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Seller versus Producer concentration: incorporating the impact of foreign trade

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The major reason for this seeming neglect is the absence of harmonised production and trade data observed at the firm level for most countries. This is certainly true for the UK, and the purpose of this paper is to present a second-best bounds approach for adjusting estimates of producer concentration into seller concentration which requires only industry-level data on imports and exports and their geographical dispersion over partner trading countries. As an illustration this is applied with striking results for a sample of 119 UK manufacturing 4-digit level, 1998-2018. We show that the main result found in most previous UK studies – a distinct upward trend in typical producer concentration – does not apply for trade-adjusted seller concentration, and the incidence of industries which would be defined as “concentrated” or “highly concentrated” using conventional anti-trust policy definitions is much reduced.

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The last decade has witnessed many studies pointing to increasing concentration of industries in the USA and beyond. Some have interpreted this as evidence of a pervasive decline in the intensity of competition. We are more cautious - in not necessarily equating high concentration with soft competition - but we do not deny that concentration remains a potentially valuable metric when tracking the evolution of markets over time. Our concern in this paper is with a particularly important measurement issue which has been overlooked in most previous studies: typically, concentration is measured, with data from business registers or censuses, on the size distribution of producers in a given industry rather than the concentration of sellers in its associated market. No account is taken of importers while exports are not subtracted from domestic turnover/production, even though, for domestic consumer choice, the former may count for a lot but the latter for nothing.

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1 Introduction and Motivation

The initial stimulus for this paper was the surge of empirical research and policy interest in recent years questioning whether the forces of competition have been declining in markets in the USA and more widely elsewhere in the world. While most of the evidence suggests that competition has been on the wane, there are serious doubts, which we share, about one of the key metrics used to represent "competition" - the traditional indices of concentration, such as the Hirschman-Herfindahl (HHI).

Davies (2021) has summarised some of these doubts – some are conceptual: what do we mean by "competition"?, and some are more technical/definitional/practical data problems. Each of these will be pursued in future research, but this paper focuses on just one: how to adjust an index of the concentration of domestic producers to allow for the impact of imports into and exports out of the market? Less prosaically, the underlying issue is what does a measure of *producer concentration* in an industry tell us about the *concentration of sellers* in its associated market? Most studies in this recent literature have largely ignored this issue, employing measures derived from business registers, which invariably estimate domestic producer concentration, but, as competition economists, we should be more focused on competition between the main sellers. Especially for trade-reliant countries such as the UK, competition from imports often matters for market power, while quite often a sizeable proportion of the home firms' turnover is exported and has no direct impact on competition within the domestic market.

This is not to argue that even a trade-adjusted measure of seller concentration is an unambiguous indicator of the intensity of competition. As Davies (2021) and many others have stressed, there are important conceptual reasons why concentration, even appropriately measured, does not necessarily reflect the intensity of competition in a market. The familiar endogeneity issue which first surfaced in the old Structure-Conduct-Performance/Chicago debates of 50 years ago and has remained ubiquitous ever since, continues to remind us that high concentration is not necessarily indicative of competition-dampening market power. Instead, it could be the consequence of intense rivalry, with large market shares the reward for innovation and efficiency. We sidestep this fundamental issue in this paper, and we are careful not to equate concentration with competition: the words are simply not synonyms. This is not to deny that concentration should remain one of the most important metrics at our disposal – it is likely to be a key indicator of the outcome of the competitive process as well as, in turn, a determinant of those outcomes.

Against this backdrop, the paper has two objectives. The first is to establish a framework which allows us to combine business register data on production[1] within a country and trade data, recognising the reality that, in most countries, firm-level information on imports and exports are not available. It is important that this framework should recognise that it is not only the magnitude of the trade flows at the market level which matter, but also the market shares of the firms undertaking the trade. For example, in some cases imports might merely be the supply from a price-taking competitive fringe, but, in others, there may be only a few potentially dominant importers. The second objective is to use this framework to generate some illustrative statistics for the UK which give a feel for how big trade adjustments to concentration might be. Here, precisely because no theory will fit all, and given the absence of firm-level trade data[2], we opt for a cautious approach, in which we estimate plausible lower and upper adjustments to producer concentration which allow for very different conjectures about the concentration of importers. Although the range between the lower and upper bounds turns out to be wide, it is sufficiently narrow to allow two important qualitative inferences about the importance of distinguishing producer and seller concentration. First, while producer concentration has grown, on average, consistently for much of the last two decades, seller concentration has probably not. Second, the number of individual industries which can be labelled "concentrated" in terms of producers is much reduced when concentration is measured in terms of sellers.

Section 2 sets the context with a literature survey which covers the recent empirical work on trends in concentration worldwide and the few previous studies which have directly addressed alternative ways for adjusting concentration to allow for trade. Section 3 employs a case study of the UK car industry/market, which is unusually data- rich at the firm level, allowing us to accurately estimate producer and seller concentration from primary sources. It shows vividly just how far the two may differ. Section 4 sets out our framework - a decomposition which converts an index of producer concentration into seller concentration. This reveals that there can be no general prediction on the impact of trade on concentration: it depends on the relative concentrations of the importers and exporters. More positively however, it allows us to identify lower and upper bounds on the magnitude of the adjustment. Section 5 describes our database. Given the very imperfect data currently available for the UK, this represents our best efforts to combine the key Business Register with the trade classifications of imports and exports. Section 6 applies the decomposition to these

[1] Throughout, we use the term "production" as a shorthand for the turnover of domestic firms' domestic production which is what is typically reported in business registers or censuses.

[2] Even the CMA (2020) in its official statistical summary of the State of Competition in the UK reports only the sparsest of data on trade – merely for aggregate imports at the very aggregate 2-digit SIC level.

data to derive a picture of the current state and evolution of seller concentration in the UK 1998-2018. The results show that the impact of incorporating trade statistics into domestic measures of concentration could be sufficiently large to overturn the evidence of rising and prevalent concentration for at least a significant subset of manufacturing industries.

2 Relevant literatures

Dating back to the early days of Structure-Conduct-Performance, the role of imports in the modelling and measurement of competition in domestic markets has rarely attracted the attention it merits. This is still true, albeit with some exceptions, in the recent literatures assessing the state of competition in developed countries since the turn of the millennium, and in spite of an emerging, mainly theoretical literature on competition and trade. We begin with a brief résumé including some results from a parallel paper by the authors for the UK which sets out the key facts on producer concentration (i.e. before attempting to adjust for trade.)

The recent reawakening of interest in rising concentration was instigated by a number of influential studies, not just confined to Industrial Organisation (IO)[3], which claimed to show that the intensity of competition has declined in the USA. An important part of the evidence-base of these claims was high and increasing concentration levels – initially in the USA but increasingly across the world. Some commentators have interpreted this as evidence that markets and Competition Authorities are not functioning well (especially with respect to lax merger control.) Others (Autor et al, 2017) argue, on the contrary, that evidence points to a new breed of firm - revolutionising markets and competition - the superstar firm. Although there have been influential cautionary reviews, (Shapiro (2019), Berry et al (2019)) recalling older debates about how to interpret concentration, Competition Authorities around the world have taken an increasing interest. In the UK, for example, the CMA (2020) published a report reviewing the evidence on the state of competition, and a large part of the evidence was information on trends and levels of concentration, using data from the comprehensive Business Structure Database (BSD) on the domestically generated turnovers of the full population of firms in the UK.

