7
Of which: coordination	0.8	0.4	0.2	0.5	0.7	0.1	0.4
% increase over partial reform	35.5	31.5	16.6	383.9	34.9	6.6	34.9
Median → 10%							
Overall effect	1.9	1.0	1.0	0.5	1.9	0.5	1.2
Of which: coordination	0.3	0.1	0.1	0.2	0.3	0.0	0.2
% increase over partial reform	15.7	14.5	8.0	54.6	15.5	3.5	15.4

Source: Authors' calculations.

[1]Reported estimates measure annual employment growth impact.

[2]Model A is based on five-year averages, model B on annual data. See Table 1 for details.

[3]FE = fixed effects, RE = random effects, IV = instrumental variable, AB = Arellano-Bond.

[4]Partial policy simulations refers to a move from the 50th to the 10th percentile on the regulation index in one market. Comprehensive reform refers to a simultaneous move to the 10th percentile in both markets.

the effort does not change the result much. Comprehensive reform doubles the impact trivially to between 1.0 and 1.3 percentage points simply because it involves a double effort in both markets.

In addition to the direct effects of deregulation, policy coordination also generates a positive synergy effect as a result of the interaction term identified in the empirical exercise. This effect can be measured by the difference between the sum of partial product and labor market deregulation and a comprehensive reform. On average, coordinating reform efforts across markets increases the estimated employment effects by about 0.15 percentage point in the small-effort scenario (that is, the shift from median to 10th percentile) and by 0.35 percentage point in the large-effort scenario (75th to 10th percentile). And even though the size of the estimated effects varies substantially across models, generally the coordination effects significantly boost the overall effect.

II. Implications for Deregulation Decisions

The empirical results make a strong case for coordinated labor and product market reforms, because both types of deregulation have direct effects as well as indirect interaction effects on employment growth. Optimal economic policy will approach deregulation from a holistic point of view and take all spillovers into account. In contrast, if multiple policymakers are responsible, chances are they act with a partial, market-by-market view and fail to coordinate their deregulation efforts. As a consequence, the resulting policies may yield inefficient results from an employment perspective.

In practice, the regulatory power for product and labor markets is rarely in one place. More often than not, product and labor market regulation are implemented and overseen by different entities—for instance, a national competition authority and a government department in charge of social and labor market affairs. And even at the legislative level multiple decision makers may be involved if, as within the European Union (EU), product market regulation is subject to both national and international authority. A case in point is the EU commission's increasing authority in regulating product markets as exemplified by the EU directive on services markets. In contrast, labor market regulations have remained firmly in national hands with little influence from supranational authorities.

To provide some insight into why coordinated reform may be difficult to achieve despite its benefits, we illustrate the consequences of noncoordinated labor and product market reforms. Specifically, we contrast the outcome of decentralized decision making with the first-best policy in a simple cost-benefit framework. The basic result from the model is that if decision makers are weighing gains from labor and product markets separately (for example, because of separate constituencies), then too much or too little deregulation may occur. Even indirect coordination through sequential decision making does not preempt a suboptimal outcome. The rationale for these results is derived below.

In the model, decision makers compare the benefits from reforms of the labor and/or product markets with their costs. The benefits are represented by a stylized version of the employment equation estimated earlier. The costs are likely to include transaction costs—for instance, frictional unemployment or the cost of moving or scrapping physical capital—that occur when resources are being reallocated to more efficient uses.[19] For the time being, we will leave out political reform costs.

The theoretical model makes a number of simplifying assumptions to illustrate the basic mechanisms at work. First, interaction between policymakers is based on standard noncooperative game theory, in particular Nash and Stackelberg games.[20] Second, we focus on discrete deregulation choices rather than on the optimal level of regulation, asking whether a regulatory authority finds it beneficial to lower the regulatory activity level by a fixed increment.[21] Third, we assume that the marginal costs of such reforms are constant. Although the analysis easily extends to a more general setup, the simple framework is sufficient to explore the more salient features of the problem at hand.

First-Best Policy: A Benchmark

From a social perspective, deregulation policies should be implemented when their marginal benefit exceeds the marginal cost. The stylized facts from the empirical section suggest that employment growth or, more generally, benefits (B) have the general form

$$B = \bar{\alpha} - \alpha_{LM} R_{LM} - \alpha_{PM} R_{PM} + \gamma R_{LM} R_{PM}, \tag{2}$$

where the α and γ terms are positive constants and the R_i, with $i = LM, PM$, are the measures of the level of regulatory activity in the labor and product market introduced earlier. Moreover, based on the impact simulations summarized in Table 5, the net change in benefits stemming from partial reform in either market will be positive; that is, for $i = LM, PM$ we have

$$\alpha_i - \gamma R_{\neq i} > 0. \tag{3}$$

As discussed, without loss of generality, we make a number of simplifying assumptions. First, regulation can take only two values, high and low,

[19]The report of the Australian Productivity Commission (2005) provides a comprehensive account of such costs. Hughes Hallet, Jensen, and Richter (2005) show that high up-front costs can be another barrier to reform.

