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An analysis of Market Channel Alternatives for the U.S. Ornamental Plants Growers

by Xuan Wei, Hayk Khachatryan, Ariana Torres, Robin Brumfield, Alan W. Hodges, Marco A. Palam, and Charles R. Hall

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10	Abstract

The introduction of internet-based process has gradually changed ornamental horticulture 11 industry's marketing paradigm in the past two decades. Combing four waves of the National 12 Nursery Survey from 2004-2019, we explore the relationship between firms' choices of entering 13 wholesale markets, diversification of wholesale market channels, and market shares among 14 15 major market channels. Over the survey period, traditional wholesale market channels such as 16 landscape services companies, re-wholesalers, and single-location garden centers remained 17 mainstream channels. Surveyed firms also reported 30% of their 2018 sales were generated from direct sales, indicating that direct-to-consumer channel, as a relatively new addition to the 18 19 conventional channels, has the potential to gain significant market share. While sales are 20 balanced across different market channels, there is a positive correlation between firms' 21 perceived importance in production cost, labor costs and competitions, and the number of 22 wholesale market channels. Plant types are important factors of firms' choices of entering a 23 specific wholesale market channel. The housing price index (as a proxy for housing market 24 trends) is positively associated with the landscape services channel's market share, but 25 negatively associated with the re-wholesalers' market share. This relationship suggests a 26 substitution effect between landscape services and re-wholesaler markets depending on the 27 economic situation.

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29 Keywords: fractional logit, market diversification, market channels, market share

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50 JEL Classifications: C50, M31, L14

51 **1. Introduction**

52 The ornamental horticulture industry provides important economic contributions to the U.S.

53 agricultural sector. Contributions include indirect and induced effects in other sectors estimated

54 at \$348 billion in output and 2.32 million jobs (Hall et al., 2020). In recent years, not counting

55 the surge in demand for houseplant categories due to the COVID-19 pandemic, the ornamental

56	horticulture industry has experienced diminishing revenue and shrinking profit margins
57	(Madigan, 2020). Considerable within-industry consolidation, increased competition, and
58	relatively weak consumer demand were some of the factors that contributed to the downward
59	trend (Hall, 2010; Madigan, 2020).
60	The industry's average annual sales revenue was about \$1.39 million per firm in 2018
61	(Khachatryan et al., 2020) compared to 1.83 million in 2013 (Hodges et al., 2015). The Census
62	of Horticultural Specialties showed a drastic reduction in number of producers (in all
63	horticultural specialty crops) from 23,221 in 2014 to 20,655 in 2019, while sales slightly
64	decreased in that same period from \$13.79 billion to \$13.78 billion (USDA, 2020). The plant and
65	flower growing sector in the U.S. (NAICS 11142) showed a similar pattern in the number of
66	business operations from 2011 to 2020 but gradually catching up in market size (Figure 1).
67	Meanwhile, the markets facing nursery producers have changed dramatically in the past
68	two decades. As a relatively low-cost but highly effective marketing method, digital marketing
69	can expand the boundary of wholesale and retail markets by complementing conventional
70	wholesale and retail channels. The rise in social media usage and online advertising has shifted
71	marketers' attention to new forms of promotion and advertising. Business to business (B2B)
72	online markets (e.g., Amazon.com) and social media platforms (e.g., blogs, Facebook, YouTube,
73	etc.) have been widely adopted for various B2B marketing objectives such as lead segmentation,
74	subscriber/customer engagement, and branding, to name a few (Bruce et al., 2012; Fan et al.,
75	2015; Järvinen et al., 2012; Vieira et al., 2019). The recent growth of consumer-generated
76	media (CGM) on major social media platforms such as Facebook or Instagram, and the creation
77	of digitally enabled communities have also fundamentally changed the interaction format
78	between consumers and firms (Thompson et al., 2007). The use of digital marketing can also be

a viable strategy for smaller, resource-constrained firms in the green industry to reach out to
customers (Peterson et al., 2018; Yao et al., 2018). Several recent studies have focused on the
role of social media marketing and its impact on sales in the ornamental horticulture industry
(Barton and Behe, 2017; Li et al., 2019; Palma et al., 2012; Peterson et al., 2018; Yao et al.,
2018). However, with the exception of Hinson et al. (2012), no studies exist on market access,
market diversification, and shifts among market channels within the ornamental horticulture

Understanding market structure by exploring how the number of firms in a market, firms' 86 87 sizes, potential competitors, and the extent of firms' product lines affect competition and firm 88 profits is the main focus of the field of industrial organization (IO)(Berry and Reiss, 2007). 89 Market diversification has been considered one of the most important strategic management 90 concepts for increasing market share and profitability, while minimizing business risk (Ayal and 91 Zif, 1979; Kotler and Keller, 2012). By increasing the access to markets, businesses in the 92 ornamental horticulture industry can better utilize physical and digital resources and improve 93 financial resilience to changes. In this study, we combine four waves of the National Nursery 94 Survey (2004, 2009, 2014 and 2019) to explore the relationship between firms' choices of 95 entering the wholesale market, diversification of wholesale market channels, and market shares 96 among major market channels. We primarily focus on wholesale market channels (e.g., mass 97 merchandiser retailers, home centers, garden centers, landscapers, and rewholsalers) which have 98 been traditionally used by ornamental horticulture business (Hinson et al., 2012). Observing increasing use of digital marketing strategies in the ornamental horticulture industry along with 99 100 the changes in agricultural supply chains, the 2019 survey questionnaire included direct-to-101 consumer (DTC) in addition to these aforementioned conventional market channels. We

therefore further investigate the interactions between DTC and other conventional wholesale market channels separately using 2019 data only. With the ongoing consolidation within the industry, uncertainty in demand for horticultural products and services, and an increasingly competitive business landscape, exploring the availability of existing market channels and new sales opportunities is critical for the industry firms to maintain competitiveness.

2. Methods

108 **2.1 Data**

109 The primary data used in our empirical analysis were the National Nursery Survey conducted by 110 the Green Industry Research Consortium at a five-year interval beginning in 1989. The National 111 Nursery Survey aimed to collect detailed information on the production and marketing practices 112 of ornamental plant growers and allied industries. As the survey's main content remained similar 113 over time, we were able to combine the four most recent surveys conducted in 2005, 2009, 2014, 114 and 2019 to create a larger longitudinal data set. The survey questionnaire consisted of six broad 115 sections, including general firm information (e.g., location, employment), nursery product types, 116 production and management practices, marketing and promotion practices, regional trade 117 patterns, and firm perceptions on factors affecting business. By combining four waves of data, 118 we aimed to provide a dynamic picture of the green industry since the mid 2000s. 119 Accounting for the significant variations in firm size and practices in the green industry, a 120 stratified random sampling procedure was adopted to ensure sample randomness and 121 representativeness. Based on the size of operation (e.g., open field, greenhouse), firms we 122 stratified by four sizes: very small, small, medium, and large firms. large and medium-sized 123 firms were purposely oversampled to reflect their dominant activities in the green industry as 124 well as to maximize response rate. A total of 2,485 firms in 2004, 3,044 firms in 2009, 2,657

125 firms in 2014 and 2,170 firms in 2019 responded and completed the survey. More detailed 126 information regarding the surveys' scope, sampling methodology and descriptive summary about 127 data can be found in Brooker et al. (2005) for the 2004 survey, in Hall et al. (2011) for the 2009 128 survey, in Hodges et al. (2015) for the 2014 survey, in Khachatryan et al. (2020) for the 2019 129 survey. In this study, a cross-sectional data was created by pooling all firms across four survey 130 years together. Table 1 illustrates the wholesale and retail market access reported by survey 131 year. Tables 2 and 3 summarize the wholesale market access proportions in a greater detail. 132 Table 2 presents the number of firms within each wholesale market outlet by survey year, while 133 Table 3 summarizes the number of firms associated with possible numbers of market channels. 134 Table 4 summarized the key variables included in our empirical analysis. We divided these 135 variables into four broad categories: regional indicator variables representing the firms' location, 136 major plant product types, firms' production characteristics and perceptions about factors 137 impacting product price formation and factors impacting business in general. It is worth noting 138 here that even though regional dummy variables were suppressed from our empirical results (i.e., 139 Tables 5, 6.1 and 6.2), region and fixed effects were included in all regression analysis. 140 We supplemented the National Nursery Survey data with the 5-digit zip-code-level house 141 price index (HPI) in 2004, 2008, 2013, and 2018 to reflect the local housing markets, where the 142 participating ornamental plant growing firms were located.¹ While data on new constructions 143 and building developments can capture the pull mechanism of housing on the green industry, the

146 index of single-family house prices, which is an accurate indicator of house price trends in the

lack of data availability of such information throughout the analysis period motivates the use of

HPI information as an approximate. The HPI at 5-digit zip code level is a weighted, repeat-sales

144

145

¹ HPI data are available from the Federal Housing Finance Agency website (https://www.fhfa.gov).

local area. We normalized the HPI indices using the year 2000 as a base year to be consistentacross survey years.

