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Hervé Boulhol

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Hervé Boulhol. International competition and labor market interactions in developed countries. Economics and Finance. Université Panthéon-Sorbonne - Paris I, 2007. English. NNT: . tel-00165106

**HAL Id: tel-00165106**

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UNIVERSITE DE PARIS I PANTHEON – SORBONNE

U.F.R. DE SCIENCES ECONOMIQUES

**THESE POUR LE DOCTORAT EN SCIENCES ECONOMIQUES**

présentée et soutenue publiquement par

**Hervé Boulhol**

**INTERNATIONAL COMPETITION AND LABOR MARKET  
INTERACTIONS IN DEVELOPED COUNTRIES**

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Janvier 2007

L'Université de Paris I n'entend donner aucune approbation ou improbation aux opinions émises dans cette thèse. Ces opinions doivent être considérées comme propres à leur auteur.

# Remerciements

Dans le cadre de mes études, de mon parcours professionnel et de ma thèse, il y a des gens qui comptent. Lionel Fontagné occupe une place spéciale et je souhaite lui témoigner ma profonde reconnaissance. Il a été un directeur subtil sachant tout à la fois me guider et me laisser explorer des pistes de recherche plus ou moins prometteuses, m'y perdre parfois. Je lui sais gré de sa disponibilité pour la présentation de mes travaux, en friches ou plus aboutis. Au-delà de ce rôle, je le remercie bien chaleureusement pour m'avoir associé à différents projets. J'ai apprécié sa modestie, sa bonne humeur, son ouverture d'esprit et la franchise de nos échanges.

Après une douzaine d'années de vie professionnelle dans l'entreprise, j'ai rencontré à Team et dans le monde de la recherche, plus généralement, une capacité d'écoute, une solidarité, une ouverture à l'échange d'idées rafraîchissantes. Nombre de discussions ont alimenté la progression de ma réflexion et je tiens à remercier tout particulièrement Patrick Artus, Pierre Cahuc, Matthieu Crozet, Sabien Dobbelaere, Sébastien Jean, Philippe Martin et Joaquim Oliveira Martins. J'exprime également toute ma gratitude à Jean Imbs et Didier Laussel pour avoir accepté de juger ce travail.

Tout au long de ces travaux, de nombreuses personnes m'ont aidé par leurs commentaires, ou plus simplement par leur disponibilité et leur gentillesse. Je remercie sincèrement Philippe Askenazy, Chantal Bartholin, Olivier Bertrand, Grégory Corcos, Bruno Crépon, Rodolphe Desbordes, Gautier Duflos, David Galvin, Guillaume Gaulier, Keith Head, Pamina Koenig-Soubeyran, Isabelle Laudier, Sara Maioli, Jacques Mairesse, David Margolis, Thierry Mayer, Daniel Mirza, Giuseppe Nicoletti, Thomas Piketty, Glenn Rayp, Frédérique Sachwald, David Spector et Habib Zitouna.

Marie mérite évidemment une mention spéciale. Au cours de ces quatre années, j'ai eu la chance de pouvoir compter sur son soutien de chaque instant, sa souplesse au quotidien, son dynamisme, sa tendresse et ses poireaux vinaigrette. Basile aussi qui, avec son air coquin du genre : « mon p'tit gars ta thèse, c'était une idée d'avant que j'arrive », m'a donné l'énergie de le faire mentir. Enfin je suis reconnaissant à mes parents pour m'avoir très tôt encouragé dans mes études, et je remercie mes amis proches, que l'économie ennuie, pour beaucoup d'entre eux, et qui m'ont aidé sans le savoir.

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## **General Introduction**

What is the difference between domestic and foreign competition? What is the difference when the French region Rhône-Alpes trades with Franche-Comté, Bade-Wurtemberg, the Midlands or California, not to mention Silesia, Minas Gerais or Canton? Is it distance, history, language, a feeling of belonging, scale? Nobody would seriously be opposed to trade between Rhône-Alpes and Franche-Comté. The realities of competition between firms are inseparable from those of competition between workers, which generate both stimulation and stress. Economic theory often represents firms as cold entities, tending to omit that they are, quite literally, embodied in human beings. One central idea developed in this thesis is that, beyond scale, a critical difference may originate in distinct and so-called “social models” between countries, since foreign competition may put pressure on domestic labor market institutions. This is an important topic because labor market institutions are closely related to social relations, themselves deeply rooted in each country’s culture and collective history.

Over the last decade, the debate about the contribution of trade with developing countries to the well documented rise in wage inequality in the USA and the UK seems to have been settled. A broad consensus has emerged that trade contributed to, at most, 25% of the phenomenon, the unexplained part being attributed, by default, to skill-biased technological change. Even the new research emphasizing that this bias in technical progress could itself be spurred by trade (Thoenig and Verdier, 2003) does not seem to have triggered the need to reassess the question. The main workhorse models of trade theory have traditionally exhibited gains from trade for each partner through

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reallocations between sectors or through the dissipation of rents. In both cases, trade has distributive consequences which generate aggregate gains, but pain for some. Notwithstanding the aggregate gains, both gains and pains are commensurate with each other to a certain extent. The more the trading partners differ or the greater the imperfections of competition, the larger the total gains and the dearer the pains for the losers. Nevertheless, some opponents to globalization are very upset with the huge pains without seeing any gain, while the opposite position is as fiercely defended. In any case, one important failure comes from the inability of policy makers advised by economists to implement an effective mechanism using the gains to compensate the would-be identified losers. Spector (2001) shows how opening the economy could generate a conflict between the gains reaped from trade and the loss in the capacity of governments to redistribute them. More deeply, as the twentieth century saw the rise of the welfare states, Laïdi (2004) considers that, in the absence of an efficient global governance mechanism, the loss in national sovereignty is the source of a pervasive anxiety, a “great perturbation”.

As the fragmentation of the value chain is greatly facilitated by the spreading of recent technological innovations and decreasing trade costs, as the emergence of large countries like China, India and Brazil durably shape the world markets, globalization takes on new forms at an unprecedented scale. Beyond its direct effects on wages and employment, Gaston and Nelson (2004) consider that a major source of the social concern about globalization is its transformative nature. That is, “globalization is taken to transform the economic and political structures in ways that might be obscured when we apply the standard toolkit of trade theory” (p. 771). According to Blanchard (2004), it is because product and financial market deregulation put strong pressures on labor market institutions that the national governments of EU countries have delegated the power to deregulate to the European Commission, which attenuates the risk of a reversal. Since the early ‘seventies, the economies of the developed countries have profoundly changed, potentially affecting the labor market structures. On average across countries, import and export ratios have increased by more than 13 points of GDP, on a 0 to 6 scale the index of product market regulation calculated by the OECD has been reduced by 2.5 points, stock market capitalization as a percentage of GDP has been multiplied by 7, the inflation rate has decreased by 5 points, the share of manufacturing employment in total employment has lost 8 points.

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Peyrelevade (2005), an advisor to the French socialist Prime Minister Pierre Mauroy in the early 'eighties, a professor of economics and Head of large financial institutions, considers that financial globalization has contributed to a shift of the Rhenish model towards Anglo-Saxon capitalism by altering the relationship between managers and shareholders. According to Peyrelevade, managers' objectives are now closely in line with shareholders' interests, whereas they used to take into account, with some discretion, the social value of the firm, a vague notion encompassing the interests of workers, suppliers, customers, lenders and shareholders.

Within the last two years, especially in Germany and France, competition from Eastern Europe seems to have goaded workers into accepting less favourable conditions. For example, in the car industry which is facing saturated markets in developed countries, Volkswagen's and Opel's management invoke that global competition requires drastic cuts in labor costs and succeed in enforcing wage moderation. In September 2004, Volkswagen had just started a negotiation with the largest German union, IG Metall, with the declared objective of reducing labour costs by 30%. In a press conference, the carmaker's Director of Human Resources, Peter Hartz who has since become the instigator of the Hartz I to IV German labor market reforms, said: "Times have changed, we need new and creative solutions. [...] We cannot isolate ourselves from the situation of worldwide competition".<sup>1</sup> It is difficult to know if these changing times reflect the impact of increased competition on long lasting rents, as predicted by trade theory, or a shift in the bargaining power detrimental to workers, and indeed these two possibilities may be intertwined. In the USA, under intense pressure from their Japanese competitors, the Big Three started, in September 2006, to renegotiate the generous health and pension plans granted to their workers with the powerful United Auto Workers union. After Siemens initiated the move in Germany in June 2004, the threat of relocations has been driving employees at Bosch and Fenwick, among others, in France to accept longer working hours at the same monthly wage, a development with few precedents in recent economic history. Although rather isolated, the symbolic weight of these measures has brought the interactions between product market competition and the balance of power in the labour market to the forefront.

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<sup>1</sup> Quoted from the newspaper Les Echos, 08/24/04, my translation.

## GENERAL INTRODUCTION

In many countries competition is at the top of the political agenda. The rise in competition in the EU due to the single market and participation in the world trade markets have often been seen as a source of efficiency gains. Competition is a prominent concept in the economics literature. **The subject of this thesis is the impact of international competition on the product and the labor markets in developed countries.** The first part analyzes the impact of international trade on market power in the product market, whereas the second part investigates the interactions between globalization and the labor market.

The **first part** deals with the trends in price-cost margins (PCMs) in the context of the increasingly opening OECD economies. The idea that trade increases competition is often considered as the oldest insight in the area of trade policy under imperfect competition (Levinsohn, 1993). Before specifying what this pro-competitive effect means, let us start with what sounds like a more basic question: what is competition? Boone (2000) insists that a coherent definition is still missing. Indeed, the theoretical literature parametrizes competition in different ways: a reduction in entry barriers, a switch to a more aggressive interaction between firms, e.g. a move from Cournot to Bertrand competition, a rise in the elasticity of substitution between firms' goods. On the other hand, the empirical literature generally measures competition with industry concentration, number of firms, PCMs, markups, profit ratios, etc. However, Boone stresses that these measures are not systematically monotonous in a given theoretical parameter. This is because, as detailed in Sutton (1991), the market structure is endogenous to the competitive environment. For instance, if goods become more substitutable the least efficient firms might be forced to exit, which would raise concentration. Therefore, a fall in the number of firms can be caused by either a decrease in competition (higher entry cost) or an increase in competition, as in this example. Boone finds that two results are robust outcomes of increased competition defined by either of the parameters above. Firstly, competition reduces the profits of the least efficient firm in the market. Secondly, it increases the profits and output of any firm relative to the profits and output of a less efficient one.

The pro-competitive effect of trade is the idea that imports increase competition specifically by bringing prices closer to marginal costs, thereby reducing market power. Although an old idea, it has only been

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formalized recently with the 'new' trade theory of international trade which introduced imperfect competition to account for the prominence of intra-industry trade. This mechanism operates through the increase in the elasticity of the demand perceived by firms facing import competition. Clearly, under the assumption of identical firms, Boone's first result implies that the PCM of each firm is reduced by increased competition, whatever the definition.

However, if firms differ in efficiency, as in the 'new new' trade theory (Baldwin, 2005) stressing the heterogeneity of firms, the second result indicates that less efficient firms suffer more than more efficient ones, which does not exclude that some firms are better off when competition intensifies. This result comes from the reallocation of profit and output between firms and has become commonplace due to the expanding audience of the literature on firm heterogeneity (e.g. Melitz and Ottaviano, 2005, Bernard, Eaton, Jensen and Kortum, 2003). It captures the Darwinian metaphor that competition magnifies the consequences of the differences in costs or efficiency between firms by punishing the laggards more severely. To the extent that the most efficient / larger firms have the highest markups, the reallocation effect tends to mitigate the negative impact of trade on market power. This literature highlights also that the lowering of foreign protection creates new markets for the most efficient firms, which is most likely to improve their margins, but this foreign market access effect channels through exports.

Importantly, import competition operates specifically through the effective entry of new competitors which displace low efficient firms because the former are more efficient. Therefore, overall, domestic producers are likely to face a fall in their domestic market share and perceive their demand elasticities as rising as a result of lower domestic protection, making the pro-competitive effect of trade a theory's strong prediction. In other words, even though domestic concentration might increase, global concentration of active firms in the domestic market is bound to decrease.

The pro-competitive effect of trade is an important topic of research because it is one of the sources of the usual gains from trade, as exemplified by the reciprocal dumping model of Brander and Krugman (1983). Reducing firms' market power, i.e. distortions due to imperfect competition, is beneficial because, as relative marginal costs move closer to relative marginal utilities, it triggers a better

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allocation of resources between sectors. This is a strong presumption which is as close as we will get, in this first part, to the relation between competition and welfare. Let us just mention, however, the recent contribution of Aghion et al. (2005). When the dynamic impact of competition on the innovation effort is factored in, the relation between competition and welfare needs not be unequivocal. Aghion et al. show that there is a conflict between the Schumpeterian forces by which competition is bad for growth as it deters innovation and the “Darwinian view” that competition forces firms to innovate in order to survive. They find an inverted U-shaped relationship between competition and innovations, the positive effect dominating at lower levels of competition while the Schumpeterian effect have the upper hand at high initial levels of competition.

By narrowing the focus on the pro-competitive effect of international trade, it is acknowledged that other channels through which foreign competition has an impact on efficiency are not investigated. This is the case of the positive contribution of the reallocation effect on aggregated productivity, central to the firm heterogeneity literature. Another distinct mechanism links trade liberalization to firms’ technical performance by reducing X-inefficiencies, independently of firms’ pricing behaviour. Caves (1980, p.88) points that the “economists’ vague suspicion that competition is the enemy of sloth can be specifically documented in the effect of competition on the decision-making structures and control devices used by firms”. A more competitive environment might reduce agency problems when ownership is separate from management and induces management to higher efforts, as in Horn, Lang and Lundgren (1995).

**Chapter 1** focuses on the methodologies used to estimate markup *levels*. The extent of market power is a key parameter in such important areas as competition, monetary and trade policies. Hall’s (1986, 1988) seminal contribution was to show how imperfect competition creates a wedge between the Solow residual and the growth rate of true total factor productivity. Moreover, market power magnifies the impact of demand shocks on the usual measures of productivity growth, which can explain the magnitude of economic fluctuations from smaller shocks than required in the real business cycle theory. Hall’s method to estimate markup of price to marginal cost has been widely used, however intricate simultaneity issues are well identified and not satisfactorily solved when the exercise is carried out using sector level data.

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The interest in the price-based method proposed by Roeger (1995), derived from the difference between the (primal) Solow residual and the residual of the dual cost function, is to avoid these econometric difficulties, and therefore provides an appealing framework frequently used in the empirical analyses. However, several studies point to an “anomaly”. Indeed, capital services and user cost are well known to be difficult to measure. As Euler’s equation links the markup to the factor shares in output, one can infer the capital share from the markup estimate and the data-based labor and material shares. It turns out that these implied capital shares often run into negative territory, a feature also found herein.

The main contribution of Chapter 1 is to elucidate this puzzle by showing that the price-based method leads to an overestimation of markups. In total, although the price-based method appears less sensitive to the econometric issues which weaken the scope of Hall’s approach with sector data, its limitations might be more profound as the price-based equation is misspecified when capital is quasi-fixed. These results qualify Klette’s (1999) who was suspicious of the advantages of this price-based method compared to more direct measures like PCMs, extensively used in the Structure-Conduct-Performance literature to infer the impact of concentration and foreign competition on market power.

**Chapter 2** is dedicated to the analysis of the trends in PCMs for 132 country x sector pairs of OECD manufacturing industries between 1970 and 2000. As the extension of globalization is probably the main striking feature of these last decades, one would have expected from the impact of intensified competition a general decrease in PCMs. Instead, although the results are consistent with a deeper economic integration of the developed countries, the pattern which emerges from the analysis is clearly distinct from these expectations.

For most of the time series, the changes in the structural PCM over the period are significant, and two main results stand out. First, there is no common trend toward lower PCMs, not even on average. In fact, the average PCM at the end of the period is not lower than at any previous year. The only period where PCM declined is in the ‘seventies and inflationary pressures were probably the main driver. Second, there is a clear pattern of convergence in PCMs across both sectors and countries. The initially high PCMs decreased on average, which is consistent with the impact of increased

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competition that should have induced a convergence to the bottom of the range. In contrast, initially low PCMs increased on average, which entailed a tendency of the PCM distribution to collapse toward the average: over the period, the dispersion of the PCMs declined by around a third. Naturally, the improved efficiency of capital markets is a good candidate to explain this convergence.

These results have a clear implication. Either the pro-competitive effect due to increasing imports did not materialize or there existed some counterbalancing influences, and **Chapter 3** has two main objectives. The first is to pay a specific attention to the quantification of this 'imports-as-market-discipline' hypothesis, based on the theoretical prediction, the empirical evidence assembled to date and the contribution of the current analysis. The sample used in the first two chapters has been extended up to 2003 and to seventeen OECD countries. This is the first attempt to assess the pro-competitive effect on such a large panel, the closest exercise being that of Chen, Imbs and Scott (2004, 2006) for seven European countries. The second objective is to study the other determinants of the PCMs and understand why, despite increasing openness, PCMs have not declined overall.

A simple model is developed comprising fairly general assumptions: price rigidities, labor market imperfections, differentiated goods, firm heterogeneity and conjectural variations. What is then the impact of say a ten points increase in the import ratio, which is slightly less than the actual average change over the period? In the case of Bertrand competition, the effect is negligible: there is not much to discipline. However, if competition is Cournot, then the effect varies from zero if the competition is monopolistic to as much as a decrease of five points in the PCM if the sector is highly concentrated. To get a better sense of what this order of magnitude means, it is worth referring it to the average PCM level in the sample of around 0.12. Based on the model, the sensitivity of PCM to the import ratio lies in a  $(-0.5, 0)$  range depending on the various parameters.

The chapter includes a survey of twenty three studies estimating the pro-competitive effect of trade since the 'seventies. There is clearly some evidence of the 'imports-as-market-discipline' hypothesis, but it is not overwhelming, especially given the strength of the theoretical intuition highlighted above. When found, the average sensitivity is -0.14 when trade is considered as exogenous and -0.29 when instrumented (only four studies), in the middle of the theoretical range. Taking the endogeneity of the



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import variable into account is important because a high PCM attracts foreign firms, which creates a *positive* relationship between PCMs and imports. Therefore, ignoring this endogeneity leads to an underestimation of the (absolute) impact.

The new empirical evidence in this chapter provides a robust support in favor of the assumption that foreign competition curtails domestic market power in import competing industries. The estimated sensitivity of around -0.5 / -0.4 lies in the top of the theoretical range and is consistent with Chen et al.'s findings. This would imply a large decrease of four / five points in the PCMs on average over the period. In addition, the deregulation trend in domestic product market competition, mostly common to OECD countries, reinforces this tendency to lower markups. However, this is the second important result, these effects are found to be almost entirely counterbalanced overall by the impacts of disinflation, exports and financial deepening.

The **second part** of this thesis focuses on how international competition in the product market interacts with the labor markets in the developed countries. In the Heckscher-Ohlin-Samuelson framework, international trade affects employment through reallocations between sectors, and wages through the Stolper-Samuelson mechanism. These are the *direct* effects of trade on a perfect labor market according to the comparative advantages. Moreover, with imperfect competition, taking into account the rent-sharing between workers and shareholders, wages in import competing industries are also directly hit due to lower rents. However, there seems to be a growing acknowledgement that, beyond these direct effects, the *structure* of the labor market is not left unchanged by globalization, i.e. that trade and foreign direct investment put pressure on labor market institutions.

Labor market institutions is a notion which takes many forms. They shape social relations within a country and serve such diverse functions as insurance against risks affecting the labor market, improvement of the working conditions and economic efficiency. Of course, they can be related to the capital / labor struggle over rents, but Saint-Paul (2004) stresses that they are probably as much related to a conflict between insiders and outsiders. Also, in the case of the minimum wage for

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instance, labor market institutions create an equilibrium in which low skilled workers are in a better situation than in a purely market-oriented labor market.

In models which feature trade between a flexible labor market economy and a binding minimum wage economy, this second best situation, i.e. the presence of distortions, prevents the extension of the usual gains from trade reasoning. Brecher (1974), Krugman (1995) and Davis (1998) all warn that the initial distortion is in fact amplified by trade, leading theoretically to a dramatic increase in the unemployment rate in the minimum wage country. Such a situation would necessarily contribute to undermining the support for the institution, when the economy is opening up.

Another prominent parameter in the economists' representations of labor market institutions is workers' bargaining power, which is not directly observable. Therefore, identifying shifts in the bargaining power is not an easy task. In addition, we still lack a well founded theoretical framework of the determinants of bargaining power. Here are some intuitions. Rodrik (1997) stressed two channels through which globalization could weaken workers' bargaining power. Firstly, fiercer international competition means that domestic and foreign workers are closer substitutes, which leads to an increase in the elasticity of labor demand. This in turn renders wages more responsive to external shocks, thereby increasing the volatility of earnings and the feeling of insecurity. Secondly, new investment opportunities strengthen the bargaining position of shareholders by upgrading their outside options. Scheve and Slaughter (2002) provide evidence that FDI has increased the workers' perception of economic insecurity, while Fabbri, Haskel and Slaughter (2003) show that labor demand for less-skilled workers has become more elastic in the UK and US manufacturing industries.

A competitive environment makes it more difficult to pass on any cost due to labor market regulation to customers. Tensed by competition, the management is likely to adopt a tougher stance in bargaining. The pro-competitive effect itself may also contribute to the decline in the bargaining power and in union participation. Indeed, as union premium depends positively upon the size of the rents, dwindling rents act as a disincentive to unionize, hence a fall off in union participation and therefore in the bargaining position of the unions. Let us take the example of the steep decline in union density in the United Kingdom from 57% to 29% over the last thirty years. It is sometimes argued that the

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composition impact of deindustrialization is a driving force, however Machin (2003) finds that only 20% of the decline is due to the composition change. Pencavel (2004) documents how the changes in the legal and political framework in the 'eighties and 'nineties were undoubtedly detrimental to union membership, but he also stressed that it is the *context* of fiercer product market competition which determined the *impact* of the new laws. Hornstein, Krusell and Violante (2005) suggests that, as union density did not fall in the public sector, competitive pressure reasonably seems a cause of overall deunionization.

In addition to simple shifts in the demand for labor, globalization might also be changing the nature of the employment contract. Bertrand (2004) finds evidence that import competition induces a switch in the employment relationship, from implicit agreements between employers and workers over wage setting to a more spot market transaction.

Most of the studies evaluating the pro-competitive effect of trade are based on the assumption of a perfect labor market. Ignoring rent-sharing leads to an underestimation of market power because then only the share kept by firms is accounted for. **Chapter 4** uses an extension of Hall's approach embodying wage bargaining to estimate both the markup and the bargaining power from UK firm data covering the 1988-2003 period. Estimating these two parameters jointly has never been carried out before for the UK. A significant drop in both parameters is found in the mid-'nineties. Evidence is provided in support of what we call 'the import-as-product-and-labor-market' hypothesis, i.e. the idea that trade might curtail market power in the product as well as in the labor market.

When the origin of the imports is differentiated, only imports from *developed* countries contribute to these changes. At the core of the pro-competitive effect on markup is imperfect competition and intra-industry trade, which arguably characterize trade with developed countries better. In addition, the differentiated impact on workers' bargaining power might be due to the fact that, because of similar characteristics in terms of education, productivity and skills, foreign workers in developed countries are more substitutable through imports to UK workers than those in developing countries. Alternatively, Greenaway, Hine and Wright (1999) suggest that it is difficult to find an impact of imports

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from developing countries on the UK labor market since the 'eighties because the competition from developing countries is in industries that had already declined in the 'seventies.

Even through its direct effects on employment, international trade could have a “structural” impact if it alters the broad composition of the economy by fostering deindustrialization. The civil society, as well as numerous commentators and politicians, are often associating offshoring, and more generally competition from developing countries, with the observed decline in the manufacturing employment share. **Chapter 5** evaluates the contribution of trade with developing countries to deindustrialization in developed countries between 1970 and 2002, updating a previous estimation by Rowthorn and Ramaswami (1998) for the period 1963-1994 and upgrading the econometric methodology. Three results stand out.

First, deindustrialization is mostly an internal phenomenon which originates in the intrinsic faster productivity growth in the industry relative to services. Combined with an elasticity of substitution between goods and services lower than unity and with the saturation of the relative demand for industrial “things” from a certain level of average income, technological development naturally triggers the relative decline in manufacturing employment. Second, trade with developing countries has a significant impact averaging a contribution of 20% to the decline of the manufacturing employment share across the sixteen countries under study. The econometric analysis highlights that, due to the different factor contents of exports and imports, balanced trade with developing countries is associated with employment losses. Third, when the period is split in two, the sensitivity of deindustrialization to the trade with the South does not appear greater since the mid-'eighties. However, the overall impact is twice as large in the second sub-period due to the expansion of imports.

Work at the OECD shows that product and labor market (LM) deregulations are correlated across countries. In fact, trade and financial market reforms have generally preceded domestic product market reforms, themselves preceding LM reforms. The main purpose of **Chapter 6** is to formalize how opening the economy can put pressure on LM institutions. Since the seminal paper by Blanchard and Giavazzi (2003), the closest study to this focus is that of Ebell and Haefke (2006) who develop a

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theoretical model endogenizing the bargaining regime. They show how intensified product market competition induces a shift from collective to individual bargaining and suggest that the strong decline in coverage and unionization in the US and the UK might have been a direct consequence of product market reforms in the early 'eighties.

Since the early 'nineties, while geography models have been widely used to analyze European integration, the distinct features and heterogeneity of European LM regulations have been discarded in this literature. The proposed theoretical model in this last chapter is a first attempt to introduce LM imperfections within an economic geography framework, embodying efficient bargaining into the Footloose Capital Model, which generates a segmented LM à la McDonald-Solow. Moreover, endogenized LM institutions reflect social preferences and social partners decide upon the level of LM regulation based on the extent of their pro-labor inclination.

In this model, LM regulation increases wages in the rent / unionized sector at the cost of unemployment and lower capital return. When the domestic country opens its economy to a trade partner which has a totally deregulated LM, because of its own preferences, capital flows are subject to two forces. As differences in labor costs between countries totally reflect differences in productivity, absent any LM regulation, capital would flow from the small / poor to the large / rich country, because of the market size effect. Secondly, LM regulation tends to trigger an outflow of capital. The resulting optimal level of regulation, from the point of view of social partners, depends on the level of goods market integration. Above a certain threshold level of integration, LM protection is ineffectual as rents are transferred abroad and LM regulation just makes imported goods more expensive. Therefore, opening the economy induces the social partners to endorse deregulation: the driver of these changes is the *threat* of relocations, which is more efficient when trade costs are low and results in minimal *actual* relocations. Even the more pro-worker social partners, who therefore choose to highly regulate in autarky, opt for a totally deregulated LM when trade costs are very low.

In sum, with capital liberalization, barriers to trade could be harmful, especially if the LM is highly regulated, and therefore, capital mobility renders trade liberalization critical. In turn, falling trade costs reinforces agglomeration and triggers LM deregulation. In addition, if the foreign country has also a

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regulated LM, non-cooperation between social partners across countries entails a race to deregulate. Therefore, this model suggests that liberalization measures should be thought of as tied to the LM deregulation they trigger. This combination might be well accepted by countries with initial low protection. However, countries that attached importance to LM protection may face a difficult situation once engaged in the liberalization process. Conversely, a government, which is prone to liberalize on all fronts, could start with capital, which makes trade protection very costly, then follow with trade openness which eases the burden of high import prices and finally let the social partners, potentially undergoing this new environment, opt for LM deregulation and support further trade liberalization in their own interests.

## **Part I**

# TRENDS IN PRICE-COST MARGINS AND THE PRO-COMPETITIVE EFFECT OF TRADE

## Chapter 1

# Methodology Issues in the Estimation of Markups Using Sector Data<sup>1</sup>

### 1.1. Introduction

The level of markup over marginal cost provides an indication of the degree of imperfect competition, a question of paramount consequences in different fields of economic theory. It is central to the measure of true productivity growth, to our understanding of the causes of macroeconomic fluctuations and of the shape of market structures. Therefore, markup estimates are a valuable input for the conduct of economic policy, especially for monetary and competition policies.

Starting from the question “Why is productivity procyclical?”, Basu and Fernald (2000) explain why economists care about the quantification of imperfect competition. The real business cycle theory emphasizes that changes in productivity are the main explanation for aggregate fluctuations and downplays the impact of price-wage rigidity and market imperfections. Conversely, the Keynesian tradition gives more importance to demand shocks and its explanation of procyclical productivity relies

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<sup>1</sup> This chapter is based on Boulhol H., 2006, “The Upward Bias of Markups Estimated from the Price-based Methodology”, revised from the working paper TEAM, 2005.55, Cahiers de la MSE, with the same title.



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on the slow adjustment of labor inputs. However, Hall (1986) shows that even the hypotheses of labor hoarding or overhead labor must refer to imperfect competition in order to account for procyclical productivity. Shapiro (1987) outlines that, even though one might not share Hall's interpretation based on demand shocks, his contribution is to highlight the role of imperfect competition in amplifying their impacts. In other words, because market structure is important for the propagation of macroeconomic shocks, the amplitude of the shocks consistent with the size of the observed fluctuations is lower under imperfect competition than in the real business cycle explanation which relies solely on shifts in the production function.

The degree of market power also reveals the extent of the inefficient allocation of resources in the economy and could be linked to the employment performance of a country. Therefore, reducing the size of rents is the primary target of product market deregulation, and one of the important sources of the gains from trade in the "new trade theories" stems from the impact of foreign competition in reducing markups, the so-called pro-competitive effect of international trade. Moreover, the difference between markups over marginal costs and profit rates highlights the extent of fixed costs in the industries, valuable information on market structures.

Considering such profound questions, the main conclusion of this chapter, i.e. the upward bias of markups obtained from one common estimation method, although modest, is relevant for a more precise quantification of market power. The bottom line is that, in a given industry, a markup of say 1.10 has very different quantitative implications than one of 1.20. As Basu and Fernald (2000) insist, we care about the level of markups because this parameter has important consequences on the workings of dynamic equilibrium model used by macroeconomists of all persuasions.

Let us quickly review the genesis of the central issue in this chapter. Industrial economics is indebted to Hall (1986) for estimating markups at sector level. Hall's key insight was to show that, due to imperfect competition, the Solow residual is an inadequate measure of technical progress and, more precisely, the sum of a pure technology component and a markup component. This relationship was the core of an innovative method to estimate markups. Roeger's (1995) starting point was to focus on the stylized fact highlighted by Shapiro (1987) of a poor correlation between the (primal) Solow

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residual and the residual of the dual cost function. Assuming perfect competition, Shapiro advocates that the fixity of capital is the main explanation for this poor correlation. Extending Hall's insight to the dual productivity measure, Roeger provides an alternative explanation. He shows that, by controlling for imperfect competition, the two productivity measures are in fact highly correlated. As a by-product of his analysis, Roeger proposes a new methodology to estimate markups that circumvents intricate endogeneity issues in Hall's approach. In fact Roeger's method only identifies the ratio of the markup to the returns to scale, i.e. the markup over average variable cost which coincides with the markup over marginal cost under constant returns to scale. Both approaches have further been improved to take into account Basu's (1995) contribution, highlighting the importance of paying greater attention to materials. Basu and Fernald (1997, 2000) have further insisted that proper markup estimates should be based on gross-output rather than on value-added. Moreover, they have shown that the level of aggregation matters, without denying the interest of computing markups at aggregated levels.

Because Roeger's methodology overcomes certain econometric difficulties in Hall's, it represents an appealing framework, extensively used in empirical analyses. However, it turns out to have problems of its own. From Euler's equation and first order conditions on profit maximization, the sum of factor shares in total output is directly linked to the markup. Hindriks, Nieuwenhuijsen and de Wit (2000) and Oliveira Martins (2002) use this relationship and note that the level of markups estimated by Roeger's methodology is too high, as capital shares implied from the estimated markups are unrealistically low, even often negative, a feature confirmed by the empirical analysis herein. No justification for this pattern has been put forward to date. The purpose of this chapter is to contribute to elucidating the puzzle raised by the too high level of markups estimated by Roeger's methodology. Three theoretical explanations are provided. The choice of normalization, capital quasi-fixity and measurement error in capital expenditures, each of these three elements is shown to bias Roeger-type markup upwards. The empirical analysis based on 129 OECD two-digit time series will show that these three explanations are complementary.

The choice of normalization is a well known issue in cointegration literature. In a nutshell, estimating the Lerner index (reverse regression) as in Roeger's original estimate, from which the markup is

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deduced, or the markup directly (forward regression) makes a noticeable difference. The econometric relationship is such that markups derived from the Lerner index estimates are greater than those directly estimated. Moreover, it is argued, following Bartelsman (1995) using Hall's approach, that the forward regression ought to be preferred.

However, even after accounting for the difference due to the choice of normalization, the puzzle, albeit attenuated, remains. The mismeasurements of the capital services and of the user cost are known to be a serious concern. Under fairly general assumptions, measurement error tends also to bias Roeger's markup upwards. Indeed, the change in capital expenditures appears on both sides of Roeger's equations in such a way that the bias caused by mismeasurement is an amplification bias.

Without downplaying the contribution of measurement error, the latter does not seem to be sufficient to explain the magnitude of the problem. Indeed, an upper bound for the markup is given by the inverse of the sum of average labor and material shares in output. However, in most of the 129 country x sector series in the sample, Roeger's estimated markup is not significantly different from this upper bound. Importantly, this stylized fact is consistent with the case of capital fixity. It is shown here that, when capital is fixed, Roeger's estimate does not lead to the markup over marginal cost (even under constant *total* returns to scale) but to markup over the average cost of *variable* inputs, i.e. the markup over marginal cost divided by the returns to scale on the *variable* inputs only. Therefore, markup over marginal cost is overestimated to the extent that the returns to scale on the *variable* factors are decreasing. In the case of fixity, the marginal revenue of capital is not equal to its user cost and the first order condition on capital is irrelevant. It is therefore incorrect to link capital share to the markup. Although Roeger himself notes that "Hall's original method for estimating the markup does not require the use of capital costs and may therefore be more robust by allowing for cases in which capital is a true fixed factor of production", although the slow adjustment of capital is a widespread working hypothesis in both the theoretical and empirical literature, the quantitative impact of quasi-fixity on price-based markup measures has so far either been ignored or underestimated.

The three causes highlighted above combine to provide complementary explanations for the "anomaly" noted by Hindriks et al. The chapter is organized as follows. Section 1.2 presents the primal

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approach due to Hall and the price-based approach innovatively developed by Roeger. Section 1.3 addresses the normalization issue, Section 1.4. treats the case of quasi-fixity and Section 1.5 assesses the impact of the mismeasurement of capital. Section 1.6 provides the empirical evidence and finally, Section 1.7 concludes.

### 1.2. Hall-type and Roeger-type regressions

The common framework assumes a homogeneous production function:

$$Y = A \cdot F(K, L, M) \quad (1)$$

where  $Y$  is output,  $K$  capital,  $L$  labor,  $M$  materials and  $A$  a productivity term.

#### 1.2.1. Primal approach

The logarithm differential of any given  $Z$  variable is denoted  $dz$  and  $e_i$  is the elasticity of output to factor  $i$ . Differentiating (1) leads to:

$$dy = e_k \cdot dk + e_l \cdot dl + e_m \cdot dm + da \quad (2)$$

Euler's equation links the returns to scale,  $x$ , to the elasticities:

$$e_k + e_l + e_m = x \quad (3)$$

Substituting in (2) the elasticity of output to capital derived from (3) entails:

$$dy = e_l \cdot (dl - dk) + e_m \cdot (dm - dk) + x \cdot dk + da \quad (4)$$

Finally, using the first order profit maximization conditions on the labor and material inputs,  $e_i = \mu \cdot a_i$  for  $i = L, M$ , establishes Hall-type specification, where  $a_i$  denotes the share of factor  $i$  in output and  $\mu$  the markup over marginal cost:

$$dy = \mu \cdot [a_L \cdot (dl - dk) + a_M \cdot (dm - dk)] + x \cdot dk + da \quad (5a)$$

In terms of the Solow residual,  $SR$ , equation (5a) is equivalent to:

$$SR \equiv dy - a_L \cdot dl - a_M \cdot dm - (1 - a_L - a_M) \cdot dk = (\mu - 1) \cdot [a_L \cdot (dl - dk) + a_M \cdot (dm - dk)] + (x - 1) \cdot dk + da \quad (5b)$$

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The important point is that equation (5) is established without assuming that the marginal revenue of capital is equal to its user cost. Therefore, the Hall-type equation is valid even if capital is slow to adjust. In addition, it firstly makes it clear, how imperfect competition amplifies changes in output compared to changes in factor inputs (at constant capital stock), rendering *measured* productivity, i.e.  $SR$ , pro-cyclical. Secondly, it emphasizes that market power creates a wedge between true and measured productivity, i.e. between  $da$  and  $SR$ , even when returns to scale are constant.

The main difficulty in estimating Hall-type equations lies in the potential correlation between the TFP-growth term,  $da$ , and the RHS variables. The problem arises because the productivity shocks are unobserved by the econometrician but not necessarily by the firms which might, at least, anticipate them before choosing their factor inputs. In this case, OLS estimates are likely to be biased. This issue is common to empirical works on production functions, discussed at length by Griliches and Mairesse (1998). Estimation must therefore rely on instrumental variables, but finding an efficient and valid instrument is a cumbersome task. Most proposed in the literature, like military spending or energy prices, have been criticized. With firm-level data, the Generalized Method of Moments may enable one to overcome the difficulty, however, at a more aggregated level, this solution is not an option. The main interest in the price-based approach proposed by Roeger is to avoid this problem by cancelling the TFP-growth term.

### 1.2.2. Price-based or dual approach

The price-based approach requires that the first-order condition on capital applies, i.e.  $e_K = \mu a_K$ .

When capital cost is allocative, Euler's equation (3) entails that the factor shares are linked:

$$a_K + a_L + a_M = x / \mu \quad \Rightarrow \quad a_K = x / \mu - a_L - a_M \quad (6a)$$

$$\text{i.e.} \quad P.Y = v. (R.K + W.L + Q.M) \quad (6b)$$

where  $v \equiv \mu / x$  stands for the markup adjusted for returns to scale,  $P$  being the price of output, and  $R$ ,  $W$  and  $Q$  the factor prices. As shown by Oliveira Martins, Scarpetta and Pilat (1996), Roeger's specification can be obtained by differentiating (6b) and by using the capital share inferred from (6a):

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$$dpy - drk = v \cdot [a_L \cdot (dwl - drk) + a_M \cdot (dqm - drk)] \quad \text{which is denoted} \quad dx = v \cdot dz \quad (7)$$

with  $dx$  and  $dz$  being the respective LHS and RHS variables of equation (7). Reading (7) literally, Roeger's equation links the markup to the sensitivity of the capital share to the changes in relative factor shares. In fact, Roeger estimates a specification equivalent to (7) but expressed in terms of the Lerner index adjusted for returns to scale,  $L \equiv 1 - 1/\nu$ . Indeed, denoting the dual, or price-based, Solow residual,  $SRP \equiv a_L \cdot dw + a_M \cdot dq + (1 - a_L - a_M) \cdot dr - dp$ , equation (7) is equivalent to:

$$SR - SRP = dx - dz = L \cdot dx \quad (8)$$

Equation (8) is the original Roeger equation, improved to take into account materials as advocated by Basu (1995). The main advantage of Roeger's approach is that the difference between the Solow residual and the price-based Solow residual cancels the TFP-growth term which, as previously mentioned, biases Hall-type equations if appropriate instruments are not available. Roeger suggests that poor instruments could be responsible for strange markups obtained by Hall and advocates that the selected instruments fail to capture demand shocks only. Another real advantage of Roeger's is that it only requires variables in value terms whereas Hall's needs outputs and materials in volume terms.<sup>2</sup> On the other hand, Hall's methodology allows for the identification of both markup over marginal cost and returns to scale, whereas Roeger's can only estimate their ratio which is the markup over average cost. Moreover, Hall's does not need any computation of rental capital cost. Finally, as discussed in greater details in Section 1.4, the main disadvantage of Roeger's might be that, contrary to Hall's, the price-based specification is not robust to the case of capital fixity.

Finally, Klette (1999, footnote 40) wonders about the advantage of estimating equation (7) or (8) rather than (6b) directly.<sup>3</sup> Indeed, both require the series on capital stock and cost. However, it will be shown below that the comparison of the estimates from (7) and (6b) is rich in both surprises and outcomes, as it reveals the central role played by capital fixity.

<sup>2</sup> Moreover, contrary to Hall's, Roeger's specification is unaffected whether the technological change is Harrod-neutral or biased against labor.

<sup>3</sup> More generally, Klette (1998) highlights that "From (6b) we can directly calculate the markup, given the assumptions maintained by Roeger that (i) constant returns to scale prevail, (ii) we can impute the rental costs for capital, and (iii) capital is fully adjusted to the rental costs" (p.7).

### 1.3. Normalization issue

The first reason why Roeger's markups derived from (8) could be biased upwards is linked to a well-known normalization issue in the cointegration analysis (see Hamilton, 1994, p.589). Roeger's methodology based on equation (8) assumes that the cointegrating vector  $[(dx-dz), dx]$  is normalized to unity on the first variable. This choice makes a material difference compared to the direct estimates of (7), the more the  $R^2$  is low. Extending Basu and Fernald's (1997) denomination to Roeger's specification, equation (7) is called the "forward regression" because output appears on the LHS only, whereas (8) is called the "reverse regression", as output is on both sides. Let us compare Roeger's  $\nu$ -based markup estimated from the forward regression,  $dx = \nu \cdot dz$ , which we denote  $\hat{\nu}$ , to the original Roeger's, estimated from the reverse regression,  $(dx - dz) = L \cdot dx$ , which is written  $\hat{\nu}_L \equiv 1 - 1/\hat{L}$  based on the estimates of the Lerner index  $\hat{L}$ . We now establish the following relations based on OLS estimates without a constant term (in practice, adding a constant has no impact as it is not significant):

$$\hat{L} = \frac{\sum dx_t \cdot (dx_t - dz_t)}{\sum dx_t^2} = 1 - \frac{\sum dz_t^2}{\sum dx_t \cdot dz_t} \cdot \frac{(\sum dx_t \cdot dz_t)^2}{\sum dx_t^2 \cdot \sum dz_t^2} = 1 - \frac{R_\nu^2}{\hat{\nu}}$$

where  $R_\nu^2$  is the R-squared from (7). Consequently, it is easy to conclude that the original Roeger's estimates are higher than  $\nu$ -based markups:

$$\hat{\nu}_L \equiv \frac{1}{1 - \hat{L}} = \frac{\hat{\nu}}{R_\nu^2} \Rightarrow \hat{\nu}_L > \hat{\nu} \quad (9)$$

Even though, the fit is generally good with an average  $R_\nu^2$  of 0.98 across the 129 country x sector pairs in the data described in Section 1.6, the average  $L$ -based markup stands at 1.147 versus 1.123 for the average  $\nu$ -based markup. Hindriks et al. were the first to note this hierarchy between  $L$ - and  $\nu$ -based markups, without elucidating the relationship between the two measures.<sup>4, 5</sup>

<sup>4</sup> They concluded that  $\nu$ -based estimates are more reliable because of higher R-squared levels, which is not relevant, and also because they imply more reasonable capital shares, which is (see Section 1.6).

<sup>5</sup> It is important to realize that the convexity of the relation linking  $\hat{\nu}_L$  to  $\hat{L}$  has a very minor offsetting impact. Indeed, a Taylor-development around  $\hat{L}$  leads to  $E\nu_L = \hat{\nu}_L + \sigma^2 / \hat{\nu}_L^3$ , where  $\sigma^2$  is the variance of  $L$ , and based on the estimates, the convexity impact  $\sigma^2 / \hat{\nu}_L^3$  averages a negligible 0.001.

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This normalization issue highlights in fact the endogeneity of Roeger's RHS variable,  $dx$ . However, because output appears on the LHS only in the forward regression, the simultaneity bias is largely attenuated in (7). In addition, as mentioned above, the difference between the two estimates, although significant, is not large, which suggests that endogeneity issues in Roeger's are not too problematic. From the spirit of the markup equation, whereby firms choose their price as a markup over cost, the specification (7) is more appropriate. Indeed, based on Bartelsman (1995) using Hall's approach, Basu and Fernald (1997, p.262) conclude that "the forward regression follows more naturally from theory and suffers fewer econometric problems".

### 1.4. Capital fixity in the price-based approach

Equation (6b)  $P.Y = v.COST$  holds in fact for  $COST$  representing the total cost of the true variable factors used by firms to maximize profits. It is essential at this point to recall that the markup equation comes from first order conditions and captures the idea of market power, i.e. the capacity firms have to mark up *variable* costs in setting their prices at the desired level. If capital is fixed, at least in the short run, then costs related to capital will be fixed costs. They will impact overall profitability but will disappear from the markup equation which becomes:

$$P.Y = v_{fix} \cdot (W.L + Q.M) \quad \Leftrightarrow \quad v_{fix} \cdot (a_L + a_M) = 1 \quad (10)$$

Naturally in this case, the markup is adjusted for returns to scale on the variable factors only:  $v_{fix} \equiv \mu / x_{LM}$ .<sup>6</sup> Differentiating equation (10) leads to Roeger's specification adapted to the case of capital fixity:

$$dpy = v_{fix} \cdot [a_L \cdot dwl + a_M \cdot dqm] \quad (11)$$

Based on (10), (11) is equivalent to:

$$dpy - drk = v_{fix} \cdot [a_L \cdot (dwl - drk) + a_M \cdot (dqm - drk)] \quad \Leftrightarrow \quad dx = v_{fix} \cdot dz$$

... which is equation (7)! It is therefore immediately clear that, if capital is fixed, the estimate from Roeger's methodology will be  $v_{fix}$ , i.e. the markup over total variable cost, and not the markup over average cost,  $v$ . This means that, in this case, Roeger's markup is in fact directly linked to the so-

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<sup>6</sup> Equation (10) is therefore strictly correct only if the production function is homogenous in the labor and material inputs. In the general case where  $x_{LM} \equiv (F_L L + F_M M) / F = x - F_K K / F$  is not a constant, after some calculations, whether capital adjusts perfectly or not, one arrives at:  $dpy = \mu / x_{LM} \cdot [a_L \cdot dwl + a_M \cdot dp_m m] - dx_{LM} / x_{LM}$ .



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called price-cost margin defined, as Schmalensee (1989, p.960) reminds us, as the difference between revenue and variable cost, i.e. the sum of labor and material expenditures, over revenue.

Therefore, even if total returns to scale are constant, Roeger's methodology overestimates markups to the extent that the returns to scale on the *variable* factors are decreasing. To make it very clear, consider the Cobb-Douglas case,  $Y = K^a L^b M^{1-a-b}$ . Roeger's estimates will then result in  $\mu_R = \mu / (1 - a)$ , and even under perfect competition, Roeger's markups will be greater than unity.

Considering only the case of perfect competition, Shapiro (1987) focuses on capital fixity to explain why the Solow residual is poorly correlated to the price-based Solow residual. Recall equation (8) established assuming perfectly adjusting capital:  $SR - SRP = L.(dpy - drk)$ . In the case of perfect competition,  $L = 0$  and the two measures of productivity are identical except for measurement errors. In his sample, Shapiro finds a low  $R^2$  between  $SR$  and  $SRP$  of 0.13 and shows that capital fixity explains a good share of this weak correlation. On the other hand, Roeger disregards the question of fixity and explains this low correlation by market power according to (8). The two explanations are, however, not exclusive of each other and the empirical results in Section 1.6 will show that, indeed, both market power and capital fixity is relevant.

### 1.5. Measurement error in the price-based approach

Before turning to the empirical evidence that the slow adjustment of capital biases Roeger's estimates upwards, let us consider an alternative explanation to the puzzle identified: measurement errors of capital services and user costs. Indeed, *levels* of capital services are difficult to measure and identifying the role of capital in the production function empirically has often proved unfruitful. However, it is believed, and difficult to deny, that the *growth rate* of capital services is easier to grasp. Moreover, Burnside, Eichenbaum and Rebelo (1995) have shown that the cyclical behavior of capital services is underestimated, although the extent of this underestimation remains an open question, as stressed by the discussion following their paper.

Growth rates of capital variables, stock *and* user cost, are generally constructed by using a measure of the level as the denominator. The only advantage of Roeger's specification (7) over equation (6b)

## CHAPTER 1: METHODOLOGY ISSUES IN THE ESTIMATION OF MARKUPS

stems from the better measurement of growth rates than that of series in levels. However, it is not so obvious that this is the case. In particular, such a line of reasoning is much less convincing when applied to the user cost of capital. Indeed,  $\Delta R / R$  can be extremely volatile, especially as  $R$  is low (consider real interest rates during the oil crisis), and therefore there is little reason to believe that  $\Delta RK / RK$  is better measured than  $RK$ .

The main objective in this section is to assess how measurement issues matter for the markup estimates based on the price-based approach. To separate the issues and because we think in terms of an alternative explanation, only the case of perfectly adjusting capital is considered. Let us start from equation (7),  $dx = v \cdot dz$ , where the RHS variable is observed with a measurement error due to the capital variable  $drk$ , an asterisk indicating an unobserved true variable:

$$dz = dz^* + u \quad (12)$$

Classically, the error  $u$  is assumed to be independent of  $dz^*$ :  $E(u \cdot dz^*) = 0 \Rightarrow E(u \cdot dz) = E(u^2) \equiv \sigma_u^2$

Equation (12) implies that  $drk = drk^* - u / (a_L + a_M)$  and, as  $drk$  also appears on the LHS, the observed dependent variable is:

$$dx = dx^* + u / (a_L + a_M) \quad (13)$$

The true relation  $dx^* = v \cdot dz^* + \varepsilon$  is now:

$$dx = v \cdot dz + \left( \frac{1}{a_L + a_M} - v \right) u + \varepsilon \quad (14)$$

Denoting  $v_{fix} = E(1 / (a_L + a_M))$ , the markup if capital were a fixed factor, and the residual

$\zeta = 1 / (a_L + a_M) - v_{fix}$ , equation (14) becomes:

$$dx = v \cdot dz + (v_{fix} - v)u + \zeta \cdot u + \varepsilon$$

By assuming that the error terms  $\varepsilon$  and  $\zeta$  are independent of  $dz$ , and noting  $\hat{v}_R$  Roeger's  $v$ -based markup estimated from (7), one gets:

$$plim \hat{v}_R = v + (v_{fix} - v) \cdot \theta \quad (15)$$

where 
$$0 < \theta = \frac{\sigma_u^2}{plim (dz^*)^2 + \sigma_u^2} < 1 \quad (16)$$

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The impact of measurement error in the capital variables on Roeger's estimated markup is reflected by  $\theta$ . It follows that  $\hat{\nu}_R$  is unbiased only if  $\theta = 0$ . Also, in all cases,  $\nu_{fix}$  is an upper bound to the true markup  $\nu$ : whether or not capital is a fixed factor,  $a_L + a_M = 1/\nu - e_k / \mu < 1/\nu$ . This entails that Roeger's markup is biased upwards and towards  $\nu_{fix}$ :  $\nu < \hat{\nu}_R < \nu_{fix}$ .<sup>7</sup>

One of the most convincing illustrations regarding the importance of properly measuring capital services, especially through the cycle, is provided by Shapiro (1993) and Burnside et al. In both cases, the idea is that true capital services,  $K^*$ , should take into account the workweek of capital,  $\Psi$ , so that:

$$K^* = \Psi.K \quad \Rightarrow \quad dk^* = d\psi + dk$$

This fits well within the framework above with  $u = (a_L + a_M).d\psi$  and is likely to bias Roeger's estimate towards  $\nu_{fix}$ , the extent of the bias depending on the correlation between  $d\psi$  and  $dz$ . However, in this context, capital expenditures might not be much affected:  $(RK)^* \approx (RK)$ . Although the concept of the workweek of capital is perfectly designed for the measurement of total factor productivity, in the price-based approach, this has an impact for estimated markup only to the extent that additional usage of capital induces higher costs. As Shapiro put it p.232: whether it has an impact "will depend on what the firm pays for increasing hours (*of capital usage, my precision*). [...] Simple calculations based on average shift premia suggest that the incremental cost of using capital at night is quite low. If this is the case, then the share of capital hours in cost would be low".

### 1.6. Empirical evidence

Data for this chapter is from the OECD STAN database and is described in the Appendix. It covers two-digit industries in thirteen OECD countries between 1970 and 2000, which represent 129 country x sector series in total. The estimated  $\nu$ -based markup from equation (7),  $\hat{\nu}_R$ , will now be shown to overestimate markups. Given the econometric relationships established in Section 1.3 devoted to the

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<sup>7</sup> In order to reach (15), the classical independence of the measurement error with  $dz^*$  is critical. However, a less stringent assumption leads to a similar result. Indeed, if instead of  $E(u.dz) = E(u^2) \equiv \sigma_u^2$  the following reasonable inequalities apply:  $E(u.dz) > 0$  and  $E(dz.dz^*) > 0$ , then the relationship (15) holds with  $0 < \theta = E(u.dz) / (E(u.dz) + (E(dz.dz^*))) < 1$ , with the same interpretation of  $\theta$  as indicator of the degree of measurement error.

## CHAPTER 1: METHODOLOGY ISSUES IN THE ESTIMATION OF MARKUPS

normalization issue, this overestimation extends *a fortiori* to the original Roeger  $L$ -based markup from (8).

### 1.6.1. Confirming that markups are too large in the price-based approach

The estimated markup from the equation in level (6b) is denoted  $\hat{\nu}_{level}$ . Aside from any measurement issue, when capital adjusts perfectly, both  $\nu_R$  and  $\nu_{level}$  provide an unbiased estimate of the true markup  $\nu$ . Note that  $\hat{\nu}_{level}$  is a weighted average of the observed markups  $\nu_t = PROD_t / COST_t$  for time  $t$ . Indeed, it is straightforward that:

$$\hat{\nu}_{level} = \frac{\sum COST_t \cdot PROD_t}{\sum COST_t^2} = \sum \omega_t \cdot \nu_t, \text{ where } \omega_t = COST_t^2 / (\sum COST_t^2)$$

Empirically,  $\hat{\nu}_{level}$  proves very close to the unweighted average of the observed markups.

With US manufacturing sectors as an illustrative example, Table 1.1 shows that Roeger's estimates are much greater than  $\hat{\nu}_{level}$ , for which Durbin-Watson statistics indicate the need to correct for auto-correlation, although once done, the estimates do not change much.<sup>8</sup> Roeger's markups are greater than the average level,  $\hat{\nu}_{level}$ , in 11 out of 14 sectors, being perceptibly lower in 1 sector only, and Roeger's average stands at 5.1 points above the mean of  $\hat{\nu}_{level}$ , which equals 1.056.

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<sup>8</sup> Estimates are produced from an AR(2) process for the residuals, which successfully corrects for auto-correlation.

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**Table 1.1: Difference between Roeger's Markups and (weighted) Average Markup Levels,  
USA two-digit sectors, 1970-2000**

|             |            |                                 | Level equation (6b)<br>(OLS) |                   | Level equation (6b)<br>(AR2)* |              | Roeger's equation (7)<br>(OLS) |              |                   | Roeger's<br>– level<br>diffe-<br>rence** |
|-------------|------------|---------------------------------|------------------------------|-------------------|-------------------------------|--------------|--------------------------------|--------------|-------------------|--|
| Country     | ISIC Rev.3 |                                 | $\hat{V}_{level}$            | Durbin-<br>Watson | $\hat{V}_{level}$             | std          | $\hat{V}_R$                    | std          | Durbin-<br>Watson |  |
| usa         | 15         | Food and Beverages              | 1.057                        | 0.408             | 1.024                         | 0.051        | 1.076                          | 0.020        | 2.399             | <b>0,052</b>                             |
| usa         | 16         | Tobacco                         | 1.130                        | 0.970             | 1.124                         | 0.029        | 1.227                          | 0.041        | 1.667             | <b>0,103</b>                             |
| usa         | 19         | Leather and Footwear            | 1.125                        | 0.448             | 1.039                         | 0.074        | 1.023                          | 0.043        | 2.534             | <b>-0,016</b>                            |
| usa         | 20         | Wood and Cork                   | 1.098                        | 0.720             | 1.096                         | 0.011        | 1.219                          | 0.036        | 1.885             | <b>0,122</b>                             |
| usa         | 21         | Pulp and Paper                  | 1.031                        | 0.900             | 1.032                         | 0.009        | 1.154                          | 0.031        | 1.835             | <b>0,122</b>                             |
| usa         | 22         | Printing and Publishing         | 1.075                        | 1.045             | 1.075                         | 0.007        | 1.140                          | 0.035        | 2.799             | <b>0,065</b>                             |
| usa         | 23         | Coke, Ref.Petrol., Nuclear Fuel | 1.041                        | 0.615             | 1.037                         | 0.018        | 1.026                          | 0.033        | 2.194             | <b>-0,010</b>                            |
| usa         | 24         | Chemicals                       | 1.126                        | 0.133             | 1.143                         | 0.040        | 1.169                          | 0.032        | 1.438             | <b>0,026</b>                             |
| usa         | 25         | Rubber and Plastic              | 1.018                        | 0.606             | 1.019                         | 0.011        | 1.065                          | 0.018        | 2.464             | <b>0,046</b>                             |
| usa         | 26         | Other Non-Metallic Mineral      | 1.022                        | 0.296             | 1.038                         | 0.034        | 1.155                          | 0.028        | 2.167             | <b>0,117</b>                             |
| usa         | 27         | Basic Metals                    | 0.971                        | 0.467             | 1.047                         | 0.082        | 1.125                          | 0.052        | 2.863             | <b>0,078</b>                             |
| usa         | 28         | Fabricated Metal                | 1.080                        | 0.162             | 1.078                         | 0.013        | 1.105                          | 0.021        | 1.263             | <b>0,027</b>                             |
| usa         | 34         | Motor Vehicles and Trailers     | 1.040                        | 0.283             | 1.062                         | 0.024        | 1.091                          | 0.073        | 1.824             | <b>0,029</b>                             |
| usa         | 35         | Other Transport Equipment       | 0.973                        | 1.027             | 0.974                         | 0.007        | 0.925                          | 0.096        | 2.326             | <b>-0,048</b>                            |
| <b>mean</b> |            |                                 | <b>1.056</b>                 |                   | <b>1.056</b>                  | <b>0.029</b> | <b>1.107</b>                   | <b>0.040</b> |                   | <b>0.051</b>                             |

(\*): Estimates are produced from an AR(2) process for the residuals, which corrects for auto-correlation successfully. Standard deviations are robust to heteroscedasticity and autocorrelation.

(\*\*): Difference between  $\hat{V}_R$  and  $\hat{V}_{level}$  (AR2)

Table 1.2 compares the estimates from four different computations of capital variables, referring to depreciation, interest rates and initial capital stock.<sup>9</sup> The pattern identified above proves recalcitrant. Moreover, as the capital share in total output, based on our preferred computation of capital stock and rental cost – the first one in table 1.2 being used to produce table 1.1 -, varies on average over the period from 3.6% for “Leather products and footwear” to 9.8% for “Basic metals”, mismeasurement is not likely to account for the magnitude of the problem substantially.

<sup>9</sup> I tested more extreme assumptions with a similar outcome overall.

**Table 1.2: Robustness of the Difference across Different Measures of Capital Services and Cost\*, USA two-digit sectors, 1970-2000**

|   |    | Level equation markup estimates |              |              |              | Difference (Roeger's – level) |              |              |              | Average capital share of output |              |              |              |
|---|----|---------------------------------|--------------|--------------|--------------|-------------------------------|--------------|--------------|--------------|---------------------------------|--------------|--------------|--------------|
|   |    | $\hat{v}_{level}$               |              |              |              | $\hat{v}_R - \hat{v}_{level}$ |              |              |              |                                 |              |              |              |
| sector  |    | K1                              | K2           | K3           | K4           | K1                            | K2           | K3           | K4           | K1                              | K2           | K3           | K4           |
| usa   | 15 | 1.024                           | 1.025        | 1.028        | 1.039        | <b>0.052</b>                  | 0.046        | 0.076        | 0.067        | 0.041                           | 0.037        | 0.065        | 0.056        |
| usa   | 16 | 1.124                           | 1.285        | 1.090        | 1.103        | <b>0.103</b>                  | -0.056       | 0.162        | 0.150        | 0.038                           | 0.035        | 0.066        | 0.056        |
| usa   | 19 | 1.039                           | 1.038        | 1.053        | 1.072        | <b>-0.016</b>                 | -0.034       | 0.086        | 0.069        | 0.036                           | 0.031        | 0.093        | 0.078        |
| usa   | 20 | 1.096                           | 1.106        | 1.029        | 1.048        | <b>0.122</b>                  | 0.127        | 0.165        | 0.150        | 0.059                           | 0.053        | 0.108        | 0.094        |
| usa   | 21 | 1.032                           | 1.038        | 1.015        | 1.031        | <b>0.122</b>                  | 0.127        | 0.105        | 0.089        | 0.086                           | 0.081        | 0.095        | 0.082        |
| usa   | 22 | 1.075                           | 1.079        | 1.078        | 1.090        | <b>0.065</b>                  | 0.050        | 0.027        | 0.013        | 0.053                           | 0.049        | 0.062        | 0.052        |
| usa   | 23 | 1.037                           | 1.039        | 1.030        | 1.038        | <b>-0.010</b>                 | -0.017       | 0.045        | 0.037        | 0.049                           | 0.045        | 0.056        | 0.048        |
| usa   | 24 | 1.143                           | 1.147        | 1.046        | 1.076        | <b>0.026</b>                  | 0.022        | 0.123        | 0.092        | 0.085                           | 0.078        | 0.140        | 0.119        |
| usa   | 25 | 1.019                           | 1.022        | 1.015        | 1.025        | <b>0.046</b>                  | 0.038        | 0.020        | -0.001       | 0.059                           | 0.056        | 0.056        | 0.048        |
| usa   | 26 | 1.038                           | 1.050        | 1.027        | 1.044        | <b>0.117</b>                  | 0.115        | 0.117        | 0.102        | 0.085                           | 0.077        | 0.084        | 0.072        |
| usa   | 27 | 1.047                           | 1.055        | 1.000        | 1.009        | <b>0.078</b>                  | 0.080        | 0.045        | 0.034        | 0.098                           | 0.082        | 0.073        | 0.063        |
| usa   | 28 | 1.078                           | 1.083        | 1.040        | 1.056        | <b>0.027</b>                  | 0.019        | 0.064        | 0.046        | 0.052                           | 0.047        | 0.082        | 0.069        |
| usa   | 34 | 1.062                           | 1.065        | 1.019        | 1.042        | <b>0.029</b>                  | 0.033        | 0.055        | 0.035        | 0.056                           | 0.050        | 0.158        | 0.136        |
| usa   | 35 | 0.974                           | 0.979        | 1.003        | 1.008        | <b>-0.048</b>                 | -0.083       | 0.018        | 0.013        | 0.057                           | 0.050        | 0.030        | 0.025        |
| <b>mean</b>                                   |    | <b>1.056</b>                    | <b>1.072</b> | <b>1.034</b> | <b>1.049</b> | <b>0.051</b>                  | <b>0.034</b> | <b>0.079</b> | <b>0.064</b> | <b>0.061</b>                    | <b>0.055</b> | <b>0.083</b> | <b>0.071</b> |
| <b>difference / capital share correlation</b> |    |                                 |              |              |              | <i>0.40</i>                   | <i>0.62</i>  | <i>0.42</i>  | <i>0.34</i>  |                                 |              |              |              |

(\*) Capital variables are described in the Appendix. Sector description is given in Table 1.1.

