International Trade and the Dispersion of Market Power*

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September 2006

PRELIMINARY AND INCOMPLETE

Abstract

In this paper, we argue that the procompetitive effect of international trade may bring about significant welfare costs that have not been recognized. We formulate a simple general equilibrium model with a continuum of imperfectly competitive industries to show that, under plausible conditions, a trade-induced increase in competition can actually amplify monopoly distortions. This happens because trade, while lowering the average level of market power, may increase its cross-sectoral dispersion. Using data on US industries, we document a dramatic increase in the dispersion of market power overtime, we show evidence that trade might be responsible for it, and calibrate the induced welfare cost.

JEL Numbers: F12, F15.

Keywords: Markups, Market Power Dispersion, Procompetitive Effect, Trade and Welfare.

*We would like to thank Omar Licandro, Jaume Ventura and partecipants to the UPF Faculty Lunch for comments and discussion. All errors are our own.

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1 Introduction

There is a general consensus that exposure to international trade reduces domestic firms' market power and that welfare gains are likely to materialize through this procompetitive effect (e.g., Helpman and Krugman, 1985, Roberts and Tybout, 1996). There is also a large literature emphasizing the beneficial effects of product market deregulation aimed at lowering entry barrier (e.g., Schiantarelli, 2005). Yet, what most studies on procompetitive gains from trade neglect is that the social cost of market power may not depend on its average level only, but rather on its dispersion across sectors. The aim of this paper is to study the link between trade and the dispersion of market power and its effect on welfare.

The insight that welfare is a negative function of the dispersion of market power is often overlooked because classical analysis of monopoly distortions is usually conducted in partial equilibrium. On the contrary, in this paper we build a general equilibrium model in which the degree of market power can vary across industries and show that its dispersion, independently of its average level, leads to misallocations. The reason is that the equilibrium allocation depends on relative prices and when relative prices reflect differences in market power the economy will deviate from the social optimum. Our goal is to relate the degree of monopoly power in a sector to the presence of foreign competition and study how various forms of economic integration can affect welfare by changing the dispersion of market power.

When trade lowers markups over marginal costs but increases their dispersion, for instance because trade affects some sectors and not others, we derive the somewhat paradoxical result that an increase in competition may actually amplify monopoly distortions. More generally, we discuss cases in which the average market power of firms matters too and show that conventional procompetitive gains from trade can be reduced or magnified depending on whether trade also increase or decrease the dispersion of market power. We also propose policy remedies for the misallocation of resources that international integration may induce. In particular, our model suggest that when trade makes open sectors more competitive than the rest of the economy, it is advisable to promote competition in those sectors that remain less exposed to trade. That is, integration of international markets may call for deregulation in domestic markets.

Understanding the welfare effects of changes in the dispersion of market power due to foreign competition is important because there are many instances in which trade can change the dispersion of monopoly power in the economy. Indeed, there are good reasons to expect the impact of trade to differ across industries. This might be the case because trade policy varies substantially across sectors and because there are sectors (e.g., services) that are naturally less exposed to international competition. Even among freely traded goods, transportation costs vary dramatically implying that some sectors are more shielded from foreign competition than others.

How trade affects the dispersion of market power and whether the welfare effects we emphasize are sizable are ultimately empirical questions. We take a first step at answering them in the final part of the paper where we study the evolution of the dispersion of markups across industries in the US economy and how it depends on trade. Following Tybout (2003), we use price-cost margins as a proxy for industry markups. We build our measures using data on industry sales and total costs from the NBER productivity file, a unique database on industry-level inputs and outputs covering about 450 manufacturing industries at the 4-digit SIC level for the period between 1958 and 1996. Our findings suggest that the dispersion of price-cost margins increased dramatically, starting in the mid-70s, and that trade is partly responsible for this phenomenon. Finally, we provide some plausible quantifications of the welfare loss due to the increased dispersion in markups. In most cases, this loss is far from negligible.

This paper is related to the literature studying the welfare effects of trade in models with imperfect competition. The fact that, in the presence of distortions, trade might be welfare reducing is just an application of second best theory and it is not *per se* so surprising. A notable example seemingly related to ours is the paper by Brander and Krugman (1983), showing that a fall in trade costs can lower welfare when oligopolistic firms produce homogeneous goods and compete in quantities. Yet, the intuition for their result relies on the fact that trade is intrinsically wasteful in their model, while in our paper trade does not impose any additional cost. More than being just an application of second best theory, this paper is the first to emphasize the general insight that trade can affect welfare by changing the cross-sectoral dispersion of market power.[1]

This paper also contributes to the growing literature on deregulation of markets.[2] Most of the works in this area focus on entry regulations in closed economy or identify trade liberalization as a free market policy. On the contrary, this paper suggests that international trade

[1] Some papers have instead recognized that symmetry may neutralize monopoly distortions. These include the classical article by Lerner (1934) and more recent contributions such as Neary (2003) and Koeniger and Licandro (2006).

[2] Blanchard and Giavazzi (2003) is a prominent example. See Schiantarelli (2005) for an extensive survey.

and entry regulations in domestic markets should be studied together. In particular, it shows that the process of globalization, by increasing the wedge between market power in domestic and international markets, may reinforce the case for deregulation in sectors, such as services, that remain less exposed to foreign competition.

The remainder of the paper is organized as follows. Section II shows how the procompetitive effect associated to international trade affects welfare by changing the dispersion of market power and might lead to welfare losses. Section III shows evidence that the dispersion of market power increased across US manufacturing sectors and provides a quantification of the implied welfare loss, followed by some suggestive evidence that trade might be responsible for it. Section IV concludes.

2 International Trade, Competition and Welfare

We build a simple model of a world economy populated by a large number of identical countries. There is a continuum $[0, 1]$ of industries and each industry is composed of varieties of differentiated goods. Following Armington, countries are specialized in different varieties and may trade with each other. However, we consider a situation of imperfect market integration in which trade may not be allowed in all industries. To introduce imperfect competition and rents in the simplest way, we assume that there is a monopolistic firm per country and per sector and entry is restricted. Firms in different industries are exposed to different degrees of competition depending on possibility to trade their products internationally. Firms producing nontraded goods only face competition from other sectors of the economy. Firms in traded sectors must also compete with foreign firms producing similar varieties within the same sector. We use this model to explore how the process of international integration, described as an increase in the number of traded sectors and/or trading partners, can affect the pricing decision of firms and welfare.

2.0.1 The Basic Set-Up

In what follows, we use the letters $i, j \in [0, 1]$ to indicate sectors and the letters $n, m \leq N \in \mathbb{N}^+$ to indicate varieties within a sector. Given that each country produced a single variety in every sectors, N will also be the number of countries. Preferences of the representative agent in any country are given by the following CES utility function:

$$U = \left[\int_0^1 \gamma(i) C(i)^\alpha \, di \right]^{1/\alpha}, \quad \alpha \in (0,1), \quad \int_0^1 \gamma(i) \, di = 1, \tag{1}$$

where $C(i)$ is the subutility derived from consumption of differentiated goods produced in sector $i \in [0,1]$, $1/(1-\alpha)$ is the elasticity of substitution between sectors and $\gamma(i)$ represent the weight of sector i in utility. Maximization of (1) subject to a budget constraint yields relative demand:

$$\frac{P(i)}{P(j)} = \frac{\gamma(i)}{\gamma(j)} \left[\frac{C(j)}{C(i)} \right]^{1-\alpha} \tag{2}$$

where $P(i)$ $(P(j))$ is the cost of one unit of the consumption basket $C(i)$ $(C(j))$.