149 Understanding green industry firms' choices of marketing channels is of our primary 150 interest. We first tabulated the numbers of firms entering wholesale or retail market. As shown in 151 Table 1, about two fifths of the ornamental plant grower firms have marketed their plants 152 through both retail and wholesale channels. Approximately 35% of ornamental plant firms 153 entered only wholesale markets and 25% entered only retail markets. The number of firms 154 engaged in wholesale, retail or both market channels were stable prior to the 2014 survey. 155 Likely due to the financial crisis from 2007 to 2009, a significant number of firms exited the 156 wholesale market (as revealed in the 2014 survey), while the proportion of firms entering the 157 retail market increased. By 2019, the number of firms engaged in wholesale markets bounced 158 back reaching 45% of the participating firms, while the number of firms engaged in retail 159 markets fell back to the pre-2009 level.

160 Given the importance of wholesale markets to the ornamental horticulture businesses, we 161 then consider a subset of firms engaged in the wholesale market (i.e., firms entered the wholesale 162 market only, and firms both wholesale and retail markets). A closer look at the wholesale market 163 outlets distribution in Table 2 reveals that garden centers (including both single location and 164 multiple locations), landscapers, and re-wholesalers used to be the dominant wholesale channels, 165 accounting for more than 80% of firm-level sales of ornamental plants. Even though the demand 166 from big-box stores has been growing, supply to mass merchandisers and home centers remains 167 low. In fact, the share of sales to big-box stores has been gradually decreasing over the past 15 168 years. On the other hand, the direct-to-consumer channel seized a market share of 30% in the 169 2019 survey. With the increasing availability of social media platforms, the direct-to-consumer

channel is gradually taking over the leading positions of landscapers and wholesalers andbecoming an expanding market segment.

172 In contrast, overall supply to the other six wholesale market outlets has declined with 173 major market channels (e.g., single and multiple location garden centers, landscaper and re-174 wholesalers) almost down to half of their 2004 levels. Expansion in the direct-to-consumer 175 channel is consistent with the rising trend of digital marketing and online sales strategies in the 176 U.S. ornamental horticulture industry (Peterson et al., 2018: Yao et al., 2018; Torres, Barton, and 177 Behe, 2019). Table 3 demonstrates the diversity of firms' wholesale market channels based on 178 the numbers of wholesale market channels firms participated from 2004 to 2019. Even though 179 the number of firms selling through a single market channel has remained stable, the proportion 180 of those firms has increased from 33% to 53%, indicating firms are becoming more concentrated 181 on a single market segment instead of diversifying market channels. The number of firms selling 182 through more than one channel declined significantly after 2009 and was not yet restored to the 183 same levels by 2019. The size of firms selling through more than three market channels has been 184 shrinking, with only approximately 8% of firms in the 2014 and 2019. This may indicate that 185 changes in the industry and consumer demand for more environmentally friendly plants (e.g., 186 Wei et al., 2020; Yue et al., 2016) have created bifurcation of the industry, in which larger 187 businesses relying on economies of scale are consolidating and selling larger amounts in fewer 188 wholesale channels. In contrast, smaller businesses rely on the consumer-generated media and 189 are accessing lower volumes but higher value market segments.

190 **2.2 Econometric Models**

191 Wholesale market channel diversity: tobit model

As shown in Table 1, some firms chose not to enter the wholesale market, so zero responses were observed. For example, over the period of 2004-2019, a total of 2,202 firms reported having retail sales only. On the other hand, some firms sold to only one major channel, while others used omni channel marketing approach (Table 3). Thus, the data on the number of wholesale market channels followed a pattern of a corner solution, where some responses were concentrated at zero levels, while others took on strictly positive values. Because of this data distribution, we employed a Type I tobit.

Following Wooldridge (2010), we used a latent variable formulation to exploit the diversity of wholesale market channels. The number of whole market channels *c* chosen by a firm was indicated by a latent variable c^* , which depended on firms' characteristics and other factors that influenced individual firms' choice. Assuming the error term *u* has a zero mean and variance σ^2 , the Type I tobit model could be written as following.

204
$$c = \max[c^*, 0]$$
 (1.1)

$$205 \quad c^* = \mathbf{x}\mathbf{\gamma} + u \tag{1.2}$$

206
$$u|x \sim Normal(0, \sigma^2)$$
 (1.3)

207 The probability density function for estimation can be presented as follows:

208
$$f(c|\mathbf{x}) = [1 - \Phi(\mathbf{x}\boldsymbol{\gamma}/\sigma)]^{1[c=0]} [\sigma^{-1}\phi[(c-\mathbf{x}\boldsymbol{\gamma})/\sigma]]^{1[c>0]}.$$
 (2)

209 The expected number of wholesale market channels utilized by firms is given by:

210
$$E(c|\mathbf{x}) = P(c = 0|\mathbf{x}) \cdot 0 + P(c > 0|\mathbf{x}) \cdot E(c|\mathbf{x}, c > 0)$$

211
$$= \Phi(\mathbf{x}\mathbf{y}/\sigma)\mathbf{x}\mathbf{y} + \sigma\phi(\mathbf{x}\mathbf{y}/\sigma).$$
 (3)

For a random firm *i*, the associated log-likelihood function was estimated using the following:

213
$$\ell_i(\boldsymbol{\gamma}, \sigma) = \mathbf{1}[c_i = 0] \log[1 - \Phi(\boldsymbol{x}_i \boldsymbol{\gamma} / \sigma)] + \mathbf{1}[c_i > 0] \{\log \phi[(c_i - \boldsymbol{x}_i \boldsymbol{\gamma}) / \sigma] - \log(\sigma)\}$$

215 Factors influencing shares of major wholesale market channels

216 To investigate factors influencing the share of the wholesale market channels, we used a 217 fractional logit model following Papke and Wooldridge (1996). As the dependent variable was 218 the proportion of sales through wholesale markets, i.e., with values ranging between zero and 219 one with corners at both zero and one, it was natural to consider two-limit tobit model as an alternative approach.² However, a two-limit tobit model required a full set of distributional 220 221 assumptions including restrictive assumptions of homoskedasticity and normality of the error 222 term. Both heteroskedasticity and nonnormality will result in the tobit estimators being 223 inconsistent. On the other hand, a fractional logit model had a useful property that produced 224 consistent coefficient estimates and average partial effects (APEs) as long as the conditional 225 mean function was correctly specified. The APEs were of more interest here to understand 226 market share changes among different outlets since we have explored the firms' likelihood of 227 entering a wholesale market as well as choices of market channels in our previous two steps. 228 Letting s to be the share of the sales to a given wholesale market channel, the conditional 229 mean function could be expressed as 230 $E(s|\mathbf{x}) = exp(\mathbf{x}\boldsymbol{\delta})/[1 + exp(\mathbf{x}\boldsymbol{\delta})].$ (5) 231 Conditional expectations could be obtained similar to the expectations in the standard 232 logit. Nonetheless, conditional expectations in a fractional logit model are on the mean and not 233 the response probability as in a logit model.

