"Exports-at-Risk": the Effect of Multi-Market Contact in International Trade*

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I. Introduction

There is a well-established literature examining possible impacts on competition in oligopolistic markets from multi-market contact (MMC) among diversified firms. While much of this work is related to Edwards (1955) it was not formalized and broadly tested until the late 1970s. The theoretical work of Bernheim and Whinston (1990) has led to more recent research in this area. However, only recently have trade theorists begun to apply a similar approach to examining the effects of trade, where MMC among exporters may limit (or reverse completely) the anticipated pro-competitive role of imports.

This paper presents a first effort to test the empirical importance of a measure of this MMC, called "exports-at-risk," on import-unit values. I examine 10 highly-traded 4-digit HS products within the broad category of "fats and oils" – focusing on the 20 leading import markets and the 5 major exporters to each market.

II. Previous Literature

Edwards (1955) was among the first to raise the concern that firms meeting in multiple markets would have incentive to refrain from vigorous competition, coining the term "mutual

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forbearance." Others followed with efforts to more formally model and test this hypothesis. Heggestad and Rhoades (1978) examined the impact of MMC in local banking markets, finding it to result in a lessening of competition as predicted. Scott (1982), distinguishing between randomly occurring and what he calls "purposive" MMCs, finds the latter to increase large company profit rates across manufacturing.

Feinberg (1984) illustrated, via a multimarket conjectural variations duopoly model, how the cross-market effects of mutual forbearance can influence firm behavior, implying performance closer to monopoly (or cartel) results. Empirical work which followed, based on cross-industry manufacturing industry data (Feinberg (1985)), and experimental research (Feinberg and Sherman (1988) and Philips and Mason (1991)) was supportive of MMC lessening competition. Bernheim and Whinston (1990), employing repeated Bertrand models of MMC, find more subtle theoretical results supportive of the view that MMC can (though will not always) increase the extent of collusion (by relaxing the incentive constraints which often limit such collusion). Empirical work has continued to find evidence in the domestic market of the relevance of MMC; examples include Evans and Kessides (1994) and Ciliberto and Williams (2010) for airlines, Parker and Roeller (1997) for mobile telephones, and Jans and Rosenbaum (1997) for cement, though Waldfogel and Wulf (2006) find little impact of MMC in broadcast radio advertising.

More recently, trade theorists have extended the analysis of MMC to the international arena. Bond and Syropoulos (2008), also focusing on deviation incentives, develop a two-firm two-market model in which cross-hauling of identical goods and greater ease of collusion may occur with MMC and relatively low trade costs.[1] Choi and Gerlach (2009) bring international antitrust enforcement into their model, examining both how collusion incentives in one market are

[1] Other recent work (both theoretical and empirical) which relates to MMC in an international setting includes Ma (1998), Yu et al. (2009), and Alcantara and Mitsuhashi (2011).

affected by competitive conditions in another and how national antitrust authorities may interact with (and perhaps free ride on) enforcement in other countries.

To my knowledge there has been no empirical investigation of international MMC (beyond anecdotal discussion). In what follows, I consider a major category of traded goods, fats and oils, and the impact that multiple meetings of major exporters for the same and related types of fats and oils have on import prices.

III. Theoretical Motivation

Feinberg (1984) proposed a generalized conjectural variations quantity-setting model allowing for MMC among firms leading to each firm anticipating not only the familiar within-market conjectures (whether Cournot, Stackelberg, or any other variety) but also a response by rivals across market boundaries. The main result is that if firms expect an increase in their output in market 1 to be met by a rival's increase in market 2 (and vice versa), their equilibrium output in each market will be closer to the monopoly level than if these cross-market conjectures were not present. Furthermore, as the number of multimarket rivals (and markets) increase, the greater will be the impact on equilibrium output in each market.

Bernheim and Whinston (1990) investigate a repeated multi-market Bertrand game with optimal punishments for deviations from a collusive equilibrium, deriving a number of important results. The key issue is the extent to which MMC involves the pooling of incentive constraints across all markets in which the firms meet, potentially relaxing deviation incentives and enhancing the likelihood of collusive behavior being sustained. While finding that MMC does not promote collusion if identical firms meet in identical markets,[2] their results do suggest that where market shares, costs, or discount rates (which may proxy growth prospects) differ across firms and markets, MMC may facilitate collusion.