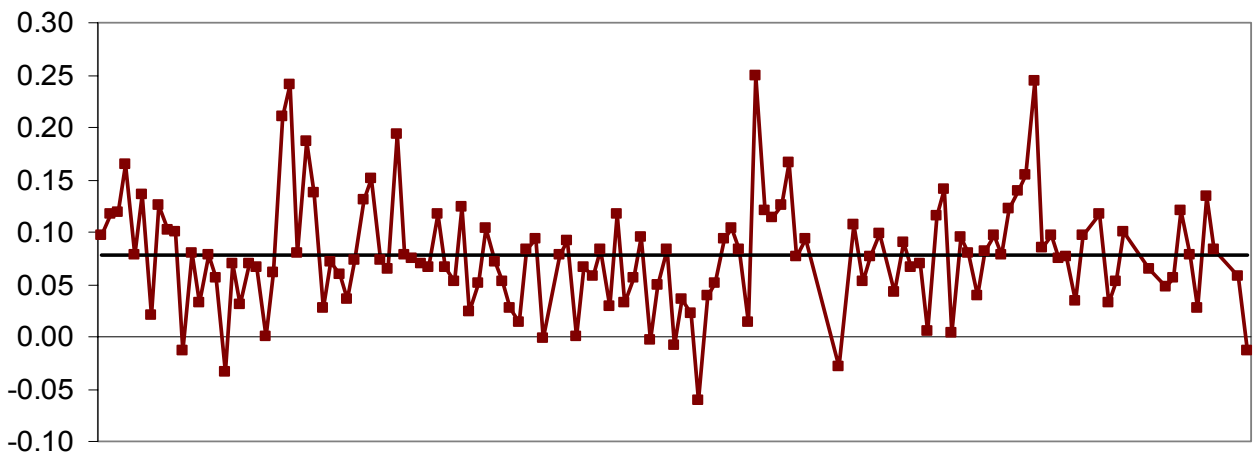
**Note**

The last row of the table computes the linear correlation coefficient between the difference in the estimates  $\hat{v}_R - \hat{v}_{level}$  (second part of the table) and the average capital share from the data, for each capital series respectively. The distinct positive correlation is consistent with the theoretical relationship found when capital is fixed in the Cobb-Douglas case (at the end of Section 1.4), whereby the difference is positively related to  $a$ , the long term capital share in total cost.

Including all the other countries, Figure 1.1A plots the difference between  $\hat{v}_R$  and  $\hat{v}_{level}$  for each of the 129 country x sector pairs. This difference averages a high 7.8 points, which is the gap between the respective averages of 1.123 and 1.045: in other words, margins calculated from the same series appear almost three times larger in the price-based approach. Recall from Section 1.3 that, on top of this, the choice of normalization in Roeger's original specification pushes the average markup further from 1.123 to 1.147. In Figure 1.1B, the country x sector pairs are ranked according to the difference between  $\hat{v}_R$  and  $\hat{v}_{level}$ , which is negative in eight cases only, and is in the (0.025;0.150) range for three quarters of the 129 sectors. At first sight, this hierarchy between the two estimates is puzzling since the two specifications are very closely related – remember that equation (7) is obtained by differentiating (6b).

Figure 1.1A: Difference between Roeger-type Markup and (weighted) Average Markup Level\*

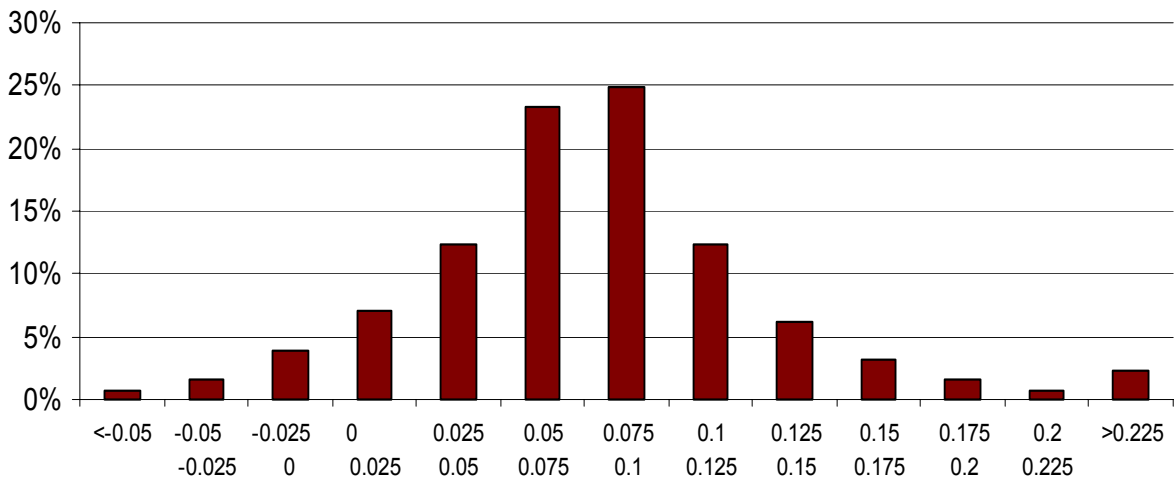
$$\hat{v}_R - \hat{v}_{level} \quad (\text{Equations 6b and 7})$$



Average difference = 0.078

(\*): Each square represents one of the 129 country x sector pairs

Figure 1.1B: Distribution of the Difference between Roeger-type Markup and (weighted) Average Markup Level,  $\hat{v}_R - \hat{v}_{level}$ , (% of the 129 sectors)



Difference between Roeger-type Markup and (weighted) Average Markup Level

Obviously, it does not yet prove that the price-based markups are biased upwards. However, independent of the possibility that  $\hat{v}_{level}$  underestimates the true markup, the important point is that  $\hat{v}_R$  is just too high in absolute terms. The fact that Roeger-type markups seem too large has been highlighted by other studies based on different database. Among those studies, Hindriks et al. note that inferred capital shares from Roeger's estimates are unrealistically low as a large proportion run

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into negative territory. Table 1.3 compares effective capital shares with those inferred from equation (6a),  $a_K = 1/\hat{\nu} - a_L - a_M$ , and indicates the frequency of negative occurrences. Taking the first time series as an example, Roeger's estimates lead to inferred capital shares very close to zero on average (1.8% of output against 5.8% inferred from the equation in level), whereas the capital shares taken directly from the data, used for these same estimates, average 6.1% of output. Moreover, Roeger's implied capital shares are negative for 43% of the 334 observations available for the USA. Note that these results are not very sensitive to the choice of the method for computing capital data, even though the two selected for illustration purposes – the first and third from table 1.2 – generate important variations in capital share measures. These computations are in line with those of the papers mentioned before and, as these different studies rely on different data and computations of capital expenditures, this new piece of evidence appears to reject the possibility that measurement errors are the main source of the problem. In contrast, the fact that the implied capital shares are close to zero gives support to the capital fixity assumption, as we now discuss.

**Table 1.3: Implied Capital Shares from  $a_K = 1/\hat{\nu} - a_L - a_M$ , USA two-digit sectors, 1970-2000**

|             |        | Capital computation : K1                            |  |                              |                        |  |                                     | Capital computation : K3                     |                              |                        |  |                                     |
|-------------|--------|---|--|------------------------------|------------------------|--|-------------------------------------|--|------------------------------|------------------------|--|-------------------------------------|
|             |        | Frequency of Labor + Material shares greater than 1 | Frequency of negative implied capital shares |                              | Average capital shares |  |                                     | Frequency of negative implied capital shares |                              | Average capital shares |  |                                     |
| Country     | Sector | Computed from data                                  | Level (eq. 6b)                               | $\nu$ - based Roeger (eq. 7) | Computed from data     | Inferred from $\hat{\nu}_{level}$ (eq. 6b) | Inferred from $\hat{\nu}_R$ (eq. 7) | Level (eq. 6b)                               | $\nu$ - based Roeger (eq. 7) | Computed from data     | Inferred from $\hat{\nu}_{level}$ (eq. 6b) | Inferred from $\hat{\nu}_R$ (eq. 7) |
| usa         | 15     | 0.00  | 0.00   | 0.21                         | 0.041                  | 0.066                                      | 0.018                               | 0.00   | 0.52                         | 0.065                  | 0.062                                      | -0.004                              |
| usa         | 16     | 0.00  | 0.04   | 0.71                         | 0.038                  | 0.069                                      | -0.006                              | 0.00   | 0.78                         | 0.066                  | 0.097                                      | -0.024                              |
| usa         | 19     | 0.00  | 0.00   | 0.00                         | 0.036                  | 0.112                                      | 0.126                               | 0.00   | 0.39                         | 0.093                  | 0.099                                      | 0.030                               |
| usa         | 20     | 0.00  | 0.00   | 0.87                         | 0.059                  | 0.063                                      | -0.029                              | 0.00   | 0.73                         | 0.108                  | 0.122                                      | -0.012                              |
| usa         | 21     | 0.00  | 0.00   | 0.83                         | 0.086                  | 0.083                                      | -0.020                              | 0.00   | 0.39                         | 0.095                  | 0.099                                      | 0.007                               |
| usa         | 22     | 0.00  | 0.00   | 0.25                         | 0.053                  | 0.060                                      | 0.007                               | 0.00   | 0.00                         | 0.062                  | 0.058                                      | 0.034                               |
| usa         | 23     | 0.00  | 0.08   | 0.00                         | 0.049                  | 0.057                                      | 0.067                               | 0.00   | 0.35                         | 0.056                  | 0.064                                      | 0.026                               |
| usa         | 24     | 0.00  | 0.04   | 0.42                         | 0.085                  | 0.050                                      | 0.030                               | 0.00   | 0.39                         | 0.140                  | 0.130                                      | 0.031                               |
| usa         | 25     | 0.00  | 0.00   | 0.13                         | 0.059                  | 0.054                                      | 0.012                               | 0.00   | 0.00                         | 0.056                  | 0.058                                      | 0.039                               |
| usa         | 26     | 0.00  | 0.03   | 0.87                         | 0.085                  | 0.066                                      | -0.032                              | 0.03   | 0.77                         | 0.084                  | 0.076                                      | -0.024                              |
| usa         | 27     | 0.00  | 0.17   | 1.00                         | 0.098                  | 0.019                                      | -0.047                              | 0.00   | 0.13                         | 0.073                  | 0.063                                      | 0.020                               |
| usa         | 28     | 0.00  | 0.00   | 0.29                         | 0.052                  | 0.045                                      | 0.023                               | 0.00   | 0.26                         | 0.082                  | 0.079                                      | 0.024                               |
| usa         | 34     | 0.00  | 0.21   | 0.42                         | 0.056                  | 0.020                                      | -0.004                              | 0.04   | 0.35                         | 0.158                  | 0.061                                      | 0.009                               |
| usa         | 35     | 0.21  | 0.13   | 0.04                         | 0.057                  | 0.047                                      | 0.101                               | 0.21   | 0.26                         | 0.030                  | 0.017                                      | 0.000                               |
| <b>mean</b> |        | <b>0.015</b>  | <b>0.050</b>                                 | <b>0.430</b>                 | <b>0.061</b>           | <b>0.058</b>                               | <b>0.018</b>                        | <b>0.020</b>                                 | <b>0.380</b>                 | <b>0.083</b>           | <b>0.077</b>                               | <b>0.011</b>                        |

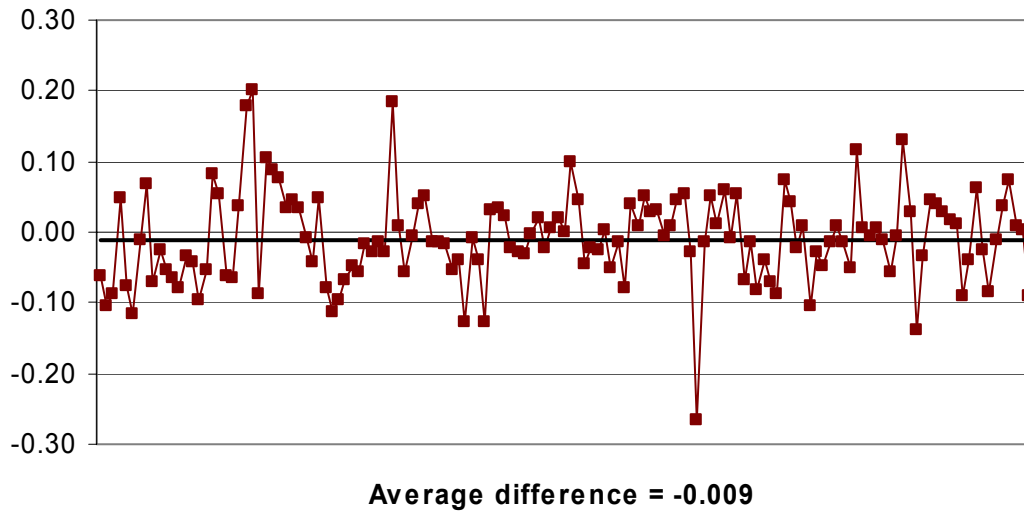


**1.6.2. The case of capital fixity**

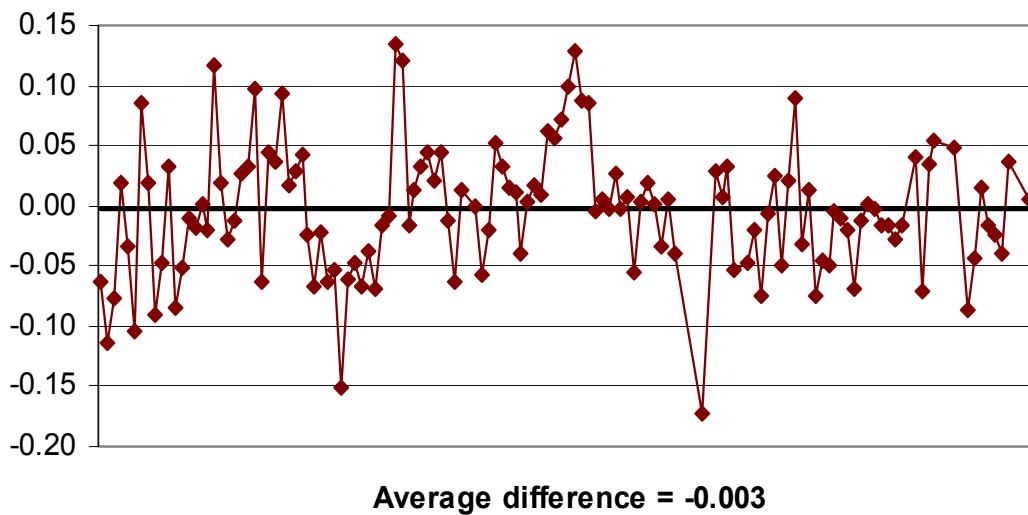
We now replicate the exercise above under the assumption of capital fixity, that is we compare  $\nu_R^{fix}$  from equation (11) to  $\nu_{level}^{fix}$  from equation (10). Figure 1.2A plots the difference in the two estimates for each series in a similar way to Figure 1.1A. Anticipating the formal testing in sub-section 1.6.3, the difference between the two estimates is rarely significant and the average difference is -0.9 point. By comparing with Figure 1.1A, this reveals that capital series create noise in the “perfectly adjusting” case. However, the extent of that noise suggests that mismeasurement could only be part of the story.

Indeed, it is remarkable that  $\nu_R$  and  $\nu_R^{fix}$  give the same estimates on average, 1.123 and 1.120 respectively, as displayed in Figure 1.2B. This means that  $drk$  seems to play no role in the price-based markup  $\nu_R$ . Consequently, the markup estimated under the fixity assumption from the equation in level,  $\hat{\nu}_{level}^{fix}$ , is very close to Roeger’s  $\nu$ -based estimated markup,  $\hat{\nu}_R$ . Figure 1.3 plots the distribution of the difference across the 129 series. The average difference is a negligible -0.3 point and the absolute difference is lower than 2.5 points for 50% of the series, and lower than 5 points for 75%. This is a strong result since  $\nu_{level}^{fix}$  represents an upper bound for any markup estimate, i.e. whatever the assumptions made. Therefore, it is also no surprise that Roeger’s implied capital shares come out close to zero on average.

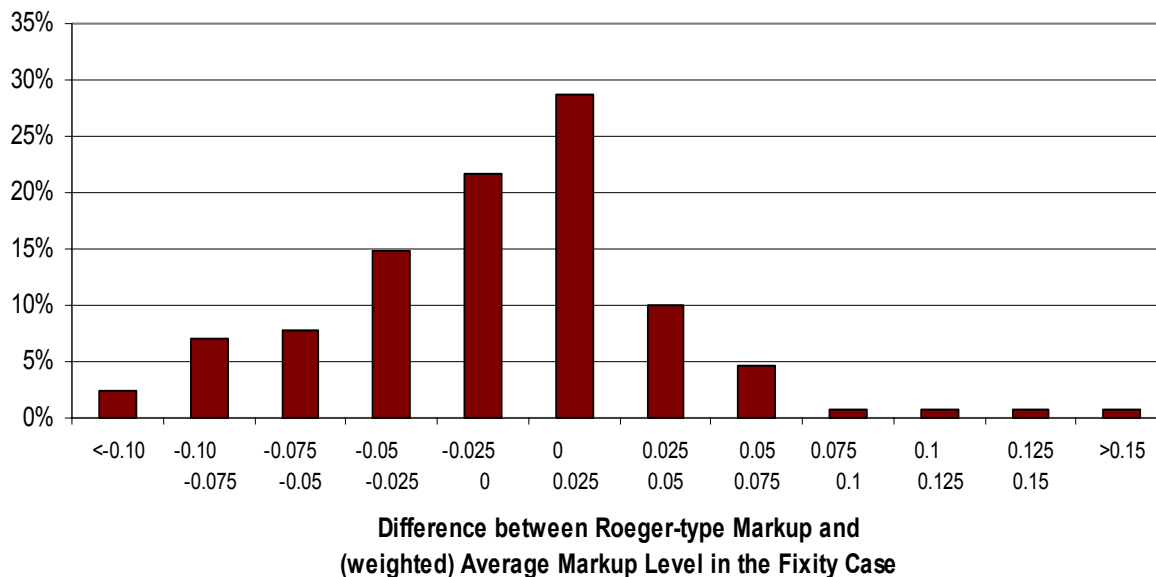
**Figure 1.2A: Difference between Roeger-type Markup and (weighted) Average Markup Level in the Case of Capital Fixity,  $\hat{v}_R^{fix} - \hat{v}_{level}^{fix}$  (Equations 10 and 11)**



**Figure 1.2B: Difference between Roeger-type Markups, Perfectly adjusting case vs capital fixity case,  $\hat{v}_R^{fix} - \hat{v}_R$  (Equations 7 and 11)**



**Figure 1.3: Distribution of the Difference between Roeger-type Markup and (weighted) Average Markup Level in the Fixity Case,  $\hat{\nu}_R - \hat{\nu}_{fix}^{level}$**   
(% of the 129 sectors)



### 1.6.3. Formal testing

The first test directly assesses whether equation (10) makes more sense than equation (6b). From the following specification:

$$PY = v.(WL + QM) + h.v.RK + u \quad (17)$$

If the parameter  $h$  is not significantly different from 0 then the assumption that capital is a quasi-fixed factor cannot be rejected. At the 95% (90% respectively) confidence level, the parameter  $h$ , is significantly positive in only 23% (28% resp.) of the 129 sectors tested: stated differently, the fixity of capital cannot be rejected in 77% (72% resp.) of the cases. Moreover, this result is robust to various measures of capital stock and cost.

Table 1.4 and Figure 1.4 illustrate these results for the USA. The first two columns reproduce results from Table 1.1, whereas the third column gives the average markup level in the case of capital fixity: as is apparent the systematic difference with Roeger's disappears. Then, the estimates of equation (17) are successively reported, first bounding  $h$  between 0 and 1, and lastly relaxing the constraints. On average, the  $h$  parameter takes a value of 0.34 and 0.22 respectively and is almost never significantly different from 0, suggesting a very low speed of capital adjustment to the optimal level.

## CHAPTER 1: METHODOLOGY ISSUES IN THE ESTIMATION OF MARKUPS

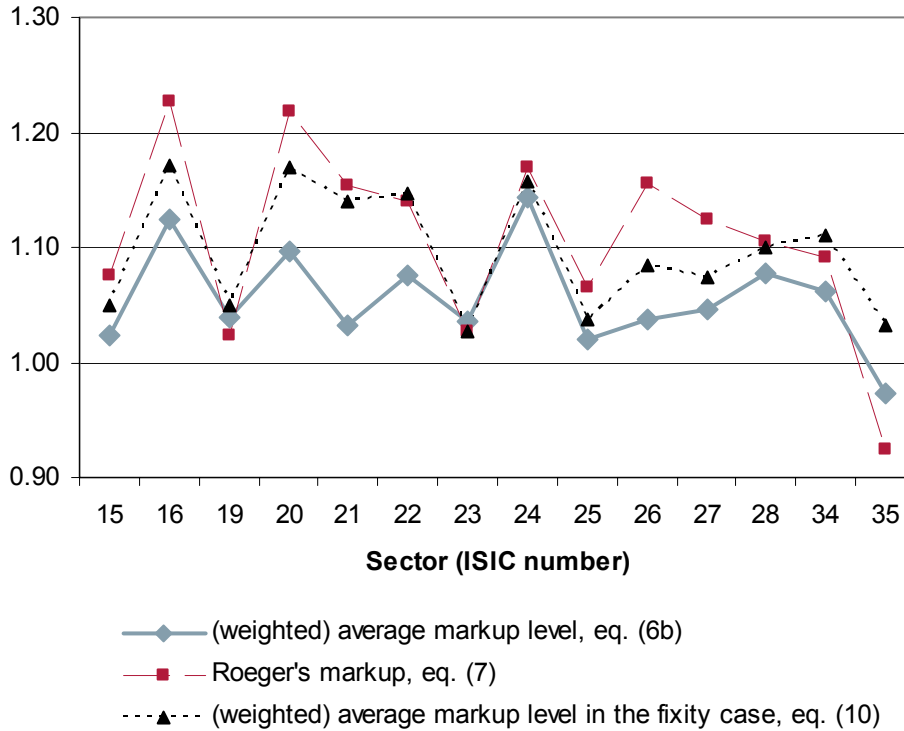
Moreover, the average difference between the unbounded estimate and Roeger's mostly vanishes, and the average absolute difference (not reported here) is more than halved. Supportively, it is remarkable that when the initial difference between Roeger's and level equation estimates (first two columns) is high, the capital fixity estimate,  $\hat{v}_{level}^{fix}$  in the third column, or the very similar unbounded version, brings markups closer towards Roeger's.

**Table 1.4: Blunt Test of the Capital Fixity Assumption**

$$P.Y = v.(W.L + Q.M) + h.v.R.K + u$$

| country     | sector | level             | Roeger's     | level                   |              | level        |             |          | level         |             |          |
|-------------|--------|-------------------|--------------|-------------------------|--------------|--------------|-------------|----------|---------------|-------------|----------|
|             |        | $h = 1$           | s            | $h = 0$                 |              | $0 < h < 1$  |             |          | unbounded $h$ |             |          |
|             |        | (1)               | (2)          | (3)                     | s.d.         | (4)          |             |          | (5)           |             |          |
|             |        | $\hat{v}_{level}$ | $\hat{v}_R$  | $\hat{v}_{level}^{fix}$ |              | $v$          | $h$         | s.d. (h) | $v$           | $h$         | s.d. (h) |
| usa         | 15     | 1.024             | 1.076        | 1.049                   | 0.048        | 1.043        | 0.25        | 0.37     | 1.043         | 0.25        | 0.37     |
| usa         | 16     | 1.124             | 1.227        | 1.171                   | 0.054        | 1.145        | 0.57        | 1.10     | 1.145         | 0.57        | 1.10     |
| usa         | 19     | 1.039             | 1.023        | 1.050                   | 0.076        | 1.039        | 1.00        | 0.00     | 1.037         | 1.26        | 1.56     |
| usa         | 20     | 1.096             | 1.219        | 1.170                   | 0.014        | 1.170        | 0.00        | 0.00     | 1.187         | -0.22       | 0.39     |
| usa         | 21     | 1.032             | 1.154        | 1.141                   | 0.010        | 1.140        | 0.00        | 0.00     | 1.180         | -0.33       | 0.22     |
| usa         | 22     | 1.075             | 1.140        | 1.146                   | 0.005        | 1.141        | 0.07        | 0.51     | 1.141         | 0.07        | 0.51     |
| usa         | 23     | 1.037             | 1.026        | 1.027                   | 0.027        | 1.027        | 0.00        | 0.00     | 1.042         | -0.93       | 0.84     |
| usa         | 24     | 1.143             | 1.169        | 1.158                   | 0.049        | 1.149        | 0.18        | 0.35     | 1.149         | 0.18        | 0.35     |
| usa         | 25     | 1.019             | 1.065        | 1.038                   | 0.038        | 1.029        | 0.20        | 0.32     | 1.029         | 0.20        | 0.32     |
| usa         | 26     | 1.038             | 1.155        | 1.084                   | 0.064        | 1.084        | 0.00        | 0.00     | 1.098         | -0.21       | 0.37     |
| usa         | 27     | 1.047             | 1.125        | 1.073                   | 0.016        | 1.073        | 0.00        | 0.00     | 1.123         | -0.44       | 0.09     |
| usa         | 28     | 1.078             | 1.105        | 1.100                   | 0.021        | 1.080        | 0.96        | 0.33     | 1.080         | 0.96        | 0.33     |
| usa         | 34     | 1.062             | 1.091        | 1.110                   | 0.018        | 1.081        | 0.56        | 0.60     | 1.081         | 0.56        | 0.60     |
| usa         | 35     | 0.974             | 0.925        | 1.032                   | 0.009        | 0.974        | 1.00        | 0.00     | 0.932         | 1.79        | 1.05     |
| <b>mean</b> |        | <b>1.056</b>      | <b>1.107</b> | <b>1.096</b>            | <b>0.032</b> | <b>1.084</b> | <b>0.34</b> |          | <b>1.091</b>  | <b>0.22</b> |          |

**Figure 1.4: Comparison between Markup Estimates, USA two-digit Sectors**  
 (weighted) average markup level  $\hat{\nu}_{level}$  (equation 6b), Roeger's markup  $\hat{\nu}_R$  (equation 7),  
 (weighted) average markup level in the fixity case  $\hat{\nu}_{fix}^{level}$  (equation 10)



More importantly and more formally, we now prove that  $\nu_R$ , estimated from equation (7), is very close to its capital fixity counterparts,  $\nu_{level}^{fix}$  and  $\nu_R^{fix}$  from (10) and (11) respectively, whereas it is biased compared to the perfectly adjusting measure,  $\nu_{level}$  from (6b). The null hypothesis that the parameters  $\nu_{level}$ ,  $\nu_R$ ,  $\nu_{level}^{fix}$  and  $\nu_R^{fix}$  are equal is tested, and results are reported in Table 1.5. At the 5% level, the equality  $\nu_{level} = \nu_R$  is rejected for 78 of the 129 time series. The number of rejections falls to 18 in the fixity case ( $H_0: \nu_{level}^{fix} = \nu_R^{fix}$ ). More strikingly, the null hypothesis that Roeger's markup  $\nu_R$  equals the upper bound  $\nu_{level}^{fix}$  is rejected in only 5 (15 respectively) sectors at the 1% level (10% respectively). Finally,  $\nu_R$  and  $\nu_R^{fix}$  cannot be distinguished. These results are strong evidence of both the fixity assumption and the overestimation of Roeger-type markups.

**Table 1.5: Formal Tests: Number of Sectors for Which the Equality of the Parameters Can Be Rejected out of the 129 Country x Sector Time Series**

| Null Hypothesis               | Significance level |    |     |
|-------------------------------|--------------------|----|-----|
|                               | 1%                 | 5% | 10% |
| $H_0$                         |                    |    |     |
| $V_{level} = V_R$             | 56                 | 78 | 89  |
| $V_{level}^{fix} = V_R^{fix}$ | 9                  | 18 | 25  |
| $V_R = V_R^{fix}$             | 0                  | 4  | 13  |
| $V_{level}^{fix} = V_R$       | 5                  | 14 | 15  |
| $V_{level}^{fix} = V_{level}$ | 76                 | 89 | 96  |

Equations

$$P.Y = v_{level} \cdot (R.K + W.L + Q.M) \quad (6b)$$

$$dpy - drk = v_R \cdot [a_L \cdot (dwl - drk) + a_M \cdot (dqm - drk)] \quad (7)$$

$$P.Y = v_{level}^{fix} \cdot (W.L + Q.M) \quad (10)$$

$$dpy = v_R^{fix} \cdot [a_L \cdot dwl + a_M \cdot dqm] \quad (11)$$

**Reading:** The null hypothesis that the markup estimated from the equation in level (6b) equals the markup estimated from the price-based equation (7) is rejected in 78 sectors out of the 129 in the sample at the 5% significance level.

## 1.7 Conclusion

Estimation of markups is an important issue in economics. The degree of market power has, in particular, substantial implications for the analysis of macroeconomic fluctuations and market structures. Roeger's methodology is appealing because it raises fewer econometric issues than Hall's. However, it has problems of its own. Previous studies have highlighted that markups, estimated from Roeger's methodology, are too high and this chapter confirms these findings, illustrating that these estimated margins of price to marginal cost could be three times too large. The additional contribution of this chapter is to provide three complementary explanations for this pattern.

The normalization choice, i.e which variable is the dependent, is shown to be one of the reasons. However, this covers only a part of the problem. Additionally, the slow adjustment of capital and the mismeasurement of capital expenditures both tend to bias price-based markups upwards.

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Even when the impact of the normalization choice is factored in, measurement error in itself could hardly account for the magnitude of the overestimation, suggesting the three explanations combine. Moreover, the case of capital fixity finds strong empirical support. Theoretically, when capital is a fixed factor, it is shown that Roeger's estimation leads to the markup adjusted for returns to scale on the *variable* inputs only. Therefore, markup over marginal cost is overestimated to the extent that returns to scale on the *variable* factors are decreasing, a very likely possibility. This is the case, in particular, when the returns to scale on all production factors are constant. Finally, consistently with capital fixity, capital shares inferred from price-based markup estimates are found to be close to zero on average, which elucidates the puzzling outcomes of previous studies pointing at many occurrences in which (wrongly) inferred capital shares turn out negative. The difficulties in Hall's method are well understood. They refer to the identification of appropriate instruments, an often complex quest. Although Roeger's methodology appears less sensitive to these econometric issues, its limitations might be more profound as capital fixity induces misspecification.

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### Appendix: Data description

Data comes from the OECD Structural Analysis (STAN) database and covers thirteen OECD countries: Austria, Belgium, Canada, Denmark, Finland, France, Italy, Japan, Netherlands, Norway, Sweden, United Kingdom and United States. Two samples have been built covering manufacturing industries at the two-digit level for the period 1970-2000 (ISIC, third revision). One has more detailed information but is sparse, as some sectors are missing for a number of countries, and is composed of 132 time series (a country-sector crossing). The other contains more aggregated data but is more balanced with 129 annual time series available out of a total of 143. Sector identification is given in Table 1.A1.

#### Capital

The price of capital,  $p_k$ , used here is the price of investment calculated from the Gross Fixed Capital Formation at current prices (GFCF) and in volume (GFCFK). When data is not available, the price of the GDP deflator (source OECD Economic Outlook) is chosen for  $p_k$ . The user cost of capital is calculated classically according to:  $R = p_k.(r + d - \dot{p}_k^a)$ , where  $r$  is the interest rate,  $d$  the depreciation rate and  $\dot{p}_k^a$  is the expected relative change in the price of capital. By default,  $r$  was chosen as the long-term interest rate (but an alternative with short-term rate was also tested), the depreciation was fixed at 0.05 (but 0.07 was also tested, see below) and  $\dot{p}_k^a$  was set at the average of the price change over the last three years. Net capital stock (NCAPK) is available directly in the data for Belgium and Italy only. For the other countries, I calculated the series based on the Gross Fixed Capital Formation in volume (GFCFK) according to:  $K_t = (1-d).K_{t-1} + GFCFK_t$ . Only, the starting point value for the net capital stock is missing to build the series. It was derived differently depending on the countries, due to data availability. For Austria, Finland, Japan, Norway and the USA, I used the Consumption of Fixed Capital (CFC) and inferred:  $p_{k0}.K_0 = CFC_0 / d$  for the first date. For Canada, France, the UK, the Netherlands and Sweden, I computed  $p_{k0}.K_0 = \chi.VALU_0.\theta$ .  $\chi$  is the average, for each sector across countries for which the gross capital stock (CAPK) is available, of  $p_k.CAPK / VALU$  and is reported in Table 1.A2. The parameter  $\theta$  reflects the ratio of net capital stock to gross capital stock. I ran simulations based on various methodologies (double-decline, geometric, hyperbolic, see



## CHAPTER 1: METHODOLOGY ISSUES IN THE ESTIMATION OF MARKUPS

OECD, 2001) and reasonable values of parameters to arrive at a ratio of between 0.50 and 0.85. I chose  $\theta = 0.70$  by default, but compared the results with  $\theta = 0.55$ . Finally, as Denmark provides gross capital stock only, I used the constant ratio  $\theta$  to deduce net capital stock for all dates.

I shall now detail the various computations used for the case of the USA as they appear in Table 1.2.  $K_1$  was calculated, as described above, from the investment flows, a depreciation rate  $d$  of 0.05 and an initial capital stock derived from  $p_{k0} \cdot K_0 = CFC_0 / d$ .  $K_2$  was calculated similarly but using  $d = 0.07$ . With the idea of testing extreme assumptions,  $K_3$  was bluntly derived from  $p_{kt} \cdot K_t = CFC_t / d$  for every date  $t$  and  $d = 0.05$ .  $K_4$  was calculated as  $K_3$  but with  $d = 0.07$ . I also tested as  $r$ , the average of the short-term and the long-term rates, and even a constant for the real interest rate.

**Table 1.A1: ISIC Rev. 3 Classification**

| Sector description |   | More aggregated sample |  |
|--------------------|---|------------------------|--|
| 15                 | FOOD PRODUCTS AND BEVERAGES                               | 15-16                  | FOOD PRODUCTS, BEVERAGES AND TOBACCO                 |
| 16                 | TOBACCO PRODUCTS  | 17-19                  | TEXTILES, TEXTILE PRODUCTS, LEATHER AND FOOTWEAR     |
| 17                 | TEXTILES  | 20                     | WOOD AND PRODUCTS OF WOOD AND CORK                   |
| 18                 | WEARING APPAREL, DRESSING, DYING OF FUR                   | 21-22                  | PULP, PAPER, PAPER PRODUCTS, PRINTING AND PUBLISHING |
| 19                 | LEATHER, LEATHER PRODUCTS AND FOOTWEAR                    | 23-25                  | CHEMICAL, RUBBER, PLASTICS AND FUEL PRODUCTS         |
| 20                 | WOOD AND PRODUCTS OF WOOD AND CORK                        | 26                     | OTHER NON-METALLIC MINERAL PRODUCTS                  |
| 21                 | PULP, PAPER AND PAPER PRODUCTS                            | 27-28                  | BASIC METALS AND FABRICATED METAL PRODUCTS           |
| 22                 | PRINTING AND PUBLISHING                                   | 29                     | MACHINERY AND EQUIPMENT, N.E.C.                      |
| 23                 | COKE, REFINED PETROLEUM PRODUCTS AND NUCLEAR FUEL         | 30-33                  | ELECTRICAL AND OPTICAL EQUIPMENT                     |
| 24                 | CHEMICALS AND CHEMICAL PRODUCTS                           | 34-35                  | TRANSPORT EQUIPMENT                                  |
| 25                 | RUBBER AND PLASTICS PRODUCTS                              | 36-37                  | MANUFACTURING NEC; RECYCLING                         |
| 26                 | OTHER NON-METALLIC MINERAL PRODUCTS                       |                        |  |
| 27                 | BASIC METALS  |                        |  |
| 28                 | FABRICATED METAL PRODUCTS, except machinery and equipment |                        |  |
| 29                 | MACHINERY AND EQUIPMENT, N.E.C.                           |                        |  |
| 30                 | OFFICE, ACCOUNTING AND COMPUTING MACHINERY                |                        |  |
| 31                 | ELECTRICAL MACHINERY AND APPARATUS, NEC                   |                        |  |
| 32                 | RADIO, TELEVISION AND COMMUNICATION EQUIPMENT             |                        |  |
| 33                 | MEDICAL, PRECISION AND OPTICAL INSTRUMENTS                |                        |  |
| 34                 | MOTOR VEHICLES, TRAILERS AND SEMI-TRAILERS                |                        |  |
| 35                 | OTHER TRANSPORT EQUIPMENT                                 |                        |  |
| 36                 | MANUFACTURING NEC   |                        |  |
| 37                 | RECYCLING   |                        |  |

**Table 1.A2: Computation of initial capital stock for each sector:  
Average over time and countries (Belgium, Canada, Finland, France and Italy) of**

$$p_k \cdot CAPK / VALU$$

| sector | $\chi$ |
|--------|--------|
| 15-16  | 2.75   |
| 17-19  | 2.07   |
| 20     | 3.91   |
| 21-22  | 2.89   |
| 23-25  | 3.31   |
| 26     | 3.15   |
| 27-28  | 3.14   |
| 29     | 1.52   |
| 30-33  | 1.52   |
| 34-35  | 2.39   |
| 36-37  | 2.55   |

## Chapter 2

# The Convergence of Price-cost Margins<sup>1</sup>

### 2.1. Introduction

The main objective of this chapter is to provide an analysis of the price-cost margin (PCM) trends at two-digit sector level for OECD countries, while controlling for the macroeconomic price shocks that affected the world's economies between 1970-2000 and for cyclical fluctuations. In particular, it does not aim to identify the determinants on these trends, which is the central topic of the following chapter.

The last decades have seen the strengthening of economic integration, especially between developed countries, a phenomenon often referred to as globalization. In addition, for European countries, integration has intensified since the launch of the Single Market Program in 1985. Increased competition and efficiency are generally the expected outcomes of such a process, which should result in the decrease in distortions due to imperfect competition and in broadened arbitrage opportunities. This means a decrease in and convergence of PCMs. Determining whether PCMs in OECD countries behaved as expected in a period characterised by trade and capital liberalisation and domestic deregulation is an important question; this study is the first to focus on *comparing* trends in PCMs across sectors and developed countries thoroughly. Sauner-Leroy (2003) and Badinger (2004) are the

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<sup>1</sup> This chapter is based on Boulhol H., 2006, "The Convergence of Price-cost Margins", forthcoming in *Open Economies Review*.

## CHAPTER 2: THE CONVERGENCE OF PRICE-COST MARGINS

closest exercises, but their emphasis is placed on European countries and the implications of the Single Market Program. They both conclude that, ultimately, markups have not decreased through the implementation of the single market.

Starting at the *aggregated* manufacturing level, Figure 2.1A plots observed PCMs for the thirteen countries in our sample.<sup>2</sup> Only Japan's aggregated PCM appears to have followed a downward trend and, except Japan, PCMs in 2000 are not specifically lower than in any preceding year. Focusing on the usual dispersion indicators, Figures 2.1B and 2.1C illustrate the downward trend in PCM dispersion. The following sector level analysis dramatically reinforces the evidence pointing at PCM convergence. Based on 132 country x sector time series, PCMs did not decrease overall, but the dispersion drifted by around a third lower over the last three decades.

As discussed in more detail in the next chapter, which provides an extensive survey, there is some empirical support for the pro-competitive effect of international trade, i.e. the idea that foreign competition lowers the distortions from imperfect competition by reducing markups. The pro-competitive assumption is consistent with the convergence of PCMs, with this convergence expected to take place at the lowest levels. However, the first result of this chapter is to highlight that the general decrease in PCMs has certainly not occurred, which is in line with the more or less stable corporate profit ratios over the last thirty years in developed countries. In fact, while the highest initial PCMs tended to be lower, the lowest initial PCMs tended to increase.

On the one hand, the trimming of the highest markups fits in well with the pro-competitive story. Increased competition, through facilitation of new entry or international trade for instance, lowers concentration and induces an increase in the perceived elasticity of demand faced by firms, triggering a fall in desired markups, which is all the greater in absolute term that the initial markup is high. On the other hand, through the lower bound approach, Sutton (1991, 1997) insists on the non-monotonic relation between the intensity of competition and the concentration of activity. When market structure is endogeneised, especially when competition operates not only through prices but also through R&D and advertising, more competitive pressure generates the scaling up of expenditures which forces out

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<sup>2</sup> The neat characteristic of PCM is that it does not suffer from any aggregation bias: aggregated PCM is just the average PCM of all firms weighted by their share in output (refer to the definition in Section 2.2).

## CHAPTER 2: THE CONVERGENCE OF PRICE-COST MARGINS

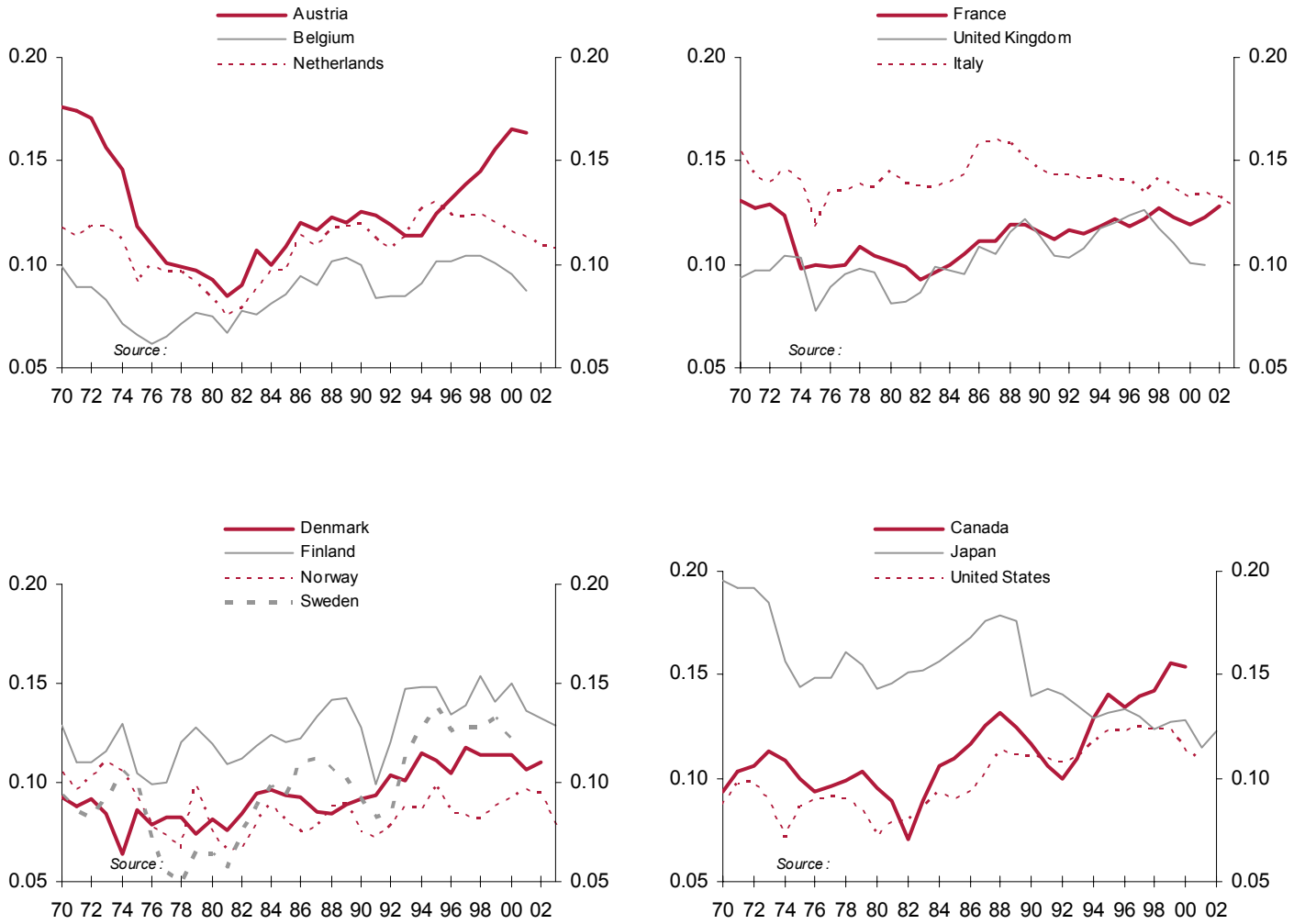
the less efficient firms, unable to keep that pace. Their exit may entail a rise in average markup, especially if these firms had lower markups initially. Moreover, the merger and acquisition waves of the 'eighties and 'nineties give examples of an endogenous reaction of firms aiming at improving their market power. It may well be that the sectors with the lowest markups were subject to such intense competition that the implied low level of concentration "could not" be maintained. This Darwinian-type effect is also featured in the burgeoning literature on firm heterogeneity (e.g. Bernard, Eaton, Jensen and Kortum, 2003, Melitz and Ottaviano, 2005) where exports play a role in the reshuffling of production within sectors.

In comparison, the convergence story has received very little attention. This is unfortunate because the convergence of PCMs is an important indicator of increased integration and the establishment of global markets. Put differently, convergence might stress that important competitive forces are at work, even if they do not show up in the general decrease in PCMs. The convergence of PCMs is not a totally new result, as it meets those of Domowitz, Hubbard and Petersen (1986) studying US manufacturing between 1958 and 1981 and of Davies (2001) focusing on the changes in European concentration levels, but this pattern of convergence has neither been noticed nor even clearly displayed to date. It is very likely that better capital efficiency is an important underlying force as it induces convergence through the arbitrage of rates of return across both sectors and countries. However, in order to be consistent with our findings of convergence to the average of the range and not to the bottom, some role has to be attributed to credit or financial constraints. In any case, the main message is to draw the attention of researchers to the need to explain this convergence pattern and to find the determinants of PCMs countervailing the pro-competitive effects. No doubt that the understanding of the underlying mechanisms is important for the drawing up of competition and trade policy.

The chapter is organised as follows. Section 2.2 proposes a framework that links markups, PCMs and assumptions regarding the adjustment of capital stocks. The econometric specification is then presented in Section 2.3, and results follow in Section 2.4. Section 2.5 zooms on European integration and Section 2.6 gives concluding remarks.

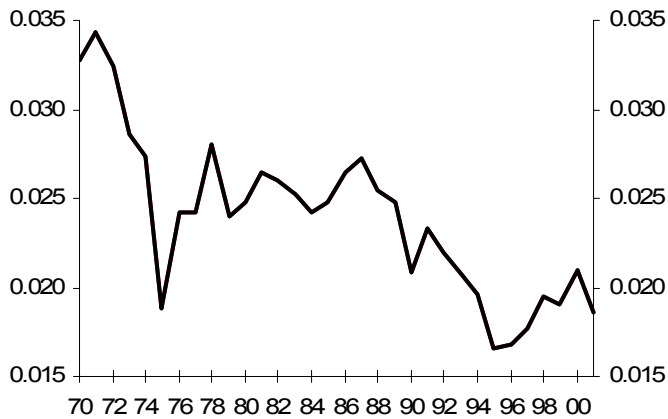
## CHAPTER 2: THE CONVERGENCE OF PRICE-COST MARGINS

**Figure 2.1A: Observed Price-Cost Margin at Aggregated Manufacturing Level**

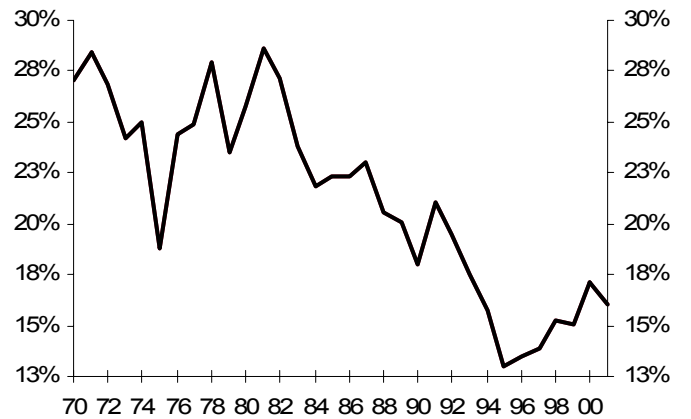


### Dispersion

**Figure 2.1B: Standard deviation of PCMs across countries, aggregated manufacturing level**



**Figure 2.1C: Coefficient of variation of PCMs across countries, aggregated manufacturing**



## 2.2. Price-cost margin and markup equation

The PCM is defined (Schmalensee 1989, p.960, Tybout, 2003) as the difference between sales and variable costs over sales, variable costs being the expenditures on labor and material:

$$PCM \equiv \frac{\text{sales} - \text{labour expenditures} - \text{material expenditures}}{\text{sales}} \quad (1)$$

PCM is therefore the margin of price to average variable cost. What is the relation between PCM and markup to marginal cost? The usual framework assumes that identical firms in a given sector have the following production function:

$$Y = A \cdot F(K, N, M) \quad (2)$$

where  $Y$  is output,  $K$  capital,  $N$  labor,  $M$  materials and  $A$  a productivity term. If all factors adjust perfectly,  $\mu$  denoting the markup over marginal cost and  $x$  the returns to scale, first order conditions and Euler's equation lead to:

$$P.Y = \frac{\mu}{x} \cdot (R.K + W.N + Q.M) \quad (3a)$$

where  $P$  is the price of output, and  $R$ ,  $W$  and  $Q$  are the respective factor prices of capital, labor and materials. Aggregating across all firms in the sector leads to a similar equation with the aggregated markup being the averaged markup across firms weighted by firms' cost. If capital is fixed, however, the first-order condition on capital is irrelevant and, as detailed in chapter 1, the markup equation becomes:

$$P.Y = \frac{\mu}{x} \cdot (W.N + Q.M) \quad (3b)$$

provided that  $x$  is the returns to scale on the *variable* factors.<sup>3</sup> Markup comes from first order conditions in profit maximisation and captures the idea of market power, i.e. the capacity firms have under imperfect competition to mark up *variable* costs in setting their prices at the desired level. If capital is fixed, at least in the short run, then costs related to capital are fixed costs. They impact overall profitability but disappear from the markup equation.

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<sup>3</sup> Equation (3b) is therefore strictly correct only if the production function is homogenous in the variable inputs.

## CHAPTER 2: THE CONVERGENCE OF PRICE-COST MARGINS

In the general case, equations (3a) and (3b) can be condensed into:

$$PCM \equiv \frac{P.Y - (W.N + Q.M)}{P.Y} = 1 - \frac{1}{\nu} + h \cdot \frac{R.K}{P.Y} \quad (4)$$

where  $\nu$  stands for the markup to marginal cost,  $\mu$ , adjusted for the returns to scale on the variable factors  $x$ :  $\nu \equiv \mu/x$  and  $h$  takes the value of 0 or 1 depending on the treatment of capital as a fixed or perfectly adjusting factor respectively. Insofar as returns to scale are time invariant, relative changes in adjusted markups  $\nu$  equal relative changes in markups over marginal cost  $\mu$ . Chapter 1 has highlighted the difficulties in the two most common methods used to estimate markups.<sup>4</sup> Hall's methodology runs into serious econometric difficulties with sectoral data due to simultaneity bias, whereas Roeger's does not appear superior to a more direct measure like the PCM. In addition, the quasi-fixity of capital plays an important role and in that case, according to equation (4), there is a one to one relationship between markup and PCM:

$$h = 0 \Rightarrow \nu = \frac{1}{1 - PCM} \Rightarrow \text{Log}(\nu) = -\text{Log}(1 - PCM) \approx PCM \quad \text{and} \quad \frac{\Delta \nu}{\nu} \approx \Delta PCM \quad (5)$$

and, indeed, many studies used PCM as the dependent variable in assessing the impact of concentration or import penetration on margins, among which Domowitz et al. (1986) and most papers surveyed by Tybout (2003).

### 2.3. Econometric specification

The markup of interest to us reflects structural parameters like the level of concentration in the industry, the intensity of competition, the demand elasticities. However, there are various reasons why observed markups or PCM may differ from their structural levels. Observed markups may be affected by transitory shocks and influenced by such economic events as cycles and price developments and therefore, the specification should control for these effects.

#### 2.3.1. Cyclical behavior

Because of its importance in the drawing up of macroeconomic policies, an abundant literature deals with the cyclicity of markups but whether markups are pro- or counter-cyclical remains unresolved, although the evidence seems to support better the counter-cyclicity assumption (e.g. Bills, 1987, and

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<sup>4</sup> The structural approach is the third method often used as exemplified by Morrison (1992). It allows for the treatment of a second quasi-fixed factor and consists of the estimation of supply and demand relations, i.e. the cost and demand elasticities. However, its drawback refers to the need to impose a functional form in either the production or cost function.



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Oliveira Martins and Scarpetta, 2002). Rotemberg and Woodford (1999) treat in details the cyclical behaviour of markups. Their in-depth analysis provides two conflicting effects for the empirical study. On the one hand, counter-cyclical in true markups can come theoretically from varying elasticity of demand, financial market imperfections or variable entry. On the other hand, they show that various realistic assumptions which depart from the general framework presented in the preceding section, like overhead labor, monopsony power in the labor market, adjustment costs and labor hoarding, render the difference between true markup and observed markup counter-cyclical, mostly because of mismeasurement of factor services. This latter effect means that observed markup or PCM could be found pro-cyclical, as in Domowitz et al.

Therefore in our empirical specification, the cycle impact is controlled for, at sector and country levels, by the introduction of two variables. At sector level, following Bils (1987), the annual change in employment is used for the cycle variable, and *EMPCYC* is the de-trended series using a Hodrick-Prescott filter. At the country level, the output gap, *GAP* (OECD 2003 Economic Outlook), is used.

### 2.3.2. Price rigidities

Related to the cycle, but nevertheless distinct, is the specific impact of inflation on markups. A price shock impacts markups if there are rigidities in the sense that prices are slow to adjust to changes in nominal marginal costs. At the macroeconomic level, for the period under study, the oil price shocks have had major impacts on observed markups resulting in distortions of value-added sharing between factor shares and profits. Among numerous reasons are: unexpected price developments, wage indexation, price stickiness, adjustment costs, terms of trade effects. It is well known that for continental Europe, especially France and Italy, wage indexation during the two oil price shocks resulted in an increased labor share and a squeezing of corporate profits and markups.

Rotemberg and Woodford (1999) present a model with sticky prices and show that the slowness of prices to adjust to changes in marginal cost leads to a negative relationship between current inflation and the difference between observed and steady-state markups. Studying eight OECD economies, Banerjee and Russell (2001) establish a negative long-run relationship between inflation and markup.<sup>5</sup> In order to control for this distortion due to price rigidities, the change in the GDP deflator, *DEFL*, is

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<sup>5</sup> Chapter 3 formalizes this idea in a simple model.

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included in the regressors. In addition, in order to account for the oil price shocks specifically, two variables are built: *OIL1* is the (log of the) price of WTI barrel (source OECD Economic Outlook) expressed in local currency and deflated by GDP prices; *OIL2* is the share of oil consumption in total GDP (constructed from the number of barrels consumed, source OPEP) times the change in real oil prices over the last five years. The main justification for using *OIL2* lies in the decreased dependency of energy consumption on oil over the last two decades.

### 2.3.3. Specification

The logarithm of the structural markup  $v_{ijt}$ , where  $i$  indices country,  $j$  sector and  $t$  time, is represented by a polynomial of time, specific to the country x sector. The order of the polynomial was limited to two *ex post*, as greater numbers did not alter the estimates significantly. Due to data limitations, the effects of the control variables defined at the country level (*DEFL*, *OIL1*, *OIL2* and *GAP*) are pooled across sectors for a given country, and thus the estimation is run at the country level. Therefore, the full specification is the following:

$$\begin{aligned} \text{Log}\left(\frac{PY}{WN + QM + h.RK}\right)_{ijt} &= \text{Log}v_{ij} + b_{ij}.t + c_{ij}.t^2 \\ &+ \lambda_i^{DEFL}.DEFL_{it} + \lambda_i^1.OIL1_{it} + \lambda_i^2.OIL2_{it} + \lambda_{ij}^{EMP}.EMPCYC_{ijt} + \lambda_i^{GAP}.GAP_{it} + u_{ijt} \end{aligned} \quad (6)$$

where all RHS variables are taken as their respective difference to the average and the structural markup is given by:  $\text{Log}(v_t)_{ij} = \text{Log}v_{ij} + b_{ij}.t + c_{ij}.t^2$ . Data from the OECD STAN database are described in the appendix of Chapter 1 and Table 2.1 gives some summary statistics.

**Table 2.1: Descriptive statistics**

|                                      | Mean   | Standard deviation |
|--------------------------------------|--------|--------------------|
| Observed price-cost margins          | 0.110  | 0.048              |
| Labor share in value added           | 0.684  | 0.101              |
| Labor share in output                | 0.243  | 0.065              |
| Material share in output             | 0.645  | 0.070              |
| Capital share at user cost in output | 0.064  | 0.021              |
| Output gap                           | -0.277 | 2.446              |
| Cyclical employment                  | -0.046 | 3.880              |
| Change in GDP deflator               | 0.058  | 0.044              |
| OIL1                                 | 3.318  | 0.550              |
| OIL2                                 | 0.019  | 0.041              |

### 2.4. Results

The results presented below correspond to the case of quasi-fixity of capital ( $h = 0$ ) and sub-section 2.4.3 returns to the question of the sensitivity to capital treatment. In the case of fixity, according to (5), (log of) markups and PCMs can be used interchangeably. In order to summarise the results, changes through time are often represented between two reference points, one common to all time series, 1980, the other being the last available point, 2000, except for Canada and Sweden, 1996, and the UK, 1998. Residual analysis indicates the need to correct for auto-correlation at the second order. Consequently, estimates are produced from an AR(2) process for the residuals, the correlation parameters being specific to the country x sector pair.

#### 2.4.1. Variance analysis

A variance analysis of the dependent variable in equation (6) on country, sector and time fixed effects reveals that the explained variance (45%) of the PCM *level* comes mostly from the sector dimension, accounting for 48% of it, then the country, with 41%, and finally time, with the remaining 11%. The prevalence of sector is not surprising given that markups are mostly determined by market structures, which should be similar for a given sector across OECD countries, but may vary substantially across sectors. The heterogeneity in the country dimension likely reflects differences in goods and labor market regulations.

#### 2.4.2. Estimated structural markups

Once controlled for price and cycle effects, we can focus on the estimated structural markup changes. First, changes through time are significant: the assumption that there is no markup change over the period is rejected for 82 of the 132 country x sector pairs at the 1% confidence level and for 93 of them at 5%.<sup>6</sup> Second, the general result points to a slight average increase of 1.4% from 1980. Figure 2.2 compares the trends in observed markups and in estimated structural markups, computed from the average of our 132 time series. Overall since 1980, *observed* markups increased by 3.1%, 1.0% being due to the temporary effects of cycle and disinflation; as expected, an increase in inflation is associated with a decrease in markups and details on the impacts of the control variables are found in

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<sup>6</sup> Wald test on  $b$  and  $c$  parameters in equation (6).

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the Appendix. Average structural markups are U-shaped with time, with lowest levels reached in the mid-'eighties.

**Figure 2.2: Average Observed and Structural Price-Cost Margin**

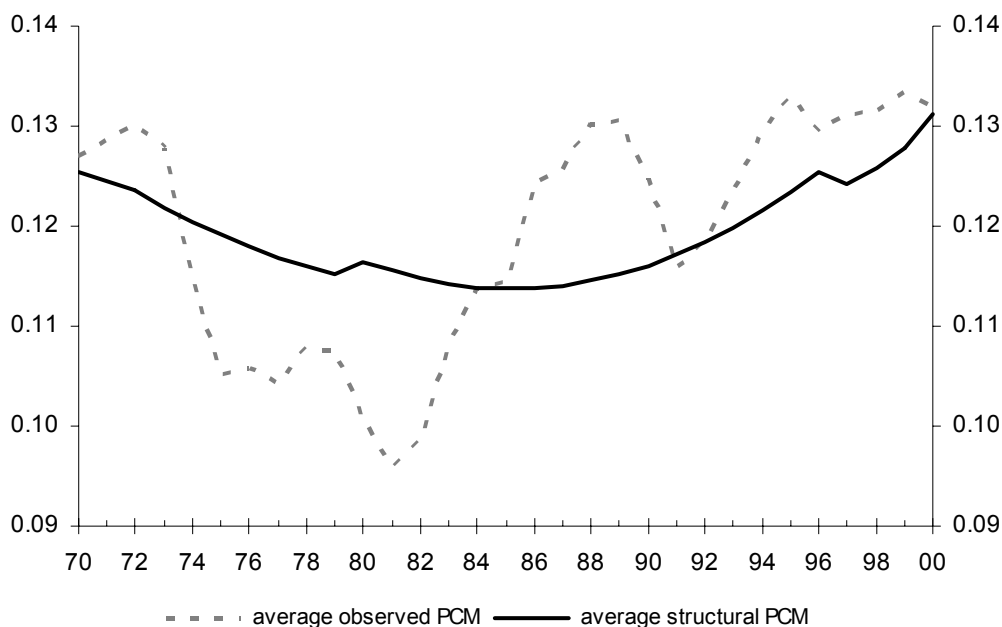


Table 2.2 provides the estimates per country and sector, the first column being the estimated structural markups in 1980, the second the standard error and the third reporting the relative change between 1980 and the end of the period. Among all the sectors, 76 post a markup increase from 1980, with an average increase of 5.5%, whereas for the 56 remaining sectors, the decrease averages -3.5%. All countries but Italy, Japan and Norway experience an increase on average. Sweden, starting from rather low markups in 1980, posts the greatest increases in all sectors but one.