In addition to the CMA report, a number of other recent studies have reported evidence on the evolution of concentration levels in the UK, including Resolution Foundation (2018), Social Market Foundation (2017, 2018), Aguda et al (2021) and Davies (2021). Most also use the BSD data, and the consensus, although not unanimous, finding of these studies is that average levels of concentration

[3] *Inter alia* Furman and Orszag (2015), Economist (2016), Gutierrez and Philippon (2017, 2018), Philippon (2019), De Loecker and Eeckhout (2017, 2018), OECD (2018) includes a comprehensive survey.

increased somewhat in the first 10-15 years of this millennium before levelling off. The Social Market Foundation's studies were case study based using primary sources, and they confirm prevailing high levels of concentration.

Figure 1, taken from Davies (2021), is fairly representative of the time series results of these studies, concerning average HHI across 361 4-digit industries.

Figure 1 Typical Industry Concentration 1998-2018

Davies also reports the distribution of HHI across industries (see Table 1). In terms of conventional yardsticks used in the UK, over 30% qualify as "concentrated" (HHI > 1000), of which nearly half are "highly concentrated" (HHI > 2000); the number of "highly concentrated" industries doubled between 2000 and 2018. Bearing in mind that the typical 4-digit industry will comprise a large number of Anti Trust Markets (ATM), which will typically be much more concentrated than the 4 digit industry itself (Davies, 2021, section 4), it is fair to conclude that the UK is now characterised by widespread concentration, after an extended period of sharply increasing concentration levels.

Table 1 Size Distribution of industries by HHI

It should be stressed again however that this and all other UK evidence relates only to producer concentration, with no adjustments having been made for the impact of trade. As already mentioned, one of the objectives of the current paper is to explore how robust are these findings once the data have been converted into estimates of seller concentration.

Outside the UK, there has been a handful of studies, all for the US, which have addressed the measurement of importer concentration. At one extreme, Covarrubais et al (2019, p. 56) employ an adjustment which echoes the treatment of imports in a few early S-C-P empirical studies (see, for example, Esposito and Esposito (1971)). This is to simply inflate the denominator of the concentration ratio to include imports, while leaving the numerator unchanged[4]. By definition, this attributes to imports a deconcentrating and, by implication, pro-competitive role. At the other extreme, an adjustment employed by Autor et al (2017, p.183) assumes individual importers with potentially considerable market shares. While they do not have access to a firm-level breakdown of imports, they are able to disaggregate imports into six broad country region-groups of origin.[5] They

[4] For instance, if C8=60%, industry domestic turnover is 100 and imports are 20, trade-adjusted C8 would be 60/120=50%: implicitly assuming that no single importer is sufficiently large to be amongst the leading sellers in the market.

[5] The six groups are: Canada, Mexico/CAFTA, China, low income countries, eight developed countries and the rest of the world.

assume that there is a sole importer from each of these regions, and if one or more of these is sufficiently large, they become one of the leaders.[6] We think of this assumption as "regional monopoly".

Feenstra and Weinstein (2017, Table 2) employ an intermediate methodology. In their case, while they do not appear to have individual importing firm data, they do have access to HHI indices of imports from each of the main partners of the US: Canada, Japan, Mexico, Germany and China. These are then averaged, for each product, along with the US domestic HHI to generate a weighted average HHI for each industry[7] which they then use in subsequent work on welfare and markups.

The work of Bonfiglioli et al 2021 deals explicitly with the measurement of importer concentration. For the US they find that concentration among US importers has fallen, and is lowest for imports from Western Europe, SE Asia, India and China. The study is limited in that, while the authors do have access to firm level import data, they do not incorporate export or home sales data and so are unable to measure what we define as seller concentration. They also only have import data for sea shipments and therefore not the full universe of firms (a problem shared by Feenstra & Weinstein, 2017).

In each of the above approaches, the authors, like us, do not have access to individual importing firms' share of the domestic market, but in a very recent paper, Amiti and Heise (2021) report results based on their access to comprehensive confidential data from the U.S. Census Bureau on the sales of individual importing firms. As they point out, their study is therefore the "first to include all of the foreign firms' sales to measure concentration in the US" (2021, p.2). Their estimates are at the at the 5-digit NAICS industry level at 5 yearly intervals over the period 1992-2012, and establish various stylised facts, the two most relevant for our purposes are that (i) "market concentration (measured with concentration ratios) in U.S. manufacturing, adjusted for foreign firms, remained stable *on average* between 1992 and 2012", and (ii) "foreign firms have *on average* increased their presence among the top 20 firms, but their share in the top 20 remains low (because their growth has been in the bottom part of the sales distribution" (our italics added). This study is, in terms of data availability, the "effective gold standard", which unfortunately we are unable to emulate for the UK

[6] Their preferred concentration measures are concentration ratios, e.g. C4, and so, in this case if imports from a given country-region, say Canada, are greater than the market share of the fourth largest domestic firm, "Canada" replaces that firm and C4 is increased by an amount equal to the difference between imports from Canada and the domestic turnover of the fourth largest US firm.

[7] If our reading is correct, their weighted average HHI for each product is similar, but not identical to our index of seller concentration (HS). Their weights are the simple country-shares, while we show that, if the aggregate index is to be defined as an HHI of all sellers in a market, the weights should be the squared country-shares.

(and also, one suspects, for most other countries), given what is currently available at least in the near future. Moreover, there are no reasons for assuming that their stylised facts will also apply for the UK, given its greater historical reliance on trade and, more recently, extensive European integration.)

Beyond the relatively narrow literature just reviewed, confined to the effects of trade on the measurement of concentration, there are, of course, wider theoretical and empirical literatures at the interface of Industrial Organisation and International Trade, which explore the possible causal relationship between import competition and concentration. An extensive survey of these literatures in unnecessary here given the objectives of the current paper, but two observations from this literature merit attention: the first is the so called "Two and a Half Theories of Trade" and the lack of consideration for large firms in trade theory; the second is ambiguity surrounding the mechanisms behind the impact of imports on domestic markets.

From a theoretical perspective the study of international trade is dominated by two paradigms, the theory of comparative advantage based on perfect competition, and the theory of product differentiation and increasing returns based on monopolistic competition. Analysis of the role of large firms in international trade has not garnered as much attention, which has given rise to what Neary, (2010)[8]. Refers to as the "Two and A Half Theories of Trade" Clearly, the differences between these paradigms in how they characterise foreign firms and the implications for how they will impact markets & competition. For our work in this paper two of the more relevant works are that of Shimomura & Thisse (2012) and Parenti (2018). Shimomura & Thisse (2012) model a hybrid market combining elements of oligopoly and monopolistic competition. They characterise a domestic market with an exogenous number of large firms and a monopolistically competitive fringe determined by free entry and exit. In this model when faced with entry by a large (foreign) firm, the fringe shrinks, competition increases, and welfare improves. Parenti (2018) expands on this hybrid approach by allowing the large firms to decide how many products to offer. Trade liberalisation can then increase or decrease welfare depending on trade costs, and the number of trading partners / large foreign firms. Finally, we would be remiss to not mention Cowling et al (2000) which pointed out the issue we are attempting to solve over 20 years ago. For a sample of transportation industries within the UK they demonstrate how concentration has been incorrectly measured due to an assumption that all imports are competitive and thus a solely deconcentrating force. With that said,

[8] Both Neary (2010) as well as Head & Spencer (2017) discuss the fluctuating interest in this third paradigm and discuss the reasons why oligopoly in international trade has not received as much attention but is now undergoing somewhat of a resurgence.

empirical work measuring the size and strength of foreign firms within domestic markets is severely lacking. Our work then serves as a contribution to this literature in attempting to assess how much potential powerful foreign firms may possess.

