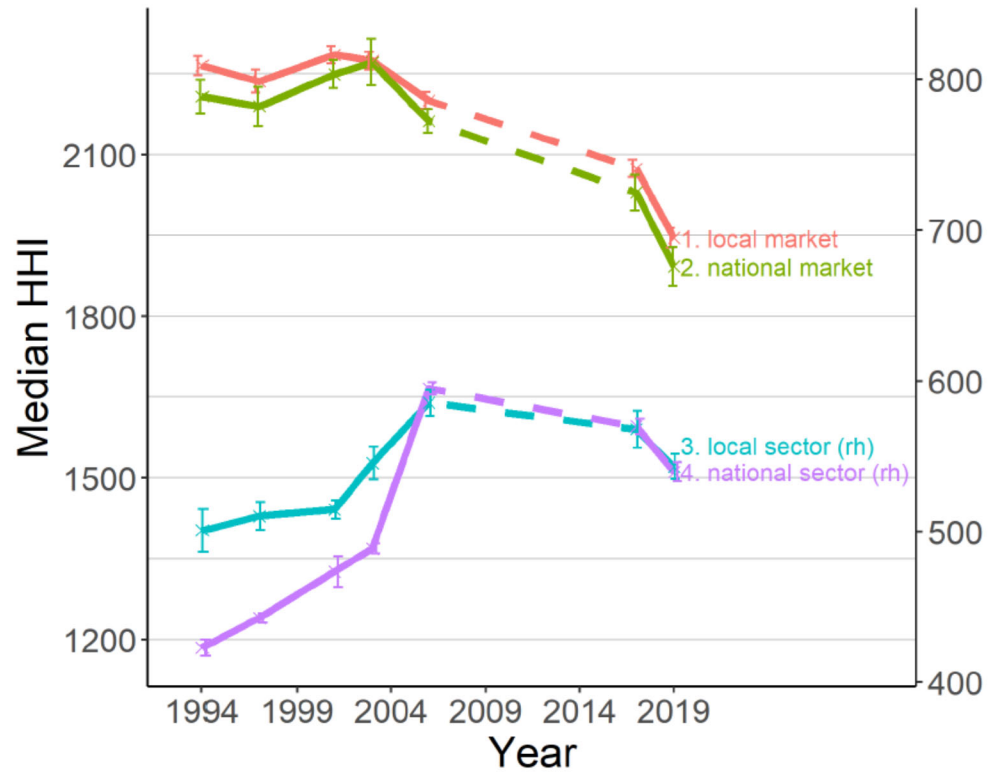


Figure 1: Median HHI over time, by market definition



*Notes.* Local markets are defined as product markets in each of 29 state groups. Sectors are defined by aggregating related national product markets. Product market measures are on the left hand side axis. Sector level measures are on the right hand side axis. Error bars are 95% CIs, based on standard errors from a nonparametric bootstrap.

## 2.1 Extracting product information from MRI-Simmons survey

We use respondent level data from the annual “Survey of the American Consumer” available from MRI-Simmons, a market research firm.<sup>14</sup> We use data from 1994 to 2019. MRI surveys approximately 25000 consumers per year in a rolling fashion.

From the survey, we extract all questions that ask consumers to report brands that they purchase. For example, under “Motor oil” in the 2006 survey, the MRI data allows consumers to report purchases of 24 different brands of motor oil, such as Valvoline, Castrol, Amoco, Havoline, and Chevron, as well as an “Other” option. In total, we extract brand purchase information for 337 products; we will call these “product markets”. We divide these product markets into 17 broader groups, such as “Home products – Food” or “Airlines”; we will call these broader groups “sectors”. Table 1, which we describe below, lists all the sectors in our data, the number of product markets in each sector, and examples of product markets within each sector. We also distinguish between “manufacturing” and “non-manufacturing” sectors. The manufacturing sectors tend to have a larger number of product markets.

## 2.2 Brand ownership information from Kantar Adspender

We derive brand ownership information by merging MRI brand names to Kantar Adspender. Kantar Adspender is a database that tracks brands' advertising expenditures across different advertising media. We digitized hard copies of Kantar Adspender for the years 1992, 1997, 2001, 2003, 2006, and downloaded data from Kantar Adspender in 2017 and 2020.<sup>15</sup> Kantar Adspender contains data on advertising expenditures; the brand name advertised, and the ultimate parent company of the brand. For the pre-2016 data, only a single parent company name is available. For the 2017 and 2020 data, there are a number of different ownership fields: "ultimate parent", "parent", "subsidiary", and "advertiser". We use the "ultimate parent" field.