We do not intend to place too much stock in the average increase in structural markups for two reasons. First, 1980 is chosen arbitrarily because of the unavailability of full data before this date. Indeed, fifteen time series are missing at the beginning of the period. Second, 1980 almost coincides with the second oil crisis and our control variables might account only partially for the impact of the shock. However, no matter how we look at the data, the main message is that markups on average are not lower at the end of the period than at any previous year. The only period where markups declined is in the 'seventies and mounting inflation then seems to largely explain this decrease.

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Table 2.2: Estimated Markup Changes between 1980 and 2000 (continued next page)

| sector      | Austria             |                       |                                 | Belgium             |                       |                                 | Canada              |                       |                                 |
|-------------|---------------------|-----------------------|---------------------------------|---------------------|-----------------------|---------------------------------|---------------------|-----------------------|---------------------------------|
|             | <i>Struct. Mkup</i> | <i>Standard error</i> | <i>Relative Change</i>          | <i>Struct. Mkup</i> | <i>Standard error</i> | <i>Relative Change</i>          | <i>Struct. Mkup</i> | <i>Standard error</i> | <i>Relative Change</i>          |
|             | $V_{1980}$          |                       | $\frac{V_{2000}}{V_{1980}} - 1$ | $V_{1980}$          |                       | $\frac{V_{2000}}{V_{1980}} - 1$ | $V_{1980}$          |                       | $\frac{V_{2000}}{V_{1980}} - 1$ |
| 15-16       | 1.121               | 0.008                 | 6%                              | 1.113               | 0.006                 | 0%                              | 1.108               | 0.007                 | 6%                              |
| 17-19       | 1.111               | 0.007                 | 1%                              | 1.037               | 0.005                 | 6%                              | 1.088               | 0.007                 | 2%                              |
| 20          | 1.233               | 0.011                 | -6%                             | 1.111               | 0.006                 | -2%                             | 1.056               | 0.009                 | 5%                              |
| 21-22       | 1.129               | 0.016                 | 7%                              | 1.117               | 0.006                 | 3%                              | 1.140               | 0.011                 | 1%                              |
| 23-25       | 1.098               | 0.009                 | 13%                             | 1.113               | 0.006                 | 4%                              | 1.073               | 0.007                 | 8%                              |
| 26          | 1.178               | 0.008                 | 4%                              | 1.117               | 0.005                 | 5%                              | 1.167               | 0.009                 | -1%                             |
| 27-28       | 1.119               | 0.008                 | 4%                              | 1.060               | 0.004                 | 3%                              | 1.078               | 0.008                 | -1%                             |
| 29          | 1.081               | 0.009                 | 6%                              | .                   | .                     | .                               | 1.127               | 0.007                 | 0%                              |
| 30-33       | 1.081               | 0.008                 | 6%                              | .                   | .                     | .                               | 1.142               | 0.007                 | -7%                             |
| 34-35       | 1.093               | 0.010                 | 2%                              | 1.040               | 0.008                 | 0%                              | 1.056               | 0.009                 | 3%                              |
| 36-37       | 1.092               | 0.008                 | 7%                              | 1.090               | 0.006                 | 1%                              | 1.094               | 0.014                 | 5%                              |
| <b>mean</b> |                     |                       | <b>4.6%</b>                     |                     |                       | <b>2.1%</b>                     |                     |                       | <b>1.8%</b>                     |
|             | Denmark             |                       |                                 | Finland             |                       |                                 | France              |                       |                                 |
| 15-16       | 1.079               | 0.007                 | -1%                             | 1.094               | 0.009                 | 0%                              | 1.150               | 0.006                 | -1%                             |
| 17-19       | 1.112               | 0.006                 | -2%                             | 1.121               | 0.013                 | 3%                              | 1.045               | 0.014                 | 7%                              |
| 20          | 1.128               | 0.007                 | -1%                             | 1.100               | 0.007                 | 1%                              | 1.120               | 0.005                 | 3%                              |
| 21-22       | 1.081               | 0.007                 | 5%                              | 1.132               | 0.007                 | 8%                              | 1.150               | 0.005                 | -2%                             |
| 23-25       | 1.105               | 0.007                 | 10%                             | 1.177               | 0.008                 | -1%                             | 1.158               | 0.006                 | 0%                              |
| 26          | 1.135               | 0.006                 | 2%                              | 1.216               | 0.008                 | -2%                             | 1.078               | 0.014                 | 12%                             |
| 27-28       | 1.084               | 0.007                 | 6%                              | 1.115               | 0.010                 | 2%                              | 1.103               | 0.004                 | 3%                              |
| 29          | 1.082               | 0.006                 | 2%                              | 1.159               | 0.009                 | -6%                             | 1.169               | 0.029                 | -5%                             |
| 30-33       | 1.087               | 0.010                 | 5%                              | 1.166               | 0.010                 | 7%                              | 1.211               | 0.044                 | -9%                             |
| 34-35       | 1.034               | 0.005                 | -2%                             | 1.087               | 0.007                 | 0%                              | 1.022               | 0.008                 | 7%                              |
| 36-37       | 1.142               | 0.007                 | -5%                             | 1.212               | 0.007                 | -9%                             | 1.238               | 0.005                 | -5%                             |
| <b>mean</b> |                     |                       | <b>1.8%</b>                     |                     |                       | <b>0.4%</b>                     |                     |                       | <b>0.9%</b>                     |
|             | UK                  |                       |                                 | Italy               |                       |                                 | Japan               |                       |                                 |
| 15-16       | 1.087               | 0.005                 | 4%                              | 1.146               | 0.005                 | 0%                              | 1.144               | 0.009                 | -11%                            |
| 17-19       | 1.098               | 0.004                 | 0%                              | 1.197               | 0.006                 | -4%                             | .                   | .                     | .                               |
| 20          | 1.115               | 0.005                 | 2%                              | 1.285               | 0.005                 | -1%                             | .                   | .                     | .                               |
| 21-22       | 1.075               | 0.004                 | 5%                              | 1.183               | 0.006                 | 0%                              | .                   | .                     | .                               |
| 23-25       | 1.119               | 0.004                 | -1%                             | 1.123               | 0.006                 | 5%                              | 1.168               | 0.009                 | 6%                              |
| 26          | 1.120               | 0.005                 | 0%                              | 1.280               | 0.007                 | -7%                             | .                   | .                     | .                               |
| 27-28       | 1.049               | 0.004                 | 4%                              | 1.187               | 0.005                 | -2%                             | 1.138               | 0.009                 | -1%                             |
| 29          | 1.135               | 0.016                 | 2%                              | 1.218               | 0.011                 | -8%                             | 1.150               | 0.008                 | -7%                             |
| 30-33       | 1.194               | 0.034                 | -3%                             | 1.225               | 0.006                 | -9%                             | 1.162               | 0.009                 | -7%                             |
| 34-35       | 1.016               | 0.004                 | 4%                              | 1.111               | 0.007                 | -3%                             | 1.120               | 0.010                 | -8%                             |
| 36-37       | 1.096               | 0.005                 | 6%                              | 1.228               | 0.005                 | -4%                             | .                   | .                     | .                               |
| <b>mean</b> |                     |                       | <b>1.9%</b>                     |                     |                       | <b>-2.9%</b>                    |                     |                       | <b>-4.8%</b>                    |

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| sector      | Netherlands     |                   |                                 | Norway          |                   |                                 | Sweden          |                   |                                 |
|-------------|-----------------|-------------------|---------------------------------|-----------------|-------------------|---------------------------------|-----------------|-------------------|---------------------------------|
|             | Struct.<br>Mkup | Standard<br>error | Relative<br>Change              | Struct.<br>Mkup | Standard<br>error | Relative<br>Change              | Struct.<br>Mkup | Standard<br>error | Relative<br>Change              |
|             | $V_{1980}$      |                   | $\frac{V_{2000}}{V_{1980}} - 1$ | $V_{1980}$      |                   | $\frac{V_{2000}}{V_{1980}} - 1$ | $V_{1980}$      |                   | $\frac{V_{2000}}{V_{1980}} - 1$ |
| 15-16       | 1.085           | 0.007             | 4%                              | 1.059           | 0.007             | -1%                             | 1.012           | 0.009             | 13%                             |
| 17-19       | 1.129           | 0.007             | -4%                             | 1.088           | 0.006             | 0%                              | 0.971           | 0.010             | 16%                             |
| 20          | 1.019           | 0.005             | 8%                              | 1.098           | 0.006             | -4%                             | .               | .                 | .                               |
| 21-22       | 1.110           | 0.005             | 5%                              | 1.093           | 0.007             | 2%                              | 1.079           | 0.010             | 11%                             |
| 23-25       | 1.128           | 0.006             | 1%                              | 1.104           | 0.007             | 3%                              | 1.086           | 0.009             | 15%                             |
| 26          | 1.188           | 0.006             | 0%                              | 1.161           | 0.007             | -1%                             | 1.051           | 0.006             | 13%                             |
| 27-28       | 1.096           | 0.006             | -1%                             | 1.123           | 0.005             | -3%                             | 1.080           | 0.008             | 9%                              |
| 29          | 1.064           | 0.030             | 2%                              | 1.124           | 0.028             | -3%                             | .               | .                 | .                               |
| 30-33       | 1.107           | 0.027             | -3%                             | 1.143           | 0.094             | -3%                             | .               | .                 | .                               |
| 34-35       | 0.976           | 0.008             | 6%                              | 1.029           | 0.006             | 1%                              | 1.133           | 0.014             | -1%                             |
| 36-37       | 1.152           | 0.006             | -7%                             | 1.133           | 0.007             | -9%                             | .               | .                 | .                               |
| <b>mean</b> |                 |                   | <b>0.9%</b>                     |                 |                   | <b>-1.5%</b>                    |                 |                   | <b>11.0%</b>                    |
|             |                 |                   | <b>USA</b>                      |                 |                   |                                 |                 |                   | <b>All countries</b>            |
| 15-16       | 1.070           | 0.003             | 4%                              |                 |                   |                                 |                 |                   |                                 |
| 17-19       | 1.065           | 0.004             | 0%                              |                 |                   |                                 |                 |                   |                                 |
| 20          | 1.178           | 0.005             | -5%                             |                 |                   |                                 |                 |                   |                                 |
| 21-22       | 1.123           | 0.005             | 0%                              |                 |                   |                                 |                 |                   |                                 |
| 23-25       | 1.097           | 0.005             | 10%                             |                 |                   |                                 |                 |                   |                                 |
| 26          | 1.078           | 0.005             | 8%                              |                 |                   |                                 |                 |                   |                                 |
| 27-28       | 1.078           | 0.006             | 4%                              |                 |                   |                                 |                 |                   |                                 |
| 29          | 1.081           | 0.014             | -3%                             |                 |                   |                                 |                 |                   |                                 |
| 30-33       | 1.092           | 0.011             | 6%                              |                 |                   |                                 |                 |                   |                                 |
| 34-35       | 1.039           | 0.006             | 4%                              |                 |                   |                                 |                 |                   |                                 |
| 36-37       | 1.105           | 0.004             | 4%                              |                 |                   |                                 |                 |                   |                                 |
| <b>mean</b> |                 |                   | <b>3.0%</b>                     |                 |                   |                                 |                 |                   | <b>1.4%</b>                     |

### Notes

Sector description is given in the appendix of Chapter 1. Estimates are produced from equation 6 ( $h = 0$ ) and AR(2) residuals. Control variables defined at the country level are pooled across sectors for a given country. The correlation parameters are specific to the country x sector pair. Averages across sectors presented in the table are unweighted, i.e. treating each equally, because our prime interest lies in the mechanisms at work rather than in the impact for the total economy.

**Result 1:** *Markup changes over the last 25 years are mostly significant and are very heterogeneous across sectors and countries. Average markups are not lower at the end of the period than at any previous year. Based on the estimates, more sectors see their structural markups increasing, and those increasing change more in absolute terms than those decreasing.*

This general picture is, to a large extent, surprising. Indeed, the widespread perception is certainly one which deems that competition has become fiercer over the last three decades, due to trade

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liberalisation and to extended domestic enforcement of competition rules. Numerous country case studies identify that trade liberalisation has had a pro-competitive effect, reducing the distortions from imperfect competition. The negative impact of these measures on PCMs suggests that other counterbalancing forces are at work. This will be the main focus in Chapter 3. For the USA, this pattern is consistent with that highlighted by Katics and Petersen (1994, p.284), moreover, Broda and Weinstein (2006), using disaggregated data on imported products to the USA, found that the elasticity of substitution between varieties has decreased since 1972, from which they infer an increase in markups.

The second result is the most striking and highlights some form of PCM convergence within countries. On the one hand, high PCMs tended to go down over time, which is consistent with Oliveira Martins, Scarpetta and Pilat (1996), who use the same database between 1970 and 1992 and with Borjas and Ramey (1995) who study the impact of imports on rents in US concentrated industries. On the other hand, low PCMs tended to go up. The combination results in a robust PCM convergence, which is now illustrated in different ways.

First, Table 2.3 gives the Pearson correlation between the estimated change in the structural markup since 1980 and the estimated level in 1980 across sectors for each country. This correlation is negative for twelve of the thirteen countries in the sample. It equals -0.60 on average and is very significant overall and for six countries.

Second, one can directly turn to the data. For illustration purposes, Figures 2.3A to 2.3C chart the observed PCM trends in the case of France, sorting the sectors according to their ISIC number. In each of these charts, the convergence is clearly visible, with an increase in initially low margins, a decrease in initially high margins and a lower dispersion of PCMs over time.<sup>7</sup> In Figure 2.3A, the striking feature is the upward convergence of the “Textile, Leather and Footwear” PCM to the other sectors’ PCMs. By the early ‘eighties, the textile industry had already suffered from the competition of developing countries. Afterwards, the levelling off of the product quality for the remaining activities restored profitability and is consistent with the increase in PCMs. In Figure 2.3B, the convergence is

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<sup>7</sup> From these charts, we might infer that the removal of price-control in France in the mid-‘eighties has mattered.

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extreme in the middle of the 'eighties and the hierarchy of PCMs across sectors is reversed between the beginning and the end of the period. Finally, PCM trends in Figure 2.3C present a funnel shape, with the range between the lowest and the highest PCM being noticeably narrower in 2000 than in 1970, a common characteristic of these three charts.

**Table 2.3: Markup Convergence across Sectors**

| Country | Pearson correlation<br>between<br>( $\Delta v / v$ ) <sub>2000/1980</sub><br>and $v_{1980}$ |
|---------|---|
| Aut     | -0.67**   |
| Bel     | -0.23   |
| Can     | -0.59**   |
| Dnk     | -0.16   |
| Fin     | -0.41   |
| Fra     | -0.87***  |
| Gbr     | -0.74***  |
| Ita     | -0.52*  |
| Jpn     | 0.49  |
| Nld     | -0.72***  |
| Nor     | -0.40   |
| Swe     | -0.82***  |
| Usa     | -0.45   |
| Total   | -0.60***  |

**Notes**

The correlated variables are the estimated structural markups reported in Table 2.2  
 (\*):significance at 10%, (\*\*) at 5%, (\*\*\*) at 1%

Combining the sector and country dimensions, the results indicate a global convergence of markups, as Figure 2.4 illustrates compellingly. Each diamond represents one of the 132 country x sector pairs, the x-axis is the estimated markup in 1980, whereas the y-axis is the estimated markup change between 1980 and 2000. Moreover, regressing the log-difference of estimated markups between the end period and 1980 on the 1980 markup and on country and sector fixed effects for the 132 sectors yields a parameter for the initial (1980) markup of -0.72, being very significant (Student of -11.3). It is as if we could write a conditional convergence equation:

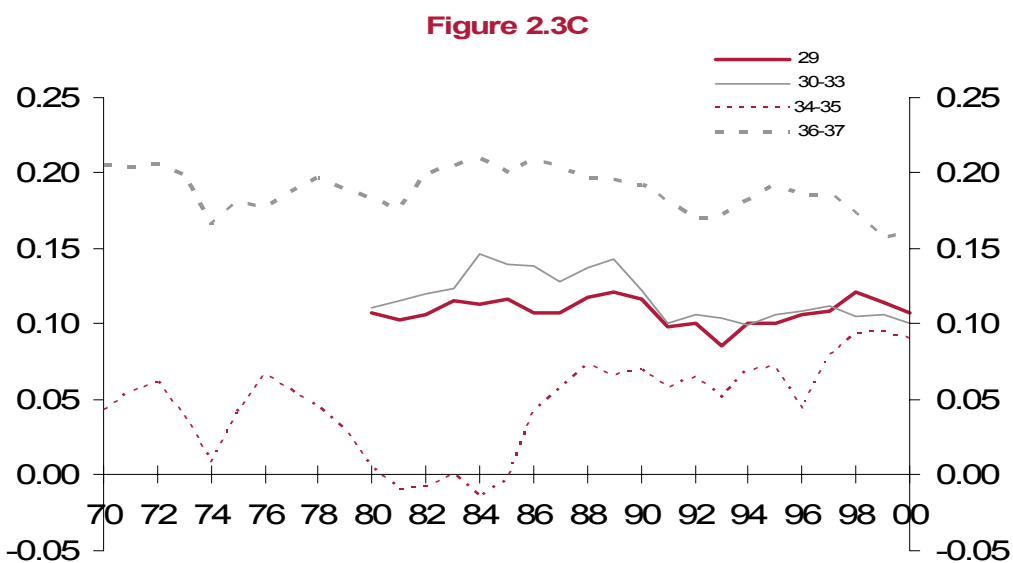
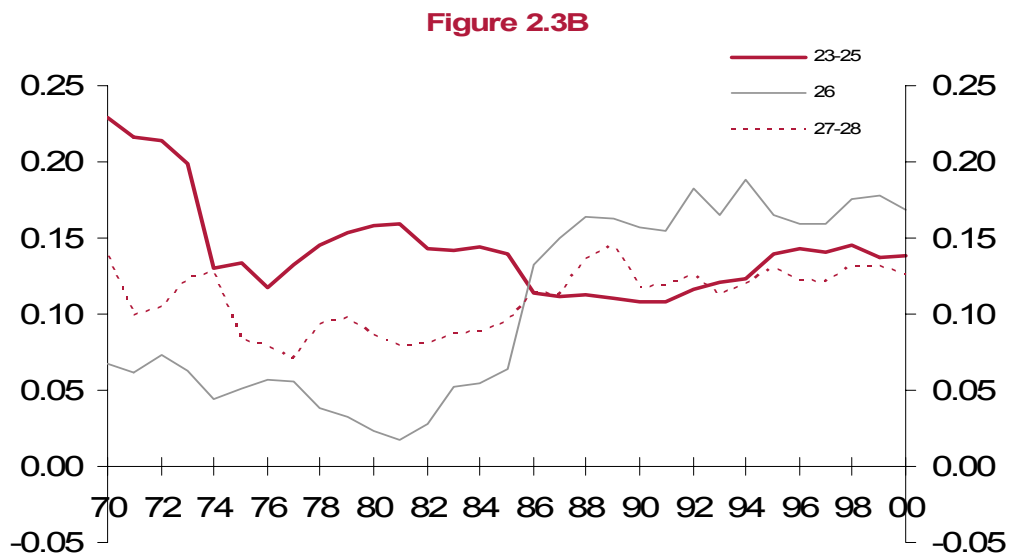
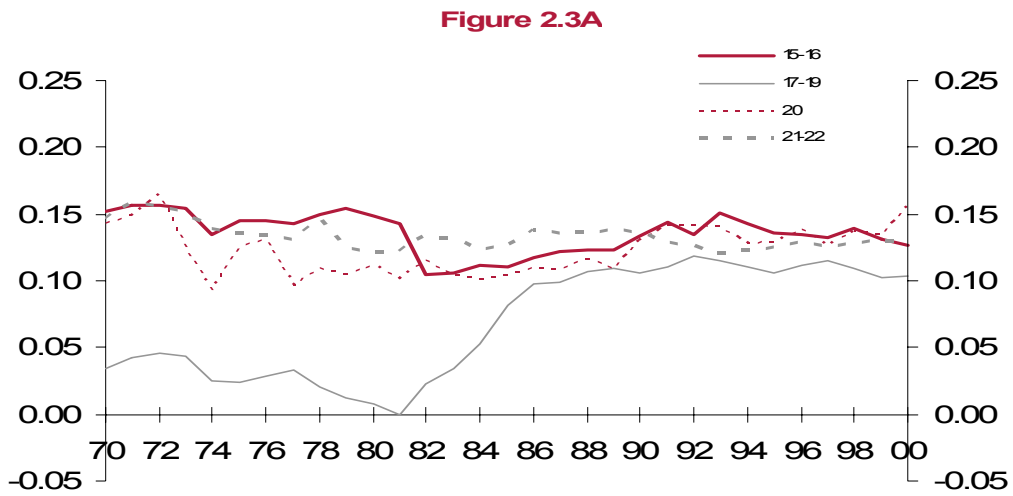
$$\text{Log}\mu_{ijt} = (1 - \kappa)\text{Log}\mu_{ijt} + \kappa.\text{Log}\bar{\mu}_{ij}$$

with  $\kappa = 0.72$ ,  $T = t + 20$  years and  $\bar{\mu}_{ij}$  being the long term markup of which the estimate is read from the fixed effects.

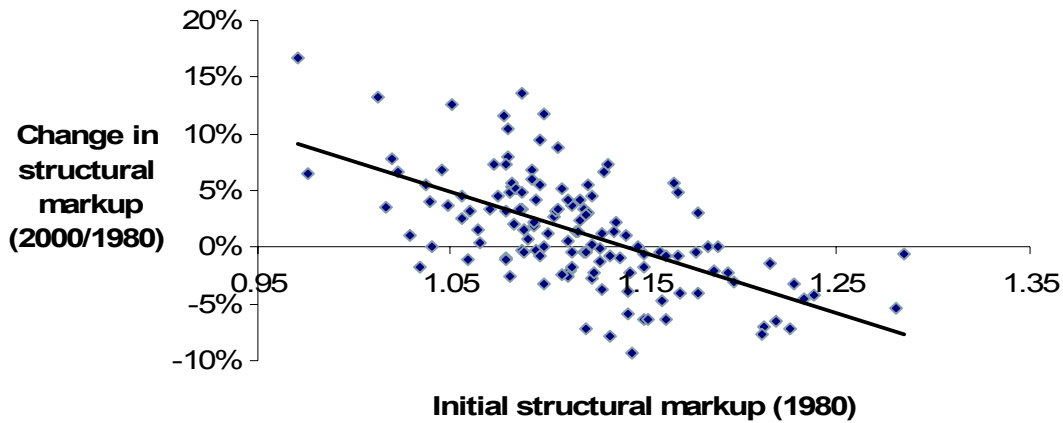


CHAPTER 2: THE CONVERGENCE OF PRICE-COST MARGINS

Figure 2.3: France: Convergence of (observed) Price-Cost Margins



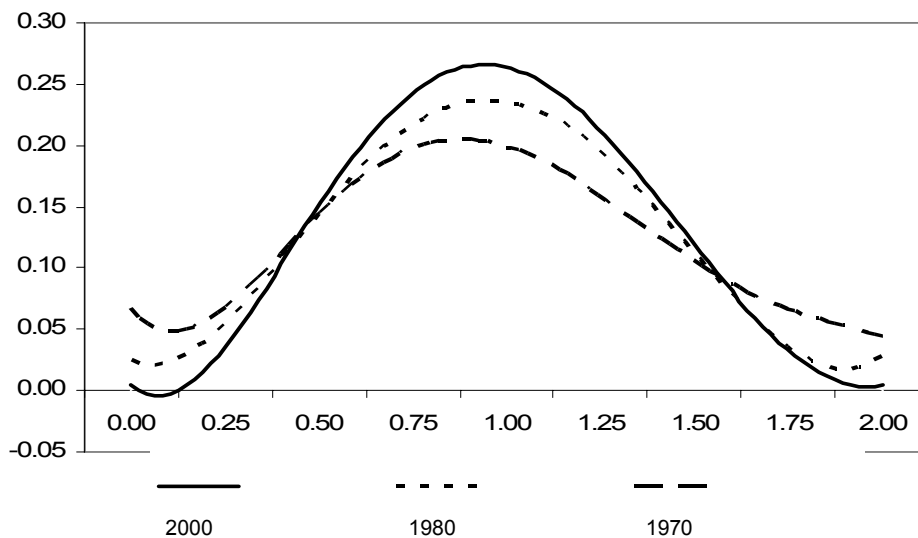
**Figure 2.4: Convergence in structural markups**



*Note: Each diamond represents one of the 132 country x sector pairs*

However, despite the illustration proposed in Figure 2.4, the sceptical reader might be concerned that our results are plagued by Galton's fallacy of regressions towards the mean. Indeed, as we have mainly highlighted  $\beta$ -convergence ( $0 < \kappa < 1$ ) so far, the critic of Quah (1993) and Bliss (1999) might apply. The concern is that the pattern displayed in Table 2.3 or Figure 2.4 might not necessarily imply a downward trend in markup dispersion. To address this issue, the distribution of structural PCMs are computed for each year, normalizing the series by the average as in Quah (1993, Fig.3.1). Figure 2.5A plots these distributions for 1970, 1980 and 2000, and clearly shows that there is a tendency in the normalized distribution to collapse towards unity.

**Figure 2.5A: Distribution of Structural Price-Cost Margins in 1970, 1980 and 2000**

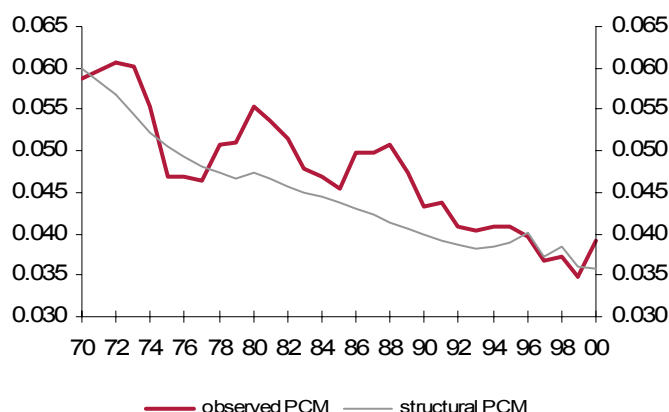


*Note: On the x-axis, the 132 structural PCMs are normalized to the average for each date. Distributions are smoothed using a polynomial of order five.*

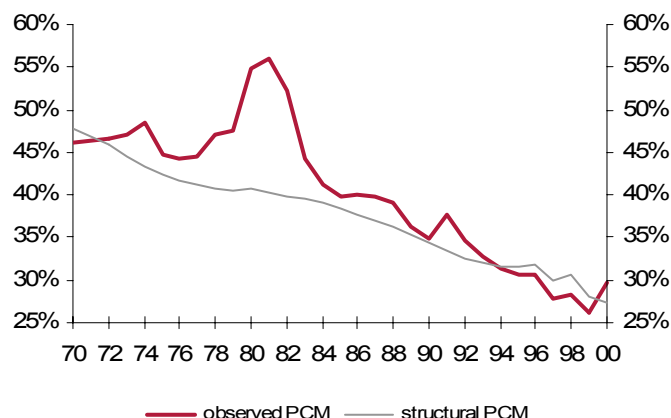
## CHAPTER 2: THE CONVERGENCE OF PRICE-COST MARGINS

Moreover, we calculate for each year the dispersion of the observed PCMs and of the structural PCMs. Figures 2.5B and 2.5C represent the trend in standard deviation and in the coefficient of variation respectively. Whatever the indicator, the dispersion was reduced by around a third over the period. Note that the convergence is smoother with structural PCMs, which indicates that our control variables are doing a good job in accounting for temporary shocks on markups, especially at the end of the 'seventies.

**Figure 2.5B: Standard deviation of Price-Cost Margins**



**Figure 2.5C: Coefficient of Variation of Price-Cost Margins**



Finally, the markup convergence also appears clearly within sectors across countries. Table 2.4 shows that, although estimated structural markups increased on average in 7 out of the 11 sectors from 1980 as reported in the third column, the dispersion across countries decreased in 8 sectors (last column). Indeed as indicated in the last row, the standard deviation of estimated markups across countries decreased by around 25% on average for all the sectors, from 0.049 in 1980 to 0.038 in 2000. All this provides strong evidence that, to make the analogy with growth theory, in addition to  $\beta$ -convergence, there is  $\sigma$ -convergence, "big time".

**Result 2:** *There is a strong convergence of PCMs through time across sectors within countries. This comes both from the decrease in initially high PCMs, which is consistent with the generally expected impact of intensified competition, and the increase in initially low PCMs. At sector level, PCMs are converging across countries.*

## CHAPTER 2: THE CONVERGENCE OF PRICE-COST MARGINS

**Table 2.4: Markup Convergence within Sectors across Countries**

| sector | Structural Markup average |       |        | Structural Markup standard deviation |       |        |
|--------|---------------------------|-------|--------|--------------------------------------|-------|--------|
|        | 1980                      | 2000  | Change | 1980                                 | 2000  | Change |
| 15-16  | 1.097                     | 1.116 | +      | 0.039                                | 0.044 | +      |
| 17-19  | 1.089                     | 1.110 | +      | 0.056                                | 0.029 | -      |
| 20     | 1.131                     | 1.131 | <>0    | 0.075                                | 0.056 | -      |
| 21-22  | 1.118                     | 1.157 | +      | 0.032                                | 0.036 | +      |
| 23-25  | 1.119                     | 1.177 | +      | 0.032                                | 0.041 | +      |
| 26     | 1.148                     | 1.176 | +      | 0.065                                | 0.030 | -      |
| 27-28  | 1.101                     | 1.121 | +      | 0.037                                | 0.033 | -      |
| 29     | 1.125                     | 1.109 | -      | 0.047                                | 0.030 | -      |
| 30-33  | 1.144                     | 1.132 | -      | 0.050                                | 0.045 | -      |
| 34-35  | 1.058                     | 1.069 | +      | 0.047                                | 0.033 | -      |
| 36-37  | 1.144                     | 1.129 | -      | 0.058                                | 0.045 | -      |
| mean   | 1.116                     | 1.130 | 0.014  | 0.049                                | 0.038 | -0.011 |

**Note:** The structural markups are the estimated parameters reported in Table 2.2. The averages and standard deviations are calculated across countries.

Three previous studies are consistent with the pattern of convergence in PCMs, although it is rarely noticed. First, Domowitz et al. report in their table 1 that, although the average PCM across the 284 US industries they study increases from 0.244 to 0.273 between 1958-1965 and 1974-1981, the standard deviation declines considerably from 0.058 to 0.033. This spectacular narrowing of PCM dispersion comes from the increase in PCMs of low concentrated sectors. Second, Bottasso and Sembenelli (2001) study the impact of the EU Single Market Program on the market power of Italian firms. They split the firms according to the sensitivities of their industries to the European integration Program. Highly sensitive firms see their average markup fall from 1.23 to 1.12, whereas moderately sensitive firms do not record any significant change with markup around 1.14 and for non-sensitive firms, average markup increases from 1.06 to 1.13. Third, Davies (2001, p.43) reaches a similar conclusion as regards concentration: "While our typologies [...] continue to have some success in explaining inter-industry differences in the *level* of concentration, it does not appear that they have much explanatory power concerning changes in market concentration". Most interestingly, Davies also highlights the convergence of concentration ratios across sectors (Table 5.1.5). Therefore, based on the new results displayed here, this convergence seems to follow a long term trend. As yet, economic literature has not paid enough attention to the forces behind such a development.

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### 2.4.3. Capital sensitivity

In the case of quasi-fixity, an average increase in PCM's might reflect an endogenous increase to restore profitability in the face for instance of higher real interest rates which weigh on fixed costs. However, when treating capital as a perfectly adjusting factor ( $h=1$ ), the slight increase in markups found on average is attenuated somewhat, but results pointing at various types of convergence are maintained. These conclusions proved to be robust to different computations of capital variables. In other words, although markup levels depend on the specification, markup changes are not really sensitive to this choice. This suggests that capital changes are not large enough to invalidate the convergence pattern, which is not too surprising given the low capital shares in total output. As Tybout (1996, p.212) put it: "If industry effects are controlled, temporal variation in capital intensity is not significantly related to fluctuations in price-cost margins within industry".

### 2.4.4. Better financial market efficiency as a convergence force

One cause favouring markup convergence is the improved efficiency of financial markets. Following an arbitrage argument, an investor chooses the sector providing her or him with the best return. For a given sector, the gross rate of return  $\rho$  is:

$$\rho = \frac{PY - WN - QM}{K} = \frac{PCM}{a_K} \cdot R \quad (7)$$

$a_K$  being the capital share in output at user cost. If financial markets are efficient, the excess return variable  $\pi \equiv \rho / R = PCM / a_K$  should be equal for every sector: in other words, the assumption of equalised returns across sectors implies that the PCM should be proportional to the capital share in output. This does not mean that PCM's should be equal in every sector, but this creates a strong convergence constraint. To better illustrate this, using data for the USA as an example and average capital shares for each sector, the average excess return  $\bar{\pi}$  equals 1.7. If excess returns were equal to this average in each sector – the stylised assumption of capital market efficiency – we could infer the PCM level for each sector  $j$ , based on the same capital shares, from  $PCM_j = \bar{\pi} \cdot a_{K,j}$ . This computation puts forward that in this case, although average PCM would barely change, the dispersion of PCM's would be reduced by almost 50%. In other words, although these calculations are admittedly rough, they clearly point to the link between capital market efficiency and PCM convergence. The channel is of course the capital mobility from low profit sectors to high profit ones.

## 2.5. Zoom on European integration

The sample enables us to focus on the relation between European integration and the pattern of PCMs across countries. Among the thirteen countries, Belgium, France, Italy and the Netherlands are the founding Members (Germany and Luxembourg are missing), Denmark and the United Kingdom joined in 1973, Austria, Finland and Sweden joined in 1995, Norway is the only European country outside the EU, finally, Canada, Japan and the USA are the non-European countries. Given the time period covered by the data, our benchmark is the average structural PCM of the six countries in the sample being Members since 1973 and called here EU-6. We can assess, for each country in the sample, how the strengthening of economic integration has shaped the pattern of PCMs, and interestingly analyze the impact of the adhesion of Austria, Finland and Sweden in 1995, especially as compared to the four other non-Member countries.

The evolution through time in the average levels of observed and structural PCM for EU-6 is very similar to those for the whole sample shown in Figure 2.2 and is therefore not reported here. In particular, the average EU-6 structural PCM is U-shaped with the bottom reached in the mid-'80s. To measure the degree of convergence to the EU-6 level, we calculate the average of the absolute difference in structural PCMs across sectors for each country and each year. Figure 2.6A provides the trends in this indicator for the three largest countries in EU-6. The convergence to the EU-6 average is clear for each country, however differences appear in the timing of the process. France follows a gradual convergence with the average absolute difference in structural PCM falling steadily from more than 4 points in 1970 to around 1.5 points in the '90s with a small trough at 1.2 in 1992-1995. It is often considered that European countries put a lot of effort into the preparation of the Single Market Program, which came into effect at the end of 1992 but was launched in a 1985 White Paper by the European Commission identifying 300 directives needed to remove physical, technical, and fiscal barriers. The UK shows a similar pattern, but this indicator is lower overall and the more pronounced trough in 1993 also coincides with the exit of Sterling from the EMS in September 1992. Although Italy is one of the founding Members, the level of integration measured by this indicator looks to have been delayed until the end of the '80s, from which time the convergence of Italy's levels towards those of France and the UK is rapid.

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Figure 2.6B focuses on the three small EU-6 countries and Norway for comparison. Belgium and the Netherlands record trends similar to those of France and the UK with a decrease below 2 points at the end of the period, while Denmark had already reached the 2-point mark in the early '70s. In contrast, although Norway looked very well integrated, based on this indicator, the trend from the early '80s clearly signals divergence. Figure 2.6C deals with the three countries that joined on January 1<sup>st</sup>, 1995. The patterns are very contrasted and the levels are higher than those seen in the graphs above, especially for Sweden and Austria. Austria started with a level far from the benchmark but the convergence took place early on. The 1995 event seems to have pushed the average difference to an unsustainably low level, lower than 1 point, from which it bounced back. Sweden follows a similar pattern from a much higher level since the '80s, suggesting a fairly low level of integration. Finally, Finland shows a smoother trend with a decrease of 40% in the indicator between the beginning and the end of the period, and a steady decrease in the '90s. All in all, it is difficult to depict one specific impact of the 1995 event. There seems to be a decrease in the absolute PCM differences before the enlargement, but followed by a recovery in the case of Austria and Sweden.

Finally, the non-European countries are represented in Figure 2.6D. Canada and the USA converged towards the 2-point mark. This suggests that the convergence pattern highlighted in the three graphs above is probably more related to a general process of worldwide economic integration beyond the sole construction of Europe. In addition to Norway, Japan is the other exception pointing at divergence from the EU-6 benchmark from the '90s, potentially related to the deep and specific economic crisis faced by this country.

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Figure 2.6: Average absolute difference in structural PCMs with EU-6 (\*)

Figure 2.6A: Large countries

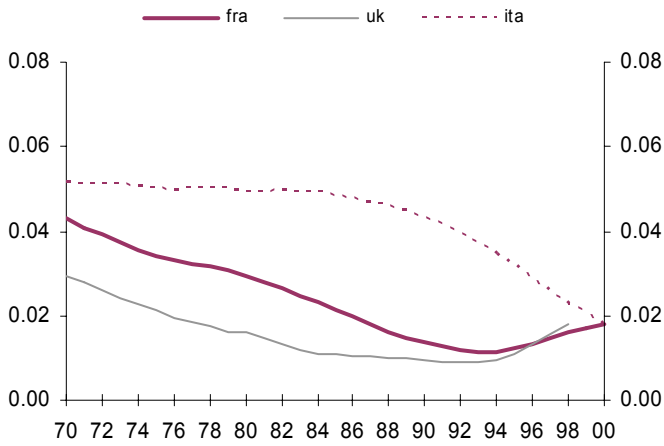


Figure 2.6B: Small countries

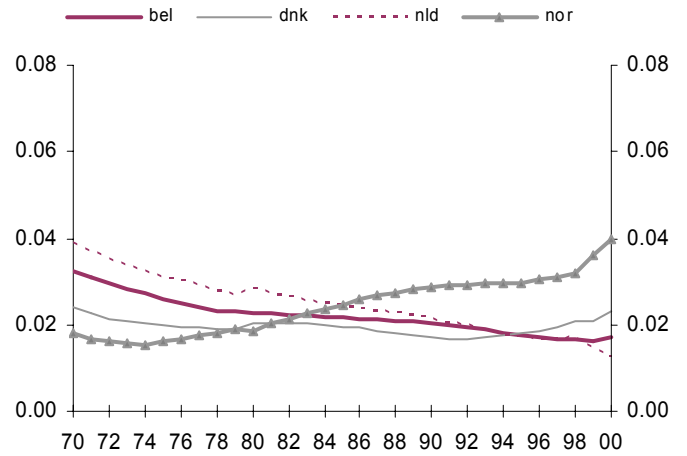


Figure 2.6C: 1995 Enlargement

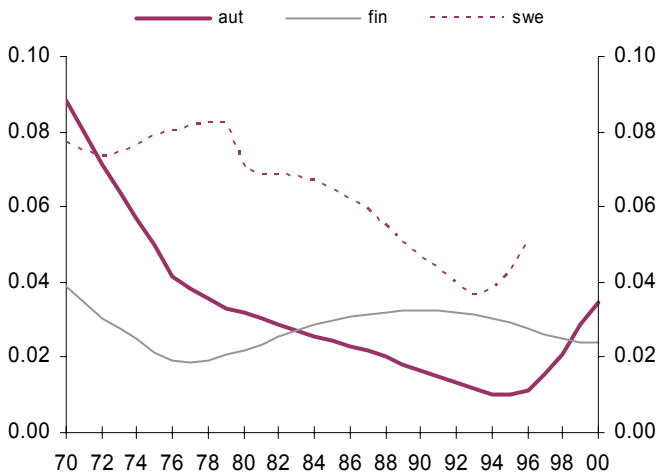
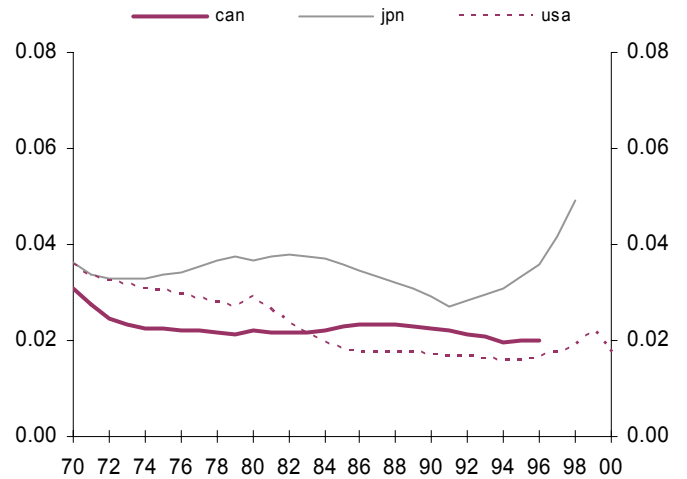


Figure 2.6D: Non-European countries



(\*): EU-6 is composed of the six countries in the sample that were already Members of the EU from 1973: Belgium, France, Italy, the Netherlands, Denmark, the UK.

### 2.6. Conclusion

Two main results stand out from this study. First, there is no common trend towards lower PCMs in the OECD manufacturing industries, not even on average. Second, a strong pattern of convergence in PCMs is exhibited across both sectors and countries. The convergence combines two phenomena: high margins have shrunk *and* low margins have grown, well beyond a simple reversion to the sample



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mean. As in Domowitz et al., the latter plays an important role in the decrease in the dispersion of PCMs.

Probably a driving force in this convergence pattern, better capital market efficiency cannot by itself explain the above two results. The increased facility to move capital across sectors and countries has to be combined with some forms of financial constraints, which limit the downside potential in markups. Explaining the role of financial market imperfections in the relationship between competition and markups could be an interesting avenue for further research.

Moreover, these results should encourage economists to search for countervailing effects to the impact of import competition, the most obvious determinant of changes in PCMs over the last decades. Exports, targeted at high margin markets, cost-saving through outsourcing, the endogenous reactions of firms, the decline in workers' bargaining power could all play a role, and more work is needed to disentangle these different explanations. Trying to link the markup trends to those in its structural determinants would enrich the analysis dramatically. These will be the topic of the following two chapters.

## Appendix: Impacts of inflation and cycles on observed price-cost margins

### Estimated price effects

Table 2.A shows that price changes and observed markups are estimated to be negatively linked: a decrease in inflationary pressures induces larger (observed) markups, as in Blanchard (1997). This is consistent with price stickiness, forcing firms to cut their margins in the face of unfavourable cost developments. However, the variable *DEFL* is significant for only 4 of the 13 countries at the 5% level, which is likely to be due to the correlation with oil price variables over the period. When it is significant, it implies that a decrease of 10 points in the GDP deflator, not uncommon since 1980, leads to a 1%-2% increase in observed markups. Moreover, the two oil price variables are jointly very significant. Oil price changes between 1980 and the end period entail, beyond the *DEFL* impact, an average increase of 0.7% in observed markups for all countries, ranging from -0.6% for the UK - the only negative point - to 3.8% for Japan, very dependent on oil. Overall, disinflation between 1980 and 2000 has triggered an average transitory increase in markups of 1.3% across countries.

### Estimated cycle effects

At the *sectoral* level, although the estimates are weakly significant, they confirm the counter-cyclicity of markups, supported empirically by Bills (1987) and Oliveira Martins and Scarpetta (2002) among others. Over the 132 sectors, the parameter  $\lambda^{EMP}$  is negative in 92 cases, being significant at 10% level in only 32 sectors against 16 when positive. On average per country (Table 2.A), the effect of *EMPCYC* is counter-cyclical for 10 countries, pro-cyclical for 2 only and neutral in the case of the USA. Overall, a cycle materialising in an increase of 1% above trend in sectoral employment induces a decrease of 0.07% in the markups.

The estimated impact of the *macroeconomic* cycle, through the *GAP* variable, is more robust and clearly leans towards the pro-cyclicity of markups. This may be due to some externality in demand and is consistent with the observed pro-cyclicity of accounting profits. From the latter observation, scepticism about the counter-cyclicity of markups is implied in Christiano, Eichenbaum and Evans (1996). On balance, these estimates may provide an explanation for why the debate concerning the cyclicity of markups remains unresolved. There may be a supply-driven counter-cyclical partial

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equilibrium effect dampened by a pro-cyclical general equilibrium one. Table 2.A implies that, on average across countries, an increase in the output gap of 1 point of GDP results in an average increase in markups of 0.20%. Although the average sensitivity is three times larger than the *EMPCYC* one, employment at the sector level could fluctuate much more than at the country level.

**Table 2.A: Price and Cycle Effects on Observed Markups from 1980 to 2000 (a)**

$$\text{Log}\left(\frac{PY}{WN + QM + h.RK}\right)_{ijt} = \text{Log} v_{ij} + b_{ij}.t + c_{ij}.t^2 + \lambda_i^{DEFL}.DEFL_{it} + \lambda_i^1.OIL1_{it} + \lambda_i^2.OIL2_{it} + \lambda_{ij}^{EMP}.EMPCYC_{ijt} + \lambda_i^{GAP}.GAP_{it} + u_{ijt}$$

|             |                   | PRICE                                   |             |              | CYCLE                       |                   |   |              |                  |
|-------------|-------------------|---|-------------|--------------|-----------------------------|-------------------|---|--------------|------------------|
| country     | Number of sectors | DEFL                                    | OIL         | Total        | $\bar{\lambda}_i^{EMP}$ (c) | $\lambda_i^{GAP}$ | EMPCYC                                  | GAP          | Total            |
|             |                   | Effect                                  | Effect (b)  | Price Effect |                             |                   | Effect (c)                              | Effect       | Cycle Effect (c) |
|             |                   | DEFL + OIL                              |             |              | EMPCYC + GAP                |                   |   |              |                  |
|             |                   | Parameter Estimate x Change in Variable |             |              | Parameter Estimate          |                   | Parameter Estimate x Change in Variable |              | Total Effects    |
| aut         | 11                | -0.2%                                   | 0.8%***     | <b>0.6%</b>  | -0.08                       | 0.03              | 0.0%                                    | 0.0%         | <b>0.0%</b>      |
| bel         | 9                 | -0.3%                                   | 0.4%***     | <b>0.1%</b>  | -0.20                       | 0.16**            | -0.4%                                   | -0.1%        | <b>-0.6%</b>     |
| can         | 11                | 1.9%***                                 | 0.4%**      | <b>2.3%</b>  | 0.16                        | 0.06              | -0.2%                                   | -0.2%        | <b>-0.4%</b>     |
| dnk         | 11                | 1.1%**                                  | 0.3%        | <b>1.4%</b>  | -0.02                       | 0.09              | -0.2%                                   | 0.2%         | <b>0.0%</b>      |
| fin         | 11                | -0.7%                                   | 0.7%**      | <b>0.0%</b>  | -0.14                       | 0.09              | -0.4%                                   | -0.1%        | <b>-0.5%</b>     |
| fra         | 11                | 0.4%                                    | 0.7%***     | <b>1.1%</b>  | -0.13                       | 0.16*             | -0.1%                                   | 0.0%         | <b>-0.1%</b>     |
| gbr         | 11                | 1.8%***                                 | -0.6%***    | <b>1.1%</b>  | -0.09                       | 0.43***           | 0.1%                                    | 1.5%         | <b>1.6%</b>      |
| ita         | 11                | 2.1%**                                  | 0.1%        | <b>2.2%</b>  | -0.15                       | 0.46***           | 0.5%                                    | -1.8%        | <b>-1.3%</b>     |
| jpn         | 6                 | 0.4%                                    | 3.8%***     | <b>4.1%</b>  | -0.10                       | 0.21              | -0.3%                                   | -0.4%        | <b>-0.8%</b>     |
| nld         | 11                | 0.2%                                    | 1.4%***     | <b>1.5%</b>  | 0.05                        | 0.29***           | 0.1%                                    | 0.6%         | <b>0.7%</b>      |
| nor         | 11                | -0.7%*                                  | 1.4%***     | <b>0.7%</b>  | -0.08                       | 0.02              | 0.2%                                    | 0.0%         | <b>0.2%</b>      |
| swe         | 7                 | 0.9%                                    | 0.0%        | <b>0.8%</b>  | -0.16                       | 0.63***           | -0.5%                                   | -2.3%        | <b>-2.8%</b>     |
| usa         | 11                | 0.4%                                    | 0.8%***     | <b>1.2%</b>  | 0.00                        | 0.02              | -0.5%                                   | 0.1%         | <b>-0.4%</b>     |
| 132         |                   |   |             |              |                             |                   |   |              |                  |
| <b>mean</b> |                   | <b>0.6%</b>                             | <b>0.7%</b> | <b>1.3%</b>  | <b>-0.07</b>                | <b>0.20</b>       | <b>-0.1%</b>                            | <b>-0.1%</b> | <b>-0.25%</b>    |

### Notes

(a): 1996 for Canada and Sweden. 1998 for the UK. The observation period starts as early as 1970 when data is available. The "Effect" of a given variable is the value of the estimated parameter times the change in the variable over the period. For example, the effect of the change in the GDP deflator (DEFL) in Denmark of 1.1% is  $\lambda_{Denmark}^{DEFL} = -0.24$  times the change in the deflator between 1980 and 2000, -0.046.

(b) Significance is based on the joint significance of the two oil parameters.

(c): average across sectors:  $\bar{\lambda}_i^{EMP} = \text{Mean}(\lambda_{ij}^{EMP})$ .

(\*):Significance at 10%. (\*\*) at 5%. (\*\*\*) at 1%

## Chapter 3

# Pro-competitive Effect and Offsetting Impacts<sup>1</sup>

### 3.1. Introduction

Trade theory teaches that international trade reduces markups through the so-called pro-competitive effect. The price-elasticity of demand perceived by domestic firms increases with foreign competition, which gives them an incentive to cut their margin. However, this theoretical effect does not apparently square with the raw data. Figure 3.1 plots the price-cost margin (PCM) and the import penetration ratio at aggregated manufacturing level for seventeen OECD countries from 1970: at first sight, trade developments do not seem to have the expected effect on PCMs. Indeed, the negative correlation between the two series is apparent for Japan and Spain only. Does this mean that the pro-competitive effect does not materialize or that there are counterbalancing phenomena?

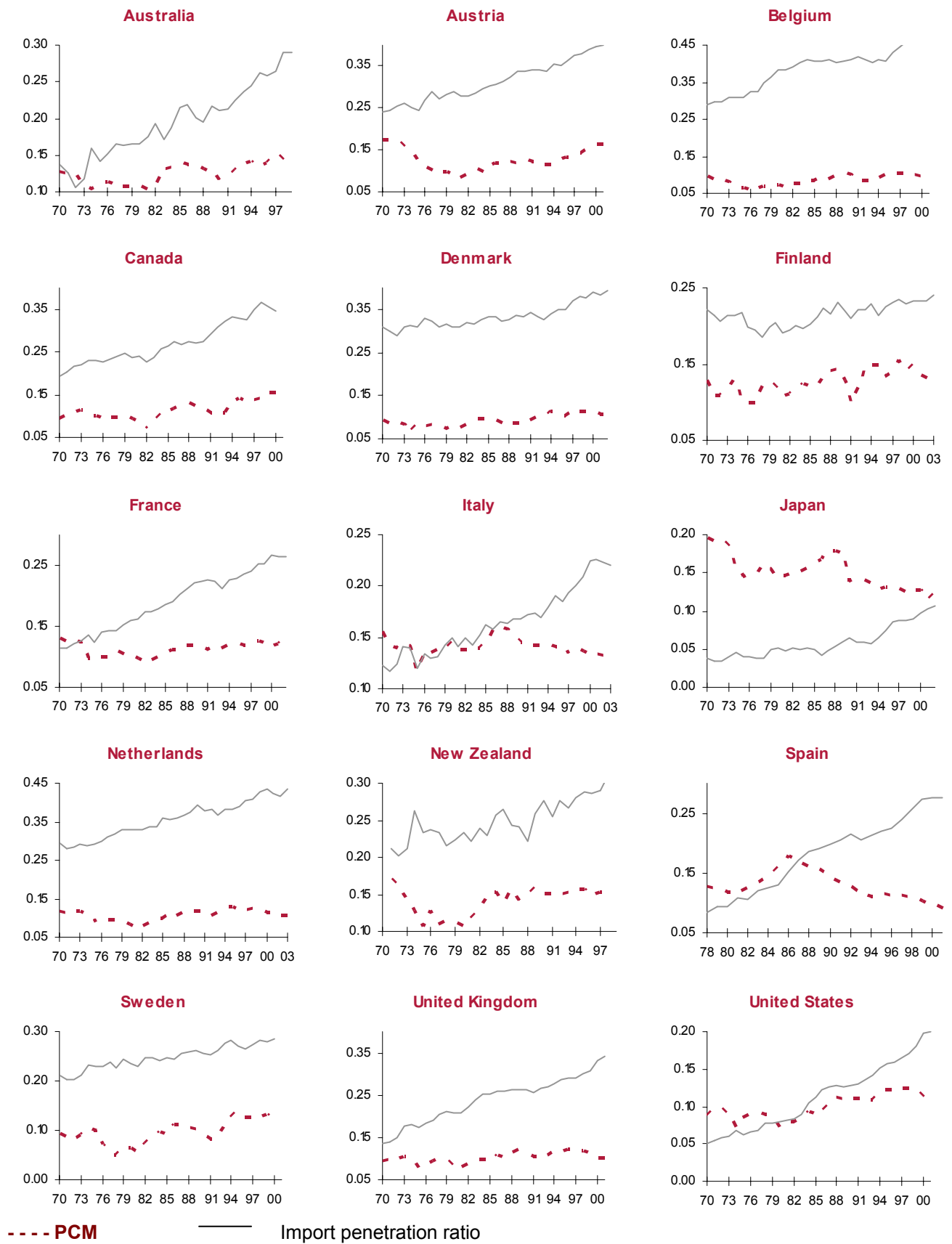
As pointed out by Levinsohn (1993), the idea that trade increases competition is often considered as the 'oldest insight' into the area of trade policy and imperfect competition. Based on the twenty-three studies surveyed in the following section, the pro-competitive effect of imports finds some empirical support but there is still a significant gap between the depth of the theoretical intuition and the reality of the quantified effects. Moreover, when found, the magnitude of the pro-competitive effect is

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<sup>1</sup> This Chapter is based on a revised version of Boulhol H., 2005, "Why Haven't Price-cost Margins Decreased with Globalization?", working paper TEAM, 2006.07, Cahiers de la MSE.

## CHAPTER 3: PRO-COMPETITIVE EFFECT AND OFFSETTING IMPACTS

Figure 3.1: Price-Cost Margin and Import penetration ratio at manufacturing level



Source: STAN, author's calculations

### CHAPTER 3: PRO-COMPETITIVE EFFECT AND OFFSETTING IMPACTS

relatively low to have an overpowering impact on welfare (De Ghellinck, Geroski and Jacquemin, 1988).

This chapter is the first study trying to assess the pro-competitive effect for a large panel of seventeen developed OECD countries at two-digit level. The closest exercise has been made by Chen, Imbs and Scott (2004, 2006) for seven European countries. The current chapter has two main objectives. The first is to pay very specific attention to the *quantification* of the impact of trade on market power. This dedication applies to the theoretical prediction, the empirical evidence accumulated to date and the new econometric results herein. The second consists in trying to understand why, despite trade liberalization, PCMs have not fallen in general.

The most obvious offsetting influence on PCM might be that of exports. Khalilzadeh-Shirazi (1974), Geroski (1982), De Ghellinck et al., Conyon and Machin (2001) and Görg and Warzynski (2003), all find a positive relationship between exports and PCM, although the estimated effect can only partially counterbalance that of imports. Moreover, the theoretical channels through which exports may have an impact on PCM are not that straightforward (Clerides, Lach and Tybout, 1998).

There is now extensive literature recognizing that wages are partly determined by rent-sharing between capital holders and workers. Since competition affects rents, it seems of critical importance to account for labor market imperfections, especially as labor market institutions have evolved substantially. Indeed, workers' bargaining power creates a wedge between markups and PCMs and Blanchard (1997) suggests that the erosion of workers' bargaining power would reconcile lower markups, not lower PCMs and decreasing manufacturing labor share. Also it is often argued that increased capital mobility makes domestic and foreign labor more substitutable (e.g. Rodrik, 1997).

Moreover, as discussed in greater detail below, researchers have linked markups to business cycles, inflation and stock market capitalization. These are important determinants to take into account in the empirical analysis given that the period under study covers the two oil crises. Our main results are the following. Imports have a robust and strong negative effect on PCMs as an increase of one point in the

## CHAPTER 3: PRO-COMPETITIVE EFFECT AND OFFSETTING IMPACTS

import intensity is estimated to trigger a decrease of around half a point in PCM. On average for manufacturing across countries, the increase in imports is estimated to have reduced the PCM by 0.046, from an average level of around 0.12. In addition, domestic product market deregulation seems to have reinforced this trend towards lower markups. However, these pro-competitive effects are counter-balanced by the positive impacts on PCMs of increased exports, financial deepening and disinflation. In some specifications, union participation is negatively linked to PCM, consistent with its expected relation to workers' bargaining position.

The chapter is organized as follows. The next section develops a model leading to the expression of the PCM with fairly general assumptions: price rigidities, differentiated goods, firm heterogeneity, conjectural variations and imperfect labor market. The model prediction is confronted to the surveyed empirical evidence concerning the pro-competitive effect of imports, and the contribution of the recent theoretical developments on firm heterogeneity follows. Section 3.3 focuses on the econometric specification and results are presented in Section 3.4. Section 3.5 concludes.

### 3.2. Trade and price-cost margins

Building on previous work dating back to at least the early 'seventies, Levinsohn (1993) termed the phenomenon by which international competition forces firms to behave more competitively, in the specific sense of bringing prices more in line with marginal costs, as the 'imports-as-market-discipline' hypothesis. The reciprocal dumping model of Brander and Krugman (1983) is probably the reference model highlighting this pro-competitive effect of trade, however Levinsohn stresses that the positive impact of protection on markups is robust to many different models making the discipline hypothesis a "theory's strong prediction". In this section, we are firstly interested in the *quantification* of this effect both in theory and practice and, secondly, in the contribution of the rapidly expanding literature on firm's heterogeneity to the topic.

#### 3.2.1. Model with wage bargaining and price rigidities

We now develop a model linking the PCM at sector level to import competition with fairly general assumptions: price rigidities, differentiated goods, firm heterogeneity, conjectural variations and imperfect labor market. The economy of a given country is composed of  $J$  sectors. The utility of the

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representative agent is CES of elasticity  $\sigma$  and depends on the consumption  $C_j$  of the differentiated good  $j$  for  $j = 1, 2, \dots, J$ , according to:

$$U = \left( \sum_j a_j \cdot C_j^{(\sigma-1)/\sigma} \right)^{\sigma/(\sigma-1)}, \quad a_j \geq 0 \quad (1)$$

Each variety  $l$  of good  $j$  is produced by one firm only, under constant returns to scale in the variable factors: labor  $N$ , of price  $w$ , and other variable inputs  $I$  of price  $q$  and  $\sigma_j$  is the constant elasticity of substitution between varieties:<sup>2</sup>

$$C_j = \left( \sum_l C_{jl}^{(\sigma_j-1)/\sigma_j} \right)^{\sigma_j/(\sigma_j-1)}, \quad \sigma_j > \sigma \quad \forall j \quad (2)$$

The PCM is defined (Schmalensee, 1989, p.960, Tybout, 2003) as the difference between revenue and variable cost over revenue:

$$PCM_{jl} \equiv \frac{p_{jl}Y_{jl} - (wN_{jl} + qI_{jl})}{p_{jl}Y_{jl}} \quad (3)$$

If there are rigidities in the sense that prices are slow to adjust to changes in nominal marginal costs, a price shock has an impact on markups. Rotemberg and Woodford (1999) present a model with sticky prices and show that the slowness of prices to adjust to changes in marginal cost leads to a negative relationship between current inflation and the difference between observed and steady-state markups. Moreover, studying eight OECD economies, Banerjee and Russell (2001) establish a negative relationship between inflation and markup. We model price rigidities in the simplest way by assuming that output price  $p_t$  for time  $t$  adjusts to the desired level  $p_t^*$  according to:

$$p_t = \frac{p_t^* + \beta \cdot p_{t-1}}{1 + \beta} \Leftrightarrow p_t = \frac{1}{1 + \beta \cdot \pi_t / (1 + \pi_t)} p_t^* \quad (4)$$

where  $\beta$  is an indicator of the rigidities and  $\pi_t$  is the inflation rate. Because of rigidities, the measured  $PCM$  differs from the desired level,  $PCM^*$ , given by the first-order profit maximization conditions, is negatively related to inflation and more so, the slower the prices adjust:

$$PCM_{jl} = 1 - \frac{wN_{jl} + qI_{jl}}{p_{jl}^* Y_{jl}} \cdot \left( 1 + \beta \cdot \frac{\pi_{jl}}{1 + \pi_{jl}} \right) = PCM_{jl}^* - \beta \cdot \frac{\pi_{jl}}{1 + \pi_{jl}} \cdot (1 - PCM_{jl}^*) \approx PCM_{jl}^* - \beta \cdot \pi_{jl} \quad (5)$$

<sup>2</sup>  $I$  and  $q$  can be seen as vectors.



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Labor market imperfections are introduced using the two main wage bargaining models, right-to-manage and efficient bargaining. Under the right-to-manage model, the firm and workers bargain over wages first and, in a second step, the firm decides on employment levels. In this case, wages remain allocative: because they are settled before employment decisions, first order conditions on profit maximization are left unchanged compared to the perfect labor market case. In the efficient bargaining model however, as firm and workers bargain over both wages and employment simultaneously, wages differ from the marginal revenue of labor. Crépon, Desplatz and Mairesse (2002) and Dobbelaere (2004), among others, give empirical support in favor of the efficient against the right-to-manage model.  $\mu_{jl}$  being the markup over marginal cost, the Appendix shows that in this case first-order conditions and Euler's equation leads to the markup equation,:

$$p_{jl}^* Y_{jl} = \frac{\mu_{jl}}{1 + \gamma \cdot (\mu_{jl} - 1)} \cdot (wN_{jl} + qI_{jl}) \Leftrightarrow PCM_{jl}^* = (1 - \gamma) \cdot \left( 1 - \frac{1}{\mu_{jl}} \right) \quad (6)$$

where  $\gamma$  is the bargaining power of workers. Equation (6) is valid under right-to-manage or perfect labor market with  $\gamma = 0$ . One can easily interpret these equations. The PCM is seen from the point of view of the firm paying the wage  $w$ , which includes the rents kept by workers. It refers therefore to the share kept by the firm, hence the term  $(1 - \gamma)$ .<sup>3</sup> Equation (6) reveals that the changes in the PCM over time are determined by changes in both the markup *and* the bargaining power:

$$\Delta PCM_{jl}^* = (1 - \gamma) \cdot \frac{\Delta \mu_{jl}}{\mu_{jl}^2} - \left( 1 - \frac{1}{\mu_{jl}} \right) \cdot \Delta \gamma \quad (7)$$

The Appendix derives the general expression of the aggregated PCM at sector level, given the assumptions of the model in equations (1), (2) and (4):

$$PCM_j = (1 - \gamma) \cdot \left( \frac{1}{\sigma_j} + \left( \frac{1}{\sigma} - \frac{1}{\sigma_j} \right) \cdot g_j \cdot H_j \cdot (1 - \theta_j) \right) - \beta \cdot \pi_j \quad (8)$$

$\theta_j$  being the import ratio of sector  $j$  defined as the ratio of imports over the sum of imports and domestic production,  $H_j$  the Herfindahl index for domestic production and  $g_j$  a conjectural variation parameter measuring the intensity of competition. To facilitate the interpretation of equation (8), note that it generalizes two well-known cases with identical firms, perfect labor market ( $\gamma = 0$ ) and no

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<sup>3</sup> The straightforward implication is that when labor market imperfections are ignored, as is the case in most markup estimates, the degree of product market imperfection, as represented by markup over marginal cost, is under-estimated, and even more so the greater the bargaining power.