On the empirical side, many studies have found imports to boost competition among domestic firms but the exact mechanism behind this is often unclear (see for example De Loecker and Goldberg (2014), Pavcnik (2002) and Syverson, 2011). However, the effect of foreign competition on domestic firms does not necessarily reflect the wider impact on the market in question. Arkolakis et al., (2019) show it is "perfectly possible for domestic and foreign markups to move in opposite directions (following trade liberalisation)" (p.77). To truly understand the competitive landscape we must fully incorporate foreign firms into any analysis. Our approach of using seller rather than producer concentration is one example of how this kind of omission can be avoided.

3 An Illustration: the UK Car Industry and Market

This section briefly illustrates the difference between the concentration of sellers in a market and the concentration of producers in the domestic industry. It uses the car industry as a case study, partly because firm level data are readily available online[9], and partly because it is one of the UK's most trade-intensive intensities: in 2020 it accounted for 7% of all UK's exported goods and 6% of all imported goods.

In the UK SIC, car manufacturing is SIC 2910, and the public Business Structure Directory (BSD) reports the HHI as 1837 and the 5-firm concentration ratio as 78.8% (see Table 2). In our terminology, these are indexes of producer concentration. Access to individual firm shares is restricted for confidentially but in this particular case, the trade body regularly publishes detailed information about the volumes of production and sales for individual firms.

The five largest producers in the UK, JLR, Nissan, PSA, BMW, Honda and Toyota, are subsidiaries of foreign owned multinationals, and over 80% of their production is exported. According to our calculations, the HHI of producers (HP) is 2190 and C5=93.2. Within the domestic UK market, on the other hand, most cars are imported (88%); and only three of the top ten models are produced in the

[9] 2019-UK-AUTOMOTIVE-TRADE-REPORT.pdf (smmt.co.uk); 2019 UK automotive trade report, SMMT (Society of Motor Manufacturers and Traders.)

UK. The top five selling firms, VW, Ford, BMW, PSA and Mercedes source their sales exclusively or mainly by imports and account for 62% of the market and the HHI of sellers (HS) is 967.

In this case, there are two particularly noteworthy points. First, the official BSD estimates under-record the level of producer concentration, presumably it applies an industry definition which includes other related supply or adjacent markets, while our definition is stricter and confined exclusively to finished cars. Second, and much more important, producer concentration, whether estimated by us or in the BSD, is significantly higher than seller concentration (the HHI is twice as large.) Although this is a market with very high import penetration, the concentration of imports is much lower that the concentration of UK car producers.

Table 2 Concentration in UK Car Market, 2018

4 A Framework for Converting Producer into Seller Concentration

The above example benefited from the availability of published firm-level data, but unfortunately this is not the case for the overwhelming majority of industries and markets. In the UK at present, we only have public access to data at the industry level to summary concentration statistics such as the HHI and C5 on the production side and data at the commodity level for trade. This Section sets out our methodology in the absence of such firm-level data. We first present a formal decomposition which links producer and seller concentration and leads to a Proposition which suggests that seller concentration will probably be typically lower than producer concentration. It also establishes the key role of "importer concentration". Unfortunately, the absence of firm-level trade data prevents us from accurately estimating this, and in the second part of the section we develop a bounds approach which fully utilises the data we do have – at the industry (more correctly commodity) level for annual imports and exports, in total and by country of origin/destination[10] - to derive special cases in which importer concentration takes its minimum and maximum levels. These are then taken to the data in the following sections.

4.1 A Decomposition

We first present a decomposition which can be used, given appropriate data, to convert an index of producer into seller concentration; we illustrate with the HHI partly because it is the most widely employed index of industrial concentration and partly because it is easily decomposed statistically. It

[10] The trade data can also be disaggregated by national destinations of exports, but this is superfluous for our purposes here.

distinguishes four separable effects, depending on: (i) the magnitude of exports, (ii) the concentration of exporters, (iii) the magnitude of imports and (iv) the concentration of importers.

Definition BOX here

Note first that the HHI index of "size" in a population comprising *k* groups can be decomposed into the weighted average HHI within the groups, where the weights are the groups' squared shares of the population size. So, in this case, identifying two types of sellers in the domestic market, domestic sellers and importers, market seller concentration is:

$$HS = (1-m)^2 HDS + m^2 HM \quad (1)$$

Similarly, if imports are sourced from *k* foreign countries, concentration of aggregate imports is the weighted sum of the concentration of importers within the source countries:

$$HM = \sum_j HM_j (m_j/m)^2 \quad (2)$$

Note that the distribution of the weights in (2) can be thought of as an index of Geographic Dispersion in the sources of Imports:

$$HGD = \sum_j (m_j/m)^2 \quad (3)$$

HGD varies between (1/k) if imports are sourced in equal magnitudes from all foreign countries to 1 if all imports come from a single country.

Second, we introduce a simplifying assumption, largely for expositional clarity[11]:

A1 **Proportionate exporting**. All domestic producers export the same proportion (x) of their production. If so, each firm's share of the industry total remains unchanged, and the HHI of domestic sellers is identical to the HHI of domestic producers:

$$HDS = HP \quad (4)$$

Substituting (4) into (1) leads to:

[11] If larger firms export disproportionately more than smaller firms, HP will overstate HDS. In turn, this would reduce our estimates of HS below. However, our proportionality assumption seems a reasonable first approximation in the absence of detailed evidence to the contrary. See Freund and Pierola (2015) and Mayer and Ottaviano (2008) for evidence on the dominant shares of the largest firms in a country's exports.

$HS = (1-m)^2\ HP + m^2 HM$ (5)

Proposition (i) Seller concentration (HS) will be lower than producer concentration (HP) unless importers are "considerably" more concentrated than domestic producers and the market is highly trade intensive, (ii) As trade intensity increases, producer concentration becomes an increasingly weaker indicator of seller concentration.

Proof: for (i), HS > HP only if $\{(1-m)^2 - 1\} + m^2.(HM/HP) > 0$, i.e. if $(HM/HP) > \{(2-m)/m\}$. Note that $\{(2-m)/m\} > 1$ for all $m < 1$ and rises at an increasing rate as m falls below 1. For (ii), recall that m = M/(P-X+M), which is increasing in both X and M, for given P, and increasing m reduces the weight of HP as a determinant of HS in (5).

Implications

Both parts of the Proposition may be somewhat intuitively obvious, but nevertheless merit the emphasis of a formal Proposition – if only to suggest caution when interpreting the evidence of the previous literature - increasing producer concentration in a period of increasing trade intensity does not necessarily imply the same for seller concentration. Part (ii) of the Proposition shows that producer concentration becomes an increasingly less reliable signal of what is happening to seller concentration in a world of rising trade intensity; and Part (i) requires quantification on how to interpret "considerably", and it is to this that we now turn.

4.2 A Bounds Approach when Importer Concentration is unknown

Given that, along with nearly all previous studies except for a very few US cases, we do not have access to individual importer data, and cannot therefore estimate HM accurately, we pursue a second-best "bounds" approach. This uses the data that we do observe to place plausible upper and lower bounds on HM, and thus HS. As always with a bounds approach, the hope is that this will narrow down the set of plausible outcomes in a meaningful way. In the case of the UK, we currently have access to data for HP and m (from M, X and P), and we also have information on the geographical dispersion of imports across their countries of origin (which allow us to estimate HGD).

