COMPETITION OR CONCENTRATION?
OLD DEBATE WITH NEW IMPLICATIONS FOR ANTITRUST ENFORCEMENT IN DEVELOPING COUNTRIES

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ABSTRACT

This paper empirically studies the effect of competition on growth. It enriches a decades-long debate, between Darwinian and Schumpeterian advocates, with evidence from both developed and developing countries. Its implications are particularly important for developing countries that seek to enforce their antitrust laws and organize their markets to attain the highest possible growth potential. Growth is measured using labor productivity growth rates, and competition is measured using a proxy of the Lerner Index. Both are calculated using UNIDO's industrial statistics database. The relationship between product market competition and labor productivity growth in developed and developing countries' manufacturing industries is investigated using a fixed effects panel data estimation model. The results show that an increase in product market competition is associated with higher labor productivity growth rates. Yet, the results also support - with regards to developing countries - that the relationship is nonlinear, following an inverted U-shape, thereby constraining the positive effect of absolute perfect competition and inviting tailored antitrust enforcement.

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I. INTRODUCTION

> [T]heories present general relationships, and which part of a theory is decisive in a particular context is a matter of empirical evidence."[1]

Developing countries have been increasingly adopting antitrust laws to organize their markets and prevent market failures. Enforcing these legislations carried the promise of realizing the missing link necessary to achieve growth and development.[2] Once adopted, either due to foreign pressure or domestic need, enforcers tried to align enforcement with a wider development agenda to reap the promised benefits. This required, and continues to require, that developing countries seek, with their antitrust enforcement, a policy that has development at its center. Which is in line with a new direction proposed in recent literature that seems most suitable to guide developing countries antitrust project, namely to aim at achieving growth and development *with* antitrust enforcement. This has been proposed by Joseph Brodley, Michael Porter, Eleanor Fox, Alice Amsden and Ajit Singh, among others. They all consider growth as *the* goal that should be achieved with antitrust enforcement.[3] This also is in line with the most pressing issue in developing countries, namely achieving higher levels of growth.[4]

Achieving growth has been on the agenda of developing countries as one of their priority objectives. Many developing countries have adopted a competition law believing the rhetoric of international institutions about its positive impact on growth and development.[5] Thus, formulating a competition policy with growth as its objective seems like a policy orientation that would not be alien to the needs of developing countries. It is also part of the new thinking about what antitrust laws should aim at achieving.[6] It is, however, a break from mainstream antitrust policy that is either formulated at the Chicago

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[1] George J. Stigler, *The Economist and the State,* in THE CITIZEN AND THE STATE: ESSAYS ON REGULATION 38, 51 (1975).

[2] *See e.g.* United Nations Center on Trade and Development (UNCTAD), *The United Nations Set of Principles and Rules on Competition,* TD/RBP/CONF/10/Rev.2 (2000), available at: http://unctad.org/en/docs/tdrbpconf10r2.en.pdf; Organization for Economic Cooperation and Development (OECD), *Implementing Competition Policy in Developing Countries* in Promoting Pro-Poor Growth: Private Sector Development 39 (2006).

[3] *See* Dina I. Waked, *Antitrust Goals in Developing Countries: Policy Alternatives and Normative Choices,* 38 SEATTLE L. REV. 945, 984-995 (2015) (introducing the proposal for growth and redistribution to guide antitrust enforcement in developing countries).

[4] Many have argued that growth should be a priority of law; *see e.g.* Cass R. Sunstein, FREE MARKETS AND SOCIAL JUSTICE 210 (1997) ("[t]ime and time again, it has been shown that economic growth can do more than welfare and employment programs to benefit the disadvantaged.").

[5] *See See* Dina I. Waked, *Adoption of Antitrust Laws in Developing Countries: Reasons and Challenges,* 12(2) J. L. ECON. & POL'Y 193, 198 - 203 (2016) (discussing that one of the main reasons why developing countries adopted antitrust laws, was pressure by supranational bodies and promises of growth and development).

[6] Michael E. Porter, *Competition and Antitrust: Towards a Productivity-based Approach to Evaluating Mergers and Joint Ventures,* 46 ANTITRUST BULL. 919, 920 (2001) ("[the] new thinking [about the goals of antitrust] sets forth productivity growth as the basic goal of antitrust policy.").

school with economic efficiency at the center, or at more centrist schools of thought, as Harvard, where consumer welfare is the efficiency standard promoted.[7]

To use antitrust laws to further growth and development is in itself not an easy task. What is in accordance with recent empirical and theoretical thinking is that innovation or dynamic efficiency is the accelerator of growth.[8] Thus, to promote an antitrust policy aiming for growth one needs to stimulate innovation. This has been confirmed with the recent endogenous growth theories that put innovation at the center of their models.[9]

In the first neoclassical growth models, technological progress or innovation was treated as an exogenous phenomenon for analytical convenience.[10] The evolutionary and neo-Schumpeterian literature by the 1980s dealt with innovation as an endogenous phenomenon in a theory of economic growth.[11] To model endogenous innovation they drew on the literature of industrial organization.[12] This led to the neoclassical growth theory treating endogenous innovation as a central factor explaining economic growth, whereby innovation is itself a factor of production.[13] In endogenous growth theory the rate of growth is proportional to the innovation rate.[14]

Innovations speed up improvements in production processes that lower production costs in the long-run. They can thus lead to lower prices in addition to new or improved products that consumers can enjoy.[15] "[I]nnovation's crucial role in generating economic growth and in enhancing global competitiveness warrants a more central role in antitrust analysis."[16] Michael Porter's following quote is in line with this new thinking about the role of antitrust:

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[7] *See* Waked, *supra* note 3, at Part II (discussing the different goals in detail); *see* Einer Elhauge, *Harvard, Not Chicago: Which Antitrust School Drives Recent U.S. Supreme Court Decisions?,* 3(2) COMPETITION POL'Y INT'L 57 (2017).

[8] *See* Waked, *supra* note 3, at Part IV (detailing the importance of innovation as an accelerator of growth).

[9] *See e.g.* Philippe Aghion and Peter W. Howitt, THE ECONOMICS OF GROWTH 12-18 (2008).

[10] Bart Verspagen, *Endogenous Innovation in Neo-Classical Growth Models: A Survey,* 14(4) J. MACROECON. 631, 633(Fall 1992).

[11] *Id.* at 634-635 (referring to studies by Nelson and Winter (1982) and Dosi et al. (1988)); Larry E. Jones and Rodolfo E. Manuelli, *Neoclassical Models of Endogenous Growth: The Effects of Fiscal Policy, Innovation and Fluctuations,* in HANDBOOK OF ECONOMIC GROWTH 14, 27-28 (P. Aghion and S. Durlauf, eds. 2005) ("[T]he key in improving over the Solow model is to explicitly consider decisions made by private agents about investments they make that cause technology to improve. This both endogeneizes the growth process envisaged by Solow and breaks away from another key assumption of the exogenous growth literature, that technological change happens without any resource cost.").

[12] Verspagen, *supra* note 10, at 635.

[13] *Id.*

[14] Philippe Aghion and Rachel Griffith, COMPETITION AND GROWTH: RECONCILING THEORY AND EVIDENCE 16 (2005); *see also* Zvi Griliches, *Productivity, R and D, and Basic Research at the Firm Level in the 1970s,* 76(1) AM. ECON. REV. 141, 151 (1986) (this study tested the relationship of research and development expenditures, especially on basic research, to productivity growth in U.S. manufacturing firms during the 1970s concluded that "R&D contributed positively to productivity growth and seems to have earned a relatively high rate of return.").

[15] Porter, *supra* note 6, at 923 ("Since the seminal contributions of Schumpeter, Solow and Abramovitz, it is widely understood that the only means to achieving sustained productivity growth in an economy is through innovation. Innovation provides products and services of ever-increasing consumer value, as well as ways of producing goods more efficiently both of which contribute directly to productivity.").

[16] Richard J. Gilbert and Steven C. Sunshine, *Incorporating Dynamic Efficiency Concerns in Merger Analysis: The Use of Innovation Markets,* 63 ANTITRUST L. J. 569, 573 (1994-1995).

> It is well established in economics that progressiveness or innovativeness is by far the most important source of economic growth and welfare, greatly outweighing price/cost margins (allocative efficiency), or even static efficiency. The central focus of antitrust policy in my view, ought to be on fostering progressiveness, defined broadly to include not only technological innovation but new ways of competing in product, marketing, service, and so on.[17]

Thus, to promote development, developing countries need to formulate an antitrust enforcement policy that is encouraging of innovation and thereby growth. What kind of antitrust policy and enforcement strategy is needed to that effect is the subject of this paper. Do we need a policy favoring more competitive markets? Or do we need one that is more permissive of higher levels of concentration? Which of these market structures is responsible for more innovation and growth? These are questions this research is addressing. In a way, studying the effect of antitrust laws, and the market structure it brings about, on overall growth further aims at contributing to the big picture of studying the effect of law on the overall economic welfare of society.[18]

Studying the effect of competition on growth contributes to the rich debate surrounding the effect of competition on growth, particularly in developing countries. It helps illustrate whether the predominant theory about competition being the main accelerator of growth is true, whether Schumpetarian theory is more applicable to the countries investigated,[19] or whether the relationship between competition and growth is nonlinear, and hence falling within the two extremes of the orthodox perceptions about the topic.[20]

Policies promoting competitive markets have influenced political and economic decision makers around the world. Developing countries have been encouraged by international organizations to restructure and reform their markets to facilitate more market entry, privatization and both local and foreign competition.[21] These structural changes have promised higher growth levels and more development. Yet others have criticized the merits of product market competition and questioned whether it indeed leads to higher growth levels, particularly in developing countries. Critics of competition have argued that developing countries need to protect their national champions, to encourage concentration necessary to exploit economies of scale and to assure international competitiveness.

In an attempt to see whether more competition furthers higher growth levels this study looks at the experience of 69 developing countries and how their levels of competition impact their growth rates.

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[17] *Innovation, Rivalry, and Competitive Advantage: Interview with Professor Michael E. Porter,* 5 ANTITRUST 5, 5 (1990-1991) [hereinafter Porter Interview].

[18] Frank B. Cross, *Law and Economic Growth,* 80 TEX. L. REV. 1737, 1737 (2002) ("There remains a relative paucity of academic legal research on the big picture - what particular mix of laws and legal institutions encourage the ultimate overall economic welfare of society?").

[19] Joseph A. Schumpeter, CAPITALISM, SOCIALISM AND DEMOCRACY (3ed. Harper Prennial, 1984).

[20] Philippe Aghion et al., *Competition and Innovation: An Inverted-U Relationship*, 120(2) Q. J. ECON. 701 (2005).

[21] *See* Waked, *supra* note 5 at 201.

To assess the relationship between competition and growth, three-digit manufacturing industry level data from the United Nations Industrial Development Organization (UNIDO) database is used. This study uses price-cost margin (PCM), or markups, as the measurement of product market competition. PCM is a proxy of the Lerner Index and is a measure of pricing power which proxies competitive pressure in an industry. Growth is measured using labor productivity growth, which is a measurement of technological progress - in accordance with the findings of the vast theoretical and empirical literature arguing that technological progress is the main driving force behind overall growth levels.[22] By using this measurement for growth, the results capture the effect of competition on both growth and innovation. Panel data estimation techniques are employed to empirically test this relationship.

The paper is organized as follows: Section II sets the stage with a review of the theoretical background discussing the relationship between competition and growth against which the empirical analysis is undertaken. Section III presents the data and measurements used to calculate product market competition and labor productivity growth. Section IV descriptively analyzes the markups and labor productivity growth rates in the countries included in this study. Section V presents the empirical methodology used to assess the impact of product market competition on labor productivity growth. Section VI presents and discusses the results. Finally, Section VII concludes.

II. THEORETICAL BACKGROUND

Is product market competition good or bad for growth?[23] This question has been at the center of much theoretical and empirical work over the past decades. Nonetheless, there has been no consensus about the effect of competition on growth, which adds to the compelling nature of such an investigation. Leading theoretical models in industrial organization or growth theory in the early 1990s predicted that more intense product market competition discourages innovation and growth by destroying the monopoly rents generated by previous innovators. Joseph Schumpeter's theory is at the center of much of this line of argument.[24] This view is in contrast to the position that competition fosters growth by forcing firms to innovate, cut slack, and operate more efficiently to avoid bankruptcy and to survive.

The debate is still alive and has continued to stimulate research and studies. This quote by William Landes and Richard Posner illustrates how the debate is still ongoing: "[A]fter many years of study, it remains completely uncertain in both theoretical and empirical analysis whether concentration promotes, reduces or does not affect

[22] Gilbert and Sunshine, *supra* note 16, at 569 ("Economic progress depends on a steady stream of innovation.").
[23] This part draws heavily on Aghion and Griffith, *supra* note 14; and Aghion and Howitt, *supra* note 9.
[24] Schumpeter, *supra* note 19.

innovation."[25] The authors go on to argue that because of this confusion, "innovation is probably something that should be ignored in the administration of merger law."[26] Because of statements like this, and the desire not to exclude innovation from merger law or antitrust enforcement in general, this paper contributes to this debate by studying the effect of concentration or competition on innovation and growth. The results of this study, together with the long tradition of theory and evidence on both sides of the argument, can make sure that innovation is not ignored in antitrust analysis. As discussed before, innovation and growth should be at the center of antitrust, especially in developing countries.[27] The following will present some of the leading studies that have spurred both sides of the debate.

1. *Schumpeterian Theory: Competition hinders innovation and growth*

Those arguing that competition has a detrimental effect on innovation and growth find their theoretical underpinnings in Joseph Schumpeter's seminal work on creative destruction.[28] According to Schumpeter, monopoly profits are necessary for firms to pursue R&D and innovation.[29] Schumpeter's claims are: (1) only large businesses are able to achieve scale economies and bear the risks of investing in innovation;[30] (2) monopoly rents are an ideal source of funds to support industrial research and innovation;[31] (3) a monopoly position is a security that makes investments in innovation seem worthwhile.[32]

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[25] William M. Landes and Richard A. Posner, THE ECONOMIC STRUCTURE OF INTELLECTUAL PROPERTY LAW 385 (2003).
[26] *Id.*
[27] *See* Waked, *supra* note 3, Part IV.
[28] Schumpeter, *supra* note 19.
[29] *Id.* at 106 ("What we have got to accept is that [the large-scale establishment or unit of control] has come be the most powerful engine of [economic] progress and in particular of the long-run expansion of total output not in only in spite of, but to a considerable extent through, this strategy which looks so restrictive when viewed in the individual case and form the individual point in time. In this respect, perfect competition is not only impossible but inferior, and has no title to being set up as model of ideal efficiency.").
[30] *Id.* at 89 ("[L]rage-scale plans could in many cases not materialize at all if it were not known from the outset that competition will be discouraged by heavy capital requirements or lack of experience, or that means are available to discourage or checkmate it so as to gain the time and space for further developments.").
[31] *Id.* at 89-90 ("[E]enterprise would in most cases be impossible if were not known form the outset that exceptionally favorable situations are likely to arise which if exploited by price, quality and quantity manipulation will produce profits adequate to tide over exceptionally unfavorable situations provided these are similarly managed.").
[32] *Id.* at 88 ("Practically any investment entails, as a necessary complement of entrepreneurial action, certain safeguarding activities such as insuring or hedging. […] Hence it becomes necessary to resort to such protecting devices as patents or temporary secrecy of process or, in some cases, long-period contracts secured in advance. […] [I]f a patent cannot be secured or would not, if secured, effectively protect, other means may have to be used in order to justify the investment."); *id.* at 102 ("Thus it is true that there is or may be an element of genuine monopoly gain in those entrepreneurial profits which are the prizes offered b capitalist society to the successful innovator.").

