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Increased Competition and Completion of the Market in the European Union: Static and Steady State Effects

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Abstract

We model the effects of completion of the internal market in the European Union on trade, production and market structure. The impetus for change comes from the removal of border costs, as well as increased competition from the greater ability of EU buyers to substitute among the products of different EU producers. In turn, this increased competition arises from the single market program on standards, government procurement, and dynamic learning

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effects. Removing the border costs results in relatively small welfare gains. Increased competition more than doubles the estimated benefits, and the steady state growth effect more than quadruples the welfare gains.

I. Introduction

Completion of the market in the European Union has generated enormous interest among policy-makers and academic modellers. Estimates of the gains from the single market program are based in part on the removal of barriers on trade between member states. More importantly, the single market program involves "deep" integration. The largest estimates of gains come from models with imperfect competition which assume that completion of the market will induce a single integrated market in which international price discrimination is impossible. That is, in these analyses a uniform EU-wide price is imposed in imperfectly competitive markets.[1]

Strikingly, virtually all key authors have expressed dissatisfaction with how increased competition under the single market program has been modelled.[2] In large part this stems from the fact that no clear rationale has been articulated for how the integration process will induce a common price. That is, if arbitrage fails to eliminate price differences (net of transportation, border and standards costs) prior to 1993,[3] it is not clear why it

1. Gasiorek, Smith and Venables [1992], Haaland and Norman [1992] and Mercenier [1992] estimate the gains at between 0.5 and 1.35 percent of GDP. The official forecasts, from Cecchini et al. [1988; p.83] and Emerson et al. [1988; Table 10.1.1, p.203], were that the welfare gains would be between 4.3% and 6.4% of 1988 GDP. Since these estimates were based on extrapolations of partial equilibrium calculations for a handful of industries from the work of Smith and Venables [1988], Winters [1992; p.105] has appropriately characterized these extrapolations as "heroic".
2. For example, see Karp [1992; p.63], Smith and Venables [1988; p.1523], Mercenier [1992; p.1] and Winters [1992; p.20].
3. We use the date "1993" to refer to the nominal year in which completion of the market is to begin. The delays in national legislative efforts to implement necessary statutes, as well as other delays in application of those laws, makes this date a matter of pedagogic convenience rather than a prediction about when the EU will in face have completed the single-market program. We also refer throughout to the "European Union," despite it historically being the "European Community" at the time of some of the policy changes or data we discuss.

would eliminate price differences (net of transportation costs) after 1993.[4] We review the theory of monopolistically competitive markets and empirical work on the relatively integrated markets in the United States. Both indicate the implausibility of the modelling exercises that assume that no price discrimination is possible after the implementation of the EU92. In addition, we note that the imposition of uniform pricing results (due to the elimination of reciprocal dumping implied by uniform pricing) in the counterintuitive result that intra-EU trade *declines* subsequent to the EU92 program.[5] Thus, we model market integration within the EU92 program with an approach that captures the idea that EU92 will increase competition and rationalization in imperfectly competitive markets without imposing *complete* elimination of firm level price discrimination across the EU. We provide a rationale for the reduction of price discrimination occasioned by the EU92 program in which the extent of remaining price discrimination is endogenously determined.

The impetus for change in our framework comes from two interrelated effects. One effect is the, now standard, 2.5 percent reduction of border and supply side standards costs. In addition, we maintain that increased competition will come from an increase in the willingness of EU buyers to substitute among the products of producers in different countries. This increased willingness is due to the single market program on standards, rules on government procurement, and an increase in intra-EU trade (from border costs reductions) which is likely to lead to consumers trying new varieties they

4. Karp [1992; p.63] makes the same point: "If it were possible to price discriminate before 1992, then lowering transportation costs (broadly defined) might either increase or decrease the incentive for price discriminate before 1992, then lowering transportation costs (broadly defined) might either increase or decrease the incentive for price discrimination." Smith and Venables [1988; p.1523] note that "... it is not obvious that there exist feasible changes in EU trade policy and competition policy that could impose such a change. In practice policy may be expected to be some combination of our two experiments."

5. See, for example, Smith and Venables [1988; pp. 1520-1523]. Tarr [1994] notes that the segmented markets approach of Gasoriek, Smith and Venables assumes that there are no taste differences across countries or firms. That is, all price differences in the benchmark are calibrated as due to non-tariff barriers and all these are eliminated in the integrated markets counterfactual.

sometimes like.[6]

These effects are best modelled as a change in the elasticity of substitution of consumers in EU countries for the varieties of output of other EU firms. We simulate this change along a continuum from an initial situation, characterized by firm level product differentiation where consumers regard the output of other EU firms are equally substitutable with other *non-EU imports*, to an endpoint where consumers regard the varieties of all other EU firms as equally substitutable with *home varieties.*[7]

We develop a monopolistic competition model in which each firm's post-1992 markup is endogenously determined as a function of the substitutability of the outputs of different EU firms in the preference structure of national consumers. We show, however, that even in the extreme case of no national preferences, pricing differences and market segmentation are not eliminated. As long as arbitrage is imperfect, price differences (net of transportation costs) may persist. Firms then determine their optimal markups in each national market based on perceived elasticities that vary, among other things, with the firm's market share in each national market.[8]

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6. This assumption is supported by the views of businessmen surveyed in the "Costs of non-Europe" project who believed that they would have greater access to new regional markets and there would be increased price and non-price competitiveness as a result of the single market (Nerb [1988; p.27]).
7. Since we may calibrate the initial equilibrium as an optimum for any elasticity of substitution, we recalibrate the initial equilibrium to the new elasticities, while preserving the assumed optimality of the initial data point. This allows us to meaningfully calculate the Hicksian equivalent variation in counterfactual simulations. Our approach was independently adopted by Burniaux and Waelbroeck [1992] in a prototype model of EU92.
8. Haaland and Wooton [1992] have shown that, if trade barriers or national preferences continue to exist in the post-1992 environment, uniform EU-wide pricing that results from complete elimination of segmentatin can, contrary to the conventional wisdom, reduce welfare. The reason is that if firms are forced to charge a uniform price across the EU, but national preferences are retained, they will raise prices on their intra-EU exports and this may dominate the effects of lower markups on their domestic sales. In other words, EU92 could reduce welfare due to the loss of the beneficial aspects of a type of reciprocal dumping described by Brander and Krugman [1983]. A similar result is shown analytically by Malueg and Schwartz [forthcoming]. The Haaland-Wooton model does not, however, explain why EU92 would force uniform pricing in markets which were previously characterized by price dis

Our estimates are that the reduction of border and standards costs associated with the EU92 program will result in welfare gains of about 0.5% of EU welfare. Allowing for the additional effects of standardization on consumer substitution elasticities (our version of integration), however, more than doubles the estimated welfare gains.

We also estimate the steady state growth effects of EU92. Building on the single sector approach of Baldwin [1989; pp.266, 269], we integrate our multisector approach and the steady state effects into a single model. We estimate that the benefits in the steady state more than *quadruple* the estimate of the welfare benefits (about 2.4% of EU GDP) compared to the segmented markets comparative statics estimate, explaining some of the anticipatory euphoria.

Our general equilibrium model is described in section II, and the policy simulations are discussed in section III. In section III we develop partial equilibrium analyses to facilitate the intuitive understanding of the numerical general equilibrium results. Compared with earlier studies, we estimate dramatically greater disparity in the expected benefits from EU92 across EU countries. We show that this is explained primarily by differences in intra-EU trade intensities which we are able to uncover due to our greater regional disaggregation.