[20]The modeling framework is reminiscent of oligopoly theory, except that in our case "collusion" among decision makers may be welfare-enhancing. The main reason is that regulatory authorities are assumed to maximize social welfare, albeit from a partial perspective. Here, collusion helps to internalize possible spillovers among their activities.

[21]We derived the theoretical results in both discrete and continuous form models, and both setups yield similar results as far as the optimality of the reform effort. No relevant information is lost using the discrete specification, and we can limit the discussion of the reform costs (about which we have limited knowledge) to a necessary minimum.

$R_i = \{\bar{R}_i, \underline{R}_i\}$. Second, the status quo in both markets is a high level of regulation. Third, the economic cost of deregulation $\bar{R}_i - \underline{R}_i \equiv \Delta R_i > 0$ is a positive constant: $C_i < 0$.

Within this framework, the social planner's decision is best discussed in a stepwise fashion, developing, in turn, the conditions for optimal full reform, partial reform, and keeping the status quo. In a first step, we ask when the planner will implement full reform. In order for the planner to prefer full reform to no reform in either market, the net benefits (taking into account reform costs) in the former case must exceed net benefits in the latter

$$\begin{aligned}&(-\alpha_i \underline{R}_i - \alpha_{\neq i} \underline{R}_{\neq i} + \gamma \underline{R}_i \underline{R}_{\neq i} - C_i - C_{\neq i}) \\ &\quad - (-\alpha_i \bar{R}_i - \alpha_{\neq i} \bar{R}_{\neq i} + \gamma \bar{R}_i \bar{R}_{\neq i}) \geq 0, \end{aligned} \tag{4}$$

which after some manipulation implies

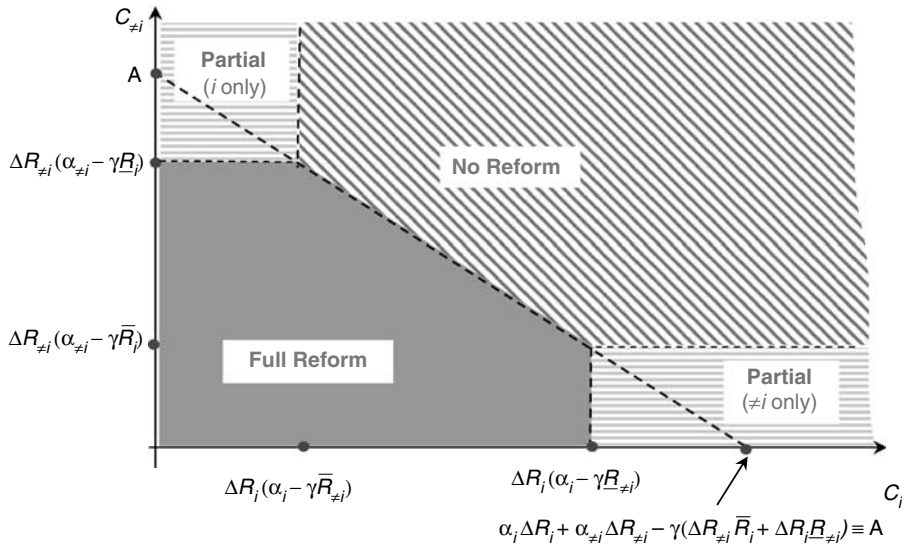
$$\alpha_i \Delta R_i + \alpha_{\neq i} \Delta R_{\neq i} - \gamma(\Delta R_{\neq i} \bar{R}_i + \Delta R_i \underline{R}_{\neq i}) \geq C_i + C_{\neq i}. \tag{5}$$

Using a similar argument the condition for full reform dominating partial reform can be derived as

$$\Delta R_{\neq i}(\alpha_{\neq i} - \gamma \underline{R}_i) \geq C_{\neq i}. \tag{6}$$

When both conditions hold, the planner will deregulate both the product and the labor market. In Figure 1, spanning the space of possible reform cost

Figure 1. Benchmark



Source: Authors' computations.

combinations, this area is shown in the solid gray area marked by relatively low levels of reform costs in both markets around the origin.