Competitive markets are, thus, considered to negatively impact firms' ability to invest in innovative technologies and processes.[33] On the one hand, possession of *ex ante* market power allows firms to invest more into R&D and innovation. While on the other hand, expectation of *ex post* market power encourages firms to invest in R&D and innovation. This has been often referred to as the *Schumpeterian effect*.[34]

Those predicting that a monopolist will invest more in innovation also argue that the monopolist has more to lose by not innovating when facing a potential entrant. A monopolist would innovate more than a potential entrant as his loss, given his current monopoly rents, would be higher than what the potential entrant would lose if he or she does not innovate.[35] This is known as the rent dissipation effect.

Some empirical studies have backed up these theories. Models by Salop[36] and Dixit and Siglitz[37] predict that more intense product market competition reduces rents of firms that have entered into the market and hence discourages other firms from entering in the first place. Scherer's early empirical work showed that the number of patents filed was related to firm size.[38] He also argued that the incidence of plants operating at sizes too small to realize economies of scale was greater the less concentrated an industry was.[39] Scherer has also argued that when "duplication of research and development yields only meager benefits […] and if the number of R&D projects rises to bring the "market for innovations" to a zero-expected profit equilibrium, the case for high seller concentration, and in extreme cases monopoly, is strengthened."[40]

Models of endogenous technical change in growth theory also point to product market competition having an unambiguous negative effect on entry or innovation.[41] Aghion and Shankerman have argued that "a higher degree of product market competition […] reduces the post-entry monopoly rents enjoyed by each firm in the market and

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[33] *See e.g.* Jean-Luc Gaffard, *Innovation, Competition, and Growth: Schumpeterian Ideas within a Hicksian Framework,* in SCHUMPETERIAN PERSPECTIVES ON INNOVATION, COMPETITION AND GROWTH 7, 21 (Cantner, Gaffard and Nesta, eds. 2009) (Gaffard's paper provides an analytical framework in which Schumpeter's ideas are reconciled with a Hicksian model. It investigates the relationship between productivity growth, on the one hand, and between competition and innovation, on the other hand. "In our perspective, which could be described as 'Schumpeter after Hicks', active macroeconomic policies and market concentrations or monopolist practices appear to be necessary ingredients for boosting innovation and growth. This is the reverse of the current consensus in Europe.").

[34] *See* Aghion and Griffith, *supra* note 14; and Aghion and Howitt, *supra* note 9.

[35] Aghion and Griffith, *supra* note 14, at 13 ("[T]he incumbent may lose more by letting the entrant win the race (she dissipates the difference between her current monopoly rents and the duopoly rents if the entrant innovates) than the potential entrant does by letting the incumbent win the race (he loses the difference between what may be at best duopoly rents if he had won the race and zero if the incumbent wins.").

[36] Steven Salop, *The Noisy Monopolist: Imperfect Information, Price Dispersion, and Price Discrimination*, 44 REV. ECON. STUD. 393 (1977).

[37] Avinash K. Dixit and Joseph E. Stiglitz, *Monopolistic Competition and Optimum Product Diversity,* 67(3*)* AM. ECON. REV. 297 (1977).

[38] F. M. Scherer, *Corporate Inventive Output, Profits and Growth,* 73(3) J. POL. ECON. 290 (1965); F.M. Scherer, *Firm Size, Market Structure, Opportunity and the Output of Patented Inventions,* 55(5) AM. ECON. REV. 1097 (1965).

[39] F. M. Scherer, INDUSTRIAL MARKET STRUCTURE AND ECONOMIC PERFORMANCE 469-70 (2nd ed., 1980).

[40] F. M. Scherer, *Antitrust, Efficiency and Progress,* 62 N.Y.U. L. REV. 998, 1012 (1987).

[41] Paul M. Romer, *Endogenous Technological Change*, 98(2) J. POL. ECON. S71 (1990); Philippe Aghion and Peter Howitt, *A Model of Growth through Creative Destruction,* 60(2) ECONOMETRICA 323 (1992); Gene M. Grossman and Elhanan Helpman, INNOVATION AND GROWTH IN THE GLOBAL ECONOMY (1993).

therefore discourages entry."[42] They go on to argue that "[t]he same result holds in simple Schumpeterian models of innovation, where more product market competition tends to discourage R&D activities and hence growth by reducing the rewards that accrue to successful innovators."[43] The authors, however, restrict the validity of this general statement to large cost firms, whereas low cost firms might enter more when competition increase.[44]

Demsetz has also argued to the benefits of concentration saying that "the cost advantage that gives rise to increased concentration may be reflected in scale economies or in downward shifts in positively sloped marginal cost curves, or it may be reflected in better products which satisfy demand at a lower cost."[45] He also argued in favor of monopolies by saying that "[t]o destroy such [market] power when it arises may very well remove the incentive for progress. […] Evidence presented […] suggests that there are definite dangers of decreasing efficiency through the use of deconcentration or anti-merger policies."[46]

Similarly, Oliver Williamson in his seminal work on the welfare tradeoffs has shown that mergers to concentration may produce cost-saving efficiencies that outweigh the allocative inefficiencies caused by transferring part of the consumer surplus to producers.[47] His graph studying the effects on resources allocation of a merger that yields economies but extends market power in a partial equilibrium context has often been used to illustrate the benefits of concentrations. The typical Williamson trade-off graph illustrates that the net welfare effects of a merger that extends market power is the difference between the cost savings and the deadweight loss that ensues because of the higher prices.[48] He also argues that "more generally it is evident that a relatively modest cost reduction is usually sufficient to offset relatively large price increases even if the elasticity of demand is as high as 2, which is probably a reasonable upper bound."[49]

The U.S. Supreme Court in its 2004 *Trinko* decision has taken the side of the Schumpeterian advocates claiming that monopoly rents are important incentives for innovation. The Court opined that "[t]he mere possession of monopoly power, and the concomitant charging of monopoly prices, is not only not unlawful; it is an important element of the free-market system. The opportunity to charge monopoly prices – at least for a short period – is what attracts 'business acumen' in the first place; it induces risk taking that produces innovation and economic growth. To safeguard the incentive to

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[42] Philippe Aghion and Mark Schankerman, *Competition, Entry and the Social Returns to Infrastructure in Transition Economies,* 7(1) ECON. TRANSITION 79, 95-96 (1999).
[43] *Id.* at 96.
[44] *Id.* at 96-97.
[45] Harold Demsetz, *Industry, Structure, Market Rivalry, And Public Policy,* 16 J. L. & ECON. 1, 1 (1973).
[46] *Id.* at 3; *id.* at 7 ("[T]he data suggest that [deconcentration or anti-merger] policies will reduce efficiency by impairing the survival of large firms in concentrated industries, for these firms do seem better abele to produce at lower cost than their competitors. […] firms in industries with concentration ratios greater than 50 per cent produce at lower average cost.").
[47] Oliver E. Williamson, *Economies as an Antitrust Defense: The Welfare Tradeoffs,* 58 AM. ECON. REV. 18, (Mar. 1968).
[48] *See* Waked, *supra* note 3, at Part II.A.3 and Figure A.4 (for a summary of the Williamson trade-off model and the Williamson tradeoff graph, respectively).
[49] Williamson, *supra* note 47, at 22-23.

innovate, the possession of monopoly power will not be found unlawful unless it is accompanied by an element of anticompetitive *conduct."*[50]

Alice Amsden and Ajit Singh have argued that the optimality of maximum competition for investment and technical process, and hence dynamic efficiency has been seriously called into question.[51] They say that "new developments in the theories of industrial organization and international trade have resurrected such heterodox ideas."[52] The authors mention the Japanese and Korean experiences to show that during the years of their most rapid growth they "have deliberately restricted [competition] in many directions in order to increase their investment rate and to accelerate their technological development."[53] They, however, acknowledged that some internal rivalry was encouraged, namely both countries fostered intense oligopolistic rivalry among competing conglomerates. They also showed that the industrial concentration levels of firms in Japan did decline because of the growth of the economy.[54] They conclude by saying that "the East Asian experience would also appear to be consonant with the version of 'plausible capitalism' in Schumpeter (1942), where large oligopolistic corporations are the main vehicles of technological progress."[55]

Others have argued that developing countries, in particular, need to support higher concentration levels to allow their firms to achieve economies of scale and operate at minimum efficient scale of production.[56] This is essential to allow developing countries' infant and struggling industries the catch-up needed for them to compete internationally or at home in the face of foreign imports.

2. Darwinian Theory: Competition furthers innovation and growth

In contrast to the above mentioned theory, economists, from Adam Smith to more recently Michael Porter have argued that competition enhances growth by forcing firms to innovate and reduce slack to maintain their market positions. This is often referred to as the escape competition effect.[57]

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[50] *Verizon Communications Inc. V. Law Offices of Curtis V. Trinko, LLP,* 540 U.S. 398, 407 (2004).
[51] Alice H. Amsden and Ajit Singh, *Growth in Developing Countries: Lessons from East Asian Countries: The Optimal Degree of Competition and Dynamic Efficiency in Japan and Korea,* 38 EUR. ECON. REV. 941, 942 (1994).
[52] *Id.* at 942 (quoting A. Jacquemin, THE NEW INDUSTRIAL ORGANIZATION (1987); Schmalensee and Willig (1989); Tirole (1990); Helpman and Krugman (1989) and T. Jordan and D. Teece, eds. ANTITRUST, INNOVATION AND COMPETITIVENESS (1992)).
[53] *Id.* at 949.
[54] It is, however, arguably that such decline in concentration levels is was caused growth - the direction of causality is not adequately treated in the study.
[55] Amsden and Singh, *supra* note 51, at 950.
[56] *See e.g.* Michal S. Gal, COMPETITION POLICY FOR SMALL MARKET ECONOMIES 195 (2003)(the author argues that concentrated market structures might need to become further concentrated to achieve minimum efficient scales. On the one hand, an aggressive stance toward mergers might prevent desirable efficiency-enhancing mergers from taking place while entrenching existing inefficient market structures.).
[57] Rachel Griffith, Rupert Harrison, Helen Simpson, *Product Market Reform and Innovation in the EU*, 06/17 Working Paper The Institute for Fiscal Studies, 5 (2006).

Kenneth J. Arrow offered an alternative view of competition's effect on innovation. He showed that a monopolist has less incentive to innovate than a new entrant or a firm in a competitive industry.[58] According to Arrow, a current monopolist would be deterred from innovating, as such innovations will reduce the profits from its current monopoly or make its existing products obsolete. Whereas, a newcomer or a firm in a competitive market does not have the same stream of monopoly products that would be displaced by innovation. This is known as the replacement effect.

Others have extended Arrow's results and have shown further evidence that competitive markets have a greater impact on innovation and R&D than do monopolies.[59] "Over the next few decades fact-mechanics (or econometricians as they are now called) did not find evidence in favor of the Schumpeterian model; in fact, quite the opposite was the case, the empirical tide turned against Schumpeter."[60]

> [The theoretical and empirical evidence] compel abandonment of the romantic but naive Schumpeterian belief that giant firms organized into highly concentrated oligopolies are essential to maintain the most vigorous pace of technological progress. There may be isolated instances in which the Schumpeterian view is correct, but they should be treated as such. More commonly, loosely structured oligopolies are likely to be at least as progressive as industries dominated by one firm or a few, and relatively small technology-oriented enterprises often prove to be more dynamic innovators than the corporate giant. Above all, it is important to keep entry open so that challengers with new ideas can force the pace of innovation.[61]

As the quote illustrates, empirical evidence was at odds with the theoretical work of the 1990s arguing that competition hampers innovation and growth. Particularly, two important microeconomic studies stand out: one by Nickell[62] and the second by Blundell, Griffith and Van Reenen.[63] Both studies have confirmed the positive effect product market competition has on growth and innovation, respectively.

Nickell's study concludes that "the broad-brush evidence form Eastern Europe and Japan is, if anything, more persuasive than any detailed econometric evidence. However,

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[58] Kenneth J. Arrow, *Economic Welfare and the Allocation of Resources to Invention,* in THE RATE AND DIRECTION OF INVENTIVE ACTIVITY 609-25 (National Bureau of Economic Research ed., 1962).
[59] *See e.g.* Gilbert and Sunshine, *supra* note 16, at note 23 (citing Partha Dasgupta & Joseph E. Stiglitz, *Uncertainty, Industrial Structure, and the Speed of R&D,* 11 BELL J. ECON. 1 (1980); Tom K. Lee & Louis L. Wilde, *Market Structure and Innovation: A Reformulation,* 94 Q. J. ECON. 429 (1980); Glenn C. Loury, *Market Structure and Innovation,* 93 Q. J. Econ. 395 (1979); Jennifer F. Reinganum, *The Timing of Innovation: Research, Development and Diffusion,* in HANDBOOK OF INDUSTRIAL ORGANIZATION 849 (Richard L. Schmalensee & Robert D. Willig eds., 1989)).
[60] Aghion and Griffith, *supra* note 14, at 20.
[61] Scherer, *supra* note 40, at 1014.
[62] Stephen J. Nickell, *Competition and Corporate Performance,* 104(4) J. POL. ECON. 724 (1996) (the author found that firms with lower market shares (lower rents) had higher levels of total factor productivity growth)
[63] Richard Blundell, Rachel Griffith and John Van Reenen, *Market Share, Market Value and Innovation in a Panel of British Manufacturing Firms*, 66(3) REV. ECON. STUD. 529 (1999).

there is support for the general thesis in the empirical results.[…] This is one of the first available pieces of systematic evidence that competition enhances growth rates."[64]

Blundell, Griffith and Van Reenen found that less competitive industries, those with higher concentration levels and lower inputs, had fewer aggregate innovations.[65] Another study by Griffith, Harrison and Simpson found that the reforms carried out under the EU Single Market Programme (SMP) have led to an increase in product market competition and subsequent increase in innovation intensity and productivity growth for EU manufacturing sectors.[66]