Following Papke and Wooldridge (1996), a simple quasi-maximum likelihood estimator
(QMLE) method was used to estimate the Bernoulli log likelihood function,

236
$$\ell_i(\boldsymbol{\delta}) = \sum_{i=1}^{N} \{ (1 - s_i) \log[1 - \Lambda(\boldsymbol{x}_i \boldsymbol{\delta})] + s_i \log[\Lambda(\boldsymbol{x}_i \boldsymbol{\delta})] \},$$
(6.1)

 $[\]frac{2}{2}$ Hinson et al. (2012) used a two-limit tobit model emphasizing observations cornered at both zero and one.

or equivalently,

238
$$\ell_i(\boldsymbol{\delta}) = \sum_{i=1}^N \left\{ (1-s_i) \log\left[\frac{1}{1+exp(\boldsymbol{x}_i\boldsymbol{\delta})}\right] + s_i \log\left[\frac{exp(\boldsymbol{x}_i\boldsymbol{\delta})}{1+exp(\boldsymbol{x}_i\boldsymbol{\delta})}\right] \right\}.$$
 (6.2)

3. Results

240 **3.1 Factors influencing wholesale market channel diversification**

241 As shown in Table 4, 76% of the surveyed firms were from four major regions: Southeast (26%), 242 Northeast (20%), Midwest (18%), and Pacific (12%). This distribution is not surprising, as these 243 four regions are known as major production regions for floriculture and nursery crops and 244 include the 15 states used as primary production states in the USDA's Census of Horticulture. 245 The other 24% of firms in our survey were distributed across the other four regions. 246 Table 5 illustrates the coefficients and marginal effects of the likelihood of entering 247 wholesale markets. Firms located in the Great Plains and Midwest tended to be less diversified 248 than firms in the Southeast region (used as a base group in the regression model). 249 Overall, we found that plant types were important determinants of firms' choices of 250 market channel diversification. Having deciduous shade and flowering trees, broad-leaved 251 evergreen shrubs, narrow-leaved evergreen shrubs, evergreen trees, vines and ground covers, and 252 foliage is likely to increase the number of wholesale market channels. Specifically, having 253 evergreen shrubs and trees, and vines and ground covers extended firms' marketing outlets with 254 an additional wholesale market channel. Conversely, having bedding plants (vegetables, fruits, 255 and herbs) and Christmas trees narrowed firms' marketing channels. These results are consistent 256 with Torres et al. (2017) who reported broad-leaved crops were a primary plant type for larger 257 businesses in the industry, while Christmas trees tend to be sold by firms engaged in retail or 258 landscape installations.

259 In terms of firm characteristics, firms with longer years of operation participated in more 260 market channels than relatively younger firms. Firm size (measured by the numbers of 261 permanent, temporary employees, and firms' total sales value) impacted the choice of market 262 channel diversification. Firms with the largest number of permanent employees tended to have 263 more market channels, but firms with the most temporary employees or highest sales value were 264 not associated with more market channels. As expected, increasing the percentage of contracted 265 sales (Sales contract) reduced firms' diversification in market channels. Contract grower firms 266 were restricted to their pre-commitment in selling their products to the specific party which could 267 limit their opportunities to explore other possible market channels. This finding aligns with 268 Torres et al. (2020) who found wholesale contracts are an indicative of larger volume customers 269 that are primarily available through wholesale markets. On the other hand, firms were more 270 likely to have more market channels if they contracted to other producers (D COP), contracted 271 to garden centers (D CGC), or contracted to mass merchandisers (D CMM). It is not surprising 272 that contracting to garden centers or mass merchandisers increased market channels as garden 273 centers and mass merchandisers were two major market channels. Being contracted to garden 274 centers or mass merchandisers indicated that firms already secured one additional market 275 channel, all other factors (e.g., firm characteristics) held constant. Meanwhile, contracting to 276 other producers likely increased diversity of market channels as firms could combine with other 277 producers to explore other possible market channel opportunities. Businesses accessing these 278 markets may have implemented a series of sales and advertising procedures resulting an 279 augmented buyer network that allow them to reach more diverse markets. 280 In addition, firms with more negotiated sales or more sales to repeat customers were

281 likely to have more diversified market channels. Repeat customers may have referred businesses

282 to other potential buyers, thus increasing the market reach of businesses. Attending more 283 tradeshows was also likely to increase the number of firms' market channels. It seems that 284 tradeshows were an effective strategy to access more markets due to the face-to-face 285 relationships built at these events. Firms' perceptions toward production cost, labor and 286 competition remained as significant factors influencing firms' market channel selection. Firms 287 who perceived that production costs, labor costs and competition were major factors impacting 288 their product price and business performance, were more likely to use relatively more market 289 channels than other firms. These firms may be focused on developing efforts to reduce costs, 290 increase revenue, and increasing profit margin. The HPI had only a mild impact on the choice of 291 market channels, which could be due to the fact that accessing wholesale markets is farther from 292 end-users. Also, as a broad indicator of the housing market, HPI may be a much noisier than a 293 direct measure of new constructions and developments.

3.2 Factors influencing market shares of major wholesale market channels

295 Table 6 presents the estimated marginal effects of factors influencing shares of sales to the six 296 major market channels from the fractional logit model (estimated coefficients are reported in 297 Table A1).³ The impact of regional indicator variables on shares of sales varied across market 298 channels.⁴ The regional impact was particularly strong on market shares for single location 299 garden centers, which is not surprising as single location garden centers tend procure from 300 regional suppliers and sell locally. Another pattern was that firms located in Midwest and 301 Mountain regions sold more to landscape firms but less to re-wholesalers (e.g., brokers) than did 302 firms in other regions. Conversely, the opposite holds for firms located in the Pacific region,

³ The DTC market channel was only included in the 2019 Survey. Therefore, there are only six market channels for the combined data. A separate analysis for the 2019 survey only with seven market channels was also conducted and results were reported in Tables A2 and A3.

⁴ The coefficients of regional and year dummies were suppressed from the results tables (Tables 5 and 6), but available from authors upon request.

303 which sold relatively less to landscapers, but more to re-wholesalers than did firms in other 304 regions. This indicates market substitution might occur not only between landscapers and re-305 wholesalers within the same region, but also across different regions.

The role of plant types in determining market channel diversification is more evident when investigating the market share of each market channel. Increasing production in herbaceous perennials, bedding plants, flowering potted plants, tree fruits, foliage and propagated materials categories was likely to increase market shares of mass merchandisers. One explanation may be this type of plant material has been reported as the leading plant category for mass merchandisers as they try to appeal to homeowners (Andrade and Hinson, 2009).

312 For sales to home centers, most plants except narrow-leaved evergreen shrubs, evergreen 313 trees had a significant impact on market shares, which was expected as home centers deal with a 314 wide variety of plant types. Firms selling herbaceous perennials, bedding plants (including 315 flowering annuals, vegetables, fruits, and herbs), and flowering potted plants were more likely to 316 supply to mass merchandisers, home centers and single location garden centers. In contrast, firms 317 producing bedding plants (e.g., vegetables, fruits, and herbs) were less likely to sell to channels 318 such as landscapers and re-wholesalers. Growers who produce roses, herbaceous perennials, 319 bedding plants and flowing potted plants may consider home centers and single location garden 320 centers as two complementary market channels, as increases in producing these plant types were 321 likely to increase market shares in both home centers and single location garden centers. Not 322 surprisingly, having sod production was found to only affect market shares to home centers 323 (positive), landscaping companies (positive) and re-wholesalers (negative). The fact that sod 324 growers are more likely to access landscapers has important implications to the growth of the sod 325 industry. Torres et al. (2017) reported sod as a major plant type purchased by landscaper,

especially large operations that primarily focused on the installment of commercial andresidential developments.

328 In addition, firms producing shrubs and trees, vines, and ground covers had large market 329 shares with landscaping companies. Interestingly, we found some evidence of shifting sales 330 between landscapers and re-wholesalers, indicating these two marketing channels could be 331 substitute markets for the similar plant types. For example, increasing broad-leaved evergreen 332 shrubs production by 100% increased market share in landscapers by 0.12 percentage point, but 333 reduced market share to re-wholesalers by about 0.16 percentage point. A similar pattern was 334 observed for vines and ground covers and sod. For foliage and propagated materials, market 335 shares shifted away from landscapers to re-wholesalers.

336 In terms of firm characteristics, firms' age had a relatively small impact on increasing 337 sales to multiple location garden center and landscaping companies, but not on sales to other 338 market channels. Firms with the most permanent employees tended to have more market share in 339 the home centers channel but less market share in mass merchandisers compared to other firms. 340 On the other hand, firms with the most temporary employees tended to sell more to mass 341 merchandisers than to landscapers. This could be attributed to the fact that plants sold to mass 342 merchandisers and home centers (such as bedding plants, flowering potted plants, tree fruits, 343 foliage) demanded more labor input, particularly low-skilled temporary workers. In addition, 344 firms selling to home centers tend to have longer contracts and invest in automated processes 345 that require less labor which help cutting production costs (Wheeler et al., 2018).