Let  $B_{mo}$  represent the set of brands owned by owner  $o$ , let  $I_s$  represent the set of customers living in state  $s$ , and let  $I$  represent the set of all consumers. The market share of owner  $o$  in state  $s$ , market  $m$ , time  $t$ , is:

$$s_{omst} = \frac{\sum_{b \in B_{mo}} \sum_{i \in I_s} e_{ibmt}}{\sum_o \sum_{b \in B_{mo}} \sum_{i \in I_s} e_{ibmt}} \quad (1)$$

where  $e_{ibmt}$  is an indicator variable, for whether customer  $i$  reports purchasing brand  $b$  in market  $m$  at time  $t$ , multiplied by the sampling weight on customer  $i$ . The national market share of owner  $o$  in market  $m$ , time  $t$ , is:

$$s_{omt} = \frac{\sum_{b \in B_{mo}} \sum_{i \in I} e_{ibmt}}{\sum_o \sum_{b \in B_{mo}} \sum_{i \in I} e_{ibmt}} \quad (2)$$

We can also aggregate to the higher level of sectors, which we will index by  $k$ . Let  $M_k$  represent the set of markets in sector  $k$ . The national market share of owner  $o$  in sector  $k$ , time  $t$  is:

$$s_{okt} = \frac{\sum_{m \in M_k} \sum_{b \in B_{mo}} \sum_{i \in I} e_{ibmt}}{\sum_o \sum_{m \in M_k} \sum_{b \in B_{mo}} \sum_{i \in I} e_{ibmt}} \quad (3)$$

Using each of these market shares, we can then compute concentration metrics at the level of stategroup-markets, markets, stategroup-sectors, and sectors.

## 2.4 Computing HHIs

The HHI is a convex function of market shares, which introduces an upward bias to HHIs calculated using unbiased finite-sample estimates of market shares. To account for this, all HHIs we report in the paper are adjusted using a nonparametric bootstrap procedure to correct for finite-sample bias, which we describe in appendix A.3. The bias adjustment reduces the estimates of stategroup-product market HHIs (the lowest level of aggregation) by around 150 points (out of 10,000), but has negligible effects on HHI estimates at other levels of aggregation.

Table 1: Descriptive Statistics

Sector	# Markets	# Brands	# Owners	Matched brands %	Matched marketshare %	Example markets
Airlines	2	28.3	20.1	95.7	99.3	DomesticTravelAirlinesUsed, ForeignTravelAirlinesUsed
Apparel	2	40.9	31.1	89.1	96.3	AthleticShoesBrandsBought, WomensLingerieUndergarments
AutoProducts	15	196.9	97.6	86.7	96.7	AirFilters, WindshieldWipers
Automobile	2	52	29.1	89.5	98.8	AutomobilesAndOtherVehiclesManufacturer, MotorcyclesMake
Beverages	39	531.3	176.9	83.6	95.1	BottledWaterSeltzer, Vodka
CarRental	3	20.6	7	100	100	CarRentalBusinessUse, TruckTrailerRentalCompanies
Electronics	5	78.1	46.3	89.0	96.4	Batteries, TelevisionSetsBrands
Financial	3	42.6	26.9	92.7	99.1	CreditCards, RealEstateWhichAgentUsed
Health	62	1,127.9	239.7	86.8	94.1	AdhesiveBandages, WartRemovers
HoProdChild	17	103.3	31.4	93.6	98.5	BabyBathWashAndSoap, VitaminsForChildren
HoProdFood	126	1,700.7	445	83.0	93.8	AmericanPasteurizedProcessedCheese, Yogurt
HoProdNonfood	43	511.1	170.6	81.3	93.0	AirFreshenersCarpetRoomDeodorizers, WritingInstrumentsBrands
HoProdPets	7	118.3	41.4	76.5	86.6	CannedWetCatFood, PackagedDryDogFood
Hotels	1	34.4	17.1	96.3	98.0	HotelsMotelsWhereStayed
Insurance	4	102.3	56.7	91.4	98.4	AutoInsurance, MedicalInsuranceCompanies
Restaurants	2	114.4	92.7	88.5	94.8	FamilyRestaurantsSteakHouses, FastFoodDriveInRestaurants
Retail	4	74.4	64.7	89.7	97.0	ApplianceHardwareElectronicsStoresTimesShopped, FurnitureStoresTimesShopped

