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

Robert M. Feinberg

American University

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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. Literature Review

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 forbearance.” Others followed with efforts to more formally model and test this hypothesis.

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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. Empirical work which followed, based on cross-industry manufacturing industry data (Feinberg (1985)), 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 may occur despite MMC and relatively low trade costs. Choi and Gerlach (2009) bring international antitrust enforcement into their model, examining both how collusion incentives in one market are affected by competitive conditions in another and how national antitrust authorities may interact (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. Data Set and Methodology

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 -- which consists 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 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). While HS chapter 15 seems relatively self-contained in this regard, 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).¹ For each of these, 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

¹ I combined HS 1509 and 1510, both involving oil products derived from olives, into a single category.

resulting 1000 observations,² separately by product, on the basis of importer income, exporter income, and a measure of multi-market contact – a variable defined as Exports-at-Risk (XAR).³

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*. These export sales are thus “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. 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 countries⁴ 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 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

² 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.

³ This variable is based on a variable, Sales-at-Risk, defined and employed in Feinberg (1985).

⁴ 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.

categories and foreign markets in which they meet.⁵ 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. Distance variables are not included.⁶

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 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 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.

⁶ 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.

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.

IV. Regression Methodology and Results

Our 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,⁷ 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,⁸ 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 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 small; a doubling of trade-weighted MMCs would lead to just a 3% increase in import prices. 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.

⁷ Due to $RXAR$ having zero values, $\ln RXAR$ is actually calculated as $\ln(RXAR+1)$.

⁸ 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.

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).

While these results are 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) (minus the product fixed effects of course) 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 4, 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

correlations are positive, +0.34 (and +0.19), suggestive of concentrated market structures allowing for MMC impacts to exist.⁹

V. 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.

⁹ 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

<u>HS Code</u>	<u>Title</u>
1504	Fish Oil
1507	Soybean Oil
1509/1510	Olive Oil
1511	Palm Oil
1512	Sunflower Oil
1513	Coconut Oil
1514	Rapeseed (Canola) Oil
1515	Other Vegetable Oils (including Corn Oil)
1516	Animal & Vegetable Fats and Oils, hydrogenated or interesterified
1517	Margarine

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. SUR Results, Dependent Variable = *ln* Import Unit Value

-- (N=90 for each product)

(z-statistics in parentheses next to coefficient estimates)

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

*= significant at 5%

**=significant at 1%