Michael Porter also advocated the positive effect competitive markets have on growth. He has argued that "[i]nnovation […] is driven by competition. While technological innovation is the result of a variety of factors, there is no doubt that healthy competition is an essential part. One need only review the dismal innovation record of countries lacking strong competition to be convinced of this fact. Vigorous competition in a supportive business environment is the only path to sustained productivity growth, and therefore long-term economic vitality." [67] Porter also argued that "[f]ew roles of government are more important to the upgrading on an economy than ensuring vigorous domestic rivalry. Rivalry at home is not only uniquely important to fostering innovation, but benefits the national industry and clusters in many other ways […] In fact, creating a dominant domestic competitor rarely results in international competitive advantage. Firms that do not have to compete at home rarely succeed abroad. Economies of scale are best gained through selling globally, not through dominating the home market."[68]

He also stressed that "the real threat of a trust […] is not so much that it elevates prices today, but that it fails to lower cost and improve quality over time."[69] He argues that "[a]ll we have learned about the innovation process suggests that a number of entities pursuing different avenues, watching each other to try to learn from the others approach, is often the best structure."[70]

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[64] Nickell, *supra* note 62, at 741.
[65] Blundell, Griffith and Van Reenen, *supra* note 63.
[66] Griffith, Harrison and Simpson, *supra* note 57.
[67] Porter, *supra* note 6, at 923.
[68] Michael E. Porter, THE COMPETITIVE ADVANTAGE OF NATIONS 662 (1990); *see also id.* at 144 ("[a] group of domestic rivalry draws attention to the industry encourages investments by individuals, suppliers and institutions that improve the national environment, and creates diversity and incentives to speed the rate of innovation, among other benefits."); *id.* at 143 ("[r]rivalry has a direct role in stimulating improvement and innovation.").
[69] Porter Interview, *supra* note 17, at 6.
[70] *Id.* at 7 ("Innovative industries often have many competitors - e.g., German card, American software, Japanese consumer electronics."); *id.* at 8 ("[T]he presence of local rivals leads directly to a superior environment for innovation and dynamism compared to competing with an international rival […] often enhanced by issues of pride and even jealousy […] the presence of local rivals nullify simple advantages such as labor or material access, inability to blame problems on "unfair" foreign competition, and so on. […] [T]he presence of local rivals engaged in active competition boosts per capita consumption of a good, and tends over time to make the local customer more sophisticated and more demanding of quality […]. Sophisticated and demanding customers, in turn, stimulate and guide innovation."); *id.* at 10 ("Protecting intellectual property is necessary up to a point, to provide incentives for progress. Having said that, if we make it impossible indefinitely for any other company to introduce products or process technology that are even a little similar, or to come up with a product that looks a little bit like the original product, then we will undermine the very foundation of economic progress."); *see also* Michael Porter, *Michael Porter On*

Scherer's more recent work has also evidenced the positive relationship between competition and growth. He argues that "[v]igorous product market competition domestically or from abroad, disciplines management to keep costs at efficient levels."[71] He also demonstrated that the typical industrial R&D investments are modest, as are the risk of technical failure.[72]

He also claimed that beyond a modest size threshold, there is no evidence that large companies are more progressive than medium-sized firms in the sense of R&D investments and technological innovations. Size and innovative input or output is on average roughly proportional. However, small firms and "outsiders" appear to originate a disproportionate fraction of the most radical innovations.[73]

Also theories of X-inefficiency predicted that monopolists are more likely to exhibit laziness and other agency problems than firms in competitive markets.[74] These and many other studies have often been cited in support of competition as the market structure responsible for higher growth levels.[75] These results have especially influenced the

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Competition, 44 ANTITRUST BULL. 841, 862 (1999)("[w]hile economies of scale are certainly present in competition, the influence of scale *per se* seem to be diminishing. Modern, flexible technologies are often less scale sensitive than in previous generations. Outsourcing coupled with close relationships with suppliers have mitigated the need for in-house volume. Globalization has opened up early access to huge foreign markets and diminished the importance of size *per se* in local markets.").

[71] Scherer, *supra* note 40, at 1004.

[72] *Id.* at 1012.

[73] *Id*.; *see also* F.M. Scherer, *Conservative Economics and Antitrust: A Variety of Influences,* in HOW THE CHICAGO SCHOOL OVERSHOT THE MARK: THE EFFECTS OF CONSERVATIVE ECONOMIC ANALYSIS ON U.S. ANTITRUST 30, 38 (Robert Pitofsky ed., 2008) (referring to Scherer et al., PATENTS AND THE CORPORATION (2d. 1959)("We found […] that for established corporations, the expectation of patent protection was in most cases unimportant to R&D commitments."); *id.* at 39 ("[I]ntellectual property plays a relatively unimportant role as a stimulus to R&D investment. If one believes that the expectation of patent rights is the *principal* inducement to innovation one will be wrong more often than right in balancing antitrust objectives against intellectual property considerations in rule of reason cases. It is like positioning a 300-pound gorilla on the pro-patent side of the balancing scale when the real-world counterpart is a 35-pound chimpanzee."); Scherer, *supra* note 40, at 1014 (citing F.M. Scherer, THE ECONOMIC EFFECTS OF COMPULSORY PATENT LICENSING 35-56 (1977) ("Patent protection appears to be a crucial means of appropriating the benefits from innovation in only a few industries such as pharmaceuticals and specialty chemicals. In most industries, first-mover advantages, high costs of duplication, retention of proprietary know- how, fear of technological displacement, and other variables are more important than patents.).

[74] Einer R. Elhauge, *Defining Better Monopolization Standards*, 56 STAN. L. REV. 253, 299–300 (2003) ("The second level at which Schumpeter's point has been criticized is by the theory of X-inefficiency which argues that monopolists are more likely than competitive firms to exhibit laziness and other agency problems.").

[75] *See among others* G. J. Stigler, *Industrial Organization and Economic Progress,* in THE STATE OF THE SOCIAL SCIENCES 278 (L. D. While ed., 1956) ("[I]ndustries with lower concentration had higher rates of technological progress."); Williamson, *supra* note 47, at 29 (quoting evidence from E. Mansfield, *Size of Firms, Market Structure, and Innovation,* 71 J. POL. ECON. 556 (1963); E. Mansfield, *Industrial Research and Development Expenditures: Determinants, Prospects, and Relation to Size of Firm and Inventive Output,* 72 J. POL. ECON. 319 (1964)); F. M. Scherer, *Firm Size, Market Structure, Opportunity, and the Output of Patented Inventions,* 55 AM. ECON. REV. 1097 (1965)) ("present evidence, while hardly abundant, suggests that, as a general rule, the research and development expenditures of the four largest firms in an industry are neither as large proportionately nor as productive as those of their immediately smaller rivals."); O. E. Williamson, *Innovation and Market Structure,* 73 J. POL. ECON. 67 (1965) (in this study the author illustrated that there is a negative correlation between the proportion on innovations

institutional view at supranational organizations, such as the World Bank, the IMF, the OECD and UNCTAD.[76] The belief that competition furthers growth has had widespread consequences, particularly as it is the driving force behind many important policy changes ranging from the deregulation of important sectors to many of the economic reforms in Eastern Europe and elsewhere.[77] It continues to influence how competition policies are to be shaped and how the newly adopted antitrust laws in developing countries are to be enforced.

Despite the ample evidence in support for these views, they have not subsumed the influence of those arguing that competition hampers innovation and growth. This is why

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introduced by the four largest firms and industrial concentration.); William W. Lewis, THE POWER OF PRODUCTIVITY: WEALTH, POVERTY, AND THE THREAT TO GLOBAL STABILITY (2004) (the author showed that undistorted competition in product markets is the most important determinant of long-run productivity and prosperity); Paul A. Geroski, *Innovation, Technological Opportunity and Market Structure*, 42 OXFORD ECON. PAPERS 586-602 (1990) (this study uses fixed effects panel data to show that concentration and other measures of monopoly power tend to reduce the rate of innovation and hence productivity growth.); Dani Rodrik, *Imperfect Competition, Scale Economies, and Trade Policy,* in TRADE POLICY ISSUES AND EMPIRICAL ANALYSIS 109, 116 (Robert E. Baldwin ed., 1988) ("[H]igh levels of protection and reliance on quantitative restrictions have served to solidify oligopolistic structures in the manufacturing sectors of developing countries. Often they have also stimulated inefficient levels of production."); Maurice E. Stucke, *Reconsidering Antitrust's Goals,* 53 B. C. L. REV. 551, 611 (2012)(quoting Steven J. Davis et al., KAUFMAN FOUND. OF ENTREPRENEURSHIP, TURMOIL AND GROWTH: YOUNG BUSINESS, ECONOMIC CHURNING, AND PRODUCTIVITY GAINS 4 (2008) ("Small start-ups that survive are found to drive dynamic competition by helping replace lower productivity businesses with new, more productive ones, thereby increasing productivity overall.")); Mark A. Dutz and Maria Vagliasindi, *Competition Policy Implementation in Transition Economies: An Empirical Assessment,* 47 European Bank for Reconstruction and Development Working Paper (2002); John Preston, *Investment Climate Reform Competition Policy and Economic Development: Some Country Experiences*, DIFID Case Study for WDR (November 2003); Aydin Hayri and Mark Dutz, *Does More Intense Competition Lead to Higher Growth?*, 2320 World Bank Policy Research Working Paper (November 30, 1999); Maria Vagliasindi, *Competition Across Transition Economies: An Enterprise-level Analysis of the Main Policy and Structural Determinants*, 68 European Bank Working Paper (December 2001); Frank B. Cross, *supra* note 18; Bruce M. Owen, *Competition Policy in Emerging Economies*, 04-10 SIEPR Discussion Paper (April 2005); Yuichiro Uchida and Paul Cook, *The Effects of Competition on Technological and Trade Competitiveness: A Preliminary Examination*, 72 Center on Regulation and Competition Working Paper Series (June 2004); Simon J. Evenett, *Links Between Development and Competition Law in Developing Countries,* Case Studies for the World Development Report 2005: Investment Climate, Growth and Poverty, 7 (October 28, 2003) ("[I]n my view the conceptual arguments and the available empirical evidence by and large supports the view that promoting inter-firm rivalry enhances the dynamic economic performance of developing countries.").

[76] *See e.g.* World Bank, THE CHALLENGE OF DEVELOPMENT: WORLD DEVELOPMENT REPORT 1 (World Bank, Washington, DC 1991) ("Competitive markets are the best way yet found for efficiency organizing the production and distribution of goods and services. Domestic and external competition provides the incentives that unleash entrepreneurship and technological progress."); R. S. Khemani, *Competition Policy and Promotion of Investment, Economic Growth and Poverty Alleviation in Least Developed Countries,* FIAS Occasional Papers No. 19, 14 available at:http://www.cuts-ccier.org/pdf/IRPDF-02.pdf ("The World Bank's Global Economic Prospects Reports (2003) points to the pro-growth and pro-poor benefits of competitive markets."); *id*. at 14 ("[E]conomies with competitive domestic markets generally tend to have higher levels and rates of growth in per capita income. Entry of firms plays an important role in the competitive process. These economies also have lower rates of poverty and attract more domestic and foreign investment. This research is consistent with the broad empirical finding that barriers to competition impede innovation, growth, and prosperity.").

[77] Nickell, *supra* note 62, at 725.

studying the effect of competition on innovation and growth in developing countries is of particular importance. Before doing so, the next part of this paper will briefly illustrate the last strand of the argument reconciling both Schumpeterian and Darwinian positions into one theory that combines both sides of the debate.

3. A Combination of Both Theories: An Inverted U-shaped relationship between competition and growth[78]

The early pronouncements of an inverted U-shaped relationship between competition and growth are found in Scherer[79], Levin, Cohen and Mowery's[80] and other studies.[81] Scherer argues that "more competition accelerates innovation within limits, but when competition becomes so intense that any given rival can anticipate appropriating only a small share of the innovation's benefit, sill more competition retards innovation."[82]

This theory was further developed by Aghion et al. in 2002.[83] The authors of this study develop a Schumpeterian growth model in which firms innovate step-by-step, and where both technological leaders and their followers engage in R&D activities. In their model, competition increases the incremental profits from innovation, but also reduces innovation incentives for laggards. They show with empirical support that the relationship between product market competition and innovation follows an inverted U-shape.

The theory presented in Aghion and Howitt explains that at any point in time, there will be two kinds of intermediate sectors in an economy.[84] First, level or neck-and-neck sectors will be present when firms are at a technological par with one another. Second, unlevel sectors will be present when one firm is a leader and lies one step ahead of its competitor, the laggard or follower, in the same industry.

Two assumptions are made: (1) knowledge spills over between the two firms in any intermediate industry so that no one firm can get more than one technological step ahead of the other firm; and (2) if a firm that is already one step ahead of the other innovates, the lagging firm will automatically learn to copy the leader's technology and thereby remain only one step behind the innovating firm.[85] Therefore, the follower firm can move one step ahead without spending anything on R&D by copying the leader's technology. Because of

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[78] This part draws heavily on Aghion and Howitt, *supra* note 9, at 267-283. See *id.* for the modeling of the theory presented here. The same theory is presented in Aghion et al., *supra* note 20; and in Aghion and Griffith, *supra* note 14.

[79] F.M. Sherer, *Market Structure and the Employment of Scientists and Engineers,* 57(3) AM. ECON. REV. 524 (1967).

[80] R. Levin, W. Cohen, and D. Mowery, *R&D Appropriability, Opportunity, and Market Structure: New Evidence on Some Schumpeterian Hypotheses,* 75 AM. ECON. REV. PROC. 20 (1985).

[81] For a discussion of the early literature, *see* W. Cohen and R. Levin, *Empirical Studies of Innovation and Market Structure,* in HANDBOOK OF INDUSTRIAL ORGANIZATION Vol. 2 1059, 1075 (1989).

[82] F. M. Scherer, INNOVATION AND GROWTH: SCHUMPETERIAN PERSPECTIVES 127 (1984); F.M. Scherer, INDUSTRIAL MARKET STRUCTURE AND ECONOMIC PERFORMANCE 369-370 (2nd ed., 1980).

[83] Aghion et al., *supra* note 20.

[84] Aghion and Howitt, *supra* note 9, at 269.

[85] *Id.*

this assumption of automatic catch-up, a leader cannot gain further advantage by innovating.

In the level sectors, firms engaged in open price competition with no collusion would push the price down to marginal cost resulting in zero profits. When competition increases in level sectors, this induces the firms to innovate in order to escape from a situation in which competition constrains profits, this the authors call an *escape-competition* effect.[86] Therefore, in level sectors, competition has a positive effect on innovation.