Setting the Bounds

Lower Bound

The case where HM is at a minimum (=0) is where all importers have trivially small market shares:

$HM_j = 0\ \forall\ j$ and (5) reduces to:

$$\text{Lower Bound HS} = (1\text{-m})^2 \text{ HP} \qquad (6)$$

This is equivalent to the standard practice in early S-C-P studies (e.g. Esposito and Esposito (1971), and as discussed earlier (Covarrubias et al, 2019) where, in effect, the concentration ratio was deflated by adding the magnitude of imports to the denominator but leaving the numerator unchanged. Loosely, this might be referred to as equivalent to a "competitive fringe" importer assumption, but because of possible ambiguous interpretation[12], we prefer the term "fragmented importers".

Upper Bound

At the other end of the spectrum is the case of only a single importer from each source country

$HM_j = 1 \; \forall \; j$ and therefore:

$$\text{Upper Bound HS} = (1\text{-m})^2 \text{ HP} + m^2 \text{ HGD} \qquad (7)$$

We refer to this as "country monopolies", and this represents the most concentrated outcome making a second working assumption:

A2 **No multinational sourcing**. No importing firm imports from more than one source country or produces in the destination country.

Cases are clearly conceivable which would violate this assumption: for example, a large multinational car manufacturer, supplementing its production in the domestic country with imports from one or more foreign countries. However, this would not be violated by a vertically integrated multinational that sources *intermediates* from abroad for a finished product produced and sold at home.

In effect, this is a refined, disaggregated, version of the assumption, employed by Autor et al 2017 as described earlier, who only segment the world into six broad regions and assume only one importer from each region.

These two assumptions set the bounds, but we also add an intermediate case which, speculatively, might indicate where within the bounds the reality might lie.

[12] It might refer to the case where imports enter at the world market price (especially perhaps for basic commodities) which either removes or limits domestic market power or alternatively to importers who are Stackleberg followers of the domestic leaders.

Intermediate Case Imports from each source country are equally concentrated as are domestic suppliers. In which case:

$HM_j = HP \; \forall \; j$ and therefore:

$$\text{Intermediate HS} = (1-m)^2.HP + m^2 \, HGD.HP \qquad `(8)$$

Returning to Proposition (i), these cases now provide a more tangible feel to the word "considerable". First, (6) confirms the intuitively obvious: with perfectly fragmented importers, the concentration of sellers is always less than domestic producer concentration since HS<HP if m>0. Perhaps less immediately obvious, (8) shows that this is also true in the intermediate case: the concentration of sellers is always less than producer concentration, even if the concentration of importers in each source country is identical to that of domestic producers.

Proof: HP-HS= HP{2m-m^2(1+HGD)}>0 since 2>m(1+HGD} given m<1 and HGD≤1.

On the other hand, from (7) the upper bound on seller concentration may exceed producer concentration if:

$(1-m)^2 \, HP + m^2 \, HGD > HP,$

i.e. if $HGD/HP > \{(2-m)/m\}$ (9)

This condition is more likely to hold the greater is import penetration (m) and the more geographically specialised are imports (the larger is HGD.) Below, we provide an assessment of how frequently this occurs, and for which industries.

5 Data

In order to estimate HM accurately, we would need a source of trade data which includes information on individual importers, classified in such a way that it can be harmonised with the domestic production data at the 4-digit SIC level from the BSD. Unfortunately, in the UK (and indeed most countries), official data on international trade by commodity are not harmonised with data on domestic production, such as censuses or business registers at the 4-digit level, and not are they available for individual importers.

Harmonising trade and production data

The best UK data at a suitable level of disaggregation is at the commodity level for what amounts to broadly the industries in the manufacturing sector[13] (UK HMRC Trade Statistics unit, HMRC 2018). This provides import and export data for a number of SITC Rev.4 industries up to the 5-digit level of disaggregation (See U.N., 2008 for information on SITC). The source currently covers 1996-2020, with information broken down by commodity and place of origin/destination. Domestic concentration data was collected from the UK BSD (see section 2). In the event, we were able to match industry and commodity definitions for a panel of 119 of the 4-digit industries in the BSD described earlier (Table 3). This sample includes half of all UK manufacturing imports and 42% of manufacturing exports. In turn, the manufacturing sector accounts for 57% of all UK imports and 45% of all UK exports. Thus, it is by no means comprehensive but it was the best concordance we could achieve with the summary data available.

Table 3 Sample Coverage

More positively, because the import data are disaggregated by country of origin, this enables us to estimate HGD and therefore the three special cases set out in the previous section.

6 Results

Recall first Figure 1 and Table 1 from the introduction to the paper which show an upward trend for UK producer concentration and a widespread incidence of concentration, even when measured at the over-aggregate, 4-digit level.

6.1 UK Trade 1998-2018

As a preliminary to making the trade adjustments, Figure 2 shows the growth of exports and imports over the time period, along with their sum expressed relative to UK GDP. This confirms that exports and imports have grown steadily and largely in tandem over this period. Crucially, for present purposes, they have outgrown GDP, allowing us to apply Proposition (ii) that levels of typical producer concentration have tended to become increasingly less reliable predictors of typical seller concentration during this period.

[13] HM Revenue & Customs, "Overseas trade data table - UK Trade Info", www.uktradeinfo.com

Figure 2 UK Trade 1998-2018

Figure 3 reports shows how the sample average (median) import weight (m) and index of geographical dispersion (HGD) have moved over this period for the 119 industries. The import share confirms the continued persistent growth already shown in the macro data of figure 2. Geographical dispersion has fluctuated, with no obvious trend, but always within a range of 1370 > HGD > 1150, or more intuitively, between the equivalent of 7 to 8 equal sized countries of origin.

Figure 3 Import share and Geographical Dispersion

6.2 The time path of typical seller concentration over time, 1998-2018

Figure 4 shows the time path estimates of the upper and lower bounds for typical seller concentration (i.e. trade-adjusted concentration) relative to typical producer concentration. For comparability, both are medians for the 119 matched sample of industries. This means that that the time series here for producer concentration is not the same as that in figure 1, which shows the median for the much fuller sample of 361 industries. Both follow the same broad pattern over the period, the smaller sample here records noticeably higher magnitudes. This reflects the fact that manufacturing industries for which we have trade data tend to be more concentrated than those in other sectors.

Turning to the bounds and the intermediate curve in the figure, there reveal 4 striking features:

1 Even the upper bound is consistently and notably lower than UK producer concentration. Thus, we can now conclude that, typically, trade-adjusted seller concentration is much lower than UK producer concentration ***even making the most concentrated of assumptions about importers[14].***

2 At the lower bound, there was a negative downward trend over the period. This confirms that, of course, the "fragmented importer" assumption will tautologically lower estimated concentration, but, more interestingly, it would be sufficient to overturn the previous upward trend detected in producer concentration over the period.

3 The intermediate curve clearly lies much closer to the lower than the upper bound, i.e. if the importers from each country selling to UK were equally concentrated as UK

[14] Strictly speaking, there is a special circumstance where importers might be even more concentrated: where large multinationals are the sole importers from more than one foreign country. While multisourcing of imports into the UK, may sometimes occur, it is unlikely that the multinational will have such widespread monopoly power. At this stage therefore, we rule this possibility out, albeit noting that it merits future empirical validification.

producers, the concentration of all sellers in UK markets would be less than half as concentrated as UK producers. However, there is no discernible trend in the intermediate series.

4 The dispersion between lower and upper bounds appears to have widened over the period – the state of our ignorance is, if anything, increasing, which underlines the need for improved, i.e. firm-level, data for the UK.

Figure 4 Producer v Seller Concentration with 3 assumptions

6.3 Incidence of high concentration markets

One of the most striking features in the series for producer concentration (HP) in Figure 4 is that its median exceeds 1000: more than half of the matched sample of 4-digit manufacturing industries is "concentrated" using a standard bench-mark statistic. Bearing in mind that concentration in the typical 4-digit industry is likely to be much lower than in its constituent anti-trust markets, this points to a manufacturing sector in which high producer concentration is pervasive. This is confirmed in Table 4, which shows that 65 of the 119 industries (55%) are concentrated[15].