II. A Multi-Regional Trade Model

A. General Model Features[9]

The model separately identifies nine regions of the EU. Along with their intra-EU trade intensities, they are: Belgium (35.6), Denmark (14.9), France (11.1), Germany (11.9), Italy (10.1), the Netherlands (29.1), Portugal (12.0), Spain (08.8), and the United Kingdom (11.9). The model also identifies

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crimination. The problems that they identify, however, have led Winters [1992; p.20] to call for further research to distinguish trade barriers and consumer preferences as a rationale for home market bias.

9. See Harrison, Rutherford and Tarr [1994, Appendix A] for a detailed algebraic formulation of the model; for the decomposition algorithm employed for solution see Rutherford [1992a] [1992b].

Morocco, Turkey, and a residual Rest of World (ROW), making twelve regions in all.

There are twenty-six sectors per region, twelve of which are characterized by increasing returns to scale (IRTS). In IRTS sectors we assume firms are Cournot oligopolists, with free entry and exit assuring zero profits. The Cost Disadvantage Ratio (CDR), which is defined as the ratio of fixed to total costs, provides a measure of the importance of scale economies in IRTS sectors.[10] All other sectors exhibit constant returns to scale (CRTS) and have a competitive market structure. The sectors are as follows: Agriculture (3), Food (3, 11), Beverage and Tobacco (2), Energy (4), Utilities (2), Iron and Steel (1, 5), Non-Metallic Mineral Products (1, 6), Chemicals (2, 6), Metal Products (2, 5), Industrial Machinery (2, 6), Office Machinery (1, 4), Electrical Goods (3, 5), Motor Vehicles (2, 11), Other Transport Equipment (1, 14), Textiles and Clothing (2), Wood (1), Paper and Printing (2, 11), Rubber and Plastics (1, 4), Construction and Repair (8), Trade (12), Financial Services (15), Transport and Communication (6), Health Services (4), Education Services (4), Other Market Services (6), General Public Services (10). The first number in parentheses is the value added of the sector as a percent of total EU value added; the second number in parentheses is the CDR for those sectors subject to IRTS.

By received standards in the literature this makes for a "big model". We adopt this relatively detailed level of sectoral and regional disaggregation since disaggregation has, as we show below, an important impact on the estimated effects of EU92. Gasiorek, Smith and Venables [1992] note that regional aggregation entails a nontrivial assumption in these exercises, since it is primarily through the reduction in border and standards costs of exporting between regions that the EU92 program will have its impact. Regional aggregation in effect converts exports, on which a cost reduction would be achieved, into domestic production. We show below that greater regional disaggregation is fundamental in revealing the considerable differences in the welfare benefits that will accrue to the EU countries with different intra-EU trade intensities.

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10. The methodology for estimation of the CDR is discussed in Harrison, Rutherford and Tarr [1994, Appendix B].

Regarding sectoral aggregation, our 26-sector model allows us to keep separate virtually all of the sectors which have significant IRTS as estimated at the 44-sector level. It also allows us to maintain some disaggregation of CRTS sectors, along the lines that might be expected to influence results (viz., traded versus non-traded, labor-intensive versus capital-intensive).

The rest of our static model is relatively standard. We have multiple price-wedge distortions, such as factor taxes in production, value-added taxes, import tariffs, export subsidies, voluntary export restraints (represented as ad valorem equivalents) and non-tariff barriers (also represented as *ad valorem* equivalents). Production entails the use of intermediate inputs and primary factors. Primary factors are mobile across sectors within a region, but are internationally immobile. Each region has a single representative consumer, as well as a single government agent.

B. Modelling the Reduction in Border and Standards Costs of Intra-EU Trade

The two types of real trade costs which constitute the "sand in the gears" in our model are border costs and standardization costs on the supply side. *Border costs* represent the costs of undertaking trade, such as administrative costs of transacting and transporting over international boundaries. These are modelled as additional purchases of the domestic "transportation" good in each region. This good represents the activity of shipping, handling and warehousing for customs purposes. *Standardization costs* on the supply side are due to differences in technical specifications and regulations across national boundaries, and are associated with the production costs of fulfilling technical regulations in foreign EU markets. These costs are more likely to be reflected in extra costs of producing the specific good itself, rather than the purchase of inputs of any specific good. Thus we model supply side standardization costs as additional value-added in each sector in which trade takes place. They do not fall on domestic sales, and hence should be interpreted as the *differential* costs of transacting with other EU countries.

Following previous studies, we assume that the sum of real trade costs from border costs and supply side standardization costs equals 2.5% for each region. From Cawley and Davenport [1988; Tables B2, A3] we have esti-

mates of border costs for the regions in our model. The weighted averages are as follows: Belgium, Denmark, France and Spain (1.7%), Germany (1.8%), United Kingdom (1.9%), Italy and the Netherlands (1.6%), and Portugal (1.5%). The region-specific standardization costs are derived residually from 2.5%. These estimated supply side standardization costs are then assumed to apply to all traded goods within the indicated region.

C. Theory and Evidence Against Uniform Pricing

Previous studies have modelled completion of the market in two stages, with the first stage being the same as ours. In the second stage, previous studies have attempted to capture the presumption that EU integration will have its strongest impact by increasing competition in IRTS sectors. Their second stage involves a shift in the pricing behavior of national firms as the result of completion. Pricing is originally undertaken with "segmented markets", and with monopolistic competition in IRTS sectors this results in lower prices in foreign markets than at home.[11] With completion of the market these segmented markets are replaced with an integrated market in which price discrimination between home and foreign markets is assumed to be impossible.

We claim that it is inappropriate either on *theoretical or empirical grounds* to model EU integration as a process that imposes complete pricing uniformity. First consider the theory. Although the possibility of price discrimination by a monopolist selling in segmented markets has long been accepted in economic theory, recent theoretical work has shown the existence of price discrimination equilibria in a variety of multi-firm settings, even with free entry (*e.g.*, Katz [1984], Borenstein [1985] and Holmes [1989]).[12] These analyses suggest that price discrimination may arise even when market power over price arises only from monopolistically competitive product differentiation.

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11. This result assumes, plausibly enough, that foreign market shares for a given firm are smaller than domestic market shares. Hence the perceived demand elasticity is different in the two markets, resulting in differences in mark-ups.
12. See Varian [1989] for a review of the theory of price discrimination under non-monopoly conditions.

On empirical grounds, consider the United States market, which is considerably more integrated than the EU is likely to become in the immediate future. Although there are generally alternative theoretical explanations for the observed pricing practices,[13] there are a wide variety of observed pricing practices in the United States that are consistent with price discrimination. These include: (1) two-part tariffs, in which a lump sum fee is charged and a usage charge per unit applies;[14] (2) discount coupons, which allow those consumers with lower opportunity cost of time to obtain a lower price; (3) selling the same product under different brand names and charging a premium for the label as occurs in supermarkets;[15] (4) discounts on products that face stiff competition, for example in the shoe machinery (Kaysen [1956]) and computer markets (Fisher, McGowan and Greenwood [1983]); and (5) geographic price discrimination under single or multiple basing points, with some absorption of transportation charges by the producer.[16]

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13. See Carlton and Perloff [1990] for alternate explanations. The welfare economics of these practices is a separate matter which we do not address.
14. Tie-in sales, where the purchaser of the product is required to purchase related products, is one type of two part tariff. For example, IBM, in requiring purchasers of its computers to buy its tabulating cards was able to obtain a higher price for the machine from the more intensive users. Xerox, is charging a per unit rental fee for copies that exceeded the marginal maintenance costs, price discriminated against intensive users. See Scherer and Ross [1990].
15. See Wolinsky [1987].
16. Some form of basing point system has been adopted by many U.S. industries including the steel, cement, lead and wood pulp industries. See Scherer and Ross [1990] for further discussion. In addition, recent studies have found evidence of price discrimination in monopolistically competitive markets. Using data from retail gasoline markets, Borenstein [1991] developed a model of spatial competition in which differences in the willingness of buyers to switch stations results in price discrimination between leaded and unleaded gasoline. As gasoline stations which offered leaded gasoline diminished, the relative price of leaded to unleaded gasoline rose. Shepard [1991] found the price difference between full service and self-service gasoline in stations that offered both services was considerably greater than the price difference across different stations that only offered one type of service. Based on a similar model, Borenstein and Rose [1991] found price discrimination in the U.S. airline industry. Pashigian and Bowen [1991] have found that the greater use of sales in the pricing of apparel in retail stores is consistent with a price discrimination theory of

A further highly counterintuitive result of the uniform pricing assumption is that intra-EU trade declines as a result of EU integration. This is because firms charge higher markups on their domestic sales than on export sales prior to integration. Uniform pricing in the EU causes firms to raise export markups and lower domestic markups, which reduces intra-EU trade.