In unlevel sectors, the Schumpeterian effect prevails as the leader cannot gain any further advantage by innovating because a follower, who is able to automatically catch up with the rival by innovating, can now capture the rents previously enjoyed by the leader thus reducing the leader's rents. Also, the rents that can be captured by the follower who succeeds in catching up with its rival by innovating are reduced. In such sectors an increase in competition will discourage innovation.[87]

Because of these effects, an increase in product market competition will have an ambiguous effect on growth. It will induce faster productivity growth in currently level sectors and slower growth in currently unlevel sectors. Thus, the overall effect on growth will depend on the (steady-state) fraction of level versus unlevel sectors.[88]

The inverted-U shape results form a "composition effect" whereby a change in competition leads to a change in the steady-state fraction of the sectors. When competition is low, firms are usually found to operate in a level state. This is because the industry will be quick to leave the unlevel state (which happens as soon as the laggard innovates) and slow to leave the level states (which will not happen until one of the neck-and-neck firm innovates).[89]

For the few firms operating in the level state, there is not much incentives for these firms to innovate until competition increases. Higher competition reduces pre-innovation rents to a larger extent in neck-and-neck sectors where firms are initially more technologically similar.[90] Especially in these sectors, an increase in competition will encourage firms to innovate so that they can "escape the competitor". This reduces the expected time interval during which an industry stays neck-and-neck. Aghion and Griffith explain that the higher the average proportion of neck-and-neck industries in the economy, the stronger the "escape competition" effect on average growth which leads to the positive part of the inverted-U relationship.[91] When competition increases, this results in a faster average innovate rate.

According to the theory, when competition increases it also increases the the average technological distance between leaders and followers. More product market competition leads to the decrease of the average degree of neck-and-neckness. This results in the industry moving to an unlevel state. Here, the Schumpeterian effect prevails, which causes the negative part of the inverted-U relationship between competition and growth.[92]

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[86] *Id.* at 272.
[87] *Id.* at 271.
[88] *Id.* at 272.
[89] *Id.* at 273.
[90] Aghion and Griffith, *supra* note 14, at 52.
[91] *Id.*
[92] *Id.*

Because of the presence of these two effects, the overall relationship between product market competition and innovation has an inverted-U shape.[93] The escape competition effect dominates initial levels of competition, whereas the Schumpeterian effect dominates at higher levels of product market competition.[94] In other words, at lower levels of competition the escape competition effect prevails up to a certain level of product market competition, where a further increase in competition will lead to the presence of the Schumpeterian effect.

Another way to look at the inverted-U relationship between competition and growth is discussed in the context of entry. Aghion and Howitt argue that increased entry and the threat of entry enhance innovation and productivity growth "not just because these are the direct result of equality-improving innovations by new entrants, but also because the threat of being driven out by a potential entrant gives incumbent firms an incentive to innovate in order to escape entry."[95] This is very similar to the *escape-competition* effect discussed above.

They go on to argue that the escape-entry effect is particularly strong for firms close to the world technology frontier. Whereas, for firms further behind the frontier, "the dominant effect of entry threat is a 'discouragement' effect that works much like the Schumpeterian appropriability effect."[96] They further postulate that "*increasing the threat of product entry (e.g., through trade liberalization) encourages innovation in advanced firms and discourages it in backward firms."*[97]

By analogy, this would mean that the effect of competition on growth depends on the steady-state fraction of advanced versus backwards firms and industries. Increasing competition in countries with more advanced firms and industries would have a positive effect on innovation and growth growth, whereas increasing competition in countries with more backward firms would have a negative effect on innovation and growth. The following sets the stage to empirically test these theories.

III. EMPIRICAL SETTING: MEASUREMENTS AND DATA

To empirically test the effect of competition on growth, the study uses measures to quantify competition and growth. The next part illustrates how each of these measurements is quantified. Then the datasets used to obtain these values are introduced.

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[93] Aghion et al., *supra* note 20.
[94] Aghion and Griffith, *supra* note 14, at 52.
[95] Aghion and Howitt, *supra* note 9, at 275-276.
[96] *Id.* at 276.
[97] *Id.* at 278 (emphasis in original) ("The higher the threat of entry, the more instrumental innovations will be in helping incumbent firms already close to the technological frontier to retain the local market. However, firms that are already far behind the frontier have no chance to win over a potential entrant. Thus, in that case, a higher threat of entry will only lower the expected net gain from innovation, thereby reducing ex ante incentives to invest in innovation.").

1. Measurements

A. Measuring Product Market Competition

Empirical studies have utilized an array of measurements of the degree of product market competition. Commonly used measurements are: market shares, concentration indices, the Herfindahl index, price-cost margins, and relative profit differences[98].

This study uses price-cost margin (PCM), which is a measure of pricing power that proxies competitive pressure in an industry. The advantages of price-cost margins as a way to measure competitive pressure over other indicators such as market shares or a Herfindahl or concentration index is that to measure any of those indicators one needs to define both the product and the geographic market in which the firm operates. This is often difficult or misleading given that many firms operate in international markets.[99] Dani Rodrik has argued that there is "ample evidence for the developing countries that concentration ratios are positively correlated with the measured levels of profits. […] Typically, measures of concentration are found to be a statistically significant determinant of "profitability" - measured as price cost margins or rates of return on capital - once the appropriate controls are introduced."[100]

Measuring pricing power, as a way to measure competitive pressure, is provided by the size of the markup of price over marginal cost of production. Price cost margins would be equal to zero in the ideal case of perfect competition.[101] Given the difficulty of measuring marginal cost of production, the way pricing power in an industry is computed in this study follows Aghion et al. by means of a proxy of the Lerner index,[102] which is a measure of rents, as used by Nickell.[103] This proxy of the Lerner index employed here is given by the differential between value added and the total wage bill as a proportion of gross output:

$$PCM = \frac{ValueAdded - TotalWages}{Output} \tag{1}$$

Capital is not included in the calculation of PCM in this study as indicted by equation (1). This is due to the lack of data on capital stock in the database used. Calculating markups without capital is in line with the measurement of PCM used by Aghion et al.[104]

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[98] Jan Boone, Rachel Griffith, and Rupert Harrison, *Measuring Competition*, AIM Research Working Paper Series (2005); Jan Boone, *A New Measure to Competition*, 118 ECON. J, 1245 – 1261 (Aug., 2008).
[99] Aghion and Griffith, *supra* note 14.
[100] Dani Rodrik, *Imperfect Competition, Scale Economies, and Trade Policy,* in TRADE POLICY ISSUES AND EMPIRICAL ANALYSIS 109, 113 (Robert E. Baldwin ed., 1988).
[101] In actual calculations it can be negative when the firms are loss making.
[102] Aghion et al, *supra* note 20; and Philippe Aghion, Matias Braun and Johannes Fedderke, *Competition and Productivity Growth in South Africa*, 16(4) ECON. TRANSITION 741, 748 (2008).
[103] Nickell, *supra* note 62.
[104] Aghion et al, *supra* note 20.

It is however important to note that the measurement that proved a more robust representation of competitiveness is the relative profit differences (RPD).[105] Comparing the performance of different measurements used to capture product market competition, Boone et al. find that the relative profit measure performs well. Their research concludes that the Herfindal index performs "the worst" of the measurements used to assess the degree of competition. As for the usefulness of price-cost margins as a measure of degree of competition the authors find that the new measure of RPD is significantly and positively correlated with the price-cost margin in about half of the industries they examined.[106] However, they state that RPD as a measure of competitiveness "gets it right more often" and they suggest that concerns about the price-cost margin as a measure of competition may have practical importance.[107]

It is also important to note that interpreting the variation of price-cost margins to mean a variation of dominance, where higher PCM means higher market dominance, is not always true. Higher PCM could be a result of efficiency and not necessarily market power.[108]

This efficiency could be due to either scale economies or absolute cost differences. Therefore, variation in PCM may be a result of variation in the cost of production and the size of the firm and not necessarily related to the market dominance because "[…] even if concentrated industries exhibit higher rates of return, it is difficult to determine whether it is efficiency or monopoly power that is at work."[109] Similarly, because average costs rather than marginal costs are used here to calculate margins, a variation in margins could be due to the difference between large fixed costs and variable costs or higher fixed costs (not marginal costs) and not necessarily due to higher degrees of market dominance.

B. Measuring Growth

This study uses labor productivity growth as the measurement of growth. Labor productivity growth is also commonly used as a measurement for technological progress or dynamic efficiency, which is broadly defined in terms of productivity growth through innovations.[110] By using this measurement for growth, the analysis incorporates dynamic efficiency or innovation in line with the evidence presented above that innovation is considered a central driving force for overall growth levels.[111] By capturing innovation within the growth measurement used, the analysis extends the effect of competition on innovation, which is central to development.[112]

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[105] Boone, *supra* note 98.
[106] Boone et al., *supra* note 98, at 2.
[107] *Id.* at 13.
[108] Demsetz, *supra* note 45, at 3.
[109] Demsetz, *supra* note 45, at 6.
[110] Scherer, *supra* note 40, at 1001 ("[T]he rate of technological progress, as manifested for example in labor productivity growth rates.").
[111] Sanghoon Ahn, *Competition, Innovation and Productivity Growth: A Review of Theory and Evidence,* OECD Economic Department Working Papers No. 317, 4 (Jan., 2002) ("'Productive (or, technical) efficiency' gains come from productivity-enhancing innovations which introduce new and better production methods, and successful innovations will eventually raise the level and growth rate of productivity in the long-run (i.e., 'dynamic efficiency' gains).").
[112] Waked, *supra* note 3.

Productivity is a measure of how efficiently goods and services are produced. Labor productivity is one of the most important determinants of a country's per capita income over the longer term. Increasing labor productivity growth in a country increases wealth and contributes to a superior standard of living. Labor productivity growth is driven by human and physical capital, as well as innovation and technological progress. Therefore, changes in labor productivity growth within industries are used as a proxy for these industries overall growth rate.

Labor productivity growth is calculated following Scherer as given by equation (2) as the difference between the log of value added over employees and the lag of the log of value added over employees:[113]

$$\Delta LPgrowth = \ln\left(\frac{ValueAdded}{Employees}\right)_t - \ln\left(\frac{ValueAdded}{Employees}\right)_{t-1} \quad (2)$$

2. Data

To define which countries are considered developing, this research relied on the 2006 World Bank classifications based on gross national income per capita (GNI/capita). Using the World Bank Atlas Method, countries that fall within these following 3 categories are considered developing: Lower Income Economies (per-capita income of $975 or less), Lower Middle Income Economies (per-capita income of $976 - $3,855), and Upper Middle Income Economies (per-capita income of $3,856 - $11,905). Countries that satisfy this criterion amount to 150. (Figure A.0 shows a map illustrating countries according to their income distribution).

The UNIDO International Industry Statistics database is used to to calculate both price-cost margins using equation (1) and labor productivity growth using equation (2). Amounts are in current US dollars. Table A.1 lists all the variables obtained from the dataset and used to calculate both equations.

Two datasets from this UNIDO database are utilized. The first is the UNIDO's INDSTAT4 2011 ISIC Rev.3 database containing time series data for the period 1990 to 2008 for 127 countries. The data are arranged at the 3- and 4-digit level of the International Standard Industrial Classification of All Economic Activities (ISIC). The study uses the 3-digit data for this dataset's 24 industries in 69 developing countries and 20 developed countries. Table A.2 lists the industries included in this database. Table A.3 reports the averages and standard deviations of labor productivity growth and PCM for total manufacturing industries calculated using this dataset in 69 developing countries. Table A.4 reports the same for 20 developed countries studied.

The second dataset used is the UNIDO's INDSTAT3 2006 Rev.2 dataset containing 3-digit level data for the period 1963-2006 for 180 countries. This database was discontinued by UNIDO in 2007 as countries moved to the newer revision of the code. The

[113] F.M. Scherer, *Inter-Industry Technology Flows and Productivity Growth*, 64(4) REV. ECON. & STAT. 627, 629 (1982); *see also* Aghion, et al., *supra* note 102, at 748 ("Real labor productivity growth is measured as the growth rate of real local currency value added per worker."). In this study, instead of real local currency - USD is used.

study uses the data for this dataset's 28 industries in 47 developing countries (Table A.5 lists the industries included in this database). Given that this dataset covers more years than the more updated 2011 dataset, it is utilized to see whether the same relationships hold when a longer time frame is investigated. All values for year 1963 are dropped from the analysis given data inconsistencies. Table A.6 reports the averages and standard deviations of labor productivity growth and PCM for total manufacturing industries calculated using this dataset in 47 developing countries.

IV. DESCRIPTIVE ANALYSIS

This part descriptively analyzes the relationship between labor productivity growth and price-cost margins, proving competition, for developing and developed countries' manufacturing industries.

Tables A.3 and A.6 summarize average labor productivity growth levels and price cost margins for total manufacturing industries across developing countries using the periods from 1990-2008 and 1963-2006, respectively. Table A.4 summarizes labor productivity growth levels and PCM for total manufacturing industries across 20 developing countries.

The average markups in developing countries are higher than their counterparts in developed countries, which is an expected finding given the higher concentration levels developing countries are known for.[114] Out of the 20 studied developed countries, the one with the highest average markup is Qatar (0.489), followed by the US (0.334) and Korea (0.309). The developed country with the lowest average markup is Germany (0.122), followed by France (0.127) and Norway (0.135). As for the developing countries with the highest average markup, using the 1990-2008 period, Armenia (0.555) is on top of the list, followed by Suriname (0.427) and Ethiopia (0.383). Those with the lowest markups using the same dataset are Macedonia (0.093), Lithuania (0.117) and Senegal (0.121).

As to the relationship between markups and growth, Figure 1 shows the two-way interaction between PCM (lagged by one year) and labor productivity growth rates for all manufacturing industries in 69 developing countries using data for the period 1990-2008. As can be seen from the figure, there is a negative relationship between margins and growth. This is supportive evidence that higher markups, i.e. lower product market competition, results in lower labor productivity growth levels. Figure A.1 illustrates the relationships using the same dataset for some selected developing countries. It also shows the same negative trend depicted in Figure 1.