Bond and Syropoulos (2008) extend the Bernheim/Whinston-type model to the international sphere, examining implications of MMC of firms in a home and foreign market, and the role that trade costs play in determining competitive performance. Their benchmark (with non-cooperative play) is the "reciprocal dumping" model of Brander and Krugman (1983). After bringing in the possibility of tacit collusion in both markets, Bond and Syropolous find that cross-hauling (each firm selling in the other's market) of homogenous goods is consistent with the no-deviation constraint under sufficiently low trade costs. The intuition of this result is that with low trade costs, a threatened expansion of output in the foreign market is more credible. More importantly, they determine that mutual reductions in trade costs (from a level already sufficiently low) can enhance collusion by further limiting deviation incentives.

IV. Data Set and Econometric Approach

Ideally one would like to examine a dataset of exporting firms from all major producing nations of a group of related products, with information on their export sales in all major destination markets; such data do not exist. Instead, I consider here bilateral country-to-country export data, using 2007 UN Comtrade data on HS Section III – Animal or Vegetable Fats and Oils – the only such section consisting of a single (2-digit) HS chapter, 15, with total world-wide imports of $61.4 billion. In addition to assuming that the same firm (or group of firms) in a country

[2] This result, however, assumes that a firm deciding to cheat in one market will always do so as well in every other in such a symmetric setting; this ignores any notion of detection risk which will likely increase as the number of markets in which deviations occur increases.

is responsible for all of that country's exports within this HS Section, it must also be assumed that this firm does not export in any other HS Section (otherwise there would be other MMCs that are missed). The choice of fats and oils to study here is based largely on the sense that HS chapter 15 is somewhat self-contained, with a reasonable likelihood that exporters of that product are relatively specialized. Of course, it must be acknowledged that the variable calculated below and employed here can only be viewed as a proxy for the true (firm-based) measure of MMC.

Of the 21 4-digit HS categories within this chapter, ten of them represented 94 percent of that total, each with global imports in 2007 of more than one billion dollars; these are listed in Table 1, along with the leading import market and leading exporter for each.[3] (Preliminary results based on a slightly expanded sample, adding two additional – lightly traded – product categories within HS 15 yielded quite similar results to what is presented below.). Note that, consistent with models suggesting cross-hauling of goods in equilibrium (though also consistent with 4-digit HS categories aggregating narrower differentiated products with one-way trade flows), the United States is both the leading exporter and importer of HS1515 – of which corn oil is prominent – and more generally it is quite common for one of the leading exporters of these products to also be one the leading import markets.

For each of these ten HS categories, I identified the 20 largest import markets and the top 5 exporting countries into each of these; collectively this data sample captures 56% of global trade in fats and oils. Following Ferrantino et al (2012), I then seek to explain import unit values (c.i.f.) of the resulting 1000 observations,[4] separately by product, on the basis of importer income, exporter income, and adding a measure of multi-market contact – a variable defined as Exports-at-Risk

[3] I combined HS 1509 and 1510, both involving oil products derived from olives, into a single category.

[4] Comtrade occasionally reports estimated quantity values, making the resulting import-unit-values of questionable reliability. In my sample of 1000, 16 observations are affected in by this approach; I describe below how I deal with this in the regression analysis.

(XAR).[5] While costs are not explicitly controlled for, product fixed effects and exporter income should proxy for variation in this determinant of pricing.

Intuitively, XAR captures the export sales that exporter A to import market B has in *other* markets where that exporter faces the *same other exporters*; consistent with both Feinberg (1984) and Bernheim and Whinston (1990), both numbers of markets and firms involved in MMC and differing magnitudes of such involvement should matter. These export sales are "at risk" from retaliation by these exporters for competitive actions A may make in B; as they are greater relative to exports A has in B, the less likely A is to aggressively price in market B. This can be viewed either in terms of a cross-market conjectural variation (firms assuming a greater likelihood a rival response in second markets to a competitive move in a first market) or in terms of reduced deviation incentives supporting a tacitly collusive solution. Formally,

XAR weights MMCs by the exports at stake in the markets in which MMCs occur. For exporter j to a particular market, say Soybean Oil in Australia (below, i)

$$XAR_{ij} = \sum_{k \neq i}(M_{ki} - 1)S_{kj}$$

where M_{ki} = the number of countries[6] exporting to both market k (which could be Soybean Oil in the UK, or Olive Oil in Germany, e.g.) and market i, and S_{kj} = exporter j's sales in market k. As one example, note that Germany exported \$5.2 million worth of fish oil (HS1504) to Belgium, but its "exports at risk" – its exports in other related product and export markets subject to retaliation from other leading fish oil exporters to Belgium – totaled \$913 million, or 175 times its exports in that particular market. Clearly German exporters may wish to consider whether aggressive

[5] This variable is based on a variable, Sales-at-Risk, defined and employed in Feinberg (1985).
[6] Of course, other formulations of "exports at risk" could be developed, but what is assumed here is that facing two rivals from market A in market B puts your exports there "at risk" twice.

competition in selling fish oil to Belgium might induce adverse responses by rivals in these other markets.