Following the same logic, the planner will prefer partial reform of market i over no reform and over full reform if

$$\Delta R_i(\alpha_i - \gamma \bar{R}_{\neq i}) \geq C_i \text{ and } \Delta R_{\neq i}(\alpha_{\neq i} - \gamma \underline{R}_i) < C_{\neq i}. \quad (7)$$

Because of the symmetry of the setup, similar conditions hold for the $\neq i$ market. In Figure 1, the cost combinations (C_i, $C_{\neq i}$) meeting these conditions are depicted by the horizontal-striped areas in the upper left and lower right.

Finally, the planner will choose no reform if the net benefits of full deregulation are negative and, at the same time, exceed the net benefits of partial reform:

$$\Delta R_i \alpha_i + \Delta R_{\neq i} \alpha_{\neq i} - \gamma(\Delta R_i \bar{R}_{\neq i} + \Delta R_{\neq i} \underline{R}_i) < C_i + C_{\neq i} \text{ and } \Delta R_i(\alpha_i - \gamma \bar{R}_{\neq i}) < C_i. \quad (8)$$

In Figure 1, the cost combinations fulfilling both conditions are designated by the downward-striped area to the right of the (A, A) line separating the no reform from the full reform area, and, to the right and above, from the partial reform areas.

We conclude that, in the presence of reform costs, full deregulation may not always be optimal even from a first-best perspective. The social planner will reform both the labor and the product markets when deregulation is associated with symmetrically low reform costs, but the planner may leave regulation at high status quo levels if reform costs are sufficiently high. And, despite the planner's overall perspective, optimal reform may take the form of only partial deregulation in scenarios with asymmetrically high reform costs in either the labor or the product market. The question is, however, how well decision makers with a restricted partial perspective will perform against this benchmark.

Partial Decision Makers in a Simultaneous Game

A plausible assumption is that the separate authorities in charge of labor and product market regulation will not fully internalize the full benefit of labor and product market regulation in determining employment growth.[22] In particular, we assume that the level of private benefits considered by

[22]The objective functions of market regulators can be interpreted as utility functions. Alternatively, one could think also of two bureaucrats maximizing sectoral employment growth functions. In this case, each regulator would consider a production function with the functional form $\Delta E_i = \bar{\alpha} - \alpha_i R_i + \gamma R_i R_{\neq i}$, which adds up to total employment growth $\Delta E = \nu \Delta E_i + (1-\nu)\Delta E_{\neq i}$, where ν is the market i's weight in total employment growth. This may lead to excessive reform activity beyond what the utility function approach implies. Additional results are available on request.

regulators is

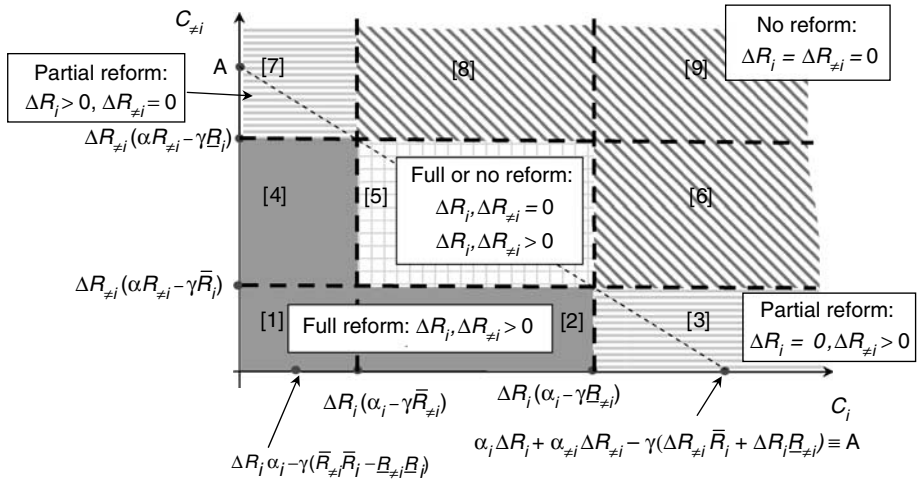
$$B_i = \bar{\alpha} - \alpha_i R_i + \gamma R_i R_{\neq i}, \tag{9}$$

with $i = LM, PM$. That is, even though both regulatory authorities take into account the indirect interaction term premultiplied by γ, they are ignorant of the direct repercussions of the other agency's regulatory activity—that is, the term $\alpha_{\neq i} R_{\neq i}$, present in the social planner's benefit function, is missing in partial decision maker i's target function. This may be the case because, from a political economy perspective, partial authorities will receive public credit only for their private efforts or because they lack the expertise or information to precisely gauge the direct effect of the other authority's regulatory activity on the other market. At the same time, we assume that partial authorities face the same marginal reform costs as the social planner: $C_i > 0$.