Before defining $C(i)$, that will generally be a basket of the N varieties produced in different countries in sector i, it is useful to describe how trade takes place in the model. We assume that in some sectors goods can be freely traded, while in others trade costs are prohibitive. Accordingly, the unit measure of sectors is partitioned into two subsets of traded and nontraded industries and sectors are ordered such that those with an index $i \leq \tau \in [0,1]$ are subject to negligible trade costs while the others, with an index $i > \tau$, face prohibitive trade costs. We consider two complementary aspects of international integration: (1) an increase in the range τ of traded sectors and (2) an increase in the number N of trading partners. We believe that both aspects capture important trends in the world economy.[3] We are now ready to define $C(i)$.

Preferences for varieties produced in different countries in sector i are represented by another CES subutility function:

$$C(i) = N^{\nu+1} \left[\frac{1}{N} \sum_{n \in N} c(i,n)^\beta \right]^{1/\beta}, \; 1 \geq \beta > \alpha, \; \nu \geq 0, \tag{3}$$

where $c(i,n)$ is consumption of the variety produced by country n in sector i and $1/(1-\beta) > 1$ is the elasticity of substitution between varieties produced in different countries. We assume that $\beta = f(N)$ with $f'(N) > 0$ so that an increase in the number of varieties N raises the elasticity of substitution between them. Note that, in nontraded sectors, (3) reduces to

[3] For example, there is growing evidence that international trade has increased mostly along the extensive margin (we trade now goods that we did not trade before), while the number of countries that are members of the WTO has increased dramatically during the past decades.

$c(i,n)$ where n is the domestically produced variety. Equation (3) has a number of important properties.

The sub-utility function $C(i)$ is a generalization, introduced by Benassy (1998), of well known Dixit-Stiglitz preferences. Its special feature is that the factor $N^{\nu+1-1/\beta}$ allows to disentangle the elasticity of substitution between varieties from the preference for variety. From (3), greater variety is associated with higher utility whenever $\nu > 0$. To see this, suppose that $c(i,n) = c$. Then, the sub-utility derived in the typical country from consumption in sector i will be $N^{\nu}c$, which is increasing in N if $\nu > 0$. The standard Dixit-Stiglitz preferences are a special case of (3) for $\nu = (1-\beta)/\beta$. There are two main reasons why we choose the Benassy formulation.

First, in our model the degree of competition in international markets will be identified by the elasticity of demand, $1/(1-\beta)$: a very elastic demand limits the ability of firms to charge high markups over marginal costs, as an increase in prices would translate into a large drop in demand. However, in studying the welfare effects of international trade, we do not want to mix the effect through competition in world markets, which is our focus, with that through the value of product diversity. Thus, we want the elasticity of demand to be potentially independent from the preference for variety. To preserve the highest clarity, throughout most of the paper we will shut down completely the preference for variety by assuming $\nu = 0$, thereby isolating the procompetitive effect of trade. This is the same route taken by Blanchard and Giavazzi (2003) in their related work on product and labor market competition. Nevertheless, we will also discuss our results when $\nu > 0$.

Second, we want a model in which competition is, in principle, desirable. When competition is parametrized by β, this need not be the case in a standard Dixit-Stiglitz framework. The reason is that, when $\nu = (1-\beta)/\beta$, high competition means a low preference for variety ν which translates into a lower utility for a given $N > 1$. Having ν independent from β gives competition the best chance to be welfare improving.[4]

Finally, it is important to understand the assumptions $\alpha < \beta$ and $\beta = f(N)$ with $f'(N) > 0$. The first means that goods within the same sectors are closer substitute than goods produced in different sectors. Given that varieties belonging to the same sector are produced by different countries, this implies that competition in international markets is stiffer than competition in

[4] Yet, we want to reassure the reader that our main results would hold in a Dixit-Stiglitz world too.

domestic markets. The second implies that an increase in the number of trading partners raises the degree of substitutability between the higher number of varieties. This is the case considered more realistic by Krugman (1979) and Blanchard and Giavazzi (2003).[5] These two assumptions deliver the procompetitive effect of trade, in that exposure to international competition and larger world markets reduce the monopoly power of firms. With $\nu = 0$, this will be the only effect of trade.

In any traded sector ($i \leq \tau$), maximization of (3) subject to a budget constraint yields demand functions with a price-elasticity of $(1-\beta)^{-1}$:

$$\frac{p(i,n)}{p(i,m)} = \left[\frac{c(i,m)}{c(i,n)}\right]^{1-\beta},$$

where $p(i,n)$ ($p(i,m)$) is the price of the variety produced by country n (m) in sector i. Cost-minimization also yields the minimum price of one unit of the consumption basket $C(i)$:

$$P(i) = N^{-\nu}\left[\frac{1}{N}\sum_{n\in N} p(i,n)^{\beta/(\beta-1)}\right]^{(\beta-1)/\beta}. \tag{4}$$

2.0.2 Firms and Market Power

Each variety is produced by a single monopolist and entry is restricted. The absence of free entry may result from the fact that conditions in each industry are such that when a second firm enters profits would drop below zero (perhaps due to the presence of fixed costs) or that there are sunk costs associated with entry and a fixed number of firms (one per sector in every country, for simplicity) have already paid it. Restricted entry also capture the presence of government regulations and reflect our desire to study the effect of trade when firms make pure profits. Although free entry might be a reasonable assumption in some industries, we believe that rents are fairly common so that our case is equally relevant. Later in the paper, we will see how fixed costs at firm level and free entry can marginally modify our results. Pure profits are rebated to consumers, though the exact form of redistribution is irrelevant in our representative agent economy

[5] This is a natural implication of the Hotelling model of competition around the circle. Competition in quantities between firms producing an homogeneous good would deliver the same result. For more details about these models, see for example Epifani and Gancia (2006). Note also that the assumption $f'(N) > 0$ is not crucial for the main result of the paper.

Monopolistic firms charge a price that is a constant markup over the marginal cost, where the latter is for simplicity the wage w (identical across countries in a symmetric world). For convenience, we define $\mu(i)$ as the inverse of the markup prevailing in sector i. The optimal markup is the usual function, $(1-1/\epsilon)^{-1}$, of the relevant price elasticity of demand ϵ. In open sectors, this elasticity is $1/(1-\beta)$, because firms compete against foreign varieties. Firms producing nontraded goods, instead, compete only against firms in other sectors, so that their relevant demand elasticity, $1/(1-\alpha)$, is lower. We assume that domestic competition policy might affect the markup charged by firms, setting an upper bound to it. This upper bound can be thought of as the limit price that the monopolist can charge to prevent entry of additional firms. We focus on the most interesting case in which this upper bound may be binding in nontraded sectors but not in open sectors, so that world markets are more competitive than domestic markets. To summarize, pricing behavior is as follows:

$$p(i,n) = p(i) = \frac{w}{\mu(i)} \text{ with } \begin{cases} \mu(i) = \beta \text{ for } i \in [0,\tau] \\ \beta < \mu(i) < \alpha \text{ for } i \in (\tau,1] \end{cases} \tag{5}$$

Note that $\mu(i) \in (0,1)$ parametrizes the degree of competition. As $\mu(i) \to 0$ the monopolist is facing a demand with a unit price elasticity and would want to sell an infinitesimal quantity at an infinite price. In the limit $\mu(i) \to 1$ the elasticity of demand is infinite so that firms cannot raise the price above the marginal cost, or else demand would drop to zero. From (5) it follows that markups and prices are lower in traded sectors. We define x as the price of any nontraded variety $i \in (\tau,1]$ relative to that of any traded variety $j \in [0,\tau]$:

$$x \equiv \frac{p(i)}{p(j)} = \frac{\mu(j)}{\mu(i)}$$

Our assumptions imply $1 < x < \beta/\alpha$.