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rigidities ( $\beta = 0$ ). The first is Cournot competition ( $g_j = 1$ ) for a homogenous good ( $\sigma_j = \infty$ ):  $PCM_j = (1 - \theta_j) / (N_j \cdot \sigma)$  where  $N_j$  is the number of domestic firms in sector  $j$ . The second is Dixit-Stiglitz case of monopolistic competition ( $H_j = 0$ ):  $PCM_j = 1 / \sigma_j$ . More generally, the more substitutable the varieties (high  $\sigma_j$ ), the fiercer competition (low  $g_j$ ), the less concentrated domestic production or the greater the import penetration, the lower the PCM is. The pro-competitive effect of international trade can be measured by the sensitivity of the PCM to the import ratio:

$$\partial PCM_j / \partial \theta_j = -(1 - \gamma) \cdot (1 / \sigma - 1 / \sigma_j) \cdot g_j \cdot H_j \quad (9a)$$

Table 3.1 gives some order of magnitude for reasonable values of the parameters, with a Cobb-Douglas utility function ( $\sigma = 1$ ). For example, with an elasticity of substitution between varieties of 8, Cournot competition and a Herfindahl index of 0.2, consistent with a PCM of 0.30 in autarky, an increase in the import ratio of 10 points induces a decrease of 1.8 points in the PCM. Note that these numbers are calculated assuming a perfect labor market. From equation (9a), with a bargaining power say of 0.2, these shall be multiplied by 0.8. With monopolistic ( $H_j = 0$ ) or Bertrand competition with identical firms ( $g_j = 0$ ), there is nothing to discipline and the pro-competitive effect is nil.

**Table 3.1: Sensitivity of the pro-competitive effect to intensity of competition ( $g$ ), concentration ( $H$ ), elasticity of substitution between varieties ( $\sigma_j$ ).**

$$\partial PCM_j / \partial \theta_j = -(1 - \gamma) \cdot (1 / \sigma - 1 / \sigma_j) \cdot g_j \cdot H_j$$

(simulation with  $\sigma = 1$  and  $\gamma = 0$ )

|                                     |     | $\sigma_j = 2$       |       |       | $\sigma_j = 8$       |       |       |
|-------------------------------------|-----|----------------------|-------|-------|----------------------|-------|-------|
|                                     |     | Herfindahl index $H$ |       |       | Herfindahl index $H$ |       |       |
|                                     |     | 0.1                  | 0.2   | 0.5   | 0.1                  | 0.2   | 0.5   |
| <i>Conjectural variation</i><br>$g$ | 0.1 | -0.01                | -0.01 | -0.03 | -0.01                | -0.02 | -0.04 |
|                                     | 0.5 | -0.03                | -0.05 | -0.13 | -0.04                | -0.09 | -0.22 |
|                                     | 1   | -0.05                | -0.10 | -0.25 | -0.09                | -0.18 | -0.44 |

**Reading:** When competition is Cournot ( $g = 1$ ), the Herfindahl index is 0.2 and the elasticity of substitution between varieties is 8, an increase of 1 percentage point in the import penetration ratio reduces the PCM by 0.0018.

Of course, equation (9a) only holds in the static case, i.e. if the concentration level,  $H$ , is constant. The work by Sutton (1991, 1997) insists on the endogeneity of market structure. An increase in the competitive environment may trigger an endogenous reaction of firms, through an increase in R&D or

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advertisement spending for instance, which forces out the firms unable to keep the pace. Also, the merger and acquisition waves give examples of an endogenous reaction of firms aiming at improving their market power. In addition, if imports generate a reshuffle of domestic production leading to the exit of firms, the Herfindahl index increases as a result, and the pro-competitive effect is dampened:

$$\partial PCM_j / \partial \theta_j = -(1-\gamma) \cdot (1/\sigma - 1/\sigma_j) \cdot g_j \cdot [H_j - (1-\theta_j) \cdot \partial H_j / \partial \theta_j] \quad (9b)$$

However, all the dynamic models with firm heterogeneity suggest that this reallocation effect occurs through the exit of the least efficient firms, which are also the smallest, and therefore this dynamic effect channelling through the increase in the Herfindahl index is likely to be moderate.

### 3.2.2. A brief survey of the empirical evidence

Table 3.2 provides a summary of the main results in the studies evaluating the pro-competitive effect of imports. This represents an extensive albeit non exhaustive survey of twenty-three papers. What emerges is some support in favor of the 'imports-as-market-discipline' hypothesis, however the evidence is not overwhelming. The current research is indebted to all these works and I would now like to highlight the main results and certain limitations in, hopefully, a constructive way.

Equation (8) indicates that the main determinant of PCM is likely to be the unobservable elasticity of substitution between varieties of a given sector. It therefore seems crucial to control for sector idiosyncrasies and in studies where the impact of imports is significant with OLS and non with sector fixed effects, the suspicion is that the trade variables capture some of these sector specificities included in the OLS residuals, thereby rendering OLS estimates biased.

The plant-level studies in Grether (1996), Roberts (1996) and Tybout (1996) provide some convincing results supporting the pro-competitive effect, especially as, consistent with the theory, the largest firms are the most affected in terms of margin. This piece of evidence would have been strengthened if, as in Roberts, the aggregation at sector level, which only consists in weighted-averaging for PCM, had confirmed the effect found at firm level.

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**Table 3.2: Survey of the pro-competitive effect of imports**

| Study   | Country                | Aggregation level                   | Period    | Trade variable                             | Method   | trade instrumented ? | Main results (impact of the trade variable on markups or PCMs) <sup>1</sup>  | assessment |
|---|------------------------|-------------------------------------|-----------|--|--|----------------------|--|------------|
| <i>Developed countries</i>                              |                        |                                     |           |  |  |                      |  |            |
| Esposito and Esposito (1971)                            | USA                    | 77 industries                       | 1963-65   | Import ratio                               | Profit rate  | no                   | -0.07  | S          |
| Domowitz, Hubbard and Petersen (1986)                   | USA                    | 265 four-digit sectors              | 1958-81   | Import ratio                               | PCM<br>OLS / sector fixed effects                    | no                   | FE: <i>positive</i> impact<br>OLS: positive for the least concentrated sectors;<br>Negative for the most concentrated            | SP         |
| Salinger (1990)   | USA                    | four-digit                          | 1972-84   | Import ratio                               | PCM  | no                   | +0.28  | SP         |
| Katics and Petersen (1994)                              | USA                    | 131 four-digit                      | 1964-86   | Import ratio                               | PCM<br>First diff.                                   | no                   | -0.17  | S          |
| Gupta (1983)  | Canada                 | 67 industries                       | ?         | Import ratio                               | PCM  | no                   | not significant  | NS         |
| Khalilzadeh-Shirazi (1974)                              | UK                     | 60 four-digit industries            | 1963      | Import ratio                               | PCM  | no                   | -0.10  | S          |
| Geroski (1981, 1982)                                    | UK                     | 52 four-digit industries            | 1968      | Import ratio                               | PCM  | yes                  | OLS: 1981: not significant<br>1982: -0.20<br>IV (only in 1981) : -0.42   | S          |
| Canyon and Machin (1991) <sup>1 2</sup>                 | UK                     | Three-digit                         | 1983-86   | Dummy import penetration ratio $\geq 0.35$ | PCM<br>Static and Partial adjustment<br>GMM          | -                    | -0.08  | S          |
| Boulhol, Dobbelaere and Maioli (2006) <sup>2</sup>      | UK                     | 9,820 firms in 20 two-digit sectors | 1988-2003 | Import ratio                               | Hall + efficient bargaining<br>firm FE / GMM         | no                   | Negative effect on markup and bargaining power when imports come from developed countries; not significant from developing -0.22 | S          |
| De Ghellinck, Geroski and Jacquemin (1988) <sup>2</sup> | Belgium                | 82 three-digit                      | 1973-78   | Import ratio                               | PCM<br>Structure-performance model<br>OLS / IV       | yes                  | IV: -0.05<br>OLS: -0.07  | S          |
| Konings, Van Cayseele and Warzynski (2002)              | Belgium<br>Netherlands | 4,700 firms                         | 1992-97   | Import ratio                               | Hall<br>GMM<br>no firm FE<br>no sector FE for markup | no                   | Belgium: not significant<br>Netherl.: +0.23  | NS         |
| Stälhammar (1991)                                       | Sweden                 | 67 industries                       | 1985      | Import ratio                               | PCM  | no                   | not significant  | NS         |
| Hansson (1992) <sup>1</sup>                             | Sweden                 | Four-digit                          | 1969-87   | Import ratio                               | PCM  | Exo g. test acc ept. | -0.03<br>not significant when from dvped countries<br>-0.12 when from dvping   | S          |
| Lundin (2004)   | Sweden                 | 3,200 firms in 93 three-digit       | 1990-99   | Import ratio                               | PCM<br>OLS / sector FE                               | no                   | FE: not significant<br>OLS:<br>0.06 / 0.09 when from high income countries;<br>-0.70/-0.60 when from low income                  | NS         |

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| Study                                     | Country                               | Aggregation level                         | Period                     | Trade variable                          | Method                                 | trade instrumented? | Main results (impact of the trade variable on markups or PCMs) <sup>1</sup>  | assessment |
|---|---------------------------------------|---|----------------------------|---|--|---------------------|--|------------|
| Chen, Imbs and Scott (2004) <sup>2</sup>  | 7 European countries                  | 10 two-digit manufacturing sectors        | 1988-2000                  | Log of import to production ratio       | PCM<br>GMM / IV                        | yes                 | $\partial PCM / \partial Logm = -0.10$<br>$\Rightarrow \partial PCM / \partial \theta \approx -0.44$<br>for average import ratio                   | S          |
| <b>Developing countries</b>               |                                       |   |                            |   |  |                     |  |            |
| Levinsohn (1993)                          | Turkey                                | 760 firms in 10 three-digit               | 1984 trade lib.<br>1983-86 | Before / after                          | Hall<br>no firm FE;<br>no intermediat. | -                   | For two out of the three industries in which trade was liberalized and markups were initially high, markups decrease significantly                 | -          |
| Harrison (1994)                           | Ivory Coast                           | 250 firms                                 | 1985 trade lib.<br>1979-87 | Import ratio;<br>Trade barriers         | Hall<br>firm FE                        | no                  | Import penetration: -0.25<br>Trade barriers: not significant   | S          |
| Haddad et al. (1996)                      | Morocco                               | 18 two-digit industries<br>4,600 firms    | 1984-89                    | Import ratio                            | PCM<br>OLS / sector FE                 | no                  | <u>Sector:</u><br>FE: + 0.17<br>OLS: -0.20<br><br><u>Plant:</u><br>FE: not significant<br>OLS:<br>+0.09-0.65*market share                          | NS         |
| Grether (1996)                            | Mexico                                | 20 two-digit industries<br>2,800 plants   | 1985-90                    | Tariff rate;<br>Import license coverage | PCM<br>OLS / sector FE                 | no                  | <u>Sector:</u><br>FE: not significant<br>OLS: pro-competitive effect<br><br><u>Plant:</u><br>FE only: pro-competitive effect for the largest firms | NS         |
| Roberts (1996)                            | Columbia                              | 28 three-digit industries<br>6,300 plants | 1977-85                    | Import ratio                            | PCM<br>Sector FE                       | no                  | <u>Sector:</u><br>-0.18 on average;<br>Bigger effect for more concentrated sectors<br><br><u>Plant:</u><br>-1.1*market share                       | S          |
| Tybout (1996)                             | Chile                                 | 28 three-digit industries<br>5,000 plants | 1979-85                    | Import ratio                            | PCM<br>OLS / sector FE                 | no                  | <u>Sector:</u><br>FE: +0.11<br>OLS: -0.09<br><br><u>Plant:</u><br>FE only: -1.4 * market share   | ?          |
| Krishna and Mitra (1998)                  | India                                 | 460 firms<br>Four-digit                   | 1991 trade lib.<br>1986-93 | Before / after                          | Hall<br>Firm random / fixed eff.       | -                   | Decrease in three sectors;<br>Increase in one  | -          |
| <b>Developed and developing countries</b> |                                       |   |                            |   |  |                     |  |            |
| Kee and Hoekman (2003) <sup>1 2</sup>     | UNIDO database<br>42 dvped and dvping | 28 three-digit industries                 | 1981-98                    | Log of import to production ratio       | Hall<br>Olley-Pakes                    | yes                 | $\partial \mu_{VA} / \partial Logm = -0.14$<br>$\Rightarrow \partial PCM / \partial \theta \approx -0.25$<br>for average import ratio              | S          |

<sup>1</sup> : For these studies, PCM are calculated with value added as the denominator. The estimates are converted using factor of 0.4 reflecting average share of value added in sales.

<sup>2</sup> : Due to the method or trade variable, the sensitivities are harmonized to make them directly comparable. Details are available upon requests.

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Another issue is related to the endogeneity of the trade variables. As discussed below, treating trade as exogenous might lead to biased estimates and, importantly in this case, the pro-competitive effect is most likely *underestimated*. Therefore, as most of the studies treat trade as exogenous, their estimates should be considered a lower bound.

Kee and Hoekman (2003) take into account the endogeneity of the ratio of imports to production,  $m$ . Using  $m$  rather than  $\theta$  introduces a non-linear relationship between the markup and the import ratio. However, they treat this non-linearity assuming that markups depend linearly on the *logarithm* of  $m$ . It is extremely unlikely that a doubling of the import ratio from 0.1% to 0.2% could have the same impact as a doubling from 10% to 20% for instance. Unfortunately, the significance of the import variable does not seem robust to less extreme non-linear functions: the  $\text{Log}(m)$  specification gives far too much weight on “small  $m$  – high markups” observations, which distorts the estimates.<sup>4</sup>

In the last column of Table 3.2, I kept the score, somehow subjectively, on whether the pro-competitive effect is significant and negative (S).<sup>5</sup> S wins over NS (not significant) plus SP (significant and positive) but with a fairly tight score of 12-8. Out of the 12 sensitivities marked ‘S’, four only are obtained treating trade as endogenous. It is noteworthy that when trade is not instrumented, the average sensitivity is -0.14 with a maximum (in absolute terms) of -0.25, whereas when instrumented the average is -0.29 in a (-0.45, -0.25) range with the exception of De Ghellinck et al. (-0.05). This average of -0.29 lies in the upper part of the expectations based on the model presented above and summarized in Table 3.1.

### 3.2.3. The pro-competitive effect in the expanding literature on firm heterogeneity

The theoretical advances focusing on firm heterogeneity are rapidly expanding. As is well known, the combination of monopolistic competition and CES utility function does not allow us to exhibit a pro-competitive effect (see equations 8 or 9 with  $H = 0$ ). This is because every firm has a constant

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<sup>4</sup> Their *econometric specification* implies that  $\partial \text{markup} / \partial m = \text{constant} / m$  and, therefore, that the derivative of the markup with respect to the import ratio is infinite when the import ratio approaches zero. In fact from their *model*, it can be shown that  $\lim_{m \rightarrow 0} \partial \text{markup} / \partial \text{Log}m = 0$ . The estimates seem to depend heavily on a few observations where markups were between

300% and 630% and import penetration of less than 0.1% Details are available upon requests.

<sup>5</sup> When OLS and FE (or IV) estimates are available, the specification guiding the assessment is the FE (IV). The studies by Levisohn and Krishna and Mitra were excluded because the pro-competitive effect cannot be quantified and Tybout's has mixed results.

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markup  $1/\sigma_j$  irrespective of its size. Departing from either the monopolistic competition case or the CES utility function, Bernard, Eaton, Jensen and Kortum (2003) and Melitz and Ottaviano (2005) respectively display a positive relation between market share and markup (as in equation A5 when competition is not monopolistic) confirmed by the empirical evidence. In these models trade liberalization has two offsetting impacts on the aggregated markup.

On the one hand, the decrease in domestic barriers induces a shift to the left of the whole markup distribution (i.e. a lower markup for each firm) generating a pro-competitive effect through additional imports (*direct effect*). On the other hand, the lowering of foreign barriers enlarges the access to markets. These export opportunities motivate the entry of new competitors, the exit of the least efficient / low markup firms and the expansion of the most efficient / high markup ones (*selection effect*). Consequently, this reshuffling of production between firms tends to increase the aggregated markups. It turns out that the distribution of firms (based on a Frechet and Pareto distribution in Bernard et al. and Melitz and Ottaviano respectively) is such that the direct effect and the selection effect exactly offset each other when liberalization is bilateral and, therefore, that the average markup remains constant.<sup>6</sup> In these two models, the impact of openness is a more efficient allocation between firms generating an increase in aggregated productivity at constant averaged markup. It is clear however that these two effects need not cancel each other out in the real world and therefore that the empirical researcher has to allow for a specific impact channelling through exports. This might be very important as the positive correlation between imports and exports can seriously bias downwards the estimation of the impact of imports should exports not be included in the regressors.

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<sup>6</sup> In Melitz and Ottaviano, the *absolute* difference between price and marginal cost decreases with trade liberalization, but this is due to the decrease in cost due to better efficiency at constant markup. In other words the relative difference between price and cost (i.e. the markup) remains constant on average.

### 3.3. Empirical specification

#### 3.3.1. Sectoral and labor market data

Manufacturing data at sector level is taken from the OECD STAN database. This unbalanced panel covers twenty-one sectors at two-digit level (ISIC Rev.3) for seventeen countries between 1970-2003. The PCM variable is calculated assuming that the variable inputs are labor and material (Schmalensee, 1989 and Tybout, 2003). Using PCM as the dependent variable is the standard approach followed in most of the studies referenced in Table 3.2.

Tables 3.3A and 3.3B give the average level and the average change over the period in the PCM, for each country and sector respectively. Average PCM over the sample is 0.116 and there is no average decrease in PCMs, but rather a strong heterogeneity of changes between both countries and sectors, as the standard deviation states. PCM trends were the prime focus of Chapter 2 in which a strong pattern of convergence in PCMs, both across sectors and countries, is exhibited. This pattern results from a decrease in initially high PCMs *and* an increase in initially low PCMs.

**Table 3.3A: Average level and average change in the price-cost margin across sectors over the period (unweighted) \***

|             | Level   |       | Change  |       |
|-------------|---------|-------|---------|-------|
|             | Average | s.d.  | Average | s.d.  |
| Australia   | 0.131   | 0.051 | 0.026   | 0.052 |
| Austria     | 0.123   | 0.031 | 0.070   | 0.085 |
| Belgium     | 0.107   | 0.031 | 0.001   | 0.025 |
| Canada      | 0.120   | 0.041 | 0.069   | 0.031 |
| Denmark     | 0.103   | 0.033 | 0.016   | 0.068 |
| Spain       | 0.133   | 0.052 | -0.091  | 0.108 |
| Finland     | 0.130   | 0.037 | -0.002  | 0.073 |
| France      | 0.106   | 0.035 | 0.030   | 0.105 |
| UK          | 0.106   | 0.026 | 0.014   | 0.065 |
| Germany     | 0.095   | 0.037 | -0.011  | 0.047 |
| Italy       | 0.140   | 0.049 | -0.029  | 0.053 |
| Japan       | 0.149   | 0.045 | -0.008  | 0.070 |
| Netherlands | 0.107   | 0.036 | -0.002  | 0.070 |
| Norway      | 0.089   | 0.023 | -0.011  | 0.070 |
| New Zealand | 0.148   | 0.033 | 0.012   | 0.041 |
| Sweden      | 0.098   | 0.071 | 0.042   | 0.065 |
| USA         | 0.111   | 0.048 | 0.023   | 0.063 |
| Total       | 0.116   | 0.044 | 0.007   | 0.079 |

(\*) : For the level, the standard deviation is the standard deviation across sectors of the average PCM through time. The change refers for a given (country x sector) to the change in the PCM between the beginning and the end of the period



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**Table 3.3B: Average level and average change in the Price-Cost Margin  
across countries over the period (unweighted) \***

|                                    | Level        |              | Change       |              |
|------------------------------------|--------------|--------------|--------------|--------------|
|                                    | Average      | s.d.         | Average      | s.d.         |
| Food and Beverages                 | 0.106        | 0.021        | 0.024        | 0.025        |
| Textiles                           | 0.111        | 0.028        | 0.022        | 0.071        |
| Wearing Apparel                    | 0.110        | 0.022        | 0.008        | 0.057        |
| Leather and Footwear               | 0.098        | 0.030        | 0.034        | 0.069        |
| Wood and Cork                      | 0.123        | 0.039        | -0.015       | 0.065        |
| Pulp and Paper                     | 0.137        | 0.029        | 0.030        | 0.060        |
| Printing and Publishing            | 0.134        | 0.036        | 0.028        | 0.059        |
| Coke, Refined Petroleum            | 0.113        | 0.078        | 0.001        | 0.176        |
| Chemical                           | 0.161        | 0.036        | 0.029        | 0.049        |
| Rubber and Plastics                | 0.123        | 0.023        | 0.011        | 0.057        |
| Other non-metallic mineral         | 0.155        | 0.035        | -0.010       | 0.060        |
| Basic metals                       | 0.095        | 0.024        | 0.010        | 0.074        |
| Fabricated Metal                   | 0.120        | 0.024        | 0.007        | 0.047        |
| Machinery and Equipment,           | 0.108        | 0.024        | -0.025       | 0.064        |
| Office, Accounting and Comp. Mach. | 0.117        | 0.047        | -0.087       | 0.097        |
| Electrical Machinery               | 0.119        | 0.022        | -0.045       | 0.078        |
| Radio, TV and Comm. Equip.         | 0.119        | 0.058        | 0.006        | 0.113        |
| Medical, Precision and Optical     | 0.120        | 0.049        | 0.025        | 0.066        |
| Motor Vehicles                     | 0.080        | 0.024        | 0.027        | 0.063        |
| Other Transport                    | 0.063        | 0.047        | 0.066        | 0.067        |
| Manuf. Nec and Recycling           | 0.113        | 0.057        | -0.002       | 0.056        |
| <b>Total</b>                       | <b>0.116</b> | <b>0.044</b> | <b>0.007</b> | <b>0.079</b> |

(\*) : For the level, the standard deviation is the standard deviation across countries of the average PCM through time.

According to the model in 3.2.1, the PCM is negatively related to the import ratio, the workers' bargaining power and the inflation rate. The variable *IMPRATIO* is the import penetration ratio  $\theta$  defined in the preceding section. Two direct labor market indicators are used from the Labour Market Institutions Database assembled by Nickell and Nunziata (2001): *EP* is the employment protection legislation index scaled on a (0;2) range, and *UDNET* is net union density.<sup>7</sup>

Hoekman, Kee and Olarreaga (2001) found that stock market capitalization has a significant positive impact on average industry markups. They consider that financial deepening reduces the cost of capital, thus increasing the overall profitability of the economy. It is not very clear, however, why this decrease in factor cost would not be passed on to customers, except of course if market power increases. Moreover, even though a decrease in the user cost can increase profitability, this effect would not show up in the PCM computed without taking into account capital costs. Within the theoretical framework detailed above, another way through which financial deepening may influence PCMs is by weakening workers' bargaining power due to increased capital mobility. Another channel links the rise in stock market prices with M&A activities which may increase market power through

<sup>7</sup> The data for about half of the countries ends in 1995, and extends to 1998 for the rest. However, as highlighted by the most recent data available (OECD Employment Outlook, 2004, Chapter 2), employment protection legislation has not changed much between 1998 and 2003.

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increased concentration. This relation between financial deepening and M&A is clearly put forward by Hobijn and Jovanovic (2001), especially for the M&A waves of the 'eighties and 'nineties, and provides a mechanism linking markups and market capitalization positively. To take this effect into account, the logarithm of stock market capitalization as a share of GDP, *LOGCAPIT*, is considered.

Finally, in order to control for price developments, the change in the GDP deflator, *DEFL*, is included in the regressors. According to theory and some empirical studies reviewed above, the pro-competitive effect is expected to be the stronger the more concentrated the domestic production. Unfortunately, levels of concentration for such a large panel are not available and our estimates therefore apply to average concentration levels.

### 3.3.2. Other potential determinants of markups

Models with firm heterogeneity which link exporting activity and markup at firm level have been discussed above. In these models, more efficient firms self select so that they are able to cover the fixed costs of exporting and benefit from the market expansion triggered by foreign liberalization. Although the learning by exporting assumption finds little empirical support, Bernard and Jensen (1997) and Maurin, Thesmar and Thoenig (2002) put forward an export based channel by which firms reorganize to access foreign markets; the very act of exporting seems to require a skill upgrading. In addition, firms naturally orientate their production to the higher PCM markets, hence a direct positive relationship between exports and PCMs. This is particularly the case with differentiated products when exporters focus in niche markets abroad. Indeed, the positive effect of exports depends upon whether margins in the export markets exceed that in the domestic one. The variable *EXPRATIO* is defined as the ratio of exports to the sum of domestic production and imports.

According to equation (8), PCM is negatively related to the domestic intensity of competition. As domestic product market deregulation has accompanied trade liberalization over the last decades, omitting variables reflecting the intensity of domestic competition might bias the pro-competitive effect of international trade upwards. Therefore, the sensitivity of the estimates will be assessed by including the product market regulation index available for years 1978, 1982, 1988, 1993, 1998 (Nicoletti et al., 2001) and 2003 (Conway, Janod and Nicoletti, 2005). The *PMR* variable is constructed by linearly

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interpolating between those dates.<sup>8</sup> The series is built on a 0-6 scale. *PMR* ranges, for the 17 countries, from 4 (USA) to 6 (France) in 1978 and from 1.0 (Australia, United Kingdom) to 2.7 (Italy) in 2003. Therefore, the changes clearly reflect a deregulation trend, mostly common to the countries in the sample.

Because of its importance in the drawing up of macroeconomic policies, abundant literature deals with the cyclicity of markups, but whether markups are pro- or contra-cyclical remains unresolved. The cyclicity is mostly due to mismeasurement of factor services and, in order to control for cycles, two variables are introduced. At sector level and following Bils (1987), the de-trended annual change in the logarithm of employment, *EMPCYC*, is computed using a Hodrik-Prescott filter. At the country level, the output gap, *GAP*, from the OECD 2003 Economic Outlook, is used. Table 3.4 gives summary statistics.

**Table 3.4: Summary Statistics**

| Variable     | Mean   | s.d.  | Q1     | Q3     |
|--------------|--------|-------|--------|--------|
| PCM          | 0.116  | 0.056 | 0.085  | 0.151  |
| IMPRATIO     | 0.279  | 0.190 | 0.130  | 0.384  |
| EXPRATIO     | 0.231  | 0.149 | 0.111  | 0.332  |
| EP           | 1.11   | 0.53  | 0.74   | 1.43   |
| UDNET        | 0.426  | 0.219 | 0.243  | 0.554  |
| LOGCAPIT (*) | 1.305  | 0.999 | 0.533  | 1.974  |
| PMR          | 3.85   | 1.27  | 2.86   | 4.92   |
| DEFL (*)     | -0.063 | 0.051 | -0.095 | -0.028 |
| GAP (*)      | -0.010 | 0.031 | -0.031 | 0.010  |
| EMPCYC (*)   | -0.015 | 0.080 | -0.056 | 0.021  |

(\*): These variables are taken as differences with their 1980 level. This convention is harmless since all f.e. are cancelled.

### 3.3.3. Econometric specification

Sticking to the model presented in sub-section 3.2.1 suggests estimating the following specification:

$$PCM = f(IMPRATIO, EP, UDNET, LOGCAPIT, DEFL)$$

Moreover, following the preceding discussion, the sensitivity of the estimates will be tested by including *EXPRATIO*, *PMR*, *GAP* and *EMPCYC* as control variables. The relationship linking the PCM to its determinants is fundamentally a static one, assuming an equilibrium relationship. However, for various reasons including adjustment costs in input demands, it is likely that PCMs respond with lags

<sup>8</sup> The indicator is based on seven non-manufacturing sectors, however it is very correlated (linear coefficient of around 86%) to the regulation index for the whole economy, only available for 1998 and 2003.

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to changes in explanatory variables, which suggests that a lagged dependent variable is a necessary part of the empirical specification. Consequently, the static representation will be confronted to a simple dynamics, the very common partial adjustment model. The full specification is:

$$PCM_{ijt} = [\rho.PCM_{ijt-1} +] a.IMPRATIO_{ijt} + b.EP_{it} + c.UDNET_{it} + d.LOGCAPIT_{it} + e.DEFL_{it} \\ [+ f.EXPRATIO_{ijt} + g.PMR_{it} + h_G.GAP_{it} + h_E.EMPCYC_{ijt}] + e_{ij} + u_{ijt} \quad (10)$$

,where  $i$ ,  $j$  and  $t$  stand for country, sector and time respectively,  $e_{ij}$  is a (country x sector) effect, potentially correlated to RHS variables, and  $u_{ijt}$  is assumed to be an i.i.d. residual.

The empirical model will be estimated by including or not the lagged dependent variable and the control variables between brackets. The panel is composed of 6,403 observations split among 298 (country x sector) couples. Within the dynamic setting, the Least Squared Dummy Variables estimator (LSDV) is biased for finite time dimension of the panel, even if the cross-section dimension - 298 in our case - is very large, but the bias here might not be too severe as the average time period is slightly above 21 observations.<sup>9</sup> Therefore, to get rid of the  $e_{ij}$  effects, transformation of the data is required.

The most common transformation is first-differencing and, in this case, the first difference of the lag dependent variable should be instrumented due to the correlation with the residual first difference. To check the robustness of the estimates, the following estimators are computed. AH is the Anderson and Hsiao (1982) estimator using the second and third lags of  $PCM$  in level as an instrument and by taking into account the MA(1) structure of the differenced residuals. Efficiency could be improved substantially by using a broader set of moment conditions. GMM is the Arellano and Bond (1991) one-step estimator using two lags as instruments in block diagonal form.<sup>10</sup>

Another attractive transformation is orthogonal deviation. Arellano and Bover (1995) showed that the OLS estimate on the orthogonal transformation was the LSDV, and that the transformed residuals were i.i.d. under the above assumptions. AH estimator on the orthogonal transformation is denoted AH-ORTH, whereas GMM-ORTH uses the same valid instruments as GMM. A richer dynamics including further lags in the dependent and explanatory variables is also tested.

<sup>9</sup> For instance for the lag parameter, Judson and Owen (1999) estimate that the bias could be as high as 20% for  $T = 30$ .

<sup>10</sup> Two-step GMM estimators using Windmeijer finite sample correction were also computed, but the results are not reported as they are very close to one-step estimates.

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### 3.3.4. Endogeneity of international trade

As much as domestic exporters are attracted to high-markup foreign markets, the greater the domestic markup the more foreign firms might export to the domestic market. In other words, the export decisions of foreign firms create a *positive* relation between markup and imports, hence a classical simultaneity problem. Therefore, estimators that do not take into account the endogeneity of the import variable are likely to underestimate the pro-competitive effect.

Along the same lines, high domestic markups could act as a disincentive for the export decision of domestic firms. As a result, the positive relation between exports and markups, discussed above, is underestimated when the export variable is treated as exogenous. The first three lags of trade variables which are valid instruments will be used. More precisely, in the first-difference specification as an example,  $IMPRATIO_{t-2}$ ,  $IMPRATIO_{t-3}$  and  $IMPRATIO_{t-4}$  will serve as instruments for  $(IMPRATIO_t - IMPRATIO_{t-1})$  and similarly for  $EXPRATIO$ , in vector form or in block diagonal for AH or GMM respectively.<sup>11</sup> Finally, the validity and the relevance of the instruments will be tested.

## 3.4. Results

### 3.4.1. Precautionary remark

Six of the ten potential RHS variables in (10) lack the sector dimension. Following Moulton (1986), country x year group effects might therefore be responsible for a significant underestimation of standard errors, and programs currently available for GMM do not correct for this bias. In our sample, this issue does not seem too serious because these variables have a country x year dimension of size  $17 \times 30 = 510$  only lacking the sector dimension of size 21. Moreover, we can assess the magnitude of this issue by computing robust standard errors clustered at the country x year level for least squares estimates and by comparing them with non robust standard errors. This exercise reveals that the underestimation bias in standard errors does not impact the variables defined at the full country x sector x year dimension, ie  $PCM_{t-1}$ ,  $IMPRATIO$ ,  $EXPRATIO$  and  $EMPCYC$ . However,  $UDNET$ ,  $LOGCAPIT$ ,  $PMR$  and  $GAP$  are affected with standard errors being underestimated by as much as 30% in some cases, whereas for  $EP$  and  $DEFL$  the bias is less than 10%. This entails that

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<sup>11</sup> Trade variables lagged 3, 4 and 5 will also be tested as instruments in case the second lag is correlated with residuals.

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for these former variables, the significance of GMM estimates should be handled with care, with Student ratios being potentially overestimated by as much as 30%. Pragmatically, we will consider that, for these variables, the 90% confidence level is not reliable whereas the 99% one offers enough room for reliability, the ratio of Student critical value at 90% relative to that at 99% being 0.66.

### 3.4.2. Treating trade as exogenous

Table 3.5 provides the estimates when trade is treated as exogenous. In the static case (columns 1, 2 and 4, with clustered standard errors), *IMPRATIO* is significant and negatively related to PCM with a pro-competitive effect of around -0.10 / -0.40. Testing the dynamic specification points to significant persistence in the data with an estimate of the lagged dependant variable parameter between (0.55, 0.70)<sup>12</sup>. Importantly, the rejection of the overidentifying restrictions from the Sargan-Hansen test points to misspecifications, which essentially come from the endogeneity of trade, as shown below.

### 3.4.3. Treating trade as endogenous

Estimates for the partial adjustment model are reported in Table 3.6. GMM1 is the GMM estimator using one lag only of the trade and lagged dependent variables as instruments. The lagged dependent parameter is not too affected when trade is treated as endogenous. The specification tests detailed at the end of the sub-section clearly lean towards the dynamic specification but the static equation yields similar sign and significance although the orders of magnitude are lower, around half as shown in Table 3.A in the Appendix. The left part of Table 3.6 is limited to the model developed in 2.1, whereas the right part includes all the explanatory variables discussed in 3.2.

### **International trade**

Import penetration is significant at 99% for all the specifications. As expected from the discussion in Section 3.3, comparison of Tables 3.5 and 3.6 confirms that treating trade as exogenous leads to an underestimation of its effect on PCM. This implies that the instruments are effective, at least partly. Depending on the estimator, the *IMPRATIO* long-term parameter ranges from -0.40 to -0.80. An increase of 10 percentage points in the import penetration ratio lowers the PCM by around 5 points on

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<sup>12</sup> Arellano and Bover (1995, p.40) showed that GMM estimators do not depend on which transformation – first-difference or orthogonal- is used, provided that the instruments are block diagonal and that those used for period *t* are maintained for subsequent periods. Neither of these conditions are met here because each exogenous variable is used for instrumenting as *one* vector, and because maintaining all lags would create far too many moments.

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average. Export intensity has a positive effect on PCM, although the *EXPRATIO* variable is not always significant. In magnitude, the effect from exports is around a third in the opposite direction of the one found for the pro-competitive effect of imports, consistent with the findings of the studies providing support for a link between exports and PCM and referenced in the introduction.

### **Prices**

As expected, inflation tends to reduce PCM. The parameter on the change of the GDP deflator is highly significant and robust across estimators. A value of around -0.20 gives the order of magnitude for the rigidity parameter  $\beta$  in equation (8): a decrease of 1 point in the GDP deflator triggers an increase of 0.2 point in the PCM.

### **Labor market**

The employment protection variable, *EP*, is never significant. Union density, *UDNET*, is not significant in the first-difference specification, but is in the orthogonal deviation one (and in the static version reported in Table 3.A). In line with its link to workers' bargaining power, a decrease in union density leads to an increase in PCM. When significant, this means that a decrease of 10 percentage points in union coverage entails an increase of around 1.5 points in the PCM, an order of magnitude consistent with the findings by Karier (1985) and Conyon and Machin (1991).

### **Stock market capitalization**

The market capitalization variable, *LOGCAPIT*, is significant at the 99% level for most of the estimators. A doubling of the capitalization is associated with an increase of around half a point in the PCM. This is consistent with Hoekman et al. (2001). Following the discussion above, although it is difficult to disentangle the various channels through which stock market developments operate, the econometric analysis reveals a robust positive relationship with PCM.

### **Product market deregulation**

As expected, product market deregulation reduces PCMs and appears significant at the 95% level. However, the clustering issue suggests caution at this level of confidence. Nevertheless, a 1 point drop in the *PMR* index seems to induce a decrease of around 0.8 point in the PCM.

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**Table 3.5: Determinants of the price-cost margin when trade variables are treated as exogenous**

|  | First-differences<br>(1) | First-differences<br>(2) | GMM<br>(3)               | First-differences<br>(4) | GMM<br>(5)                | GMM-ORTH<br>(6)           |
|--|--------------------------|--------------------------|--------------------------|--------------------------|---------------------------|---------------------------|
| Lag (PCM)                                |                          |                          | 0.583***<br>(0.108)      |                          | 0.550***<br>(0.089)       | 0.744***<br>(0.038)       |
| Import ratio                             | -0.114***<br>(0.030)     | -0.138***<br>(0.031)     | -0.185***<br>(0.045)     | -0.158***<br>(0.032)     | -0.197***<br>(0.050)      | -0.023**<br>(0.010)       |
| Export ratio                             |                          |                          |                          | -0.030<br>(0.021)        | -0.003<br>(0.026)         | 0.010<br>(0.010)          |
| Employment Protection                    |                          | -0.0018<br>(0.0190)      | 0.0138*<br>(0.0083)      | -0.0055<br>(0.0175)      | 0.0066<br>(0.0081)        | 0.0039<br>(0.0046)        |
| Union Density                            |                          | -0.061<br>(0.053)        | 0.008<br>(0.005)         | -0.040<br>(0.052)        | 0.004<br>(0.040)          | -0.039***<br>(0.015)      |
| Product Market Regulation                |                          |                          |                          | 0.0027<br>(0.0041)       | 0.0014<br>(0.0017)        | 0.0029***<br>(0.0008)     |
| Market Capitalization                    |                          | 0.0100***<br>(0.0024)    | 0.0042***<br>(0.0014)    | 0.0086***<br>(0.0025)    | 0.0052***<br>(0.0019)     | 0.0029***<br>(0.0010)     |
| Inflation                                |                          | -0.040*<br>(0.022)       | -0.092***<br>(0.019)     | -0.041*<br>(0.022)       | -0.090***<br>(0.019)      | -0.046***<br>(0.014)      |
| Output gap                               |                          |                          |                          | 0.140***<br>(0.040)      | 0.103***<br>(0.039)       | 0.014<br>(0.019)          |
| Sector cycle                             |                          |                          |                          | -0.024*<br>(0.013)       | -0.038**<br>(0.015)       | -0.047***<br>(0.008)      |
| Sargan-Hansen test                       |                          |                          | 93.3 (62)<br><i>0.01</i> |                          | 102.5 (62)<br><i>0.00</i> | 116.4 (62)<br><i>0.00</i> |
| m1                                       |                          |                          | -8.18 (0.00)             |                          | -7.76 (0.00)              | -2.19 (0.03)              |
| m2                                       |                          |                          | 0.87 (0.38)              |                          | 0.95 (0.34)               | 0.70 (0.48)               |
| Nb Obs                                   | 6105                     | 6105                     | 6105                     | 6105                     | 6105                      | 6105                      |
| <b>Significant long-term sensitivity</b> |                          |                          |                          |                          |                           |                           |
| IMPRATIO                                 | -0.114                   | -0.138                   | -0.444                   | -0.158                   | -0.438                    | -0.090                    |
| EXPRATIO                                 |                          |                          |                          | n.s.                     | n.s.                      | n.s.                      |
| EP                                       |                          | n.s.                     | 0.033                    | n.s.                     | n.s.                      | n.s.                      |
| UDNET                                    |                          | n.s.                     | n.s.                     | n.s.                     | n.s.                      | -0.152                    |
| PMR                                      |                          |                          |                          | n.s.                     | n.s.                      | 0.011                     |
| LOGCAPIT                                 |                          | 0.010                    | 0.010                    | 0.009                    | 0.012                     | 0.011                     |
| DEFL                                     |                          | -0.040                   | -0.221                   | -0.041                   | -0.200                    | -0.180                    |
| GAP                                      |                          |                          |                          | 0.140                    | 0.229                     | n.s.                      |
| EMPCYC                                   |                          |                          |                          | -0.024                   | -0.084                    | -0.184                    |

- (i) The dependent variable is the PCM and the specification is given in equation (10), with potentially correlated (sector x country) effects. Robust standard errors for the static case in columns (1), (2) and (4) are clustered at the country x year level. GMM is the one-step Arellano-Bond estimator, using as instruments the second to third lag of the dependent variable in block diagonal form. GMM-ORTH is the GMM estimator for the orthogonal specification using the same set of instruments as GMM. In this table, the lag of the dependent variable only is treated as endogenous.
- (ii) Asymptotic standard errors, between parentheses, are robust to heteroscedasticity and autocorrelation and computed from Roodman (2003). \*, \*\* and \*\*\* indicate significance at 90%, 95% and 99% confidence level, respectively.
- (iii) For the Sargan-Hansen test, the J-statistic is reported. The number of excluded instruments is between parentheses, and the P-value of the overidentifying restrictions is reported in italic below.
- (iv) m1 and m2 are Arellano-Bond tests for first- and second-order correlation. P-values are in parentheses.



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Table 3.6: Determinants of the price-cost margin when trade variable are treated as endogenous

|                         | AH                                       | GMM1                  | GMM                    | GMM-ORTH               | AH                   | GMM1                  | GMM                    | AH-ORTH              | GMM-ORTH               |
|-------------------------|--|-----------------------|------------------------|------------------------|----------------------|-----------------------|------------------------|----------------------|------------------------|
|                         | (1)                                      | (2)                   | (3)                    | (4)                    | (5)                  | (6)                   | (7)                    | (8)                  | (9)                    |
| Lag (PCM)               | 0.576***<br>(0.072)                      | 0.592***<br>(0.084)   | 0.607***<br>(0.064)    | 0.704***<br>(0.042)    | 0.541***<br>(0.055)  | 0.544***<br>(0.073)   | 0.553***<br>(0.058)    | 0.697***<br>(0.054)  | 0.701***<br>(0.039)    |
| Import ratio            | -0.249***<br>(0.086)                     | -0.198***<br>(0.048)  | -0.212***<br>(0.043)   | -0.137***<br>(0.037)   | -0.376**<br>(0.153)  | -0.21***<br>(0.065)   | -0.176***<br>(0.052)   | -0.203***<br>(0.079) | -0.115***<br>(0.032)   |
| Export ratio            |  |                       |                        |                        | 0.099<br>(0.114)     | 0.117**<br>(0.052)    | 0.076**<br>(0.038)     | 0.053<br>(0.068)     | 0.051*<br>(0.032)      |
| Employment Protection   | -0.0015<br>(0.01)                        | 0.0113<br>(0.0077)    | 0.0122<br>(0.0076)     | 0.0101*<br>(0.0055)    | 0.0013<br>(0.0133)   | 0.0019<br>(0.0082)    | -0.0036<br>(0.0081)    | 0.0111<br>(0.0077)   | 0.0084<br>(0.0055)     |
| Union Density           | -0.003<br>(0.041)                        | 0.010<br>(0.042)      | 0.013<br>(0.038)       | -0.041**<br>(0.021)    | 0.000<br>(0.038)     | -0.018<br>(0.037)     | -0.015<br>(0.033)      | -0.055***<br>(0.022) | -0.048***<br>(0.018)   |
| Prod. Market Regulation |  |                       |                        |                        | -0.0011<br>(0.0022)  | 0.0039**<br>(0.002)   | 0.0042**<br>(0.0018)   | 0.0008<br>(0.0016)   | 0.0021**<br>(0.001)    |
| Market Capitalization   | 0.0061**<br>(0.0029)                     | 0.0061***<br>(0.0018) | 0.0064***<br>(0.0016)  | 0.0028***<br>(0.0011)  | 0.0046<br>(0.0031)   | 0.006***<br>(0.0021)  | 0.0064***<br>(0.0018)  | 0.0037**<br>(0.0015) | 0.0033***<br>(0.0012)  |
| Inflation               | -0.07***<br>(0.028)                      | -0.09***<br>(0.019)   | -0.081***<br>(0.019)   | -0.079***<br>(0.015)   | -0.067**<br>(0.029)  | -0.086***<br>(0.02)   | -0.073***<br>(0.019)   | -0.072***<br>(0.021) | -0.06***<br>(0.016)    |
| Output gap              |  |                       |                        |                        | 0.168***<br>(0.063)  | 0.123***<br>(0.04)    | 0.115***<br>(0.039)    | 0.067<br>(0.043)     | 0.055**<br>(0.027)     |
| Sector cycle            |  |                       |                        |                        | -0.045***<br>(0.018) | -0.033**<br>(0.015)   | -0.036**<br>(0.015)    | -0.065***<br>(0.014) | -0.057***<br>(0.01)    |
| Sargan-Hansen test      | 2.2<br>(3)<br>0.53                       | 88.9<br>(62)<br>0.01  | 184.9<br>(154)<br>0.05 | 194.7<br>(154)<br>0.02 | 2.8<br>(5)<br>0.73   | 113.5<br>(93)<br>0.07 | 242.3<br>(246)<br>0.56 | 7.7<br>(5)<br>0.17   | 243.2<br>(246)<br>0.54 |
| m1                      | -6.68<br>(0.00)                          | -8.22<br>(0.00)       | -7.12<br>(0.00)        | 1.42<br>(0.16)         | -6.01<br>(0.00)      | -7.72<br>(0.00)       | -6.77<br>(0.00)        | 1.33<br>(0.18)       | 0.61<br>(0.54)         |
| m2                      | 1.20<br>(0.23)                           | 0.85<br>(0.40)        | 0.83<br>(0.40)         | 1.72<br>(0.09)         | 1.35<br>(0.18)       | 0.98<br>(0.33)        | 0.94<br>(0.35)         | 2.44<br>(0.02)       | 1.74<br>(0.08)         |
| Nb Obs                  | 5509                                     | 6105                  | 6105                   | 6105                   | 5509                 | 6105                  | 6105                   | 6105                 | 6105                   |
|                         | <b>Significant long-term sensitivity</b> |                       |                        |                        |                      |                       |                        |                      |                        |
| IMPRATIO                | -0.587                                   | -0.485                | -0.539                 | -0.463                 | -0.819               | -0.461                | -0.394                 | -0.670               | -0.385                 |
| EXPRATIO                |  |                       |                        |                        | n.s.                 | 0.257                 | 0.170                  | n.s.                 | 0.171                  |
| EP                      | n.s.                                     | n.s.                  | n.s.                   | 0.034                  | n.s.                 | n.s.                  | n.s.                   | n.s.                 | n.s.                   |
| UDNET                   | n.s.                                     | n.s.                  | n.s.                   | -0.139                 | n.s.                 | n.s.                  | n.s.                   | -0.182               | -0.161                 |
| PMR                     |  |                       |                        |                        | n.s.                 | 0.009                 | 0.009                  | n.s.                 | 0.007                  |
| LOGCAPIT                | 0.014                                    | 0.015                 | 0.016                  | 0.009                  | n.s.                 | 0.013                 | 0.014                  | 0.012                | 0.011                  |
| DEFL                    | -0.165                                   | -0.221                | -0.206                 | -0.267                 | -0.146               | -0.189                | -0.163                 | -0.238               | -0.201                 |
| GAP                     |  |                       |                        |                        | 0.366                | 0.270                 | 0.257                  | n.s.                 | 0.184                  |
| EMPCYC                  |  |                       |                        |                        | -0.098               | -0.072                | -0.081                 | -0.215               | -0.191                 |

Notes.

- (i) See notes to Table 3.5.
- (ii) AH and AH-ORTH are the Anderson-Hsiao estimator for the equation in first-differences and orthogonal deviations.
- (iii) In addition here, trade variables are treated as endogenous. Lags 2 to 4 of the import and export ratios are used as instruments in block diagonal form. This means, for example, that  $\theta_{t-2}, \theta_{t-3}, \theta_{t-4}$  serve as instruments in the first-difference equation for  $(\theta_t - \theta_{t-1})$  and in the orthog. transformation for  $(\theta_{t-1} - (\theta_t + \theta_{t+1} + \dots + \theta_T))/(T - t + 1)$ .
- (iv) GMM1 is the GMM estimator using one lag only as instruments.
- (v) Treating the other explanatory variables as endogenous leads to very comparable results.

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### **Cycles**

Cycle effects are very significant and robust across the different estimators. PCM is found to be pro-cyclical at sector level, as a rise of 1% of cyclical employment induces a decrease of around 0.15 point in the PCM. On the other hand, PCM appear to react positively to the whole country cycle: an increase of 1% of GDP in the output gap entails a decrease of around 0.25 point in the PCM. These results are consistent with those of the preceding chapter, obtained from a different methodology, and similar in magnitude. There might be a supply-driven counter-cyclical partial equilibrium effect, consistent with most empirical findings (Bils, 1987, Rotemberg and Woodford, 1999, Oliveira Martins and Scarpetta, 2002, among others) dampened by a pro-cyclical general equilibrium one, consistent with the pro-cyclicality of total profits (Christiano, Eichenbaum and Evans, 1997).

### **Validity of the specification**

The first test is the Sargan-Hansen test of overidentifying restrictions, which generally tends to over-reject the validity of the instruments. However, a large number of weak instruments might lead to under-rejection (Sevestre, 2002). With only five excluded instruments, AH estimators are almost immune to this risk. As a matter of fact, none of the specifications using AH instruments can be rejected. In contrast the other estimators using the limited set of variables (left part of Table 3.6) are rejected, although the estimates are not significantly different from their respective counterparts using the full set (right part). We therefore limit ourselves to the discussion of the broader specification.

At the 5% level, and in contrast to the results in Table 3.5, the Sargan-Hansen test no longer rejects the validity of the instruments for the five estimators. However, the probability falls to 0.07 for GMM1, using one lag only as instrument. Therefore, the good news is that the two AH estimators seem reliable based on this test. On the other hand, the fact that GMM does not reject the null with 153 additional restrictions compared to GMM1, which almost rejects it, puts the validity of the broader set of instruments into doubt.

To investigate this issue further, statistics for the first-stage regressions are presented in Table 3.7. Bound, Jaeger and Baker (1995) remind us that the presence of weak instruments biases the estimates towards OLS in finite samples. Consequently, they suggest that partial R-square and F-

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statistic be reported routinely, to help diagnose weak instruments, and Stock and Yogo (2002) formalize what the notion of weak instrument means. More precisely, based on the number of excluded instruments, they compute the value of the F-statistic above which the bias of the IV estimate is not greater than say 10% of the OLS bias, at a 5% significance level for instance. The rule of thumb of Staiger and Stock (1997) of 10 for the F-stat is therefore refined but still holds reasonably well. However, when there is more than one endogenous regressor, Shea (1997) warns that the F-stats are insufficient in case of strong correlation between the instruments. To detect the problems that might be generated by this type of correlation, the comparison between the standard partial  $R^2$  (second column in table 3.7) and Shea partial  $R^2$  (first column), which takes the inter-correlations among the instruments into account, is useful. As indicated by Baum, Schaffer and Stillman (2003), when these two measures are close to each other, then the correlation between the instruments is low enough, not to be a source for concern.

**Table 3.7: Relevance of the instruments,  
First-stage regressions statistics**

| Endogenous Variable:<br>first-differences<br>or orthogonal<br>transformation | First-Difference                                 |   |             | Orthogonal Deviation                             |   |             |
|--|--|---|-------------|--|---|-------------|
|  | Shea Partial $R^2$<br>of excluded<br>instruments | Partial $R^2$<br>of excluded<br>instruments | F statistic | Shea Partial $R^2$<br>of excluded<br>instruments | Partial $R^2$<br>of excluded<br>instruments | F statistic |
|  | <i>AH – Column (1) in Table 5</i>                |   |             | <i>AH-ORTH – Column (4) in Table 5</i>           |   |             |
| Lag (PCM)  | 0.066  | 0.067                                       | 12.7        | 0.185  | 0.195                                       | 52.0        |
| Import ratio   | 0.012  | 0.032                                       | 22.1        | 0.022  | 0.043                                       | 23.0        |
| Export ratio   | 0.010  | 0.028                                       | 14.5        | 0.035  | 0.070                                       | 26.3        |
|  | <i>GMM1 – Column (2) in Table 5</i>              |   |             | <i>GMM-ORTH – Column (5) in Table 5</i>          |   |             |
| Lag (PCM)  | 0.080  | 0.080                                       | 3.6         | 0.319  | 0.337                                       | 6.4         |
| Import ratio   | 0.062  | 0.073                                       | 5.3         | 0.129  | 0.152                                       | 4.2         |
| Export ratio   | 0.063  | 0.075                                       | 6.0         | 0.187  | 0.213                                       | 3.4         |
|  | <i>GMM – Column (3) in Table 5</i>               |   |             |  |   |             |
| Lag (PCM)  | 0.191  | 0.193                                       | 3.8         |  |   |             |
| Import ratio   | 0.155  | 0.157                                       | 5.2         |  |   |             |
| Export ratio   | 0.166  | 0.169                                       | 4.9         |  |   |             |

Based on the upper panel of Table 3.7, the limited set of instruments for the two AH estimators display an F-stat far above the 10 threshold in both cases. Reading the table vertically from the upper to the lower part reveals that adding a large number of instruments, even though it increases the fit of the

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first-stage regressions, actually deteriorates the F-stat. From Stock and Yogo's Table 1, one cannot reject the possibility that the bias of these GMM estimators be as much as 25% of the OLS bias – which nevertheless implies that this bias has been substantially reduced. In other words, even if the GMM estimators seem to respect the orthogonality conditions, first stage statistics are less supportive for the relevance of the broader set of instruments.

For the equation in first differences, the two auto-correlation statistics (middle part of table 3.6) validate the specification: strong first-order correlation that is dealt with by the Arellano-Bond estimator, no significant second-order correlation. For the orthogonal transformation equation, residuals are supposed to be i.i.d. This is only partially confirmed by the tests. Although the absence of first-order correlation is accepted, the m2 statistic detects second-order correlation, especially for AH-ORTH.

In summary, the instruments used for the two AH estimators seem more reliable. However this comes at the cost of less precise estimates. The three GMM estimates might rely on less relevant instruments but, comfortably, the five estimators lead to close estimates, except for the labor market parameters.

As a further robustness check, we used the third to fifth lags of trade variables as instruments, rather than the second to fourth. Results not reported but available upon requests were very close. Also we tested a richer dynamic than the common partial adjustment specification. A more complete autoregressive distributed lag model was tested, by including the second lag of the dependent and the first lag of trade variables as explanatory variables. To save space, the results are not presented here. The precision is much poorer than for the partial adjustment model, probably because of multicollinearity. However, long-term sensitivities are very comparable, except for trade and country cycle parameters, which are lower. All in all, compared to the partial adjustment, this more complete model does not add valuable information and loses in precision.

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### 3.4.4. Are these numbers large?

The Table below broadly summarizes our results.

|                           | Long-term sensitivity<br>of the price-cost margin | Significance |
|---------------------------|---|--------------|
| Imports                   | -0.7 / -0.4                                       | High         |
| Exports                   | 0.2   | Medium       |
| Employment Protection     | -   | No           |
| Union Density             | -0.15 / 0   | Medium / Low |
| Product Market Regulation | 0.008   | Medium       |
| Market Capitalization     | 0.010 / 0.015                                     | High         |
| Inflation                 | -0.2  | High         |
| Country Cycle             | 0.2 / 0.3   | High         |
| Sector Cycle              | -0.2 / -0.1                                       | High         |

Are these numbers large? For the pro-competitive effect of imports, a centre estimate of -0.5 is as large as it could be, given the simulations presented in Table 3.1: it is consistent only with high-differentiated goods, high concentration and fairly weak domestic competition (Cournot).

More generally, the quantitative effects detailed above imply important impacts in the retrospective of the tremendous changes OECD economies have gone through, from the 'seventies. Table 3.8 indicates, in the upper part, the changes over the period of the non-cyclical variables for each country, using trade at the whole manufacturing level for illustration purposes. For instance, on average across countries, stock market capitalization as a percentage of GDP has been multiplied by six, and inflation has receded by five percentage points. The comparison of the average change and the average absolute change illustrates that the trends are mostly common to OECD countries, except for the labor market evolutions. Indeed, there is no average change in union density, whereas the absolute change is 12 percentage points on average.

The lower part of the table applies the GMM-ORTH estimates of Table 3.6 to these changes, in order to give some order of magnitude of the impacts on the PCM. Four main lessons can be drawn. First, the average effect across countries of the increase in imports is to reduce the PCM by 0.042. This is very large indeed, given that the average PCM is around 0.12. Second, measures taken to deregulate domestic product markets are estimated to contribute further to the lowering of PCMs, as the average impact from the *PMR* variable is -0.017. Third, these pro-competitive effects are countervailed by the

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combination of increased exports, financial market development and disinflation, which overall impacts are 0.021, 0.021 and 0.010 respectively. Fourth, the average *absolute* effect due to the changes in union participation is 0.019, even though the average effect is nil because of the contrasted trends between countries.

**Table 3.8: Impact of the changes  
in OECD economies on the price-cost margin overall**

|                                   | Changes in the explanatory variables over the period       |              |                       |               |                           |                           |                     |
|-----------------------------------|--|--------------|-----------------------|---------------|---------------------------|---------------------------|---------------------|
|                                   | Import ratio   | Export ratio | Employment Protection | Union Density | Product Market Regulation | Stock Market Capitalizat. | GDP Deflator Change |
| Australia                         | 0.15   | 0.06         | 0.00                  | -0.08         | -3.19                     | 1.86                      | -0.037              |
| Austria                           | 0.16   | 0.18         | 0.65                  | -0.16         | -1.92                     | 1.80                      | -0.022              |
| Belgium                           | 0.19   | 0.21         | -0.18                 | 0.12          | -2.62                     | 1.63                      | -0.028              |
| Canada                            | 0.15   | 0.13         | 0.00                  | 0.07          | -1.67                     | 2.65                      | -0.009              |
| Denmark                           | 0.09   | 0.19         | -0.28                 | 0.17          | -2.84                     | 1.90                      | -0.068              |
| Spain                             | 0.19   | 0.13         | -0.36                 | 0.09          | -1.48                     | 3.41                      | -0.165              |
| Finland                           | 0.02   | 0.15         | -0.12                 | 0.28          | -3.35                     | 2.82                      | -0.017              |
| France                            | 0.15   | 0.15         | 0.70                  | -0.12         | -2.20                     | 2.64                      | -0.038              |
| UK                                | 0.21   | 0.13         | 0.11                  | -0.13         | -3.39                     | 1.45                      | -0.054              |
| Germany                           | 0.04   | 0.11         | -0.12                 | -0.05         | -1.77                     | 0.94                      | -0.003              |
| Italy                             | 0.10   | 0.11         | -0.22                 | 0.02          | -1.56                     | 1.94                      | -0.045              |
| Japan                             | 0.07   | 0.09         | 0.00                  | -0.08         | -2.50                     | 0.26                      | -0.079              |
| Netherlands                       | 0.14   | 0.23         | -0.12                 | -0.12         | -2.22                     | 1.10                      | -0.030              |
| Norway                            | 0.05   | 0.06         | -0.16                 | 0.05          | -2.25                     | 1.86                      | -0.104              |
| New Zealand                       | 0.10   | 0.07         | 0.00                  | -0.11         | -3.74                     | 1.95                      | -0.108              |
| Sweden                            | 0.07   | 0.18         | 0.96                  | 0.23          | -2.57                     | 3.18                      | -0.005              |
| USA                               | 0.15   | 0.08         | 0.00                  | -0.12         | -2.71                     | 1.14                      | -0.030              |
| Average change                    | 0.119  | 0.133        | 0.051                 | 0.003         | -2.47                     | 1.91                      | -0.050              |
| Average of <i>absolute</i> change | 0.119  | 0.133        | 0.235                 | 0.118         | 2.47                      | 1.91                      | 0.050               |
|                                   | <b>Impact of these changes on the PCM across countries</b> |              |                       |               |                           |                           |                     |
| Minimum                           | -0.079   | 0.010        | -0.010                | -0.045        | -0.027                    | 0.003                     | 0.001               |
| Maximum                           | -0.008   | 0.040        | 0.027                 | 0.026         | -0.010                    | 0.038                     | 0.032               |
| Average effect                    | -0.046   | 0.023        | 0.001                 | 0.000         | -0.017                    | 0.021                     | 0.010               |
| Average of <i>absolute</i> effect | 0.046  | 0.023        | 0.006                 | 0.019         | 0.017                     | 0.021                     | 0.010               |

### 3.5. Conclusion

This chapter analyzes the determinants of price-cost margins at sector manufacturing level for OECD countries between 1970 and 2003. An increase of one percentage point in the import penetration ratio is estimated to lower the PCM by around half a point. This sensitivity lies within but on the upper end of theoretical prediction and empirical evidence accumulated to date. This is a large effect, as it means that on average, across countries and manufacturing industries, imports contributed to a decrease of

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0.04 / 0.05 in the PCM over the period from an average level of around 0.12. In addition, domestic product market deregulation seems to have lowered the PCMs. However, these pro-competitive effects are countervailed by the impacts of exports, financial deepening and disinflation.

The positive impact of stock market capitalization on markups was pointed out by Hoekman et al. (2001). More theoretical and empirical work is needed to clarify the channels through which financial deepening could have an impact on markups. The same remark applies concerning the role of exports. Understanding better these underlying mechanisms would provide an important input for the drawing up of competition and trade policy.