What are the consequences of the decision makers' partial perspective when they move simultaneously? The formal analysis (detailed in the Appendix) is quite straightforward. Figure 2 sums up the possible equilibria of the game, showing that partial perspective must not always equal inefficiency. We will discuss the results in turn.

When reform costs C_i and $C_{\neq i}$ are extreme, at least one regulator will follow a dominant strategy, and the simultaneous game produces first-best results. Comparing Figure 2 and Figure 1, this holds true for the full reform and the no reform equilibria at symmetrically low and symmetrically high levels of deregulation costs, where both players implement matching dominant strategies (that is, the gray and the striped areas around [1] and [9] in Figure 2). Familiar from the social planner setup, too, are the partial reform results in equilibria with highly asymmetrical deregulation costs,

Figure 2. Simultaneous Model Equilibria



Source: Authors' computations.

where the dominant strategy for one player is to reform and for the other not to reform (areas [3] and [7]). Finally, in areas [2] and [4], only one of the players follows a dominant strategy, but the other player reacts in line with the first-best policy benchmark.

Incompatibility between partial and social interests can occur, however, when both regulators operate in the intermediate range of reform costs. In area [5], none of the players has a dominant strategy and the incentive to deregulate is determined by the interaction term in each player's private benefit functions. As a result, two Nash equilibria exist. In one equilibrium, neither regulator reforms; in the other, both do. This can lead to either "too little" or "too much" reform from a first-best perspective. Recall that the social planner would opt for full reform only for combinations of C_i and $C_{\neq i}$ below the (A, A) line and abstain from reform for cost combinations above the (A, A) line.[23] Because this threshold does not influence the equilibrium in the simultaneous game, the full reform equilibrium will be inefficient for cost combinations above and the no reform equilibrium will be inefficient for cost combinations below the (A, A) line.

The reason for optimal outcomes consistent with the choices of the social planner is the absence of a trade-off between partial and social interests. A dominant strategy for regulator *i* implies strictly positive net benefits from *i*'s regulatory decision independent of the other player's actions. Obviously, then, in areas [1], [9], [3], and [7], where both partial regulators follow a dominant strategy of reform or no reform, aggregate deregulation costs will always be lower than aggregate benefits, ensuring a desirable result from a social perspective. In areas [4] and [2], only one of the two regulators faces very low reform costs and follows a dominant deregulation strategy. This triggers reform by the other regulatory authority if (and only if) that authority faces deregulation cost in the intermediate range.[24] As a result, full deregulation occurs under low to intermediate levels of deregulation costs, which in the present framework guarantees a socially optimal outcome despite the partial perspective of decision makers.

The expectation for a suboptimal outcome through partial decision making is that partial regulators would treat their counterpart's efforts as exogenous. The social planner takes into account all interaction effects when comparing the net benefits of full and no reform, but a partial regulator looks for an optimal response given expectations of the other regulator's behavior and, thus, ignores possible interaction effects. As a consequence, regulators can be trapped in a no-reform equilibrium despite relatively low reform costs. This is because they fail to internalize the positive benefits of their own deregulation effort on the other market and are unaware of the implications

[23]Refining the Nash equilibrium concept, while requiring additional assumptions, could help eliminate one of the two equilibria in the coordination cost range—albeit without guaranteeing an efficient result.

[24]Higher or lower reform costs would lead us into area [7] or [1], respectively, where one regulator's actions would no longer be influenced by the counterpart's decision.

this may have for the other regulator's deregulation decision. Equivalently, they may be confined to a full-reform equilibrium despite relatively high reform costs because they are ignorant of the repercussions a change of strategy would have in the other market. In a first-best world, regulators would take into account all arguments, opting for a controlled joint reform effort up to a certain aggregate level of reform costs.

Extensions

Sequential game

Deregulation could also take place in a sequential rather than in a simultaneous manner. For instance, effective labor market regulation is often influenced by labor courts, which may reduce the speed of regulatory change in this sector of the economy.[25] Or, if a reduction in employment protection requires changing labor court behavior itself—through changes in the appointment procedure of judges, say—the process will take relatively long. This could translate into a first-mover advantage for the authority overseeing (or initiating) labor market regulation vis-à-vis the product market regulation authority. On the other hand, a hard-negotiated product market deregulation involving multiple national governments (for example, by way of a trade liberalization or EU action) may have the power to reverse relative commitment power, turning the labor market regulation authority into a follower.