Total sale value and other firms' size were found to only influence market shares to landscapers and re-wholesalers. Firms with large total sales values tended to sell more of their products to landscapers, but less to re-wholesalers. An explanation may be that accessing 349 landscaper markets can help ornamental horticulture businesses to increase revenues, as long as 350 they are able to grow the plant material these buyers demanded. Contracted sales largely reduced 351 firms' sales shares to garden centers but increased sales share to re-wholesalers. Particularly, 352 contracting to other producers were likely to increase sales to re-wholesalers (17 percentage 353 points) by diverting sales from garden centers (-8.4 percentage points) and landscapers (-8.6 354 percentage points). In contrast, contracting to garden centers increased sales to both single-355 location garden centers (by 18.9 percentage points) and multiple-location garden centers (by 3.8 356 percentage points). This increase in sales shares came from sales cuts primarily in landscapers (-357 13.8 percentage points), re-wholesalers (-12.3 percentage points), and slightly in mass 358 merchandisers (-1.5 percentage points). It is interesting to note that contracting sales had a higher 359 impact to single-location garden centers than multiple-location ones, which is consistent with the 360 literature reporting that growers used as selling to reduce the transactions costs and number of 361 transactions (Masten, 2000).

362 Similarly, contracting to mass merchandisers significantly increased firms' sales to mass 363 merchandisers and home centers by simultaneously decreasing sales to three market channels, 364 including single-location garden centers, landscapers, and re-wholesalers. Nonetheless, unlike 365 the previous two contracting methods, the impact of contracting to mass merchandisers was 366 asymmetric. Gain in increased market shares from both mass merchandisers and home centers 367 (10.3 percentage points total) was significantly smaller than the decreased market shares from 368 the other three major market shares (-40.7 percentage points). Increasing sales that were negotiated were likely to divert market share from single-location garden centers and 369 landscaping companies to mass merchandisers. On the other hand, increasing sales with repeat 370

371 customers were likely to shift sales from landscaping companies to multi-location garden centers372 and wholesalers.

Interestingly, while attending trade shows had a significant influence on firms' decisions of entering multiple wholesale market channels, the number of trade shows had little impact on market sales of major market channels. It is likely trade shows allow firms to have face-to-face interactions with potential buyers, which can help them focus on those that are more profitable. On the other hand, firms with more internet expenditures than other firms tended to have slightly more sales to single-location garden centers, but less to landscapers and wholesalers than other firms.

380 As an indicator of potential demand for ornamental plants, increases in the HPI increased 381 firms' sales shares to landscapers who were closely related to the housing market by redirecting 382 sales from re-wholesalers to landscapers. The demand from landscapers went up due to the 383 buoyant housing market in the last two decades (Landvoigt et al., 2015), which has had an 384 impact on the demand of landscape companies and the ornamental horticulture industry. In line 385 with Hinson et al. (2012), the major wholesale market channels were generally substituting to 386 each other. However, this pattern was particularly persistent for sales between landscapers and 387 re-wholesalers. In contrast, sales to multi-location garden centers tended not to sell to other 388 market channels.

The fractional logit model was estimated separately for the 2019 survey data only as the 2019 survey included DTC sales as a new wholesale market channel. Tables A2-A3 in the Appendix section summarize the results. Producing landscape plants such as evergreen shrubs and trees, vines and ground cover, foliage, and sod decreased market shares in the DTC markets, while producing bedding plants increased the share to DTC. It seems that the DTC channel offers 394 more diverse opportunities for the firms that grow bedding plants. In addition, small-scale firms 395 with relatively more temporary employees (as opposed to permanent employees) tended to have 396 more DTC marketing. Firms with a contract to other producers or sales to repeated customers 397 had fewer market shares in the DTC market. In general, the pattern of substituting among major 398 whole market shares was persistent in 2019.

399 Conclusions

400 The ornamental horticulture industry was among the fastest-growing agricultural industries in the 401 1980s and 1990s (Khachatryan et al., 2020). As the industry gradually reached the mature stage 402 of its life cycle (Hall, 2010), digital advertising and the possibility to access to profitable markets 403 became critical to increasing market share, generate profit, and maintain competitiveness among 404 peers. In this study, we explored the relationship between firm's production and business 405 characteristics and choices of entering the wholesale market, diversification of wholesale market 406 channels, and market shares among major market channels. To the best of our knowledge, this is 407 the first study to comprehensively analyze firms' wholesale market channel choices in the U.S. 408 ornamental horticulture industry. We use the number of wholesale market channels (extensive 409 margin) and market share of each channel (intensive margin) to measure market channel 410 diversification. Based on the results from the 2019 survey data, we also find that the DTC 411 channel has overtaken some conventional wholesale market channels such as landscapers and re-412 wholesalers, becoming a leading marketing channel. This finding is consistent with the rising 413 trend of Internet marketing strategies in the U.S. Ornamental horticulture industry (Peterson et 414 al., 2018: Yao et al., 2018; Torres, Barton, and Behe, 2019).

Even though traditional market channels such as garden centers, landscaping companies,and re-wholesalers remained mainstream, the wide use of the Internet along with a wide range of

social media and online sales platforms has gradually changed the marketing paradigm. While
firms still maintain omni-channel marketing strategies to reduce market uncertainty and balance
sales across different market channels, increasing number of firms have become more
concentrated in one major wholesale market. We find landscapers and re-wholesalers are
apparent substitutes to each other, which suggests a market substitution effect between these two
channels.

423 Growers who perceived production cost, labor costs and competitions as more important 424 factors affecting their business, tend to be more diversified and have more wholesale market 425 channels. Plant types are important predictors of firms' choices of entering a specific wholesale 426 market channel. Past research has linked improvements in residential landscapes to increased 427 real property values. In this paper we propose a direct relationship between changes in the 428 housing market and the ornamental horticultural industry's performance. The HPI is a strong 429 predictor of market share. The HPI is positively associated with the market share of landscaping 430 companies, but negatively associated with the market share of re-wholesalers. The sales among 431 major wholesale markets depending on the economic situation and reallocating among major 432 wholesale market channels. With improving economic conditions, we are likely to observe more 433 sales directed from re-wholesalers to landscaping companies.

These findings are critical to our understanding of the market structure of the green industry. They provide answers to the question what determines, over time, the set of firms present in the green industry. The results will help to enable participants in the green industry in making strategic decisions regarding competitiveness of entering a specific market channel and market diversification. In addition, policy makers have better information to inform their decisions regarding efficient allocation of resources (e.g., water and labor) among competing

440	industries and interests. Our results could be generalized to assist policy makers, growers, and
441	researchers interested in understanding market competition and diversification across specialty
442	crops industries. Given the types of product offering, growers may consider either concentrating
443	on a single market or diversifying across multiple markets to mitigate potential market risk
444	exposure, and decide which option best suits the short- and long-term goals of their operations.
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446 447	References
448 449 450	Andrade, M.A.V., and R.A. Hinson. "Making the Choice between Rewholesalers and Other Nursery Market Channels." HortScience 44, 2 (2009): 372-376.
451 452 453	Ayal, I., and J. Zif. "Marketing Expansion Strategies in Multinational Marketing." Journal of Marketing 43,2(March 1979):84-94.
454 455 456 457	Barton, S.S., and B.K. Behe. "Retail Promotion and Advertising in the Green Industry: An Overview and Exploration of the Use of Digital Advertising." HortTechnology 27,1(February 2017):99-107.
457 458 459 460	Berry, S., and P.Reiss. 'Chapter 29 Empirical Models of Entry and Market Structure'. In M. Armstrong & R. Porter (Eds.), <i>Handbook of Industrial Organization</i> , Volume (3), Elsevier, (pp. 1845-1886). 2007.
461 462 463 464 465	Brooker, J., D. Eastwood, C. Hall, K. Morris, A. Hodges, and J. Haydu. "Trade Flows and Marketing Practices within the United States Nursery industry 2003." Southern Cooperative Series Bulletin 404, 2005.
465 466 467 468 469	Bruce, N.I., and N.Z. Foutz, C. Kolsarici. "Dynamic Effectiveness of Advertising and Word of Mouth in Sequential Distribution of New Products." Journal of Marketing Research 49,4(2012):469–486.
470 471 472 473	Fang, E., X. Li, M. Huang, and R.W. Palmatier. "Direct and Indirect Effects of Buyers and Sellers on Search Advertising Revenues in Business-to-Business Electronic Platforms." Journal of Marketing Research 52,3 (2015):407–422.
474 475	Hall, C.R. "Making Cents of Green Industry Economics." HortTechnology 20 (2010):832-835.
476 477 478 479	Hall, C.R., A.W. Hodges, H. Khachatryan, and M.A. Palma. "Economic Contributions of the Green Industry in the United States in 2018." Journal of Environmental Horticulture 38,3(2020):73-79.