Notes. Summary statistics by sector. All numbers are averaged by year. "# markets" is the number of product markets in the sector. "# brands" and "# owners" are respectively the total number of brands and owners within a sector. "Matched brands %" and "Matched marketshare %" are, respectively, the number of brands and fraction of market share matched to owners. "Example markets" shows examples of markets within the sector

Table 2: Top 10 brand owners by year, manufacturing sectors

rank	1994	2003	2017
1	procter & gamble co	altria group inc	procter & gamble co
2	philip morris cos inc	procter & gamble co	kraft heinz co
3	unilever nv	unilever	unilever
4	conagra inc	general mills inc	general mills inc
5	johnson & johnson	conagra foods inc	johnson & johnson
6	nestle sa	clorox co	conagra brands inc
7	campbell soup co	pepsico inc	clorox co
8	johnson sc & sons inc	johnson & johnson	nestle sa
9	general mills inc	reckitt benckiser plc	sc johnson & son inc
10	clorox co	nestle sa	jm smucker co

*Notes.* Top 10 largest brand owners by year for manufacturing sectors.



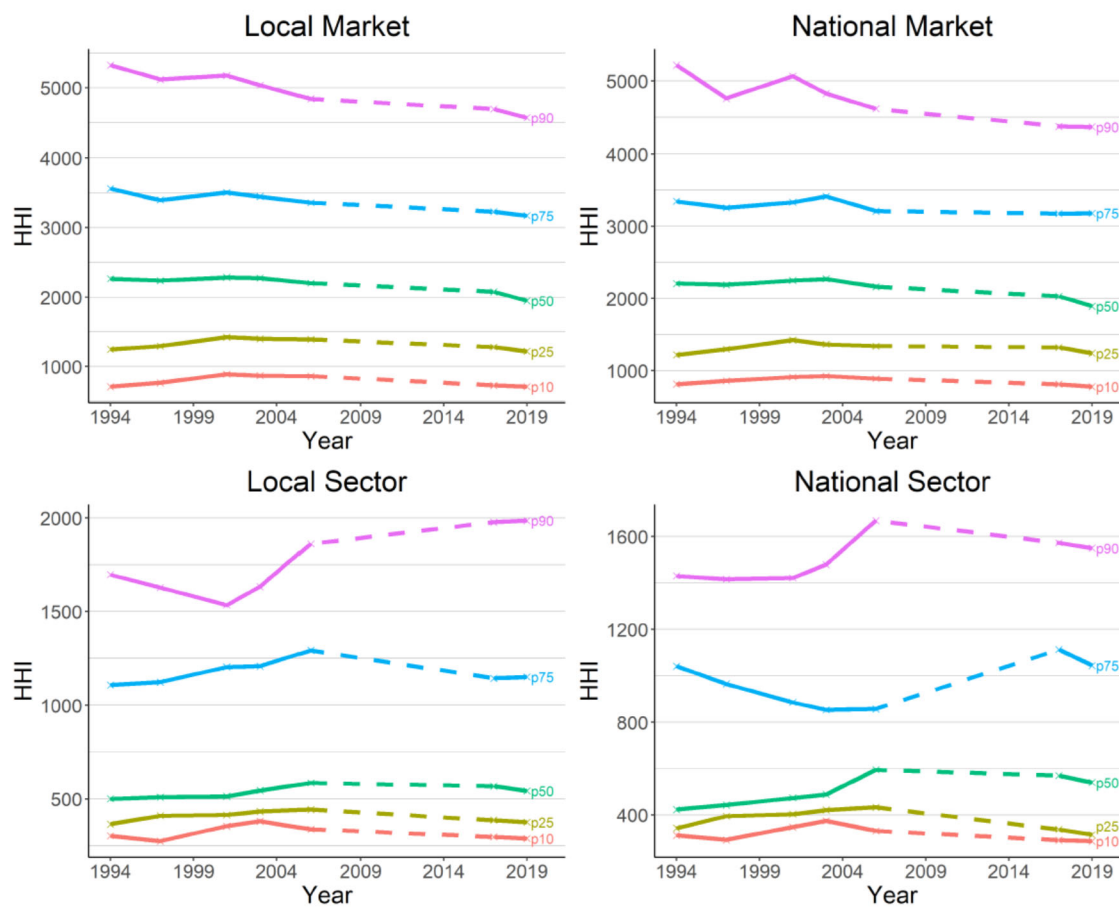
Table 3: Top 10 brand owners by year, non-manufacturing sectors