From a welfare perspective, introducing sequential decisions has advantages and disadvantages compared with the simultaneous game (see the Appendix for details).[26] A possible advantage is that it allows implicit coordination (or communication) between regulators. The regulator moving first (the so-called Stackelberg leader), not unlike the social planner, internalizes the choice of the other regulator. This helps to avoid the excessive regulation result that can occur in the simultaneous game when both regulators operate in the intermediate cost range (see area [5] in Figure 2).

At the same time, however, the sequential game amplifies the negative consequences of the regulatory authorities' partial perspective. By assumption, the partial authorities ignore the direct reform links between markets. As a consequence, the Stackelberg leader will be less inclined to induce a lower level of regulation in the other market than the social planner in the same situation. This can come to bear in the cost range below the (A, A) line in Appendix Figures A.1 and A.2, where the Stackelberg leader will not allow full reform, even though full reform would be beneficial from a

[25]In Germany, for instance, labor courts play an important role in determining the effective level of labor market regulation (Berger and Neugart, 2006).

[26]The sequential setup assumes that regulators move in sequence, but effects of reforms occur at the same time. In all other aspects—regarding preferences, reform costs, and notation—the model is similar to the simultaneous game.

social perspective. In the simultaneous game, however, full reform was always realized in area [4], and an efficient full reform equilibrium in area [5] was at least a possibility.

We conclude that the sequential results, too, can fall short of the first-best benchmark, suggesting that the inefficiency caused by decentralized reform efforts are not confined to a particular model of decision making.

Political costs

In addition to economic reform costs, political costs may also play a role in deregulation decisions.[27] For instance, interest groups may try to influence the distributional effects of a reform or politicians might take into account the potential loss of votes from the displaced workers and their dependents. The OECD (2004b) also stresses the role of political economy factors.

The introduction of political economy considerations would add another source of inefficiency to the model even without assuming endogenous political costs (see Berger and Danninger, 2005). Consider a single decision maker that, in addition to the economic reform costs considered by the social planner, also takes into account political costs or suffers from benefit myopia introduced by a short-lived political cycle. This would affect the reform decision by shifting inward the boundary between the reform and no-reform areas compared with the first-best solution in Figure 1. At the now reduced level of benefits from deregulation, lower reform costs are required to make deregulation worthwhile. If the inward shift is large enough relative to the level of economic reform costs in both markets, it may cause the policymaker to forgo reforms even though deregulation would be socially optimal.

III. Concluding Remarks

In this paper we provide new evidence of the economic benefits of labor and product market reform. We show for a sample of OECD member countries that market deregulation is associated with a significant increase in aggregate employment growth. The effect relies in part on sizable interactions between labor and product market reforms linking the effectiveness of deregulation in one market to the level of regulation in the other market. Intuitively, liberalizing the labor market generates higher employment growth when the product market is more competitive, and vice versa. Comparable interaction effects have been reported in other studies, and their presence may help

[27]Among the more influential papers on the political economy behind (de)regulation are Stigler (1971); Becker (1983); and Peltzman (1976 and 1989), who stress the role of powerful interest groups. In a voting framework, Fernandez and Rodrik (1991) argue that uncertainty about individual winners and losers can lead to a bias against reforms. Coate and Morris (1999) point out that adjustment to political action might inherently lead to political pressures against (further) changes. Dewatripont and Roland (1995) show that, in a more complex political-economic setup, policy complementarities might be compatible with a gradual (or partial) reform approach, if this helps build support for the overall policy program, and "big bang" reforms are more costly to reverse.

explain why the benefits of structural reforms have differed so much among industrial countries (for example, Kugler and Pica, 2004; and Estevão, 2005).

We find that the employment effects are largest when deregulation includes both labor and product markets, and the estimated employment gains can be sizable. A country moving from median levels of regulation to the lowest decile stands to gain about 1 percentage point in annual employment growth, partially owing to spillover effects from joint deregulation. A caveat is that these findings—although rather robust along many dimensions—are based on a panel with only limited time variation in regulatory indicators. However, key results have been replicated in an alternative data set using regulatory indicators with more time variation but smaller coverage of the economy.

The empirical results seem to suggest ample reason for coordinated labor and product market reforms, but actual regulatory power is rarely in one place. This is true for many EU countries, with the added complication that the EU itself has a say in area-wide competition policy. A possible consequence of this institutional setup may be that separate authorities will fail to fully internalize the consequences of their action for the payoffs of other regulators.