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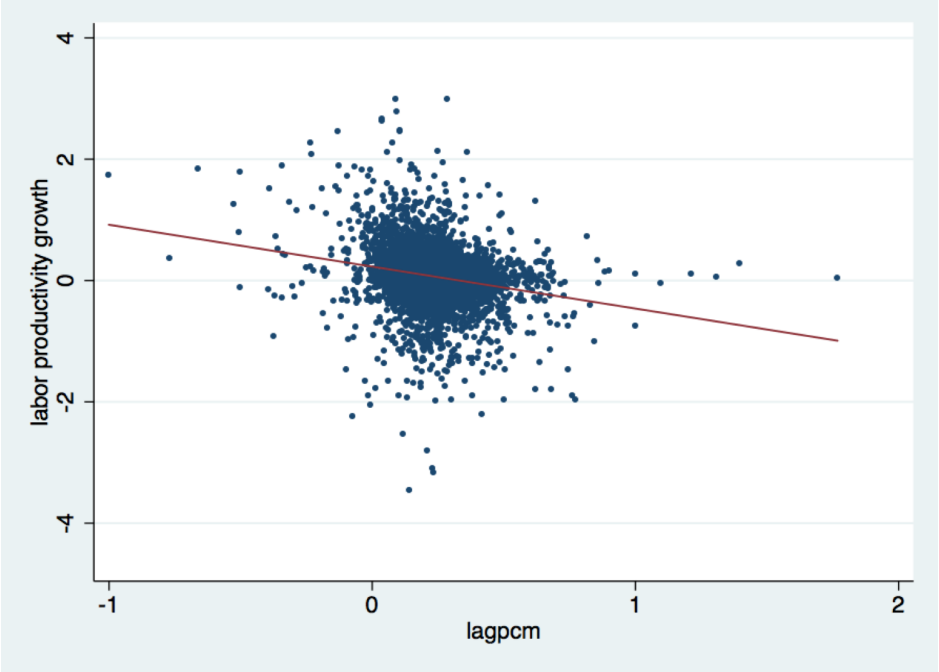
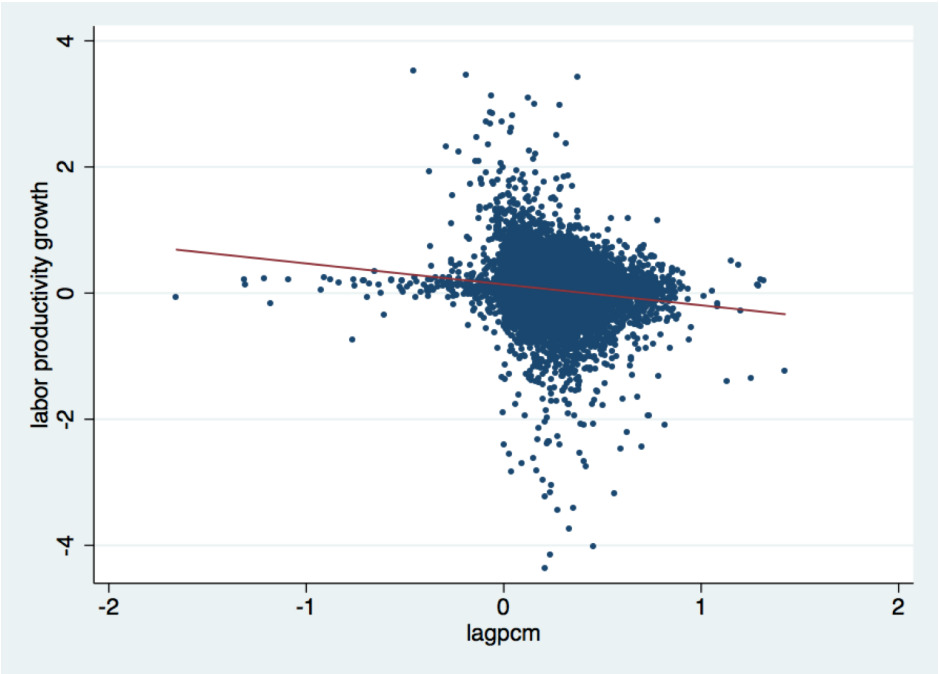
[114] *See e.g.* Todd Mitton, *Institutions and Concentration*, 86(2) J. DEV. ECON. 367, 367 (2008) ("In a new dataset of 1.3 million firms in 155 countries, I establish a number of regularities in cross-country differences in economic concentration. Concentration of sales and employment is substantially higher in smaller countries and in less-developed countries."); Michal S. Gal, *Size Does Matter: The Effect of Market Size on Optimal Competition Policy*, 74 S. CAL. L. REV. 1437, 1445 (2001) (the author argues that because of the low demand and the need for firms to achieve minimum efficient scale of production (MES) to be able to operate efficiently (at lowest cost), the market will not be able to support more than a few number of firms); Paul Cook, *Competition Policy, Market Power and Collusion in Developing Countries,* 33 Center on Regulation and Competition Working Paper Series 3, 16 (December 2002) ("Concentration levels are higher in developing countries than in industrialized countries.").

Figure 1. TWO-WAY INTERACTION BETWEEN THE LAGGED VALUE OF PRICE COST MARGINS (PCM) AND LABOR PRODUCTIVITY GROWTH IN 69 DEVELOPING COUNTRIES MANUFACTURING INDUSTRIES (1990-2008)



Note: This graph uses UNIDO's INDSTAT4 2011 data.

Figure 2. TWO-WAY INTERACTION BETWEEN THE LAGGED VALUE OF PRICE COST MARGINS (PCM) AND LABOR PRODUCTIVITY GROWTH IN 47 DEVELOPING COUNTRIES MANUFACTURING INDUSTRIES (1963-2006)

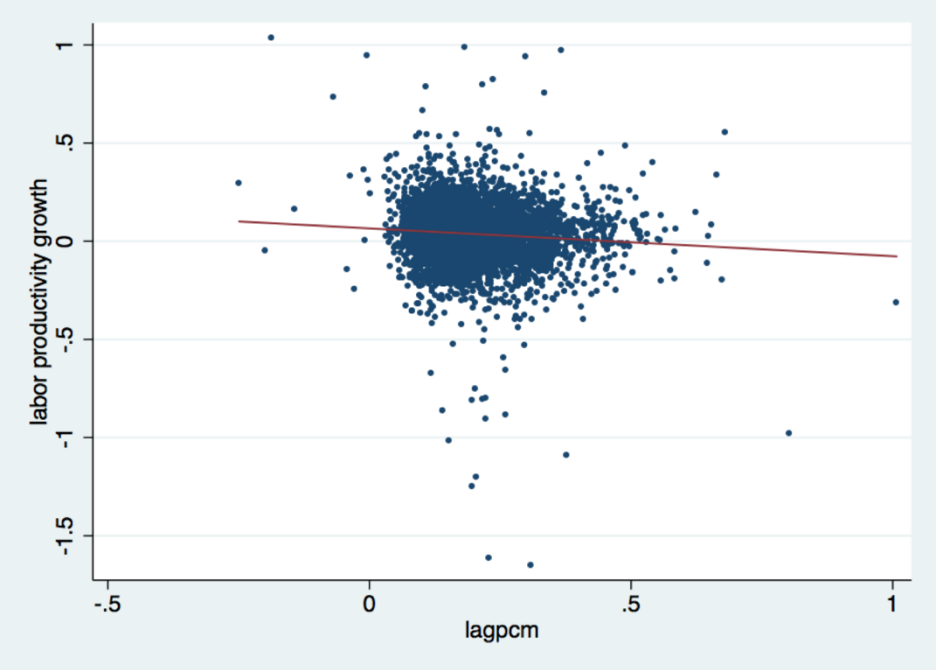


Note: This graph uses UNIDO's INDSTAT3 2006 data.

Figure 2 shows that the same negative trend holds when using the UNIDO's Industrial Statistics Database of 2006 covering a much longer period (1963-2006). Similarly, Figure A.2 shows that one continues to observe a negative relationship between the lagged values of price cost margins and labor productivity growth levels across selected developing countries using the longer time frame.

Figure 3 shows that the same negative relationship between the lagged value of price cost margins and labor productivity growth holds for developed countries. It affirms that the negative relationship between markups and labor productivity growth is not a unique phenomenon for developing countries. Also, Figure A.3 shows that when isolating the effects for some developed countries one observes the same negative relationship.

Figure 3. TWO-WAY INTERACTION BETWEEN THE LAGGED VALUE OF PRICE COST MARGINS (PCM) AND PRODUCTIVITY GROWTH IN 20 DEVELOPED COUNTRIES MANUFACTURING INDUSTRIES (1990-2008)



Note: This graph uses UNIDO's INDSTAT4 2011 data.

Despite the apparent negative relationship between the lag of PCM and labor productivity growth, the depicted graphs are not sufficient evidence to draw conclusions about this relationship. The reason why the figures are inconclusive in terms of the relationship between PCM and labor productivity growth is due to the possibility that there might be contemporaneous shocks affecting both margins and growth. In order to isolate the relationship between PCM and labor productivity growth certain restrictions need to be taken into consideration, such as controlling for time-series correlation and country and industry specific characteristics.

The graphs merely represent the correlation between PCM and labor productivity growth but cannot isolate the effects of other factors affecting them. To be able to identify the relationship between markups and growth, a more rigorous framework was needed, and

it was essential to empirically study this relationship by utilizing panel data estimation techniques to arrive at conclusions as to how PCM influences labor productivity growth. This was tested by regressing labor productivity growth on the lag of PCM as detailed in the next part of the paper.

V. EMPIRICAL METHODOLOGY

This part introduces the empirical methodology used to test which of the theories presented above is more suitable to describe the relationship between competition and growth in developing countries.

The specifications of the model used to empirically test the effect of product market competition on labor productivity growth is given by:

$$LPgrowth_{jit} = \alpha + \beta PCM_{jit-1} + I_j + I_i + I_t + \varepsilon_{jit} \quad (3)$$

where $LP\text{growth}_{jit}$ measures labor productivity growth in country *j,* industry *i* at time *t,* PCM_{jit-1} is the lagged markups of country *j,* industry *i* at time *t* used as a measure of competitive pressure*,* I_j stands for country fixed effects, I_i stands for industry fixed effects and I_t for year fixed effects.

To see whether the relationship between competition and growth follows an inverted U-shaped graph, as predicted by Aghion et al.[115] a quadratic term (the square of PCM) is added to the right hand side of equation (3).

Using fixed-effects panel data framework, the attempt is to isolate the impact of competition on the *level* of labor productivity growth. What the results illustrate is the impact of changes in the level of competition on changes in productivity.

Using the country fixed-effects model "controls for all time-invariant differences between the [countries], so the estimated coefficients of the fixed-effects model cannot be biased because of omitted time-invariant characteristics..[like culture, religion, race, etc.]."[116] Also, using fixed-effects captures unobserved individual heterogeneity across countries. "The key insight is that if the unobserved variable does not change over time, then any changes in the dependent variable must be due to influences other than these fixed characteristics." [117] In other words, using fixed effects controls for the unobserved heterogeneity by adding a dummy variable for each country and thus helps estimate the pure effects of the independent variables on the dependent ones. These dummy variables help absorb the effects particular to each country.

Using time fixed effects shields the results from the effects that unexpected variation or special events may have on labor productivity growth over time. Industry fixed effects shield the results from other industry characteristics that may affect PCM but are not observed**.** For example, the difference between marginal and average cost may be different across industries because of their various economies of scale. Another such

[115] Aghion et al., *supra* note **Error! Bookmark not defined.**.
[116] Kohler, Ulrich, Frauke Kreuter, DATA ANALYSIS USING STATA 245 (Stata Press: 2nd ed. 2009).
[117] James H. Stock and Mark W. Watson, INTRODUCTION TO ECONOMETRICS 289-290 (Addison Wesley 2nd ed. 2003).

characteristic is the exclusion of financial cost from the PCM measurement used here which might have different effects across industries. If labor productivity growth is correlated with these characteristics or time special events, then using ordinary least square (OLS) regressions without restrictions will suffer from omitted variable bias and would lead to spurious correlation between PCM and growth. Assuming that these characteristics are time-invariant, then fixed effects regression will eliminate omitted variable bias.

These fixed effects basically control for country, industry and time specific unobservable factors that may be correlated with labor productivity growth. For example, it is unlikely that product market competition is the single major determinant of labor productivity growth in a country or industry. Other factors such as infrastructure, skills, or technological opportunity may play a more important role.

A problem that might arise when trying to identify the effect of product market competition on labor productivity growth is endogeneity and direction of causality. It may be the case that labor productivity growth is affecting competition and not the other way round. This reverse causality can be controlled for by instrumenting margins with instrumental variables, that provide exogenous variation and affect labor productivity growth only though their effect on product market competition. Instrumenting margins with import penetration "turned out not to be a good instrument in most cases."[118] . Contrastingly, using 'product market reforms' has yielded a good instrumental variable,[119] but due to its unavailability and the lack of a proper IV for the dataset at hand, the results of the regressions in this study should be interpreted cautiously.

In an attempt to partly address the endogeneity problem, price-cost margins are lagged by one year. Moreover, lagging PCM assumes that their effect take time to impact the level of growth. In the absence of lags, the assumption is that this years markups are directly responsible for this years growth levels, which is a difficult assumption to make. When using the lags, the assumption of instant effects is relaxed in favor of one that predicts that this years markups affect next years growth levels. Lagging PCM by two years did not change the results obtained and presented below.

The observations are not assumed to be independent within each country so the significance levels are computed using errors that are clustered at the country level. The data is likely to show various sorts of cross-sectional and temporal dependencies, which can lead to biased statistical inference. Therefore, to avoid ignoring the possible correlation of regression disturbances and to ensure the validity of statistical results, the coefficient estimates are adjusted by clustering at the country level. Clustering relaxes the assumption of independent errors, allowing for arbitrary correlation between errors within *clusters,* here countries, of observations.[120] This approach is robust to arbitrary heteroskedasticity.[121] The results are also tested for clustering at both the country and industry levels.

The parameters of interest are the β coefficients. The inclusion of country, industry, and year dummies means that the β coefficients are identified using differential variation over time within industries, within countries. If product market competition, measured using markups spurs innovation and growth, the β coefficients are expected to be negative.

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[118] Aghion et al., *supra* note 102, at 758.
[119] Griffith et al., *supra* note 57.
[120] Christopher F. Baum, Austin Nichols and Mark E. Schaffer, *Evaluating One-way and Two-way Cluster-robust Covariance Matrix Estimates,* BOS'10 Stata Conference Presentation (July 2010).
[121] *Id.*

Figures 1-3 in the descriptive part above showed that growth and markups are moving in opposite directions. The empirical part is expected to affirm this negative impact of PCM on growth. The results are presented in the next part of the paper.

VI. RESULTS AND DISCUSSION

Table 1 shows the results of the empirical analysis by regressing labor productivity growth on the lag of price cost margins using the UNIDO's 2011 dataset for 69 developing countries and 24 industries over the period 1990-2008. If we expect the escape competition effect to prevail, whereby competition induces innovation and growth, then we would expect a negative relationship between PCM and growth. Column (1) reports the result only controlling for country fixed effects. Column (2) adds year fixed effects and column (3) adds industry fixed effects. For columns (1) to (3) the errors are clustered on country. Finally, column (4) clusters the errors on both country and industry.[122] As discussed in the previous section, adding country, year and industry fixed effects controls for unobserved heterogeneity across countries, industries and years.

Table 1. MARGINS AND GROWTH IN 69 DEVELOPING COUNTRIES (UNIDO'S INDSTAT4 2011, 1990-2008)

Dependent Variable: Labor Productivity Growth				
	[1]	[2]	[3]	[4]
Price Cost Margin *t*-1	-0.869 (0.133)***	-0.878 (0.131)***	-1.039 (0.153)***	-1.039 (0.144)***
Country Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	No	Yes	Yes	Yes
Industry Fixed Effects	No	No	Yes	Yes
Constant	0.343 (0.023)***	-0.243 (0.036)***	0.021 (0.111)	0.430 (0.092)***
R2	0.10	0.14	0.15	0.15
N	6,799	6,799	6,799	6,799

Notes: Significance levels: * $p<0.1$; ** $p<0.05$; *** $p<0.01$. Errors in brackets are clustered at the country level, except for column [4] where the errors are clustered at both the country and industry levels.