- 480 Hinson, R.A., K.P. Paudel, and M.Velástegui. "Understanding Ornamental Plant Market Shares
- to Rewholesaler, Retailer, and Landscaper Channels." Journal of Agricultural and Applied
 Economics 44,2(May 2012):173-189.
- 483
- Hinson, R.A. and D.W. Hughes. "Estimating the Value of the Green Industry to Louisiana's
 Economy." Journal of Agribusiness 18,2(2000):2017-220.
- 486
- 487 Hodges, A., M. Palma, and C. Hall. "Trade Flows and Marketing Practices within the U.S.
- 488 Nursery Industry, 2008." Southern Cooperative Bulletin 411, (2009).
- 489
- 490 Hodges, A.W., H. Khachatryan, C.R. Hall, and M.A. Palma. "Production and Marketing
- 491 Practices and Trade Flows in the United States Green Industry, 2013." Southern Cooperative
- 492 Bulletin 420, 2015.
- 493
- Järvinen, J., A. Tollinen, H. Karjaluoto, and C. Jayawardhena. "Digital and Social Media
- 495 Marketing Usage in B2B Industrial Section." Marketing Management Journal 22,2 (September
 496 2012):102-117.
- 497 Khachatryan, H., Hodges, A.W., Hall, C.R., and M.A. Palma. "Production and Marketing
- 498 Practices and Trade Flows in the United States Green Industry, 2018." Southern Cooperative
 499 Series Bulletin #420, May 2020.
- 500
- Kotler, P., and Keller, K.L. Framework for Marketing Management (5th Edition). Pearson: New
 York, 2012.
- 503
- 504 Landvoigt, T., M. Piazzesi, and M. Schneider. "The Housing Market (s) of San
- 505 Diego." American Economic Review 105(4) (2015):1371-1407.
- 506
- 507 Li, Y., M.A. Palma, C.R. Hall, H. Khachatryan, and O. Capps, Jr. "Measuring the Effects of
- 508Advertising on Green Industry Sales: A generalized Propensity Score Approach." Applied509Economics 51(2019):1303–1318.
- 510 Madigan, J. Plant & Flower Growing in the US. IBISWorld Industry Report 11142 (December511 2020).
- 512 Masten, S.E. "Transaction-Cost Economics and the Organization of Agricultural Transactions."
- 513 Industrial organization: Volume 9. M. R. Baye eds. Emerald Group Publishing Limited, 2000.
- 514 Palma, M.A., Hall, C.R., Campbell, B., Khachatryan, H. Behe, B. and Barton. S. Measuring the
- 515 Effects of Firm Promotion Expenditures on Green Industry Sales. Journal of Environmental
- 516 Horticulture 30,2(June 2012): 83–88.
- 517 Papke, L.E., and J.M. Wooldridge. "Econometric Methods for Fractional Response Variables
- 518 with an Application to 401(K) Plan Participation Rates." Journal of Applied Econometrics
- 519 11(1996):619-632.

- 520 Peterson, H.H., C.R. Boyer, L.M. Baker, B.H.Yao. "Trends in the Use of New-Media Marketing
- 521 in U.S. Ornamental Horticulture Industries." Horticulturae 4,4(2018):32.
- 522
- 523 Thompson, C.J., and G. Coskuner-Balli. "Countervailing Market Responses to Corporate Co-
- optation and the Ideological Recruitment of Consumption Communities." Journal of Consumer
 Research 34,2 (2007):135-152.
- 526
- 527 Torres, A.P., S.S. Barton, and B.K. Behe. "Business and Marketing Practices of US Landscape
 528 Firms." HortTechnology 27,6 (2017): 884-892.
- 529
- Torres, A.P., S.S. Barton, and B.K. Behe. "Evaluating the Business and Owner Characteristics
 Influencing the Adoption of Online Advertising Strategies in the Green Industry."
- 532 HortTechnology 29,3(2019):374-381.
- 533
- Torres, A.P., N.A. Lancaster, and L.H. Vilas Boas. "Categorizing Organic Grain Buyers in the
 Midwestern United States." Sustainability *12*, 12 (2020): 5169.
- 536
- 537 United States Department of Agriculture, National Agricultural Statistics Service
- 538 (USDA/NASS). Floriculture Crops 2015 Summary. Washington, DC (April 2016).
- 539
 540 United States Department of Agriculture (USDA). 2019 Census of Horticultural Specialties.
 541 Volume 3 Special Studies Part 3 AC-17-SS-3 (December 2020).
- 541 Volume 3 Special Studies Part 3 AC-17-SS-542
- Vieira, V.A., M.I.S. de Almeida, R. Agnihotri, N.S.D.A.C. da Silva, and S.Arunachalam. "In
 Pursuit of an Effective B2B Digital Marketing Strategy in an Emerging Market." Journal of the
 Academy of Marketing Science 47 (2010): 1085–1108
- 545 Academy of Marketing Science 47 (2019): 1085–1108.
- 546

547 Wei, X., H. Khachatryan, and A.Rihn. "Consumer Preferences for Labels Disclosing the Use of
548 Neonicotinoid Pesticides: Evidence from Experimental Auctions." Journal of Agricultural and
549 Resource Economics 45,3(2020): 496-517.

- 550
- Wheeler, W.D., P. Thomas, M. van Iersel, and M. Chappell. Implementation of sensor-based
 automated irrigation in commercial floriculture production: A case study. HortTechnology 28,6
 (2018): 719-727.
- 553 (2 554
- Wooldridge, J. M. Econometric Analysis of Cross Section and Panel Data, Volume 1. The MIT
 Press, 2010.
- 557
- 558 Yao, B., A. Shanoyan, H.H. Peterson, C. Boyer, and L. Baker. "The Use of New-Media
- 559 Marketing in the Green Industry: Analysis of Social Media Use and Impact on Sales."
- 560 Agribusiness 2 (February 2019):1-17.
- 561
- 562 Yue, C., B. Campbell, C. Hall, B. Behe, J. Dennis, and H. Khachatryan. "Consumer Preference
- for Sustainable Attributes in Plants: Evidence from Experimental Auctions." Agribusiness
 32,2(2016): 222–235.





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567 Source: IBIS World.

568 Note: * Values for 2021 are forecast.

569 Table 1: Market channels (2004-2019)

	Market Channels									
Survey	Wholesale only		Retail or	nly	Both					
Year	Frequency	(%)	Frequency	(%)	Frequency	(%)				
2004	903	(37.36)	470	(19.45)	1,044	(43.19)				
2009	911	(34.11)	588	(22.01)	1,172	(43.88)				
2014	534	(24.42)	804	(36.76)	849	(38.82)				
2019	767	(45.49)	340	(20.17)	579	(34.34)				
Total	3,115	(34.76)	2,202	(24.57)	3,644	(40.67)				

570

571 Table 2: Distribution of wholesale market outlet channels (2004-2019)

Survey Year	Wholesale Market Outlets ^a									
	Mass Merchandiser	Home Center	Single location GC	Multiple location GC	Landscaper	Re- wholesaler	Direct-to- consumer ^b			
2004	215 (8.65%)	229 (9.22%)	982 (39.52%)	468 (18.83%)	1,322 (53.20%)	1,138 (45.79%)	-			
2009	168 (5.52%)	197 (6.47%)	1018 (33.44%)	305 (10.02%)	1,309 (43.00%)	1,140 (37.45%)	-			
2014	88 (3.31%)	105 (3.95%)	650 (24.46%)	151 (5.68%)	801 (30.15%)	685 (25.78%)	-			
2019	64 (2.95%)	69 (3.18%)	391 (18.02%)	101 (4.65%)	440 (20.28%)	460 (21.20%)	642 (29.59%)			
Total	535 (5.17%)	600 (5.79%)	3041 (29.36%)	1025 (9.90%)	3872 (37.39%)	3423 (33.05%)	642 (6.20%)			

57 Abotes: ^aThe percentages of all wholesale market outlets do not necessarily sum up to 100% as growers may be engaged in 57 Bultiple market outlets (see Table 3 for more details). ^b Category "Direct-to-consumer" was only included in the 2019 survey.