2.0.3 General Equilibrium

Goods market clearing, together with symmetry across countries, allows us to solve for consumption of the representative agent:

$$C(i) = \begin{cases} N^{\nu} L(i)/L \text{ for } i \in [0,\tau] \\ L(i)/L \ \text{ for } i \in (\tau,1] \end{cases} \tag{6}$$

where $L(i)$ is employment in sector i and L is the total labor supply of any country. Equations (6) shows that domestic consumption equals $1/N$ of world output of traded sectors, while it equals domestic production in nontraded industries. Finally, allocation of labor across sectors can be solved using (6), (5) and (4) into (2). Comparing employment in any sector $j \in [0,\tau]$ exposed to trade to any other nontraded sector $i \in (\tau,1]$ yields:

$$L(j) = L(i)\left[\frac{\mu(j)}{\mu(i)}\frac{\gamma(j)}{\gamma(i)}\right]^{1/(1-\alpha)} N^{\nu\alpha/(1-\alpha)}. \tag{7}$$

That is, sectors with a lower markup (high μ) and facing stronger demand (high γ) attract more workers. Demand for traded goods is also stronger the higher the gains from product variety, $N^{\nu\alpha/(1-\alpha)}$. Finally, we assume that labor supply is inelastic and impose labor market clearing:

$$\int_0^1 L(i)\,di = L \tag{8}$$

2.1 Procompetitive Losses from Trade

We are now ready to discuss how trade affects welfare. To gain intuition, we start with the simplest case of symmetric preferences, $\gamma(j) = 1\ \forall j \in [0,1]$ and no preference for variety, $\nu = 0$, so that trade has no effects other than through changes in firms' market power. Equations (7) and (8) imply:

$$L(i) = \begin{cases} L\left[\tau + (1-\tau)(x)^{1/(\alpha-1)}\right]^{-1} \text{ for } i \in [0,\tau] \\ L\left[\tau(x)^{1/(1-\alpha)} + (1-\tau)\right]^{-1} \text{ for } i \in (\tau,1] \end{cases} \tag{9}$$

Note that traded sectors attract more workers for they are more competitive and thus pay a higher share of revenues in wages. Substituting (9) and (6) into (1) we obtain utility of the

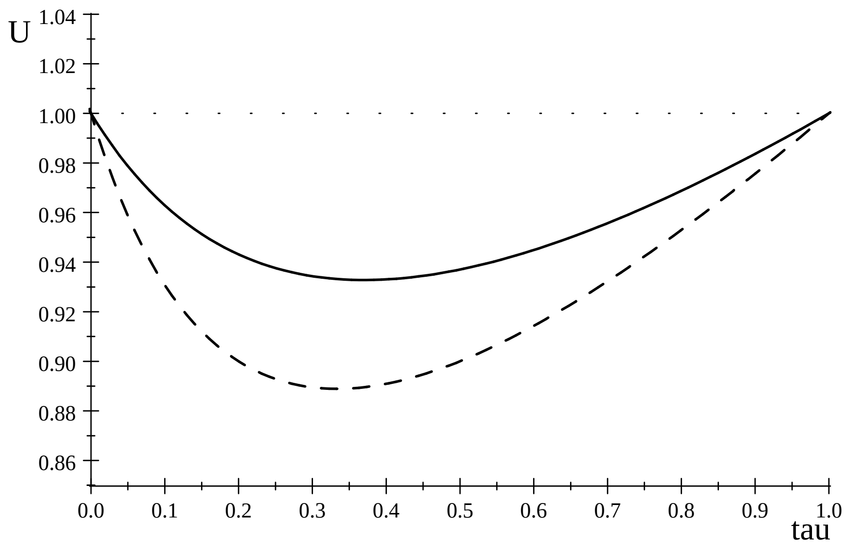

Figure 1: Trade and Welfare

representative agent as a function of τ and x:

$$U(\tau, x) = \frac{\left[1 - \tau + \tau x^{\alpha/(1-\alpha)}\right]^{1/\alpha}}{1 - \tau + \tau x^{1/(1-\alpha)}} \tag{10}$$

Equation (10) is our measure of welfare. We start by noting that in a fully competitive, first best, world we have $x = 1$ and $U(\tau, x) = 1$. The same utility level is attained both in the case of autarky ($\tau = 0$) and when trade is free in all sectors ($\tau = 1$). However, the opening of trade in some sectors starting from autarky necessarily lowers welfare, while it increases it only after τ has reached a critical point. To see this, we derive equation (10) with respect to τ and evaluate the expression at $\tau = 0$ and $\tau = 1$:

$$\left.\frac{\partial U}{\partial \tau}\right|_{\tau=0} = 1 - \frac{1}{\alpha} - x^{1/(1-\alpha)}\left(1 - \frac{1}{\alpha x}\right) < 0$$

$$\left.\frac{\partial U}{\partial \tau}\right|_{\tau=1} = 1 - \frac{x}{\alpha} - x^{1/(1-\alpha)}\left(1 - \frac{1}{\alpha}\right) > 0$$

Proof. See the Appendix ■

Thus, as depicted in Figure 1 (solid line), welfare is a U-shaped function of τ and converges to the autarky level only once all sectors have become open. In other words, *an equilibrium with* *trade is (weakly) Pareto inferior to autarky*: $U(\tau, x) \leq U(0, x)$. What happens as international integration increases the number of trading partners N? Given that $\beta'(N) > 0$, an increase in N makes demand for traded varieties more elastic and force firms in open sectors to lower their markups. The markup in sectors closed to trade remain unaffected, so that an increase in N raises the relative price of nontraded goods, as captured by x. In turn, as shown in Figure 1 (broken line) a higher x necessarily lowers welfare:

$$\frac{\partial U}{\partial x} < 0, \ \forall \tau \in (0, 1)$$

Proof. See the Appendix ■

Thus, the *procompetitive effect of an increase in the number of trading countries brings welfare losses*. The intuition behind this rather dismal view of the effects of trade integration is simple. In this model, the only distortion is noncompetitive pricing. Yet, markup pricing distorts decisions only to the extent that the degree of market power varies across goods. For $\tau = 0$ or $\tau = 1$, the markup is the same for all products, meaning that relative prices reflect relative marginal costs and the allocation of resources dictated by relative prices is the optimal one.[6] Trade breaks this symmetry by lowering markups in some sectors but not in others. This distorts the allocation of labor: the relative price of traded goods fall and the resulting increase in demand is met by hiring more workers. Thus, despite the fact that preferences and marginal costs are identical across goods, the economy experiences underproduction of the more expensive nontraded goods.[7]

What can be done to counteract this negative effect of market integration? We have seen that the first best solution is attained when $x = 1$. Thus, if trade lowers markups in some sectors, competition policy might be used to match the change in market power in nontraded sectors too. If competition policy cannot be used, the first best solution can still be achieved by giving an appropriate subsidy to sectors producing nontraded goods.

Finally, it is shown in the Appendix that the distortion due to asymmetric market power,

[6] Markup pricing also implies that wages are too low, but this does not distort any decision as long as labor supply is inelastic.

[7] A real world example might be illustrative. Assume that producers of mobile phones are more competitive than providers of telecommunication services, because the former are more exposed than the latter to foreign competition. Then, our paper suggests that the price of mobile phones is too low relative to the price of telecommunication services, and hence that consumers buy too many mobile phones, but use them too little, with respect to the social optimum.