D. Modelling the Price Effects of Integration

Impact of Standards, Government Procurement and Dynamic Learning Effects on Substitution: The single market program should increase the ability and willingness of EU buyers to substitute among the products of EU suppliers due to the impact of standards, government procurement and dynamic learning effects on substitution. Regarding standards, the EU92 program involves *interchangeability* standards which are designed for the express purpose of allowing buyers greater substitution possibilities among different suppliers. Interchangeability standards have had a powerful impact on competition in the United States. Well known interchangeability standards are those in the auto industry which were imposed on parts suppliers by the Society of Automotive Engineers (SAE) on behalf of auto assemblers; these standards were designed so that assemblers would be able to substitute among different suppliers of parts such as wheel rims, spark plugs and screws and bolts.[17]

Standards are sometimes imposed by suppliers for anticompetitive purposes.[18] For example, fearing anticompetitive standards, the U.S. Federal Communications Commission mandated standardized interconnection for terminal equipment and open network architecture (ONA), which means that the components of the telephone system are made available on an

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pricing (as well as greater uncertainty), in which consumers who are more interested in being in fashion have less elastic demand and pay higher prices early in the season.

17. It is also possible that *quality standards* will arise. Products that are graded for quality typically have little product differentiation advantages. This includes milk, eggs, meat, lumber, soybeans, diamonds and mushrooms. See Hemenway [1975] for a detailed discussion of the impact of standards on competition.

18. Another prominent reason for suppliers to desire standards is to gain economies of scale. This was discussed above and included in the model.

unbundled basis so that competing supplier services can be combined in any manner desired. These standards have been highly successful, at least judged by the wide variety of independent supplier equipment and services that have developed.[19]

As part of its single market program, EU policy is attempting to implement similar reforms in standards. The EU green paper on telecommunications policy indicates that through the promotion of Europe-wide standards it shall provide equal access to all market participants (EC [1987; p.5]). Moreover, ONA has been mandated by the Maastricht treaty partly to insure the uniform interpretation of essential requirements across the EU in order to limit the possibilities for the imposition of restrictive licensing conditions.[20]

Probably the best known example of supplier-based anticompetitive standards is national standards that have the force of law for the purpose of protection, which the EU refers to as technical regulations. For example, EU courts interpreted German beer purity laws as protectionist and required that beer manufactured in any member state could be imported into Germany. This is an application of the mutual recognition principle in which products produced in one member state may be sold throughout the EU. In the absence of specific EU legislation however, EU states may still block intra-EU imports if certain national interests are involved. So the EU has attempted to achieve harmonization of technical regulations in which EU directives indicate mandatory requirements for national regulations.[21] In either event, the European consumer will be able to consume products from other EU states that previously were illegal to import.

Regarding *government procurement*, broadly speaking the single market program is designed to require governments to accept the goods and ser-

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19. See Besen and Saloner [1987] for further details.

20. See XIII, September 1993, p.12 (the magazine of DG XIII of the EU) and Emerson et al. [1988; p.86].

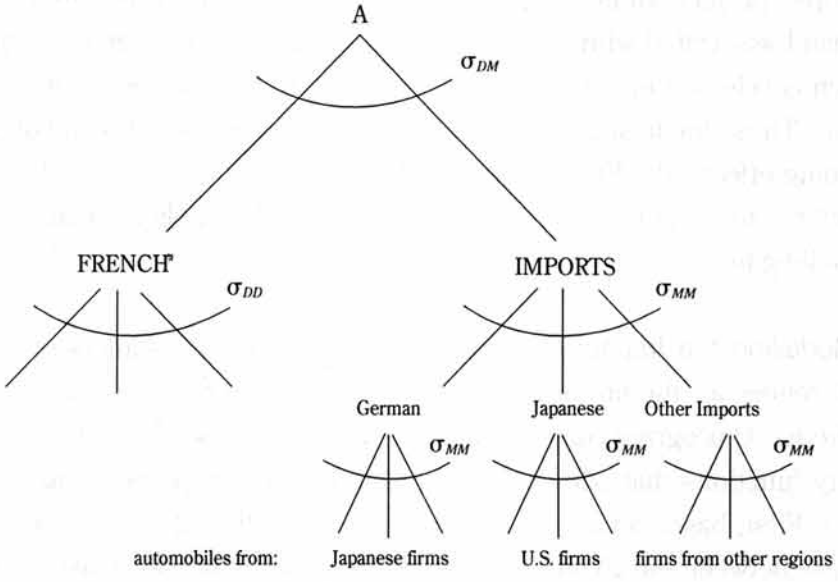
21. A manufacturer may meet the technical requirements either by producing a product that meets the defined essential requirements (which allows manufacturer variety subject to the constraint of meeting the essential requirements of the product) or by producing a product in conformity with European standardization bodies (Emerson et al. [1988; p.40]).

vices of non-national EU producers as closer substitutes to products of their national producers. Finally, based on the surveys of the "Costs of non-Europe" project, some observers concluded that "there is a dynamic of demand associated with the *learning process* of consumers and enterprises which is released or accelerated when barriers are removed" (Nerb [1988; p.26]). Thus, due to standards, government procurement rules and dynamic learning effects, the EU92 program should substantially increase the ability of buyers to substitute among the products of EU suppliers, justifying our modelling focus.

Modelling the Impact of Increased Substitution: Consumers may have preferences for the products of firms depending on region of origin. Prior to the EU92 program consumers are assumed to possess weakly separable utility functions that allow multiple stage budgeting of their choice decisions. First, based on a Cobb-Douglas utility function at the top level, they choose between the 26 different composite goods which were listed earlier, such as "motor vehicles" and "textiles and clothing". Having chosen how much to spend on each aggregate commodity, they then choose between domestic and imported composites of this commodity: between "domestic autos" or "imported autos", for example. This decision is based on a CES sub-utility function. Having decided how much to allocate to imported autos, consumers then decide how much to allocate to imports from different regions in the model. This decision is also based on a Constant Elasticity of Substitution (CES) sub-utility function. Finally, given the decision on how much to spend on autos from each country, consumers allocate expenditures on the different varieties from each country based on the lowest level CES sub-utility function.[22] Figure 1 displays the typical structure of preferences, after the initial Cobb-Douglas choice of how much to spend on the aggregate commodity, taking French consumers of autos as an example.

22. Given that the elasticities of substitution for these last two levels of choice with respect to foreign country and foreign firm variety (within a country) are the same, the structure is equivalent to firm level competition among all imports. A special case of this structure, with all elasticities of substitution equal, yields firm level competition among all firms that is independent of the country of origin.