Implicitly, this approach assumes that the same firm (or firms) within a country exports all 4-digit "fat and oil" products to all foreign markets served, hence the notion that they may react in their pricing to their "sales-at-risk" of retaliation by other countries' exporters in other product categories and foreign markets in which they meet.[7] While this may not hold universally, it seems clearly more plausible for product categories within a single narrowly-defined HS section than for all 4-digit trade categories.

In explaining bilateral import unit values, Ferrantino et al. (2012) employ importer and exporter per-capita income and population, as well measures of distance (and other variables intended to capture trade costs). I also include here 2007 importer and exporter per-capita income (in $US on a PPP basis from the World Bank's World Development Indicators database) as explanatory variables, along with product fixed effects to capture cost factors. Neither distance variables nor exporting/importing country populations are included, in an effort to focus on the main variable of interest.[8]

Table 2 presents some descriptive statistics on the sample of the 5 top exporters in each of 200 product/country markets. XAR, normalized by the exporter's sales in the market in question (Relative XAR, or RXAR), varies from zero (where the exporter either does not sell in another market or does not face any of the 4 rivals from this market elsewhere) to 135,282 -- Indonesia's XAR relative to its exports of palm oil to Japan. Indonesia has 62 multimarket contacts in the

[7] Complicating the picture would be the possibility of multinational firms exporting the same product to the same market from different countries. In addition, negligible competition from domestic sources in these destination markets is assumed.

[8] Ferrantino et al (2012), in their more than 3500 regressions within 6-digit HS categories explaining pairwise import-unit values, find that distance, contiguity, and land-locked status of exporter and importers generally had little impact. Even at the very low threshold of one-tail 10% significance, well under half of these coefficients were found to have an effect. Population measures had even less impact, and were rarely significant.

context of its exports in that market, i.e., the other related markets where it faces rivals for the Japanese market for palm oil (the maximum possible would be 796, if Indonesian exporters faced all 4 rivals from that market in each of the other 199 markets). The maximum number of multimarket contacts is 131, for the Netherlands in the exports of HS 1516 to the United Kingdom.

Further describing the sample, the operations of exporters range from El Salvador and Namibia, both one of the top 5 exporters in just one product and to one country, to Germany, a top-5 exporter in all ten product categories and for at least one of these in twenty destination countries – representing 73 of the maximum 200 product/country markets considered, and the Netherlands, also a top-5 exporter in all 10 product categories, and for at least one of these in 26 destination countries – representing 100 of the maximum 200 product/country markets considered.

V. Regression Results

The econometric specification is quite simple:

(1) $\ln P_{ij} = \alpha + \beta \ln RXAR_{ij} + \gamma \ln \text{Importer Income} + \delta \ln \text{Exporter Income} + \text{Product Fixed Effects} + \varepsilon$,

where P_{ij} represents the import unit value (price) in product/country market i charged by exporter j, RXAR is as defined above,[9] and Importer and Exporter Income are percapita Income. Using OLS with robust standard errors to estimate this equation on the pooled sample of 990 observations,[10] results are shown in column (1) of Table 3. The effects of importer and exporter income are as expected, both positive and statistically significant – with, as found in Ferrantino et al (2012), considerably larger exporter income effects (consistent with "quality-ladder" theories of trade by

[9] Due to RXAR having zero values, ln RXAR is actually calculated as ln(RXAR+1).
[10] 10 datapoints were dropped for Australia where no quantity measure was available (for HS1504 – fish oil – and HS1516 -- hydrogenated or interesterified oils), hence no import unit value could be calculated.

heterogeneous firms) than importer income effects (consistent with pricing-to-market views of trade price determination).