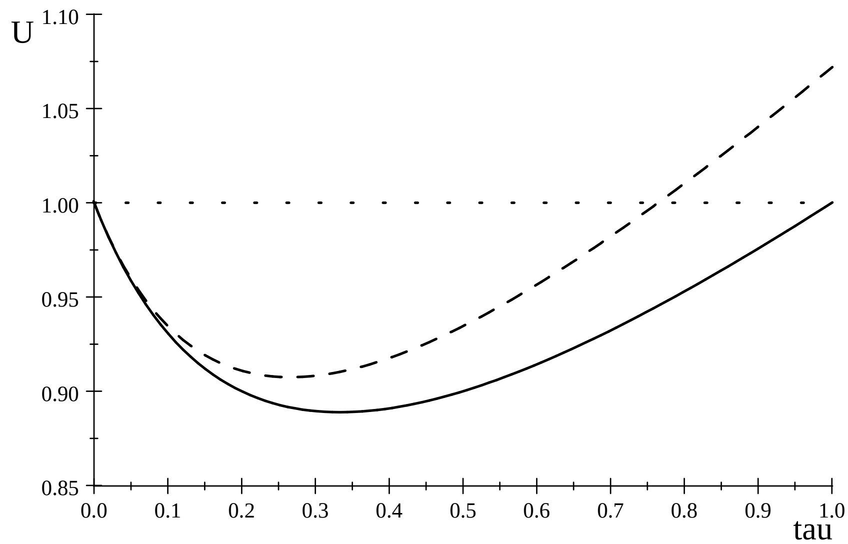

Figure 2: Trade and Welfare with $\nu \geq 0$

$x > 1$, and thus the potential loss from trade, is increasing in α. The effect of substitutability across sectors, captured by α, on the monopoly distortion is not an obvious one. On the one hand, a high substitutability means that the cost of overproduction in traded sectors is small: indeed, this cost goes to zero as goods become perfect substitutes. On the other hand, equation (9) shows that, for a given x, a high substitutability magnifies the misallocation of labor towards traded sectors. It turns out that the latter effects dominates if $\alpha < \beta/x$, as we assumed, so that perhaps counter-intuitively a lower curvature in the utility function leads to a higher cost of markup dispersion.

What happens when trade also brings gains by increasing product variety? It is easy to show that, when $\nu > 0$, utility of the representative agent becomes:

$$U(\tau, x, \nu, N) = \frac{\left[1 - \tau + \tau \left(xN^{\nu}\right)^{\alpha/(1-\alpha)}\right]^{1/\alpha}}{1 - \tau + \tau \left(xN^{\nu\alpha}\right)^{1/(1-\alpha)}}$$

Figure 2 depicts welfare as a function of τ for the previous case $\nu = 0$ (solid line) and the new case $\nu > 0$ (broken line). In the latter, an equilibrium with some trade might still be Pareto inferior to autarky when τ is low, for the gains from small volumes of trade might be too low to dominate the price distortion. However, when τ is large enough, the gains from variety will eventually dominate the (falling) cost of misallocations. With gains from trade of any sort, the equilibrium with full integration ($\tau = 1$) must necessarily dominate autarky.

2.2 Market Power and Welfare

We now derive a more general formula to quantify the welfare loss due to the monopolistic distortion when markups and demand conditions are allowed to vary across sectors. This will enable us to show that, under more general conditions, the monopolistic distortion may not depend on the average markup but rather on a precise measure of its dispersion. We will then discuss some conditions under which the average markup matters too, such as when there is free entry or the labor supply is elastic. The formula we derive will also be used to asses whether the effects we discuss are more than just a *curiosum*.

We start by relaxing the restriction that $\gamma(i)$ be equal to one in all sectors. We also allow $\mu(i)$ to vary freely across sectors. This will be the case if β and domestic entry regulations can vary across goods. For the purpose of this section, we are not interested in quantifying overall gains from trade so that we can safely maintain the assumption $\nu = 0$. Next, we solve for labor allocation in any sector i:

$$L(i) = \frac{[\mu(i)\gamma(i)]^{1/(1-\alpha)}}{\int_0^1 [\mu(i)\gamma(i)]^{1/(1-\alpha)}\, di} L \tag{11}$$

Using (11) together with the goods market clearing condition $C(i) = L(i)/L$ into (1) we find a general expression for utility:

$$U = \frac{\left\{\int_0^1 [\gamma(i)\mu(i)^{\alpha}]^{1/(1-\alpha)}\, di\right\}^{1/\alpha}}{\int_0^1 [\gamma(i)\mu(i)]^{1/(1-\alpha)}\, di} \tag{12}$$

From (12) it is easy to verify that when $\mu(i)$ is constant across sectors (no dispersion in market power), then utility is independent of $\mu(i)$. Likewise, utility is homogeneous of degree zero in average markup: multiplying $\mu(i)$ by any given constant leaves welfare unaffected. Welfare is instead a complex function of the dispersion of markups. To see this, rewrite (12) as follows:

$$U^{\alpha} = \frac{\mathrm{E}(\widehat{\mu}^{\alpha})\,\mathrm{E}(\widehat{\gamma}) + \mathrm{cov}(\widehat{\gamma}, \widehat{\mu}^{\alpha})}{[\mathrm{E}(\widehat{\mu})\,\mathrm{E}(\widehat{\gamma}) + \mathrm{cov}(\widehat{\gamma}, \widehat{\mu})]^{\alpha}}, \tag{13}$$

where $\widehat{\gamma} = \gamma(i)^{1/(1-\alpha)}$ and $\widehat{\mu} = \mu(i)^{1/(1-\alpha)}$. Then, assuming for simplicity that $\widehat{\mu}$ and $\widehat{\gamma}$ are independently distributed and given the concavity of the function $\widehat{\mu}^{\alpha}$, equation (13) shows that a mean preserving spread of the distribution of $\widehat{\mu}$ lowers the numerator while leaving the denominator unaffected. Thus, more dispersion from the mean leads to lower welfare.

2.2.1 Free Entry

So far, each firm is making positive profits and barriers to entry prevent potential competitors from challenging incumbent firms and sharing the rents. Without those barriers, entry will take place until pure profits are driven to zero. We now allows for this possibility in some industries. For the current purpose, we need not specify how competition takes place between producers of the same variety and how the equilibrium markup is determined. All we require is that there is a fixed cost of production so that, given the industry markup, the number of firms adjusts to guarantee that each of them breaks even. In this way, in equilibrium, all operating profits are used to cover the fixed cost.

For simplicity, we assume that the fixed cost is in terms of a bundle of goods with the same composition as final consumption (1). Then, to find utility of the representative agent, we can simply subtract the resources invested in fixed costs (i.e., operating profits) in sectors with free entry from (12):

$$U = \frac{\left\{\int_0^1 \left[\gamma(i)\,\mu(i)^{\alpha}\right]^{1/(1-\alpha)} di\right\}^{1/\alpha}}{\int_0^1 \left[\gamma(i)\,\mu(i)\right]^{1/(1-\alpha)} di} - \int_0^1 I(i)\,\pi(i)\,di, \tag{14}$$

where $\pi(i) = c(i)[p(i) - w]$ is the sum of all operating profits in sector i and $I(i)$ is an indicator function taking value one if there is free entry in sector i and zero otherwise. Given that a fraction $1 - \mu(i)$ of revenue $c(i)\,p(i)$ goes into profits (see equation 5), an increase in competition, $\mu(i)$, has now a direct positive welfare effect in industries with free entry. The reason is that a fall in operating profits means that some firms must exit and less resources are wasted in fixed costs. This is the "rationalizing effect" of competition (see, for example, Helpman and Krugman, 1985), originating from a combination of free entry and fixed costs in models with variable markups. Although free entry introduces and additional (positive) effect of competition, it leaves the first term in (14), and thus our basic considerations on the costs of markup dispersion, unaffected.