However, once the trade adjustments are made, less than 20% of industries remain in the concentrated range at the lower bound, and even at the upper bound, 43 industries (little more than a third) are concentrated.

Table 4 Size Distribution of seller concentration of sample industries

Again, it is necessary to remember that even unconcentrated 4-digit industries may include concentrated ATMs, and it is also apparent that there is a small core of industries which will remain concentrated regardless of whatever assumptions are made about the concentration of importers: even at the lower bound there are 12 such industries, rising to 19 at the upper bound. Indeed, these include a smaller subset of industries in which the upper bound trade adjustment actually increases the level of concentration. These shown by the points above the 45 degree line in Figure 5.

To illustrate, two examples are shown in Table 5. In both, imports render (upper bound) seller concentration higher than producer concentration. In the case of watches, this makes an already

[15] It should be recalled that the incidence of highly concentrated industries here (for a sample of manufacturing industries) is much higher than that for the wider and larger sample shown earlier in Figure 1 and Table 1.

highly concentrated industry even more highly concentrated; in the case of imitation jewellery, this shifts it from unconcentrated to concentrated.

Figure 5 Upper Bound Seller Concentration versus Producer concentration

Table 5 Examples where Seller concentration may exceed Producer Concentration

7 Conclusions and Qualifications

To our knowledge, this paper is the first attempt to adjust the current evidence on concentration in UK industries, for the effects of international trade – effectively, converting measures of producer concentration into indices of seller concentration. Such a conversion is desirable if we are interested in the nature of competition in UK markets.

This task has been considerably constrained by the absence of publicly accessible data on imports and exports at the firm level, and of a ready-to-use concordance between UK data on domestic business activity and trade commodity classifications. For these reasons we are unable to make exact, and instead we opt for a bounds approach, corresponding to alternative extreme assumptions about the (unknown) concentration of importing firms.

While these bounds are significantly and increasingly different over time, they do allow us to draw some important qualitative conclusions. In particular, even at the upper bound, typical seller concentration is lower than producer concentration. This means that the number of 4-digit industries which would be classified as “concentrated” or “highly concentrated” is much reduced. It also seems likely that the upward trend observed in producer concentration in the first two decades of this century is, at most, much less pronounced and, at least, not at all paralleled by seller concentration. These are important qualifications to the prevailing consensus from most previous UK studies.

Having said this, the inevitable imprecision of our results is not ideal; nor is the fact that we have only been able to match business and trade data for a subset of manufacturing industries. It is to be hoped that those responsible for collecting and producing the relevant statistics can be persuaded to allow better access in the future.

It is also important for us to stress two important limitations on the interpretation of our results. First, the 4-digit level of industry aggregation we are obliged to use is far too aggregate for us to claim with confidence that these industries correspond to any meaningful definition of an anti-trust market (ATM) level (the level at which competition takes place.) In the UK’s industrial classification,

the little more than 600 4-digit industries undoubtedly comprise a far greater number of ATMs (our wild guess would be in excess of 10,000). This is important because recorded concentration tends to increase the less aggregated is the industry definition. For example, concentration in the pharmaceutical industry broadly defined is relatively low but this conceals the fact that it may be extremely high, with few significant sellers, in many of the therapeutic classes which make up pharmaceuticals.

Second, we have stressed throughout the paper that concentration should not be interpreted as a clearcut measure of competition. Concentration may be an (admittedly interesting) outcome of the competitive process, but not necessarily a determinant of market power – especially when outcomes are only observed in snapshots. Further research is needed if more meaningful measures of the dynamic competition can replace simple comparisons over time of concentration. These more conceptual doubts will be a major focus of our future research.

The purpose of this paper, above all else, is to stress the need to fully incorporate foreign firms and foreign sales into any IO related analysis. Our concept and decomposition of seller concentration represents one approach towards this goal of combining importer concentration with domestic producer concentration. We then adopt a bounds approach which can be used even in the absence of perfect data, to better understand the role of foreign competition in determining concentration.

References

Aguda O, Galanakis I, Hwang K, Savagar A, (2021), “Product Market Concentration and Productivity in the UK”

Amiti, M. and Heise, S., 2021. U.S. Market Concentration and Import Competition. SSRN Electronic Journal. [online] https://doi.org/10.2139/ssrn.3847929.

Arkolakis, C., Costinot, A., Donaldson, D. and Rodríguez-Clare, A., 2019. “The Elusive Pro-Competitive Effects of Trade”. The Review of Economic Studies, 86(1), pp.46–80. https://doi.org/10.1093/restud/rdx075.

Autor *et al* (2017). Concentrating on the Fall of the Labour Share, *AER P&P*, 107(5), 180-185

Bajgar M, Xriscuolo C and Timmis J (2021), “Intangibles and Industry Concentration: Supersize me”, *OECD Science, Technology and Industry Working Papers* 2021/12

Berry S, Gaynor M, and Scott Morton F, (2019) “Do increasing markups matter? Lessons from Empirical IO”, *Journal of Economic Perspectives*, Vol 33 No.3: 44-68

Bonfiglioli, A., Crinò, R. and Gancia, G., 2021. Concentration in international markets: Evidence from US imports. *Journal of Monetary Economics*, *121*, pp.19-39.

Competition and Markets Authority, (2020), “The State of UK Competition, CMA 133 https://www.gov.uk/government/publications/state-of-uk-competition-report-2020

Covarrubais M., Gutiérrez, G and T Philippon. (2019), "From Good to Bad Concentration? U.S. Industries over the past 30 years, *NBER Working Paper Series* 25983

Cowling, K., Yusof, F.M. and Vernon, G., 2000. “Declining Concentration in UK Manufacturing? A problem of measurement”. International Review of Applied Economics, 14(1), pp.45–54. https://doi.org/10.1080/026921700101470.

Davies, S W, (2021), “Competition and Concentration: Charting the Faultlines”, CCP Working Paper 21-11, 94b719c0a8878fba45d16271a2d1dc4ac77e16ec.pdf (sanity.io)

De Loecker J, and J Eeckhout. 2018a. "Global Market Power." *NBER Working Paper No.24768.*

De Loecker, J, and J Eeckhout. 2017. "The Rise of Market Power and the Macroeconomic Implications." *NBER Working Paper No. 23687.*

De Loecker, J. and Goldberg, P.K., 2014. “Firm performance in a global market”. *Annu. Rev. Econ.*, *6*(1), pp.201-227.

De Loecker, J., Goldberg, P.K., Khandelwal, A.K. and Pavcnik, N., 2016. Prices, Markups, and Trade Reform. Econometrica, 84(2), pp.445–510. https://doi.org/10.3982/ECTA11042.

Edmond, C., Midrigan, V. and Xu, D.Y., 2015. Competition, Markups, and the Gains from International Trade. American Economic Review, 105(10), pp.3183–3221. https://doi.org/10.1257/aer.20120549.

Esposito, L. and Esposito, F.F., 1971. Foreign Competition and Domestic Industry Profitability. The Review of Economics and Statistics, 53(4), pp.343–353. https://doi.org/10.2307/1928735.

Feenstra R C and Weinstein D E, (2017), “Globalization, Markups and US Welfare”, Journal of Political Economy, 125.4

Freund, C. and Pierola, M.D., 2015. Export Superstars. The Review of Economics and Statistics, 97(5), pp.1023–1032. https://doi.org/10.1162/REST_a_00511.