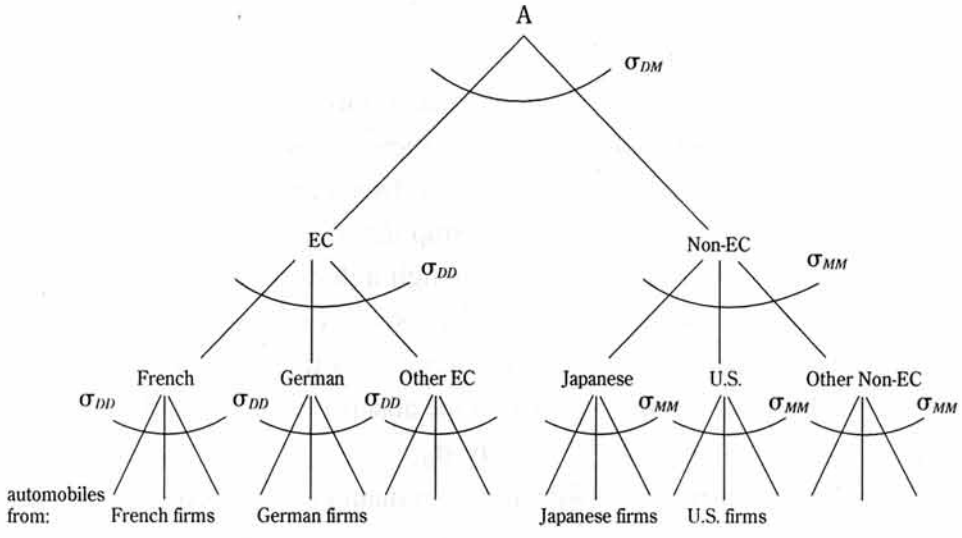
Figure 1
Structure of Preferences before the EU92 Program



Due to EU92 programs regarding standards, government procurement, and due to dynamic learning effects, EU-produced goods become better substitutes, and this is perceived by EU consumers. This reflects a demand change by EU consumers, which we simulate along a continuum where in the limit consumers regard the products of all EU firms as equally substitutable. The latter preference structure is shown in Figure 2, again taking French consumers of autos as an example.

Specifically, in the fully integrated scenario the preference structure of consumers is directly analogous to the segmented scenario prior to EU92. Having decided how much to spend on any aggregate commodity, such as autos, consumers allocate that income among imported and domestic varieties of the commodity. However, now the notion of a "domestic variety" includes all other EU-produced varieties, even if they are not produced in the EU country in which the consumer lives. That is, we shift from treating other EU products as being "foreign varieties" and treat them as if they were "domestic varieties". The preference structure is modelled as a weighted average of the two extreme preference structures, where

Figure 2
Structure of Preferences after the EU92 Program



"percent integration" represents the weight of the fully integrated structure.[23]

Our measure of Hicksian equivalent variation is well defined because when we employ the post-EU92 preference structure (elasticities), we recalibrate the initial equilibrium with the same preference structure (elasticities). This is possible because given prices, incomes and quantity choices, the initial data point can be calibrated as an optimum for any elasticity of substitution.[24] That is, nothing is changed in the benchmark equilibrium by

23. We assume that this fraction is constant across all countries, reflecting the overall progress towards completion of the EU92 program. It would be a simple matter to let it vary across EU countries, perhaps reflecting the differential speed with which EU countries are accepting EU-wide standards and are removing border costs on EU imports. There is some anecdotal evidence of such differentials, at least as measured by the speed of enacting national legislation to implement the EU92 program (*e.g.*, *The Economist*, July 3-9, 1993, Survey on the European Community).

24. For example, in two dimensions suppose that prices, income and the consumer's budget constraint are given along with the observed quantity choice. Then given an initial elasticity of substitution from the utility function, the observed point is calibrated as an optimum by choosing other parameters of the utility function such that the indifference curve is tangent to the budget line at the observed quantity choice, i.e.,

the recalibration, but the different elasticity structure impacts the results in the counterfactual.

The key elasticities of substitution are denoted σ_{DM}, σ_{DD} and σ_{MM}, and reflect the substitutability between domestic (D) and imported (M) goods, alternative domestic varieties, and alternative foreign countries (and varieties), respectively. Our priors are that products produced in the same country will be more substitutable among themselves than products from different countries. This gives us the relationship that $\sigma_{MM} < \sigma_{DD}$; this inequality plays a crucial role in the analysis.[25] Although it does not play an important role in the analysis, we also posit that domestic consumers are less willing to substitute foreign varieties for domestic varieties than they are among different varieties from foreign sources. In the absence of data-based estimates of these elasticities we initially specify $\sigma_{DM} = 5$, $\sigma_{MM} = 10$, and $\sigma_{DD} = 15$. These three key elasticities of substitution remain the same when applied to the pre or post EU92 preference structure.

A formal derivation is provided in Harrison, Rutherford and Tarr [1994, Appendix A], but intuition into how market integration affects markups and intra-EU trade can be obtained through examination of the markup equations. Define the markup for firms from one EU country (r) selling into another EU country (r') in the segmented market situation as $m_{rr'}$, and in the fully integrated equilibrium as $m^*_{rr'}$. The markup under segmented markets is:

$$m^*_{rr'} = \frac{1}{\sigma_{MM}} + \left[\frac{1}{\sigma_{DM}} - \frac{1}{\sigma_{MM}}\right] \frac{\theta_{rr'}}{N_r \theta^M_{r'}} + \left[1 - \frac{1}{\sigma_{DM}}\right] \frac{\theta_{rr'}}{N_r} \qquad (1)$$

and the markup under fully integrated markups is:

$$m^*_{rr'} = \frac{1}{\sigma_{DD}} + \left[\frac{1}{\sigma_{DM}} - \frac{1}{\sigma_{DD}}\right] \frac{\theta_{rr'}}{N_r \theta^{EC}_{r'}} + \left[1 - \frac{1}{\sigma_{DM}}\right] \frac{\theta_{rr'}}{N_r} \qquad (2)$$

where

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it is optimal. Changing the curvature of the utility function will not change the point of tangency in the initial equilibrium. The curvature of the utility function is important in the counterfactual because the slope of the budget constraint changes or because of imperfect competition, but it is irrelevant in determining the initial equilibrium.

25. It also implies, along with later assumptions, that $\sigma_{DM} < \sigma_{DD}$.

$$\theta^{M}_{r'} = \sum_{r \neq r'} \theta_{rr'} \qquad \theta^{EC}_{r'} = \sum_{r \in EC} \theta_{rr'}$$

$\theta_{rr'}$ denotes the market share of region r firms in region r', and N_r is the number of firms in region r. The change in markup, defined as the fully integrated minus the segmented markup, simplifies to:

$$m^{*}_{rr'} - m_{rr'} = \left[\frac{1}{\sigma_{DD}} - \frac{1}{\sigma_{MM}}\right] + \frac{\theta_{rr'}}{N_r}\left[\frac{1}{\theta^{EC}_{r'}}\left[\frac{1}{\sigma_{DM}} - \frac{1}{\sigma_{DD}}\right] - \frac{1}{\theta^{M}_{r'}}\left[\frac{1}{\sigma_{DM}} - \frac{1}{\sigma_{MM}}\right]\right] \quad (3)$$

When this expression is negative, markups on intra-EU trade will fall and trade will tend, *ceteris paribus*, to increase. We assumed that $\sigma_{DM} = 5$, $\sigma_{MM} = 10$, and $\sigma_{DD} = 15$. The first term in this simplified expression is negative when $\sigma_{DD} > \sigma_{MM}$, and for our specific values equals –0.033; however, there is some ambiguity with respect to the second term. Given the ranking of the elasticities of substitution, the second term will be positive the smaller is $\theta^{EC}_{r'}$ in relation to $\theta^{M}_{r'}$, *i.e.*, the smaller the share domestic firms have of the domestic market relative to non-EU imports in the domestic market.[26] Given our specific values, the change in the markup equals:

$$-0.033 + \frac{\theta_{rr'}}{N_r}\left[\frac{(.133)}{\theta^{EC}_{r'}} - \frac{(.1)}{\theta^{M}_{r'}}\right].$$

Numerically, we find that the sign of the second term is positive in most cases, but considerably smaller than the first term because it is multiplied by the ratio of a share ($\theta_{rr'}$) divided by the number of firms. For example, for Belgium's markup in Germany we have the share of Belgian exports in the German market divided by the number of Belgian firms. Thus, we find that the change in the markup is uniformly negative, and in most cases the decline in the markup is between 2 and 3.3 percent.