The results show, across all four columns of Table 1, that an increase in PCM negatively impacts labor productivity growth. All the coefficients of PCM are negative and significant at the 1% level. The fact that across all four columns the coefficients of PCM are negative and significant testifies to the robustness of this relationship. This suggests that product market competition positively impacts labor productivity growth. This result affirms that when looking at a linear relationship between product market competition and labor productivity growth the escape competition effect generally dominates. The escape

[122] Table 2 and Tables A.7-10 use the same specifications for their columns (1) to (4).

competition effect, as presented before, argues that an increase in product market competition encourages innovation and fosters growth, which is verified by the results presented here in Table 1. It proves, with empirical backing, that competition stimulates innovation and growth for developing countries. By doing that, it supports the Darwinian claims made above about the merits of competition and its positive impact on growth and development.

Directly interpreting the coefficients from Table 1 to assess the impact of PCM on labor productivity growth is problematic given that the values for labor productivity growth are logged while the nominal values for PCM are used. Due to this measurement difference a direct interpretation of the coefficients is not possible. Therefore, an alternative methodology is employed to quantify the impact of margins on labor productivity growth, namely calculating the marginal effects.[123]

Using this methodology to assess the impact of increasing PCM on labor productivity growth using the specifications given in column (3) of Table 1 shows that when the mean PCM of 0.22 increases by 10% labor productivity growth decreases by 2.29% per year. The magnitude is quite significant, showing that price-cost margin plays a significant impact on the level of growth in developing countries' manufacturing industries. It would erode the growth levels of many of the industries studied.

The results are very similar to the ones found in Aghion et al. where the authors find for a 115-world sample that a 10% increase in PCM reduces labor productivity growth by 2.4% per year.[124]

Table A.7 reports the results obtained by regressing labor productivity growth on the lag of price cost margins using the UNIDO's 2006 dataset for 47 developing countries and 28 industries over the period 1964-2006. The results are much weaker than the ones obtained using the more recent dataset and reported in Table 1. The coefficients are negative and significant only at the 10% level in column (1) and (4). Column (1) reports the results of the regression without year and industry fixed effects. Whereas, column (4) reports the results using country, industry and year fixed effects and clustering the errors at both the industry and country levels. Obtaining a significant and negative result in column (4) might be the most telling relationship, given that the specifications of the model used in column (4) are more restrictive than the ones reported in the first three columns of the table. Despite the weakness of these results, they do show that the relationship is still negative when a longer time period is investigated.

A negative and significant relationship between markups and growth is also found regressing labor productivity growth rates on the lag of PCM in 20 developed countries as reported in Table A.9. The coefficients are negative and significant at the 1% level across all columns of the table. This affirms that the positive relationship between competition and growth holds also for developed countries.

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[123] Calculating marginal effects (or partial effects) computes the predicted values of the dependent variable at specific values of the independent variables. These predicted values are estimate values of labor productivity growth given specific values of the lag of PCM. The first step is to calculate the estimated value of labor productivity growth given the mean of the lag of PCM. The second step is to increase the mean of PCM by 10% and then to predict the new value of labor productivity growth given the increased PCM value. Comparing the two predicted values of labor productivity growth, the first when PCM was at its mean and the second when the mean value of PCM was increased by 10%, illustrates the impact an increase of PCM by 10% has on labor productivity growth.

[124] Aghion et al., *supra* note 102, at 758.

Calculating the marginal effects for developed countries, shows that when their mean margin of 0.20 increases by 10%, labor productivity growth falls by slightly less than 0.96%. This magnitude is significantly lower than for developing countries, indicating that the effect of increasing competition on growth has a stronger impact in developing countries than in developed ones.

Table 2 reports the results when regressing labor productivity growth on both PCM and on the square of PCM. The reason why the square of PCM is included in the regression is to test the non-linear relationship between markups and growth, i.e. testing for the inverted U-shaped relationship predicted by Aghion et. al.[125] If the regressions report a significant and positive relationship between labor productivity growth and PCM-squared then the existence of an inverted U-shaped relationship can be supported by the data at hand.[126] As predicted by Aghion et al., the relationship between margins and productivity is indeed U-shaped as the coefficients for the squared markups are significant and positive across all columns in Table 2.

Table 2. MARGINS AND GROWTH IN 69 DEVELOPING COUNTRIES TESTING FOR NON-LINEAR RELATIONSHIPS (UNIDO'S INDSTAT4 2011, 1990-2008)

Dependent Variable: Labor Productivity Growth				
	[1]	[2]	[3]	[4]
Price Cost Margin *t*-1	-1.120 (0.189)***	-1.145 (0.189)***	-1.310 (0.213)***	-1.310 (0.248)***
(Price Cost Margin *t*-1)^2	0.484 (0.227)**	0.517 (0.226)**	0.523 (0.256)**	0.523 (0.299)*
Country Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	No	Yes	Yes	Yes
Industry Fixed Effects	No	No	Yes	Yes
Constant	0.367 (0.027)***	0.023 (0.119)	0.026 (0.119)	0.214 (0.078)***
R2	0.11	0.15	0.16	0.16
N	6,799	6,799	6,799	6,799

Notes: Significance levels: * $p<0.1$; ** $p<0.05$; *** $p<0.01$. Errors in brackets are clustered at the country level, except for column [4] where the errors are clustered at both the country and industry levels.

Table A.8 reports the results using the UNIDO's INDSTAT3 2006 dataset for 47 developing countries investigating the non-linear relationship between competition and growth. In Table A.8 there is no evidence of the existence of the inverted U-shaped relationship. All the coefficients for PCM-squared are not significant. This shows that the evidence of the existence of a U-shaped relationship is not robust across different datasets.

As for the same investigation using the developed country data, Table A.10 also shows that for developed countries the data does not support such an inverted U-shaped relationship between markups and growth. Here, the coefficients of PCM-squared are also not significant across the four columns of the table.

[125] Aghion et al., *supra* note 20.
[126] *Id.*

Despite the weak evidence for the existence of a U-shaped relationship between competition and growth in developing countries, an explanation for its existence might be that as competition increases in developing countries the distance between the laggard and the frontier firms increase, which leads to the existence of the Schumpeterian effect once competition increases beyond the initially low levels of competition where firms are more likely to be operating in a leveled state. It might also be read to mean, as predicted by the theory in Aghion and Howitt,[127] that firms further away from the technological frontier will be discouraged to innovate when competition increases, as they know they will not be able to catch up with the more advanced firms, and hence competition will lead to a negative impact on labor productivity growth. It is quite realistic to assume that a higher fraction of firms in developing countries are farther away from the technological frontier, than their counterparts in developed countries. Therefore, increasing competition in developing countries would lead to a Schumpeterian effect (the negative part of the U-shaped graph) after a certain threshold, whereas in developed countries this Schumpeterian effect will not take place, as a higher fraction of firms are closer to the technological frontier.

This is supported by the results in Table A.10, which clearly show that for developed countries the relationship between competition and growth does not follow an inverted U-shaped graph. The results in Table A.10 only confirm the positive relationship between competition and growth. This means that in the developed countries an increase in competition will only foster innovation and growth without constraints. When competition increases in developed countries, firms' incentives to innovate increases as well, which continues to have a positive impact on growth.[128]

VII. CONCLUSION

This paper analyzes the relationship between competition and growth to illustrate which market structure is more desirable to realize innovation and growth - a more competitive or a more concentrated one. Ample and often contradictory theories have addressed this relationship in both law and economics. This analysis is necessary to guide antitrust policy in developing countries – especially with regards to formulating an antitrust enforcement strategy that seeks to promote innovation, growth and development. The results of this study add to the rich debate surrounding whether competition is good or bad for growth. They supplement existing theories with empirical support to illustrate their validity in the context of the analysis chosen here.

The main results of the study are as following: First, using panel data estimation techniques, controlling for both country and year fixed effects, the results show that higher levels of competition, i.e. lower markups or PCM, are associated with higher levels of labor productivity growth. This affirms that competition is furthering growth. The impact of PCM on labor productivity growth in developing countries is remarkable; a 10% increase in PCM decreases labor productivity growth by almost 2.3%. Finding a robust and significant negative relationship between PCM and labor productivity growth points to the

[127] Aghion and Howitt, *supra* note 9, at 274-81.

[128] *Id.* at 281 ("Disregarding entry and competition was no big deal for Europe during the 30 years after WWII when European industries were still far behind their counterparts int eh US, yet now that Europe has come closer to the technological frontier, it needs to open up its markets in order to foster growth.").

advantage of policies promoting competitive markets and encouraging market entry. Therefore, pursuing higher competitive levels should be a goal of antitrust enforcement that is targeting higher growth levels. It casts some doubt on assumptions that developing countries need higher levels of concentration to achieve minimum efficient scale of production, and that they need to protect their national champions, to grow.[129]

Nonetheless, this is constrained by the second main finding of the paper, namely for the developing countries studied, when exploring a non-linear relationship between competition and growth, the results support the existence of an inverted U-relationship.[130] This cautions countries, desiring to achieve the highest growth potential, from furthering competition indefinitely, i.e. seeking the perfect competition textbook ideal. Empirical evidence, albeit weak, indicate the existence of an inverted U-shaped relationship between competition and growth.

This means that when competition is weak, an increase in competition will further growth, yet only up to a certain extent, after which more competition will be associated with lower growth levels. The turning point is unique to each industry and can be predetermined using empirical analysis. These results indicate that for competition enforcement to be considered efficient and growth promoting, it should aim at increasing the levels of competition but not in an absolute manner. In some countries, or specific industries, this is constrained by the Schumpeterian effect that dominates after a certain level of competition is already attained.

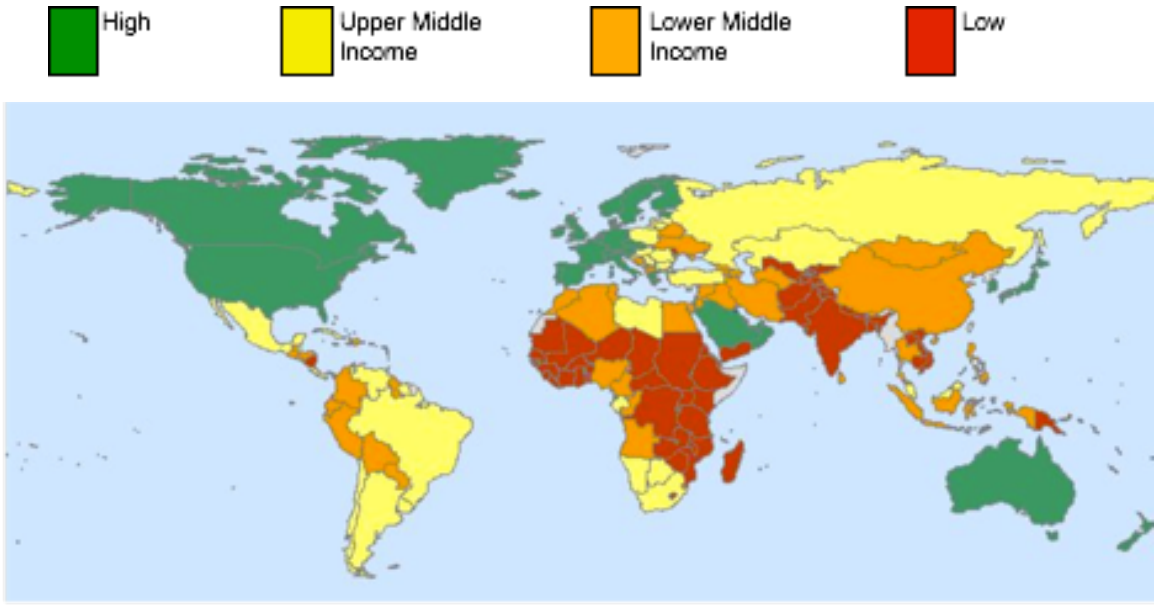
These findings have serious implications for antitrust enforcement. They encourage tailor-made policies and enforcement strategies that are specifically targeting the maximization of growth in each industry. They thereby discourage a one-size fit all antitrust policy, invite adapted assessment, and call for customized strategies that are not only unique to each country, but to each industry within a given country. This entails a strong critique against current practices that seek to align antitrust enforcement policy in developing countries with those in developed ones. Not only is there a mismatch between their levels of development and thereby their needs and capabilities, but also if growth and development is at the center of their agendas, then a uniquely fashioned antitrust policy is necessary.

Antitrust enforcers need to predetermine the balance between competition and concentration that would allow each industry to maximize their growth potential. In some industries a smaller number a firms would be necessary to maximize growth, in yet others more firms might be needed to achieve the same impact on growth. This analysis is helpful to put growth at the center of antitrust enforcement, in line with new thinking on the topic, and also in furtherance of a development agenda.

[129] *See e.g.* Gal, *supra* note 114.
[130] Aghion et al., *supra* note 20.

APPENDIX

Figure A.0. MAP OF COUNTRIES INCOME DISTRIBUTION IN 2006 BY GNI PER CAPITA US$



Source: World Development Indicators
Note: Countries considered developing in this research correspond to the colors: yellow, orange and red.

Table A.1 UNIDO'S INDSTAT DESCRIPTION OF VARIABLES

Variable	Definition	Source
Number of employees	The number of persons engaged is defined as the total number of persons who worked in or for the establishment during the reference year. However, home workers are excluded. The concept covers working proprietors, active business partners and unpaid family workers as well as employees. The figures reported refer normally to the average number of persons engaged during the reference year, obtained as the sum of the "average number of employees" during the year and the total number of other persons engaged measured for a single period of the year. The **number of employees** is including all persons engaged other than working proprietors, active business partners and unpaid family workers.	Four major sources have been used in compiling and cleaning the data contained in the UNIDO database. First, industry data reported in country questionnaires are included. National publications for industrial censuses, annual surveys and input-output tables are the second. Thirdly, international sources, both published and unpublished, have been used. Finally, a fourth source has been national data compiled by statisticians engaged by UNIDO to work in specific countries. Furthermore, the data have been supplemented with UNIDO estimates. Data for OECD member countries are collected by OECD through OECD/UNIDO joint country questionnaires and provided to UNIDO for inclusion in the database.
Wages and salaries	Wages and salaries include all payments in cash or in kind paid to "employees" during the reference year in relation to work done for the establishment. Payments include: (a) direct wages and salaries; (b) remuneration for time not worked; (c) bonuses and gratuities; (d) housing allowances and family allowances paid directly by the employer; and (e) payments in kind. Excluded are employers contributions in respect of their employees paid to social security, pension and insurance schemes, as well as the benefits received by employees under these schemes and severance and termination pay.	
Output	The measure of **output** normally reported is the census concept, which covers only activities of an industrial nature. The value of census output in the case of estimates compiled on a production basis comprises: (a) the value of all products of the establishment; (b) the net change between the beginning and the end of the reference period in the value of work in progress and stocks of goods to be shipped in the same condition as received; (c) the value of industrial work done or industrial services rendered to others; (d) the value of goods shipped in the same condition as received less the amount paid for these goods; and (e) the value of fixed assets produced during the period by the unit for its own use. In the case of estimates compiled on a shipment basis, the net change in the value of stocks of finished goods between the beginning and the end of the reference period is also included. Gross output is equivalent to census output plus the revenue from activities of a non-industrial nature. Valuation may be in factor cost, excluding all indirect taxes falling on production and including all current subsidies received in support of production activity, or in producers' prices, including all indirect taxes and excluding all subsidies.	
Value Added	The measure of **value added** normally reported is the census concept, which is defined as the value of census output less the value of census input, which covers: (a) value of materials and supplies for production (including cost of all fuel and purchased electricity); and (b) cost of industrial services received (mainly payments for contract and commission work and repair and maintenance work). If input estimates are compiled on a "received" rather than on a "consumed" basis, the result needs to be adjusted for the net change between the beginning and the end of the period in the value of stocks of materials, fuel and other supplies. Total value added is the national accounting concept. It is ideally represented by the contribution of the establishments in each branch of activity to the gross domestic product. For the measure of total value added, the cost of non -industrial services is deducted from and the receipts for non-industrial services are added to census value added. The estimates, whether in terms of census value added or total value added, may be gross of depreciation and other provisions for capital consumption. The	

Variable	Definition	Source
	valuation may be in factor cost or in producers' prices, depending on the treatment of indirect taxes and subsidies.	