Finally, we mention briefly another reason why welfare can be decreasing in the average level of market power. In this model, wages are compressed by profits and are thus too low compared to the competitive equilibrium. When labor supply is elastic, this will distort the work-leisure decision. The strength of this distortion will depend upon the elasticity of labor supply.

3 Procompetitive Losses from Trade: Evidence from US Industries

In this section we provide evidence suggesting that the procompetitive losses from trade highlighted in the previous section may be far from a theoretical *curiosum*. To quantify these effects, all we need is a time-varying measure of market power at the industry level. Following a large empirical literature on the procompetitive effect of trade liberalization (see, e.g., Roberts and Tybout, 1996; Tybout, 2003), we use price-cost margins (PCMs) as a proxy for market power. For our purposes, an important advantage of PCMs is that they can vary both across industries and overtime, thereby allowing to study the time path of the sectoral dispersion of market power.[8]

We use data from the NBER Productivity Database by Bartelsman and Gray. To our knowledge, this is the most comprehensive and highest quality database on industry-level inputs and outputs, covering about 450 US manufacturing industries at the 4-digit SIC level for the period between 1958 and 1996.[9] Price-cost margins are computed as the value of shipments (adjusted for inventory change) less the cost of labor, capital, materials and energy, divided by the value of shipments.[10] Capital expenditures are computed as $(r_t + \delta)K_{it-1}$, where K_{it-1} is the capital stock, r_t is the real interest rate and δ is the depreciation rate. Data

[8] An alternative approach would be to estimate markups from a structural regression *a là* Hall (1988). One problem with this approach is that, to estimate markups across industries or over time, either the time or industry dimension is to be sacrificed, implying that markups have to be assumed constant over time or across industries.

[9] We would ideally want to study the economy-wide dispersion of market power, rather than focusing on the manufacturing sector only. In fact, according to our model, international trade may raise the dispersion of market power also by increasing asymmetries in markups between traded (mainly manufacturing) and non-traded sectors (mainly services). Unfortunately, however, economy-wide data on sectoral sales and costs are generally available at a much higher level of sectoral aggregation, thereby hiding much of the within-sector dispersion of market power. A careful scrutiny of economy-wide data is left for future research. Recall, however, that the quantifications illustrated below should be thought of as a lower bound for the economy-wide effects of market dispersion.

[10] According to our model, $PCM(i) = (p(i)q(i) - wL(i))/p(i) = 1 - \mu(1)$, where $p(i)q(i)$ is the value of shipments and $wL(i)$ is the variable cost. Although in our simple model labor is the only variable cost, we also net out materials and capital expenditures in our empirical definition of price-cost margins. This avoids spurious variation in the PCMs due to variation in intermediates-intensity and capital-intensity.

on US real interest rates come from the World Bank-*World Development Indicators*.[11] As for the depreciation rate, we choose a value of δ equal to 7%, implying that capital expenditures equal, on average, roughly 10 percent of the capital stock.[12]

Figure 3 plots the standard deviation of PCMs of US industries from the late 50s to the mid 90s. It is immediate to see that, starting from the mid 70s, the dispersion of PCMs shows a relentless increase. This is *prima facie* evidence that the latest wave of globalization was associated with a rising dispersion of market power across US industries. Figure 4 describes the evolution of the entire distribution of price-cost margins. The solid and dash lines represent the kernel density estimates of PCMs at the beginning (1959) and end (1996) of the period, respectively. The figure clearly shows a fattening of the distribution overtime and suggests that the increase in the second moment of the distribution was not driven by outliers. The figure also documents an increase in average PCMs. Table 1 provides more information on this latter fact. It shows the results of Fixed-Effects within regressions of US PCMs on openness and technological determinants. We define openness as the ratio of an industry's imports plus exports over the value of shipments. Data on US imports and exports by 4-digit SIC industry for the period from 1958 to 1994 come from the NBER Trade Database by Feenstra. Column (1) shows that, in line with a vast empirical literature, an increase in the openness ratio is associated with a statistically highly significant fall in the average PCMs. In column (2), we control for technology using the index of total factor productivity (TFP5) reported in the NBER Productivity file. Note that the coefficient of TFP is positive, large and significant, and leaves the coefficient of the openness ratio unaffected. This suggests that technical change is the main source of the observed increase in average PCMs. Finally, in column (3) we control for the capital output ratio, whose coefficient is negative and highly significant, probably because this variable captures the cyclical fluctuations in capacity utilization. More importantly for our purposes, the inclusion of this control leaves the other coefficients unaffected.[13]

Having shown that the dispersion of market power has increased overtime, we next move to a quantification of the induced welfare cost. We start by calibrating equation (12) in the simplest case in which goods are equally weighted in utility, i.e., for $\gamma(i) = 1 \ \forall i \in [0,1]$.

[11] The US real interest rate has a mean value of 3.75 percent (with a standard deviation of 2.5 percent) over the period of analysis.

[12] The depreciation rates used in the empirical studies generally vary from 5% for buildings to 10% for machinery.

[13] See also Epifani and Gancia (2006) for more evidence on the procompetitive fall of PCMs in US industries.

Computing utility requires choosing a value for α, i.e., for the elasticity of substitution among manufacturing goods. Available estimates of this elasticity vary widely across studies. Most of them are in the range $(2, 10)$, implying a value of α between 0.5 and 0.9. Therefore, in Figures 5 and 6 we plot utility for $\alpha = 0.5$ and $\alpha = 0.9$, respectively. As expected, utility falls overtime due to the increased dispersion of PCMs. In particular, Figure 5 suggests that, for $\alpha = 0.5$, the welfare cost of the increased markup dispersion was greater than one percentage point of utility, a significant effect, although not a huge one. Figure 6 suggests instead a welfare loss of more than 3 percentage points of utility when using a less prudential value for α.

In Figures 7 and 8 we plot utility (relative to the benchmark case of perfect competition, which is now associated with a level of utility generally different from one) in the more general case of $\gamma(i) \neq 1$, $i \in [0, 1]$. As in the previous two graphs, we assume $\alpha = 0.5$ and $\alpha = 0.9$, respectively. Our model suggests that the $\gamma(i)$s, the weights in utility associated to different goods, can be calibrated using data on PCMs and expenditure shares, as follows:

$$\gamma(i) = \frac{\theta(i)^{1-\alpha} \mu(i)^{-\alpha}}{\int \theta(i)^{1-\alpha} \mu(i)^{-\alpha} di},$$

where $\theta(i)$ is the expenditure share of good i and is calculated as the value of an industry's production plus net imports, divided by the total expenditure on industrial goods. The time path of the new measures of relative utility is qualitatively similar to that shown in Figures 5-6. For $\alpha = 0.5$, the results are also quantitatively similar (compare Figures 5 and 7). The interesting novelty is that with a high elasticity of substitution ($\alpha = 0.9$), the welfare cost of increased market dispersion becomes very large. In particular, Figure 8 suggests a fall in relative utility of roughly 7 percentage points in the period of analysis.