III. The Effects of Completion of the Market

A. Static Welfare Effects

Table 1 displays the results of completion of the market on aggregate EU welfare. In effect, this measure of the welfare effects adopts a utilitarian

26. Specifically, the second term will be positive if and only if $4\sum_{r \notin EC} \theta_{rr'} + \sum_{\substack{r \notin EC \\ r \neq r'}} \theta_{rr'} > 3\theta_{r'r'}$.

Table 1
Welfare Effects of EU92 on the EU [a]

Percent Integration		Percent Removal of Border and Standards Costs									
		0%		25%		50%		75%		100%	
		Static (1)	Steady state (2)	Static (3)	Steady state (4)	Static (5)	Steady state (6)	Static (7)	Steady state (8)	Static (9)	Steady state (10)
0%	IRTS	0.00	0.00	0.12	0.38	0.25	0.85	0.38	1.33	0.52	1.79
	CRTS	0.00	0.00	0.11	0.34	0.22	0.74	0.34	1.15	0.46	1.56
25%	IRTS	0.11	0.30	0.24	0.72	0.37	1.14	0.51	1.57	0.66	2.03
	CRTS	0.00	0.00	0.11	0.33	0.23	0.70	0.35	1.08	0.47	1.48
50%	IRTS	0.23	0.59	0.36	0.98	0.50	1.38	0.65	1.80	0.81	2.25
	CRTS	0.00	0.00	0.11	0.30	0.23	0.64	0.35	0.99	0.49	1.37
75%	IRTS	0.36	0.83	0.50	1.20	0.65	1.59	0.81	2.00	0.98	2.44
	CRTS	0.00	0.00	0.11	0.27	0.23	0.57	0.36	0.90	0.50	1.24
100%	IRTS	0.50	1.04	0.65	1.38	0.82	1.76	0.99	2.16	1.18	2.60
	CRTS	0.00	0.00	0.11	0.23	0.23	0.49	0.36	0.79	0.50	1.10

Note: a. Welfare effects are in each case the aggregate equivalent variation as a percent of aggregate EU GDP.
Source: Model estimates.

social welfare function for the EU, such that we simply add up the welfare effects for individual EU countries. In Table 1 we display a matrix of results where we simulate partial and full removal of border and supply side standards costs and well as partial and complete change in the elasticities of substitution (referred to in the table as percent of integration).

First, consider the static welfare effects with IRTS in Table 1. These estimates imply that *removal of internal trade barriers and market integration are complementary* to each other, which is consistent with the received wisdom from previous studies. Full integration with complete removal of internal trade barriers results in an aggregate welfare gain of 1.13% of GDP per annum.

Table 2

Country Composition of the Welfare Effects of EU92[a]: 100% Integration and Removal of Border and Standards Costs

Region	Percent change in:								
	Welfare[b]		Welfare in dollars[c]		Real wages		Real price[d] of capital	Real consumer prices	
	Static	Steady state	Static	Steady state	Static	Steady state		Static	Steady state
Belgium (BE)	3.37 (1.53)	6.39	3.32 (1.51)	6.31	5.2 (2.6)	6.7	3.3 (1.3)	1.4 (0.7)	1.0
Germany (DE)	1.10 (0.44)	2.03	7.27 (2.90)	13.39	1.0 (0.4)	1.6	0.9 (0.3)	0.1 (0.1)	0.1
Denmark (DK)	1.82 (0.81)	3.78	1.21 (0.54)	2.51	2.4 (1.2)	3.0	1.7 (0.8)	0.7 (0.4)	0.4
Spain (ES)	0.80 (0.36)	1.96	2.19 (0.98)	5.36	0.8 (0.4)	1.4	1.2 (0.5)	0.4 (0.2)	0.0
France (FR)	1.13 (0.50)	2.47	7.07 (3.14)	15.44	1.1 (0.5)	1.8	1.4 (0.7)	0.3 (0.2)	0.1
Italy (IT)	1.05 (0.46)	2.03	4.62 (2.03)	8.88	1.0 (0.4)	1.5	0.8 (0.3)	0.0 0	–0.1
The Netherlands (NL)	2.48 (1.20)	7.73	3.41 (1.65)	10.63	3.0 (1.3)	4.9	4.0 (2.5)	1.2 (0.7)	1.1
Portugal (PT)	1.04 (0.42)	1.72	0.53 (0.21)	0.87	0.5 (0.3)	0.6	1.3 (0.8)	–0.2 0	–0.6
United Kingdom (UK)	0.80 (0.29)	1.49	4.31 (1.57)	7.97	0.1 (–0.2)	0.4	1.0 (0.4)	–0.3 (–0.3)	–0.3
Rest of World (ROW)	–0.00 (–0.005)	0.05	–0.35 (–0.42)	4.06	–0.00 (–0.1)	0.0	0.3 (0.1)	0 0	0.0

Notes: a. Numbers without parentheses are for IRTS in fully integrated scenario with all border and standards.

b. Equivalent variation s a percent of GDP.

c. Equivalent variation in billions of 1985 U.S. dollars.

d. Real price of capital is fixed in the steady state scenario.

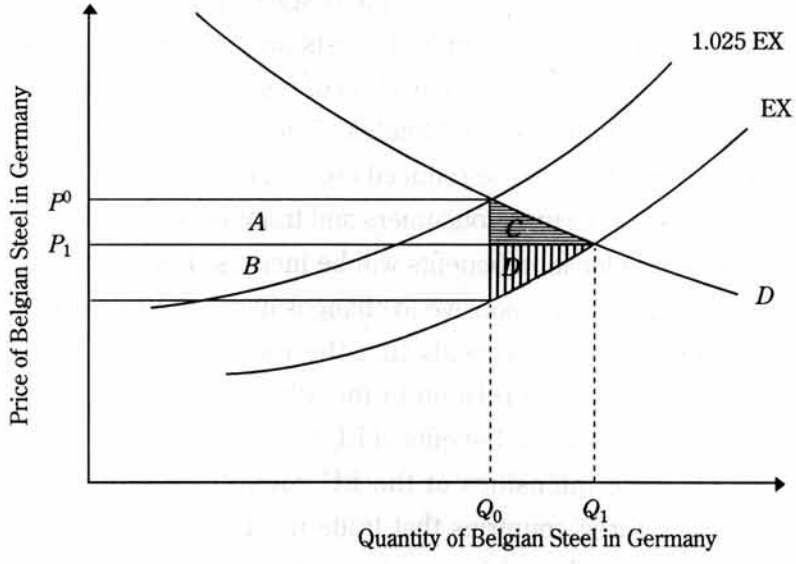
The *relative contribution of market integration and removal of trade barriers appears to be roughly additive and, as it turns out, somewhat symmetric.* That is, *x*% integration and *y*% removal of sand achieves about the same welfare increase as y% integration and *x*% removal of sand, provided neither *x* nor *y* are zero.

CRTS Results and Comparison with IRTS: To build intuition, it is helpful to consider the results in the case in which all sectors are subject to CRTS. We implement this by setting the CDR equal to zero for all sectors. Given that there are no rationalization gains to be realized from improved scale efficiency in a CRTS model, we would expect that the welfare effects of EU92 would be much smaller, and indeed they are. In Table 1 the effect of assuming IRTS and monopolistically competitive pricing in our model is seen to increase the welfare gains by almost nothing (if we assume zero price integration) or by as much as 100% (if we assume full price integration).