Table A.2 INDUSTRIES IN UNIDO'S INDSTAT4 2011

Industries	
Basic chemicals	Other textiles
Beverages	Paper and paper products
Building and repairing of ships and boats	Printing and related service activities
Casting of metals	Processed meat, fish, fruit, vegetables, fats
General purpose machinery	Products of wood, cork, straw, etc
Grain mill products; starches; animal feeds	Publishing
Manufacturing n.e.c.	Rubber products
Medical, measuring, testing appliances, etc.	Special purpose machinery
Non-metallic mineral products n.e.c.	Spinning, weaving and finishing of textiles
Other chemicals	Struct. metal products; tanks; steam generators
Other food products	Tanning, dressing and processing of leather
Other metal products; metal working services	Transport equipment n.e.c.

Table A.3 DEVELOPING COUNTRIES' TOTAL MANUFACTURING INDUSTRY AVERAGES IN UNIDO'S INDSTAT4 2011 (1990-2008)

#	Country	Labor Productivity Growth			Price Cost Margins		
		# of Obs.	Average Value	Standard Deviation	# of Obs	Average Value	Standard Deviation
1	Albania	8	0.177	0.093	9	0.161	0.013
2	Argentina	9	-0.065	0.239	10	0.213	0.037
3	Armenia	3	0.213	0.122	4	0.555	0.068
4	Brazil	11	0.025	0.159	12	0.331	0.008
5	Bulgaria	11	0.109	0.168	12	0.137	0.027
6	Chile	5	0.212	0.208	6	0.367	0.051
7	China	4	0.187	0.037	5	0.220	0.003
8	Colombia	5	0.096	0.108	6	0.377	0.004
9	Croatia	0			0		
10	Czech Republic	12	0.104	0.103	13	0.158	0.011
11	Ecuador	12	0.062	0.512	13	0.335	0.071
12	Egypt	3	0.189	0.116	6	0.197	0.034
13	Estonia	14	0.180	0.094	16	0.154	0.032
14	Ethiopia	18	0.001	0.152	19	0.383	0.037
15	Fiji	2	0.119	0.074	3	0.145	0.012
16	Gambia	0			1	0.204	
17	Georgia	8	0.261	0.127	9	0.198	0.029
18	Ghana	0			1	0.290	
19	Hungary	15	0.103	0.109	14	0.167	0.025
20	India	9	0.106	0.095	10	0.154	0.010
21	Indonesia	9	0.152	0.141	10	0.307	0.023
22	Iran	11	0.036	0.442	12	0.306	0.015
23	Iraq	0			0		
24	Jordan	14	0.064	0.122	15	0.235	0.022
25	Kazakhstan	0			0		
26	Kenya	8	0.078	0.090	9	0.190	0.022

#	Country	Labor Productivity Growth			Price Cost Margins		
		# of Obs.	Average Value	Standard Deviation	# of Obs	Average Value	Standard Deviation
27	Kyrgzstan	8	0.131	0.266	10	0.195	0.044
28	Lao	0			1	0.301	
29	Latvia	14	0.141	0.175	15	0.229	0.046
30	Lithuania	8	0.162	0.123	9	0.117	0.021
31	Malawi	2	-0.057	0.101	3	0.262	0.027
32	Malaysia	7	0.037	0.122	8	0.158	0.022
33	Mauritius	10	0.064	0.075	11	0.191	0.014
34	Mexico	7	0.185	0.409	9	0.281	0.009
35	Mongolia	13	0.000	0.378	15	0.217	0.081
36	Morocco	8	0.077	0.103	8	0.187	0.020
37	Nepal	1	0.152		2	0.301	0.033
38	Nigeria	0			0		
39	Pakistan	0			1	0.272	
40	Panama	7	0.089	0.228	9	0.149	0.046
41	Papua New Guinea	0			2	0.309	0.004
42	Paraguay	1	-0.077		2	0.299	0.043
43	Peru	7	0.096	0.056	9	0.249	0.030
44	Philippines	4	-0.008	0.145	8	0.270	0.079
45	Poland	15	0.086	0.136	10	0.214	0.038
46	Moldova	12	0.100	0.199	13	0.229	0.040
47	Romania	17	0.067	0.231	18	0.192	0.071
48	Russia	7	0.286	0.092	8	0.237	0.035
49	Rwanda	0			1	0.350	
50	Saudi Arabia	0			1	0.305	
51	Senegal	4	-0.026	0.391	5	0.121	0.033
52	Serbia	0			0		
53	Slovakia	14	0.118	0.187	15	0.122	0.022

#	Country	Labor Productivity Growth			Price Cost Margins		
		# of Obs.	Average Value	Standard Deviation	# of Obs	Average Value	Standard Deviation
54	South Africa	10	0.060	0.154	14	0.172	0.101
55	Sri Lanka	2	-0.025	0.107	3	0.332	0.039
56	Suriname	8	0.123	0.238	9	0.427	0.232
57	Syria	8	0.237	0.554	9	0.058	0.039
58	Tajikistan	0			0		
59	Thailand	4	-0.074	0.442	5	0.180	0.027
60	Macedonia	8	0.062	0.140	10	0.093	0.048
61	Tunisia	0			4	0.187	0.005
62	Turkey	14	-0.037	0.210	15	0.285	0.100
63	Uganda	7	0.112	0.359	0		
64	Ukraine	3	0.235	0.039	4	0.158	0.014
65	Tanzania	4	-0.032	0.118	5	0.245	0.009
66	Uruguay	8	-0.036	0.225	9	0.239	0.029
67	Viet Nam	1	-0.000		2	0.182	0.002
68	Yemen	8	-0.085	0.239	8	0.242	0.062
69	Zimbabwe	0			0		
Overall Averages		**6.4**	**0.085**	**0.187**	**7.3**	**0.235**	**0.037**

Table A.4. DEVELOPED COUNTRIES' TOTAL MANUFACTURING INDUSTRY AVERAGES IN UNIDO'S INDSTAT4 2011 (1990-2008)

#	Country	Labor Productivity Growth			Price Cost Margins		
		# of Obs.	Average Value	Standard Deviation	# of Obs.	Average Value	Standard Deviation
1	Australia	1	0.029			0	
2	Austria	17	0.047	0.099	17	0.170	0.007
3	Belgium	10	0.003	0.085	12	0.138	0.009
4	Canada	17	0.038	0.064	18	0.225	0.022
5	Cyprus	8	0.067	0.096	9	0.198	0.011
6	France	16	0.031	0.114	17	0.127	0.016
7	Germany	9	0.047	0.114	10	0.122	0.004
8	Greece	9	0.056	0.072	11	0.194	0.019
9	Italy	15	0.025	0.105	16	0.146	0.023
10	Japan	13	0.009	0.101	14	0.267	0.006
11	Netherlands	9	0.061	0.112	13	0.141	0.009
12	Norway	13	0.042	0.082	15	0.135	0.012
13	Portugal	11	0.045	0.093	12	0.147	0.007
14	Qatar	6	0.160	0.210	7	0.489	0.088
15	Korea	16	0.081	0.131	17	0.309	0.019
16	Spain	14	0.054	0.098	15	0.149	0.008
17	Sweden	17	0.043	0.119	18	0.168	0.014
18	Switzerland		0.000			0	
19	United Kingdom	14	0.060	0.086	15	0.163	0.007
20	United States of America	8	0.038	0.056	11	0.334	0.008
Overall Averages		**11.7**	**0.047**	**0.102**	**13.7**	**0.181**	**0.016**

Table A.5 INDUSTRIES IN UNIDO'S INDSTAT3 2006

Industries	
Food products	Misc. petroleum and coal products
Beverages	Rubber products
Tobacco	Plastic products
Textiles	Pottery, china, earthenware
Wearing apparel, except footwear	Glass and products
Leather products	Other non-metallic mineral products
Footwear, except rubber or plastic	Iron and steel
Wood products, except furniture	Non-ferrous metals
Furniture, except metal	Fabricated metal products
Paper and products	Machinery, except electrical
Printing and publishing	Machinery, electric
Industrial chemicals	Transport equipment
Other chemicals	Professional & scientific equipment
Petroleum refineries	Other manufactured products

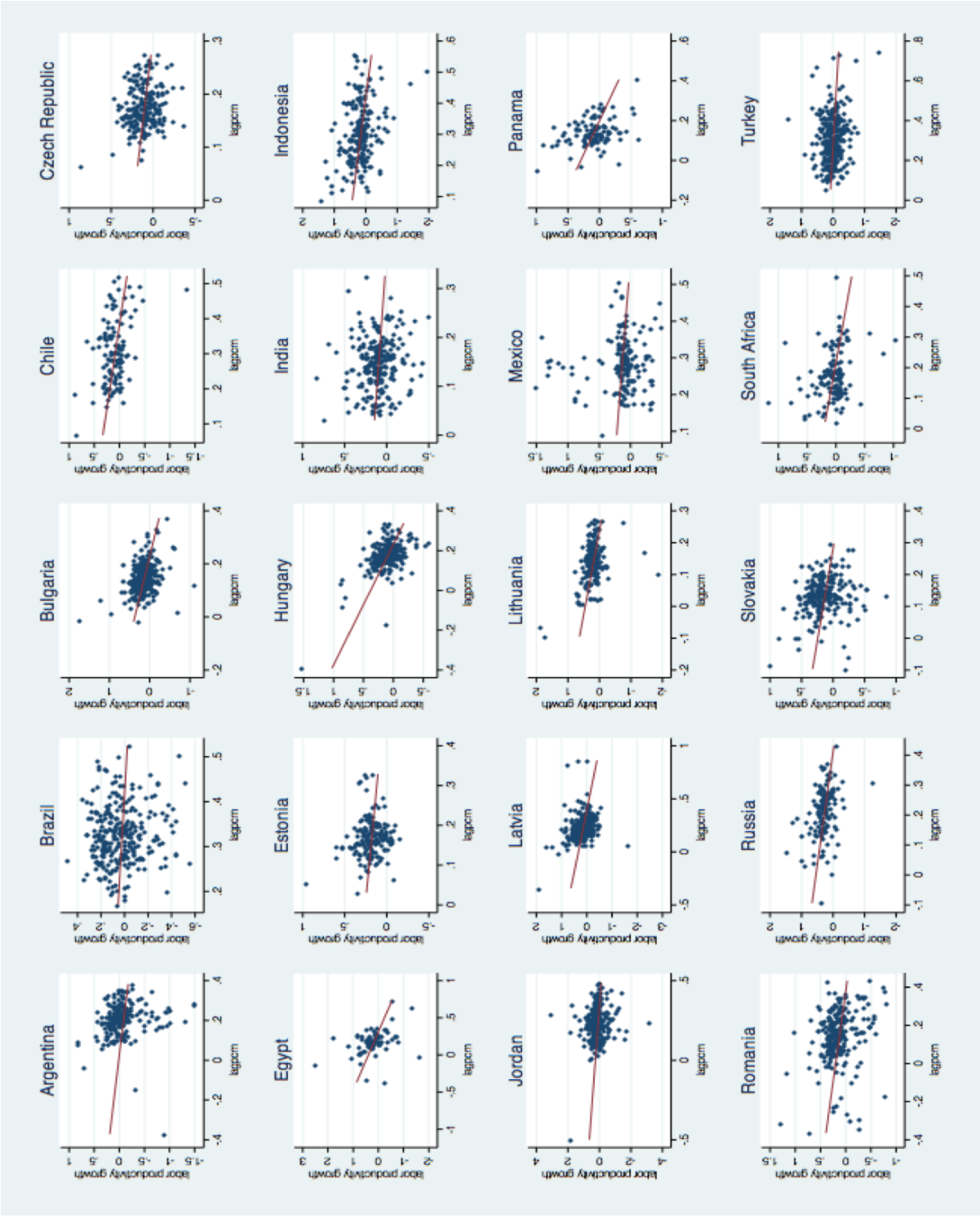
Table A.6 DEVELOPING COUNTRIES' TOTAL MANUFACTURING INDUSTRY AVERAGES IN UNIDO'S INDSTAT3 2006 (1963-2006)

#	Country	Labor Productivity Growth			Price Cost Margins		
		# of Obs.	Average Value	Standard Deviation	# of Obs.	Average Value	Standard Deviation
1	Albania	2	-0.281	0.368	0		
2	Argentina	14	0.015	0.225	16	0.278	0.113
3	Armenia	0			0		
4	Barbados	27	0.104	0.141	28	0.156	0.094
5	Bosnia	1	0.189		2	0.332	0.051
6	Brazil	3	0.111	0.086	5	0.453	0.032
7	Bulgaria	6	0.046	0.153	7	0.131	0.022
8	Chile	37	0.065	0.193	38	0.397	0.064
9	Colombia	36	0.057	0.101	37	0.335	0.021