Having shown that the welfare cost associated with the increased dispersion in market power is likely to be sizeable, we finally show that international trade may be the main culprit. In the top panel of Table 2, we regress the standard deviation of PCMs on the openness ratio, with and without controls. Column (1) shows that an increase in the average openness of US industries is associated with a large and statistically highly significant increase in the standard deviation of PCMs. Indeed, the openness ratio alone explains more than 80 percent of the total variance of PCMs. In columns (2)-(4), we control for the average TFP and its standard deviation, for the average PCM and, finally, for a time trend. Yet, the coefficient of the openness ratio is stable across specifications and is always very precisely estimated.

Technical progress and its variance across sectors seem to affect negatively the dispersion of market power, although their coefficients are not robust across specifications. The partial correlation between average PCMs and their standard deviation is also negative. Interestingly, the coefficient of the time trend proves insignificant when controlling for the openness ratio.

In the mid and bottom panels of Table 2 we rerun the same regressions using as the dependent variable relative utility, i.e., our calibration of equation (12) (unweighted and weighted, respectively, assuming $\alpha = 0.5$). Given that relative utility is dictated by the standard deviation of PCMs[14], we now find that the coefficient of the openness ratio is negative and highly significant. Thus, an increase in the exposure to international trade, that has been shown to foster competition and compress markups in Table 1, is also associated with a significant drop in utility due to the increase in dispersion of market power.

4 Concluding Remarks

Competition is not perfect in most sectors of economic activity. By exposing firms to foreign competition, trade is widely believed to help alleviate the distortions stemming from monopolistic pricing. While this argument is certainly appealing and often well-grounded, it neglects the fact that, in general equilibrium, pricing distortions depend both on *absolute* and *relative* market power and that a trade-induced fall in markups may bring unexpected costs when it raises their variance.

By no mean we want to claim that the dispersion of monopoly power matters more that the average. Yet, we have shown that disregarding it altogether can lead to potentially large mistakes in quantifying the welfare effects of trade and competition policy. As a corollary, policy makers should recognize that the characteristics of sectors affected by the ongoing process of international integration and particularly their competitiveness relative to the rest of the economy are important factors to correctly foresee the costs and benefits of globalization.

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5 Appendix

We prove the properties of the welfare function (10). The derivative with respect to τ is:

$$\frac{\partial U}{\partial \tau}=\frac{\left[1-\tau+\tau x^{\frac{1}{1-\alpha}}\right]\frac{1}{\alpha}\left[1-\tau+\tau x^{\frac{\alpha}{1-\alpha}}\right]^{\frac{1-\alpha}{\alpha}}\left[x^{\frac{\alpha}{1-\alpha}}-1\right]-\left[x^{\frac{1}{1-\alpha}}-1\right]\left[1-\tau+\tau x^{\frac{\alpha}{1-\alpha}}\right]^{\frac{1}{\alpha}}}{\left[1-\tau+\tau x^{\frac{1}{1-\alpha}}\right]^{2}} \tag{15}$$

First, we evaluate this derivative at the autarky point ($\tau = 0$):

$$\left.\frac{\partial U}{\partial \tau}\right|_{\tau=0}=1-\frac{1}{\alpha}-x^{1/(1-\alpha)}\left(1-\frac{1}{\alpha x}\right) \tag{16}$$

Note that this derivative is zero when $x = 1$:

$$\left.\frac{\partial U}{\partial \tau}\right|_{\tau=0}=0 \text{ if } x=1.$$

That is, if there is no asymmetry in markups, a marginal move from autarky to trade in some sectors does not affect welfare. Taking the derivative of (16) with respect to x we find:

$$\left.\frac{\partial^2 U}{\partial \tau \partial x}\right|_{\tau=0}=\frac{\alpha^2(1-x)}{1-\alpha}x^{1/(1-\alpha)}<0, \tag{17}$$

because $x > 1$. Thus, as x grows, the effect of trade on welfare given by (16) becomes negative. By inspection of (17), the effect is greater the higher is α. Thus, the negative welfare effect of a marginal increase in trade starting from autarky is stronger when x and α are high.

Second, we evaluate the derivative (15) at the point $\tau = 1$:

$$\left.\frac{\partial U}{\partial \tau}\right|_{\tau=1}=1-\frac{x}{\alpha}-x^{1/(1-\alpha)}\left(1-\frac{1}{\alpha}\right) \tag{18}$$

Note that this derivative is zero when $x = 1$:

$$\left.\frac{\partial U}{\partial \tau}\right|_{\tau=1}=0 \text{ if } x=1$$

That is, if there is no asymmetry in markups, a final move to free trade in all sectors (in a neighborhood of $\tau = 1$) does not affect welfare. Taking the derivative of (18) with respect to

x we find:

$$\left.\frac{\partial^2 U}{\partial \tau \partial x}\right|_{\tau=1} = \left[x^{\alpha/(1-\alpha)} - 1\right] > 0 \qquad (19)$$

because $x > 1$. Thus, as x grows, the effect of trade on welfare given by (18) becomes positive. By inspection of (19), the effect is greater the higher is α. Thus, the positive welfare effect of a marginal increase in trade in the vicinity of $\tau = 1$ is stronger when x and α are high.