To illustrate the consequences of decentralized reform decisions when regulators have a partial market perspective, we look at a simple theoretical model. Decision makers compare the benefits from reforms of the labor and/or product markets with their economic costs, including, for instance, frictional unemployment or the cost of moving or scrapping physical capital. Benefits are modeled to represent the estimated employment equation.

A number of results emerge. First, socially optimal deregulation will often take the form of a coordinated reform package. Unless deregulation costs are very asymmetric across markets, optimal deregulation is likely to involve both the labor and the product markets and require some form of coordination. Second, compared with this benchmark, decentralized deregulation choices are not always optimal. If decision makers interact simultaneously, there is a chance that reform efforts could be either insufficient or excessive because they fail to take important spillovers of their activities into account. Third, the potential inefficiency of decentralized reform decisions is not confined to a particular model of decision making. For instance, while a sequential setup implicitly helps regulators internalize some of the repercussions of their reform efforts, it also amplifies the negative consequences of their partial perspective. Finally, the introduction of political economy considerations would likely add another source of inefficiency to the decentralized decision-making process.

These findings have interesting policy implications. If welfare-enhancing reforms are sidestepped because of a partial or limited understanding of how benefits are distributed across labor and product markets, education of voters and policymakers can make a difference. For instance, unions might view labor market liberalization in a different light if it were undertaken simultaneously with competition-enhancing product market reforms and

the beneficial interactions between both efforts were sufficiently communicated. The goal would then be to augment the partial objective functions or views of the regulation authorities. A different approach may need to be taken if benefit spillovers are not recognized for political reasons. Here, transferring reform responsibilities to technical experts or other nonpartisan groups and insulating them from political pressures may work well. For sure, there is no simple policy solution, and improving our understanding of reform effects and policy environments should be a priority for further research.

APPENDIX

Simultaneous Game

Equilibria

Assuming a Nash solution strategy, the equilibrium regulation outcome $(R_i^*, R_{\neq i}^*)$ satisfies $W_i(R_i^*, R_{\neq i}^*) \geq W_i(R_i, R_{\neq i}^*)$ and $W_{\neq i}(R_i^*, R_{\neq i}^*) \geq W_{\neq i}(R_i^*, R_{\neq i})$.

Optimal reform strategies

Equilibrium strategies can be determined by deriving the players' reaction strategies at different levels of costs. Appendix Figure A.1 and Table A.1 summarize the optimal strategies and equilibria of the simultaneous game, which are discussed below.

If deregulation costs are prohibitively high, neither player will conduct a reform even if the other market is deregulated: $\Delta R_i(\alpha_i - \gamma \underline{R}_{\neq i}) < C_i$, for $i = LM, PM$. Both players will reform if net benefits are positive, even if the other player does not deregulate: $\Delta R_i(\alpha_i - \gamma \bar{R}_{\neq i}) \geq C_i$. Both cases result in a symmetric equilibrium in dominant strategies.

At cost levels sufficiently high or low for one player, $\neq i$, to have a dominant strategy, partial, joint, or no reform is possible. In this case, player i's reform strategy depends on $\neq i$'s decision. If $R_{\neq i} = \underline{R}_{\neq i}$, i will choose to reform if $\Delta R_i(\alpha_i - \gamma \underline{R}_{\neq i}) \geq C_i$. If $R_{\neq i} = \bar{R}_{\neq i}$, i will choose to reform only if $\Delta R_i(\alpha_i - \gamma \bar{R}_{\neq i}) \geq C_i$.

Finally, both players could operate in an intermediate cost range. In this case, positive net benefits from reform accrue only if the other player also reforms; that is, we have for i: $\Delta R_i(\alpha_i - \gamma \bar{R}_{\neq i}) < C_i \leq \Delta R_i(\alpha_i - \gamma \underline{R}_{\neq i})$, and for $\neq i$: $\Delta R_{\neq i}(\alpha_{\neq i} - \gamma \bar{R}_i) < C_{\neq i} \leq \Delta R_{\neq i}(\alpha_{\neq i} - \gamma \underline{R}_i)$. This situation describes the essential features of a coordination game. Two pure-strategy Nash equilibria exist. (1) *No reform equilibrium*: Assume that player i chooses no reform, $\bar{R}_i$, in equilibrium, then it does not pay for $\neq i$ to deviate from no reform if $\Delta R_{\neq i}(\alpha_{\neq i} - \gamma \bar{R}_i) < C_{\neq i}$. In the relevant cost region this condition always holds. A similar condition holds for player i. Thus no reform is an equilibrium strategy. (2) *Full reform equilibrium*: Assume that player i chooses reform, $\underline{R}_i$, in equilibrium, then it would pay for $\neq i$ to reform as well if $\Delta R_{\neq i}(\alpha_{\neq i} - \gamma \underline{R}_i) \geq C_{\neq i}$, and a similar condition holds for i, and both are fulfilled in the relevant cost region. Thus, full reform is also an equilibrium strategy.