In Table 2 we present results showing the distributional effects across countries. We find considerable disparity in the welfare effects across EU countries, even though all gain. Table 2 shows the effect on welfare in percentage and in absolute terms (equivalent variation as a percent of GDP and in billions of 1985 U.S. dollars, respectively), the percentage change in the real wage and the real price of capital, and finally the percentage change in the real cost of living. The numbers without parentheses are for the IRTS fully integrated scenario in which all border and standards costs "sand" are removed. The CRTS results are in parentheses.

Examining Table 2 for the distribution of welfare gains across the countries of the EU in the CRTS case, one sees that Belgium and the Netherlands are the countries which experience the largest increase in welfare as a percent of GDP. The key to understanding this is to recognize that we have modelled the impact of the EU92 program on standards and borders costs as costs which will be reduced on intra-EU exports only. That is, there are no cost reductions on production for the domestic market. Border costs require resources of the domestic transportation sector in our model, and supply side standards costs are a component of value-added to the extent that the good is exported. Since the single market program is assumed to

Figure 3
Distribution of EU92 Benefits under CRTS:
Case of Belgian Steel in Germany



Note: The initial equilibrium for Belgian steel in Germany is at (P_0, Q_0), determined by the intersection of the export supply curve of Belgian steel producers to Germany (1.025 EX), and the demand by German consumers for Belgian steel (D). Following the changes of EC92, the export supply curve shifts down by 2.5 percent to EX, resulting in a new equilibrium (abstracting from general equilibrium effects) at (P_1, Q_1). There are rectangles of benefits **A** (to Germany) plus **B** (to Belgium), the sum of which is 2.5 percent of the initial exports; plus triangles of benefits from reduced distortion costs equal to **C** (to Germany) and **D** (to Belgium).

reduce the border and standards costs of intra-EU exporting by 2.5 percent, the first order effect on welfare (as a percent of GDP) will be approximately equal to the share of intra-EU trade in GDP times 2.5 percent. But there will be additional gains from removing distortion costs.

In Figure 3 we depict the partial equilibrium welfare economics of a 2.5% reduction in the costs of intra-EU exporting under CRTS. We take the example of Belgian exports of steel to Germany. There is a rectangle of benefits from the reduction of the costs of exporting Belgian steel to Germany, equal

to 2.5% of the initial costs of exporting. Provided neither German demand for steel, nor Belgian supply of steel, are limiting elasticity cases, the initial rectangle of benefits will be shared between the exporting and importing country (*A* to German consumers and B to Belgian producers in the figure).

In addition, the border and standards costs are analogous to distortions to trade. Their removal allows a reallocation of resources with an increase in intra-EU trade. That is, there are "triangles" of benefits that augment the "rectangles" of benefits from the reduced costs of exporting. In Figure 3 triangle *C* is a benefit to German consumers and triangle *D* is a gain to Belgian exporters. These reallocation benefits will be increased or decreased to the extent that the country is responsive to changes in relative prices of imports and exports. Figure 3 also reveals that the more elastic is a country's demand or supply curves in relation to the other countries of the EU, the smaller will be its share of the benefits of EU92.

The intra-EU trade intensities of the EU countries in our model were noted earlier. The three countries that trade most intensely within the EU are Belgium, Netherlands and Denmark, and these are the three countries that gain the most from the EU92 program in the CRTS case. For the remaining countries there is little difference in their intra-EU trade intensities (ranging from 12% to 8.8%), and there is also relatively little difference in their welfare gain as a percent of GDP (ranging from 0.5% to 0.29%).

The benefits for all countries under CRTS exceed the first order effect of the lowering of the cost of production. In particular, 2.5% times the trade intensity ratio yields the following first order welfare effect in percent of GDP: Belgium 0.89, Netherlands 0.37, Denmark 0.37, Germany 0.30, Portugal 0.30, U.K. 0.30, France 0.28, Italy 0.25, and Spain 0.22. Other than for the U.K. and Denmark, the welfare benefits are between 1.4 and 2.2 times this "first order" effect, suggesting that the triangles in Figure 3 are quite large.[27] By the standards of CRTS models, we have assumed rather large trade elasticities in our benchmark equilibrium, so the triangles in Figure 3 are almost as large as the rectangles.[28] Examining Figure 3 reveals that the

27. For the U.K. the benefits are close to the first order effect, indicating that the U.K. is obtaining a relatively small share of the benefits of integration. As discussed above, this suggests that U.K. import demand or export supply is more elastic than that of the other EU countries.

benefits would be closer to the rectangles the more inelastic are the demand elasticities.[29] When we counterfactually reduce all three import demand elasticities for all countries in our model to one-fourth their original values, the benefits for most EU countries are reduced to between 1.17 and 1.28 of the simple rectangle effect.[30]

Thus, the intensiveness with which a country engages in trade is of first order importance in explaining the benefits that are likely to be achieved from CRTS sectors. More aggregated models have aggregated small countries such as Belgium with larger countries. In so doing they have produced a region which is closer to average with respect to trade intensities, which will mask important distributional effects across the EU countries.[31]

In column 9 of Table 1 the CRTS welfare gain to the aggregate EU from complete removal of border and standards costs barriers to intra-EU trade varies from 0.46% to 0.5%, depending on the degree of market integration. Market integration, which in our model is greater substitutability among EU products, has only a very small effect on welfare in a CRTS model (by inducing slightly more resource movement) because it does not affect markups or entry and exit.

The Impact of IRTS: Examination of Tables 1 and 2 reveals that the wel-

28. Similar to the approach of Gasiorek, Smith and Venables [1992], we choose to calibrate with elasticities to be consistent with price-cost margins given by estimates of the CDR subject to a zero profit model assumption. Nonetheless, the trade elasticities are small in relation to those used in their models.
29. We show below, however, that the higher elasticities reduce the additional welfare gain from rationalization and consumption efficiency gains in IRTS sectors. Thus, the high elasticities have offsetting effects regarding their welfare impact.
30. Exceptions are Denmark, which remains an outlier and obtains benefits equal to 1.78 times the rectangle effect, and Germany and the U.K. which obtain less than the rectangle effect. The large demand elasticities that we have employed, however, result in somewhat higher estimates of the welfare effects and of the adjustment across industries in both the CRTS and IRTS cases.
31. Our interpretation of border costs follows Smith and Venables [1988] and others, who have modelled EU92. An alternate view is that border costs are highest where trade is lowest. Thus, when border costs are removed, the countries with the lowest trade intensities will gain more for the same shares of trade. Although trade intensities would still matter, the results across countries could change significantly.