rank	1994	2003	2017
1	sears roebuck & co	state farm mutual auto	visa usa inc
2	state farm mutual auto	wal-mart stores inc	state farm mutual auto
3	k mart corp	visa usa inc	blue cross & blue shie
4	visa international	home depot inc	home depot inc
5	wal-mart stores inc	blue cross & blue shie	mastercard intl inc
6	pepsico inc	allstate corp	lowes cos inc
7	blue cross & blue shie	mcdonalds corp	wal-mart stores inc
8	southland corp	cendant corp	berkshire hathaway inc
9	mcdonalds corp	mastercard intl inc	allstate corp
10	mastercard internation	ito-yokado co ltd	seven & i holdings co

*Notes.* Top 10 largest brand owners by year for non-manufacturing sectors.

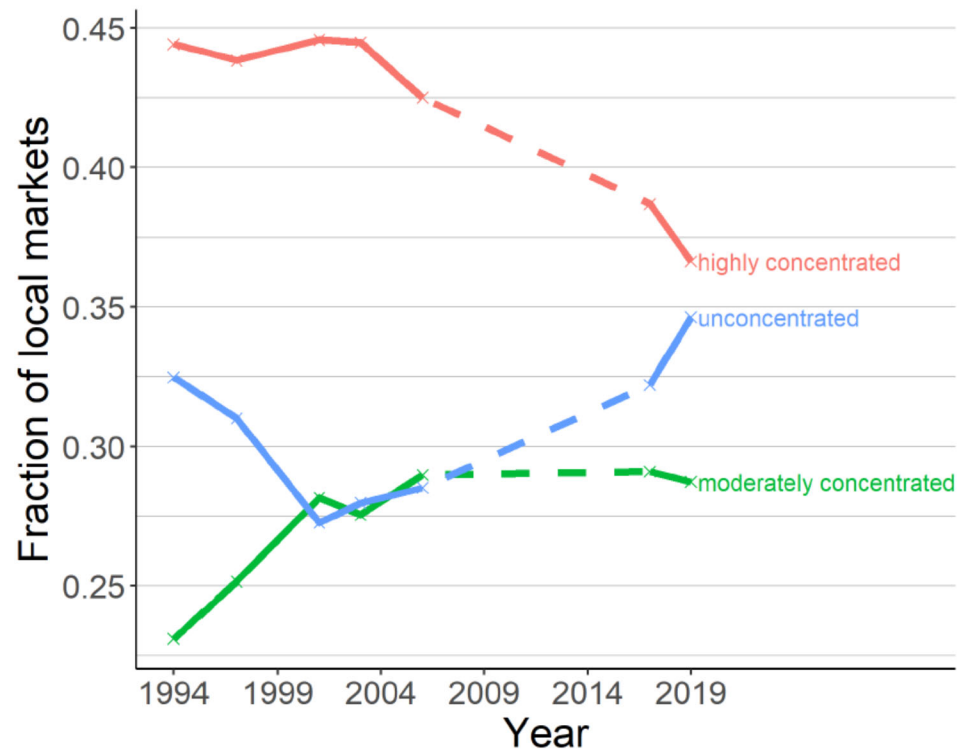


Figure 2: HHI percentiles at different market levels over time



Notes. Percentiles of HHI over time, at the stategroup-product market (top left), product market (top right), state group-sector (bottom left), and sector (bottom right) levels.

Figure 3: Fraction of local markets by concentration



*Notes.* The fraction of local markets by their level of concentration: highly concentrated (HHI higher than 2500), moderately concentrated (HHI between 1500 and 2500), and unconcentrated (HHI lower than 1500).

## 4 Model

To rationalize the empirical results, we use a simple version of the Melitz and Ottaviano (2008) model to study the determinants of concentration at different levels of market definition. We derive analytical expressions for HHIs in the model, and show which changes in model primitives are consistent with the trends we observe in the data.

In the model there are two identical markets, 1 and 2, indexed by  $j$ . These markets have two alternative interpretations. They can be thought of as two geographic regions, such as US states. A firm that is headquartered in one state can export to another state, but at a higher marginal cost. Alternatively, the two markets could be different product markets within the same sector, such as orange juice and soda. Each firm specializes in one product (its "home" product market), and can also produce the other product, but at a higher marginal cost.