Sequential Game

This variant of the model assumes that deregulation in market i will be determined ahead of market $\neq i$, but (for the sake of simplicity) the effects of reforms materialize at

Table A.1. Summary of Equilibria Involving Dominant Strategies

[1]	Reform dominating for i and $\neq i$:	Full reform
[2] & [4]	Reform dominating for i and $\neq i$ follows and vice versa:	Full reform
[3] & [7]	Reform (no reform) dominating for $\neq i$ (for i) and vice versa:	Partial reform
[6] & [8]	No reform dominating for i and $\neq i$ follows and vice versa:	No reform
[9]	No reform dominating for i and $\neq i$:	No reform

Source: Authors' definitions.

the same time. This leaves us with the following sequence of events for $i = LM, PM$:

Stage 1: i decides on R_i and credibly commits to its decision
Stage 2: $\neq i$ decides on $R_{\neq i}$
Stage 3: simultaneous implementation and payoffs

Under full information and certainty, the equilibrium of the game between the two players, the regulatory authorities in markets i and $\neq i$, can be found by recursively solving the optimization problems.

Deregulation at stage 2

Player $\neq i$'s welfare is $W_{\neq i} = -\alpha_{\neq i} R_{\neq i} - \gamma R_i R_{\neq i} - C_{\neq i}$. Given the sequence of events, player $\neq i$ takes player i's decision as given. If player i does not reform—that is, if $R_i = \bar{R}_i$—player $\neq i$ will reform if $\Delta R_{\neq i}(\alpha_{\neq i} - \gamma \bar{R}_i) \geq C_{\neq i}$. On the other hand, if player i does reform—that is, if $R_i = \underline{R}_i$—player $\neq i$ will reform if $\Delta R_{\neq i}(\alpha_{\neq i} - \gamma \underline{R}_i) \geq C_{\neq i}$. Note that the cost threshold in the latter case, $\Delta R_{\neq i}(\alpha_{\neq i} - \gamma \underline{R}_i)$, is higher than in the former, $\Delta R_{\neq i}(\alpha_{\neq i} - \gamma \bar{R}_i)$. This implies the following decision rule for player i:

$$\text{Reform} \quad \Leftrightarrow W_{\neq i} = \Delta R_{\neq i}(\alpha_{\neq i} - \gamma R_i) \geq C_{\neq i} \quad \forall R_i = \bar{R}_i, \underline{R}_i$$

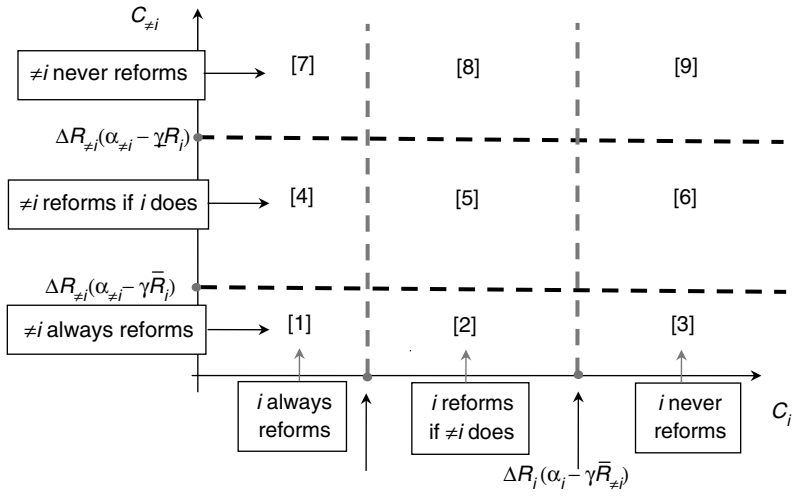
$$\text{No reform} \quad \Leftrightarrow W_{\neq i} = \Delta R_{\neq i}(\alpha_{\neq i} - \gamma R_i) < C_{\neq i} \quad \forall R_i = \bar{R}_i, \underline{R}_i.$$