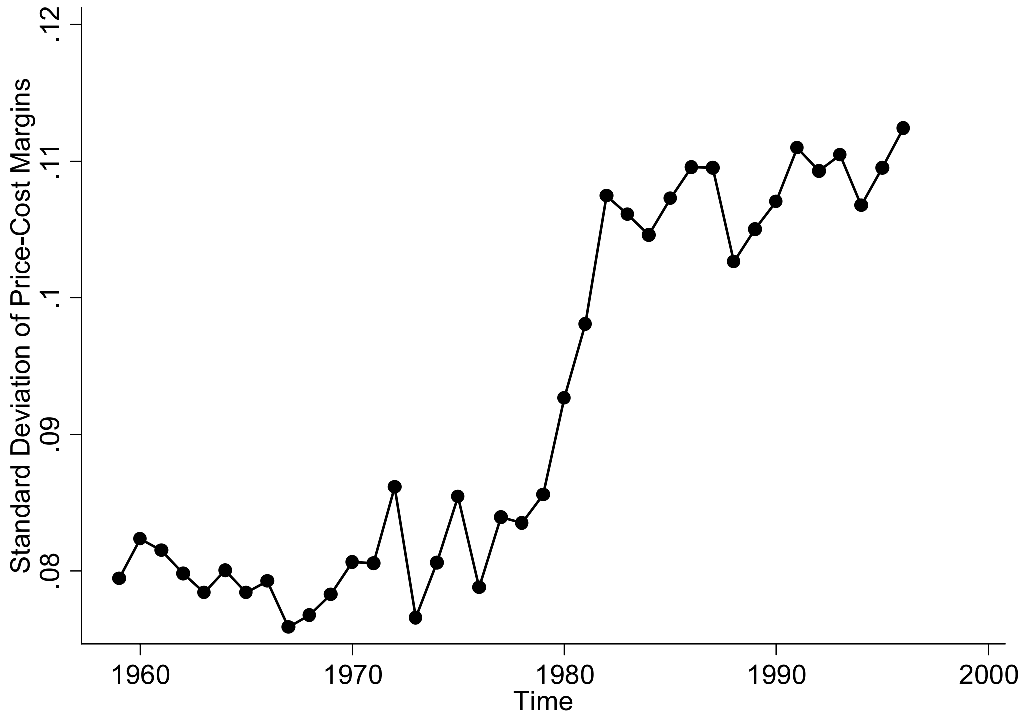

Figure 3 – Dispersion of Price-Cost Margins Overtime

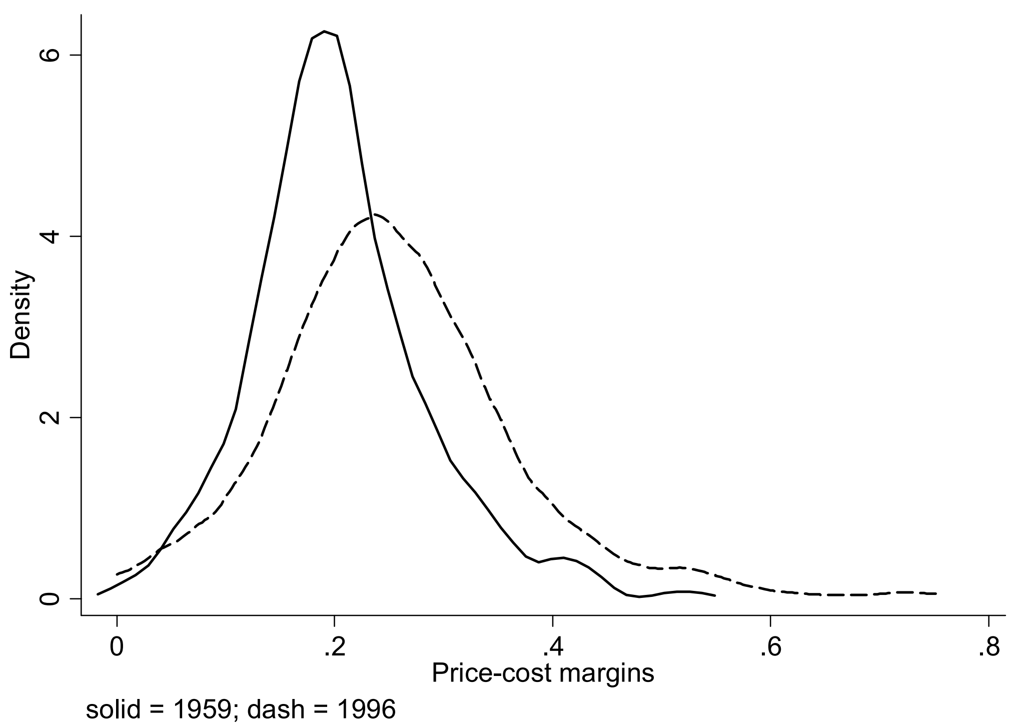

Figure 4 – Distribution of Price-Cost Margins Overtime

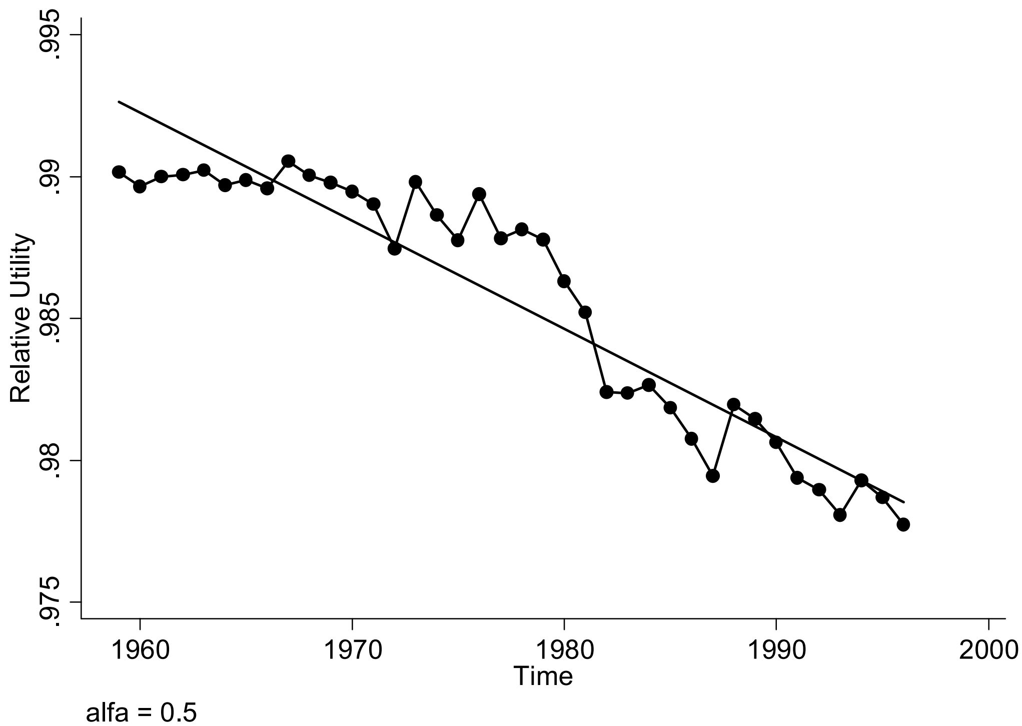

Figure 5 – Utility Cost of Dispersion of Market Power
(Unweighted Utility, α = 0.5)

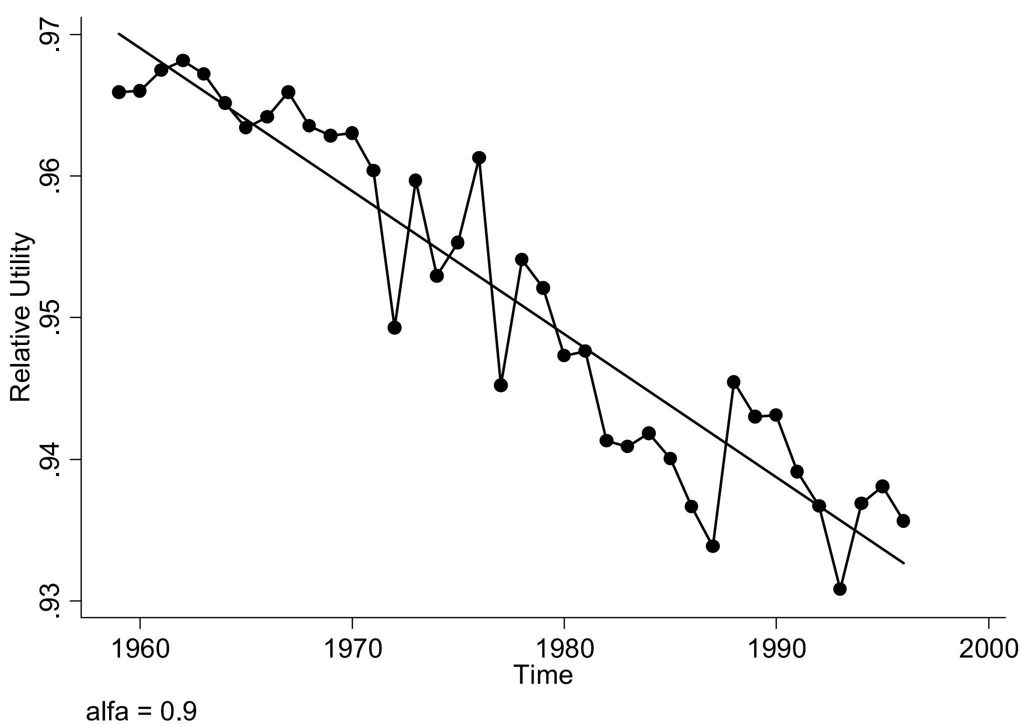

Figure 6 – Utility Cost of Dispersion of Market Power
(Unweighted Utility, α = 0.9)