Union participation is estimated to be negatively related to PCM. However, because of the strong heterogeneity of changes in labor market institutions between countries, the average effect of labor market trends across countries is not meaningful. All these results put the textbook version of the pro-competitive effect into the perspective of the important macro-economic trends OECD economies have gone through.

**Appendix: Expression of the Price-Cost Margin**

With  $\gamma$  being the bargaining power of workers and  $w_u$  the reservation wage, the objective function being maximised in the Nash-bargaining process is classically, omitting the subscripts:

$$\Pi^{1-\gamma} [(w-w_u).N]^\gamma \equiv [p^*Y - (wN + qI)]^{1-\gamma} [(w-w_u).N]^\gamma .$$

The first order conditions with respect to factor levels are:

$$(1-\gamma) \cdot \frac{\frac{p^*}{\mu} \cdot \frac{\partial Y}{\partial N} - w}{\Pi} + \frac{\gamma}{N} = 0 \Leftrightarrow p^* \cdot \frac{\partial Y}{\partial N} = \mu \left( w - \frac{\gamma}{1-\gamma} \cdot \frac{\Pi}{N} \right)$$

$$p^* \cdot \frac{\partial Y}{\partial I} = \mu \cdot q$$

Euler's equation leads to:

$$p^*Y = \mu.(wN + qI - \frac{\gamma \cdot \Pi}{1-\gamma}) \Leftrightarrow p^*Y = \mu.(p^*Y - \frac{\Pi}{1-\gamma}) \Leftrightarrow PCM^* \equiv \frac{\Pi}{p^*Y} = (1-\gamma) \cdot (1 - \frac{1}{\mu}) \quad (A1)$$

For denotation simplicity, we initially ignore price-rigidities, i.e. we omit the \* superscript for all the prices. Maximization of utility by the representative agent can classically be achieved in two steps. For a given good  $j$ , consumptions of two varieties  $k$  and  $l$  are related according to:

$$p_{jk} = p_{jl} \cdot (C_{jk} / C_{jl})^{-1/\sigma_j} \quad (A2)$$

which leads to the familiar Dixit-Stiglitz expression for any variety  $l$ :

$$p_{jl} \cdot C_{jl} = \left( p_{jl}^{1-\sigma_j} / \sum_k p_{jk}^{1-\sigma_j} \right) \cdot P_j \cdot C_j \quad , \text{ where the price index of good } j \text{ is given by } P_j = \left( \sum_k p_{jk}^{1-\sigma_j} \right)^{1/(1-\sigma_j)}$$

and  $k$  indexes all firms, domestic and foreign. In a second step, utility is maximized between the

different goods, and first-order conditions lead to  $C_j = C_i \left( \frac{P_i / a_i}{P_j / a_j} \right)^\omega$  from which we infer the

consumption share of sector  $j$ :

$$P_j \cdot C_j = \sum_k p_{jk} \cdot C_{jk} = R \cdot \frac{a_j^\sigma \cdot P_j^{1-\sigma}}{G(p)^{1-\sigma}} \quad (A3)$$

where  $R$  is total revenue and  $G(p) = \left( \sum a_j^\sigma \cdot P_j^{1-\sigma} \right)^{1/(1-\sigma)}$  is the general price index. Using equation

(A2), (A3) becomes:



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$$p_{jl} \cdot C_{jl}^{1/\sigma_j} \cdot \sum_k (C_{jk})^{1-1/\sigma_j} = R \cdot \frac{a_j^\sigma}{G(p)^{1-\sigma}} (p_{jl} \cdot C_{jl}^{1/\sigma_j})^{1-\sigma} \left( \sum_k (C_{jk})^{1-1/\sigma_j} \right)^{\frac{1-\sigma}{1-\sigma_j}}, \text{ which simplifies into:}$$

$$(p_{jl} \cdot C_{jl}^{1/\sigma_j})^\sigma = R \cdot \frac{a_j^\sigma}{G(p)^{1-\sigma}} \left( \sum_k (C_{jk})^{1-1/\sigma_j} \right)^{\frac{\sigma_j - \sigma}{1-\sigma_j}}. \text{ Using market clearing conditions: } C_{jk} = Y_{jk} \quad \forall k,$$

this equation implicitly gives the demand faced by firm  $l$  in function of its price and the production of the other varieties of the same good. Differentiating this expression with respect to  $Y_{jl}$ , at constant revenue and by ignoring the impact on the overall manufacturing price index, leads to:

$$\frac{1}{p_{jl}} \cdot \frac{\partial p_{jl}}{\partial Y_{jl}} + \frac{1}{\sigma_j \cdot Y_{jl}} = - \frac{\sigma_j - \sigma}{\sigma_j \cdot \sigma} \cdot \frac{\sum_k (Y_{jk})^{-1/\sigma_j} \cdot \frac{\partial Y_{jk}}{\partial Y_{jl}}}{\sum_k (Y_{jk})^{1-1/\sigma_j}}$$

Using again equation (A2) and rearranging gives:

$$\frac{Y_{jl}}{p_{jl}} \cdot \frac{\partial p_{jl}}{\partial Y_{jl}} = - \frac{1}{\sigma_j} - \left( \frac{1}{\sigma} - \frac{1}{\sigma_j} \right) \cdot \frac{\sum_k p_{jk} \cdot \frac{\partial Y_{jk}}{\partial Y_{jl}}}{\sum_k p_{jk} \cdot Y_{jk}} \cdot Y_{jl} = - \frac{1}{\sigma_j} - \left( \frac{1}{\sigma} - \frac{1}{\sigma_j} \right) \cdot x_{jl} \cdot \sum_k \frac{p_{jk}}{p_{jl}} \cdot \frac{\partial Y_{jk}}{\partial Y_{jl}} \cdot (1 - \theta_j) \quad (\text{A4})$$

where  $x_{jl}$  is the share of firm  $l$  in sector  $j$  domestic output and  $\theta_j$  is the import penetration ratio of sector  $j$  defined as the ratio of imports over the sum of imports and domestic production. Classically, profit maximization for a firm producing the variety  $l$  of good  $j$  gives the expression linking the markup to  $\varepsilon_{jl}$ , the price-elasticity of the demand faced by the firm:  $\frac{1}{\mu_{jl}} = 1 + \frac{1}{\varepsilon_{jl}} \equiv 1 + \frac{Y_{jl}}{p_{jl}} \cdot \frac{\partial p_{jl}}{\partial Y_{jl}}$ . From (A4) and

(A1), we derive the PCM:

$$PCM_{jl} = (1 - \gamma) \cdot \left( 1 - \frac{1}{\mu_{jl}} \right) = (1 - \gamma) \cdot \left[ \frac{1}{\sigma_j} + \left( \frac{1}{\sigma} - \frac{1}{\sigma_j} \right) \cdot x_{jl} \cdot g_{jl} \cdot (1 - \theta_j) \right] \quad (\text{A5})$$

where  $g_{jl} \equiv \sum_{k \in \text{all firms}} \frac{p_{jk}}{p_{jl}} \cdot \frac{\partial Y_{jk}}{\partial Y_{jl}}$ . Reintroducing the \* superscript and aggregating the  $PCM_{jl}^*$  given by

(A5) at the domestic sector level lead to:

$$PCM_j^* \equiv \sum_{l \in \text{domestic firms}} x_{jl} \cdot PCM_{jl}^* = (1 - \gamma) \cdot \left( \frac{1}{\sigma_j} + \left( \frac{1}{\sigma} - \frac{1}{\sigma_j} \right) \cdot g_j \cdot H_j \cdot (1 - \theta_j) \right) \quad (\text{A6})$$

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where  $g_j = \frac{\sum_{l \in \text{domestic firms}} g_{jl} \cdot x_{jl}^2}{\sum_{l \in \text{domestic firms}} x_{jl}^2}$ , a weighted average of the  $g_{jl}$ , is an aggregated indicator

measuring the intensity of competition. For example in the case of identical firms,  $g_j = g_{jl} = \partial Y_j / \partial Y_{jl}$

where  $Y_j$  is the total available production, domestic plus imports, of sector  $j$ . In this case,  $g_j$  ranges

from 0 if competition is Bertrand to 1 if Cournot. Combining (A6) with equation (5) in the main text gives

the general expression (8).

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**Table 3.A: Static specification when the trade variables are treated as endogenous**

|                         | AH                                       | GMM1                 | GMM                   | GMM-ORTH              | AH                  | GMM1                  | GMM                    | GMM-ORTH               |
|-------------------------|--|----------------------|-----------------------|-----------------------|---------------------|-----------------------|------------------------|------------------------|
|                         | (1)                                      | (2)                  | (3)                   | (4)                   | (5)                 | (6)                   | (7)                    | (8)                    |
| Import ratio            | -0.279**<br>(0.109)                      | -0.268***<br>(0.068) | -0.270***<br>(0.066)  | -0.257***<br>(0.077)  | -0.421**<br>(0.193) | -0.309***<br>(0.102)  | -0.221***<br>(0.081)   | -0.225***<br>(0.069)   |
| Export ratio            |  |                      |                       |                       | 0.128<br>(0.148)    | 0.120*<br>(0.069)     | 0.054<br>(0.058)       | 0.042<br>(0.063)       |
| Employment Protection   | 0.005<br>(0.013)                         | 0.024*<br>(0.014)    | 0.023<br>(0.015)      | 0.019<br>(0.017)      | 0.008<br>(0.015)    | 0.006<br>(0.013)      | 0.000<br>(0.013)       | 0.016<br>(0.018)       |
| Union Density           | -0.075**<br>(0.035)                      | -0.110***<br>(0.037) | -0.110***<br>(0.038)  | -0.153***<br>(0.036)  | -0.045<br>(0.038)   | -0.105***<br>(0.038)  | -0.109***<br>(0.037)   | -0.140***<br>(0.038)   |
| Prod. Market Regulation |  |                      |                       |                       | -0.0013<br>(0.0029) | 0.0049*<br>(0.0029)   | 0.0052**<br>(0.0027)   | 0.002<br>(0.0027)      |
| Market Capitalization   | 0.010***<br>(0.003)                      | 0.012***<br>(0.002)  | 0.012***<br>(0.002)   | 0.011***<br>(0.003)   | 0.008***<br>(0.003) | 0.012***<br>(0.002)   | 0.012***<br>(0.002)    | 0.010***<br>(0.003)    |
| Inflation               | -0.050**<br>(0.024)                      | -0.089***<br>(0.023) | -0.082***<br>(0.023)  | -0.051*<br>(0.030)    | -0.054**<br>(0.025) | -0.104***<br>(0.023)  | -0.09***<br>(0.021)    | -0.059*<br>(0.03)      |
| Output gap              |  |                      |                       |                       | 0.240***<br>(0.075) | 0.215***<br>(0.047)   | 0.178***<br>(0.042)    | 0.146***<br>(0.044)    |
| Sector cycle            |  |                      |                       |                       | -0.039**<br>(0.017) | -0.031**<br>(0.013)   | -0.027**<br>(0.013)    | -0.055***<br>(0.014)   |
| Sargan-Hansen test      | 0.34<br>(2)<br>0.85                      | 68.5<br>(31)<br>0.00 | 134.1<br>(92)<br>0.00 | 138.9<br>(92)<br>0.00 | 2.71<br>(4)<br>0.61 | 101.5<br>(62)<br>0.00 | 224.0<br>(187)<br>0.02 | 211.3<br>(184)<br>0.08 |
| m1                      | -3.11<br>(0.00)                          | -3.24<br>(0.00)      | -3.24<br>(0.00)       | 8.39<br>(0.00)        | -3.27<br>(0.00)     | -3.37<br>(0.00)       | -3.24<br>(0.00)        | 8.77<br>(0.00)         |
| m2                      | -1.40<br>(0.16)                          | -2.07<br>(0.04)      | -2.03<br>(0.04)       | 7.64<br>(0.00)        | -0.91<br>(0.36)     | -1.63<br>(0.10)       | -1.70<br>(0.09)        | 7.99<br>(0.00)         |
| Nb Obs                  | 5509                                     | 6403                 | 6403                  | 6403                  | 5509                | 6403                  | 6403                   | 6403                   |
|                         | <b>Significant long-term sensitivity</b> |                      |                       |                       |                     |                       |                        |                        |
| IMPRATIO                | -0.279                                   | -0.268               | -0.270                | -0.257                | -0.421              | -0.309                | -0.221                 | -0.225                 |
| EXPRATIO                |  |                      |                       |                       | n.s.                | 0.120                 | n.s.                   | n.s.                   |
| EP                      | n.s.                                     | 0.024                | n.s.                  | n.s.                  | n.s.                | n.s.                  | n.s.                   | n.s.                   |
| UDNET                   | -0.075                                   | -0.110               | -0.110                | -0.153                | n.s.                | -0.105                | -0.109                 | -0.140                 |
| PMR                     |  |                      |                       |                       | n.s.                | 0.005                 | 0.005                  | n.s.                   |
| LOGCAPIT                | 0.010                                    | 0.012                | 0.012                 | 0.011                 | 0.008               | 0.012                 | 0.012                  | 0.010                  |
| DEFL                    | -0.050                                   | -0.089               | -0.082                | -0.051                | -0.054              | -0.104                | -0.090                 | -0.059                 |
| GAP                     |  |                      |                       |                       | 0.240               | 0.215                 | 0.178                  | 0.146                  |
| EMPCYC                  |  |                      |                       |                       | -0.039              | -0.031                | -0.027                 | -0.055                 |

See notes to Table 3.6.

## **Part II**

# INTERNATIONAL TRADE AND LABOR MARKET INTERACTIONS

## Chapter 4

# Imports as Product and Labor Market Discipline<sup>1</sup>

### 4.1. Introduction

Chapter 3 contains a survey of the studies assessing the negative impact of foreign competition on markups (see Table 3.2). In particular for the UK, Khalilzadeh-Shirazi (1974), Geroski (1981, 1982) and Conyon and Machin (1991) find a negative impact of imports on price-cost margins (PCMs). On the other hand, focusing on the labor side and inspired by Rodrik's (1997) argument that increased international trade weakens the position of the workers, only two studies (Brock and Dobbelaere, 2006 and Dumont, Rayp and Willemé, 2006) investigate, with mixed results, whether stronger import competition squeezes workers' bargaining power: Dumont et al. find a negative impact, whereas Brock and Dobbelaere do not. Following Levinsohn (1993), many *firm-level* studies draw on Hall's (1988) approach to estimate price-marginal cost markups and test the imports-as-market-discipline hypothesis. However, Hall's method relies on perfect labor markets. Using the extension proposed by Crépon, Desplatz and Mairesse (1999, 2002) to take into account labor market imperfections, the main contribution of this chapter is to provide evidence of international competition curtailing domestic market power in the product market as well as in the labor market for UK manufacturing sectors.

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<sup>1</sup> This chapter is based on Boulhol, H., Dobbelaere, S., Maioli, S., 2006, "Imports as Product and Labor Market Discipline", IZA Discussion Paper No. 2178.

## CHAPTER 4: IMPORTS AS PRODUCT AND LABOR MARKET DISCIPLINE

Figure 4.1. displays the evolution in PCMs at the UK sector level since 1970.<sup>2</sup> At first sight, there is little evidence of a general decline in PCMs despite a steady increase in openness. In fact, at the aggregated manufacturing level, the PCM was 9.4% in 1970, 8.2% in 1980, 11.5% in 1990 and 9.2% in 2003. How could we reconcile these trends with the evidence of the pro-competitive effect of international trade highlighted above? In short, the effect of trade on the PCM is not limited to its impact on the markup, because the PCM only captures the part of the rents kept by the firms (equation 6 in the previous chapter). PCMs are therefore negatively related to the workers' bargaining power and a weakening of the workers' bargaining power may countervail, at least partly, a decrease in markups.

Taking into account labor market imperfections, Borjas and Ramey (1995) provide evidence of foreign competition exerting a negative impact on wages by reducing rents in concentrated sectors. However, the finding of lower rents per se does not mean that the rent-sharing scheme between capital and labor has changed. The seminal paper by Blanchard and Giavazzi (2003) draws attention to the importance of product and labor market interactions, which are the primary focus of Chapter 6 providing the main references dealing with the impact of product market competition on the structure of the labor market. In particular, Ebell and Haefke (2006), endogenizing the bargaining regime, argue that the strong decline in coverage and unionization in the US and the UK might have been a direct consequence of product market reforms of the early 'eighties. This chapter suggests that the trend in UK PCMs is partially the result of the joint decline in the markup and the workers' bargaining power following increased openness of the economy.

We contribute to the literature in different ways. We take advantage of a rich firm-level dataset consisting of 9,820 firms in the UK manufacturing industry covering the period 1988-2003. This enables us to estimate markup and workers' bargaining power parameters simultaneously for 20 sectors split according to 3 firm size categories and 3 time periods. To our knowledge, investigating the cross-sectional heterogeneity in the two parameters at this level of disaggregation has never been carried out for the UK. Whereas previous empirical studies have tested the imports-as-market-discipline hypothesis either on the product market or on the labor market, this chapter bridges the gap

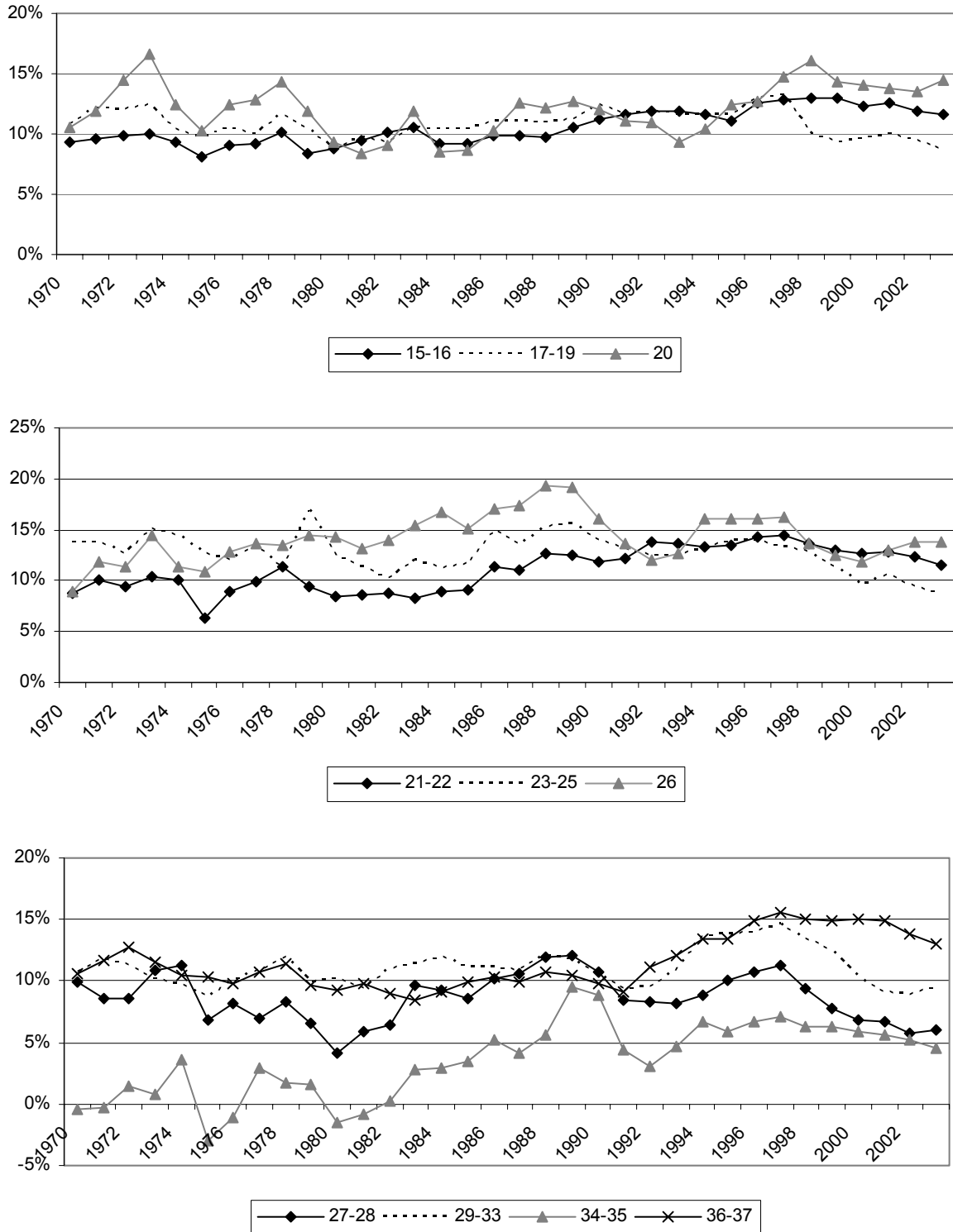
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<sup>2</sup> As recalled in the preceding chapters, price-cost margin is defined as revenue minus labor and material costs over revenue; it is the (relative) margin of price to average variable cost.

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by verifying the impact of increased import competition on both markups and workers' bargaining power parameters.

**Figure 4.1: Price-cost margins for large UK manufacturing sectors**  
(description in the Appendix), 1970-2003, STAN database



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We follow a two-stage approach in which we first estimate markups and workers' bargaining power parameters according to three dimensions (sector, firm size and time period). Our results point to a significant drop in both parameters in the mid-nineties. In the second stage, we identify factors explaining markups and workers' bargaining power with a special focus on international trade. We find clear evidence of imports from *developed* countries having contributed significantly to the decline in both markups and workers' bargaining power.

In the remainder, we first describe the theoretical framework and the empirical strategy (Section 4.2). Section 4.3 concentrates on the first-stage results and Section 4.4 discusses the second-stage results where we evaluate the "pro-competitive effect" on both markups and workers' bargaining power. Section 4.5 concludes.

### 4.2. Methodology

#### 4.2.1. Theoretical framework

Hall's approach for evaluating markups remains rooted to one crucial assumption: firms consider input prices as given prior to deciding their level of inputs. In other words, there is no imperfection in the labor market. However, there is widespread evidence of rent-sharing, hence the need for a framework to bring together imperfect competition in product and labor markets. Crépon, Desplatz and Mairesse (1999, 2002), hereafter CDM, extend Hall's approach to allow for the possibility that wages are bargained over between firms and workers and we rely on the CDM model detailed further by Dobbelaere (2004). We start from a production function  $Q_{it} = A_{it} \cdot F(N_{it}, K_{it}, M_{it})$  where  $i$  and  $t$  index firm and time respectively,  $N$  is labor input,  $M$  material,  $K$  capital, and  $F(\cdot)$  is assumed to be homogeneous in its arguments.  $A_{it}$  is an index of technical change or "true" total factor productivity. The logarithmic differentiation of the production function gives, where  $\varepsilon_X^Q$  is the elasticity of output to factor  $X$ :

$$\Delta q_{it} = \varepsilon_{N_{it}}^Q \cdot \Delta n_{it} + \varepsilon_{M_{it}}^Q \cdot \Delta m_{it} + \varepsilon_{K_{it}}^Q \cdot \Delta k_{it} + \Delta a_{it} \quad (1)$$

Each firm operates under imperfect competition in the product market. On the labor side, we assume that the union and the firm are involved in an efficient bargaining procedure with both wages ( $w$ ) and



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labor ( $N$ ) being the subject of an agreement (McDonald and Solow, 1981).<sup>3</sup> The union is risk neutral and its objective is to maximize  $U(w_{it}, N_{it}) = w_{it} \cdot N_{it} + \bar{w}_{it} \cdot (\bar{N}_{it} - N_{it})$ , where  $\bar{N}_{it}$  is union membership ( $0 < N_{it} < \bar{N}_{it}$ ) and  $\bar{w}_{it}$  is the alternative wage ( $\bar{w}_{it} < w_{it}$ ). Consistent with capital quasi-fixity, the firm objective is to maximize its short-run profit function:  $\pi(w_{it}, N_{it}, M_{it}) = R(N_{it}, M_{it}) - w_{it} \cdot N_{it} - j_{it} \cdot M_{it}$  where  $R_{it} = P_{it} \cdot Q_{it}$  stands for total revenue. The outcome of the bargaining is the asymmetric generalized Nash solution to:

$$\begin{aligned} & \max_{w_{it}, N_{it}, M_{it}} \left[ U(w_{it}, N_{it}) - \bar{w}_{it} \cdot \bar{N}_{it} \right]^{\gamma_{it}} \cdot [\pi(w_{it}, N_{it}, M_{it})]^{1-\gamma_{it}} \\ & = \max_{w_{it}, N_{it}, M_{it}} \left[ (w_{it} - \bar{w}_{it}) \cdot N_{it} \right]^{\gamma_{it}} \cdot [R(N_{it}, M_{it}) - w_{it} \cdot N_{it} - j_{it} \cdot M_{it}]^{1-\gamma_{it}} \end{aligned} \quad (2)$$

where  $\gamma_{it}$  represents workers' bargaining power. Maximization with respect to material input gives:

$$R_{M, it} = j_{it} \Rightarrow \varepsilon_{M, it}^Q = \mu_{it} \cdot \alpha_{M, it} \quad (3)$$

with  $\mu_{it} \equiv P_{it} / C_{Q, it}$  is the markup to marginal cost and  $\alpha_{M, it} \equiv (j_{it} \cdot M_{it}) / (P_{it} \cdot Q_{it})$  is the share of materials in output. Maximization with respect to employment and the wage rate respectively gives the following first-order conditions:

$$w_{it} = R_{N, it} + \gamma_{it} \cdot \frac{R_{it} - R_{N, it} \cdot N_{it} - j_{it} \cdot M_{it}}{N_{it}} \quad (4)$$

$$w_{it} = \bar{w}_{it} + \frac{\gamma_{it}}{1-\gamma_{it}} \cdot \frac{R_{it} - w_{it} \cdot N_{it} - j_{it} \cdot M_{it}}{N_{it}} \quad (5)$$

Equation (5) states that the wage premium over the alternative wage is positively related to the workers' bargaining power and to the size of the rents. Solving simultaneously (4) and (5) leads to the expression for the contract curve:  $R_{N, it} = \bar{w}_{it}$ . Expressing the marginal revenue of labor as  $R_{N, it} = R_{Q, it} \cdot Q_{N, it} = P_{it} \cdot Q_{N, it} / \mu_{it}$  and using this expression together with (4) and the expression for the contract curve, the elasticity of output with respect to employment can be written as:

$$\varepsilon_{N, it}^Q = \mu_{it} \cdot \alpha_{N, it} - \mu_{it} \cdot \frac{\gamma_{it}}{1-\gamma_{it}} (1 - \alpha_{N, it} - \alpha_{M, it}) \quad (6)$$

<sup>3</sup> In the right-to-manage model, although wages are determined non competitively, they are given before the firms' employment decision. Consequently, as in the perfect labor market case, the marginal revenue of labor is equal to the wage and firms remain on their labor demand curve. In the right-to-manage model, Hall's equation remains valid.

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with  $\alpha_{N,it}$  being the labor share in output. Assuming constant returns to scale ( $\varepsilon_{N,it}^Q + \varepsilon_{M,it}^Q + \varepsilon_{K,it}^Q = 1$ ), the capital elasticity can be expressed as:<sup>4</sup>

$$\varepsilon_{K,it}^Q = 1 - \mu_{it} \cdot \alpha_{N,it} - \mu_{it} \cdot \alpha_{M,it} + \mu_{it} \cdot \frac{\gamma_{it}}{1 - \gamma_{it}} (1 - \alpha_{N,it} - \alpha_{M,it}) \quad (7)$$

Inserting (3), (6) and (7) in (1) and rearranging terms gives the expression of the Solow residual,  $SR_{it}$  :

$$\begin{aligned} SR_{it} &\equiv \Delta q_{it} - \alpha_{N,it} \cdot \Delta n_{it} - \alpha_{M,it} \cdot \Delta m_{it} - (1 - \alpha_{N,it} - \alpha_{M,it}) \cdot \Delta k_{it} \\ &= \beta_{it} \cdot (\Delta q_{it} - \Delta k_{it}) - \phi_{it} \cdot (1 - \alpha_{N,it} - \alpha_{M,it}) \cdot (\Delta n_{it} - \Delta k_{it}) + (1 - \beta_{it}) \cdot \Delta a_{it} \end{aligned} \quad (8)$$

where  $\beta_{it} \equiv 1 - 1/\mu_{it}$  is the Lerner index and  $\phi_{it} \equiv \gamma_{it}/(1 - \gamma_{it})$ , strictly increasing functions of the markup and the bargaining power respectively.

By embedding the efficient bargaining model into a microeconomic version of Hall's (1988) framework, the Solow residual can be broken down into the three components of the RHS of equation (8): (1) a factor linked to imperfection in the product market ( $\beta_{it}$ ), (2) a factor reflecting the relative bargaining power of the workers ( $\phi_{it}$ ) and (3) a technological term ( $\Delta a_{it}$ ). Note that, as  $\Delta n_{it}$  and  $\Delta q_{it}$  are positively correlated, the original Hall approach, which assumes allocative wages i.e. which neglects the second term, generates a downward bias in estimated markups. Moreover, this bias increases with the bargaining power of the workers. Intuitively, this underestimation corresponds to the omission of the part of product rents captured by the workers. Indeed, CDM estimate their model with and without the bargaining term on 1,026 French firms over the period 1986-1992. They find that ignoring labor market imperfections leads to significant underestimation of the actual markup. The bargaining power is estimated at 0.66 and the average markup 1.41, compared to 1.11 only when ignoring the incidence of rent sharing, both being consistent with a PCM or Lerner index of 10%.<sup>5</sup>

### 4.2.2. Empirical framework

To test the imports-as-product-and-labor-market-discipline hypothesis, we follow a two-stage estimation strategy. In the first part, we estimate the reduced-form equation (8) which allows us to

<sup>4</sup> The assumption of constant returns to scale is motivated by the large problem of identification which arises when markup and scale elasticity parameters are estimated simultaneously.

<sup>5</sup> See Dobbelaere, 2004 and Dobbelaere and Mairesse, 2005 for sector-level evidence in the Belgian and the French manufacturing industry respectively.

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identify our structural parameters of interest, i.e. the average markup ( $\mu$ ) and workers' bargaining power ( $\gamma$ ). We estimate these parameters for 20 sectors in the UK manufacturing industry, split according to 3 size categories and 3 time periods. In the second part, our estimated parameters are regressed on international trade variables to test the hypothesis that international competition curtails product and labor market power.

### 4.3. Part I: Identifying the parameters of interest $\hat{\mu}$ and $\hat{\gamma}$

In this section, we first present the data. Second, we outline our empirical strategy and compare consistently fixed effects (FE) and Generalized Method of Moments (GMM) estimates of our parameters of interest at the sectoral level *for all firms and all periods*. Finally, we split the sample as described and conduct a variance analysis along the three dimensions, sector, firm size and period.

#### 4.3.1. Data

Our analysis is based on two firm-level surveys: OneSource, which covers the years 1988-1998, and Financial Analysis Made Easy (FAME), which offers coverage for the years 1994-2003.<sup>6</sup> We only keep firms within the manufacturing industry for which we have at least 4 observations for all variables, ending up with an unbalanced panel of 9,820 firms with the number of observations for each firm varying between 4 and 14.<sup>7</sup>

We use turnover deflated by the producer price index at the four- and five-digit level, according to availability, as a proxy for output ( $Q$ ).<sup>8</sup> Labor ( $N$ ) refers to the average number of employees in each firm for each year. Intermediate inputs ( $M$ ) are calculated by subtracting the value added from the value of production, deflated by the two-digit materials and fuel price index. The capital stock ( $K$ ) is measured by the gross book value of fixed assets deflated by a price index of net capital defined at the two-digit level. All deflators are drawn from the UK Office for National Statistics (ONS). The input shares ( $\alpha_N$  and  $\alpha_M$ ) are computed by dividing the firm total labor cost and undeflated intermediate

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<sup>6</sup> OneSource is a database of company accounts constructed by OneSource Information Services Ltd, whilst FAME is gathered by Bureau Van Dijk Electronic Publishing and both derive ultimately from the information which companies are required to deposit at Companies House. For FAME a maximum of 10 years of complete data history can be downloaded at once. For OneSource we used the CD-ROM entitled "UK companies, Vol. 1", October 2000. Further details on the OneSource dataset can be found in Oulton (1998).

<sup>7</sup> In OneSource, the holding companies are reported in addition to their subsidiaries. To avoid the double accounting, we excluded the holdings.

<sup>8</sup> The PPI is available at the 5-digit level for the period 1990-2000 and at the 4-digit level for the period 2001-2003.

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inputs respectively by the value of production and by taking the average of these ratios over adjacent years. Table 4.1. reports the means, standard deviations and first and third quartiles of our main variables used in the Part I estimation.

**Table 4.1: Summary statistics**

| Variables   | 1990-2003 |                    |                          |                          |
|---|-----------|--------------------|--------------------------|--------------------------|
|   | Mean      | Standard deviation | 1 <sup>st</sup> quartile | 3 <sup>rd</sup> quartile |
| Real firm output growth rate $\Delta q$                 | 0.014     | 0.166              | -0.081                   | 0.107                    |
| Labor growth rate $\Delta n$                            | 0.003     | 0.129              | -0.061                   | 0.062                    |
| Capital growth rate $\Delta k$                          | 0.006     | 0.178              | -0.090                   | 0.088                    |
| Intermediate inputs growth rate $\Delta m$              | 0.029     | 0.189              | -0.084                   | 0.138                    |
| Share of labor in nominal output $\alpha_N$             | 0.287     | 0.130              | 0.192                    | 0.369                    |
| Share of intermediates in nominal output $\alpha_M$     | 0.656     | 0.137              | 0.567                    | 0.752                    |
| Solow residual $SR$                                     | 0.001     | 0.079              | -0.037                   | 0.037                    |
| $\Delta q - \Delta k$                                   | 0.007     | 0.219              | -0.116                   | 0.137                    |
| $(1 - \alpha_N - \alpha_M) \cdot (\Delta n - \Delta k)$ | -0.000    | 0.019              | -0.005                   | 0.005                    |

*Number of observations: 60,579*

We split the total sample into 20 two-digit sectors according to the Standard Industrial Classification 2003.<sup>9</sup> Employment coverage of our sample is on average 60% of total UK manufacturing employment (SIC 15-37). Table 4.A.1. in Appendix shows the sector description of the sample.

### 4.3.2. Empirical Strategy

As discussed at greater length in Chapter 1, the main difficulty in estimating the extended Hall-type equation (8) lies in the potential correlation between the TFP-growth term ( $\Delta a$ ) and the RHS variables. The problem arises because the productivity shocks are unobserved by the econometrician but not necessarily by the firms which, at least, might anticipate them before choosing their factor inputs. In this case, OLS estimates are likely to be biased. Moreover, the burgeoning literature on firm heterogeneity stresses the differences in productivity level and growth rate across firms (Bernard et al., 2003 for the US and Eaton et al., 2004 for France). As in Harrison (1994), this problem could be addressed by decomposing the productivity growth term into a firm and a time fixed effect, the latter capturing possible unobservable aggregate shocks and productivity shocks common to all firms within sector  $j$ , plus a disturbance term:

$$u_{ijt} \equiv (1 - \beta_j) \cdot \Delta a_{ijt} = e_{ij} + e_{jt} + v_{ijt} \quad (9)$$

<sup>9</sup> We paid attention to the fact that some firms were recorded in two sectors at different times. To create a one-to-one match between firms and sectors, each firm was attributed to the most recorded sector. Sectors 16 and 23 have been dropped due to parsimonious data.

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However, since inputs and output are simultaneously determined, the fixed-effects (FE) estimator might still be biased. Taking advantage of the panel dimension of the data, equation (8) can be estimated using the Generalized Method of Moments (GMM) technique. We use the 3- to 5-year lagged values of the factor inputs as instruments.

### 4.3.3. Comparison of FE and GMM estimates

Table 4.2. reports the FE and GMM estimates for each of the 20 sectors.<sup>10</sup> For the GMM estimates, the parameters of interest ( $\hat{\mu}_j$  and  $\hat{\gamma}_j$ ,  $j=1, \dots, 20$ ) are computed from the two-step estimated values of the reduced-form coefficients ( $\hat{\beta}_j$  and  $\hat{\phi}_j$  respectively). The estimated standard errors ( $\hat{\sigma}$ ) of the estimated parameters are computed using the Delta Method (Wooldridge, 2002).<sup>11</sup>

The estimated Lerner index ( $\hat{\mu}_j$ ) is always very significant. The estimated parameter ( $\hat{\phi}_j$ ), a direct function of workers' bargaining power, is significant for 19 out of the 20 sectors with FE, and this number drops to 10 with GMM. However, comparing FE and GMM estimates, average parameters are very similar, around 0.20 for  $\hat{\beta}_j$  and 0.70 for  $\hat{\phi}_j$ , which implies an average estimated markup ( $\hat{\mu}_j$ ) of 1.25 and an average estimated bargaining power parameter ( $\hat{\gamma}_j$ ) of 0.40 respectively. The latter is above Van Reenen's (1996) estimates, lying in (0.22-0.29) range, but is very close to the UK estimates obtained by Dumont et al. (2006) using a smaller set of firms and sectors. More specifically, the FE range across sectors is (1.12 - 1.45) for the estimated markup and (0.19 - 0.56) for the estimated workers' bargaining power. The GMM specification tests behave well. The overidentification test is not rejected in all but two sectors. The autocorrelation tests are not rejected for sixteen sectors.<sup>12</sup>

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<sup>10</sup> The GMM estimation was carried out in Stata 9.1 (Roodman, 2005). Note that a non negligible share of firms generates negative profits in a given year. For instance, the sum of the shares of variable factors in output exceeds 1 for 21% of the observations, which is not uncommon. In this case, (8) is not symmetrical as bargaining does not apply to negative profits. In particular, wages cannot be lower than the marginal revenue of labor. It follows directly that the rent-sharing term in (8) (second term in the RHS) should be replaced by zero when the sum of the variable input shares exceeds one. We also tried to limit the sample to those observations for which the sum of the variable input factors is lower than 1.05 and found similar results.

<sup>11</sup>  $\sigma_{\hat{\mu}} = \sigma_{\hat{\beta}} / (1 - \hat{\beta})^2$ ;  $\sigma_{\hat{\gamma}} = \sigma_{\hat{\phi}} / (1 + \hat{\phi})^2$

<sup>12</sup> Test results not reported but available upon request.

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Table 4.2: Sector analysis

Estimated sector-level markup  $\hat{\mu}_j$  and workers' bargaining power  $\hat{\gamma}_j$ , FE and GMM results

| Co de          | # Obs<br>(# firms) | FIRM AND YEAR FIXED EFFECTS |   |                     |  | GMM                 |   |                     |  |
|----------------|--------------------|-----------------------------|---|---------------------|--|---------------------|---|---------------------|--|
|                |                    | $\hat{\beta}_j$             | $\hat{\mu}_j = \frac{1}{1 - \hat{\beta}_j}$ | $\hat{\phi}_j$      | $\hat{\gamma}_j = \frac{\hat{\phi}_j}{1 + \hat{\phi}_j}$ | $\hat{\beta}_j$     | $\hat{\mu}_j = \frac{1}{1 - \hat{\beta}_j}$ | $\hat{\phi}_j$      | $\hat{\gamma}_j = \frac{\hat{\phi}_j}{1 + \hat{\phi}_j}$ |
| 15             | 3893<br>(787)      | 0.195***<br>(0.008)         | 1.242***<br>(0.012)                         | 0.670***<br>(0.120) | 0.401***<br>(0.043)                                      | 0.198***<br>(0.032) | 1.247***<br>(0.050)                         | 0.350<br>(0.441)    | 0.259<br>(0.242)   |
| 17             | 1957<br>(377)      | 0.178***<br>(0.010)         | 1.216***<br>(0.014)                         | 1.137***<br>(0.165) | 0.532***<br>(0.036)                                      | 0.211***<br>(0.037) | 1.267***<br>(0.059)                         | 1.679***<br>(0.543) | 0.627***<br>(0.076)                                      |
| 18             | 834<br>(192)       | 0.111***<br>(0.012)         | 1.124***<br>(0.015)                         | 0.420*<br>(0.254)   | 0.296***<br>(0.126)                                      | 0.134***<br>(0.027) | 1.155***<br>(0.036)                         | 0.022<br>(0.711)    | 0.022<br>(0.681)   |
| 19             | 432<br>(74)        | 0.103***<br>(0.019)         | 1.115***<br>(0.023)                         | 0.238<br>(0.371)    | 0.192<br>(0.242)   | 0.101***<br>(0.036) | 1.112***<br>(0.045)                         | 1.272*<br>(0.68)    | 0.560***<br>(0.132)                                      |
| 20             | 948<br>(213)       | 0.145***<br>(0.016)         | 1.170***<br>(0.022)                         | 0.597**<br>(0.268)  | 0.374***<br>(0.105)                                      | 0.076***<br>(0.021) | 1.082***<br>(0.025)                         | -0.302<br>(1.840)   | -0.433<br>(3.777)  |
| 21             | 1565<br>(306)      | 0.197***<br>(0.013)         | 1.246***<br>(0.019)                         | 0.841***<br>(0.145) | 0.457***<br>(0.043)                                      | 0.213***<br>(0.037) | 1.271***<br>(0.060)                         | 1.155***<br>(0.274) | 0.536***<br>(0.059)                                      |
| 22             | 4824<br>(1120)     | 0.187***<br>(0.007)         | 1.230***<br>(0.011)                         | 0.244***<br>(0.075) | 0.196***<br>(0.048)                                      | 0.191***<br>(0.035) | 1.236***<br>(0.053)                         | 0.316<br>(0.287)    | 0.240<br>(0.166)   |
| 24             | 4061<br>(781)      | 0.235***<br>(0.009)         | 1.308***<br>(0.015)                         | 0.821***<br>(0.104) | 0.451***<br>(0.031)                                      | 0.209***<br>(0.038) | 1.264***<br>(0.061)                         | 1.171**<br>(0.460)  | 0.539***<br>(0.098)                                      |
| 25             | 3194<br>(612)      | 0.200***<br>(0.009)         | 1.250***<br>(0.014)                         | 0.455***<br>(0.107) | 0.313***<br>(0.050)                                      | 0.212***<br>(0.034) | 1.269***<br>(0.055)                         | 0.066<br>(0.358)    | 0.062<br>(0.315)   |
| 26             | 1607<br>(305)      | 0.236***<br>(0.016)         | 1.309***<br>(0.027)                         | 0.978***<br>(0.174) | 0.494***<br>(0.044)                                      | 0.253***<br>(0.056) | 1.339***<br>(0.100)                         | 0.552<br>(0.476)    | 0.356*<br>(0.198)  |
| 27             | 1779<br>(337)      | 0.186***<br>(0.011)         | 1.329***<br>(0.017)                         | 0.733***<br>(0.192) | 0.423***<br>(0.064)                                      | 0.210***<br>(0.033) | 1.266***<br>(0.053)                         | 1.385**<br>(0.566)  | 0.581***<br>(0.100)                                      |
| 28             | 5061<br>(1115)     | 0.190***<br>(0.007)         | 1.235***<br>(0.011)                         | 0.442***<br>(0.109) | 0.306***<br>(0.053)                                      | 0.175***<br>(0.034) | 1.212***<br>(0.050)                         | -0.231<br>(0.264)   | -0.300<br>(0.446)  |
| 29             | 5417<br>(1101)     | 0.198***<br>(0.006)         | 1.247***<br>(0.010)                         | 0.829***<br>(0.100) | 0.453***<br>(0.030)                                      | 0.225***<br>(0.031) | 1.29***<br>(0.052)                          | 0.869*<br>(0.507)   | 0.465***<br>(0.145)                                      |
| 30             | 563<br>(142)       | 0.179***<br>(0.018)         | 1.219***<br>(0.026)                         | 0.523***<br>(0.202) | 0.344***<br>(0.087)                                      | 0.159***<br>(0.037) | 1.189***<br>(0.052)                         | 0.179<br>(0.251)    | 0.152<br>(0.181)   |
| 31             | 2181<br>(475)      | 0.273***<br>(0.012)         | 1.375***<br>(0.023)                         | 1.228***<br>(0.147) | 0.551***<br>(0.030)                                      | 0.318***<br>(0.043) | 1.466***<br>(0.092)                         | 1.046**<br>(0.451)  | 0.511***<br>(0.108)                                      |
| 32             | 1393<br>(325)      | 0.309***<br>(0.015)         | 1.448***<br>(0.032)                         | 1.289***<br>(0.211) | 0.563***<br>(0.040)                                      | 0.39***<br>(0.041)  | 1.639***<br>(0.110)                         | 1.316***<br>(0.467) | 0.568***<br>(0.087)                                      |
| 33             | 2155<br>(478)      | 0.222***<br>(0.012)         | 1.285***<br>(0.019)                         | 0.637***<br>(0.148) | 0.389***<br>(0.055)                                      | 0.210***<br>(0.033) | 1.266***<br>(0.053)                         | 0.252<br>(0.488)    | 0.201<br>(0.311)   |
| 34             | 1682<br>(320)      | 0.193***<br>(0.012)         | 1.239***<br>(0.019)                         | 0.807***<br>(0.223) | 0.447***<br>(0.068)                                      | 0.269***<br>(0.026) | 1.368***<br>(0.049)                         | 1.526***<br>(0.486) | 0.604***<br>(0.076)                                      |
| 35             | 847<br>(205)       | 0.234***<br>(0.015)         | 1.306***<br>(0.026)                         | 0.951***<br>(0.188) | 0.488***<br>(0.049)                                      | 0.230***<br>(0.026) | 1.299***<br>(0.044)                         | 0.807**<br>(0.368)  | 0.447***<br>(0.113)                                      |
| 36             | 2468<br>(555)      | 0.173***<br>(0.009)         | 1.210***<br>(0.013)                         | 0.627***<br>(0.136) | 0.385***<br>(0.051)                                      | 0.174***<br>(0.031) | 1.211***<br>(0.045)                         | 0.265<br>(0.414)    | 0.209<br>(0.259)   |
| Sector average |                    | 0.197<br>(0.012)            | 1.250<br>(0.018)                            | 0.723<br>(0.172)    | 0.403<br>(0.065)   | 0.208<br>(0.034)    | 1.272<br>(0.057)                            | 0.685<br>(0.517)    | 0.310<br>(0.378)   |

Equation (8):  $SR_{it} = \beta \cdot (\Delta q_{it} - \Delta k_{it}) - \phi \cdot (1 - \alpha_{N_{it}} - \alpha_{M_{it}}) \cdot (\Delta n_{it} - \Delta k_{it}) + e_t + v_{it}$

Time dummies are included but not reported. FE: robust standard errors in parentheses. GMM: robust standard errors with finite-sample correction (Windmeijer, 2005). \*\*\* Significant at 99%, \*\* Significant at 95%, \* Significant at 90%.

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It is worth noting that the estimated markup and the estimated workers' bargaining power parameter are positively correlated across sectors. The correlation between the two estimated structural parameters is 0.71 for the FE estimates and 0.53 for the GMM estimates. This is consistent with Dobbelaere (2004) and Dobbelaere and Mairesse (2005), who find that the bargaining power is positively linked to the size of the rents. Chapter 2 suggested that, as capital return is determined by the share of the rents kept by the firms, an arbitrage reasoning based on capital mobility across sectors can explain this positive correlation.

Table 4.3. compares the FE and the GMM estimates more synthetically. The trade-off between the two should be that GMM reduces the bias at the cost of less precise estimates. The results indicate that GMM estimates are more dispersed across sectors, even leading to two (insignificant) negative bargaining power parameters. However, the correlation between the FE and the GMM estimates is strong and significant. For the estimated Lerner indexes, the Pearson correlation coefficient is close to 0.90 between FE and GMM. For the estimated parameter related to the bargaining power ( $\hat{\phi}_j$ ), it reaches 0.57 unweighted and 0.72 when weighted to take into account the precision of the estimates. Average standard errors are three times larger for GMM than for FE. All in all, FE is as efficient as GMM in reducing the OLS bias and generates more precise estimates: this comparison suggests that the fixed effects do a good job in accounting for the heterogeneity in productivity growth across firms. Dobbelaere and Mairesse (2005) reach a similar conclusion. Harrison (1994) shows that her FE and IV estimates are very close and, consequently, sticks to the FE results, as Levinsohn (1993) does. We follow the same route for the remainder of this chapter.

**Table 4.3: Correlation between FE and GMM estimates**

|                 |     |       |          |        |       |                         | Correlation FE – GMM |          |          |
|-----------------|-----|-------|----------|--------|-------|-------------------------|----------------------|----------|----------|
|                 |     | Mean  | St. Dev. | Min    | Max   | Average standard errors | Unweighted           | Weight 1 | Weight 2 |
| $\hat{\beta}_j$ | FE  | 0.197 | 0.048    | 0.103  | 0.309 | 0.012                   | 0.89***              | 0.85***  | 0.86***  |
|                 | GMM | 0.208 | 0.069    | 0.076  | 0.390 | 0.044                   |                      |          |          |
| $\hat{\phi}_j$  | FE  | 0.723 | 0.298    | 0.238  | 1.289 | 0.172                   | 0.57***              | 0.72***  | 0.71***  |
|                 | GMM | 0.685 | 0.611    | -0.302 | 1.679 | 0.517                   |                      |          |          |

*Weight 1:  $1/\hat{\sigma}_{FE}^2$  , Weight 2:  $1/(\hat{\sigma}_{FE}\hat{\sigma}_{GMM})$*

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### 4.3.4. Variance Analysis

The above estimates should be considered as sectoral average parameters. There are, however, many reasons to believe that markup and bargaining power parameters vary across time and firm size. What follows confirms this presumption. In addition to the sectoral dimension, the sample is split according to size and period criteria. For the former, the sample is divided between small firms (fewer than 75 employees on average), medium-sized firms (between 75 and 200 employees) and large firms (more than 200 employees), which provides three sub-samples of comparable size. For the latter, three sub-periods are defined: 1991-1994, 1995-1998, 1999-2003.<sup>13</sup> This leaves us with 179 estimates for the markup and the bargaining power parameter: 20 sectors x 3 periods x 3 size classes, minus sector 19, first period, small firms due to lack of data.

These 179 "observations" are used in our Part II estimates. Before formally assessing the determinants of the two parameters of interest, we conduct a variance analysis along the three dimensions presiding over the splitting of the sample. Each of these Part I estimates is weighted by the inverse of the sampling variance. 19 out of the 179 Part I estimates display a negative estimated bargaining power. Therefore, as a robustness check, the various results are compared with and without the 19 "outliers".

As for the estimated markups (see the left part of Table 4.4), the three dimensions (sector, size and period) are very significant at the 99% confidence level, the sectoral dimension accounting for the larger part of the explained variance, as expected. Two findings show up clearly. First, markups drop significantly and importantly by around five percentage points between the first and the second period. Second, the estimated markup is increasing in firm size. This is consistent with both theory (e.g. Cournot competition) and empirical evidence in the heterogeneous firm literature. The difference according to firm size is especially true between the small firms and the others.

The right part of Table 4.4. reports the variance analysis for the estimated workers' bargaining power parameters. The sector share of the explained variance is also predominant. Similar to the estimated markup, the workers' bargaining power dropped significantly, by around 0.12, after the first period. This decrease in the workers' bargaining power echoes Blanchflower and Bryson (2004) who find a

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<sup>13</sup> We start in 1991 to allow for lags.



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significant decline in the union wage premium after 1994 for the UK. It is also consistent with the diluted role of UK labor market institutions, documented by Machin (1997). In addition to other legislative measures, he draws attention to the abolition of the Wages Council system of minimum wages in August 1993, covering 2.5 million workers at that time. Moreover, the workers' bargaining power is estimated to be lower, by around 0.05, for the smaller firms. However, this difference is only significant with the medium-sized firms.<sup>14</sup>

**Table 4.4: Variance analysis**

|                                      | Markup<br>$\hat{\mu}_{jsp}$ | Bargaining power<br>$\hat{\gamma}_{jsp}$ |
|--------------------------------------|-----------------------------|--|
| <b>PERIOD (reference: 1991-1994)</b> |                             |  |
| 1995-1998                            | -0.053***<br>(0.019)        | -0.120***<br>(0.019)                     |
| 1999-2003                            | -0.048**<br>(0.020)         | -0.126***<br>(0.020)                     |
| <b>SIZE (reference: small firms)</b> |                             |  |
| Medium-sized                         | 0.047***<br>(0.012)         | 0.055**<br>(0.021)                       |
| Large                                | 0.049***<br>(0.016)         | 0.029<br>(0.021)                         |
| Adjusted R <sup>2</sup>              | 0.310                       | 0.573                                    |
| # Obs.                               | 179                         | 179                                      |
| <b>SHARE OF EXPLAINED VARIANCE</b>   |                             |  |
| Sector                               | 73%***                      | 71%***                                   |
| Period                               | 11%***                      | 26%***                                   |
| Size                                 | 16%***                      | 3%**                                     |

\*\*\* Significant at 99%, \*\* Significant at 95%, \* Significant at 90%.

### 4.4. Part II: Testing the imports-as-product-and-labor-market-discipline hypothesis

This section concentrates on the identification of the effect of increased import competition on the estimated markups and workers' bargaining power parameters. Each Part I estimate is weighted by the inverse of the sampling variance. A description of all variables used in this section and data sources are reported in Table 4.A.2. in the Appendix.

<sup>14</sup> When we drop the 19 "outliers", we find very similar results.

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### 4.4.1. Markup

#### 4.4.1.1. Specification

Firms under intensifying foreign competition are induced to reduce their margins because of the increase in the perceived elasticity of the demand they are facing. As detailed in Chapter 3, this elasticity depends on the elasticity of substitution between varieties, the concentration level and the intensity of competition.

The following variables are defined. *IMPORT* is the share of imports in sectoral demand. Trade theory highlights that the impact of imports is differentiated depending on the origin of imports. For a developed country like the United Kingdom, trade with developing countries is supposedly based on comparative advantage and the impact of trade is mainly channelled through reallocation between sectors. In contrast, trade with developed countries is mostly intra-industry, as exemplified by the reciprocal dumping model of Brander and Krugman (1983). It is based on imperfect competition and is therefore a better candidate for the pro-competitive effect on markups. We distinguish *IMP NORTH*, which is the share of imports from Western Europe, North America, Japan, Australia and New Zealand in total demand, from *IMP SOUTH*, its complement. Since firms are likely to select foreign markets based on the margins they offer for their products, exports could be positively related to markups. The export ratio at the firm level is *EXPFIRM*. Table 4.5. summarizes the changes of the import variables over the period. The absence of correlation between the changes in imports from developed countries and those from developing countries across sectors is particularly striking (linear coefficient of -3%!), implying that these trends reflect a very distinct rationale.

When competition intensifies firms' reaction is not limited to pricing behavior and, indeed, Sutton (1991, 1997) insists on the endogeneity of market structure. An increase in the competitive environment may trigger an endogenous reaction of firms, through an increase in R&D or advertisement spending for instance. This might force out firms that are unable to keep the pace. R&D could hence be positively related to markups. *R&DRATIO* is defined as the share of R&D spending in total output at the sectoral level.

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There is a lack of data to take into account the change in domestic competition at the sectoral level. At the country level, we test three variables that might have an impact on markups. *PMR* is the product market regulation index computed by the OECD on a scale from 0 to 6, in ascending order of regulation. The series is available for 1988, 1993, 1998 (Nicoletti et al., 2001) and 2003 (Conway et al., 2005), and is linearly interpolated between these years.<sup>15</sup> For the UK, it has decreased from 3.5 in 1988 to 1.0 in 2003. The second variable is the (log of) stock market capitalization as a share of GDP, *LOGCAPIT*. Hoekman et al. (2001) argue that financial deepening reduces the cost of capital, thus increasing the overall profitability of the economy. They provide evidence of stock market capitalization exerting a significantly positive impact on average industry markups and in the preceding chapter a positive relationship between market capitalization and PCM has been put forward. Finally, concentration is one of the most consistent theoretical determinants of markup. However, Schmalensee (1989, stylized fact 4.5) insist that the effect is weak statistically and, when found, it is usually small. The Herfindahl index, *HERF*, is calculated from our sample. Caution is required using this variable as it is very sensitive to the entry or exit of big firms in the *database* at different times.

Also, as discussed in the preceding chapters, the cyclicity of markups is an important question in both theoretical and empirical research. To control for cyclical fluctuations, we use the annual change in value-added and *VALUCYC* is the de-trended series using a Hodrik-Prescott filter. Our empirical specification can be expressed as:

$$\hat{\mu}_{jsp} = a_1 \text{Lag}(\text{IMPORT}_{jp}) + a_2 \text{Lag}(\text{EXPFIRM}_{jsp}) + a_X X_{jsp} + e_j + e_s + e_p + \xi_{jsp} \quad (10)$$

with  $j$ ,  $s$  and  $p$  indexing sector, size and period respectively.

To overcome the endogeneity problem of trade and other variables, all explanatory variables are lagged, except for firm size, the cyclical variable and the Herfindahl index. We use 3-year lagged values of the endogenous variables. In order to avoid overlapping between the sub-periods, ideally we would need 5-year lags. However, such a long lag is likely to weaken the explanatory power substantially and we therefore use it as a robustness check only.

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<sup>15</sup> The indicator is based on seven non-manufacturing sectors (energy, communication and transport). It is highly correlated (linear coefficient of around 86%) to the regulation index for the whole economy, only available for 1998 and 2003.

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**Table 4.5: Summary statistics for the import variables**

| sector             | IMP NORTH |       |       | IMP SOUTH |       |       | Change in                | Change in                |
|--------------------|-----------|-------|-------|-----------|-------|-------|--------------------------|--------------------------|
|                    | 1988      | 1994  | 2000  | 1988      | 1994  | 2000  | IMP NORTH<br>1988 / 2000 | IMP SOUTH<br>1988 / 2000 |
| 15                 | 0.117     | 0.123 | 0.139 | 0.056     | 0.067 | 0.069 | 0.022                    | 0.014                    |
| 17                 | 0.201     | 0.210 | 0.194 | 0.166     | 0.253 | 0.345 | -0.008                   | 0.179                    |
| 18                 | 0.201     | 0.210 | 0.234 | 0.166     | 0.254 | 0.417 | 0.033                    | 0.251                    |
| 19                 | 0.215     | 0.260 | 0.303 | 0.178     | 0.314 | 0.539 | 0.088                    | 0.361                    |
| 20                 | 0.218     | 0.206 | 0.188 | 0.105     | 0.110 | 0.127 | -0.030                   | 0.022                    |
| 21                 | 0.312     | 0.285 | 0.291 | 0.042     | 0.055 | 0.067 | -0.022                   | 0.024                    |
| 22                 | 0.062     | 0.067 | 0.065 | 0.008     | 0.013 | 0.015 | 0.002                    | 0.006                    |
| 24                 | 0.258     | 0.334 | 0.403 | 0.085     | 0.108 | 0.137 | 0.145                    | 0.052                    |
| 25                 | 0.183     | 0.182 | 0.181 | 0.050     | 0.064 | 0.083 | -0.003                   | 0.034                    |
| 26                 | 0.115     | 0.115 | 0.123 | 0.037     | 0.044 | 0.057 | 0.008                    | 0.021                    |
| 27                 | 0.195     | 0.275 | 0.314 | 0.248     | 0.173 | 0.156 | 0.119                    | -0.092                   |
| 28                 | 0.106     | 0.101 | 0.115 | 0.028     | 0.036 | 0.053 | 0.009                    | 0.024                    |
| 29                 | 0.390     | 0.401 | 0.455 | 0.078     | 0.078 | 0.114 | 0.065                    | 0.036                    |
| 30                 | 0.672     | 0.684 | 0.660 | 0.138     | 0.192 | 0.406 | -0.012                   | 0.268                    |
| 31                 | 0.235     | 0.312 | 0.377 | 0.072     | 0.106 | 0.188 | 0.143                    | 0.116                    |
| 32                 | 0.372     | 0.465 | 0.590 | 0.147     | 0.261 | 0.311 | 0.218                    | 0.164                    |
| 33                 | 0.412     | 0.419 | 0.493 | 0.098     | 0.117 | 0.138 | 0.081                    | 0.040                    |
| 34                 | 0.379     | 0.409 | 0.489 | 0.073     | 0.101 | 0.128 | 0.110                    | 0.054                    |
| 35                 | 0.153     | 0.148 | 0.365 | 0.371     | 0.353 | 0.349 | 0.213                    | -0.022                   |
| 36                 | 0.178     | 0.166 | 0.195 | 0.147     | 0.177 | 0.184 | 0.017                    | 0.037                    |
| Unweighted average | 0.249     | 0.269 | 0.309 | 0.115     | 0.144 | 0.194 | 0.060                    | 0.079                    |

### 4.4.1.2. Results

The estimates are presented in Table 4.6. The main result is that imports exert a negative impact on markups, although this effect is not significant when the origin of imports is not differentiated. As column (2) indicates, this is because only imports from developed countries appear to have a significant effect, which is consistent with the discussion above. An increase of one point in the share of imports from the North in total demand would trigger a decrease of around one point. Note that, compared to the variance analysis, the explanatory power measured by the adjusted  $R^2$  increases from 0.31 to 0.36.

Exports never show up as being significant. Consistent with the heterogeneous firm literature, we find that exports increase with firm size, as the export ratio is on average 0.065 higher for the large compared to the small firms. However, it seems that the size-effect on markups is not amplified by the export status.