574 Table 3: Diversity of wholesale market outlet channels

Survey Year		Nun	nber of Wholes	ale Market Outl	ets ^a	
	1	2	3	4	5	6 and more ^b
2004	632	531	380	246	76	26
	(33.42%)	(28.08%)	(20.10%)	(13.01%)	(4.02%)	(1.37%)
2009	746	572	393	170	56	18
	(38.16%)	(29.26%)	(20.10%)	(8.70%)	(2.86%)	(0.92%)
2014	681	365	207	72	20	10
	(50.26%)	(26.94%)	(15.28%)	(5.31%)	(1.48%)	(0.74%)
2019	628	302	167	66	25	7
	(52.55%)	(25.27%)	(13.97%)	(5.52%)	(2.09%)	(0.58%)

575 Notes: ^a Six wholesale market outlets considered here are: Mass merchandisers, Home centers Single-location

576 garden centers, Multiple location garden centers, Landscape firms, Re-wholesalers. ^b Direct-to-consumer was only

577 included in 2019 Survey and only 3 firms reported participation in all seven wholesale market channels in 2019.

Variable	Unit	Mean	SD
Region			
Appalachian	Binary (1, if Yes)	0.11	0.31
Great Plains	Binary (1, if Yes)	0.02	0.15
Midwest	Binary (1, if Yes)	0.18	0.38
Mountain	Binary (1, if Yes)	0.04	0.19
Northeast	Binary (1, if Yes)	0.20	0.40
Pacific	Binary (1, if Yes)	0.12	0.33
Southcentral	Binary (1, if Yes)	0.07	0.26
Southeast	Binary (1, if Yes)	0.26	0.44
Plant types			
PT1: Deciduous shade and flowering trees	Percent (%)	10.36	21.92
PT2: Deciduous shrubs	Percent (%)	4.66	12.07
PT3: Broad-leaved evergreen shrubs	Percent (%)	6.06	15.72
PT4: Narrow-leaved evergreen shrubs	Percent (%)	2.43	8.51
PT5: Evergreen trees	Percent (%)	8.50	21.19
PT6: Vines and ground covers	Percent (%)	1.98	8.33
PT7: Roses	Percent (%)	1.45	7.00
PT8: Herbaceous perennials	Percent (%)	8.18	20.95
PT9: Bedding plants- flowering annuals	Percent (%)	8.80	20.60
PT10: Bedding plants-vegetables, fruits, & herbs	Percent (%)	5.60	16.46
PT11: Flowering potted plants	Percent (%)	5.42	17.07
PT12: Christmas trees	Percent (%)	4.90	19.48
PT13: Tree fruits	Percent (%)	2.42	12.53
PT14: Foliage	Percent (%)	3.54	15.79
PT15: Sod	Percent (%)	1.05	9.12
PT16: Propagated materials	Percent (%)	3.12	14.31
Business and production characteristics			
Age: age of firm	Number	25.11	21.95
Perm: No. of permanent employees	Number	10.79	51.58
Temp: No. of temporary employee	Number	9.15	33.70
Sale: Total sales value of firm	Dollars (in \$100,000)	15.11	62.41
Sale_contract: Sales under contract	Percent (%)	8.78	22.61
Sale_nego: share of negotiated sales	Percent (%)	17.13	29.64
Sale_repeat: share of sales to repeat customers	Percent (%)	72.10	27.26
D_COP: Contract to other producers	Binary (1, if positive)	0.09	0.29
D_CGC: Contract to garden centers	Binary (1, if positive)	0.07	0.26
D_CMM: Contract to mass merchandisers	Binary (1, if positive)	0.03	0.16
Tradeshow: No. of trade shows attended	Number	1.04	3.54
Ad_internet: internet advertisement expenses	Dollars (in \$100,000)	0.07	1.01
Ad_tradeshow: tradeshow expenses	Dollars (in \$100,000)	0.08	2.08
Firm perceptions of factors that impact price and			
business ^a			

Table 4: Summary statistics from the National Nursery Survey for year 2005, 2009 and 2013

Unique: Product uniqueness	Likert (1-4)	2.88	1.07
Other_price: Other growers' prices	Likert (1-4)	2.70	1.01
Cost: Production cost	Likert (1-4)	3.23	1.00
Labor	Likert (1-4)	2.61	1.13
Compete: Competition/Price undercutting	Likert (1-4)	2.53	1.08
Demand: Market demand	Likert (1-4)	3.22	0.96
Housing Price Index			
HPI: House price index at 5-digit zip code level ^b	Number	142.17	27.02
HPI_change: percentage change of HPI	Percent (%)	1.74	7.76

579 Notes: a Producers were asked to rate the importance of the factors that impact the prices of their

580 products and business on a 4-point Likert scale with 1 indicating not important and 4 indicating very important. ^b Year 2000 is used as the base year to normalize HPI. For firms located in a 5-

581

digit zip code area where the HPI is missing, the state-level HPI is used. 582

583

Variable	Coefficients	Sta.	Marginal	Sta.
		Err.	Effects	Err.
Plant types				
PT1: Deciduous shade and flowering trees	0.008^{***}	(0.001)	0.006^{***}	(0.001)
PT2: Deciduous shrubs	0.003	(0.002)	0.003	(0.002)
PT3: Broad-leaved evergreen shrubs	0.012***	(0.001)	0.009***	(0.001)
PT4: Narrow-leaved evergreen shrubs	0.009***	(0.003)	0.007^{***}	(0.002)
PT5: Evergreen trees	0.006***	(0.001)	0.005***	(0.001)
PT6: Vines and ground covers	0.010^{***}	(0.003)	0.008^{***}	(0.002)
PT7: Roses	-0.002	(0.004)	-0.001	(0.003)
PT8: Herbaceous perennials	0.003^{*}	(0.001)	0.002^{*}	(0.001)
PT9: Bedding plants- flowering annuals	-0.001	(0.001)	-0.001	(0.001)
PT10: Bedding plants-vegetables, fruits, &	0.007***	(0,002)	0.005***	(0.001)
herbs	-0.007	(0.002)	-0.005	(0.001)
PT11: Flowering potted plants	0.004^{**}	(0.002)	0.003**	(0.001)
PT12: Christmas trees	-0.003**	(0.002)	-0.003**	(0.001)
PT13: Tree fruits	0.000	(0.002)	0.000	(0.002)
PT14: Foliage	0.007^{***}	(0.002)	0.005***	(0.001)
PT15: Sod	0.005^{*}	(0.003)	0.004^{*}	(0.002)
PT16: Propagated materials	-0.002	(0.001)	-0.002	(0.001)
Business and production characteristics				
Age	0.004***	(0.002)	0.003***	(0.001)
Perm	0.003***	(0.001)	0.002**	(0.001)
Temp	0.002^{*}	(0.001)	0.001*	(0.001)
Sale	0.000	(0.001)	0.000	(0.001)
Sale contract	-0.005***	(0.001)	-0.004***	(0.001)
D COP	0.510***	(0.075)	0.407^{***}	(0.060)
D CGC	0.979***	(0.075)	0.783***	(0.059)
D CMM	0.882***	(0.132)	0.705^{***}	(0.106)
Sale nego	0.005^{***}	(0.001)	0.004^{***}	(0.001)
Sale_repeat	0.015***	(0.001)	0.012***	(0.001)
Tradeshow	0.046***	(0.012)	0.019***	(0.005)
Ad internet	-0.022	(0.033)	-0.003	(0.008)
Ad tradeshow	0.001	(0.010)	0.075	(0.137)
Firm perceptions of factors that impact price and busin	less			
Unique	-0.024	(0.024)	-0.003	(0.007)
Other_price	0.029	(0.024)	-0.000	(0.007)
Cost	0.068^{**}	(0.027)	0.026***	(0.007)
Labor	0.091**	(0.024)	0.013**	(0.007)
Compete	0.096***	(0.025)	0.019***	(0.007)
Demand	0.036	(0.029)	0.004	(0.008)
Housing Price Index				
HPI	0.002*	(0.001)	0.001*	(0.000)

Table 5: Likelihood of entering wholesale market outlets: results from Tobit model

Constant	-1.295*** (0.226)	
No. of Observations	4,131	
Log likelihood	-6540.02	
Pseudo R ²	0.102	

585

Notes: a). Robust standard errors are in parentheses. b). ***, **, and * represent significance level at the 1%, 5% and 10%, respectively. c). Region and year fixed effects are included but 586

587 suppressed from the table.