Of more interest to this study, I find the impact of relative XAR to be statistically significant, though somewhat small; given the elasticity estimated, a doubling of trade-weighted MMCs would lead to just a 3% increase in import prices (although it should be noted that the very wide spread in RXAR suggests that such a change in this variable, or larger, is quite feasible). To examine whether individual exporters respond to their own RXAR or to the market average of this variable, I use the latter variable in column (2), finding quite similar results. As noted earlier, 16 of the 990 datapoints in this regression have import unit values affected by Comtrade's estimation of quantities where no such value is reported by the country in question; I tried both dropping these observations and running the regression including a dummy variable for these observations – both sets of results were virtually identical to those reported in Table 3 (and the coefficient on the dummy variable was not close to statistical significance).

The results of several robustness exercises are reported in Table 4. First, to ensure that the results are not being driven by outliers, possibly caused by measurement errors, observations containing the top and bottom 5% of unit values by product are dropped. As seen in column (1), the impact of both importer and exporter income are reduced somewhat, but the effect of the MMC variable is unchanged. In column (2) I investigate the implications of replacing importer and exporter income with fixed effects for both sides of the trading relationship; the effect of RXAR is somewhat larger – an elasticity of 0.05 – and remains statistically significant at 1%. Column (3) returns to the full sample but deletes import markets involving "cross-hauling" at the 4-digit HS level (import markets which are also leading exporters of the product); results are little changed.

Finally, column (4) reports on a replication of the column (1) specification from Table 3 on a somewhat expanded sample, adding two relatively lightly traded HS categories, 1502 and 1518;[11] again, results are quite similar to the ten-product case, with importer-income effects a bit higher, exporter-income effects slightly lower and a highly significant RXAR elasticity of 0.05.

While these results are strongly suggestive of MMC impacts in trade, one important finding in Ferrantino et al (2012) is that both importer and exporter income effects on trade prices vary quite a bit across products – it is likely that MMC effects may vary as well. To address this issue, I next estimate equation (1) separately for each of the ten 4-digit products; I do allow, however, for correlation among the error terms of each of these equations, estimating them as a "seemingly unrelated regression" (SUR) model. These results are presented in Table 5, using RXAR and RXAR-Mkt-Avg as alternate measures of MMC.

I continue to find strong evidence of exporter-income effects on bilateral import prices, however little support here for importer-income effects. In terms of MMC, RXAR has a significant positive impact (with estimated elasticities ranging from 0.04 to 0.07) for four of the ten products, and no statistically significant negative effects. The market average measure also has a significant positive impact for four products (and some weak suggestion of positive effects at considerably lower levels of statistical significance for two other products) – again, no negative impacts of MMC are identified. Feinberg (1985) found MMC effects to be stronger in more concentrated markets; to examine this issue, I performed a simple correlation between the average (truncated) Herfindahl Index for the top 5 exporters to each market within the ten 4-digit product category and the estimated RXAR (and RXAR-mkt-avg) elasticities from Table 4. These

[11] These products are Fats Of Bovine Animals, Sheep Or Goats; and Animal Or Vegetable Fats And Oils and Their Fractions, Boiled, Oxidized, Dehydrated, Sulphurized.

correlations (with n=10) are positive, +0.34 (and +0.19), suggestive of concentrated market structures allowing for MMC impacts to exist.[12]

VI. Conclusions

Despite data limitations, the results presented here suggest that multimarket contact among exporters may be a problem in international trade. I have found that top exporters in fats and oils seem to price higher in markets where they meet rivals who have the ability to retaliate against their "exports at risk". Of course, there could be alternate explanations for this pattern – perhaps groups of high-quality exporters tend to meet in the same high-income import markets, though controlling for exporting and importing country incomes should account for this possibility. Further empirical study of this issue seems called for.

[12] Where elasticity estimates not significantly different from zero are set to zero, these correlations are substantially larger, at +0.57 and +0.46, respectively.

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Table 1. 4-digit Product Categories Included in Analysis

HS Code	Title	Leading Exporter	Leading Import Market
1504	Fish Oil	Denmark	Norway
1507	Soybean Oil	Argentina	China
1509/1510	Olive Oil	Spain	Italy
1511	Palm Oil	Netherlands	China
1512	Sunflower Oil	Argentina	Germany
1513	Coconut Oil	Netherlands	US
1514	Rapeseed (Canola) Oil	Canada	Germany
1515	Other Vegetable Oils (including Corn Oil)	US	US
1516	Animal & Vegetable Fats and Oils, hydrogenated or interesterified	Germany	China
1517	Margarine	Belgium	France