#	Country	Labor Productivity Growth			Price Cost Margins		
		# of Obs.	Average Value	Standard Deviation	# of Obs.	Average Value	Standard Deviation
10	Costa Rica	18	0.040	0.064	37	0.207	0.035
11	Croatia	6	0.028	0.168	7	0.288	0.065
12	Czech Republic	0			0		
13	Egypt	32	0.054	0.206	33	0.146	0.036
14	El Salvador	27	0.086	0.320	30	0.299	0.067
15	Estonia	1	0.312		2	0.163	0.003
16	Honduras	22	-0.013	0.199	27	0.193	0.063
17	Hungary	39	0.046	0.124	40	0.205	0.049
18	India	39	0.049	0.096	40	0.119	0.023
19	Indonesia	31	0.119	0.148	33	0.265	0.034
20	Jamaica	28	0.025	0.168	29	0.189	0.031
21	Jordan	35	0.045	0.157	38	0.253	0.041
22	Kenya	39	0.038	0.118	37	0.104	0.030
23	Latvia	8	0.183	0.157	6	0.224	0.037
24	Lithuania	3	0.151	0.116	4	0.114	0.011
25	Mauritius	29	0.052	0.119	30	0.152	0.034
26	Mexico	16	0.054	0.136	17	0.309	0.015
27	Mongolia	5	-0.221	0.515	6	0.286	0.045
28	Morocco	20	0.066	0.129	22	0.165	0.045
29	Namibia	0			1	0.261	
30	Pakistan	28	0.068	0.132	30	0.278	0.029
31	Panama	35	0.038	0.095	37	0.208	0.048
32	Papua New Guiunea	26	0.115	0.147	27	0.270	0.022
33	Peru	12	0.079	0.199	14	0.348	0.053
34	Philippines	32	0.057	0.189	34	0.269	0.049
35	Poland	39	0.055	0.149	10	0.293	0.085
36	Romania	3	-0.154	0.311	4	0.177	0.015

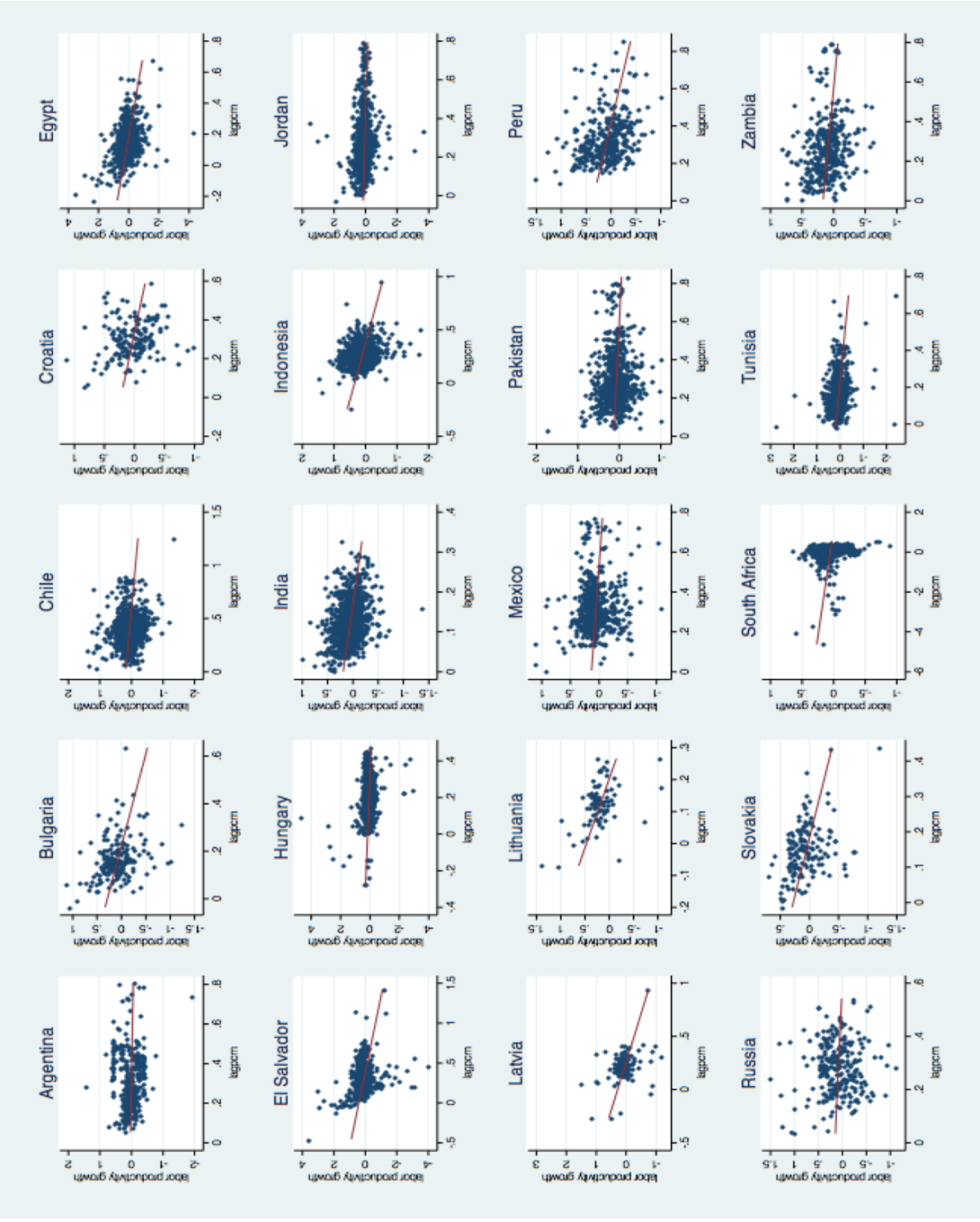
#	Country	Labor Productivity Growth			Price Cost Margins		
		# of Obs.	Average Value	Standard Deviation	# of Obs.	Average Value	Standard Deviation
37	Russia	5	0.049	0.283	6	0.277	0.050
38	Serbia	7	-0.031	0.510	8	0.311	0.019
39	Slovakia	1	0.121		3	0.149	0.058
40	South Africa	23	0.052	0.139	28	0.177	0.030
41	Sri Lanka	26	0.036	0.113	20	0.317	0.049
42	Syria	35	0.115	0.308	36	0.204	0.075
43	Tunisia	22	0.041	0.112	28	0.163	0.032
44	Turkey	34	0.079	0.138	35	0.286	0.033
45	Ukraine	0			0		
46	Venezuela	31	0.059	0.191	34	0.327	0.060
47	Zambia	14	0.097	0.117	18	0.287	0.062
Overall Averages		**19**	**0.053**	**0.184**	**20**	**0.241**	**0.044**

Figure A.1. TWO-WAY INTERACTION BETWEEN THE LAGGED VALUE OF PRICE COST MARGINS (PCM) AND PRODUCTIVITY GROWTH IN SELECTED DEVELOPING COUNTRIES' MANUFACTURING INDUSTRIES (1990-2008)



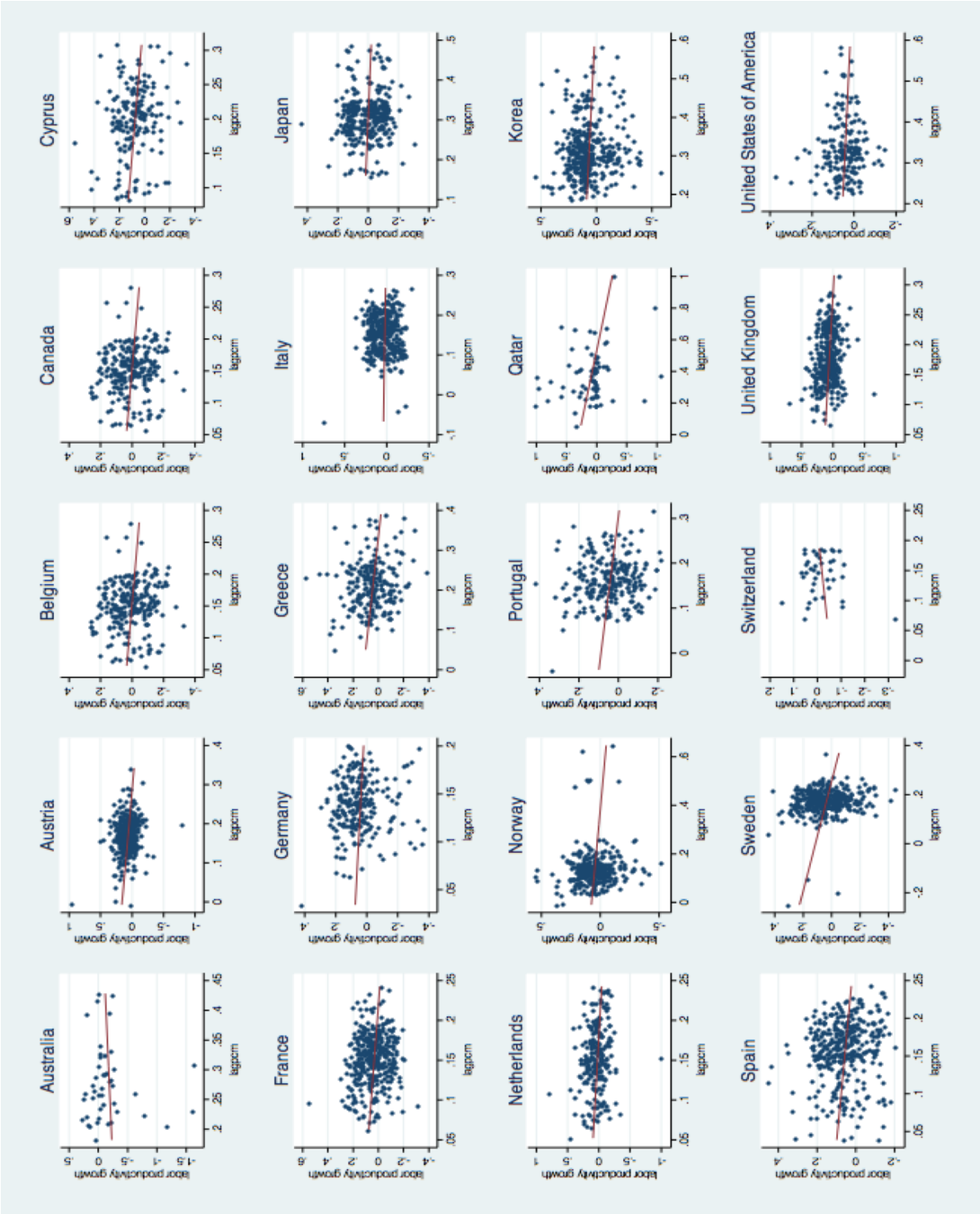
Note: This graph uses UNIDO's INDSTAT4 2011 data.

Figure A.2. TWO-WAY INTERACTION BETWEEN THE LAGGED VALUE OF PRICE COST MARGINS (PCM) AND LABOR PRODUCTIVITY GROWTH IN SELECTED DEVELOPING COUNTRIES' MANUFACTURING INDUSTRIES (1963-2006)



Note: This graph uses UNIDO's INDSTAT3 2006 data.

Figure A.3. TWO-WAY INTERACTION BETWEEN THE LAGGED VALUE OF PRICE COST MARGINS (PCM) AND PRODUCTIVITY GROWTH IN SELECTED DEVELOPED COUNTRIES' MANUFACTURING INDUSTRIES (1990-2008)



Note: This graph uses UNIDO's INDSTAT4 2011 data.

Table A.7. MARGINS AND GROWTH IN 47 DEVELOPING COUNTRIES (UNIDO'S INDSTAT3 2006, 1964-2006)

Dependent Variable: Labor Productivity Growth				
	[1]	[2]	[3]	[4]
Price Cost Margin *t*-1	-0.089 (0.051)*	-0.088 (0.053)	-0.092 (0.057)	-0.092 (0.054)*
Country Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	No	Yes	Yes	Yes
Industry Fixed Effects	No	No	Yes	Yes
Constant	0.081 (0.008)***	0.304 (0.065)***	0.310 (0.072)***	0.330 (0.038)***
R2	0.02	0.05	0.05	0.05
N	21,280	21,280	21,280	21,280

Notes: Significance levels: * $p<0.1$; ** $p<0.05$; *** $p<0.01$. Errors in brackets are clustered at the country level, except for column [4] where the errors are clustered at both the country and industry levels.

Table A.8. MARGINS AND GROWTH IN 47 DEVELOPING COUNTRIES TESTING FOR NON-LINEAR RELATIONSHIPS (UNIDO'S INDSTAT3 2006, 1964-2006)

Dependent Variable: Labor Productivity Growth				
	[1]	[2]	[3]	[4]
Price Cost Margin *t*-1	-0.125 (0.068)*	-0.125 (0.069)*	-0.134 (0.078)*	-0.134 (0.073)*
(Price Cost Margin *t*-1)^2	-0.006 (0.005)	-0.006 (0.005)	-0.006 (0.005)	-0.006 (0.005)
Country Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	No	Yes	Yes	Yes
Industry Fixed Effects	No	No	Yes	Yes
Constant	0.087 (0.011)***	0.310 (0.064)***	0.315 (0.071)***	0.339 (0.043)***
R2	0.02	0.05	0.05	0.05
N	21,280	21,280	21,280	21,280

Notes: Significance levels: * $p<0.1$; ** $p<0.05$; *** $p<0.01$. Errors in brackets are clustered at the country level, except for column [4] where the errors are clustered at both the country and industry levels.

Table A.9. MARGINS AND GROWTH IN 20 DEVELOPED COUNTRIES (UNIDO'S INDSTAT4 2011, 1990-2008)

Dependent Variable: Labor Productivity Growth				
	[1]	[2]	[3]	[4]
Price Cost Margin *t*-1	-0.347 (0.061)***	-0.317 (0.064)***	-0.478 (0.075)***	-0.478 (0.089)***
Country Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	No	Yes	Yes	Yes
Industry Fixed Effects	No	No	Yes	Yes
Constant	0.030 (0.009)***	0.120 (0.021)***	0.137 (0.019)***	0.286 (0.035)***
R2	0.06	0.28	0.29	0.29
N	5,007	5,007	5,007	5,007

Notes: Significance levels: * $p<0.1$; ** $p<0.05$; *** $p<0.01$. Errors in brackets are clustered at the country level, except for column [4] where the errors are clustered at both the country and industry levels.

Table A.10. MARGINS AND GROWTH IN 20 DEVELOPED COUNTRIES TESTING FOR NON-LINEAR RELATIONSHIPS (UNIDO'S INDSTAT4 2011, 1990-2008)

Dependent Variable: Labor Productivity Growth				
	[1]	[2]	[3]	[4]
Price Cost Margin *t*-1	-0.535 (0.177)***	-0.440 (0.175)**	-0.722 (0.188)***	-0.722 (0.208)***
(Price Cost Margin *t*-1)^2	0.354 (0.388)	0.231 (0.376)	0.433 (0.362)	0.433 (0.303)
Country Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	No	Yes	Yes	Yes
Industry Fixed Effects	No	No	Yes	Yes
Constant	0.050 (0.018)**	0.132 (0.027)***	0.161 (0.026)***	0.315 (0.042)***
R2	0.06	0.28	0.29	0.29
N	5,007	5,007	5,007	5,007

Notes: Significance levels: * $p<0.1$; ** $p<0.05$; *** $p<0.01$. Errors in brackets are clustered at the country level, except for column [4] where the errors are clustered at both the country and industry levels.