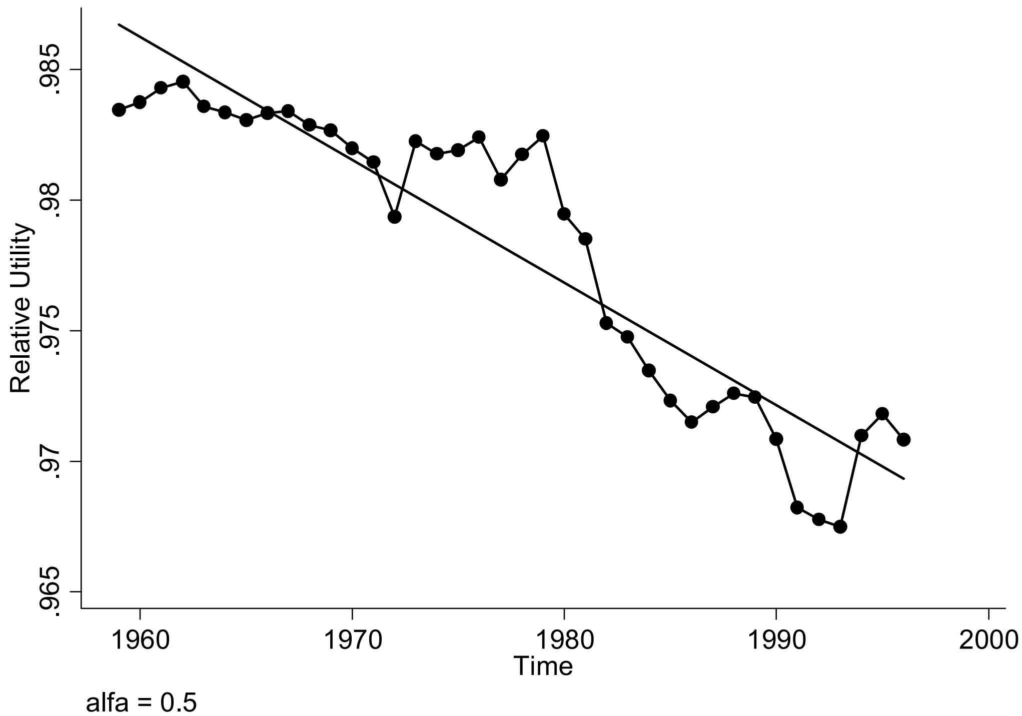

Figure 7 – Utility Cost of Dispersion of Market Power
(Weighted Utility, α = 0.5)

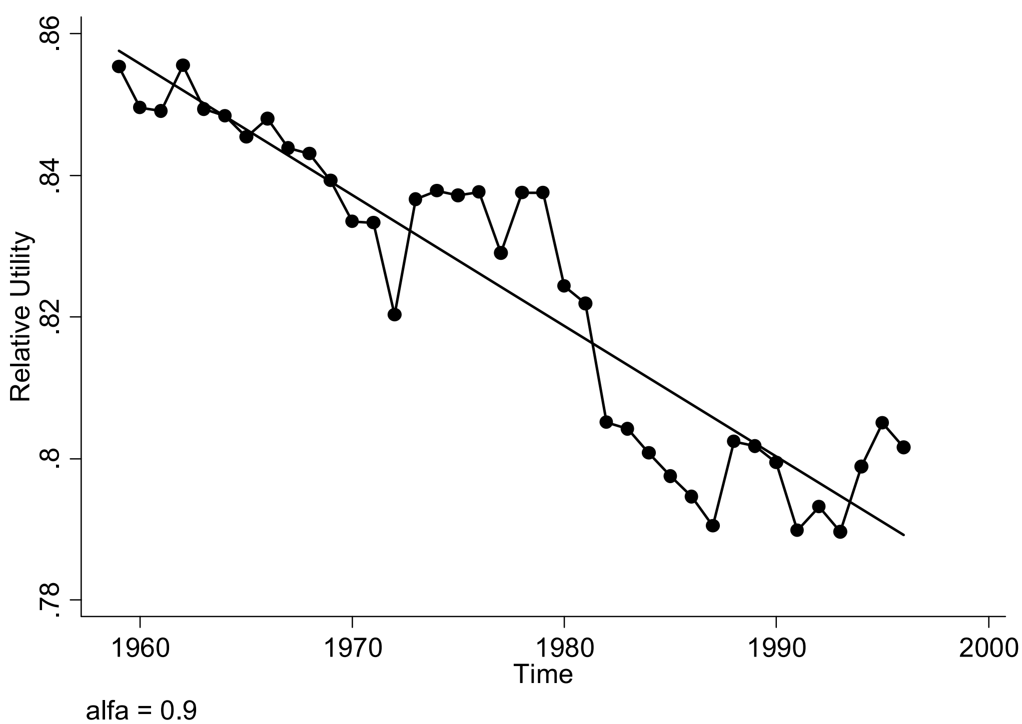

Figure 8 – Utility Cost of Dispersion of Market Power
(Weighted Utility, α = 0.9)

Table 1. Procompetitive Effect of International Trade

Dependent variable: Price-Cost Margins

	(1)	(2)	(3)
Openness	**-.007***** **(.001)**	**-.005***** **(.001)**	**-.004***** **(.001)**
TFP		.111*** (.003)	.098*** (.003)
K/Y			-.025*** (.001)
R-squared	.13	.22	.25
# *obs.*	16126	16119	16119

Notes: Fixed-Effects within regressions with standard errors in parentheses. ***,**,* = significant at the 1, 5 and 10-percent levels, respectively. All regressions include time dummies, whose coefficients are not reported in the table. Data sources: NBER Productivity Database (by Bartelsman and Gray) and NBER Trade Database (by Feenstra).

Table 2. Procompetitive Losses from Trade

	(1)	(2)	(3)	(4)
	Dependent variable: Standard Deviation of Price-Cost Margins			
Average	**.103*** **	**.096*** **	**.097*** **	**.091*** **
openness	**(.007)**	**(.010)**	**(.009)**	**(.019)**
Average		-.172***	.010	-.001
TFP		(.029)	(.044)	(.050)
St. dev.		-.077***	-.045***	-.039*
of TFP		(.015)	(.013)	(.023)
Average			-.255***	-.252***
PCM			(.060)	(.060)
Time				.0001
				.0004
R-squared	.81	.93	.95	.95
# obs.	36	36	36	36
	Dependent variable: Relative Utility (unweighted, $\alpha = 0.5$)			
Average	**-.035*** **	**-.033*** **	**-.033*** **	**-.034*** **
openness	**(.002)**	**(.003)**	**(.003)**	**(.006)**
Average		.029***	.004	.002
TFP		(.008)	(.014)	(.015)
St. dev.		.015***	.011**	.011
of TFP		(.004)	(.005)	(.008)
Average			.035	.035*
PCM			(.021)	(.019)
Time				.000
				(.000)
R-squared	.91	.95	.95	.95
# obs.	36	36	36	36
	Dependent variable: Relative Utility (weighted, $\alpha = 0.5$)			
Average	**-.046*** **	**-.044*** **	**-.044*** **	**-.047*** **
openness	**(.005)**	**(.005)**	**(.006)**	**(.008)**
Average		.013**	-.007	-.013
TFP		(.006)	(.026)	(.028)
St. dev.		.031***	.007	.010
of TFP		(.009)	(.008)	(.009)
Average			.044	.046
PCM			(.031)	(.031)
Time				.000
				(.000)
R-squared	.91	.92	.93	.93
# obs.	36	36	36	36

Notes: OLS regressions with robust standard errors in parentheses. ***,**,* = significant at the 1, 5 and 10-percent levels, respectively. Data sources: NBER Productivity Database (by Bartelsman and Gray) and NBER Trade Database (by Feenstra).