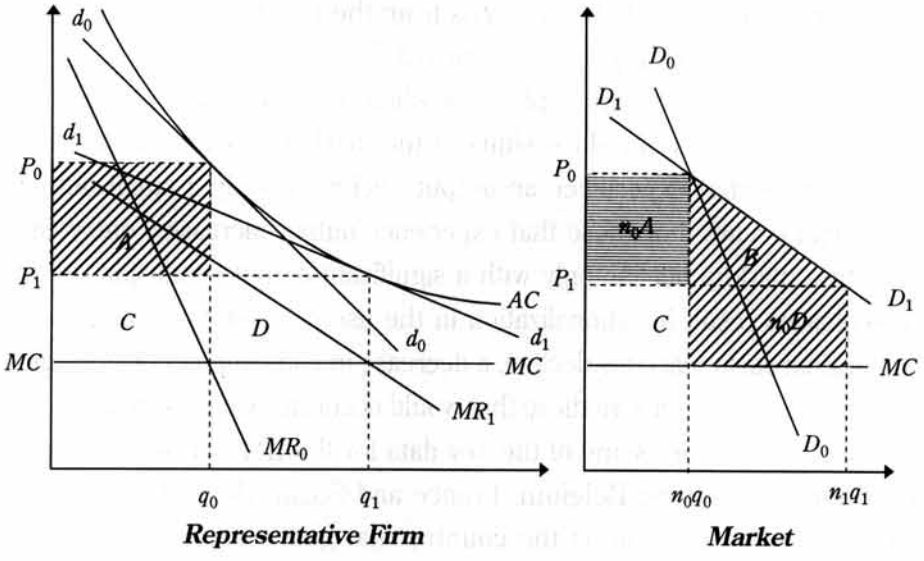
fare benefits of the complete removal of border and standards costs roughly double, both for the aggregate EU as well as for individual EU regions, when the impact of IRTS with full market integration is incorporated. The key to explaining the impact of IRTS is the role of market integration on elasticities, markups and entry and exit. To clarify this point first compare the CRTS and IRTS results with 0% integration (row 1 of Table 1). Then the static effects of removing border or standards costs are virtually identical between IRTS and CRTS. That is, without additional effects from market integration, the beneficial effects of removing border and standards costs can be attributed to "traditional" efficiency gains found in a standard CRTS framework.

The key to understanding the impact of IRTS in our model is that integration increases the elasticity of demand on intra-EU exports, thereby inducing markup declines. The equation for the markup was discussed earlier. A decline in the equilibrium markup can only be achieved through an improvement in the realization of scale efficiency.

Despite the fact that we employ equivalent variation in a general equilibrium, a partial equilibrium analysis is useful to isolate the crucial variables in IRTS sectors. In Figure 4 we present a consumer surplus interpretation of a symmetric monopolistically competitive industry with a given level of fixed costs per firm and constant marginal costs (MC). An additional simplification in Figure 4 is that it presumes a homogeneous output, so the elasticity increase is represented simply as a rotation of the market demand curve.[32] Originally there are n_0 firms charging price P_0 and producing q_0. We assume zero profits, so rectangles $A+C$ equal fixed costs per firm. As a result of an increase in the market elasticity of demand, the perceived marginal revenue of the firm will equal marginal costs at a larger output level. In the absence of general equilibrium effects which change factor costs, the marginal and average cost curves for the representative firm remain unchanged. Then, due to the zero profit constraint, exit must occur such that the new perceived demand curve of the representative firm, d_1, is tangent to the average

32. The analysis of Figure 4 extends naturally to our firm level product differentiation case by defining the market output as the CES aggregate of the output of the individual firms, and the market price as the price dual to the CES quantity aggregate.

Figure 4
Rationalization and Consumption Efficiency Gains from Increased Elasticities



Note: Increased market demand elasticity induces representative firms to lower price and some to exit industry in the new zero profit equilibrium. The welfare gain equals the area under the market demand curve above MC, *i.e.*, the consumption efficiency gain B plus the rationalization gain n_0D, where $n_0D = n_0A$.

cost curve at the new lower markup. It follows that $P_1 < P_0$ and industry output increases.

Welfare effects are shown in the panel of Figure 4 labeled Market, where D_0 and D_1 are the initial and new market demand curves. Since price exceeds marginal costs in the initial equilibrium, the expansion of output increases welfare. This welfare gain can be decomposed into two parts. First there is the typical consumption efficiency triangle B, as might occur with removal of a tax.[33] Unlike a tax, however, there is an additional gain of consumers' surplus equal to the rectangle n_0A that has no offsetting cost or lost tax revenue. The additional consumers' surplus gain derives from the rationalization gain of spreading fixed costs. That is, the expansion of output

33. Following the procedure of Burns [1973], the efficiency triangle is obtained by connecting the pre and post equilibria by a straight line.

costs society resources at the rate of MC per unit but is valued as the area under the demand curve.[34] These consumption efficiency and rationalization gains from increased elasticities in IRTS sectors are gains from the EU92 program over and above the gains from the reduction of the costs of exporting that were characterized in Figure 3.[35]

A similar interpretation will apply even when general equilibrium effects are incorporated that will induce shifts in the market demand curves. For IRTS industries that experience an output decline or only a small output increase, exit occurs. For those that experience output increases, entry can occur with a markup decline only with a significant output expansion. All of these scenarios result in rationalization in the use of fixed costs and, since price-marginal costs markups decline, a decrease in consumption deadweight loss. These are benefits above those that would occur in a CRTS sector.

In Table 3 we present some of the key data for the IRTS sectors in three representative countries: Belgium, France and Spain. We focus on these countries because Belgium is the country that gains the most from the EU92 program, France is a representative large country, and Spain is a country with relatively small trade shares in Germany. We present results for the scenario of 100 percent integration and 100 percent removal of border and standards costs.

In the first three columns we present the percent decline in the "Lerner" markup: price minus marginal costs, all divided by price. The equation for the change in the Lerner markup was presented as equation 3. Note that markups on export sales in Germany change between –1.0 and –3.3 percent for industries in all three countries. For some products there are no exports

34. Since fixed costs per firm are unchanged $A + C = C + D$, *i.e.*, $A = D$ and $n_0A = n_0D$. Then the welfare increase equals the area under the demand curve between n_0q_0 and n_1q_1 that lies above industry marginal costs.

35. The greater the absolute value of the decline in the markup, the larger will be the welfare benefits from rationalization and consumption efficiency. A proportional reduction in the elasticities of substitution in the model, however, will increase the absolute value of the decline in the markup. That is, given benchmark elasticities, $\sigma_{DD} = 15$, $\sigma_{MM} = 10$, the dominant first term in equation 3 is $(1/15) - (1/10) = -1/30$. If the elasticities of substitution were scaled down, for example by 1/5, then the first term in equation 3 would equal $(1/3)-(1/2) = -5/30$. This would result in a larger drop in the new equilibrium price in Figure 4 and greater welfare gains.

Table 3
Changes in IRTS Sectors in Belgium, France and Spain: 100% Integration and Removal of Border and Standards Costs

	Percent Change in:											
	Mark Up in Germany			Number of firms			Output per firm			Production[a]		
	BE	FR	SP	BE	FR	SP	BE	FR	SP	BE	FR	SP
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Food	-3.3	NA[b]	-3.3	-19.6	-7.7	-1.0	30	11	6	4.7 (-5.2)	2.9 (1.8)	5.1 (1.6)
Steel	-1.6	-2.9	-3.3	4.5	0	-6.2	54	12	4	60.9 (32.1)	12.3 (6.0)	-2.7 (-7.3)
Nonmetallic Minerals	NA	NA	NA	-33.1	-11.0	2.4	17	5	9	-21.6 (11.3)	-6.6 (1.1)	11.1 (0.5)
Chemicals	-2.8	-3.1	NA	-4.1	-4.6	-8.6	28	7	-1	22.8 (4.3)	1.8 (1.0)	-9.8 (-4.5)
Metal Products	NA	-3.3	-3.2	-27.2	1.4	1.4	5	3	5	-23.9 (-11.8)	4.9 (1.7)	6.9 (-1.5)
Industrial Machinery	-2.8	-3.1	-3.3	-10.9	-5.3	-11.2	33	-1	0	18.5 (11.3)	-5.9 (-4.4)	-11.1 (-12.4)
Office Machinery	NA	-2.6	-3.1	-29.6	-8.8	-0.1	13	15	1	-20.7 (-12.1)	5.3 (2.6)	0.6 (0.0)
Electrical Goods	-1.0	-3.2	-3.3	-22.9	-8.3	-12.5	44	1	2	11.1 (9.7)	-7.4 (-3.0)	-10.7 (-0.4)
Motor Vehicles	-3.1	-3.2	-3.3	49.5	-16.3	-12.1	60	27	20	139.4 (45.5)	6.7 (2.7)	5.4 (-6.1)
Other Transport Equipment	NA	-3.0	NA	-29.1	-6.7	-12.6	20	12	8	-14.8 (-12.3)	4.8 (0.4)	-5.3 (0.0)
Paper	-3.3	-3.3	-3.3	-17.0	-11.2	-7.8	51	8	11	25.2 (-0.5)	-4.5 (-2.0)	2.8 (3.8)
Rubber and Plastics	NA	-3.3	-3.3	-10.2	-2.7	-2.8	46	0	0	30.8 (25.0)	-2.8 (-2.7)	-2.3 (-8.7)

Notes: a. Value in parentheses is percent change in production under CRTS.

b. NA = Not applicable since there are no exports to Germany from this country of this product in the benchmark.

to Germany in the benchmark data, hence the markup equation is not applicable. Since the Spanish share of the German market is small, when the markup equation applies the decline in the markup is close to –3.3 percent, which is the value of the first term on the right hand side of equation 3.