Furman, J. 2015. "Business investment in the United States: Facts." Technical report, Council of Economic Advisers, Executive Office of the President of the United States.

Gutiérrez, G and T Philippon. 2017. "Declining Competition and Investment in the U.S.”NBER Working Paper No. 23583

Gutiérrez, G and T Philippon. 2019. "How EU markets became more competitive than US Markets: A study of Institutional Drift” NBER Working Paper No. 24700

Head, K. and Spencer, B.J., 2017. “Oligopoly in international trade: Rise, fall and resurgence.” Canadian Journal of Economics/Revue canadienne d’économique, 50(5), pp.1414–1444. https://doi.org/10.1111/caje.12303.

Koltay G, Lorincz S and Valletti T, (2020), “Concentration and competition: evidence from Europe and implications for policy”. OECD (2018), “Market Concentration: Issues Paper by the Secretariat”, OECD, DFEA Competition Committee, DAF/COMP/WD(2018)46

Melitz, M.J., 2003. The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity. Econometrica, 71(6), pp.1695–1725. https://doi.org/10.1111/1468-0262.00467.

Neary, P.J., 2010. Two and a Half Theories of Trade†. The World Economy, 33(1), pp.1–19. https://doi.org/10.1111/j.1467-9701.2009.01255.x.

Parenti, M., 2018. “Large and small firms in a global market: David vs. Goliath”. Journal of International Economics, 110, pp.103–118. https://doi.org/10.1016/j.jinteco.2017.09.001.

Pavcnik, N., 2002. “Trade Liberalization, Exit, and Productivity Improvements: Evidence from Chilean Plants”. The Review of Economic Studies, 69(1), pp.245–276. https://doi.org/10.1111/1467-937X.00205.

Philippon T. 2019. The Great Reversal. How America gave up on Free Markets, Harvard University Press, Cambridge Mass.

Resolution Foundation (2018), “Is everybody concentrating? Recent trends in product and labour market concentration in the UK”, 26 July 2018

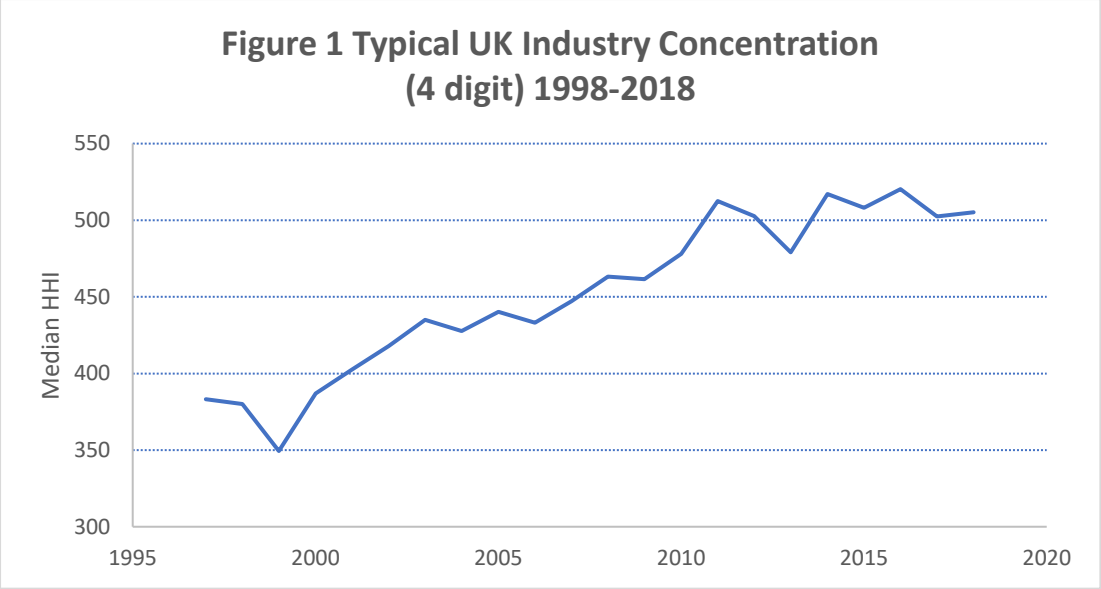
Shapiro, C. 2019. "Protecting Competition in the American Economy: Merger Control, Tech Titans, Labor Markets" *Journal of Economic Perspectives*, Vol 33 No.3: 69-93

Shimomura, K.-I. and Thisse, J.-F., 2012. “Competition among the big and the small.” The RAND Journal of Economics, 43(2), pp.329–347. https://doi.org/10.1111/j.1756-2171.2012.00168.x.

Social Market Foundation (SMF), *Concentration not competition: the state of UK consumer markets*, (2017, 2018)

Syverson, C., 2011. “What Determines Productivity?” Journal of Economic Literature, 49(2), pp.326–365. https://doi.org/10.1257/jel.49.2.326.

The Economist (2016) “Too much of a good thing. Profits are too high. America needs a giant dose of competition”, May 26th, 2016



Source: Davies (2021, Figure 1)

Table 1 Size Distribution of UK industries by HHI			
4 digit HHI range	**2018**	**2011**	**2000**
0-1000	250	244	266
1001-1500	38	42	46
1501-2000	24	24	24
2001-2500	18	16	9
>2500	31	35	16
total	361	361	361

Source: Davies (2021, Table 3)

Table 2 Concentration in UK Car Market, 2018			
	Producers	Sellers	BSD
HHI	2190	967	1837
C5	93.2%	61.6%	78.8%
Export share	81%		
Import share		88%	

Source: 2019-UK-AUTOMOTIVE-TRADE-REPORT.pdf (smmt.co.uk); 2019 UK automotive trade report, SMMT (Society of Motor Manufacturers and Traders.)

Box in Section 4

Notation (in a given product market)

Concentration indexes (0 < HHI < 1)

HS	concentration of sellers
HP	concentration of domestic producers
HDS	concentration of domestic sellers
HM	concentration of all importers
HMj	concentration of importers from country j, j=1……k
HGD	geographical concentration of imports (across countries of origin)

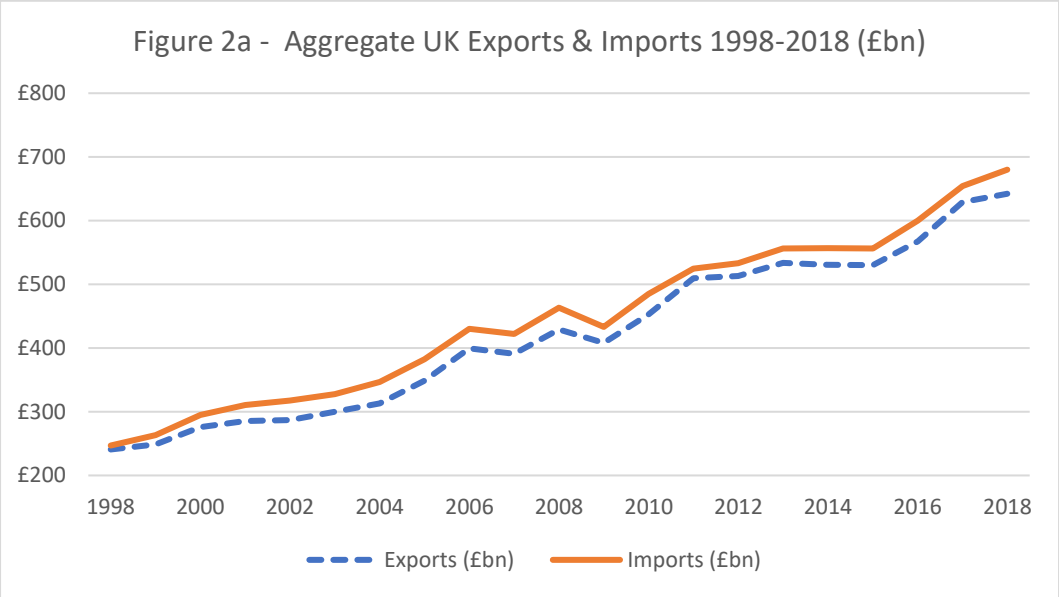
Measures of size (£)