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Table 4.6: Determinants of estimated markups  $\hat{\mu}_{j,sp}$

| Variables                 | (1) <sup>a</sup>    | (2) <sup>a</sup>     | (3) <sup>a</sup>     | (4) <sup>a</sup>     | (5) <sup>a</sup>     | (6) <sup>a</sup>    | (7) <sup>b</sup>     |
|---------------------------|---------------------|----------------------|----------------------|----------------------|----------------------|---------------------|----------------------|
| <b>1995-1998</b>          | -0.040*<br>(0.024)  | -0.053**<br>(0.024)  | -0.054**<br>(0.024)  |                      |                      |                     | -0.064**<br>(0.025)  |
| <b>1999-2003</b>          | -0.023<br>(0.023)   | -0.021<br>(0.023)    | -0.019<br>(0.023)    |                      |                      |                     | -0.037*<br>(0.022)   |
| <b>Medium-sized</b>       | 0.046***<br>(0.012) | 0.044***<br>(0.012)  |                      |                      |                      |                     | 0.044***<br>(0.012)  |
| <b>Large</b>              | 0.050***<br>(0.017) | 0.051***<br>(0.017)  |                      |                      |                      |                     | 0.051***<br>(0.017)  |
| <b>EMPL</b>               |                     |                      | 0.017***<br>(0.005)  | 0.017***<br>(0.005)  | 0.017***<br>(0.005)  | 0.017***<br>(0.005) |                      |
| <b>VALUCYC</b>            | -0.042<br>(0.210)   | 0.021<br>(0.205)     | 0.011<br>(0.200)     | -0.308**<br>(0.143)  | -0.339**<br>(0.144)  | -0.320**<br>(0.144) | 0.040<br>(0.206)     |
| <b>lag (EXPFIRM)</b>      | -0.064<br>(0.182)   | -0.102<br>(0.183)    | -0.123<br>(0.185)    | -0.117<br>(0.184)    | -0.122<br>(0.182)    | -0.117<br>(0.184)   | -0.137<br>(0.185)    |
| <b>lag (IMPORT)</b>       | -0.278<br>(0.323)   |                      |                      |                      |                      |                     |                      |
| <b>lag (IMP NORTH)</b>    |                     | -1.133***<br>(0.376) | -1.181***<br>(0.371) | -0.877***<br>(0.353) | -0.989***<br>(0.379) | -0.942**<br>(0.398) | -1.372***<br>(0.386) |
| <b>lag (IMP SOUTH)</b>    |                     | 0.254<br>(0.334)     | 0.257<br>(0.336)     | 0.314<br>(0.324)     | 0.196<br>(0.324)     | 0.326<br>(0.326)    | 0.799*<br>(0.418)    |
| <b>lag (R&amp;DRATIO)</b> | 4.37*<br>(2.48)     | 3.66<br>(2.22)       | 3.69*<br>(2.20)      | 3.66<br>(2.24)       | 3.58<br>(2.26)       | 3.42<br>(2.33)      | 2.56<br>(2.01)       |
| <b>lag (PMR)</b>          |                     |                      |                      | 0.013<br>(0.013)     |                      |                     |                      |
| <b>lag (LOGCAPIT)</b>     |                     |                      |                      |                      | -0.007<br>(0.026)    |                     |                      |
| <b>HERF</b>               |                     |                      |                      |                      |                      | -0.095<br>(0.205)   |                      |
| <b>Sector dummies</b>     | yes                 | yes                  | yes                  | yes                  | yes                  | yes                 | yes                  |
| <b>R<sup>2</sup></b>      | 0.321               | 0.357                | 0.351                | 0.336                | 0.332                | 0.332               | 0.358                |
| <b># Obs.</b>             | 179                 | 179                  | 179                  | 179                  | 179                  | 179                 | 179                  |

Robust standard errors in parentheses. \*\*\* Significant at 99%, \*\* Significant at 95%, \* Significant at 90%.

<sup>a</sup> 3-year lags used, <sup>b</sup> 5-year lags used except for EXPFIRM. For this variable, we are forced to use 3-year lags because of data availability in the first sub-period.

R&D appears to have a positive effect on markups. Although not always significant, the impact is large as one standard deviation in *R&DRATIO* makes a difference of 0.07 in markups. When we substitute the (log of) average employment, *EMPL*, to size dummies or when the sample is restricted to the positive bargaining power observations, the results are not altered. When period dummies are withdrawn, the coefficient of the cyclical variable *VALUCYC* is negative and significant, hence supporting the counter-cyclical nature of markups. As a robustness check, we use 5-year lags which

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produce in general qualitatively similar -although not always significant- results. As an illustration, we report in the last column the specification consistent with the one in column (2).

### 4.4.2. Workers' bargaining power

#### 4.4.2.1. Specification

Formalizing the impact of foreign competition on workers' bargaining strength is not as straightforward as doing so on markups, even if it is generally reflected in the increase in the elasticity of labor demand due to imports, for which Fabbri, Haskel and Slaughter (2003) provide some evidence for low skilled workers. Rodrik (1997) points out that imports increase the substitution between domestic and foreign workers. Moreover, the possibility of offshoring improves the position of employers in bargaining and at the same time narrows the range of outside options available to workers. Therefore, pressure from foreign competition could increase the risk of breakdown in bargaining and loosen labor market tightness, thereby diminishing workers' bargaining power (see Brock and Dobbelaere, 2006 and Dumont et al., 2005 for a further discussion). Pencavel (2004) documents "the surprising retreat of union Britain". He details the changes in the legal framework for unionism in the 1980s and 1990s and suggests that the *context* of a harsher domestic and international competitive environment determined the *impact* of the new laws.

In addition to the variables described in 4.4.1.1, we evaluate the effect of three labor market variables on workers' bargaining power: *UNIONDENS*, *REPLRATE* and *UNEMPRATE*, referring to union density, the replacement rate and the unemployment rate at the country level respectively. Union density and the replacement rate are expected to be positively related to the workers' bargaining power, as shown by Karier (1985) and Conyon and Machin (1991). For the unemployment rate, the link might not be clear-cut. An increase in the unemployment rate has a negative effect on the outside option, hence a negative relationship with the workers' bargaining power is expected. However, because the union wage premium softens the impact of shocks on wages, Blanchflower and Bryson (2004) find that the union wage premium is counter-cyclical, pointing to a positive relationship. Therefore, the resulting effect is, a priori, ambiguous. Product market deregulation has been found to be positively correlated to labor market deregulation across countries and seems to precede labor market reforms (see Fig. 34 in Brandt et al., 2005) and, therefore, the *PMR* variable can be expected

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to be positively linked to the bargaining power. If capital deepening (*LOGCAPIT*) is linked to increased capital mobility, it might have a negative impact on the workers' bargaining power.

It is often argued that technological change, instead of international trade, triggers changes in the labor market (see e.g. Berman et al., 1994; Krugman and Lawrence, 1996). Technological change (*R&DRATIO*) might exert an effect on the workers' bargaining power by impacting the nature of the production process.

Finally concentration can have two opposite effects on the bargaining power. On the one hand, in concentrated sector, firms may tend to have monopsony power in the labor market which weakens workers. On the other hand, as argued by Veugelers (1989), output concentration may allow firms to shift costs on to customer more easily and accept stronger unions. Ebell and Haefke (2006) find a positive correlation between concentration and union coverage in a cross-section of US industries. To test the imports-as-labor-market discipline hypothesis, we estimate the following specification:

$$\hat{\gamma}_{jsp} = b_1 \text{Lag}(\text{IMPORT}_{jp}) + b_2 \text{Lag}(\text{EXPFIRM}_{jsp}) + b_X \cdot X_{jsp} + f_j + f_s + f_p + v_{jsp} \quad (12)$$

### 4.4.2.2. Results

Our results, which are reported in Table 4.7., provide robust evidence of imports having squeezed the workers' bargaining power. When the origin is taken into account, this impact is only significant for imports from developed countries. An increase of one point in the share of imports from the North seems to have reduced the bargaining power by 0.008 on average.<sup>16</sup> The fact that only increased import competition from the North exerts a significantly negative impact seems contrary to the popular wisdom. However, one would need to rely on a more detailed skill structure within sectors to have a clearer analysis. Our results seem to point out that, because of similar characteristics in terms of education, productivity and skills, foreign workers in *developed* countries are more substitutable through imports to UK workers than those in developing countries. Interestingly, Neven and Wyplosz (1999) find similar effects. Also, Greenaway, Hine and Wright (1999) study the impact of international trade on UK *employment* between 1979 and 1991. They find that only imports from developed

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<sup>16</sup> Considering 5 EU countries (Belgium, France, Germany, Italy and the UK), Dumont et al. (2006) find a comparable effect.

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countries had a negative impact, which is even more surprising, and suggest that the competition from developing countries is in industries that had already declined in the 1970s.

**Table 4.7: Determinants of estimated workers' bargaining power  $\hat{\gamma}_{jst}$**

| Variables                     | (1) <sup>a</sup>     | (2) <sup>a</sup>     | (3) <sup>a</sup>    | (4) <sup>a</sup>    | (5) <sup>a</sup>     | (6) <sup>a</sup>    | (7) <sup>a</sup>    | (8) <sup>b</sup>     | (9) <sup>b</sup>    | (10) <sup>b</sup>   |
|-------------------------------|----------------------|----------------------|---------------------|---------------------|----------------------|---------------------|---------------------|----------------------|---------------------|---------------------|
| <b>1995-1998</b>              | -0.112***<br>(0.020) | -0.109***<br>(0.020) |                     |                     |                      |                     |                     | -0.115***<br>(0.201) |                     |                     |
| <b>1999-2003</b>              | -0.108***<br>(0.024) | -0.108***<br>(0.025) |                     |                     |                      |                     |                     | -0.119***<br>(0.026) |                     |                     |
| <b>Medium-sized</b>           | 0.049**<br>(0.022)   | 0.048**<br>(0.021)   |                     |                     |                      |                     |                     | 0.045**<br>(0.025)   | 0.061***<br>(0.025) |                     |
| <b>Large</b>                  | 0.015<br>(0.025)     | 0.016<br>(0.024)     |                     |                     |                      |                     |                     | 0.011<br>(0.032)     | 0.036<br>(0.032)    |                     |
| <b>EMPL</b>                   |                      |                      | -0.005<br>(0.006)   | -0.004<br>(0.006)   | 0.001<br>(0.006)     | -0.002<br>(0.006)   | -0.002<br>(0.006)   |                      |                     | 0.001<br>(0.006)    |
| <b>lag (EXPFIRM)</b>          | 0.284<br>(0.184)     | 0.297<br>(0.194)     | 0.378*<br>(0.206)   | 0.370*<br>(0.208)   | 0.235<br>(0.206)     | 0.348*<br>(0.210)   | 0.344<br>(0.210)    | 0.343*<br>(0.198)    | 0.200<br>(0.205)    | 0.256<br>(0.212)    |
| <b>lag (IMPORT)</b>           | -0.376**<br>(0.179)  |                      |                     |                     |                      |                     |                     |                      |                     |                     |
| <b>lag (IMP NORTH)</b>        |                      | -0.850**<br>(0.352)  | -0.655*<br>(0.383)  | -0.665*<br>(0.393)  | -1.539***<br>(0.328) | -0.817*<br>(0.415)  | -0.836**<br>(0.417) | -0.476<br>(0.510)    | -0.935*<br>(0.522)  | -1.020**<br>(0.508) |
| <b>lag (IMP SOUTH)</b>        |                      | 0.211<br>(0.288)     | 0.327<br>(0.299)    | 0.303<br>(0.314)    | -0.416<br>(0.347)    | 0.140<br>(0.369)    | 0.117<br>(0.373)    | 0.189<br>(0.396)     | -0.768<br>(0.476)   | -0.733<br>(0.543)   |
| <b>lag (R&amp;DRATIO)</b>     | -2.04<br>(2.10)      | -1.69<br>(2.08)      | -1.30<br>(2.11)     | -1.36<br>(2.16)     | -2.04<br>(2.03)      | -1.61<br>(2.31)     | -1.65<br>(2.33)     | -0.11<br>(1.97)      | -1.52<br>(2.30)     | -1.48<br>(2.29)     |
| <b>lag (PMR)</b>              |                      |                      | 0.072***<br>(0.014) |                     |                      |                     |                     |                      |                     |                     |
| <b>lag (UNION DEN)</b>        |                      |                      |                     | 1.384***<br>(0.289) |                      |                     |                     |                      |                     |                     |
| <b>lag (UNEMPRA) REPLRATE</b> |                      |                      |                     |                     | -2.281***<br>(0.691) |                     |                     |                      |                     |                     |
| <b>lag (LOGCAPIT)</b>         |                      |                      |                     |                     |                      | 3.795***<br>(1.058) |                     | -0.115***<br>(0.033) |                     |                     |
| <b>HERF</b>                   |                      | 0.274*<br>(0.156)    | 0.390**<br>(0.173)  | 0.408**<br>(0.179)  | 0.292<br>(0.186)     | 0.449**<br>(0.197)  | 0.451**<br>(0.199)  | 0.321**<br>(0.155)   | 0.501**<br>(0.215)  | 0.536**<br>(0.215)  |
| <b>Sector dummies</b>         | yes                  | yes                  | yes                 | yes                 | yes                  | yes                 | yes                 | yes                  | yes                 | yes                 |
| <b>R<sup>2</sup></b>          | 0.575                | 0.581                | 0.553               | 0.546               | 0.524                | 0.521               | 0.519               | 0.573                | 0.492               | 0.473               |
| <b># Obs.</b>                 | 179                  | 179                  | 179                 | 179                 | 179                  | 179                 | 179                 | 179                  | 179                 | 179                 |

Robust standard errors in parentheses. \*\*\* Significant at 99%, \*\* Significant at 95%, \* Significant at 90%.

<sup>a</sup> 3-year lags used, <sup>b</sup> 5-year lags used except for EXPFIRM. For this variable, we are forced to use 3-year lags because of data availability in the first sub-period.



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The coefficient on *EXPFIRM* is positive and significant at 90% for a few specifications. Next, because most of the other explanatory variables lack the sectoral dimension, we run into severe multicollinearity issues. This makes it almost impossible to disentangle the effect of these country variables. Therefore, we test each of them separately, keeping in mind that the contribution of each variable should not be cumulated. The impact of *UNIONDENS*, *PMR*, *REPLRATE*, *LOGCAPIT* and *UNEMPRATE* show up significantly. The first two variables have the highest explanatory power. De-unionization seems to be associated with a decline in the workers' bargaining power between 1991 and 2003. Product market and labor market deregulation are found to go hand in hand. A higher unemployment rate, a lower replacement rate and financial deepening seem negatively related to the workers' bargaining power. Finally, the workers' bargaining power is found to be significantly higher in concentrated sectors whereas no significant relationship is detected with *R&DRATIO*.<sup>17</sup>

### 4.4.3. Product market discipline vs labor market discipline and the price-cost margin puzzle

How does the sensitivity of the markup and of the bargaining power to imports compare with the results in Chapter 3 and with those of the studies reviewed therein? Recall that according to equation (7) in Chapter 3 the changes in price-cost margins and markups are linked under efficient bargaining:

$$\frac{\partial PCM}{\partial IMPNORTH} = \frac{1-\gamma}{\mu^2} \cdot \frac{\partial \mu}{\partial IMPNORTH} - \frac{\mu-1}{\mu} \cdot \frac{\partial \gamma}{\partial IMPNORTH} \quad (13)$$

Using the average estimates in Table 4.2. ( $\mu = 1.25$ ,  $\gamma = 0.40$ ) and the average estimates from tables 4.6 and 4.7 leads to the following break-down:

$$\begin{aligned} \Delta PCM &= \text{product - market discipline effect} + \text{labor - marker discipline effect} \\ &= -0.38 \cdot \Delta IMPNORTH + 0.16 \cdot \Delta IMPNORTH \end{aligned} \quad (14)$$

This back-of-the-envelope calculation suggests that firstly, the labor-market discipline effect has counteracted half of the product-market discipline effect and secondly, that import competition overall has contributed to a decline in the price-cost margin on average over the period. The puzzle is therefore only partially resolved. Finally, in total, the order of magnitude of  $-0.22$  is in line with those presented in the previous chapter.

<sup>17</sup> As a robustness check, limiting ourselves to the 160 non-negative bargaining power Part I estimates produces similar results. Also, we used a logarithmic transformation. The results, which are available upon request, confirm our previous findings.

#### **4.5. Conclusion**

Many empirical studies have provided evidence that trade has a pro-competitive effect by reducing markups to marginal cost in import competing industries. All of them assume a perfectly competitive labor market. In contrast, this chapter takes into account labor market imperfections and uses firm-level data for UK manufacturing sectors. Our results indicate that both the markups and workers' bargaining power decreased in the mid-'nineties. Moreover, imports from developed countries are shown to contribute significantly to these changes, whereas firm exports have a weakly significant positive influence on the workers' bargaining power. These joint effects imply that trade has exerted a conflicting impact on price-cost margins, i.e. on the share of the rents kept by the firms. We also find, consistent with the recent literature on firm heterogeneity, that small firms have lower markups. Additionally, their workers are subject to a lower bargaining power.

**Appendix: Data description**

**Table 4.A.1: Sector description**

| Code | Name  |
|------|---|
| 15   | FOOD PRODUCTS AND BEVERAGES                               |
| 17   | TEXTILES  |
| 18   | WEARING APPAREL, DRESSING, DYING OF FUR                   |
| 19   | LEATHER, LEATHER PRODUCTS AND FOOTWEAR                    |
| 20   | WOOD AND PRODUCTS OF WOOD AND CORK                        |
| 21   | PULP, PAPER AND PAPER PRODUCTS                            |
| 22   | PRINTING AND PUBLISHING                                   |
| 24   | CHEMICALS AND CHEMICAL PRODUCTS                           |
| 25   | RUBBER AND PLASTICS PRODUCTS                              |
| 26   | OTHER NON-METALLIC MINERAL PRODUCTS                       |
| 27   | BASIC METALS  |
| 28   | FABRICATED METAL PRODUCTS, except machinery and equipment |
| 29   | MACHINERY AND EQUIPMENT, N.E.C.                           |
| 30   | OFFICE, ACCOUNTING AND COMPUTING MACHINERY                |
| 31   | ELECTRICAL MACHINERY AND APPARATUS, NEC                   |
| 32   | RADIO, TELEVISION AND COMMUNICATION EQUIPMENT             |
| 33   | MEDICAL, PRECISION AND OPTICAL INSTRUMENTS                |
| 34   | MOTOR VEHICLES, TRAILERS AND SEMI-TRAILERS                |
| 35   | OTHER TRANSPORT EQUIPMENT                                 |
| 36   | MANUFACTURING NEC   |

**Table A.4.2: Description and source of variables in Part II estimates**

| Variable  | Description  | Source  |
|-----------|--|---|
| LOGCAPIT  | Log of stock market capitalization as a percentage of GDP  | Datastream                                      |
| EMPL      | Log of firm average employment level across the whole period   | OneSource, FAME                                 |
| EXPFIRM   | Firm exports / turnover ratio  | OneSource, FAME                                 |
| HERF      | Sample-based Herfindahl index  | OneSource, FAME                                 |
| IMPORT    | Sectoral import penetration ratio: imports / sectoral demand   | STAN  |
| IMP NORTH | Same as IMPORT considering only imports from Western Europe, North America, Japan, Australia and New Zealand | Bilateral Trade Database                        |
| IMP SOUTH | Complement of IMP NORTH in IMPORT  | Bilateral Trade Database                        |
| PMR       | Product Market Regulation index  | Nicoletti et al. (2001) and Conway et al.(2005) |
| R&DRATIO  | Sectoral share of R&D expenses in total output   | OECD  |
| UNEMPRATE | Country-level unemployment rate  | Nickell and Nunziata (2001)                     |
| UNIONDENS | Country-level union density  | Nickell and Nunziata (2001)                     |
| REPLRATE  | Country-level replacement rate   | Nickell and Nunziata (2001)                     |
| VALUCYC   | De-trended sectoral annual change in value added (HP filter)   | STAN  |

## Chapter 5

# International Trade, Foreign Outsourcing and Deindustrialization<sup>1</sup>

### 5.1. Introduction

International competition exhibits new patterns, characterized by the emergence of big new players and the acknowledged international relocation of industrial production in low-wage countries. How such patterns affect industrial employment in industrialized countries is a key issue for policy makers. Offshoring and outsourcing fill the columns of the newspapers, and the disconnection between the prudent diagnosis of the economic profession and the perception of the civil society is growing.

The steady decline in the share of industry in total employment currently seems to be accelerated by the forces of globalization. Consequently, the civil society, as well as numerous commentators and politicians, are associating the phenomenon of offshore outsourcing, and more generally competition with the South, with the observed deindustrialization, defined as the decline in the share of manufacturing in total employment. Such fears regularly feed the political debate, especially when a

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<sup>1</sup> This chapter is based on Boulhol, H., Fontagné, L., 2006, "Deindustrialization and the fear of relocations in industry", CEPII, Document de travail, No 7.

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downturn in economic activity matches the calendar of a political event: one may for instance recall that Ross Perot had predicted a "giant sucking sound" caused by the loss of 5 million US jobs to Mexico if Congress ratified the Agreement on the North American Free Trade Area (NAFTA).

The recent controversy between Samuelson (2004) and Bhagwati et al. (2004) should not hide the fact that the perception of these evolutions by a large majority of economists is less alarming than that of the civil society (e.g. Marin, 2004). Deindustrialization is primarily a natural outcome associated with the development of modern societies, and resulting from demand, supply and relative price effects. Therefore, competition from the South (via specialization or offshore outsourcing) is responsible for only a limited part of the above phenomenon. However, even if specialization and trade are the source of positive gains, adjustment costs can indeed be large and painful in certain regions or within certain parts of the population. Thus, the more rigid the economy, the slower the adjustments, the more pronounced the "local pains". All in all, whereas public opinion perceives deindustrialization, outsourcing, offshoring and the competition of emerging countries as the same frightening phenomenon, most professional economists consider deindustrialization as mostly a "domestic issue" rather disconnected from international competition.

However, since relative prices are at stake, one can hardly neglect another strand of argument. First, the new competitors, combining low labour costs with large productivity levels, thanks to the presence of foreign multinationals, definitely *depress international prices* for manufactured products. Second, technical progress is not exogenous: its application in factories is mainly driven by competitive pressure. *Defensive innovation* (Thoenig and Verdier, 2002) might thus reinforce the natural evolution of productivity in the industrial sector.

As a result, even if offshore outsourcing plays a limited role in lay-offs, and if deindustrialization is mainly driven by internal forces, and if the net factor content of our trade with the South remains limited, there could still be arguments highlighting the impact of competition from the South on the decline in the industry share in total employment in the North. By better addressing this issue, which matches the concerns of the civil society, we hope to contribute to clarifying the debate.

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We adopt a broad perspective and ask “*What is the responsibility of international trade with developing countries in the observed deindustrialization?*”. Obviously, the impact of trade provides a large upper-bound of that of foreign outsourcing. Such an avenue of research was initially explored by the IMF. Using data for 18 industrialized countries over the period 1963-1994, Rowthorn and Ramaswami in their 1998 paper (RR, hereafter) estimated that a one percentage point increase in the ratio of imports from low wage economies, as a share of GDP, translated into an increase in the relative productivity of manufacturing in importing countries between of 3% and 8.5%. This effect on productivity being controlled, the depressive impact on prices of imports from low wage countries is no longer significant. Beside, regressing the relative employment in manufacturing (which is an inverse measure of deindustrialization) on income per capita, openness and investment, they found that the contribution of trade with low wage economies is at most 20%. In total over the 1970-1994 period, net imports from low wage economies would have reduced the manufacturing share in total employment by 1.6 points on average. This seminal work, besides some econometric issues left pending, has a major drawback: it does not take into account the recent period, characterized by an acceleration of the participation of emerging economies in world trade. Therefore, it is necessary to update this type of study regularly in order to ensure that such an order of magnitude continues to make sense.

In the following, we replicate and extend the estimations realized by RR. First, the period is extended up to 2002 and, second, our estimation strategy relies on a dynamic panel specification using GMM methodology. In that sense, this chapter, carried out independently, complements the recent update provided by Rowthorn and Counts (2004, RC hereafter) and overcomes some limitations in their empirical methodology, which might lead to biased estimates. These limitations refer to the role of common exogenous technical change, the persistence of the series and the endogeneity of the trade variables. As we will argue, although the impact of trade with developing countries on deindustrialization is found to be very similar to RC's results *overall*, which is the main comforting message, we cannot exclude that different biases offset each other by chance as other differences between the two studies are significant.

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We will here limit our investigation to manufacturing, but one should keep in mind that offshoring of services is the other side of the coin: Amiti and Wei (2004), van Welsum (2004) and GAO (2004) are seminal contributions as far as services are concerned. However, the kind of data and methodology to be used differs largely. The rest of this chapter is organized as follows. Section 5.2 gives an overview of the debate, Section 5.3 proposes a simple theoretical framework for estimation purposes, Section 5.4 provides descriptive statistics for a panel of industrialized countries, Section 5.5 discusses the results and Section 5.6 concludes.

### 5.2. Overview of the debate

The very rapid development of the international division of labour, as fostered by the emergence of competitors with a very broad spectrum of comparative advantages in industrial activities (e.g. China), and sometimes in services too (e.g. India), has revived a leitmotiv in public debate in Europe, Japan and the United States: the “hovering-up” of jobs by competition from low-wage economies as well as the future of the manufacturing industry.

In the USA, the “Manufacturing in America” 2004 report, commissioned by President Bush from the US Department of Commerce, reflects these concerns. For the US Secretary of Commerce, *“America’s manufacturers provide our nation and our people with good jobs, a better quality of life, and inventions that have established our national identity. Manufacturing is the backbone of our economy and the muscle behind our national security”*. Such a statement echoes President Clinton’s objective of restoring manufacturing’s share of US employment from 17% to 20%. There is no need to quote European officials on the subject, as similar statements could easily be found.<sup>2</sup>

#### 5.2.1. International competition is playing a role

Opening up the economy can contribute to the decline in – though not the disappearance of – the manufacturing industry as a result of the combination of four phenomena. First, the advantage of the old industrialized economies is currently shifting from the factory to the office, distribution network or trading desk. This entails a growing specialization in services and a commensurate decline in

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<sup>2</sup> Note that the statistics tend to exaggerate the phenomenon. Indeed, the boundaries between services and industry have been increasingly blurred and many service activities owe their very existence to the presence of the manufacturing industry.

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manufacturing in the face of rising competition from imports originating in the newly industrialized countries. The result would be a Nike-style industry, designing, importing and distributing the goods that it no longer manufactures.

Second, the downward pressure exerted by new competitors with very low labour costs and lax environmental rules may have a selection effect on firms, products and technologies in the North. Only the most productive firms will survive; only upmarket products with no competition from low-cost imports will hold their own; only the most productive, least labour-intensive technologies will be chosen.

Third, firms reorganize themselves on a global level to take advantage of international cost differentials, specialising their overseas subsidiaries in different segments of the production process. The associated fragmentation of the production processes is characterized by a growing recourse to imported parts and components from low-wage countries (Fontagné et al., 1996; Hummels et al., 2001). This changing nature of trade, which exploits the modularity of products in order to benefit from the differences in costs between the various possible locations, has been on the cards for a long time (Sanyal, 1983; Sanyal and Jones, 1982; Dixit and Grossman, 1982).

Last, the new markets are in the South and factories are located near the markets. Thus, the shift in international demand to new areas leads manufacturers to locate their new capacities in the neighbourhood of these dynamic new markets.

Is there anything new about these phenomena? The answer is yes: though the emergence of new competitors is nothing new, the combination of substantial cuts in transaction costs (in particular plummeting communication costs) with the large-scale opening-up of the South's economies, possessing an abundance of cheap labour that multinational corporations can tap into using advanced technologies, smashes a hole in the logic behind the division of labour between North and South.



### 5.2.2. Arguments downplaying those fears

First, economic analysis recalls that deindustrialization is, above all, an internal development in the advanced economies. Second, the direct impact of international competition with the South on the employment level in the North is limited, notwithstanding potentially visible distributive impacts between categories of workers (Anderton and Brenton, 1999).

The grounds of the first argument are as follows. The structure of household demand is impacted by increasing purchasing power. During a lengthy industrialization phase, the spread of industrial goods in society combines with the industrialization of certain tasks (noticeably regarding housekeeping) and, possibly, a taste for material goods: the income elasticity of demand for industrial goods is high. As needs are saturated and personal wealth increases, society dematerializes, consumption shifts to services and the sale of material goods includes a growing service content. The income elasticity of demand for industrial goods diminishes. This demand effect combines with a supply effect. Indeed, technological developments bring faster productivity gains in manufacturing than in services. This is because, roughly speaking, the production process in industry can more easily automate tasks, whereas some services must take into account personal characteristics and manage more complex information. The resulting change in relative prices increases the consumption of material goods through a substitution effect. Up to a certain level of income, these two effects combine to increase *volume* demand for manufactured goods and so the volume of manufacturing output. Above that level, the substitution effect sustains stagnant or falling demand for industrial products and manufacturing industry holds its own in terms of volume. However, its share in the production in value terms – and therefore in jobs – diminishes. The decline of manufacturing share in total employment is therefore inexorable.

Regarding the second strand of the argument, the issue of the hoovering-up of jobs by trade was covered by Lawrence and Slaughter (1993). Basically, the developing countries' share of the leading industrialized countries' trade remains too small for imports from those countries to be the main determining factor in labour-market trends in the North. Hine and Wright (1998), for example, found a limited impact of imports on UK employment, around 6% of job losses in the manufacturing sector over the period 1981-91. Sachs and Shatz (1994) estimated that developing country trade is

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associated with a decline of 5.7% in manufacturing employment in the USA between 1978 and 1990, period during which the share of manufacturing in employment has decreased by 27%. Although there has been an appreciable divergence in pay or employment between skill groups in the old industrialized countries, technical progress (biased against unskilled labour) is the likeliest suspect. However, technological progress itself is not of an exogenous nature: it might be impacted by competitive pressure.

### 5.3. Simple model with two sectors

#### 5.3.1. Relative prices and productivity

There are two sectors in the economy, industry  $I$  and services  $S$ . The production functions are:

$$Y_j = A_j \cdot L_j \text{ with } j = I, S.$$

For each sector,  $L$  stands for employment,  $Y$  production,  $A$  total factor productivity (TFP, which coincides with labour productivity in this simplified case). TFP is supposed to be growing at an exogenous rate  $g_I$  in industry and  $g_S$  in services, with  $g_I > g_S$ . Relative labour productivity and price are denoted *RELPROD* and *RELPRICE* respectively:

$$RELPROD \equiv (Y_I / L_I) / (Y_S / L_S) = A_I / A_S = A_0 \cdot e^{(g_I - g_S)t} \quad (1)$$

$$RELPRICE \equiv p_I / p_S$$

The first-order conditions imply:

$$\text{Log}(RELPRICE) = cte - \text{Log}(RELPROD) \quad (2)$$

The rise in the relative productivity of industry is totally passed on the relative price. Taking into account capital and extending production functions to the case of constant elasticity of substitution,  $\sigma$ , would lead to:

$$\text{Log}(RELPRICE) = cte - \text{Log}(RELPROD) + \alpha \cdot (1 - 1/\sigma) \cdot \text{Log}(w/r)$$

where  $\alpha$  is a constant, positive if the industrial sector is relatively intensive in capital, negative otherwise, and where  $w/r$  is the relative factor cost. When taking into account the upward trend in

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relative wages, relative prices falls slightly less than relative productivity increases if the elasticity of substitution between capital and labour is lower than 1.

### 5.3.2. Employment, value added at constant and current prices

On the demand side, utility is supposed to be CES of elasticity  $\eta$  between industrial goods and services. Therefore, relative demand *at constant income* verifies:

$$\text{Log}(X_I / X_S) = \text{cte} - \eta \cdot \text{Log}(p_I / p_S) \quad (3a)$$

This simple model leads to the following results. First, combining (1), (2) and (3), relative employment is given by:

$$\text{Log}(L_I / L_S) = \text{cte} - (1 - \eta) \cdot (g_I - g_S) \cdot t \quad (4a)$$

from which the trends in the relative share of industrial employment are deduced:

$$\frac{L_I(t)}{\bar{L}(t)} = \frac{1}{1 + L_S(0) / L_I(0) \cdot e^{(g_I - g_S) \cdot (1 - \eta) \cdot t}} \quad (4b)$$

where  $\bar{L}$  stands for the total labour force. The elasticity of substitution  $\eta$  plays a key role in the deindustrialization. With  $\eta$  lower than unity, as the estimates confirm, the substitution between industrial goods and services is not large enough to compensate the decrease in the relative price resulting from higher productivity gains in the industry. Consequently, the share of industry in the labour force decreases towards zero because of productivity gains (in practice, because of the heterogeneity of industrial sectors, productivity in industry slows until it is balanced with productivity in services, and industrial employment eventually stabilizes). The pace of deindustrialization is slowed if the elasticity of substitution between goods and services is strong: with the fall in prices, demand for manufactured goods (in volume terms) increases all the more so as  $\eta$  is high; industrial employment declines at the pace  $(g_I - g_S) \cdot (1 - \eta)$ . With an elasticity of substitution of around 0.5, an annual increase of 1.5% in relative productivity entails an annual decline of 0.75% in relative employment.

Second, equations (2) and (3) imply:

$$\frac{p_I \cdot X_I}{p_S \cdot X_S} = \text{cte} \cdot \frac{X_I / A_I}{X_S / A_S} = \text{cte} \cdot \frac{L_I}{L_S} = \text{cte} \cdot (p_I / p_S)^{1 - \eta} \quad (5)$$

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Relative industrial employment moves in step with relative industrial value added (at current prices) and this corresponds to the stylized facts, as documented in Section 5.4.

Third, the economy's growth rate converges in the long term towards growth in the least buoyant sector, in other words services, i.e.  $g_S$ . Growth decelerates but from a high level of wealth: there is no other possible growth path.<sup>3</sup>

### 5.3.3. Wealth effect and the turning point

The main flaw in the model consists of the forecasts about relative value added in volume terms. For, according to equation (3), the fall in industry prices should lead to a continuous rise in relative industry output, and this does not seem to be borne out by the data, highlighting further a distortion in demand related to development (see Section 5.4). To introduce this wealth effect and building on RR, Engel's law could be extended to industrial goods. According to Engel's law, the relative consumption (in volume terms) of agricultural products decreases from a certain level of development. In other words, at constant relative price, the relative demand for industrial goods follow a hump shape as a function of the level of development. To take this effect into account, real GDP per capita at PPP,  $YCAP$ , is introduced in the relative demand equation:

$$\text{Log}(X_I / X_S) = \text{cte} - \eta \cdot \text{Log}(p_I / p_S) + a \cdot \text{Log}(YCAP) + b \cdot \text{Log}^2(YCAP) \quad (6a)$$

$$\text{Log}(p_I X_I / p_S X_S) = \text{cte} + (1 - \eta) \cdot \text{Log}(p_I / p_S) + a \cdot \text{Log}(YCAP) + b \cdot \text{Log}^2(YCAP) \quad (6b)$$

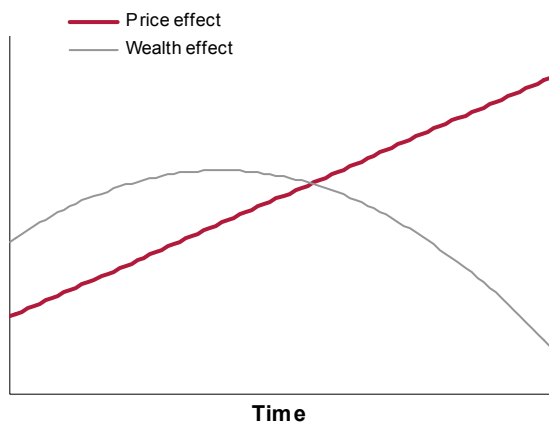
We expect to find that the relative value added of industry at constant prices increases until a certain level of per capita income, which we call the "turning point" following RR, before diminishing subsequently ( $a > 0$ ,  $b < 0$ ). Figures 5.1A and 5.1B illustrate the combined effects of decreasing relative price and economic development for value added at constant and current prices respectively, according to (6a-b).

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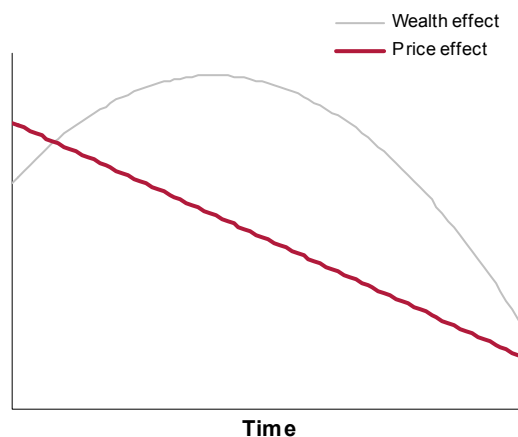
<sup>3</sup> Obviously, this is a restrictive framework because the reasoning is conducted at a fixed scope. In practice, because of innovation, new sectors are emerging, benefiting from both high productivity and sustained demand. Furthermore, international trade represents a leverage effect for the countries that manage to specialize in these vibrant sectors (and *vice versa* for the other).

At constant prices: before the turning point is reached, the share of industry in volume terms increases via the combination of the price effect (substitution) and the income effect. After the turning point, both effects oppose one another and the resultant is indeterminate. At current prices and for employment: before the turning point, the demand effect opposes the loss of industrial employment linked to productivity gains, but it loses intensity over time. From the turning point onwards, the two effects operate in the same direction and deindustrialization accelerates.

**Figure 5.1A: Price and wealth effects on relative output at constant prices**



**Figure 5.1B: Price and wealth effects on relative output at current prices and on employment**



#### 5.4. Data and descriptive statistics

The data is mainly taken from the OECD STAN Database. “Industry” is restricted to manufacturing industries (ISIC 15 to 37), and “Services” is its complement in the economy. The trends we study would have been very similar, were the scope broadened to include the whole industry (with or without construction). Trade variables are from the CHELEM-CEPII database. “Developed Countries” or “North” is composed of OECD countries except the CEECs, Turkey, South Korea and Mexico, whereas “Developing Countries” or “South” is the complement in total imports. Finally, real GDP per capita at purchasing power parity is in 1997 US dollar (source IMF).

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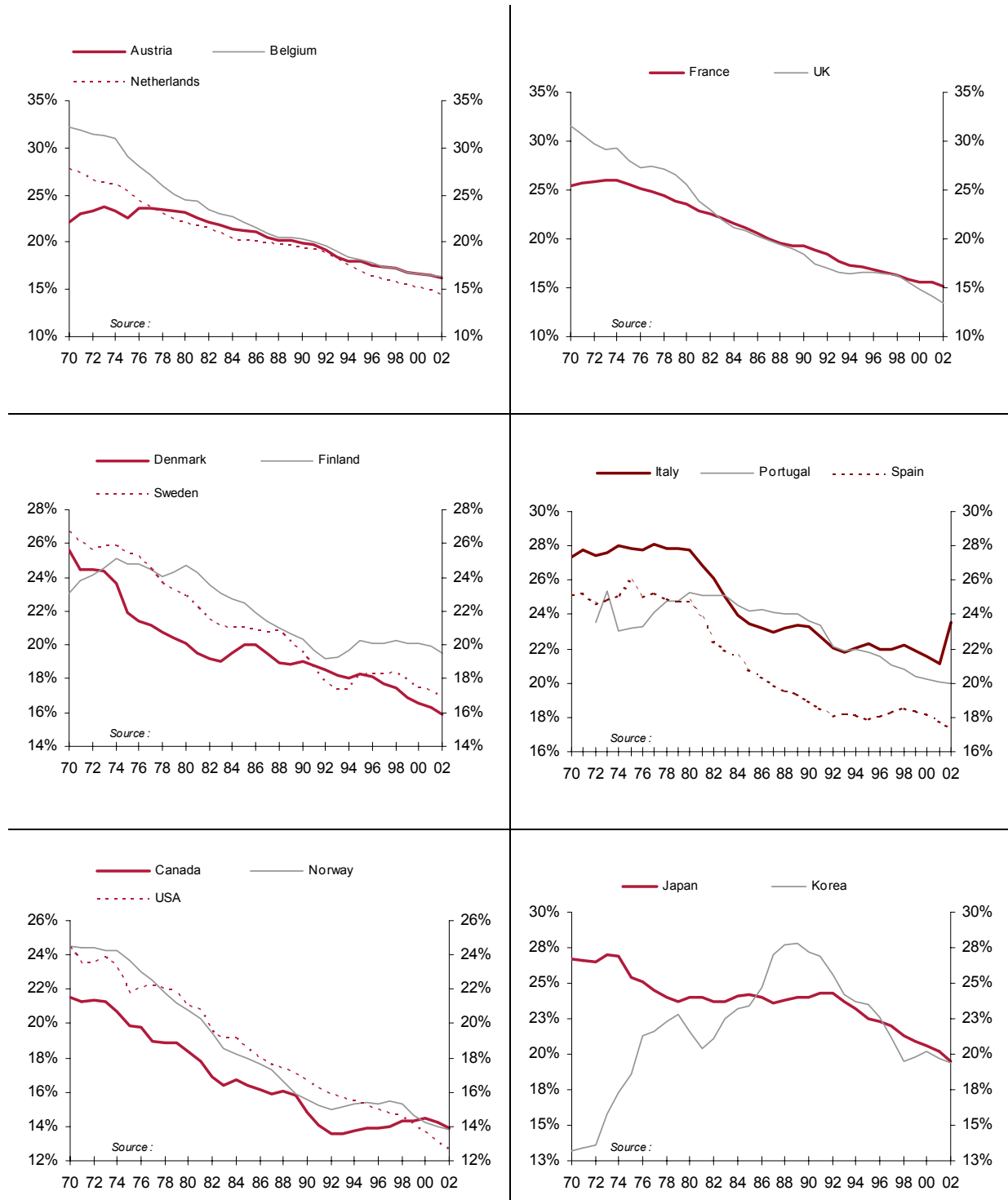
We are interested here in the change in manufacturing's share in total employment for the following countries between 1970 and 2002: Austria, Belgium, Canada, Denmark, Spain, United States, Finland, France, United Kingdom, Italy, Japan, South Korea, Netherlands, Norway, Portugal and Sweden. German data is not available for the whole period and thus this country is excluded from the sample.

### 5.4.1. The declining share of industry in total employment

Let us first look at the declining share of industry in employment in Europe (Figure 5.2). This decline is widely observed, with three exceptions: Spain, Finland and Sweden. In these countries, the decline was stopped by the early '90s. All in all, manufacturing occupies between 15% and 20% of the working force in the member states, compared with 30% on average in the early '60s.

A similar outcome has been observed in other developed economies. This is the case in Japan, the United States and Korea, since the early '90s for the latter. In Canada, the decline was stopped in the early '90s. Accordingly, the view that deindustrialization is a "natural" outcome in developed economies is at least partially confirmed: the phenomenon is recorded in various regions, for small as well as large countries, having reached the peak of their relative industrial employment at different periods, because of their different level of development. More interestingly, if one tries to date the phenomenon, we have very often to go back to the early '70s, or even to the '50s concerning the USA. In fact, six countries only (Finland, Italy, Japan, Korea, Portugal and Spain) have seen their manufacturing employment share peak between 1970 and 2002. Table 5.1 indicates that this peak was reached in a fairly narrow range of real GDP per capita (\$10,000-\$14,000) except for Portugal, where it occurred at an earlier stage of development. Hence, the very forces of globalization should not be interpreted, *prima facie*, as the engine of deindustrialization of our economies. On the contrary, we observe that certain countries have stabilized the share of industry in total employment in the recent period characterized by the acceleration of globalization.

Figure 5.2: Manufacturing Share in Employment, 1970-2002



Source: OECD, STAN

**Table 5.1: Peak of the Manufacturing Employment Share, 1970-2002**

|          | Year | Share (%) | GDP per capita (1997 PPP US dollar) |
|----------|------|-----------|-------------------------------------|
| Spain    | 1975 | 25.9      | 10,741                              |
| Finland  | 1974 | 25.1      | 13,008                              |
| Italy    | 1977 | 28.1      | 13,862                              |
| Japan    | 1973 | 27.0      | 13,120                              |
| Korea    | 1989 | 27.8      | 9,357                               |
| Portugal | 1973 | 25.4      | 7,591                               |
| Average  |      | 26.5      | 11,280                              |

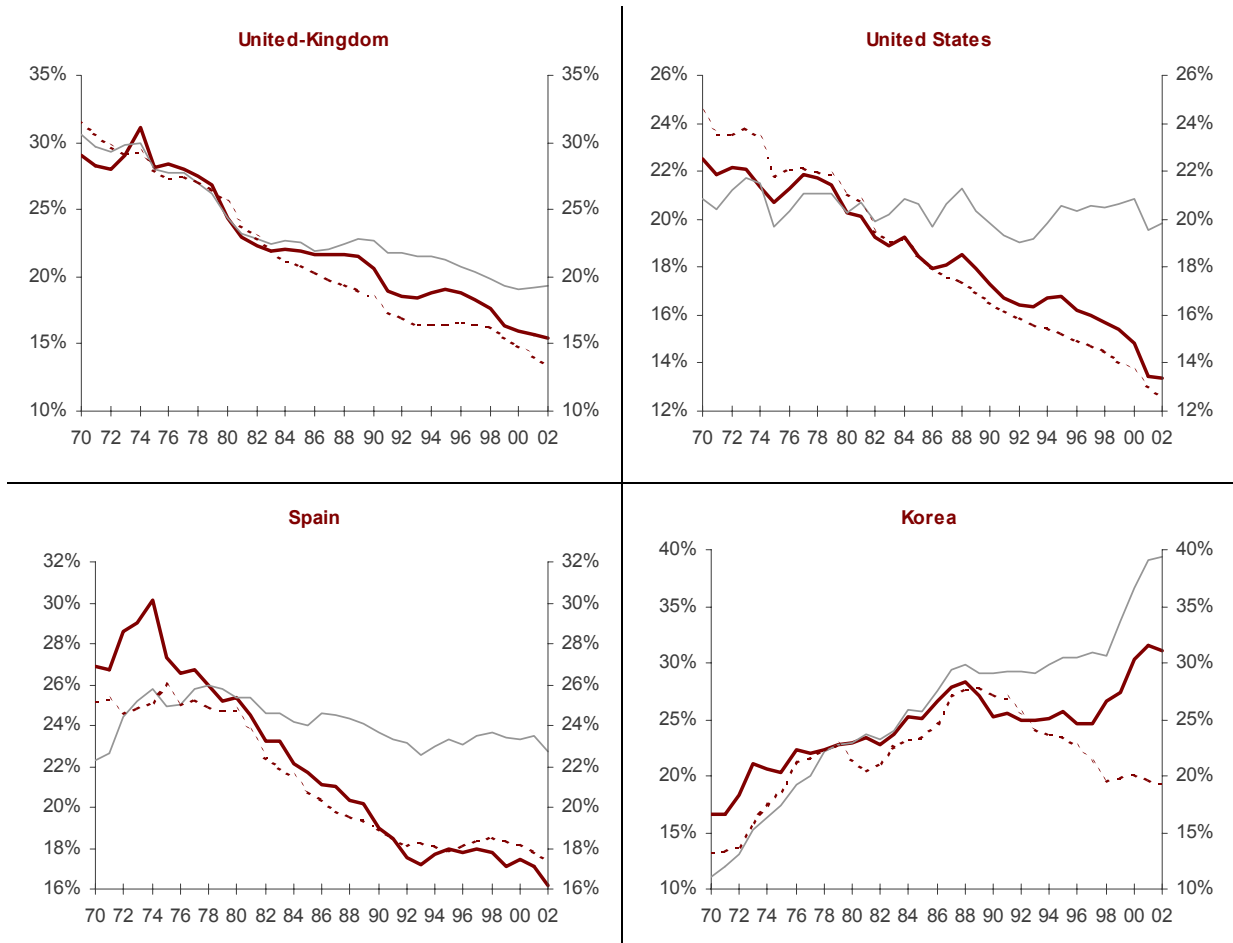
#### 5.4.2. The role of relative prices

In order to observe the relative value added of industry at constant prices, the changes in relative prices, central to the explanation of the phenomenon at stake, have to be discounted. This is done in Figure 5.3 for selected economies. The dotted line is the manufacturing share in total employment, the bold line the share of manufacturing in total value added (GDP) at current prices and the grey line this same share but at constant 1980 prices. We observe that employment is tightly link to value added at current prices, whereas the value added share at constant prices is rather stable. This confirms the mechanisms referred to above: larger productivity gains in the industry translate into a reduction in its share in total employment. But interestingly, when productivity gains are large, in the presence of increasing demand for manufactures, the share of industry in total output can increase (even at current prices), despite the decline of its share in total employment. Such outcome has been observed in Korea since the early 90s.

We plot in Figure 5.4 the manufacturing share in total employment for two periods: 1970-1986 and 1986-2002. With the exception of Korea in the first period (where this country was in the process of rapid convergence) and a negligible increase in Italy in the second period, the magnitude of the effect is, on average, a 4 percentage point change over each period (more precisely -4.4% of total employment in the first period and -3.9% in the second period). In percentage terms, the employment share lost on average 30% over the whole period, evenly spread over the two sub-periods when Korea is excluded. In total, one can hardly infer that deindustrialization has accelerated recently.

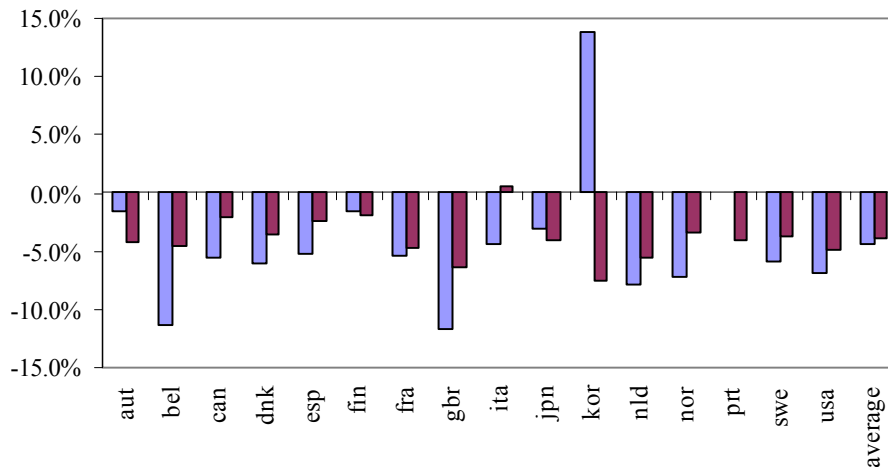


**Figure 5.3: Manufacturing Share in Employment, Value Added at Current and Constant Prices in Selected Countries, 1970-2002**



Legend: dotted line: manufacturing employment share; bold line: share of manufacturing value added at current prices; grey line: share of manufacturing value added at constant prices.

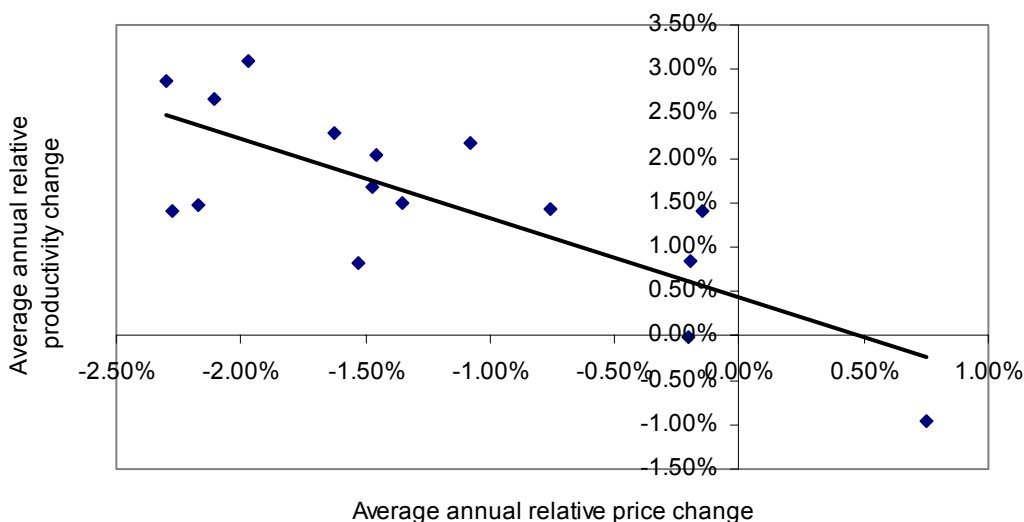
**Figure 5.4: Change in the Share of Manufacturing in Employment (in % of total employment), 1970-1986 and 1986-2002**



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On average, relative labour productivity of industry with respect to services increased at an annual pace of 1.6%, ranging from -0.9% for Norway to 3.1% for Belgium. These productivity gains triggered an average decrease in the relative price of 1.25% on average, ranging from +0.7% for Norway (the only country with an increase in the relative price) to -2.3% for Korea and Japan. Figure 5.5 illustrates the linear correlation of 76% between the two series (significant at 1%).

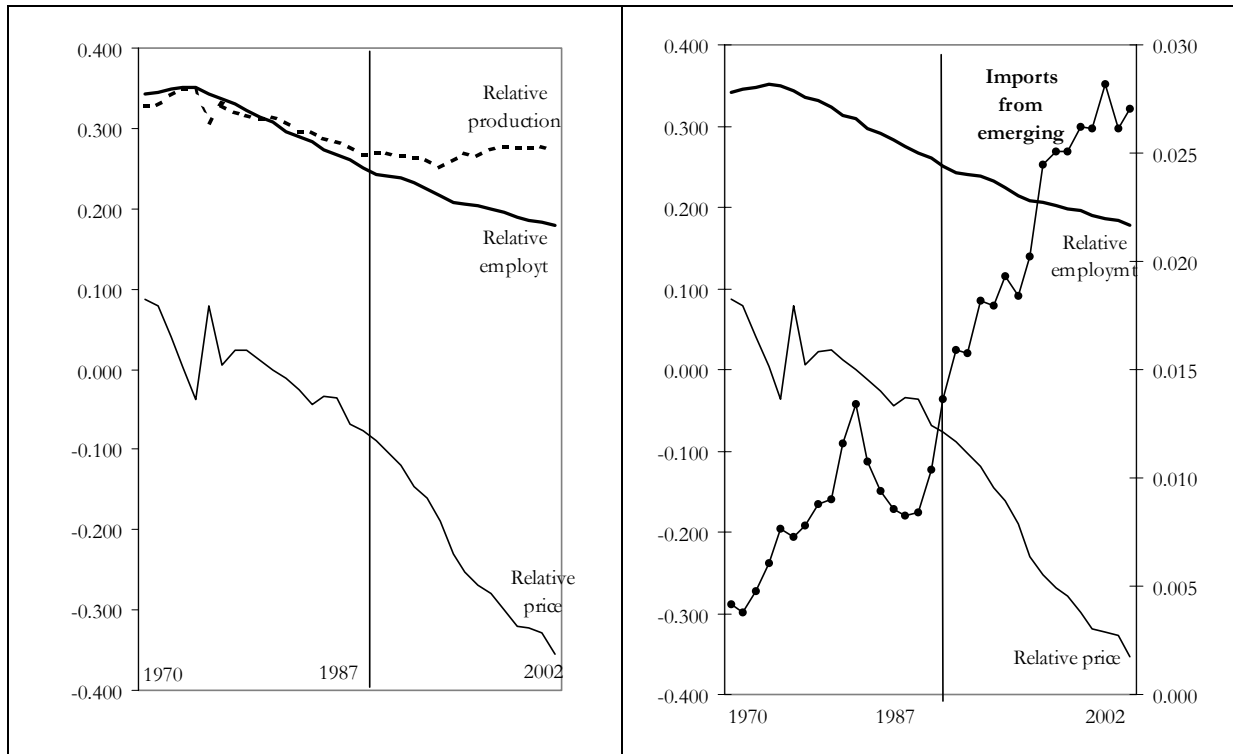
**Figure 5.5: Correlation between relative (industry vs services) price and labor productivity changes between 1970 and 2002**



Each diamond shape represents a country

Lastly, we have to take into account the potential impact of the competition from the South on those evolutions. The kind of mechanism referred to above is portrayed in Figure 5.6 in the case of France. As shown in the left hand panel, since the first oil shock France has been facing a combination of declining relative production and employment largely explained by the strong decline in relative prices: hence the suspect is definitively productivity gains. However, the right hand panel in which imports from emerging economies are plotted points to at least a coincidence of movements of relative prices and those imports. Accordingly, the decline in relative prices through the induced productivity gains might be at least partially explained by the competition from the South. The cross-country linear correlation coefficient between relative (industry vs services) productivity gains and the increase in manufacturing import ratios from developing countries between 1970 and 2002 is positive (56%) and significant at 3% level. In order to sort out these effects, an econometric exercise enables us to go beyond partial and bivariate evidence.

**Figure 5.6: Relative (Manufacturing vs Services) Employment, Production and Prices (left scale), and Imports from Developing Economies (share of GDP, right scale): France, 1970-2002**



## 5.5. Econometric specification and results

### 5.5.1. Econometric specification

The different mechanisms referred to in Section 5.3 can now be taken into account. Based on equation (6a), the determinants of the relative (industry vs services) output in volume, *RELOUTPUT*, should include the development level *YCAP* (income per capita) and the relative price, *RELPRICE*. Also as in RR and RC, insofar as capital investment increases the relative demand for manufactured products, fixed capital formation as a percentage of real GDP, *FIXCAP*, should also be included.<sup>4</sup> Finally, trade variables appear on the RHS.

$$RELOUTPUT = h(YCAP, YCAP^2, RELPRICE, TRADE, FIXCAP)$$

<sup>4</sup> The fixed capital formation series is real private fixed investment excluding stockbuilding from the OECD Economic Outlook.

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In addition, trade has an indirect impact, channelling through the relative price. The latter is supposed to depend also on exogenous relative TFP growth. To capture the total effect of trade, as relative employment is the difference between relative output and relative labour productivity (all these variables expressed in logarithm), the manufacturing share in total employment, *EMPSHARE*, is, in the reduced-form equation, of the following type:

$$EMPSHARE = f(YCAP, YCAP^2, TRADE, FIXCAP, \textit{exogenous TFP})$$

As for the impact of international trade in manufactured products, the effect of imports from developing countries should be taken into account separately. Indeed, and following Wood (1994), the labour content of trade expressed as a percentage of GDP is most likely larger if this given percentage comes from a developing country rather than a developed one. This comes from differences in both capital/labour intensity and labour costs. *IMPSOUTH* is defined as the imports from developing countries and *BALANCE* is the trade balance, both expressed as a share of GDP. As in RR, the role of trade balance is to capture the overall performance of manufacturing trade. Focusing on the 2000-2003 period for the US, Baily and Lawrence (2004) investigate the causes of the unusually weak employment recovery from the cyclical trough in 2001. They convincingly show that the main cause of the loss of manufacturing jobs during this period is the weak performance of exports, growing much less than output. The lagged effects of the strength of the US dollar explain the poor performance of manufacturing employment channelling mostly through feeble exports.

Note that the fall in prices of labour intensive products due to trade from developing countries does not have a negative effect on employment only. To the extent that it provides a stimulus to the economy, it might have an offsetting positive effect. Importantly, the specification given above captures the aggregated impact.

### 5.5.2. Results

Let us start with the relative output share (at constant prices). All estimates in Table 5.2 include country fixed effects and are in line with those of RR. In the first column, real income and relative price only are taken into account. At constant relative price, manufacturing share in real output starts by increasing and reaches its peak at around \$ 10,000 for the GDP per capita, which corresponds to the level of development reached by the most developed countries in the early '60s. Moreover, RR

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got an elasticity to the relative price of  $-0.59$ , similar to our  $-0.62$ . To the extent that this relative price is exogenous, this  $0.60$  parameter could be interpreted as the elasticity of substitution between manufactured products and services in the demand function, at constant income. Therefore, the OLS estimates are consistent with a fairly slow (relatively high elasticity of substitution) deindustrialization, being somehow accelerated by a wealth effect materialising some forty years ago for the most developed countries. However, ignoring supply effects means that this elasticity is biased downwards.

In the second column, we introduce imports from developing economies, overall trade balance and the ratio of capital formation over GDP. The “elasticity of substitution” is then estimated lower at  $0.49$ . The investment variable is significant and has the expected positive sign. In addition, the trade variables have some explanatory power and an increase in the trade balance of 1 point of GDP (which is roughly 5 points of manufacturing value added) is associated with an increase of  $1.8\%$  in the relative real value added. This applies for all trade except imports from the South, which do not appear to have any impact overall.

**Table 5.2: Dependent variable: Log (Relative Share of Manufacturing vs Services in Value Added at Constant Prices)**

|                        | OLS               | OLS               |
|------------------------|-------------------|-------------------|
| YCAP                   | 9.07<br>(0.40)    | 7.80<br>(0.51)    |
| YCAP <sup>2</sup>      | -0.491<br>(0.021) | -0.427<br>(0.027) |
| RELPRICE               | -0.619<br>(0.046) | -0.493<br>(0.044) |
| IMPSOUTH               |                   | 2.01<br>(0.83)    |
| BALANCE                |                   | 1.817<br>(0.2)    |
| FIXCAP                 |                   | 0.176<br>(0.036)  |
| country fixed effects  | yes               | yes               |
| turning point (\$ PPA) | 10 263            | 9 260             |

### Notes

YCAP is the log of real GDP per capita. *RELPRICE* is the log of the relative price of manufactures vs services. *IMPSOUTH* is the share of manufacture imports from developing countries in GDP, *BALANCE* is the manufacture trade balance and *FIXCAP* is log of fixed capital formation, both as a percentage of GDP.

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Importantly, in addition to endogeneity issues, OLS residuals suffer from auto-correlation and since the series is very likely persistent, a dynamic specification should be preferred. Therefore, estimates for the main focus of this chapter, the manufacturing employment share (defined as manufacturing over total employment), are presented now based on the GMM methodology for dynamic panels developed by Arellano and Bond (1991). In order to control for exogenous TFP, such a key determinant of deindustrialization, the reduced-form specification *must* include time-dummies. These dummies are specifically relevant to the extent that the productivity shocks, affecting industry relative to services, are common to developed countries. In contrast, RC's specification does not take into account these common shocks and implicitly assumes that the exogenous TFP is adequately accounted for by the income per capita, a strong assumption indeed. This obviously leads to confusion in the identification of the turning point in the wealth effect. To summarize, the specification being proposed here provides three improvements compared to RC's, taking good care of common technical change, persistence in the series and the endogeneity of trade variables. As shown below, these three ingredients prove to be supported by the empirics.

Results are presented in Table 5.3. For the sake of comparison, the first column reports the OLS estimates in the static specification case. Column 2 and 3 refer to the GMM estimates, using the second to fourth lags of the dependent and trade variables as instruments, for the partial adjustment model and a more complete dynamic specification respectively. The serial correlation and overidentification tests reject neither the specification nor the validity of the instruments. However, the significance of the lagged variable parameters and second-order serial correlation clearly support the more complete specification in column 3, our benchmark estimates. Moreover, column 4 presents the estimates using the third to fifth lag of the trade variables as instruments.

To get a more readable picture of the results, Table 5.4 gives the long-term sensitivities of the employment share to the explanatory variables.<sup>5</sup> The expected sign of the impacts of income per capita are recorded in all estimates. However, the turning point is somewhat lower than expected from Table 5.1.<sup>6</sup> The significant impact of investment does not resist the dynamic specification.

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<sup>5</sup> For example, the long-term sensitivity to imports from developing countries of -2.848 in column 3 is defined as the sum of 0.215 and -0.641 divided by 1 minus the sum of the lagged employment share parameters 1.009 and -0.159.

<sup>6</sup> Based on the cumulative impact of the two curves in Figure 5.1b, the employment share should peak *before* the turning point.