Deregulation at stage 1

Player i operates under full information, guided by a welfare function symmetrical to $\neq i$'s, $W_i = -\alpha_i \underline{R}_i - \gamma R_i R_{\neq i} - C_i$, and taking $\neq i$'s decision rule into account. In particular, player i's deregulation decision depends on $\neq i$'s response to the first-stage reform decision. We will discuss the three ensuing scenarios in turn. (*a*) *Player* $\neq i$ *always reforms*: In this case, player i will reform if $\Delta R_i(\alpha_i - \gamma \underline{R}_{\neq i}) \geq C_i$. (*b*) *Player* $\neq i$ *reforms only if player* i *reforms*: Given player $\neq i$'s decision rule, player i's choice boils down to choosing between a situation in which *both* players reform and a situation in which *neither* player reforms. Thus, player i will reform and chose the former scenario if $\Delta R_i \alpha_i - \gamma(\bar{R}_{\neq i} \bar{R}_i - \underline{R}_{\neq i} \underline{R}_i) \geq C_i$. (*c*) *Player* $\neq i$ *never reforms*: In this case, player i will reform if $\Delta R_i(\alpha_i - \gamma \bar{R}_{\neq i}) \geq C_i$.

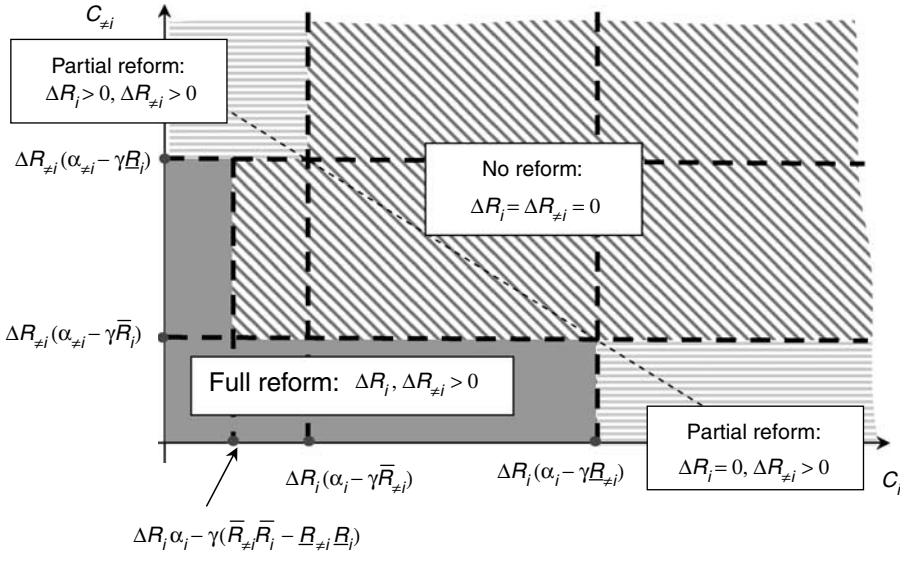
It is straightforward to show that the cost thresholds for the three cases can be ranked: $\Delta R_i \alpha_i - \gamma(\bar{R}_{\neq i} \bar{R}_i - \underline{R}_{\neq i} \underline{R}_i) < \Delta R_i(\alpha_i - \gamma \bar{R}_{\neq i}) < \Delta R_i(\alpha_i - \gamma \underline{R}_{\neq i})$; that is, the cost

Figure A.1. Reform Decisions in the Simultaneous Game



Source: Authors' computations.

Figure A.2. Equilibria of the Sequential Game



Source: Authors' computations.

threshold in scenario (*b*) is smaller than the threshold in (*c*), which is smaller than the one in (*a*). Note that for $(b) < (c)$ we require $\bar{R}_{\neq i}\bar{R}_i - \underline{R}_{\neq i}\underline{R}_i > \Delta R_i \bar{R}_{\neq i}$ or $\bar{R}_{\neq i}\bar{R}_i - \underline{R}_{\neq i}\underline{R}_i > \bar{R}_i \bar{R}_{\neq i} - \underline{R}_i \bar{R}_{\neq i}$, implying $\underline{R}_{\neq i} < {}_i\bar{R}_{\neq i}$, which holds by assumption.

Equilibria and Welfare Analysis

Figure A.2 illustrates the resulting recursive finite game full information equilibria.

Comparing the results with the first-best benchmark (Figure 1), we find the reform effort in the sequential game falls short at intermediate cost levels.[28] Although the partial reform regions marked by horizontal stripes at the top left and bottom right of Appendix Figure A.2 are similar to the respective areas in Figure 1, the (solid gray) full reform area around the origin is smaller than the relevant area determined by the social planner. Also note that sequential decision making implies the impossibility of the excessive reform identified in area [5] of Figure 2 in the simultaneous setup.

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[28]The diagonal line in Figure A.2 replicates the (A, A) line in Figure 1.

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