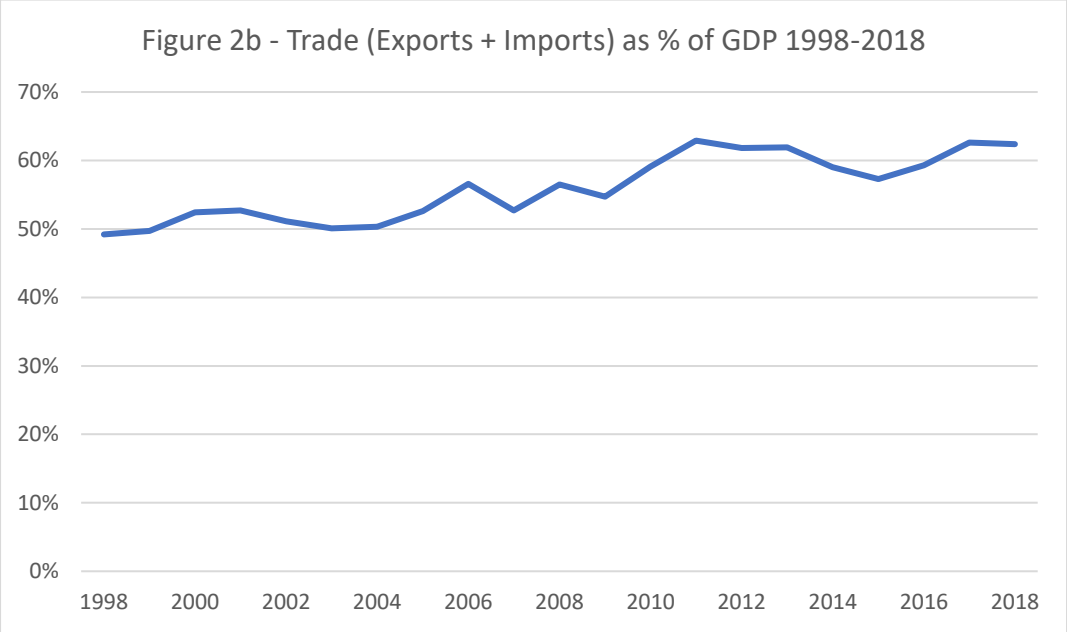
P	domestic production
X	exports
M	imports

Shares

x	export intensity = X/P
m	import penetration = M/(P-X+M)
m_j	country j's share of total imports = M_j/M

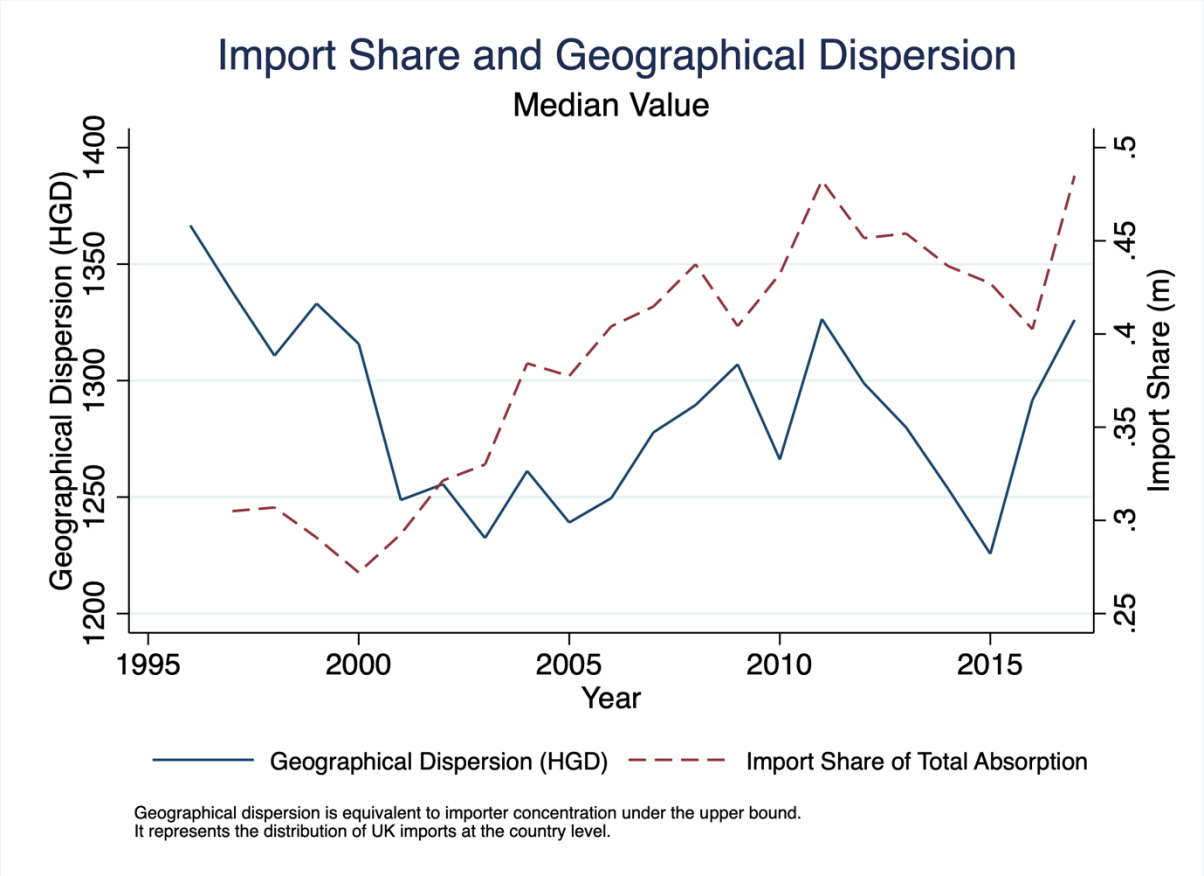
Figure 2 UK Trade 1998-2018





Source: House of Commons Briefing Paper, CBP 8261, 10 December 2020, "UK Trade, 1948-2019: statistics