Table 5.3: Dependent variable: EMPSHARE = Log (Manufacturing Share in Total Employment)

|                                 | Level                | First-differences   | First-differences   | First-differences   |
|---------------------------------|----------------------|---------------------|---------------------|---------------------|
|                                 | OLS                  | GMM                 | GMM                 | GMM                 |
|                                 | (1)                  | (2)                 | (3)                 | (4)                 |
| Lag EMPSHARE                    |                      | 0.850***<br>(0.034) | 1.009***<br>(0.073) | 0.998***<br>(0.070) |
| Lag2 EMPSHARE                   |                      |                     | -0.159**<br>(0.069) | -0.148*<br>(0.07)   |
| YCAP                            | 4.521***<br>(0.420)  | 0.271<br>(0.580)    | 3.022<br>(2.678)    | 3.072<br>(2.757)    |
| Lag YCAP                        |                      |                     | -5.301**<br>(1.893) | -5.264**<br>(1.915) |
| Lag2 YCAP                       |                      |                     | 2.864**<br>(1.104)  | 2.831**<br>(1.058)  |
| YCAP <sup>2</sup>               | -0.23***<br>(0.024)  | -0.016<br>(0.033)   | -0.142<br>(0.135)   | -0.144<br>(0.140)   |
| Lag YCAP <sup>2</sup>           |                      |                     | 0.268**<br>(0.096)  | 0.265**<br>(0.097)  |
| Lag2 YCAP <sup>2</sup>          |                      |                     | -0.159**<br>(0.058) | -0.157**<br>(0.055) |
| IMPSOUTH                        | -1.847***<br>(0.600) | -0.403<br>(0.305)   | 0.215<br>(0.229)    | 0.375<br>(0.299)    |
| Lag IMPSOUTH                    |                      |                     | -0.641**<br>(0.263) | -0.658**<br>(0.297) |
| BALANCE                         | 0.983***<br>(0.129)  | 0.137*<br>(0.076)   | 0.242**<br>(0.102)  | 0.197*<br>(0.095)   |
| Lag BALANCE                     |                      |                     | -0.076<br>(0.081)   | -0.114<br>(0.088)   |
| FIXCAP                          | 0.058**<br>(0.024)   | 0.031<br>(0.019)    | 0.035<br>(0.027)    | 0.03<br>(0.026)     |
| Lag FIXCAP                      |                      |                     | -0.044<br>(0.027)   | -0.042<br>(0.026)   |
| country dummies                 | yes                  |                     |                     |                     |
| time dummies                    | yes                  | yes                 | yes                 | yes                 |
| First-order serial correlation  |                      | 0.017               | 0.003               | 0.004               |
| Second-order serial correlation |                      | 0.120               | 0.851               | 0.800               |
| Sargan-Hansen overid. test      |                      | 1.000               | 1.000               | 1.000               |

Notes

- (i) Variables are described in Table 5.2.
- (ii) GMM is the one-step Arellano-Bond estimator, using as instruments the second to fourth lags of the dependent variable in block diagonal form and the second to fourth lags of trade variables in columns 2 and 3, and the third to fifth lags of the trade variables in column 4.
- (iii) Asymptotic standard errors, between parentheses, are robust to heteroscedasticity and autocorrelation and computed from Roodman (2003). \*, \*\* and \*\*\* indicate significance at 90%, 95% and 99% confidence level, respectively.
- (iv) For the Sargan-Hansen test, the number reported is the confidence level at which the overidentifying restrictions can be rejected.
- (v) Serial correlation statistics are P-values for Arellano-Bond tests for first- and second-order correlation.

**Table 5.4: Long-term Sensitivities based on Table 5.3,  
Dependent variable: Log (Manufacturing Employment Share)**

|                              | Level  | First-differences | <b>First-differences</b> | First-differences |
|------------------------------|--------|-------------------|--------------------------|-------------------|
|                              | OLS    | GMM               | <b>GMM</b>               | GMM               |
|                              | (1)    | (2)               | <b>(3)</b>               | (4)               |
| YCAP                         | 4.521  | 1.808             | <b>3.926</b>             | 4.285             |
| YCAP <sup>2</sup>            | -0.229 | -0.104            | <b>-0.216</b>            | -0.237            |
| IMPSOUTH                     | -1.846 | -2.682            | <b>-2.848</b>            | -1.884            |
| BALANCE                      | 0.983  | 0.915             | <b>1.118</b>             | 0.559             |
| FIXCAP                       | 0.059  | 0.205             | <b>-0.058</b>            | -0.069            |
| turning point (1997 \$, PPP) | 19 202 | 6 220             | <b>8 690</b>             | 8 550             |
| Developing / Developed ratio | 2.9    | 3.9               | <b>3.5</b>               | 4.4               |

Let us now focus on the trade variables. As explained in the preceding section, the impact of trade might operate through both output (in volume, as shown in table 5.2) and relative productivity. From column 3, we infer that an increase of 1 point of GDP in imports from the South reduces the manufacturing employment share by 4.0% in the long term, whereas that number is only 1.1% if imports come from the North. This fairly high ratio of 3.5 gives an order of magnitude for the labour content of imports from the South relative to that from the North for a given dollar value.

We also tested whether the impact of imports from developing countries, as measured by the *IMPSOUTH* parameter, was more pronounced in the second half of the period (1986-2002), and did not find any significant difference between the two sub-periods.

### 5.5.3. How do these results compare with RC's?

RC limit their approach to the static specification, OLS and no time dummies. Table 5.5 presents the comparison with our results. In the first column, RC's estimates are reported and in the second, we replicate them using our data. All the estimated parameters are very close, with the exception of *IMPSOUTH*, which is significantly lower in our case.<sup>7</sup> In the third column, we replicate the second column taking the log of manufacturing employment share as the dependent variable to facilitate the

<sup>7</sup> The estimated standard deviation is 0.134 both in RC and here.



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comparison with the results presented above. Estimates in the second and third column are basically the same with a ratio of around 1 to 5 consistent with an average employment share of 0.20. Therefore, column (3) can be read as RC's results applied to our data and the log specification. We now introduce our preferred specification in two steps.

Firstly, time dummies are included in column (4), which is the only difference compared to (3) and leads to the results reported in the first column in Table 5.4. By taking into account the common exogenous technical change, there are three striking differences. The turning point due to the wealth effect can now be identified and is estimated at a (too?) high level of GDP per capita. The ratio of the impact due to imports from the South vs the North is significantly lower compared to the 6.9 ratio in RC. The investment variable plays a lesser role. All in all the comparison of columns (3) and (4) clearly indicates that the omission of the time dummies, which are jointly highly significant, leads to biased estimates.

Secondly, the dynamic specification and the endogeneity of the trade variables are taken into account, which leads to the results of the third column in table 4.4 reported in the last column of Table 4.5. By chance, the turning point now coincides with RC's but is clearly identified here as the turning point of the wealth effect and not that of "normal growth" as in RC, mixing relative productivity and demand effects. Moreover, based on the estimates reported in the last column, the elasticity of manufacturing employment to income varies in a range of (0.25, -0.50) when GDP per capita increases from \$5,000 to \$30,000. The South / North ratio is confirmed to be around half that of RC's estimates, implying a relative factor content of imports much lower than the 6.9 ratio from RC's.

Despite the differences stressed above, and perhaps more importantly, the overall contribution of trade with developing countries to deindustrialization, to which we turn to next, is very close between the two studies, as the *IMPSOUTH* parameters from columns (3) and (5) are very similar. It turns out that in this case the two sources of bias seem to offset each other. Therefore, the dynamic specification and the treatment of trade endogeneity, with the usual reservations due to the low power of the overidentification tests, reinforce the confidence one might have in these numbers.

**Table 5.5: Comparison with Rowthorn and Coutts (2004)**

| Dependent variable           | Employment share                             | Employment share | Log (employment share) | Log (employment share)         | Log (employment share)                |
|------------------------------|--|------------------|------------------------|--------------------------------|---------------------------------------|
|                              | Rowthorn and Coutts, their Table 1, column 2 | this data        | this data              | this data, Table 5.4, column 1 | <b>this data, Table 5.4, column 3</b> |
|                              | Static OLS (1)                               | Static OLS (2)   | Static OLS (3)         | Static OLS (4)                 | <b>Dynamic GMM (5)</b>                |
| YCAP                         | 1.531 <sup>a</sup>                           | 1.413            | 7.302                  | 4.521                          | <b>3.926</b>                          |
| YCAP <sup>2</sup>            | -0.084                                       | -0.078           | -0.402                 | -0.229                         | <b>-0.216</b>                         |
| IMPSOUTH                     | -0.944                                       | -0.509           | -2.827                 | -1.846                         | <b>-2.848</b>                         |
| BALANCE                      | 0.161  | 0.131            | 0.637                  | 0.983                          | <b>1.118</b>                          |
| FIXCAP                       | 0.044 <sup>b</sup>                           | 0.035            | 0.146                  | 0.059                          | <b>-0.058</b>                         |
| Country dummies              | yes  | yes              | yes                    | yes                            | <b>yes</b>                            |
| Time dummies                 | no   | no               | no                     | <b>yes</b>                     | <b>yes</b>                            |
| turning point (1997 \$, PPP) | 9 173  | 8 584            | 8 796                  | 19 364                         | <b>8 848</b>                          |
| Developing / Developed ratio | 6.9  | 4.9              | 5.4                    | 2.9                            | <b>3.5</b>                            |

a. The slight difference compared to RC reported estimates comes from the conversion of the base year for real income, which is 1995 in RC and 1997 here. The purpose is to make the numbers strictly comparable.

b. The difference with RC's reported estimate is here due to the investment variable which is specified in log in our case and in level in RC. The conversion is based on the average investment ratio of 0.18

#### 5.5.4. Contributions to deindustrialization

Based on our benchmark estimates in column 3 of table 5.4, Table 5.6 gives the changes in the manufacturing employment share induced by the changes in explanatory variables, as well as the total contribution of trade with developing economies. The contribution of trade with low wage economies would explain on average 20% of the observed decline in the manufacturing employment share. The magnitude of such an effect varies from 7% only in Sweden, notwithstanding the remarkable internationalisation of Swedish firms, to more than 33% in Italy, Austria and Finland, where it is to be remembered that the decrease in the employment share is much lower than the average – a higher percentage of a lower number. The contribution for Korea cannot be interpreted for obvious reasons.

Stated differently, trade with developing countries is associated with an average 1.9 point decrease in the employment share, varying from 0.7 point for Korea and Sweden to 4.3 points for the Netherlands. One could calculate what would be manufacturing employment in 2002 if the countries had

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maintained their trade ratios with developing countries at the 1970 level. For the USA, Japan and France, for example, this means that, given the total employment in 2002 of 134.3, 65.4 and 24.9 million respectively, one can assess that trade with developing countries has led to the displacement of around 3.3 million, 1.4 million and 350 000 manufacturing jobs respectively to be compensated, at least partly, by jobs in the service sector.<sup>8</sup>

**Table 5.6: Changes in the Manufacturing Employment Share Induced by the Changes in Explanatory Variables and Total Contribution of Trade with Developing Economies**

*GMM estimates from column 3 of table 5.4*

| Country  | Change in the employment share (% of total employment) | Investment | Income per capita | Manufact. trade balance with developed countries | Imports from developing countries | Exports to developing countries | Residuals + exogenous TFP | Contrib. of trade with developing countries (% of total change) |
|----------|--|------------|-------------------|--|-----------------------------------|---------------------------------|---------------------------|---|
| Italy    | -3.8   | 0.3        | -4.5              | 0.2  | -2.2                              | 0.8                             | 1.6                       | 36.8  |
| Austria  | -5.8   | -0.1       | -4                | 0.1  | -2.9                              | 0.8                             | 0.3                       | 36.2  |
| Finland  | -3.5   | 0.6        | -4                | 1.8  | -2.4                              | 1.2                             | -0.7                      | 34.3  |
| Netherl. | -13.4  | 0.3        | -4                | 0.4  | -4.7                              | 0.4                             | -5.8                      | 32.1  |
| Portugal | -3.5   | 0.1        | -0.9              | -0.2   | -1.1                              | 0                               | -1.4                      | 31.4  |
| Japan    | -7.1   | 0.1        | -4.7              | 0.3  | -2.9                              | 0.8                             | -0.7                      | 29.6  |
| Canada   | -7.6   | -0.3       | -3.9              | 0.4  | -2.1                              | 0                               | -1.7                      | 27.6  |
| USA      | -11.8  | -0.3       | -5                | -0.2   | -2.7                              | 0.2                             | -3.8                      | 21.2  |
| Belgium  | -15.9  | 0          | -4.6              | 1.3  | -4.6                              | 1.4                             | -9.4                      | 20.1  |
| Denmark  | -9.6   | -0.1       | -4                | 1.1  | -2.4                              | 0.5                             | -4.7                      | 19.8  |
| Spain    | -7.7   | 0          | -2.6              | -0.3   | -1.9                              | 0.4                             | -3.3                      | 19.5  |
| Norway   | -10.6  | 0.5        | -5.7              | -0.7   | -1.6                              | -0.1                            | -3                        | 16.0  |
| France   | -10.3  | 0          | -3.9              | 0  | -1.8                              | 0.4                             | -5                        | 13.6  |
| UK       | -18.1  | -0.2       | -4.3              | -0.6   | -2.2                              | 0                               | -10.8                     | 12.2  |
| Sweden   | -9.8   | 0.1        | -4.1              | 0.9  | -1.3                              | 0.6                             | -6                        | 7.1   |
| Korea    | 6.1  | -0.5       | 2.5               | 0.5  | -2.1                              | 1.4                             | 4.3                       | -11.5   |
| average  | -8.3   | 0.0        | -3.6              | 0.3  | -2.4                              | 0.5                             | -3.1                      | 19.8 <sup>a</sup>   |

**Note.**<sup>a</sup> The average contribution is a weighted average using the absolute change in the employment share as weight. The unweighted average is slightly less than two points higher. When Korea, the only country for which the employment share has increased over the period, is excluded, the weighted average contribution increases from 19.8% to 21.2%.

**Reading.** In France, imports (exports resp.) from (to) developing countries contributed to a decrease (increase) of 1.8 (0.4) points in the manufacturing share. Therefore, trade with developing countries contributes to a decrease of 1.4 points, i.e. 13.6% of the 10.3 points total decrease.

Interestingly, one can also calculate such a contribution for the two sub-periods we have defined, namely before and after 1986. Doing so, we can identify the expected acceleration of the

<sup>8</sup> In the USA for example, the changes in trade with developing countries between 1970 and 2002 is associated with a 2.5 point loss in the manufacturing employment share and  $2.5\% \times 134.6$  millions = 3.3 millions.

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phenomenon: it is simply twice as fast in the second sub-period, entirely due to the expansion of imports (and not to the sensitivity of deindustrialization to imports). Based on this econometric exercise, the following conclusions can be drawn:

- First, net trade with low wage countries is associated with a non-negligible decrease of around 2 points on average across countries in the manufacturing employment share between 1970 and 2002.
- Second, this represents, on average, only a fifth of the deindustrialization over the period, i.e. of the average drop of 8.3 points in the manufacturing employment share, despite the acceleration of the phenomenon during the second half of our period. However, this contribution varies a lot across countries, within a range of one to five.
- Third, not all trade flows with countries of offshoring are associated with offshoring: some “autonomous” trade flows take place just because emerging economies are specialising and trading with our rich economies. Accordingly, the average 20% contribution is a pessimistic view.

### 5.6. Conclusion

The decline in the share of industry in total employment, the so-called deindustrialization, currently seems to be accelerated by the forces of globalization. Civil society has come to fear a systematic relocation of manufacturing activities towards low wage economies. Such a process is being favoured by the ongoing international fragmentation of production, which makes combining the comparative advantages of the various locations available more appealing.

In order to address these fears, we tentatively measure the impact of trade with low wage countries on the observed deindustrialization in sixteen OECD economies. We use panel data covering the 1970-2002 period in order to estimate the respective contributions of income per capita, investment and net trade with low wage countries offering new appealing locations. We find that trade in goods with developing countries accounts for, at most, a third of deindustrialization in the case of certain countries, and only a fifth on average in our sample.

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In terms of economic policy, this diagnosis must be put into perspective, by emphasizing the importance of innovation and specialization in service sectors where demand is the most buoyant. The development of Information Technology will certainly contribute significantly to productivity increases in services, and thus could dampen or even reverse the fall in the share of industry. From this point of view, it seems crucial to define a policy aimed at increasing productivity in services, thereby allowing the economy to pull out from the dilemma entailed by the relative decline of industry caused by a *good* relative performance.

## Chapter 6

# Interactions between Capital Mobility, Trade Liberalization and Labor Market Deregulation<sup>1</sup>

### 6.1. Introduction

To date, the question of product-labor market interactions has mostly been viewed through the impact of competition on employment and wages. Blanchard (2006) summarizes that the empirical evidence about the role of institutions is mixed and sees the exploration of other interactions as a promising avenue for research. Recently, from an empirical investigation which addresses multi-collinearity issues that might be responsible for the lack of robustness in previous results, Nicoletti and Scarpetta (2005) conclude that employment gains from product market deregulation are likely to be higher in countries that have rigid labor markets.

Concurrently, recent works at the OECD highlight that product market (PM) and labor market (LM) deregulations are correlated across countries and that the former seems to precede the latter. This correlation is illustrated by Figure 6.1 taken from Brandt, Burniaux and Duval (2005): changes in PM

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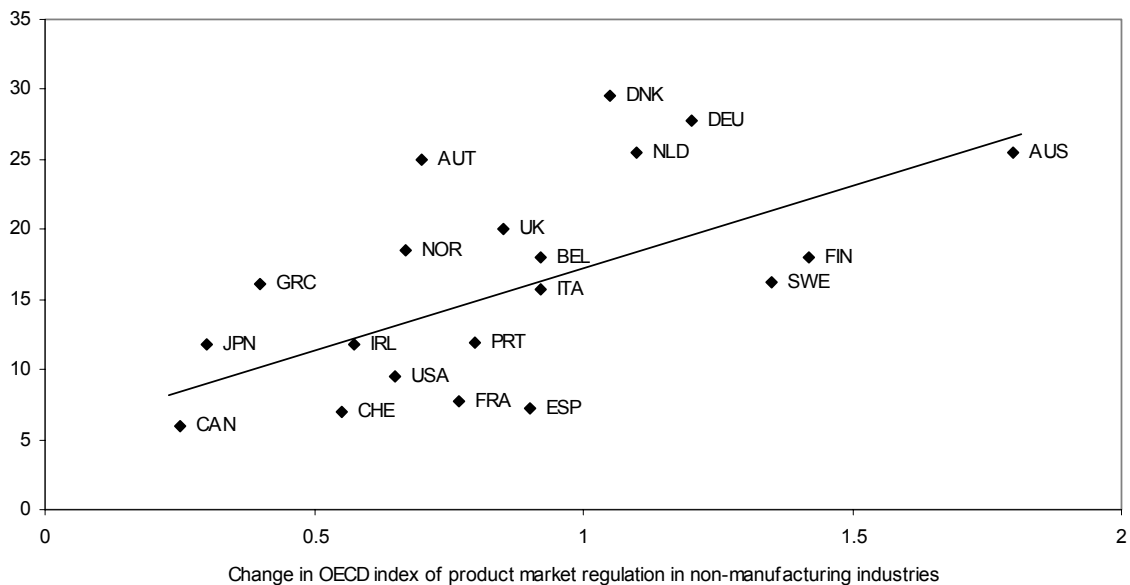
<sup>1</sup> This chapter is based on Boulhol, H., 2006, "Do Capital and Trade Liberalization Trigger Labor Market Deregulation", Cahiers de la MSE No 62.

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regulation over 1993-1998 are significantly correlated with the intensity of LM reforms recorded over 2000-2004. Said differently, “countries which have undertaken most labour market reforms recently are also those that had most deregulated their product markets beforehand” (Brandt et al., p.8). Moreover, IMF (2004) provides evidence that trade and financial market reforms have generally preceded domestic PM reforms. Even if an all encompassing liberal economic policy might seek to deregulate in both dimensions, which could explain this positive relationship, the sequence of events tells us more. The main purpose of this chapter is to shed light on mechanisms which could account for *this* interaction, from increased competition in the PM to deregulation in the LM.

**Figure 6.1: Changes in product market regulation over 1993-1998 and intensity of labour market reforms over 2000-2004**

Labour market reform intensity, per cent



Correlation coefficient: 0.51  
t-statistics 2.58\*\*

Source: Figure 34 in Brandt et al. (2005)

Empirical literature has well established that foreign competition can have a negative impact on wages by reducing rents in concentrated sectors (e.g. Borjas and Ramey, 1995). However, lower rents does not mean that the rent-sharing scheme between capital and labor has changed. Rodrik (1997) was probably the first to formalize the idea that import competition might weaken workers' bargaining power. The combination of capital mobility and cheaper trade can also weaken the bargaining position of

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workers through offshoring by limiting the availability of alternative jobs, a possibility which finds some support in Kramarz (2003) in the case of high-school graduates. Although most empirical analyses do point out that actual relocations affect a small number of workers, a recent poll in France indicates that thirty five percent of people surveyed consider that they, or someone closely related to them, face high risks of seeing their job delocalized. There is no doubt that high media coverage explains the extent of such fears, but this perception is factual and it is therefore easy to foresee how it could weaken the workers' bargaining position.

Blanchard and Giavazzi (2003), hereafter BG, is the most influential paper dealing with product-labor market interactions. In an elegant setting combining monopolistic competition and wage bargaining, BG study the dynamic impacts of PM and LM deregulations separately. A short sub-section analyzes the regulation interactions *per se* and the intuition that PM deregulation leads to LM deregulation in their model is the following: because rents are reduced, unions no longer fight as hard. However, this line of thought should apply to shareholders as well. Based on a similar model, Spector (2004) suggests that PM and LM deregulations tend to reinforce each other.

Going one step further, Ebell and Haefke (2006), endogenizing the bargaining regime, develop a theoretical model and show how intensified product market competition induces a shift from collective to individual bargaining. They suggest that the strong decline in coverage and unionization in the US and the UK might have been a direct consequence of PM reforms in the early 'eighties. Their study is the closest to the main focus of this chapter which contributes to formalizing the idea of Gaston and Nelson (2004) that globalization is transformative, i.e. that its effects do not sum up in its direct impacts on wages and employment but extends to *transforming the structures* of the labor market. On the empirical front, Bertrand (2004) shows that import competition exerts increased financial pressures on managers which alters the employment relationship in the USA, from one governed by implicit contracts into one governed by the market, and leads to increased wage flexibility. Dreher and Gaston (2005) find that globalization has contributed to deunionization in OECD countries, while Dumont, Rayp and Willemé (2006) and Chapter 4 provide evidence that international trade has weakened workers' bargaining power in Europe.



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The model proposed here brings four new contributions. It is a first attempt to introduce LM imperfections within an economic geography framework. Since the early 'nineties, while geography models have been widely used to analyze European integration, the distinct features and heterogeneity of European LM regulations have been discarded in this literature. The current chapter is a first step to bridge this gap. We do this in the easiest and most tractable geography model, the footloose capital model (FCM) developed by Martin and Rogers (1995) and further analyzed in Baldwin et al. (2003). Secondly, we take into account one aspect of globalization that does not appear in the papers discussed above, capital mobility, and therefore study the interactions between capital mobility, tradability and LM regulation. Thirdly, the level of LM regulation is endogenized, depending on the country's social preferences. Finally, new mechanisms through which opening the economy could put pressure on LM institutions are highlighted.

The intuition of the model is as follows. As detailed in OECD (2004, Chapter 2), employment protection has as a main objective to improve working conditions and the well-being of workers. It is generally believed however that this comes at a cost for employers and generates insiders/outside conflicts of interest. Employment protection therefore most likely raises labor costs and unemployment. Modelling LM regulation using a bargaining model inspired from McDonald and Solow (1985) enables us to include these general features. Rent-sharing is mainly about distributing rents and, as a high level of workers' bargaining power favors employed workers over capital owners, the institution in charge of LM regulation, referred to as "social partners" (SP) hereafter, might choose to regulate the LM based on the country's social preferences. This link between social preferences and LM institutions fits in well with Freeman's (2006) analysis, which stresses that the stylized differences between the two systems organizing the economy of the EU and the USA lie in the strength of collective bargaining and social dialogue versus market-driven worker-employer relationship respectively.

As workers capture some share of the rents, capital return is negatively affected. With capital mobility, in addition to the capital flows inherent in the FCM and which depend on the relative factor endowments, opening the economy to a country that has a fully deregulated LM (because of its own preferences) entails capital outflows. As domestic rents are transferred abroad, the positive effect of LM regulation on average real wages is reduced or even reversed, all the more so that trade costs are high and importing the "delocalized" good is costly. When trade costs fall, the agglomeration force and the

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costs of regulation in terms of geographical attractiveness gain in intensity. When they are low, even the slightest regulation deters firms from producing domestically whatever the differences in factor endowments and productivity levels between countries. LM institutions being endogenized, it is the *threat* of relocations which drives LM deregulation, neutralizing in turn the actual outflows of capital and relocations.

Therefore, capital mobility induces SP to deregulate. Falling trade costs puts additional pressure on LM institutions (at least between countries of similar population and development levels) and, with full trade liberalization, even the most pro-worker SP will optimally choose a fully deregulated LM. In terms of SP utility, opening the economy is found to be, most generally, beneficial. However, unless trade costs reach a low enough level, it has a detrimental effect if SP have a strong pro-worker inclination.

This way of formalizing LM regulation bears some resemblance to the tax competition models. One fundamental difference is that, in contrast to the tax competition literature, there is no public good to be financed by the tax receipts, which are the target of the tax competition. Here, the benefits of the regulation simply accrue to workers in the rent / unionized sector. Moreover, the link between regulation and social preferences highlights that the questions at stake are deeply rooted in the history of social relationships and collective choice. Another difference is that this “social competition” can arise between countries identical in terms of size and factor endowments. The remainder of the chapter is organized as follows. Section 6.2 integrates LM imperfections into the FCM and Section 6.3 focuses on the open economy. Section 6.4 describes the role of social preferences in optimal LM regulation and shows how capital mobility and trade liberalization induce changes in LM regulation. Finally, Section 6.5 concludes.

### **6.2. Model**

In this and the following sections, the level of labor market regulation is considered as given, whereas in Section 6.4, it is treated as endogenous and determined by social preferences.

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### 6.2.1. Footloose capital model with labor market regulation

The setting of the model is the FCM. The two factors are labor and capital, denoted  $L$  and  $K$ . The utility function of each individual is a Cobb-Douglas CES nest of the consumption of two goods:

$$V = \alpha^{-\alpha} \cdot (1-\alpha)^{-(1-\alpha)} \cdot C_R^\alpha \cdot C_A^{1-\alpha} \quad (1)$$

One sector produces a homogenous good using only labor under constant returns and perfect competition and is commonly called sector  $A$ . The rent sector  $R$  produces the Dixit-Stiglitz good composed of a mass  $n$  of differentiated products under monopolistic competition.

$$C_R = \left[ \int_0^n c(i)^{(\sigma-1)/\sigma} \cdot di \right]^{\sigma/(\sigma-1)}, \quad \sigma > 1 \quad (2)$$

One unit of capital is required to produce one variety  $i$  of the differentiated good. For each variety, labor is the only variable input and the unit labor cost is  $\beta$  times the wage. In this setting, entry is constrained by the capital endowments and the number of varieties  $n$  equals  $K$  in autarky. Good  $A$  is the numeraire and the unit choice is such that one unit of labor produces one unit of the good:

$$X_R = L_R / \beta \quad ; \quad X_A = L_A \quad ; \quad p_A = 1 \quad (3)$$

The only difference with the standard FCM lies in the decision by social partners to regulate the LM based on social preferences and the battle of wills. To reflect the idea that regulating the LM is essentially related to rent sharing, the level of employment protection is characterized by the bargaining power of workers,  $\gamma$ , as in BG. Although within this framework, the benefits of regulation are limited to pecuniary advantages, we mean it to encompass the conditions which make workers happier in their job more generally. For the firm producing the variety  $i$ , workers and shareholders bargain over wages and employment simultaneously. The Nash bargaining leads to the maximization of the product of the parties' surplus weighted by their bargaining strength, i.e. omitting the subscript  $i$  for variety:

$$[(w-z)l]^\gamma [p(x) \cdot x - w \cdot l]^{1-\gamma} \quad (4)$$

where  $z$  is the reservation wage. First order conditions on wages and employment lead to:

$$p = \mu \cdot \beta \cdot z \quad ; \quad w = [1 + \gamma \cdot (\mu - 1)]z \equiv \nu \cdot z \quad ; \quad \gamma \in [0, 1] \Leftrightarrow \nu \in [1, \mu] \quad (5)$$

where  $\mu = \sigma / (\sigma - 1)$ . Classically under efficient bargaining with a homothetic utility function, equation (5) states that the marginal revenue of labor is the reservation wage and clarifies that sector- $R$  workers receive a share  $\gamma$  of the total rent  $(\mu - 1)$ .

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The overall LM operates along the lines of McDonald and Solow (1985). Workers not employed in the rent sector could always occupy a lower paid job in the perfectly competitive sector and therefore, the reservation wage  $z$  equals the wage in sector  $A$  which is unity. The alternative is to be unemployed, total unemployment being denoted  $U$ . Indeed, being unemployed is supposed to give more time to search for a sector- $R$  job and therefore a better chance to obtain one. This creates a positive relationship between the “sectoral unemployment rate”  $u_R$  and the potential reward of obtaining a well paid job, i.e. the surplus enjoyed by manufacturing workers,  $\gamma \cdot (\mu - 1) \equiv \nu - 1$ . The reason is that, within this framework, a higher bargaining power raises the expected return from being unemployed relative to the return from working in sector  $A$ . The equilibrium unemployment rate is obtained when the expected utility of an unemployed person matches that of a sector  $A$  employed worker.

$$u_R \equiv U / (U + L_R) \quad , \quad u_R = f(\nu) \quad , \quad f' > 0 \quad , \quad f(1) = 0 \quad , \quad z = w_A = 1 \quad (6)$$

In order to understand this mechanism through a simple example, consider the Harris-Todaro case where a sector- $A$  worker gives up any opportunity to find a better paid job in the next period, whereas an unemployed person gets a probability  $q$ , negatively related to the “sectoral unemployment rate”  $u_R$ , to get a sector- $R$  job:  $q = q(u_R)$  ,  $q' < 0$ . If  $d$  denotes the exogenous unemployment benefits,  $h$  the exogenous probability to lose a high-paid job and  $r$  the discount rate, the steady state unemployment is given by Bellman’s equations which lead to the arbitrage condition:

$$q \cdot w + (h + r) \cdot d = (q + h + r) \cdot z \Leftrightarrow \nu - 1 = \frac{(h + r) \cdot (1 - d)}{q(u_R)} \quad , \quad \text{hence the positive relationship } f \quad .$$

As in BG, unemployment arises from the bargaining scheme. Moreover, following McDonald and Solow, the transitional unemployment differs from the standard notion of search unemployment. Indeed, at each moment, the unemployed do not decide between accepting and rejecting offers; they take the first manufacturing job available to them. Because some sectors are perfectly competitive and others not, regulation *de facto* generates segmented labor markets. Therefore, focusing on the function  $f$  is a short cut capturing the essential component of the LM regulation trade-off, at least as it is generally perceived. Indeed as Saint-Paul (2004) summarizes, “a rough consensus emerged that high unemployment in Europe was due to labor market rigidities” which “increase the equilibrium rate of unemployment by boosting the incumbent employee’s bargaining power in wage setting”. The more

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regulated the LM, i.e. the higher the bargaining power  $\gamma$ , the better off the rent-sector workers, the higher the unemployment rate.<sup>2</sup> Also, looking at the source of unemployment, i.e. the surplus  $\gamma \cdot (\mu - 1)$ , highlights the complementary role of PM and LM regulation. Despite the focus here not being on domestic PM deregulation, it is clear that within this setting, the more the PM is regulated (high  $\mu$ , low  $\sigma$ ), the greater the impact of LM deregulation on the unemployment rate, and vice versa.

### 6.2.2. Autarky

In addition to the trade-off discussed above, the regulation has a negative impact on the return to capital,  $\pi$ , because part of the rents are transferred to workers. Indeed, for each sector- $R$  firm:

$$\pi = p \cdot x - w \cdot l = (\mu - \nu) \cdot l = (\mu - 1) \cdot (1 - \gamma) \cdot l \Rightarrow \pi \cdot K = n \cdot \pi = (\mu - 1) \cdot (1 - \gamma) \cdot L_R \quad (7)$$

Total GDP is given by  $I = p \cdot X_R + X_A = \mu \cdot L_R + L_A$  and maximization of utility leads to:

$$L_A = (1 - \alpha) \cdot I \Rightarrow \alpha \cdot L_A = \mu \cdot (1 - \alpha) \cdot L_R \quad (8)$$

Because the relative price of the goods is not affected by the regulation, relative employment is not either, when capital is immobile. However in the open economy, efficient bargaining does not have a distributive effect only; it also has an allocative impact due to specialization. Denoting the country unemployment rate  $u$ , equation (8) and LM clearing give the sectoral employment levels:

$$L_R = \frac{\alpha \cdot (\sigma - 1)}{\sigma - \alpha} \cdot L \cdot (1 - u) \quad , \quad L_A = \frac{\sigma \cdot (1 - \alpha)}{\sigma - \alpha} \cdot L \cdot (1 - u) \quad (9)$$

The return on capital depends on the capital labor ratio  $\kappa \equiv K / L$  and is obtained using equation (7):

$$\pi = \frac{b}{\kappa \cdot (1 - b)} \cdot (1 - \gamma) \cdot (1 - u) \quad (10)$$

where  $b \equiv \alpha / \sigma$  is positively related to the share of the differentiated good sector in the economy and to the market power;  $b$  is a measure of the size of the rents in the economy. Importantly, as it will be the case throughout the chapter, the FCM is obtained in the special case of the totally deregulated LM, i.e. with  $\gamma = 0$  and therefore  $u = 0$ . LM regulation reduces capital return both directly, by transferring part of the rents to workers and indirectly, through the unemployment rate, by reducing the labor endowment available to the economy. Finally, to close the model, we need to derive the unemployment rate:

<sup>2</sup> Even though this is the general perception, the empirical support of the link between various measures of the strictness of Employment Protection Legislation and the unemployment rate had so far seriously lacked robustness (see Baker and al., 2005). However, Nicoletti and Scarpetta (2005) bring new evidence in support of this relationship.

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$$u = \frac{U}{L} = \left(1 - \frac{L_A}{L}\right) u_R = \left(1 - \frac{L_A}{L}\right) f(v) = \frac{\alpha \cdot (\sigma - 1) \cdot f(v)}{\sigma - \alpha - \sigma \cdot (1 - \alpha) \cdot f(v)} \quad (11)$$

This expression highlights that the country unemployment rate is the product of the “sectoral” unemployment rate and of the complement of the employment in sector A. This remains true with market opening and therefore, liberalization might wipe out unemployment as a result of specialization in sector A, should capital move abroad. However in autarky, the unemployment rate is positively related to the level of LM regulation unambiguously. Obviously, the lower the share of the rent / unionized sector in the economy,  $\alpha$ , the lower the impact of regulation overall and the lower the country unemployment rate.

### 6.3. Open economy

There are two countries, an asterisk referring to the foreign country. International trade in good A is costless, whereas trade costs for good R are iceberg.  $\tau$  denotes the trade costs for foreign products sold domestically and vice-versa for  $\tau^*$ . Labor is immobile and capital perfectly mobile between countries. Moreover, capital owners are assumed to consume in their home country only. Therefore in the FCM, capital is better thought of as physical capital. The two countries may differ in the factor endowments and productivity, the level of labor productivity in the foreign country being  $A^*$  times that in the domestic country:

$$X_R^* = A^* \cdot L_R^* / \beta \quad ; \quad X_A^* = A^* \cdot L_A^* \quad (12)$$

The effect of  $A^*$  simply amounts to a change in the foreign *effective* labor endowment which becomes  $A^* L^*$ . The general case enables us to consider situations in which trade is driven by differences in productivity, relative endowments, size and trade policy. In addition, the countries can differ in their social preferences; in particular, the foreign country is assumed to have preferences so that its LM is totally deregulated, but sub-section 6.4.4 considers strategic LM policy. This is reminiscent of Davis (1998) who studies the “America versus Europe dichotomy” in a general equilibrium Heckscher-Ohlin model. While Davis analyzes the impact of minimum wages, we focus on another aspect of LM imperfections and include the advances of the new economic geography. Moreover, this setting can also be thought of in the context of European countries different in terms of size, development level *and also* LM regulation.

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The movement of capital is fostered by two components. Firstly, in the absence of LM regulation, capital would flow according to the combination of the market access effect (agglomeration force) and the market crowding effect (dispersion force): in the FCM, the demand linkages are absent because income from capital is repatriated and therefore, agglomeration is not self-reinforcing. The resulting sign of these two forces in the standard FCM depends on the relative “size” of the countries, itself a function of the relative factor shares of capital and (effective, in the extension herein) labor, whereas the overall intensity depends on the level of trade costs. Secondly, due to regulation, as shareholders have to forsake part of the rents in the domestic country, the return on capital is lower *ceteris paribus* than in the foreign country. With capital mobility, this obviously tends to trigger an outflow of capital abroad. At equilibrium, the share of firms located in the domestic country,  $s_n$ , equalizes capital returns by combining these two components.

Two variables are essential for the characterization of the equilibrium: the location of firms represented by the share of firms producing in the domestic country,  $s_n$ , and the unemployment rate,  $u$ , in the domestic country, and Appendix 1 gives all the details. Equilibrium in good  $R$  leads to the expression of the capital return:

$$\pi = \frac{b}{\kappa^W \cdot (1-b)} \frac{(1-\gamma) \cdot (1-u \cdot s_L)}{1-\gamma + \gamma \cdot s_n} \quad (13)$$

where  $s_L = L / (L + A^* \cdot L^*)$  is the domestic *effective* labor share and  $\kappa^W = (K + K^*) / (L + A^* \cdot L^*)$  the world capital labor ratio. As in autarky, LM regulation in the domestic country reduces the world capital return through the two channels identified before. The impact of unemployment on the return of capital in the global market depends upon the domestic labor share, hence the  $u \cdot s_L$  term. As shown below, when the activity is fully agglomerated in the foreign country, equation (13) remains valid. In this situation, the source of unemployment, i.e. the presence of a rent sector, disappears from the home country and the capital return is equal to  $1 / \kappa^W \cdot b / (1-b)$  which is the FCM return.

We assume that the non-full-specialization condition (see Baldwin et al.), that is the condition which ensures that good  $A$  is produced in both countries, is respected. Here, this condition is  $b < (1-s_L) / (\sigma - s_L)$ . Denoting the free-ness of trade, i.e. the so-called phi-ness,  $\phi \equiv \tau^{1-\sigma}$  and taking

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equilibrium in sector  $A$  (or alternatively the balanced current account condition) into account lead to the first relationship between the share of firms and the unemployment rate in the home country:

$$s_n(\gamma, \phi) = \frac{s \cdot (1 - \phi \cdot \phi^*) - \phi \cdot (1 - \phi^*) - \gamma \cdot [\phi \cdot \phi^* + s \cdot (1 - \phi \cdot \phi^*)] - u \cdot s_L \cdot [(1 - \phi - \gamma) - b \cdot s_K^* \cdot (1 - \phi \cdot \phi^*) \cdot (1 - \gamma)]}{(1 - \phi) \cdot (1 - \phi^*) - \gamma \cdot [s \cdot (1 - \phi \cdot \phi^*) - \phi^* \cdot (1 - \phi) + b \cdot s_K^* \cdot (1 - \phi \cdot \phi^*)] - u \cdot s_L \cdot (1 - \phi - \gamma) \cdot (1 - \phi^*)} \quad (14)$$

where  $s \equiv b \cdot s_K + (1 - b) \cdot s_L$ , a weighting average of the factor shares, represents the relative “size” of the domestic country: in the standard FCM,  $s$  is the share of domestic GNP. Finally, LM equilibrium in the domestic country gives the second relationship:

$$\frac{u}{1/s_L - u} = \frac{b}{1 - b} \cdot (\sigma - 1) \cdot \frac{f(\nu)}{1 - f(\nu)} \cdot \frac{s_n}{1 - \gamma + \gamma \cdot s_n} = \frac{u^{\text{autarky}}(\gamma)}{1 - u^{\text{autarky}}(\gamma)} \cdot \frac{s_n}{1 - \gamma + \gamma \cdot s_n} \quad (15)$$

Equation (15) is easily interpreted. In the open economy, unemployment is driven by two channels. The first is the “sectoral unemployment” which directly leads to the autarky unemployment rate and to the first term on the RHS. The second channel is the number of sector- $R$  firms producing domestically, which leads to the second term. Therefore, full employment is reached either because the LM is deregulated ( $\gamma = 0 \Leftrightarrow \nu = 1$ ) which eliminates the primary cause or because the  $R$ -economy is aggregated in the foreign country ( $s_n = 0$ ). We can therefore expect the open economy unemployment rate to be hump shaped, as a function of the workers’ bargaining power. This is a result of the conflicting effects of the increase in the “sectoral” unemployment rate and of capital outflow, which triggers the decrease in the share of sector  $R$  in domestic production. The outcome, that unemployment tends to disappear when relocations expand, could at first seem strange. However, this follows very logically from two assumptions. First, the adjustment of labor in the path towards the open economy is neglected, as the equilibrium described here corresponds to the long run equilibrium. Second, it is a direct consequence of the LM model based on the trade-off between regulation and unemployment. Concretely, it implies that the unemployment which disappears with the shrinking of the rent / unionized sector is the part of total unemployment resulting specifically from the insider / outsider conflict. Given the levels of the trade costs and bargaining power, equations (14) and (15) define the location of firms and the equilibrium unemployment rate, leading to Proposition 1A.



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### Proposition 1A. Location of firms and unemployment rate in the open economy

- (i) Unilateral trade costs. Given the level of the bargaining power and of the foreign trade cost, if domestic trade costs are low enough, then all R-firms are agglomerated in the foreign country. Formally, the unilateral (U) “sustain point” (S) for the agglomeration in the foreign (F) country,  $\phi_S^{U,F}$ , is given by:

$$\phi_S^{U,F} \equiv \frac{s \cdot (1-\gamma)}{1-\phi^* \cdot (1-s) \cdot (1-\gamma)} < 1 \Leftrightarrow \gamma = g(\phi_S^{U,F}, \phi^*) \equiv 1 - \frac{\phi_S^{U,F}}{\phi_S^{U,F} \cdot \phi^* + s \cdot (1-\phi_S^{U,F} \cdot \phi^*)}$$

$$\phi \geq \phi_S^{U,F} \Rightarrow s_n = 0 \quad ; \quad \partial \phi_S^{U,F} / \partial s \geq 0 \quad , \quad \partial \phi_S^{U,F} / \partial \phi^* \geq 0 \quad , \quad \partial \phi_S^{U,F} / \partial \gamma \leq 0$$

The share of firms located in the domestic country is a decreasing function of both the workers' bargaining power and the domestic phi-ness of trade and an increasing function of

$$\text{the foreign phi-ness:} \quad \frac{\partial s_n}{\partial \gamma} \leq 0 \quad , \quad \frac{\partial s_n}{\partial \phi} \leq 0 \quad , \quad \frac{\partial s_n}{\partial \phi^*} \geq 0$$

- (ii) Bilateral trade costs:  $\phi = \phi^*$ . Given the level of the bargaining power, if trade costs are low enough, then all R-firms are agglomerated in the foreign country. Formally, the bilateral (B) “sustain point” (S) for the agglomeration in the foreign (F) country,  $\phi_S^{B,F}$  is such that:

$$\gamma = \tilde{g}(\phi_S^{B,F}) \equiv g(\phi_S^{B,F}, \phi_S^{B,F}) = 1 - \frac{\phi_S^{B,F}}{\phi_S^{B,F^2} + s \cdot (1-\phi_S^{B,F^2})} \Leftrightarrow \phi_S^{B,F} = \tilde{g}^{-1}(\gamma) < 1 \quad , \quad \tilde{g}' < 0$$

$$\phi \geq \phi_S^{B,F} \Rightarrow s_n = 0 \quad ; \quad \partial \phi_S^{B,F} / \partial s \geq 0 \quad , \quad \partial \phi_S^{B,F} / \partial \gamma \leq 0$$

The share of firms located in the domestic country is a decreasing function of the workers'

$$\text{bargaining power:} \quad \frac{\partial s_n}{\partial \gamma} \leq 0$$

- (iii) Unemployment. The domestic unemployment rate is hump-shaped in  $\gamma$ . At the foreign agglomerated equilibrium, the domestic country is, by definition, fully specialized in good A and the unemployment rate is zero:  $\phi \geq \phi_S^F \Rightarrow u = 0$

The proof follows directly from equations (14) and (15) and is given in Appendix 1. From (15) we infer that, at the level of trade costs where the firms are agglomerated in the foreign country, the unemployment rate is zero. Based on the numerator of (14), it follows necessarily that this level is defined by  $\gamma = g(\phi, \phi^*)$  which characterizes the sustain point. Naturally, this sustain point is an

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increasing function of the size of the domestic country: the larger the domestic country the lower the domestic trade costs necessary to make the agglomeration in the foreign country sustainable. It is interesting to consider the case where the relative capital share  $s_K$  is equal to the relative effective labor share  $s_L$  and therefore to the “size”  $s$ . This situation is very natural since the steady state in a typical growth model is such that capital is proportional to effective labor. Between countries of comparable population levels, ignoring the effect of LM regulation, relocations tend to take place from *the poor to the rich* country. This is because the differences in labor costs totally reflect the differences in productivity and therefore, the level of development becomes the main determinant of the size of the market and of the location of firms. Of course, in the general case where countries have different population levels the two components of effective labor, productivity ( $A$ ) and population ( $L$ ), matter.

The fact that the share of domestic firms is an increasing function of  $\phi^*$  is due to the better attractiveness of being located in the domestic country when it is cheap to serve the foreign market. The opposite applies for the relation with  $\phi$ . *In the bilateral case* ( $\phi = \phi^*$ ), these two effects oppose each other and the relative size of the countries becomes crucial.

$$\phi \leq \phi_s^{B,F} \Leftrightarrow \gamma \leq \psi \Rightarrow s_n \approx \frac{\psi - \gamma}{\chi - \gamma \cdot \psi} \approx \frac{\psi - \gamma}{\chi} \quad (16)$$

with  $\psi \equiv \tilde{g}(\phi) \in [0, 1]$ ,  $\tilde{g}' < 0$  and  $\chi \equiv \frac{(1-\phi)^2}{\phi^2 + s \cdot (1-\phi^2)}$  (if  $s = 1/2$  then  $\chi = 2 \cdot \psi$ )

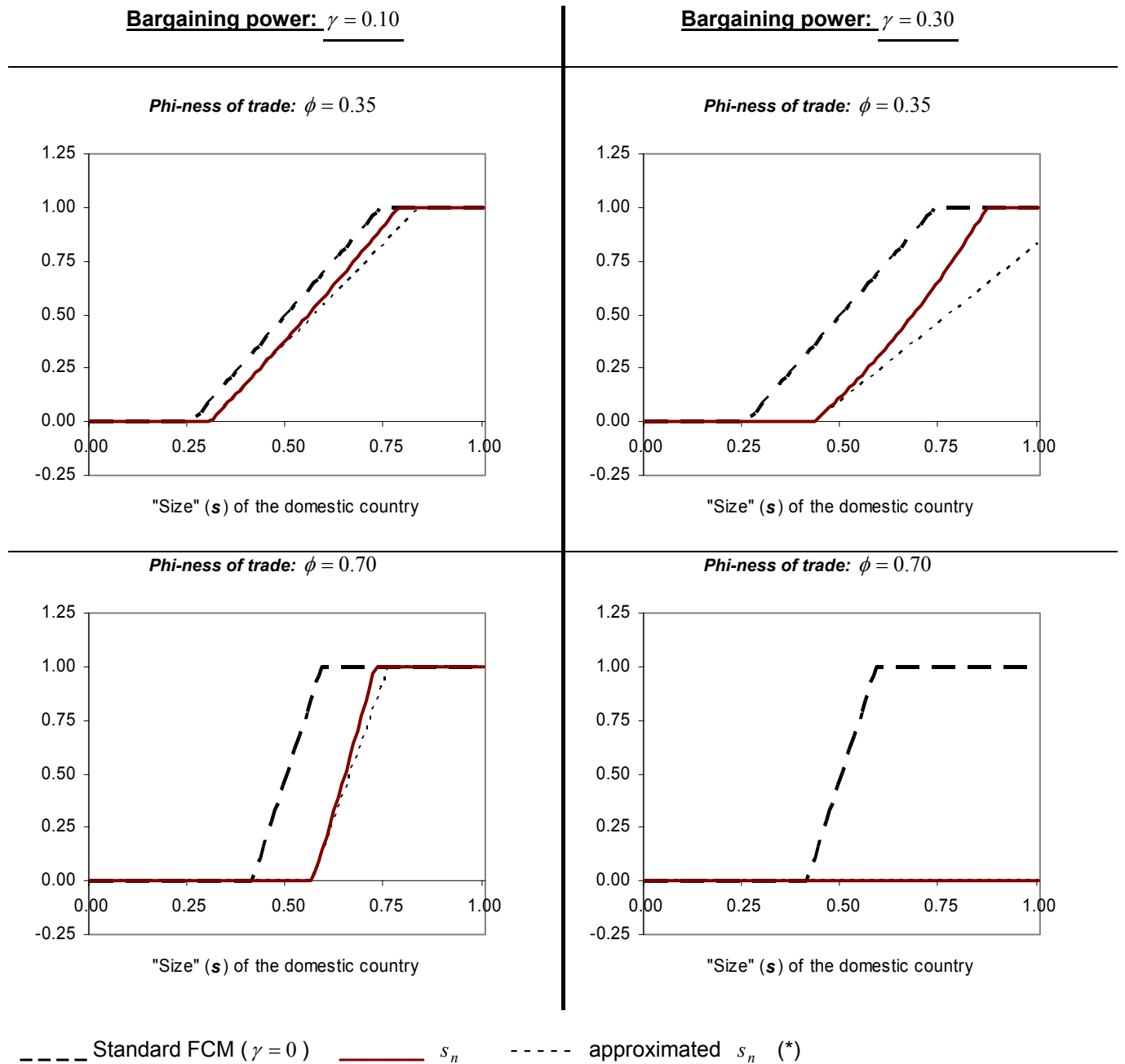
From equation (16), it is straightforward to derive the scissors diagram (Figure 6.2), which illustrates how the location of firms depends on the size,  $s$ , when  $\phi$  and  $\gamma$  are given.

$$s_n = \frac{\psi - \gamma}{\chi} \Leftrightarrow s_n = \frac{1}{2} + \frac{1+\phi}{1-\phi} \cdot \left( s - \frac{1}{2} \right) - \gamma \cdot \frac{\phi^2 + s \cdot (1-\phi^2)}{(1-\phi)^2} \quad (17)$$

Compared to the FCM, there is an extra term, the last one on the RHS, which depends on the level of LM regulation. This term shifts the diagram to the right. As in the FCM, the larger country tends to appropriate more capital and the home market effect increases with the phi-ness of trade. Importantly, the additional negative effect due to regulation dominates when trade costs are low:

$$\frac{\partial s_n}{\partial \phi} = \frac{2}{(1-\phi)^2} \cdot \left( s - \frac{1}{2} \right) - \frac{2 \cdot \gamma}{(1-\phi)^3} \cdot [\phi + s \cdot (1-\phi)] \quad (18)$$

**Figure 6.2: Scissors Diagram**  
**Share of the sector R domestic firms**  
**as a function of the relative size  $s$  of the domestic country**



**Note.**

The simulation for  $s_n$  is based on the specific function  $f(v) = \delta \cdot (v - 1)$  (see Section 6.4). However, the impact of the parameter  $\delta$  is insignificant such that the expression given by equation (16)  $s_n \approx (\psi - \gamma) / (\chi - \gamma \cdot \psi)$  cannot be distinguished from the true value. The curve labelled "approximated  $s_n$ " comes from one further approximation:  $s_n \approx (\psi - \gamma) / \chi$  and proves to be close to the true value. With  $s_n \approx (\psi - \gamma) / (\chi - \gamma \cdot \psi)$ , equation (17) becomes:

$$s_n = \frac{\psi - \gamma}{\chi - \gamma \cdot \psi} \Leftrightarrow s_n = \frac{1}{2} + \frac{1}{1 - \gamma \cdot \frac{s \cdot (1 + \phi) - \phi}{1 - \phi}} \left[ \frac{1 + \phi}{1 - \phi} \left( s - \frac{1}{2} \right) - \gamma \cdot \left( \frac{\phi^2 + s \cdot (1 - \phi^2) + \phi}{2 \cdot (1 - \phi)^2} \right) \right]$$

which demonstrates that the slope is steeper than the one resulting from the approximation.

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Indeed, an inspection of the power in the denominators makes it clear that when trade costs are low, the LM regulation effect dominates *whatever the size of the domestic country that respects the non-full specialization condition*. This is because when the goods market becomes more integrated, the location of firms is less relevant and therefore, only the negative impact of regulation on capital return matters for firm's location decision:  $\lim_{\phi \rightarrow 1} \tilde{g}(\phi) = 0 \Rightarrow \forall \gamma \neq 0, \lim_{\phi \rightarrow 1} s_n = 0$ .

Appendix 1 shows that the unemployment rate is given by:

$$\phi \leq \phi_S^{B,F} \Leftrightarrow \gamma \leq \psi \Rightarrow u \approx \frac{(\psi - \gamma)}{\chi \cdot (1 - \gamma)} \cdot \frac{u^{autarky}(\gamma)}{s_L} \quad (19)$$

The unemployment rate is exactly zero when the LM is fully deregulated or when the phi-ness of trade exceeds the sustain point. Based on equation (15), the sensitivity of the unemployment rate to trade costs has the same sign as that of the share of domestic firms. Figure 6.3a illustrates this pattern for different levels of trade costs *in the symmetric country case* ( $s_K = s_L = s = 1/2$ ). When trade costs fall, as more firms locate abroad (equation 17 with  $s = 1/2$ ), the domestic country specializes in good A, and the unemployment rate decreases. Figures 6.3b and 6.3c illustrate how the domestic share of firms and the world capital return react to the workers' bargaining power for various levels of trade costs. The difference in capital returns between the two countries drives the location of firms and the equilibrium location is the one which equalizes these returns. When this is not possible (domestic bargaining power too high, i.e.  $\gamma \geq \psi$ ), the agglomeration in the foreign country is the only equilibrium. Moreover, in autarky the greater the bargaining power, the lower the domestic return on capital. It therefore requires more firms to move to make the returns converge. In addition, as trade costs fall it is easier to serve the domestic market from abroad, which renders the location in the foreign country even more appealing. As it is clear from Figure 6.3c, with market opening, nominal capital return, i.e. capital return relative to sector-A wages, increases in the domestic country. Thus, at constant bargaining power, as inter-sector relative wages are constant, market opening benefits capital owners relative to wage earners in the regulating country.

Figure 6.3: Symmetric Countries in terms of Size and Trade Costs:  $s = 1/2$  ,  $\tau = \tau^*$

Fig. 6.3a: Unemployment Rate in the Domestic Country

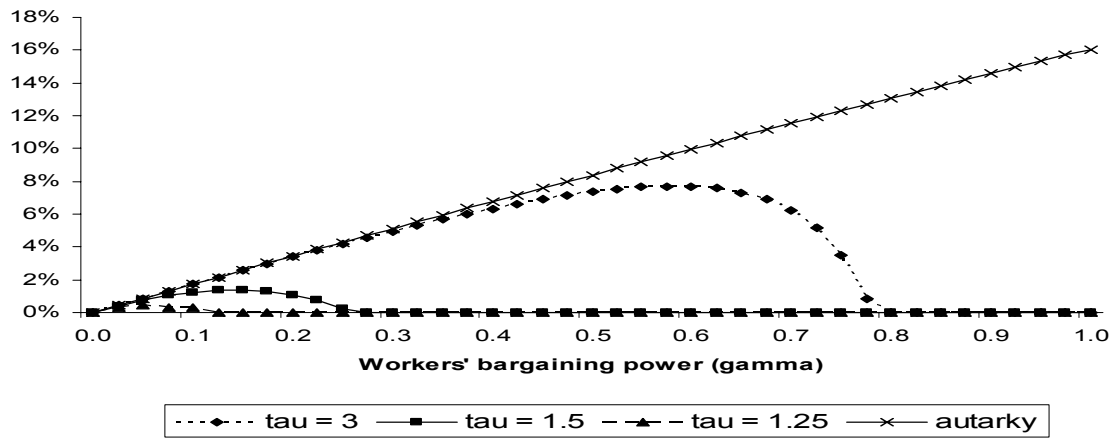


Fig. 6.3b: Share of Domestic Firms in Sector R

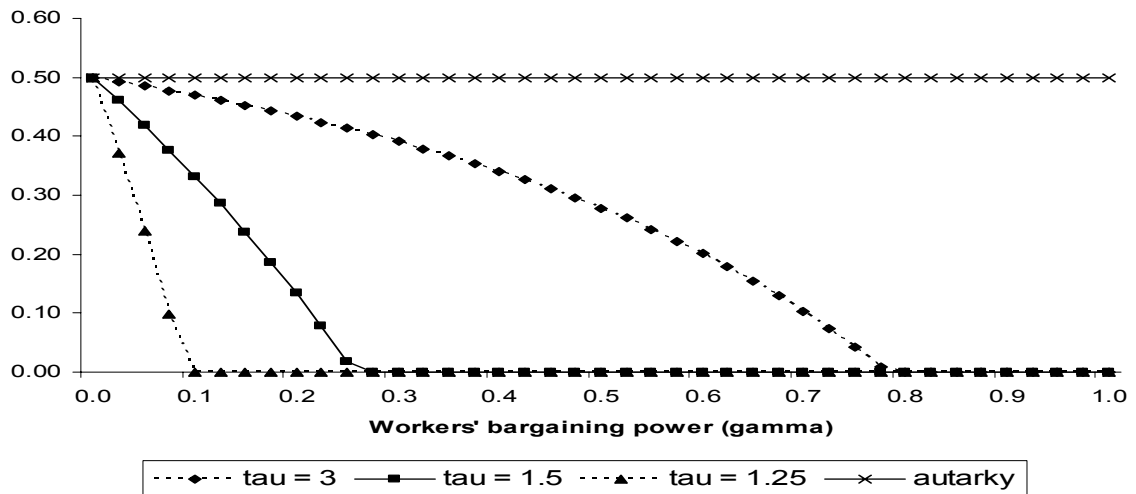
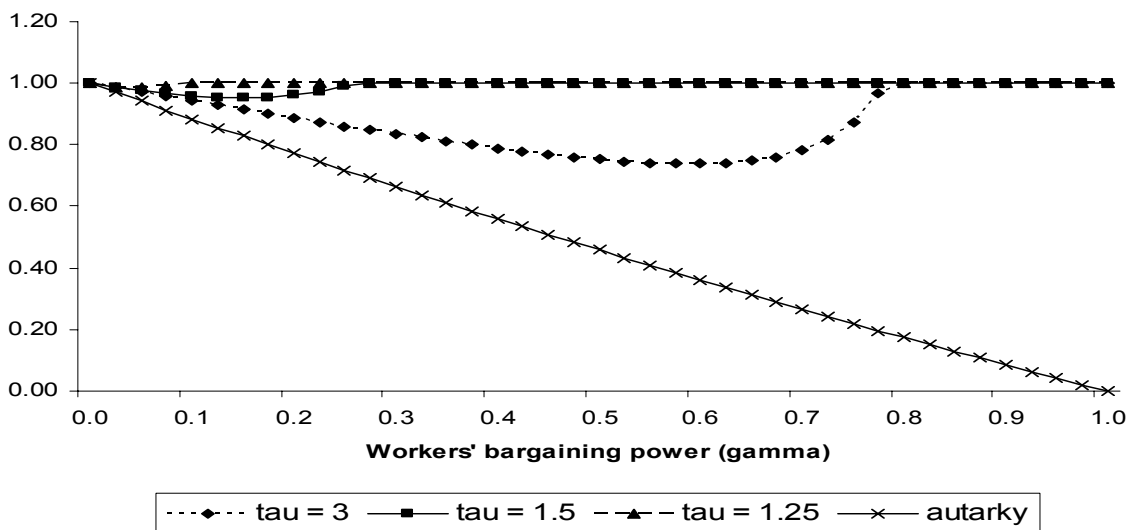


Fig. 6.3c: Capital Return (foreign autarky return = 1)



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Up to now, the model has been analyzed by assuming a given bargaining power and assessing the impact of varying trade costs. However, it is clear that all the results can be interpreted by holding the phi-ness of trade constant and studying the impact of varying the regulation level. In particular, this enables an easier characterization of the agglomerated equilibrium in the domestic country, which has been left aside. In this spirit and as a transition to the following section, Proposition 1A can be interpreted from the point of view of the “social partners” who choose the level of LM regulation.

### Proposition 1B. Minimum and maximum levels of labor market regulation

- (i) Agglomeration in the foreign country. Given the level of trade costs, there exists a maximum level of the workers' bargaining power beyond which all firms move abroad:

$$\exists \gamma_{\max} = \psi = \max [g(\phi, \phi^*), 0] = \max \left[ 1 - \frac{\phi}{\phi \phi^* + s \cdot (1 - \phi \phi^*)}, 0 \right] \leq 1 \quad \text{such that } \gamma \geq \gamma_{\max} \Rightarrow s_n = 0$$

This maximum level of the bargaining power is a decreasing (increasing) function of the domestic (foreign) phi-ness. In the bilateral case, it is decreasing with the phi-ness.

$$\gamma_{\max}(\phi = 0, \phi^*) = 1, \quad \gamma_{\max}(\phi = 1, \phi^*) = 0, \quad \partial \gamma_{\max} / \partial \phi \leq 0, \quad \partial \gamma_{\max} / \partial \phi^* \geq 0, \quad d \gamma_{\max}(\phi = \phi^*) / d \phi \leq 0$$

- (ii) Agglomeration in the domestic country. Given the level of trade costs, if the domestic country is large enough, there exists a minimum level of the workers' bargaining power under which all firms operate in the domestic country.

$$s \geq \frac{1 - \phi^*}{1 - \phi \phi^*} \Rightarrow \exists \gamma_{\min} \approx \frac{1 - \phi \phi^*}{\phi^*} \cdot \left( s - \frac{1 - \phi^*}{1 - \phi \phi^*} \right) \geq 0 \quad \text{such that } \gamma \leq \gamma_{\min} \Rightarrow s_n = 1$$

This minimum level of the bargaining power is a decreasing (increasing) function of the domestic (foreign) phi-ness. In the bilateral case, it is hump shaped in the phi-ness.

$$\gamma_{\min}(\phi = 1, \phi^*) = 0, \quad \gamma_{\min}(\phi, \phi^* = 0) = 0, \quad \partial \gamma_{\min} / \partial \phi \leq 0, \quad \partial \gamma_{\min} / \partial \phi^* \geq 0$$

$$\text{If } s < 1/2 \text{ then } \phi = \phi^* \Rightarrow \gamma_{\min} = 0$$

$$a) \phi < (1-s)/s \Rightarrow \gamma_{\min} = 0$$

$$\text{If } s > 1/2 \text{ then } \phi = \phi^* \Rightarrow b) (1-s)/s < \phi < ((1-s)/s)^{1/2} \Rightarrow d \gamma_{\min} / d \phi \geq 0$$

$$c) ((1-s)/s)^{1/2} < \phi \Rightarrow d \gamma_{\min} / d \phi \leq 0$$

Figure 6.4 illustrates the preceding results. For each chart, Proposition 1A can be read horizontally for a given bargaining power, whereas Proposition 1B is read vertically for a given level of trade cost.