Each market contains a unit mass of consumers. Preferences are defined over a continuum of differentiated varieties, where each firm, indexed by  $i \in \Omega$ , produces a single variety. There is a numeraire good,  $q_0$ . Consumers' utility is:

$$U = q_0 + \alpha \int_{i \in \Omega} q_i di - \frac{1}{2} \gamma \int_{i \in \Omega} (q_i)^2 di - \frac{1}{2} \eta \left( \int_{i \in \Omega} q_i di \right)^2$$

with a larger  $\gamma$  implying a stronger taste for variety.

We assume that there is an infinite measure of potential firm entrants in each market. Each entrant must pay some irreversible fixed cost  $f_E$  to enter. Once a firm  $i$  has entered, the firm draws a marginal cost  $c$ , distributed as:

$$G(c) = \left( \frac{c}{c_M} \right)^k$$

That is,  $\frac{1}{c}$  is Pareto distributed, with lower bound  $\frac{1}{c_M}$ , and shape parameter  $k \geq 1$ . Firms

We build on Melitz and Ottaviano by calculating market shares and Herfindahl-Hirschman indices (HHIs) at the local market and sector level and showing how they vary with model primitives. Define the total quantity in market  $j$  as the integral over all firms' production in market  $j$ :

$$Q_j \equiv \int_{i \in \Omega} q_j(c_i) di$$

We can then define the market share of a firm  $i$  in market  $j$ ,  $s_j(i)$ , as the ratio of quantity produced by firm  $i$  in market  $j$  to the total quantity in market  $j$ , and the aggregate market share  $s(i)$  as  $i$ 's total quantity across both markets, divided by aggregate market quantity. That is:

$$s_j(i) \equiv \frac{q_j(c_i)}{Q_j}, \quad s(i) = \frac{\sum_{j=1}^m q_j(c_i)}{\sum_{j=1}^m Q_j} \quad (9)$$

These are the natural continuous analogs to market shares with a discrete number of firms. We can then define HHIs at the market and aggregate level as follows.

**Definition 1.** Define the local HHI in market  $j$  as:

$$HHI_j = \int_{i \in \Omega} (s_j(i))^2 di \quad (10)$$

and the aggregate HHI as:

$$HHI = \int_{i \in \Omega} (s(i))^2 di \quad (11)$$

As noted above, local and aggregate markets can be interpreted either geographically, as state-group and national market shares, or as product markets and sectors. Since we are primarily interested in the convergence between market and sector HHIs, we will describe local HHIs as “market” and aggregate HHIs as “sector” HHIs. The following proposition characterizes market and sector HHIs in the model.

**Proposition 2.** *Market HHIs are:*

$$HHI_j = \frac{1}{N} \frac{2 + 2k}{2 + k} \quad (12)$$

*Sector HHIs are:*

$$HHI = HHI_j - \frac{k + 1}{N \left(1 + \frac{1}{\tau^k}\right) (k + 2)} \left[ 1 - \frac{1}{2} k (k + 1) (k + 2) \left( \frac{1}{k \tau^k} - \frac{2}{(k + 1) \tau^{k+1}} + \frac{2\tau - \tau^2}{(k + 2) \tau^{k+2}} \right) \right] \quad (13)$$

*The market HHI is strictly increasing in  $\tau$ . The difference between the market and sector HHIs,  $HHI_j - HHI$ , is also strictly increasing in  $\tau$ .*





can produce in their local market at constant marginal cost  $c$ . Firms can also “export” to the other market. The marginal cost a firm faces for producing in the export market is  $\tau c$ , where  $\tau > 1$ . Thus, when  $\tau$  is low, firms have similar production costs in both markets; when  $\tau$  is high, a firm based in one market faces a high marginal cost of producing in the other market.

The interpretation of  $\tau$  differs depending on whether markets represent geographic regions or product markets. If the two markets are interpreted as geographies,  $\tau$  can be thought of as representing product trade costs, such as physical transportation costs, or increased operational costs of advertising and selling across state borders. If the two markets are interpreted as product markets within a sector,  $\tau$  can be thought of as the additional costs that a specialized firm faces when it produces a different product. Firms specializing in orange juice might have a higher marginal production cost for soda due to accumulated experience from learning-by-doing, or technological factors like production equipment that is better suited to orange-juice production. The benefits to specialization may also vary across sectors and over time depending on technology and the composition of marginal costs. Certain costs, such as transportation, logistics, and marketing costs, are more likely to be common within a firm across different product markets. In sectors and time periods where these factors make up a larger share of marginal costs,  $\tau$  would tend to be lower.