Variable	Mass Merchandiser	Home Centers	Single location	Multiple location	Landscaper	Re-wholesaler
			GC	GC		
	Coefficients	Coefficients	Coefficients	Coefficients	Coefficients	Coefficients
Plant types						
PT1: Deciduous shade	-0.0007 ***	0.0002 *	-0.0008 **	0.0001	0.0013 **	** -0.0002
and flowering trees	(0.0002)	(0.0001)	(0.0003)	(0.0001)	(0.0003)	(0.0002)
PT2: Deciduous	-0.0002	0.0003 *	0.0002	-0.0001	0.0010 *	-0.0008
shrubs	(0.0003)	(0.0002)	(0.0005)	(0.0002)	(0.0006)	(0.0005)
PT3: Broad-leaved	-0.0003	0.0006 ***	0.0009 ***	-0.0002	0.0012 **	-0.0016 ***
evergreen shrubs	(0.0002)	(0.0001)	(0.0003)	(0.0001)	(0.0004)	(0.0004)
PT4: Narrow-	-0.0002	0.0001	0.0005	0.0000	0.0015 **	* -0.0006
leaved evergreen	(0.0003)	(0.0002)	(0.0006)	(0.0003)	(0.0008)	(0.0007)
shrubs						
PT5: Evergreen	-0.0004 **	-0.0002	0.0001	0.0002 *	0.0005	-0.0002
trees	(0.0002)	(0.0002)	(0.0003)	(0.0001)	(0.0003)	(0.0003)
PT6: Vines and	-0.0003	0.0005 ***	0.0005	0.0002	0.0016 **	-0.0017 ***
ground covers	(0.0002)	(0.0002)	(0.0005)	(0.0002)	(0.0006)	(0.0006)
PT7: Roses	-0.0003	0.0005 ***	0.0018 **	0.0002	0.0005	-0.0027 *
	(0.0002)	(0.0002)	(0.0008)	(0.0002)	(0.0008)	(0.0015)
PT8: Herbaceous	0.0001 **	0.0004 ***	0.0009 ***	0.0003 ***	-0.0005	-0.0012 ***
perennials	(0.0001)	(0.0001)	(0.0003)	(0.0001)	(0.0003)	(0.0004)
PT9: Bedding	0.0003 *	0.0006 ***	0.0013 ***	0.0001	0.0003	-0.0026 ***
plants- flowering	(0.0001)	(0.0001)	(0.0003)	(0.0001)	(0.0004)	(0.0004)
annuals						
PT10: Bedding	0.0002 **	0.0006 ***	0.0017 ***	-0.0001	-0.0034 **	-0.0018 ***
plants-vegetables,	(0.0002)	(0.0001)	(0.0004)	(0.0003)	(0.0007)	(0.0006)
fruits, & herbs						
PT11: Flowering	0.0004 ***	0.0005 ***	0.0015 ***	0.0002	-0.0034 **	** 0.0001
potted plants	(0.0001)	(0.0001)	(0.0003)	(0.0001)	$(0.000\overline{5})$	(0.0004)
PT12: Christmas	0.0003	0.0006 ***	0.0008 **	0.0004 ***	-0.0012 **	** -0.0004
trees	(0.0002)	(0.0001)	(0.0004)	(0.0001)	(0.0004)	(0.0004)

Table 6: Impacts on shares of major wholesale market channels: Marginal effects from fractional logit model

PT13: Tree fruits	0.0002	**	0.0006	***	0.0006		-0.0001		-0.0022	***	0.0005	
	(0.0002)		(0.0001)		(0.0005)		(0.0003)		(0.0006)		(0.0004)	
PT14: Foliage	0.0002	**	0.0005	***	0.0003		0.0003	***	-0.0032	***	0.0016	***
	(0.0001)		(0.0001)		(0.0004)		(0.0001)		(0.0004)		(0.0003)	
PT15: Sod	-0.0002		0.0006	***	-0.0009	*	0.0000		0.0032	***	-0.0029	***
	(0.0003)		(0.0001)		(0.0005)		(0.0002)		(0.0006)		(0.0002)	
PT16: Propagated	-0.0004	***	0.0003	*	-0.0004		-0.0001		-0.0040	***	0.0027	***
materials	(0.0001)		(0.0002)		(0.0004)		(0.0002)		(0.0006)		(0.0002)	
Business and produc	ction characteris	stics	· · · ·		· · · · · ·		· · · · ·		· · ·			
Age	0.0000		0.0001		-0.0001		0.0001	**	0.0006	**	-0.0002	
	(0.0001)		(0.0001)		(0.0002)		(0.0001)		(0.0003)		(0.0003)	
Perm	-0.0001	**	0.0001	***	0.0000		0.0000		0.0000		-0.0002	
	(0.0000)		(0.0000)		(0.0002)		(0.0000)		(0.0002)		(0.0002)	
Temp	0.0001	***	0.0000		0.0001		0.0000		-0.0013	***	0.0002	
	(0.0000)		(0.0000)		(0.0002)		(0.0000)		(0.0003)		(0.0001)	
Sale	0.0000		0.0000		-0.0001		0.0000		0.0003	**	-0.0003	**
	(0.0000)		(0.0000)		(0.0001)		(0.0000)		(0.0001)		(0.0001)	
Sale_contract	0.0000		0.0000		-0.0008	***	-0.0002		-0.0001		0.0008	***
	(0.0001)		(0.0001)		(0.0003)		(0.0001)		(0.0003)		(0.0003)	
D_COP	0.0035		-0.0054		-0.0837	***	-0.0064		-0.0864	***	0.1706	***
	(0.0065)		(0.0050)		(0.0149)		(0.0051)		(0.0188)		(0.0146)	
D_CGC	-0.0146	**	0.0039		0.1891	***	0.0376	***	-0.1382	***	-0.1232	***
	(0.0061)		(0.0045)		(0.0129)		(0.0054)		(0.0190)		(0.0179)	
D_CMM	0.0643	***	0.0393	***	-0.1578	***	0.0052		-0.1746	***	-0.0835	***
	(0.0062)		(0.0053)		(0.0251)		(0.0073)		(0.0375)		(0.0271)	
Sale_nego	0.0004	***	0.0001	*	-0.0005	***	0.0000		-0.0004	**	0.0003	*
	(0.0001)		(0.0001)		(0.0002)		(0.0001)		(0.0002)		(0.0002)	
Sale_repeat	0.0001		0.0002		0.0005	*	0.0007	***	-0.0017	***	0.0011	***
	(0.0001)		(0.0001)		$(0.000\overline{3})$		(0.0001)		(0.0003)		(0.0003)	
Tradeshow	0.0002		-0.0001		-0.0005		0.0005	*	-0.0016		0.0026	**
	(0.0003)		(0.0003)		(0.0009)		(0.0003)		(0.0018)		(0.0012)	
Ad_internet	-0.0077	*	-0.0003		0.0199	***	0.0002		-0.0224	***	-0.0357	**