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The bilateral case is explained as follows. When trade costs are prohibitive no agglomeration is possible. When the goods market is fully integrated, the least level of regulation triggers the agglomeration in the foreign country. At intermediate levels, the agglomeration rents are the strongest (see Baldwin et al., Chapter 15) and, if large enough, the domestic country can attract capital and support some level of regulation. The hump-shape of  $\gamma_{\min}$  when the domestic country is large enough is related to the well-identified hump-shape of the agglomeration rents in the tax competition models. However, no matter how large, if the regulation level exceeds a certain threshold, then all firms go abroad. We are now in a position to study the impact of market liberalization on LM regulation.

**Figure 6.4: Agglomeration and Sustain Points**

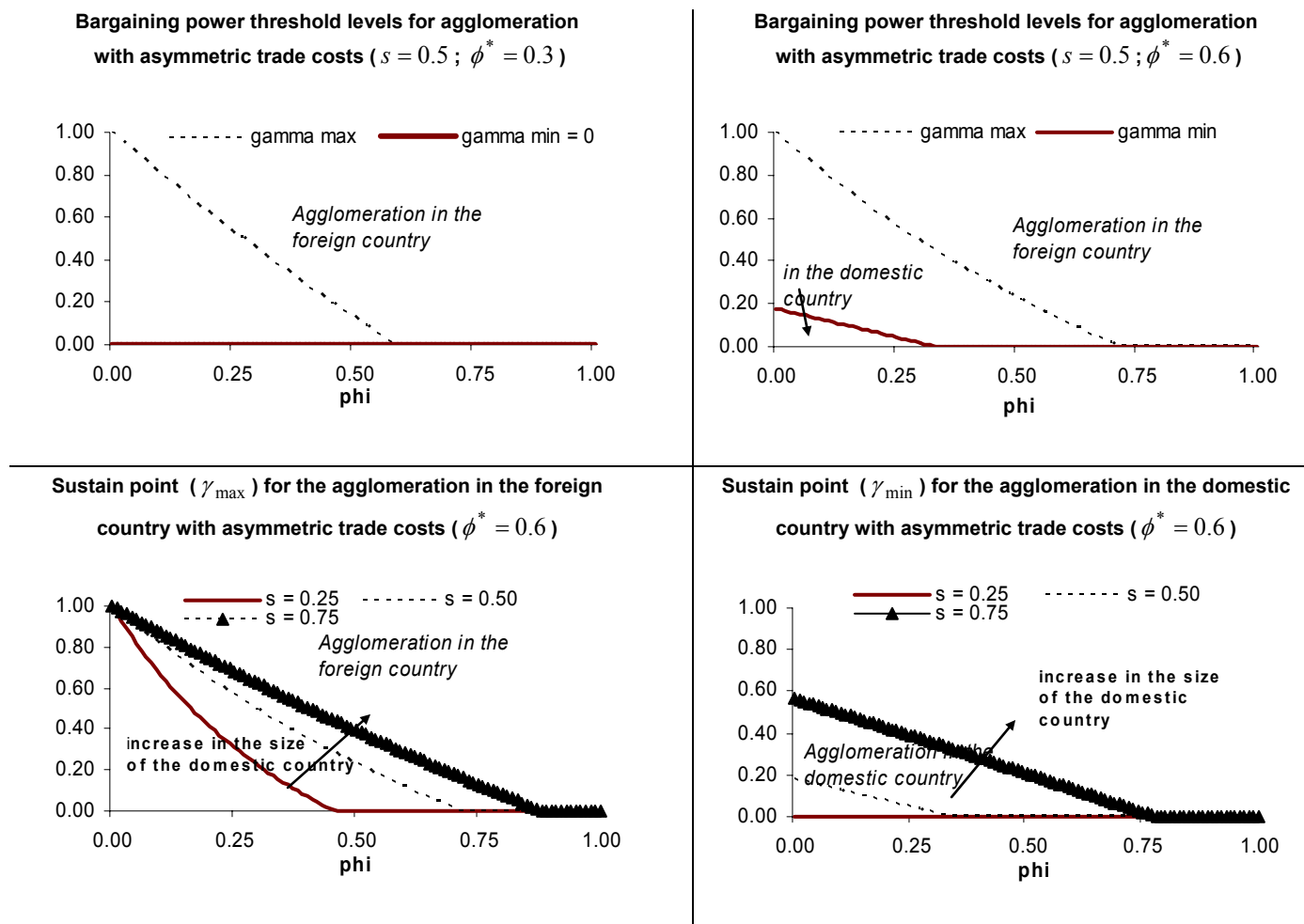
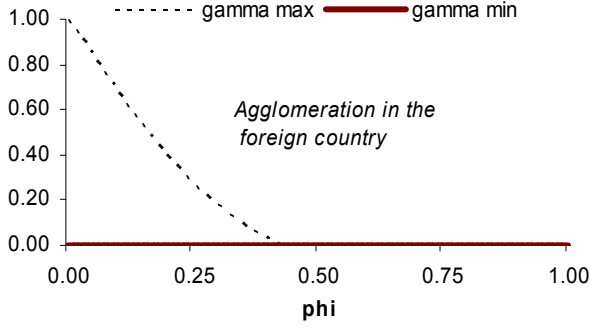
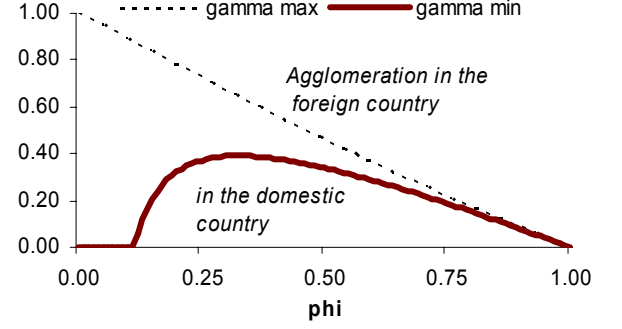


Figure 6.4: Agglomeration and Sustain Points (*continued*)

Sustain points  $(\gamma_{\min}, \gamma_{\max})$  with symmetric trade costs  
 $(\phi = \phi^*)$  when the domestic country is "small" ( $s = 0.3$ )



Sustain points  $(\gamma_{\min}, \gamma_{\max})$  with symmetric trade costs  
 $(\phi = \phi^*)$  when the domestic country is "large" ( $s = 0.9$ )



## 6.4. Endogenous labor market regulation

### 6.4.1. Autarky

In our model, the regulation of the LM clearly has a negative impact on real GDP. Indeed, the price index in autarky,  $G = p^\alpha / K^{\alpha/(\sigma-1)} = (\mu.\beta.K^{1/(1-\sigma)})^\alpha$ , does not change with the level of regulation and given equation (9), real GDP is:

$$(I/G)^{autarky} = (\mu.\beta.K^{1/(1-\sigma)})^{-\alpha} . (\mu.L_R + L_A) = \frac{K^{\alpha/(\sigma-1)}}{\mu^\alpha . \beta^\alpha} . \frac{L.(1-u)}{1-b} \quad (20)$$

The higher the unemployment rate, the lower the GDP. Consequently, a utilitarian government would choose to totally deregulate the LM. However, we consider the case where the social partners (SP) have an objective different from the maximization of the GDP depending on the extent of their pro-labor (vs pro-capital) orientation, represented by parameter  $\lambda$ . Specifically, it is assumed that they may put less weight on capital income, the greater the parameter  $\lambda$ .

$$OBJ_\lambda = \frac{w_A.L_A + w_R.L_R + (1-\lambda).\pi.K}{G} \quad , \quad \lambda \in [0, 1] \quad (21)$$

When  $\lambda = 0$ , SP are indifferent to the distribution of revenue and the objective function boils down to the real GDP. In the other extreme when  $\lambda = 1$ , SP only cares about labor income. As argued by Saint-Paul, LM regulation is mainly about distributing rents and we focus here on this distinct aspect of regulation. Furthermore, Saint-Paul demonstrates that this type of regulation is inefficient in the



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sense that a government with the same objective would primarily choose to redistribute through taxation and hence avoid the detrimental effect of unemployment. However, there are different reasons why it is interesting to analyze the consequences of LM regulation. Firstly, SP are mostly thought of as a mixed representation of union and employer organizations. Tax instruments are beyond their reach. Secondly, Saint-Paul shows how such a regulation might emerge as a result of the strength of various lobbies or even of the coalition between insiders and capital owners to the expense of outsiders. Thirdly, we intend to keep away from issues related to capital taxation *per se*.

Although the orientation of the SP,  $\lambda$ , or social preferences could come from a political process, we consider that it is idiosyncratic to a particular country and determined by such deep causes as the history of social relations, the battle of wills between various lobbies, the political orientation or the structure of shareholding – for instance, a country where the culture of stockholding is deeply rooted or where pension funds play an important role is likely to have a low  $\lambda$ . For all these reasons, trying to model the social preferences parameter explicitly based on such country's characteristics as factor endowments is likely to prove both overly ambitious and unsatisfactory: countries may differ in their social preferences which shape different institutions. What explains the differences in so-called social models, between the USA and continental Europe, between the various LM institutions in the E.U.?

Appendix 2 shows that in autarky:

$$OBJ_{\lambda} = cte.(1-u).[1 - \lambda.b.(1-\gamma)] \quad (22)$$

Equation (22) makes it clear that regulation has two effects on SP utility: a negative one through unemployment which reduces GDP and a positive redistributive effect, the term between brackets. This term is all the greater for a given bargaining power, when the size of the rents is higher ( $b$ ) and when the SP are the more pro-labor ( $\lambda$ ). Differentiating (22) leads to:

$$\frac{dOBJ_{\lambda}}{d\gamma} \geq 0 \Leftrightarrow \gamma \leq 1 - \frac{1}{b.\lambda} + \frac{1-u}{du/d\gamma} \quad (23)$$

When the expression on the RHS is positive, SP utility increases until the bargaining power hits the value of the RHS term, from which it then decreases: this value is therefore the optimal regulation level from the point of view of SP. Two points are worth noting. When the pro-labor orientation  $\lambda$  is small enough, the RHS of the inequality is negative and the SP opt for deregulation. Secondly, the

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higher the sensitivity of the unemployment rate to the regulation,  $du/d\gamma$ , the lower the RHS, and therefore the lower the optimal level of the bargaining power.

In order to move further, we have to specify a functional form  $f$  respecting (6) and to remain as general as possible, we choose  $f$  depending on a parameter  $\delta$  which measures how sensitive the unemployment rate is to the regulation level. Appendix 2 gives the full derivation, the exact function being chosen to facilitate the calculations:

$$u_R = f(\gamma) \approx \delta \cdot (\nu - 1) = \delta / (\sigma - 1) \cdot \gamma \quad (24a)$$

This function fits the Harris-Todaro case sketched out in sub-section 6.2.1 almost perfectly with

$\delta = \frac{h}{h+r} \cdot \frac{1}{1-d}$ .<sup>3</sup> As one might expect in that case,  $\delta$  is an increasing function of the probability to

lose a job,  $h$ , and of the unemployment benefits,  $d$ . Given this functional form, the autarky unemployment rate is:

$$u = 1 - \exp\left(-\frac{b}{1-b} \cdot \delta \cdot \gamma\right) \approx \frac{b}{1-b} \cdot \delta \cdot \gamma \quad (24b)$$

increasing with  $b$ ,  $\delta$  and  $\gamma$  unambiguously. Proposition 2 indicates the optimal regulation level.

### Proposition 2. Optimal labor market regulation in autarky

*The optimal level of regulation  $\hat{\gamma}(\lambda)$  is an increasing function of the social preferences parameter  $\lambda$  :*

- (i) *If  $\delta$  is greater than 1, then SP will choose a totally deregulated market whatever their preferences:  $\delta \geq 1 \Rightarrow \hat{\gamma}(\lambda) = 0 \quad \forall \lambda$*
- (ii) *If  $\delta$  is lower than 1, then any country with pro-labor orientation lower than  $\lambda_{\min}$  (given below) chooses to deregulate totally, whereas SP with a stronger pro-labor inclination decides to regulate according to  $\hat{\gamma}(\lambda) > 0$ . In particular, if  $\delta$  is lower than  $(1-b)$ , any government such that  $\lambda \geq \lambda_{\max}$  (given below) chooses to transfer all the rents to workers. Formally,*

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<sup>3</sup> Details are available upon requests.

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$$\delta \leq 1 \Rightarrow a) \quad \lambda \leq \lambda_{\min} = \delta / (1 - b + \delta b) \quad \Rightarrow \quad \hat{\gamma}(\lambda) = 0$$

$$b) \quad \lambda \geq \lambda_{\max} = \min(\delta / (1 - b), 1) \quad \Rightarrow \quad \hat{\gamma}(\lambda) = 1$$

$$c) \quad \lambda_{\min} \leq \lambda \leq \lambda_{\max} \quad \Rightarrow \quad \hat{\gamma}(\lambda) = \frac{1-b}{b} \cdot \left( \frac{1}{\delta} - 1 \right) - \frac{1}{b} \cdot \left( \frac{1}{\lambda} - 1 \right)$$

(Proof is directly derived from equation 23 and is given in Appendix 2)

The optimal LM regulation level is positively related to the pro-labor inclination,  $\lambda$ , and negatively related to the sensitivity of unemployment,  $\delta$ . The first part of the proposition states that if the unemployment rate is too responsive to regulation ( $\delta \geq 1$ ), then even the SP most inclined to favor workers will choose to fully deregulate. However, if this is not the case, the redistributive effect dominates when the social preferences are such that  $\lambda \geq \lambda_{\min}$ . The SP then decide to regulate all the more, the greater the parameter  $\lambda$ . To give an intuition of a relevant order of magnitude for  $\delta$ , consider the maximum “sectoral” unemployment rate achieved when all rents go to workers,  $u_R^{\max} = u_R(\gamma = 1) \approx \delta / (\sigma - 1)$ . Note that the case  $\delta \geq 1$  looks fairly extreme for reasonable values of  $\sigma$  since it means that  $u_R^{\max} \geq 1 / (\sigma - 1)$ .<sup>4</sup> Let us now turn to the open economy.

### 6.4.2. Pressure to deregulate the labor market in the open economy

Based on their respective preferences, the domestic country is assumed to have a regulated LM in autarky in contrast to the foreign country.<sup>5</sup> Proposition 1B states that if the regulation in the domestic country is too favourable to workers all firms move abroad. When trade costs are prohibitive, there always remain some firms in the domestic country (except in the limit case where all rents go to workers). However, when trade costs fall, this bargaining power ceiling diminishes towards zero. With free trade, all firms move to the foreign country, except if the domestic LM is completely deregulated, in which case the FCM equilibrium is reached. In addition, regulating the LM beyond  $\gamma_{\max}$  has no additional effect on the economy as the rent sector has disappeared.

<sup>4</sup> The range for the empirical estimates of  $\sigma$  is quite large. Based on price-cost margins analyzes, they should not be far from a [5, 8] range. However, these analyses almost always assume perfect LM. Because what is measured is in fact the share of the rents kept by firms, taking into account workers’ bargaining power leads to a lower range. For instance with  $\gamma = 0.3$ , the range above becomes [3.8, 5.9] - for example,  $3.8 = 1 + (1 - 0.3) \cdot (5 - 1)$  - implying  $u_R^{\max}$  between 20% and 36% for  $\delta = 1$ .

<sup>5</sup> This means that  $\delta < 1$  and  $\lambda^* < \lambda_{\min} < \lambda$ .

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However, is it that damaging if all sector- $R$  firms move to the foreign country? After all, within this framework, capital owners spend domestically. The answer depends on what the reference point is. If the comparison is with autarky, the answer is: it depends on how costly importing good  $R$  is. If the question is between alternative choices of LM policy in the open economy, then total relocation hurts unambiguously. Indeed, let us compute the general price index. Since LM regulation does not affect relative prices, the price index is standard and negatively related to the share of domestic firms:

$$G^{open} = (\mu \cdot \beta \cdot K W^{1/(1-\sigma)})^\alpha \cdot [s_n + \phi \cdot (1 - s_n)]^{\alpha/(1-\sigma)} = G^{autarky} \cdot \left[ \frac{s_K}{s_n + \phi \cdot (1 - s_n)} \right]^{\alpha/(\sigma-1)} \quad (25)$$

In other words, except if trade is costless, an increase in LM regulation entails an increase in the price index due to firm relocations abroad (because  $\partial s_n / \partial \gamma < 0$  and  $\partial G^{open} / \partial s_n < 0$ ). Very importantly, when comparing the equilibrium corresponding to the fully deregulated LM ( $\gamma = 0$ , FCM) with the agglomerated outcome in the foreign country ( $\gamma \geq \gamma_{max}$ ), one notices that wages are identical, equal to 1, unemployment is zero in both cases and nominal capital returns are equal (see equation 13). However, because the price index is lower in the first case, welfare and the utility of the SP are both greater. What is remarkable about this result is that it holds whatever the social preferences:

$$\begin{aligned} \forall \lambda, \quad OBJ_\lambda(\gamma \geq \gamma_{max}) &= \frac{G^{open}(\gamma = 0)}{G^{open}(\gamma \geq \gamma_{max})} \cdot OBJ_\lambda(\gamma = 0) \\ &= \left[ \frac{\phi}{s_n(\gamma = 0) + \phi \cdot (1 - s_n(\gamma = 0))} \right]^{\alpha/(\sigma-1)} \cdot OBJ_\lambda(\gamma = 0) \leq OBJ_\lambda(\gamma = 0) \end{aligned} \quad (26)$$

In fact, the full deregulated equilibrium is Pareto superior to the agglomerated one in the foreign country. Equation (26) implies directly that the optimal level of regulation is lower than  $\gamma_{max} = g(\phi, \phi^*)$ . As this maximum bargaining power tends to zero when trades becomes costless, the optimal choice is to fully deregulate in that case, whatever the social preferences. This is the main result.

### Proposition 3. Optimal level of labor market regulation in the open economy

- (i) *Whatever the social preferences parameter, the optimal level of regulation is lower than the level leading to the aggregated equilibrium abroad:  $\hat{\gamma}(\lambda) \leq \gamma_{max} \quad \forall \lambda$*
- (ii) *As trade becomes costless, the optimal choice is to fully deregulate:  $\lim_{\phi \rightarrow 1^-} \hat{\gamma}(\lambda) = 0$*

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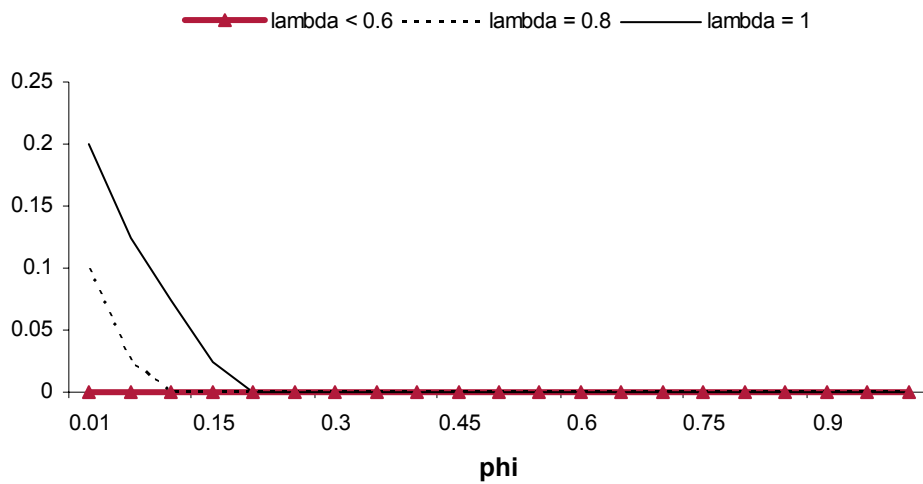
In autarky, the advantage of protection is to increase average wages. With market opening, as local firms are deterred to produce domestically, the redistributive component of LM protection is ineffectual above a threshold. Compared to the deregulated LM situation, it just makes imported goods more expensive. This threshold, in a way the maximum tolerated level, diminishes with trade liberalization. Stated differently, even the slightest protection is non optimal from the point of view of SP when trade becomes very cheap. Indeed, firstly capital mobility puts pressure on LM institutions because of the threat of outflow and secondly, trade liberalization reinforces the attractiveness of being located abroad, so that any positive effect of regulation on SP utility is wiped out when trade is costless. However, as the LM is deregulated, firms are no longer inclined to relocate their activities. The *threat* of relocation drives the changes in LM institutions. In this stylized framework, the effect of liberalization is to be found in the weakening of employment protection, with minimal *actual* outflows and relocations.

All simulations indicate that the *optimal* level of LM regulation is a decreasing function of the phi-ness of trade when the domestic country is not too large. However, establishing this relation analytically is probably not possible. Proposition 3 is therefore a weaker result but one strong enough for the main purpose of the chapter. If the domestic country is very large / rich then the relationship between the optimal regulation level and the trade costs can be non monotonic and depends on the social preferences parameter as illustrated in Figure 6.5 with symmetric trade costs. Figure 6.5a presents the case of the symmetric country where the optimal regulation level decreases in the phi-ness. When SP are utilitarian ( $\lambda = 0$ ) or even when  $\lambda$  is sufficiently small then the LM is deregulated whatever the level of trade costs. Figure 6.5b presents the case of a large / rich country ( $s = 0.9$ ) in which the SP choose optimally to regulate the LM, at least when  $\lambda$  is large enough and trade costs reach an intermediate level. The optimal level is flat at zero when  $\lambda$  is low. It is hump-shaped when  $\lambda$  is intermediate / low and negatively sloped when SP have a high  $\lambda$ . This pattern is due to two conflicting effects. The first is due to the hump shape of the agglomeration rents which enables the SP to regulate if they wish, i.e. if the social preferences are pro-worker. The second results from the fact that high- $\lambda$  SP opt for a very high degree of LM regulation when the product market is sufficiently closed (low  $\phi$ ). This second effect means that in such a country, a gradual opening can only trigger a loosening of regulation from such a high level. The combination of these two effects

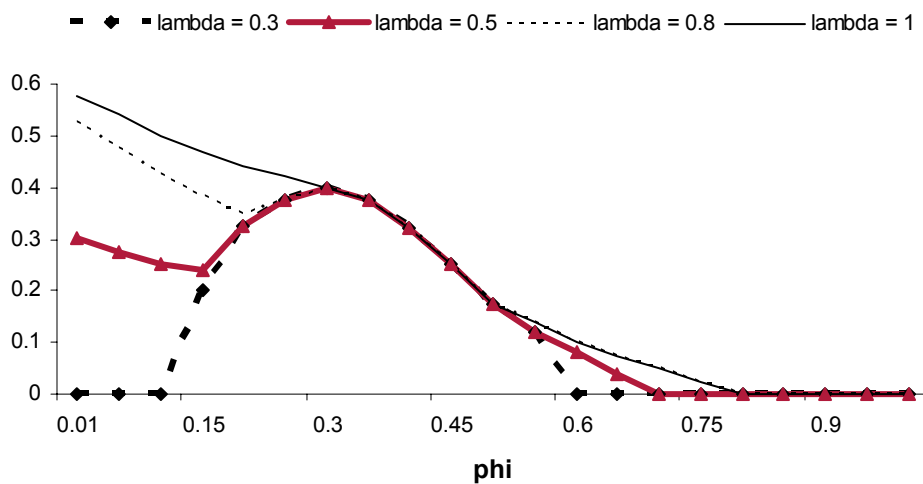
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gives the contrasted patterns depending on the social preferences parameter. For instance, when  $\lambda$  is intermediate ( $\lambda = 0.5$  in Figure 6.5b), the shape is intermediate between that obtained when  $\lambda$  is intermediate / low ( $\lambda = 0.3$ ) and when  $\lambda$  is high ( $\lambda = 0.8$ ).

**Figure 6.5a: Optimal Level of Labor Market Regulation as a Function of Trade Costs, Symmetric countries and trade costs ( $s = 0.5$ ,  $\phi = \phi^*$ )**



**Figure 6.5b: Optimal Level of Labor Market Regulation as a Function of Trade Costs, Large / Rich country ( $s = 0.9$ ,  $\phi = \phi^*$ )**



Autarky LM regulation levels are  $\hat{\gamma}^A(\lambda < 0.25) = 0$ ,  $\hat{\gamma}^A(\lambda = 0.30) = 0.32$ ,  $\hat{\gamma}^A(\lambda > 0.40) = 1$

**6.4.3. Impact of market opening on social partners' utility**

Given the pressure to deregulate with market opening, it is natural to compare the autarky and the fully deregulated trade equilibrium. Domestic capital owners unambiguously win in nominal terms with each step of the following sequence (recall Figure 6.3c): capital mobility, falling trade costs, full LM deregulation. In real terms, this effect is reinforced because trade leads to a fall in prices, at least when  $\phi \geq s_K$  (see equation 25), and in any case with symmetric countries ( $s = s_K = 1/2 \Rightarrow s_n(\gamma = 0) = 1/2$ ): this is one of the sources of the usual gains from trade. This price effect also means that, in the sufficiently open economy, sector-A workers are better off with LM deregulation. Next, autarky unemployed workers find jobs and see their real income increase too. Finally, for sector-R wage earners however, the outcome is not clear-cut. Limiting ourselves to  $\phi = \phi^*$  leads to:

$$\left(\frac{w_R}{G}\right)_{\gamma=0}^{open} \leq \left(\frac{w_R}{G}\right)_{\hat{\gamma}^{aut}}^{aut} \Leftrightarrow \frac{1}{G^{open}(\gamma=0)} \leq \frac{1 + \hat{\gamma}^{aut}/(\sigma-1)}{G^{aut}} \Leftrightarrow \hat{\gamma}^{aut} \geq (\sigma-1) \cdot \left[ \left( \frac{s_n(\gamma=0) + \phi \cdot (1 - s_n(\gamma=0))}{s_K} \right)^{\frac{\alpha}{\sigma-1}} - 1 \right]$$

$$\Leftrightarrow \hat{\gamma}^{aut} \geq (\sigma-1) \cdot \left[ \left( \frac{\max(s \cdot (1 + \phi), \phi)}{s_K} \right)^{\alpha/(\sigma-1)} - 1 \right] \approx \alpha \cdot \text{Log} \left( \frac{s}{s_K} \cdot (1 + \phi) \right) \quad \text{when } \phi \leq \frac{s}{1-s}$$

Real wages improve with market opening and deregulation, only if the initial protection, and therefore the underlying level of the pro-labor orientation, is below a certain level. This implies that when the LM is highly regulated to start with, the combination of liberalization and optimal LM deregulation might generate conflicts of interests and uncover levels of resistance among workers in the rent sector: deregulating is detrimental to them, especially when trade costs are high.<sup>6</sup> Appendix 3 shows that when trade costs and the pro-labor inclination are high enough then the gains from trade are too low to compensate for the loss of the redistributive tool and SP utility decreases with total LM deregulation.

Does the opening of the economy improve SP utility when the SP choose the optimal LM regulation? Simulations indicate that the general pattern is that opening the economy is beneficial when SP adapts the regulation level optimally. However, when SP have strong pro-labor preferences and therefore highly regulate the LM in autarky, market opening is detrimental to them unless trade costs are low enough.

<sup>6</sup> Unless the country is very labor intensive ( $s/s_K$  large) in which case opening to the world capital market has a strong beneficial price effect as shown by (25).

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To sum up, these results highlight how the different liberalizations interact. With capital liberalization, barriers to trade could be harmful, especially if the LM is highly regulated, and therefore, capital mobility renders trade liberalization critical. In turn, falling trade costs reinforces agglomeration and triggers LM deregulation as employment protection becomes ineffective.

### 6.4.4. Strategic labor market policy

We finally contemplate the case where the foreign country might also regulate its LM.

#### Proposition 4. Strategic labor market regulation

(i) *The maximum level of domestic LM regulation is an increasing function of the LM regulation level in the foreign country, a decreasing (increasing) function of the domestic (foreign) phiness.*

$$\gamma_{\max} = 1 - \frac{\phi \cdot (1 - \gamma^*)}{\phi \cdot \phi^* + (1 - \phi \cdot \phi^*) \cdot [s \cdot (1 - \gamma^*) + (1 - b) \cdot s_L \cdot \gamma^*]}$$

$$\Rightarrow \partial \gamma_{\max} / \partial \gamma^* \geq 0, \partial \gamma_{\max} / \partial s \geq 0, \partial \gamma_{\max} / \partial \phi \leq 0, \partial \gamma_{\max} / \partial \phi^* \geq 0$$

(ii) *As importing goods in the domestic country becomes costless, this maximum regulation level is lower than the foreign regulation level:  $\forall s \forall \phi^* < 1 \lim_{\phi \rightarrow 1} \gamma_{\max} < \gamma^*$ ,  $\forall s \lim_{\phi = \phi^* \rightarrow 1} \gamma_{\max} = \gamma^*$*

The straightforward implication is that when trade is fully liberalized, regulation cannot be stricter than in the foreign country and SP strategically choose a level below to attract firms. Therefore, integration with non-cooperation between SP triggers a race to deregulate, whereas cooperation could lead to a different outcome. This suggests that in order to promote their interests, unions should join forces with their foreign counterparts. If not, liberalization induces them to loosen LM regulation sharply.

### 6.5. Conclusion

This chapter is a first attempt at introducing labor market (LM) imperfections in an economic geography setting. The most obvious limitations refer to the specificities of the model integrating wage bargaining in the footloose capital model. Although we have kept away from capital taxation issues *per se*, as bargaining is directly associated with rent-sharing, this framework presents some



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similarities with capital taxation used as a redistributive purpose. It is, however, consistent with segmented LMs, which arise because the size of the rents differs across sectors.

This framework captures some interesting features, even when the analysis is limited to the case of two countries, differing only in their social preferences, opening to each other. The levels of LM regulation are chosen based on their idiosyncratic social preferences. In autarky, LM protection has the advantage of shifting part of the rents to workers and therefore, of increasing real wages. This comes though at the cost of unemployment and lower capital return. Weighing-up these components, the social partners choose the optimal level of protection.

In the context of perfect capital mobility with a country that has a totally deregulated LM (because of its own preferences), the pro-real wage effect of regulation is at best attenuated. Indeed, as firms seeking higher capital return move abroad, total rents diminish and the share kept by workers as well. Within this setting, if the domestic country has a regulated LM initially, market opening unambiguously benefits capital owners relative to wage earners. In addition, shipping the “delocalised” good has an adverse effect on the purchasing power of domestic consumers. Consequently, the benefits of LM regulation are significantly reduced, or even reversed, by the mobility of capital which leads social partners to deregulate.

When trade costs fall the intensity of the agglomeration force increases further. The level of protection beyond which all firms move abroad decreases as trade in goods becomes cheaper. When trade liberalization extends, even the slightest LM protection deters any single firm to produce domestically. The only outcome of LM regulation is then to make the imported goods more expensive compared to the fully deregulated LM equilibrium. As trade tends to become costless, the optimal choice is to totally deregulate the LM. This result is also striking because it holds even if the social partners have a strong pro-worker inclination. The threat of relocation, which becomes more credible when trade costs are low, drives the changes in LM institutions. Consequently, the effect of liberalization might be found primarily in the weakening of employment protection, with minimal actual outflows and relocations.

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Obviously, deregulation can generate conflicts of interests. Capital mobility combined with high trade costs makes the wage earners who enjoyed some share of the rents in autarky worse off. If SP have a strong pro-worker preference which is reflected by a high level of regulation in autarky, this situation generates a decrease in SP utility. It is only if the gains from trade, typical of the monopolistic competition, are large enough, i.e. trade costs low enough, that the negative impact of deregulation on real wages is offset. The current model underlines the complexity of analyzing the effects of globalization taken as a single phenomenon, even if focusing on only two aspects, capital and trade liberalization.

Generally, in terms of economic policy, support for market opening is drawn from models assuming a perfect LM. Taking into account LM regulation, this final chapter highlights how capital and trade liberalization can put pressure on LM institutions in the absence of international cooperation between SP. Therefore, liberalization measures should be thought of as tied to the LM deregulation they trigger. This combination might be well accepted by countries with initial low protection. However, countries that attached importance to LM protection may face a difficult situation once engaged in the liberalization process, especially if trade barriers are not so benign. Conversely according to this model, a government, which is prone to liberalize on all fronts, could start with capital, which makes trade protection very costly, then follow with trade openness which eases the burden of high import prices and finally let the SP, potentially undergoing this new environment, opt for LM deregulation and support further trade liberalization in their own interests.

**Appendix 1: The Open Economy**

A domestic firm produces  $X = x + \tau^* \cdot y$ , where  $x$  and  $y$  are sold in the domestic and foreign country respectively. Similarly, for a foreign firm,  $X^* = x^* + \tau \cdot y^*$ . As in autarky, capital returns are:

$$\pi = (\mu - 1) \cdot (1 - \gamma) \cdot \beta \cdot X \quad , \quad \pi^* = (\mu - 1) \cdot \beta \cdot X^* \quad (A1)$$

Therefore, the assumption of perfect capital mobility leads to the equalization of returns, as long as both countries produce good  $R$ :

$$X^* = (1 - \gamma) \cdot X \quad (A2)$$

The specific effect of potentially different productivity levels between the two countries is reflected in the wages in the foreign country as prices are linked due to trade in good  $A$ :  $p_A = p_A^* = 1$ ;  $w^* = A^*$ ;  $p^* = \mu \cdot \beta = p$ . Equation (A2) highlights that because some rents are transferred to workers in the domestic country, domestic firms should be bigger than their foreign competitors in order to cover fixed costs and be able to pay the same return to shareholders.  $I$  denoting nominal GNP, worldwide equilibrium in good  $R$  is:

$$\alpha \cdot (I + I^*) = \mu \cdot \beta \cdot (n \cdot X + n^* \cdot X^*) \quad , \quad n + n^* = K + K^* \quad (A3)$$

$$I = \pi \cdot K + v \cdot L_R + L_A \quad , \quad I^* = \pi^* \cdot K^* + A^* \cdot L^* \quad (A4)$$

Given the equalized returns condition (A2), equation (A3) becomes,

$$\mu \cdot \beta \cdot [n + n^* \cdot (1 - \gamma)] X = \alpha \cdot [\pi \cdot (K + K^*) + v \cdot L_R + L_A + A^* \cdot L^*] \quad (A5)$$

The production function of good  $R$  links sectoral output and employment:

$$L_R = n \cdot X \cdot \beta \quad (A6)$$

Using equation (A1), (A6) and  $L_R + L_A = L \cdot (1 - u)$ , equation (A5) becomes:

$$\begin{aligned} \mu \cdot \beta \cdot [n + n^* \cdot (1 - \gamma)] X &= \alpha \cdot [(\mu - 1) \cdot (1 - \gamma) \cdot (K + K^*) \cdot \beta \cdot X + (v - 1) \cdot n \cdot \beta \cdot X + L \cdot (1 - u) + A^* \cdot L^*] \Leftrightarrow \\ X &= \frac{\alpha}{\beta} \cdot \frac{L \cdot (1 - u) + A^* \cdot L^*}{\mu \cdot [n + n^* \cdot (1 - \gamma)] - \alpha \cdot (\mu - 1) \cdot [n + (1 - \gamma) \cdot n^*]} = \frac{\alpha}{\beta} \cdot \frac{L \cdot (1 - u) + A^* \cdot L^*}{K + K^*} \cdot \frac{\sigma - 1}{(\sigma - \alpha) \cdot (1 - \gamma + \gamma \cdot s_n)} \end{aligned} \quad (A7)$$

From (A1), the equilibrium capital return is then easily obtained:

$$\pi = \alpha \cdot \frac{L \cdot (1 - u) + A^* \cdot L^*}{K + K^*} \cdot \frac{1 - \gamma}{(\sigma - \alpha) \cdot (1 - \gamma + \gamma \cdot s_n)} = \frac{b}{1 - b} \cdot \frac{L \cdot (1 - u) + A^* \cdot L^*}{K + K^*} \cdot \frac{1 - \gamma}{1 - \gamma + \gamma \cdot s_n} \quad (A8)$$

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Classically with iceberg trade costs,  $p_y = \tau^* \cdot p_x = \tau^* \cdot p = \tau^* \cdot \mu \cdot \beta$  and  $p_y^* = \tau \cdot p_x^* = \tau \cdot p^* = \tau \cdot \mu \cdot \beta$ , and therefore, Dixit-Stiglitz preferences imply:  $y^* = x \cdot \tau^{-\sigma}$  and  $y = x^* \cdot \tau^{*\sigma}$ . The equilibrium for good  $R$  in the domestic and foreign country is respectively:

$$\alpha \cdot I = n \cdot p \cdot x + n^* \cdot p_y^* \cdot y^* = \mu \cdot \beta \cdot x \cdot (n + \phi \cdot n^*) \Rightarrow x = \frac{1}{\mu \cdot \beta} \cdot \frac{\alpha \cdot I}{n + \phi \cdot n^*} \quad (A9a)$$

$$x^* = \frac{1}{\mu \cdot \beta} \cdot \frac{\alpha \cdot I^*}{\phi^* \cdot n + \phi} \Rightarrow y = \frac{\tau^{*\sigma}}{\mu \cdot \beta} \cdot \frac{\alpha \cdot I^*}{\phi^* \cdot n + n^*} \quad (A9b)$$

Combining equations (A9a) and (A9b) to get  $X = x + \tau^* \cdot y$  and reciprocally for  $X^* = x^* + \tau \cdot y^*$  gives:

$$\frac{I}{n + \phi \cdot n^*} + \frac{\phi^* \cdot I^*}{\phi^* \cdot n + n^*} = \frac{\mu \cdot \beta}{\alpha} \cdot X \quad (A10a)$$

$$\frac{\phi \cdot I}{n + \phi \cdot n^*} + \frac{I^*}{\phi^* \cdot n + n^*} = \frac{\mu \cdot \beta}{\alpha} \cdot X^* = \frac{\mu \cdot \beta}{\alpha} \cdot (1 - \gamma) \cdot X \quad (A10b)$$

It is already clear that, when  $\phi$  tends to 1, the system (A10a)-(A10b) implies that the bargaining power cannot be strictly positive even if  $\phi^* = 1$ . Eliminating  $I$  from the system (A10a)- (A10b) leads to:

$$\phi^* \cdot n + n^* = \frac{\alpha}{\mu \cdot \beta} \cdot \frac{(1 - \phi \cdot \phi^*) \cdot I^*}{X \cdot [1 - \gamma - \phi]} = \frac{\alpha}{\mu \cdot \beta} \cdot \frac{(1 - \phi \cdot \phi^*) \cdot (\pi \cdot K^* + A^* \cdot L^*)}{X \cdot (1 - \gamma - \phi)}$$

Substituting successively the expressions of the capital return and of a domestic firm's output given by (A1) and (A7) leads to the first relationship linking the location of firms to the unemployment rate:

$$\begin{aligned} \phi^* \cdot n + n^* &= \frac{\alpha}{\mu \cdot \beta} \cdot \frac{(1 - \phi \cdot \phi^*) \cdot [(\mu - 1) \cdot (1 - \gamma) \cdot \beta \cdot X \cdot K^* + A^* \cdot L^*]}{X \cdot (1 - \gamma - \phi)} \\ \Rightarrow 1 - (1 - \phi^*) \cdot s_n &= \frac{1 - \phi \cdot \phi^*}{1 - \gamma - \phi} \left[ b \cdot (1 - \gamma) \cdot s_K^* + (1 - b) \cdot \frac{s_L^* \cdot (1 - \gamma + \gamma \cdot s_n)}{1 - u \cdot s_L} \right] \end{aligned} \quad (A11)$$

It is convenient to denote  $s = b \cdot s_K + (1 - b) \cdot s_L$ . The weighting of factor shares in  $s$  highlights that when the share of spending in good  $R$  and/or the degree of market power is high, i.e.  $b$  is large, then the spatial distribution of capital owners matters the most. Conversely, when  $b$  is small, labor distribution across countries is crucial. After some manipulations, equation (A11) leads to (14) in the main text:

$$s_n(\gamma, \phi) = \frac{s \cdot (1 - \phi \cdot \phi^*) - \phi \cdot (1 - \phi^*) - \gamma \cdot [\phi \cdot \phi^* + s \cdot (1 - \phi \cdot \phi^*)] - u \cdot s_L \left[ (1 - \phi - \gamma) - b \cdot s_K^* \cdot (1 - \phi \cdot \phi^*) \cdot (1 - \gamma) \right]}{(1 - \phi) \cdot (1 - \phi^*) - \gamma \cdot [s \cdot (1 - \phi \cdot \phi^*) - \phi^* \cdot (1 - \phi) + b \cdot s_K^* \cdot (1 - \phi \cdot \phi^*)] - u \cdot s_L \cdot (1 - \phi - \gamma) \cdot (1 - \phi^*)} \quad (A12)$$

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In order to reach the second relationship, i.e. equation (15), we need to calculate the sectoral employment. This is achieved easily by combining (A6) and (A7):

$$L_R = \frac{b}{1-b} \cdot (\sigma-1) \cdot [L \cdot (1-u) + A^* L^*] \cdot \frac{s_n}{1-\gamma+\gamma \cdot s_n} \Rightarrow u = \left(1 - \frac{L_A}{L}\right) u_R = \left(1 - \frac{L \cdot (1-u) - L_R}{L}\right) \cdot f(v)$$

$$\Rightarrow \frac{u}{1/s_L - u} = \frac{b}{1-b} \cdot (\sigma-1) \cdot \frac{f(v)}{1-f(v)} \cdot \frac{s_n}{1-\gamma+\gamma \cdot s_n} = \frac{u^A(\gamma)}{1-u^A(\gamma)} \cdot \frac{s_n}{1-\gamma+\gamma \cdot s_n} \quad (A13)$$

### Agglomeration in the foreign country (Proof of Proposition 1A and 1B (i))

When the activity is agglomerated in the foreign country,  $s_n = 0$  and given (A13) the unemployment rate is zero due to specialization in sector A. The sustain-point is the parameter where the numerator of (A12) is equal to zero. Substituting the expression of  $s_n$  given by (A12) into (A13) leads to the full expression of the unemployment rate in the open economy:

$$\phi \leq \phi_s^F \Leftrightarrow u(\gamma, \phi) = \frac{u^A(\gamma)}{s_L} \cdot \frac{s \cdot (1-\phi \cdot \phi^*) - \phi \cdot (1-\phi^*) - \gamma \cdot [\phi \cdot \phi^* + s \cdot (1-\phi \cdot \phi^*)]}{(1-\phi) \cdot (1-\phi^*) - \gamma \cdot [(1-\phi) \cdot (1-\phi^*) + (\phi - \phi^*)]} - \varsigma \quad (A14a)$$

where  $\varsigma = [\gamma \cdot \phi^* + b \cdot s_K^* \cdot (1-\phi \cdot \phi^*) \cdot (1-\gamma)] [\gamma + (1-\gamma) u^A] + (1-\phi-\gamma) \cdot \phi^* \cdot (1-\gamma) u^A$  is a second order term:

$$\phi \leq \phi_s^F \Leftrightarrow u(\gamma, \phi) \approx \frac{u^A(\gamma)}{s_L} \cdot \frac{g(\phi, \phi^*) - \gamma}{(1-\phi) \cdot (1-\phi^*)} \cdot (1-\gamma) = \frac{u^A(\gamma)}{s_L} \cdot \frac{\psi - \gamma}{\chi \cdot (1-\gamma)} \quad (A14b)$$

where  $\psi \equiv g(\phi, \phi^*) \equiv \frac{s \cdot (1-\phi \cdot \phi^*) - \phi \cdot (1-\phi^*)}{\phi \cdot \phi^* + s \cdot (1-\phi \cdot \phi^*)}$  and  $\chi \equiv \frac{(1-\phi) \cdot (1-\phi^*)}{\phi \cdot \phi^* + s \cdot (1-\phi \cdot \phi^*)}$

Furthermore this approximation is exact in the two following cases: the unemployment rate is zero either when the LM is totally deregulated ( $\gamma = 0 \Rightarrow u^A = 0$ ) or when the agglomerated equilibrium is reached ( $\phi \geq \phi_s^F \Leftrightarrow \gamma \geq \psi \Rightarrow s_n = 0$  and  $u = 0$ ). Combining (A13) and (A14) leads to:

$$\phi \leq \phi_s^F \Leftrightarrow \gamma \leq \psi \Rightarrow s_n = \frac{(1-\gamma) u \cdot (1-u^A)}{u^A \cdot (1/s_L - u) - \gamma u \cdot (1-u^A)} \approx \frac{(1-\gamma) u}{u^A / s_L - \gamma u}$$

$$\approx \frac{\psi - \gamma}{\chi - \gamma \cdot \frac{\psi - \gamma}{1-\gamma}} \approx \frac{\psi - \gamma}{\chi} \approx \frac{\psi - \gamma}{\chi} = \frac{s \cdot (1-\phi \cdot \phi^*) - \phi \cdot (1-\phi^*) - \gamma \cdot [\phi \cdot \phi^* + s \cdot (1-\phi \cdot \phi^*)]}{(1-\phi) \cdot (1-\phi^*)}$$

It is therefore obvious that  $\partial s_n / \partial \gamma < 0$ . Simple differentiation shows that:

$$\text{sign}(\partial s_n / \partial \phi) = -(1-s) \cdot (1-\phi^*) < 0 \quad \text{and} \quad \text{sign}(\partial s_n / \partial \phi^*) = s - \frac{\gamma}{1-\gamma} \cdot \frac{\phi}{1-\phi}$$

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Moreover,  $\gamma \leq \psi \Leftrightarrow \frac{\gamma}{1-\gamma} < \frac{s(1-\phi) - \phi(1-s)(1-\phi^*)}{\phi} < \frac{s(1-\phi)}{\phi} \Rightarrow \frac{\partial s_n}{\partial \phi^*} > 0$

In order to complete the proof, we differentiate (A14):  $\frac{\partial u}{\partial \gamma} = \frac{1}{s_L \cdot \chi \cdot (1-\gamma)} \left[ (\psi - \gamma) \frac{du^A}{d\gamma} - \frac{1-\psi}{1-\gamma} u^A \right]$

When the bargaining power is small,  $u^A$  is small, the first term between brackets dominates and the unemployment rate is an increasing function of  $\gamma$ . Conversely, when the bargaining power is close to the sustain-point ( $\gamma \rightarrow \psi$ ), the second term dominates and the unemployment rate decreases with  $\gamma$ .

### Agglomeration in the domestic country (Proof of Proposition 1B (ii))

When the activity is agglomerated in the domestic country,  $s_n = 1$  and (A13) entails  $u = u^A / s_L$ :

$$(A12) \Rightarrow s_n \geq 1 \Leftrightarrow s(1-\phi\phi^*) - (1-\phi^*) \geq \gamma[\phi^* - (1-\phi\phi^*)b.s_K^*] + u^A[\phi^*(1-\phi-\gamma) - b.s_K^*(1-\phi\phi^*)(1-\gamma)]$$

It can be shown that this necessarily implies that  $\phi^* > (1-\phi\phi^*)b.s_K^*$  and therefore:

$$\gamma_{\min} \approx \max \left[ 0, \frac{s(1-\phi\phi^*) - (1-\phi^*)}{\phi^*} \right] \text{ and with symmetric trade costs: } \gamma_{\min} \approx \frac{1-\phi^2}{\phi} \max \left[ 0, s - \frac{1}{1+\phi} \right].$$

To complete the proof, note that  $\forall \phi \frac{1}{1+\phi} > \frac{1}{2}$  and  $s > \frac{1}{1+\phi} \Leftrightarrow \phi > \frac{s}{1-s}$ . It is straightforward to show

that  $\gamma_{\min}$  is hump-shaped in  $\phi$  and reaches a maximum when  $\phi = \left( \frac{s}{1-s} \right)^{1/2}$

### Strategic labor market policy (Proposition 4)

Introducing LM regulation in the foreign country simply modifies (A2) into  $(1-\gamma^*)X^* = (1-\gamma)X$  and

repeating the steps from (A3-A13) leads ultimately to  $\gamma_{\max} = 1 - \frac{\phi(1-\gamma^*)}{\phi\phi^* + (1-\phi\phi^*)[s(1-\gamma^*) + (1-b)s_L\gamma^*]}$

**Appendix 2: Proof of Proposition 2**

Using equation (9) leads to the expression of nominal GDP,  $I$ , and SP utility:

$$I = p.X_R + X_A = \mu.\beta.X_R + X_A = \mu.L_R + L_A = \left( \frac{\sigma.\alpha}{\sigma-\alpha} + \frac{\sigma.(1-\alpha)}{\sigma-\alpha} \right).L.(1-u) = \frac{L.(1-u)}{1-b}$$

$$OBJ_\lambda = \frac{GDP - \lambda.\pi.K}{G} = \frac{1 - \lambda.b.(1-\gamma)}{G.(1-b)}.L.(1-u) \quad (A15)$$

hence (22). Differentiating this expression with respect to the bargaining power leads to:

$$\frac{d \text{Log}OBJ_\lambda}{d\gamma} \geq 0 \Leftrightarrow \frac{-du/d\gamma}{1-u} + \frac{\lambda.b}{1-\lambda.b.(1-\gamma)} \geq 0 \Leftrightarrow \gamma \leq 1 - \frac{1}{b.\lambda} + \frac{1-u}{du/d\gamma} \quad (A16)$$

$\delta$  being a constant representing the sensitivity of the unemployment rate to the regulation level, we

choose the following functional form:  $u_R = f(v) = \frac{1 - e^{-b/(1-b).\delta.\gamma}}{1 - \frac{1-b.\sigma}{1-b}.e^{-b/(1-b).\delta.\gamma}} \approx \frac{1}{\sigma-1} \delta.\gamma = \delta.(v-1)$ . Indeed

this entails from (11):  $u = 1 - e^{-b/(1-b).\delta.\gamma}$  and therefore,  $du/d\gamma = b/(1-b).\delta.(1-u)$ . It follows that:

$$\frac{d \text{Log}OBJ_\lambda}{d\gamma} \geq 0 \Leftrightarrow \gamma \leq 1 - \frac{1}{b.\lambda} + \frac{1-b}{b.\delta} \equiv \varphi(\lambda, \delta) \quad , \quad \varphi(1, 1) = 0 \quad \varphi_\lambda \equiv \frac{\partial \varphi}{\partial \lambda} > 0 \quad \varphi_\delta \equiv \frac{\partial \varphi}{\partial \delta} < 0$$

Therefore, whatever the level of parameter  $\lambda(\leq 1)$ , if  $\delta$  is greater than 1,  $\varphi(\lambda, \delta) \leq \varphi(1, \delta) < \varphi(1, 1) = 0$ . This means that, in this case, SP utility is strictly decreasing with the bargaining power and therefore, the SP choose to fully deregulate, which proves (i) of Proposition 2.

When  $\delta$  is lower than 1, it is easy to verify that  $0 \leq \frac{\delta}{1-b+b.\delta} \leq 1$  and  $\varphi\left(\frac{\delta}{1-b+b.\delta}, \delta\right) = 0$ . Therefore,

if  $\lambda \leq \lambda_{\min} \equiv \delta/(1-b+b.\delta)$  then  $\varphi(\lambda, \delta) < 0$  and  $\hat{\gamma}(\lambda) = 0$ , hence (ii) a). Moreover, as  $\varphi(\delta/(1-b), \delta) = 1$ , if social preferences are such that  $\lambda \geq \lambda_{\max} \equiv \delta/(1-b)$  then all rents are transferred to workers and  $\hat{\gamma}(\lambda) = 1$ . In the intermediate case where  $\lambda_{\min} \leq \lambda \leq \lambda_{\max}$ ,

$$\hat{\gamma}(\lambda) = \frac{1-b}{b} \cdot \left( \frac{1}{\delta} - 1 \right) - \frac{1}{b} \cdot \left( \frac{1}{\lambda} - 1 \right).$$

**Appendix 3: Comparison between autarky and fully deregulated open economy**

Based on (A15), SP utility in autarky is  $OBJ_{\lambda}^A(\hat{\gamma}^A) = [G^A \cdot (1-b)]^{-1} \cdot (1-u^A) \cdot [1-\lambda \cdot b \cdot (1-\hat{\gamma}^A)]L$  and:

$$OBJ_{\lambda}^T(\gamma=0) = [G^A \cdot (1-b)]^{-1} \cdot \left( \frac{\max(s \cdot (1+\phi), \phi)}{s_K} \right)^{\frac{\alpha}{\sigma-1}} \cdot [1-\lambda \cdot b]L \quad \left[ = \max\left( \frac{s \cdot (1+\phi)}{\phi}, 1 \right)^{\frac{\alpha}{\sigma-1}} OBJ_{\lambda}^T(\gamma \geq \psi), \forall \lambda \right]$$

(which proves Proposition 3 more explicitly). It follows that:

$$OBJ_{\lambda}^T(\gamma=0) < OBJ_{\lambda}^A(\gamma=\hat{\gamma}^A) \Leftrightarrow \left( \frac{\max(s \cdot (1+\phi), \phi)}{s_K} \right)^{\frac{\alpha}{\sigma-1}} \cdot (1-\lambda \cdot b) < (1-u^A) \cdot (1-\lambda \cdot b \cdot (1-\hat{\gamma}^A))$$

Using the specific form  $f$  detailed in Appendix 2 and following Proposition 2, if  $\delta \leq 1-b$  and  $\lambda \geq \lambda_{\max} = \delta/(1-b)$  then the optimal bargaining power equals 1 in autarky. Therefore, based on the autarky unemployment rate given by (24b):

$$\lambda \geq \lambda_{\max} \Rightarrow \left( OBJ_{\lambda}^T(\gamma=0) < OBJ_{\lambda}^A(\gamma=\hat{\gamma}^A) \Leftrightarrow \left( \frac{\max(s \cdot (1+\phi), \phi)}{s_K} \right)^{\frac{\alpha}{\sigma-1}} \cdot (1-\lambda \cdot b) < 1-u^A = \exp(-b \cdot \delta / (1-b)) \right)$$

Moreover,  $1 > \exp(-b \cdot \delta / (1-b)) \geq \exp(-b) > 1-b \Rightarrow \exists \tilde{\lambda} \in ]0, 1[$  such that  $\exp(-b \cdot \delta / (1-b)) = 1 - \tilde{\lambda} \cdot b$ :

$$\lambda \geq \lambda_{\max} \Rightarrow \left( OBJ_{\lambda}^T(\gamma=0) < OBJ_{\lambda}^A(\gamma=\hat{\gamma}^A) \Leftrightarrow \left( \frac{\max(s \cdot (1+\phi), \phi)}{s_K} \right)^{\frac{\alpha}{\sigma-1}} < (1-\tilde{\lambda} \cdot b) / (1-\lambda \cdot b) \right)$$

If SP are such that  $\lambda > \max(\lambda_{\max}, \tilde{\lambda})$  then the last term on the RHS is greater than 1 and, for low enough phi-ness, total deregulation is detrimental in terms of SP utility compared to autarky (the same remark as in footnote 8 applies).



## **General Conclusion**

Hall's method to estimate markup levels is known to be subject to endogeneity issues which are extremely difficult to overcome with sector-level data. A common substitute is to apply the price-based method proposed by Roeger which avoids these intricate difficulties for the most part. Unfortunately, there has been a suspicion that the price-based methodology leads to too high markups and Chapter 1 confirms this feature and provides several complementary explanations. Indeed, the price-based specification is shown to have its own, and probably more serious, problems because the slow adjustment of capital renders as misspecified the central equation to be estimated. This entails an overestimation of markup levels and therefore, the price-based method does not look superior to a simpler measure of market power such as the price-cost margin (PCM), which is extensively used in the literature assessing the pro-competitive effect of international trade.

The two following chapters focus on the trends in PCMs for OECD countries since the early 'seventies. Chapter 2 uncovers a strong pattern of convergence in PCMs across sectors and countries which leads to a decrease of around a third in the dispersion of PCMs. This trend is clearly consistent with a deeper economic integration of developed countries, the increased capital mobility and the better efficiency of capital markets being natural driving forces behind such a convergence. However, contrary to what could have been expected, based on the pro-competitive effect of international trade, PCMs have not decreased on average. This convergence results from both the decrease in initially high PCMs and the increase in initially low PCMs.

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This pattern has triggered the need to test explicitly the hypothesis that foreign competition exerts a negative impact on PCMs in import competing industries and to understand why, despite globalization, PCMs have not generally decreased. Based on a survey of the empirical evidence, there is still a significant gap between the depth of the theoretical intuition behind the pro-competitive effect and the reality of the quantified effects. Chapter 3 provides robust evidence supporting the disciplining role of imports on domestic market power. The quantified impact is within, but at the top of, the range that is consistent with the proposed theoretical model. It implies that imports have contributed to a decrease of around a third in PCMs on average. However, this effect is globally offset by the combined impacts of disinflation, exports and financial deepening.

Chapter 4 zooms in on UK manufacturing using firm level data and tests the 'import-as-product-and-labor-market' hypothesis based on an extension of Hall's approach, taking into account wage bargaining. We find that both the markups and workers' bargaining power decreased in the mid-'nineties. Moreover, imports from developed countries are shown to contribute significantly to these changes, whereas exports have a weakly significant positive influence on the workers' bargaining power. A back-of-the-envelope calculation suggests that the labor-market discipline effect has counteracted around half of the product-market discipline effect on PCMs.

Chapter 5 focuses on the role played by trade with developing countries in the deindustrialization of developed countries, a major source of political concern. Confirming previous results, we find that deindustrialization is primarily caused by the intrinsic faster productivity growth in the industry relative to services and by a shift in the demand in favor of services as countries get richer. Trade with developing countries accounts for 20% of the decline in the manufacturing employment share on average. The econometric analysis also points out that balanced trade with developing countries is associated with aggregated employment losses in developed countries due to the differences in the factor content of imports versus exports.

Chapter 6 develops a theoretical model formalizing the time sequence from capital and trade liberalization to labor market deregulation, pointed out by recent empirical studies. This model represents a first attempt at introducing labor market regulation into an economic geography framework. Social partners are supposed to decide upon the level of regulation based on each

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country's social preferences. When the domestic country opens up to a country having a fully deregulated labor market because of its own preferences, labor market institutions are under pressure because of the potential outflow of capital due to the negative impact of regulation on capital return. This pressure gains in intensity when trade costs fall below a certain threshold, because serving the domestic market becomes cheaper. As the global economy gets closer to free trade, social partners have to fully deregulate the labor market, whatever their social preferences, i.e. even though the labor market is highly regulated in autarky. The threat of relocations, all the more credible when trade costs are low, triggers the changes in labor market institutions.

These results are, if anything, a contribution to positive economics and not meant to lead to normative recommendations. Transforming improved knowledge into policy measures is often a difficult task. Maybe, the most obvious consequence relates to action aimed at stopping or slowing deindustrialization. There has been a recent revival of interest in industrial policy in France, and more generally in Europe. Our results do not imply that targeted measures to slow the decline of industrial employment are useless, but that linking them to the emergence of developing countries is misplaced and even potentially misleading. As a result, industrial policy, if pursued, should be primarily guided by either strategic objectives or driven by projects growing national income in the long term, beyond the reducing argument of international competitiveness. In addition, since a primary cause of deindustrialization relies on the faster exogenous productivity growth in the industry relative to the services, a policy response should be a *services* policy aimed at improving their efficiency. This would allow the economy to pull out from the dilemma entailed by the relative decline in industry caused by a good relative performance.

Formalizing how capital and trade liberalization can put pressure on labor market institutions is a first step. Reaching normative suggestions would require assessing the benefits and costs of these institutions in terms of welfare. Of course, this implies that this evaluation should be conducted precisely for each policy measure: minimum wage, collective coverage, unemployment benefits, redundancy payments, etc., and one should be careful in extrapolating from the general concept captured by the model to the detailed measures of labor market policy.

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There are two main messages in this thesis. The first robust finding is that import competition has a strong negative impact on market power in the product market. The fact that opening the economy significantly increases the intensity of competition by bringing prices closer to marginal costs is obviously not surprising. However, as we have shown, firstly, the empirical evidence to date has not provided overwhelming support in favor of the product-discipline hypothesis, contrary to what is often claimed, and secondly, the trends in price-cost margins were *a priori* inconsistent with this presumption. The second message is that the overall impact of globalization on market power is much more pervasive than what the sole pro-competitive effect implies.

Indeed, price-cost margins have not fallen on average in OECD manufacturing economies and the impacts of disinflation, exports and financial deepening might have counterbalanced the effect of import competition. Obviously, the influence of disinflation has reached a limit given the level achieved by developed countries. Moreover, although the analysis has been limited to the effect of inflation at the macroeconomic level, more work is needed to estimate the contribution of global competition on prices at the sector level. Chen, Imbs and Scott (2006) is a first attempt in this direction highlighting a significant but weak impact of trade on inflation. Rogoff (2006) highlights that the overall effect of globalization on either inflation or disinflation is ambiguous and that the importance given to terms of trade in monetary policy decisions is the subject of an ongoing academic debate.

Although exports have expanded, almost by definition, in line with imports, the effect of access to new foreign markets on the market power of domestic firms has not received the same attention than the pro-competitive effect. The burgeoning literature on firm heterogeneity paves the way for such a reappraisal, but we need more theoretical work to specify the order of magnitude one should expect and more empirical work to test it with data.

As in many areas, financial globalization probably has as many important consequences as trade in terms of competition intensity. However, although we have mentioned various ways in which capital mobility and the development of financial markets may have an impact on market power, there is still a lack of a consistent theoretical framework disentangling the different channels. Moreover, the way in which capital and trade liberalization interact seems to have repercussions on the labor markets, an assumption that has never been tested.

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This thesis includes the first attempt to assess the joint effect of trade on market power in the product and the labor market. Only two studies had previously tested the impact of imports on the workers' bargaining power, with mixed results. Clearly, more work is needed to confirm the 'import-as-product-and-labor-market' hypothesis. More generally, the impact of globalization on labor market institutions is probably an under-researched area. For instance, we do not really understand the causes behind the contrasted trends in union participation across countries, which are all facing globalization, nor behind the seemingly general decrease in collective bargaining, and even less the specific role of the various aspects of globalization on these developments.

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