In columns 4-6 we present the percent change in entry and exit, and in columns 7-9 we present the percent change in output per firm. The key differences appear in the output per firm columns. We see that rationalization is much greater in Belgium than in the other two countries. Again the reason is that the intra-EU trade intensity of Belgium is much greater than the other two countries considered here. Since export sales constitute a much larger percentage of output for Belgium, the same percentage decline in markup on exports to the various EU markets induces a much larger reallocation of resources in Belgium's IRTS sectors.

Columns 10-12 show the percent change in output in the IRTS sectors, and the numbers in parentheses show the percent change in production when these sectors are presumed to operate under CRTS. One can see that different IRTS scenarios expand and contract in the different countries (a full presentation of the output changes by industry and region is presented in Harrison, Rutherford and Tarr [1994, Appendix]). The interesting pattern is that the sign of the output change in the IRTS scenario is generally the same as the sign of the output change in the CRTS scenario. The magnitude of the change in absolute value, however, is generally larger with IRTS. Thus, traditional determinants of resource allocation, factor intensities and remaining tax wedges, play a key role in influencing industrial structure. Shifts in relative costs that occur in a CRTS world provide an impetus for output decline or expansion. If relative costs decline and output expands due to a change in factor intensities, in an IRTS world the output expansion induces a further decline in average costs and price, which magnifies the output increase.

Returning to Table 2, note that despite the fact that markups decline and real incomes[36] increase with integration, real prices also increase. For a sharp example, Belgian real incomes increase while real prices also increase by 1.4% despite some significant declines in specific IRTS sectors.[37] The key

36. Our numeraire is a basket of final consumption in the Rest of the World.

is that the relative price of labor increases by 5.2%, and the relative price of capital by 3.3%, so factor earnings increase at a faster pace than commodity prices.[38] Factor earnings increase so much in Belgium because resources are being allocated more efficiently, hence the value of the marginal product of each factor is greater than with the previous allocation of resources. In addition to the benefits that occur under CRTS, as discussed above, there are significant gains from rationalization and markup declines. All of these gains are dependent on the intra-EU trade intensity of the country.

Intra-EU Trade: In Harrison, Rutherford and Tarr [1994, Tables A2, A3] we present the percentage change in exports and imports to EU countries and non-EU countries, respectively. We have argued that a counterintuitive feature of modelling EU integration as uniform pricing is that intra-EU trade declines as a consequence. With our approach to integration, however, there is a strong increase in trade among the EU countries, and a modest decline in trade between EU countries and the rest of the world. We also note that domestic sales of EU firms typically decline. Although domestic markups increase for EU firms, the largest declines in domestic sales are not explained by differences in markup changes. Rather, the largest declines in domestic sales occur in those countries that have the highest intra-EU trade intensities.

Thus, overall we have a picture of EU countries trading much more with each other and relying less on their domestic markets for sales. Moreover, since their economies become more trade intensive, there is only a slight decline in trade with countries outside of the EU.

Regarding the decline in EU trade with the rest of the world, we have

37. For example, the following IRTS sectors experience price declines: Food by 3.3%, Iron & Steel by 4.7%, Chemicals by 3.2%, Industrial and Office Machinery by about 4.5%, and Vehicles by 5.5%. Most CRTS sectors in Belgium experience an increase in relative prices (*e.g.*, Beverages & Tobacco by 2.4%, Utilities by 2.6%, and virtually all service sectors by about 3%). In the CRTS version of the model the Belgian increase in the price level is only about 0.7% . The structural pattern of price increases and decreases is approximately the same as in the IRTS version, even though no sector has IRTS in this case.

38. The same qualitative effect occurs in the CRTS model, with the relative price of labor increasing by 2.6% and the relative price of capital by 1.3%.

modelled EU92 as a shift in relative costs for EU countries toward trading with EU countries rather than non-EU countries. That is, the 2.5% cost decrease on exports to EU countries accrues only to firms in EU countries. It is possible that some, if not all, of the border and standards costs reductions that accrue to EU firms will also benefit non-EU firms.[39] To the extent that this occurs then there would be an increase in non-EU exports and imports to and from the EU for ROW relative to what we have reported. This would also allow a welfare increase for the rest of the world in the static model since then a picture similar to Figure 3 would also apply to the rest of the world exports to EU countries.[40]

B. Modelling the Steady State Welfare Effects

In our steady state model we assume that in the initial (pre-single market) equilibrium the capital stock in each country is optimal given the rate of return on capital in the initial equilibrium. That is, increases in the rate of return on capital would induce an increase in investment until the marginal productivity of capital is driven down to the initial rate of return. The single market will produce a new equilibrium, where for almost all countries the rate of return on capital increases (relative to a price index of consumption) due to a more efficient allocation of resources. This implies that in a dynamic sense the new capital stock can no longer be optimal: investment must be forthcoming until the marginal productivity of capital is reduced to the long run equilibrium rate of return on capital.[41] Analogous to the medium-term growth bonus of Baldwin [1989], this expansion of the capital stock then

39. For example, a Moroccan truck delivering vegetables to Belgium should have reduced border costs as it passes between Spain and France and between France and Belgium.

40. In Harrison, Rutherford and Tarr [1994] we compare the welfare results of our model with those of the other principal models of EU92: Gasiorek, Smith and Venables [1992], Haaland and Norman [1992] and Mercenier [1992]. We show that the greater sectoral disaggregation of the CRTS sectors in our model results in substantial differences in the results for some EU countries, although there is little impact on the aggregate welfare results.

41. See Hansen and Koopmans [1972] and Dantzig and Manne [1974] for early multisectoral applications of this approach.

works like an "endowment effect", generating larger welfare gains since there are more resources available. In addition, as the income of the world increases, demand for goods and the derived demand for factors increases. In this model the quantity of capital will increase in response, producing a further endowment effect.[42]

We emphasize that this calculation measures an *upper bound* on potential welfare gains in the long run without endogenous growth. The capital stock can only be produced through investment, and that requires reduced consumption along the transition path. For sufficiently high discount rates, the cost of the foregone consumption could easily outweigh the longer-run benefits of the capital accumulation it allows.[43]

Table 1 shows that the steady-state welfare gains are slightly more than double those from the comparable static model. Completion of the program results in an aggregate steady-state welfare gain of 2.38% of GDP for the EU. The distribution of these welfare gains, and related economic effects, is shown in Table 2.

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42. Baldwin, Forslid and Haaland [forthcoming] have recently applied our steady state approach to an evaluation of the single market program. Harrison, Rutherford and Tarr [forthcoming] and Francois, McDonald and Nordstrom [forthcoming] apply an analogous approach to an analysis of the Uruguay Round.

43. Of course, our estimates would fail to capture endogenous growth effects. Rutherford and Tarr [forthcoming] offer a fully dynamic endogenous growth model that has a true welfare measure.

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