Table 2a. Descriptive Statistics on Exporting Countries

	Min	Max
Number of Product/Country Markets as a "Top-5-Exporter"	1	100
Number of Products as a "Top-5-Exporter"	1	10
Number of Countries Exported to as a "Top-5-Exporter"	1	28

Table 2b. Descriptive Statistics at Product/Importer/Exporter unit of observation (n=1000), 2007

	Mean	Minimum	Maximum
Import Unit Value ($/kg)	2.74	0.46	105.94
Exporter Income (PPP, percapita GDP)	26,074	788	54,626
Importer Income (PPP, percapita GDP)	29,550	4,562	53,433
Trade Value ($)	34,300,000	938	2,630,000,000
RXAR	1212	0	135,282
Mkt-Avg RXAR	1212	0.1	32,720

Table 3. Pooled Regression Results, Dependent Variable = *ln* Import Unit Value
--Robust Standard Errors and Product Fixed Effects (N=990)
(t-statistics in parentheses next to coefficient estimates)

	(1)	(2)
ln Importer Income	0.08 (2.51)*	0.09 (2.75)**
ln Exporter Income	0.15 (6.99)**	0.16 (7.32)**
ln RXAR	0.03 (3.66)**	
ln RXAR-mkt-avg		0.03 (2.96)**
R-squared	0.42	0.42

*= significant at 5%
**=significant at 1%

Table 4. Robustness Exercises
Pooled Regression Results, Dependent Variable = *ln* Import Unit Value
--Robust Standard Errors and Product Fixed Effects
(t-statistics in parentheses below coefficient estimates)

	(1) Dropping top/bottom 5% Unit Values	(2) Importer/Exporter FEs in lieu of Income	(3) Dropping Cross-Hauling	(4) 12-product Sample
ln Importer Income	0.06		0.09	0.09
	(1.85)		(1.74)	(3.10)**
ln Exporter Income	0.12		0.16	0.10
	(6.50)**		(5.34)**	(4.81)**
ln RXAR	0.03	0.05	0.04	0.05
	(3.72)**	(3.50)**	(3.38)**	(5.14)**
R-squared	0.52	0.58	0.48	0.39
N	900	990	470	1175

*= significant at 5%
**=significant at 1%

Table 5. SUR Results, Dependent Variable = *ln* Import Unit Value
-- (N=90 for each product)
(z-statistics in parentheses next to coefficient estimates)

Product	*ln* Imp. Inc.	*ln* Exp. Inc.	*ln* RXAR	*ln* RXAR-mkt-avg	quasi-R^2
1504	0.24 (1.04)	0.25 (1.54)	0.05 (0.95)		0.05
	0.19 (0.81)	0.33 (2.15)*		0.04 (0.59)	0.04
1507	0.03 (1.06)	0.09 (2.89)**	-0.02 (1.89)		0.09
	-0.01 (0.20)	0.09 (2.80)**		0.03 (1.74)	0.08
1509/1510	-0.03 (0.42)	0.16 (2.32)*	0.02 (0.94)		0.07
	0.03 (0.33)	0.13 (2.02)*		0.08 (3.11)**	0.11
1511	-0.03 (0.77)	0.10 (4.39)**	0.05 (4.57)**		0.32
	-0.02 (0.52)	0.10 (3.84)**		0.03 (2.96)**	0.25
1512	-0.05 (0.98)	0.14 (3.88)**	0.04 (3.18)**		0.29
	-0.07 (1.31)	0.18 (4.90)**		0.02 (1.38)	0.24
1513	-0.01 (0.08)	0.05 (1.60)	0.07 (4.18)**		0.16
	-0.01 (0.21)	0.07 (2.35)*		0.09 (3.68)**	0.14
1514	-0.04 (0.67)	0.01 (0.20)	0.06 (6.57)**		0.31
	-0.00 (0.03)	0.00 (0.03)		0.03 (3.86)**	0.16
1515	0.33 (1.95)	0.25 (2.84)**	-0.03 (0.45)		0.12
	0.32 (1.85)	0.24 (2.98)**		0.03 (0.47)	0.12
1516	0.18 (1.61)	0.20 (2.18)*	0.02 (0.40)		0.07
	0.19 (1.76)	0.20 (2.27)*		0.02 (0.39)	0.07
1517	0.34 (2.10)*	0.50 (3.13)**	-0.07 (1.52)		0.18
	0.33 (1.97)*	0.44 (2.70)**		-0.08 (1.09)	0.17

*= significant at 5%
**=significant at 1%