Figure 3



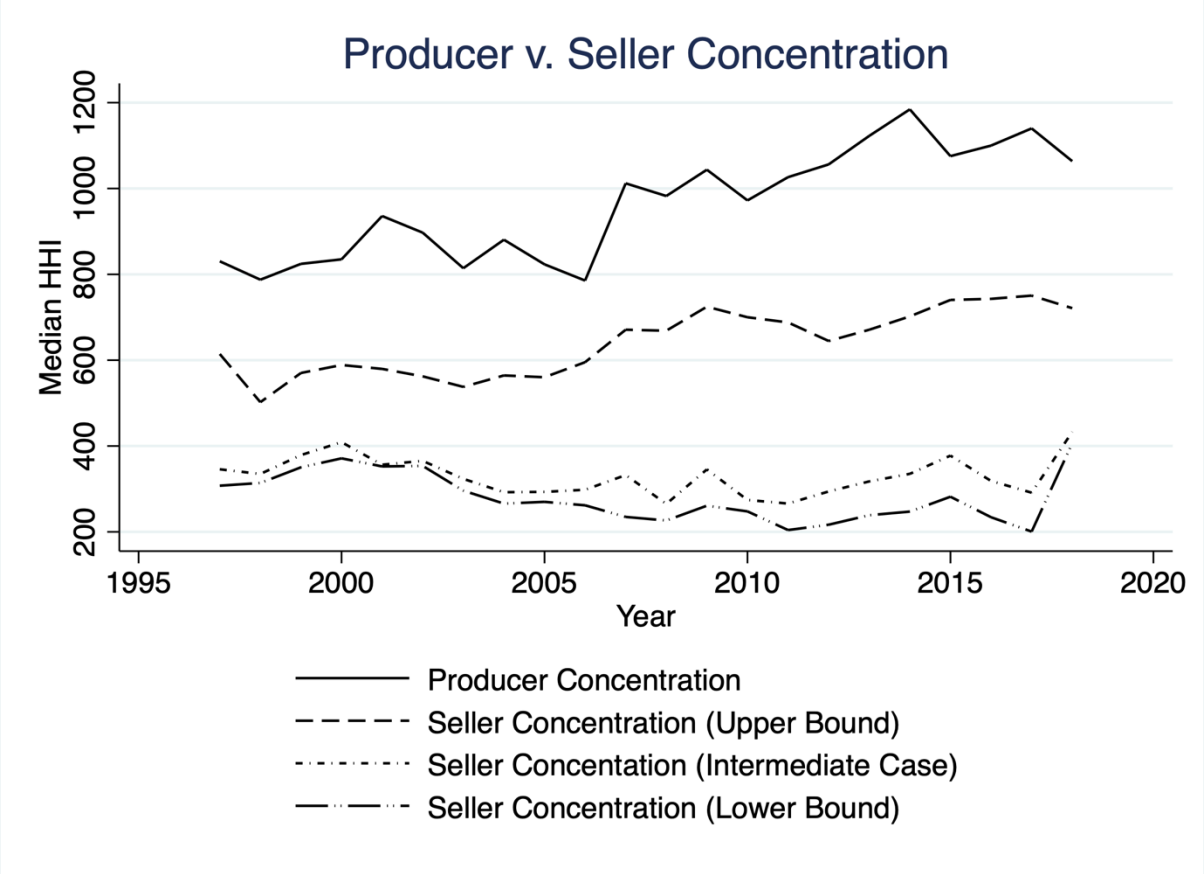
Source: HM Revenue & Customs, "Overseas trade data table - UK Trade Info", www.uktradeinfo.com

Table 3 Matched Sample Coverage (2018)

	Exports	Imports
Manufacturing share of UK total	44.60%	57.28%
Sample as share of UK manufacturing	42.12%	50.45%
	Sample	Population*
Number of 4 digit manufacturing industries	119	361

** In fact, there are 614 4-digit industries in the current UK SIC. We make various exclusions: industries for which there are very little data (typically very small industries with little or no UK production); or non-market, publicly owned, financial (for which "turnover" can not be defined in a comparable way to all other sectors) and wholesale fuel. We also exclude 142 for which there were major revisions in the SIC definitions in this period. (See Davies (2021, Table A1.)*

Figure 4 Concentration: alternative assumptions on importer concentration



Source for this and all subsequent tables: Business Structure Database and HM Revenue & Customs, "Overseas trade data table - UK Trade Info", www.uktradeinfo.com

Figure 5

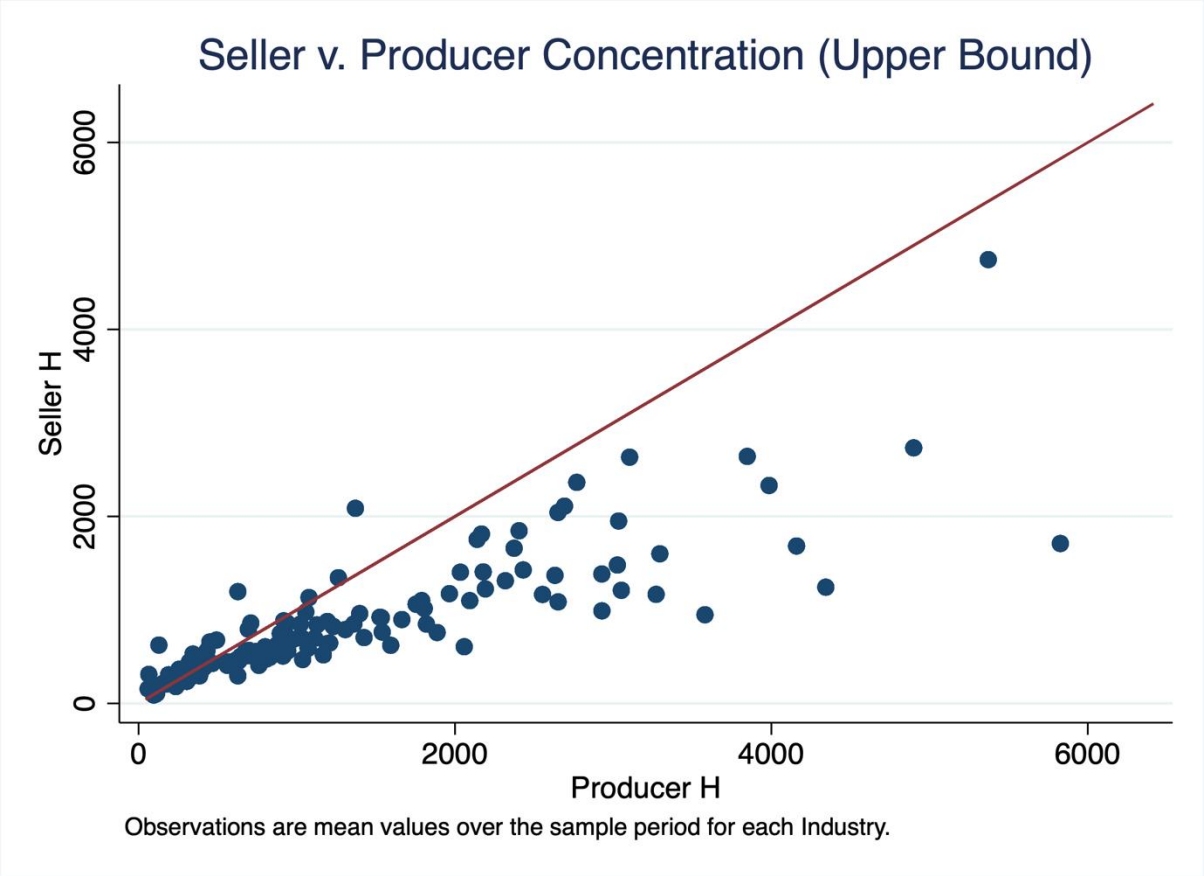


Table 4 Size Distribution of concentration (HHI) of sample industries: alternative assumptions about import concentration, (2018)				
	Producer (HP)	**Seller (HS)**		
HHI range		**Upper Bound**	**Intermediate**	**Lower Bound**
0-1000	54	76	95	98
1001-1500	21	24	11	9
1501-2000	13	8	5	5
2001-2500	8	7	6	5
>2500	23	4	2	2
total	119	119	119	119

Table 5 Examples in which the trade adjustment increases concentration*

	Seller HHI (HS)	Producer HHI (HP)	Import share
Manufacture of watches and clocks	2087	1371	90%
Manufacture of imitation jewellery and related articles	1196	628	75%

- Annual Averages 1998-2018)