	(0.0043)		(0.0013)	(0.0074)	(0.0012)		(0.0086)		(0.0179)
Ad_tradeshow	-0.0010		0.0000	-0.003	8 **	0.0004		-0.0035		0.0074
	(0.0018)		(0.0004)	(0.0018)	(0.0003)		(0.0037)		(0.0046)
Firm perceptions of	factors impactir	ng pric	e and busin	ess						
Unique	-0.0014		0.0007	0.002	5	-0.0023		0.0034		-0.0079
	(0.0022)		(0.0019)	(0.0050)	(0.0019)		(0.0062)		(0.0054)
Other_price	0.0010		-0.0012	-0.008	7 *	0.0001		0.0003		0.0081
	(0.0023)		(0.0020)	(0.005))	(0.0020)		(0.0064)		(0.0057)
Cost	0.0053	*	-0.0015	0.001	9	0.0058	**	-0.0121	*	-0.0001
	(0.0031)		(0.0021)	(0.0054)	(0.0024)		(0.0068)		(0.0060)
Labor	0.0059	**	-0.0010	-0.012	8 **	0.0008		0.0203	***	0.0091
	(0.0026)		(0.0023)	(0.0054)	(0.0021)		(0.0063)		(0.0002)
Compete	0.0049	*	-0.0019	0.000	1	-0.0002		0.0076		-0.0055
	(0.0028)		(0.0025)	(0.005)	(0.059)		(0.0067)		(0.0061)
Demand	-0.0058		0.0037	-0.003	6	-0.0023		-0.0204	***	0.0160 **
	(0.0036)		(0.0026)	(0.006)	(0.0024)		(0.0077)		(0.0075)
HPI	-0.0002		0.0001	-0.000	4 *	-0.0001		0.0008	***	-0.0006 **
	(0.0001)		(0.004)	(0.0002)	(0.0001)		(0.0003)		(0.0003)
No. of Observations	3,154		3,154	3,1	54	3,154		3,154		3,154

Appendix:

Table A1: Impacts on shares of major wholesale market channels: Estimated coefficients from fractional logit model

Variable	Mass Merchandi	iser Home C	enters	Single locar	tion	Multiple loca	tion	Landscaper	•	Re-wholesa	ler
				GC		GC					
	Coefficients	Coeffic	eients	Coefficier	nts	Coefficien	ts	Coefficients	5	Coefficient	ts
Plant types											
PT1: Deciduous shade	-0.024 **	** 0.010	*	-0.005 *	**	0.002		0.006 *	**	-0.002	
and flowering trees	(0.007)	(0.006)		(0.002)		(0.003)		(0.001)		(0.002)	
PT2: Deciduous shrubs	-0.010	0.011	*	0.001		-0.002		0.005 *		-0.005	
	(0.009)	(0.007)		(0.004)		(0.006)		(0.003)		(0.003)	
PT3: Broad-leaved	-0.010	0.023	***	0.006 *	***	-0.005		0.006 *	**	-0.010	***
evergreen shrubs	(0.006)	(0.005)		(0.002)		(0.003)		(0.002)		(0.002)	
PT4: Narrow-leaved	-0.006	0.005		0.003		0.000		0.008 **	*	-0.004	
evergreen shrubs	(0.009)	(0.009)		(0.004)		(0.008)		(0.001)		(0.005)	
PT5: Evergreen trees	-0.014 **	* -0.00)	0.000		0.006	*	0.003		-0.001	
	(0.007)	(0.008)		(0.002)		(0.004)		(0.004)		(0.002)	
PT6: Vines and ground	-0.009	0.019	***	0.004		0.005		0.008 *	**	-0.011	***
covers	(0.007)	(0.007))	(0.004)		(0.006)		(0.003)		(0.004)	
PT7: Roses	-0.004	0.021	***	0.012 *	**	0.007		0.003		-0.017	*
	(0.007)	(0.007)		(0.005)		(0.007)		(0.004)		(0.010)	
PT8: Herbaceous	0.009 **	* 0.018	***	0.007 *	***	0.009	***	-0.003		-0.007	***
perennials	(0.004)	(0.005)		(0.002)		(0.004)		(0.002)		(0.002)	
PT9: Bedding plants-	0.007 *	0.024	***	0.009 *	***	0.003		0.001		-0.016	***
flowering annuals	(0.004)	(0.004)		(0.002)		(0.004)		(0.002)		(0.003)	
PT10: Bedding plants-	0.012	0.024	***	0.012 *	***	-0.002		-0.018 **	**	-0.011	***
vegetables, fruits, &	(0.006)	(0.004)		(0.003)		(0.009)		(0.004)		(0.004)	
herbs											
PT11: Flowering potted	0.011 **	** 0.022	***	0.011 *	***	0.005		-0.017 **	**	0.001	
plants	(0.004)	(0.004)		(0.002)		(0.003)		(0.002)		(0.002)	
PT12: Christmas trees	0.005 **	* 0.026	***	0.005 *	**	0.011	***	-0.006	**	-0.003	
	(0.009)	(0.005)		(0.003)		(0.004)		(0.002)		(0.003)	

PT13: Tree fruits	0.012 *	**	0.025	***	0.004		-0.002		-0.011	***	0.003	
	(0.006)		(0.005)		(0.003)		(0.009)		(0.003)		(0.003)	
PT14: Foliage	0.008 *	**	0.020	***	0.002		0.010	***	-0.016	***	0.010 **	**
	(0.004)		(0.005)		(0.003)		(0.003)		(0.002)		(0.002)	
PT15: Sod	-0.007		0.024	***	-0.006	*	0.000		0.016	***	-0.018 **	**
	(0.007)		(0.005)		(0.004)		(0.005)		(0.003)		(0.006)	
PT16: Propagated	-0.013 *	***	0.011	*	-0.003		-0.003		-0.021	***	0.017 **	**
materials	(0.005)		(0.006)		(0.003)		(0.005)		(0.003)		(0.002)	
Business and production	characteristics											
Age	0.001		0.002		-0.001		0.004	**	0.003	**	-0.001	
	(0.003)		(0.003)		(0.002)		(0.002)		(0.001)		(0.002)	
Perm	-0.003 *	**	0.004	***	0.000		-0.001		0.000		-0.001	
	(0.001)		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)	
Temp	0.004 *	***	0.002		0.001		0.001		-0.006	***	0.001	
	(0.001)		(0.001)		(0.001)		(0.001)		(0.002)		(0.001)	
Sale	0.001		0.000		-0.001		0.001		0.002	**	-0.002 **	k
	(0.001)		(0.001)		(0.001)		(0.001)		(0.003)		(0.001)	
Sale_contract	0.000		-0.001		-0.006	***	-0.004		-0.001		0.005 **	**
	(0.003)		(0.003)		(0.002)		(0.003)		(0.002)		(0.002)	
D_COP	0.121		-0.220		-0.616	***	-0.183		-0.444	***	1.073 **	*
	(0.220)		(0.202)		(0.098)		(0.145)		(0.097)		(0.094)	
D_CGC	-0.501 *	**	0.157		-0.702	***	1.076	***	-0.710	***	-0.775 **	**
	(0.208)		(0.183)		(0.101)		(0.147)		(0.099)		(0.113)	
D_CMM	2.200 *	***	1.602	***	-0.874	***	0.150		-0.898	***	-0.525 **	**
	(0.206)		(0.201)		(0.190)		(0.210)		(0.194)		(0.172)	
Sale_nego	0.013 *	***	0.005	*	-0.004	***	-0.001		-0.002	**	0.002 *	
	(0.002)		(0.002)		(0.001)		(0.002)		(0.001)		(0.001)	
Sale_repeat	0.004		0.008		0.003	*	0.021	***	-0.008	***	0.007 **	**
	$(0.00\overline{5})$		$(0.00\overline{5})$		$(0.00\overline{2})$		(0.004)		(0.001)		(0.002)	
Tradeshow	0.008		-0.004		-0.004		0.014	*	-0.008		0.017 **	*
	(0.010)		(0.014)		(0.006)		(0.008)		(0.009)		(0.008)	
Ad_internet	-0.264 *	*	-0.012		0.139	***	0.007		-0.115	***	-0.224 **	*

	(0.145)	(0.053)	(0.052)	(0.035)	(0.044)	(0.113)
Ad_tradeshow	-0.033	0.000	-0.027 **	0.012	-0.018	0.047
	(0.062)	(0.018)	(0.012)	(0.008)	(0.019)	(0.029)
Firm perceptions of factor	ors impacting price :	and business				
Unique	-0.049	0.028	0.018	-0.066	0.018	-0.049
	(0.076)	(0.075)	(0.035)	(0.054)	(0.032)	(0.034)
Other_price	0.034	-0.051	-0.061 *	0.044	0.002	0.051
	(0.080)	(0.080)	(0.036)	(0.059)	(0.033)	(0.036)
Cost	0.182 *	-0.063	0.013	0.167 **	-0.062 *	0.000
	(0.105)	(0.087)	(0.038)	(0.067)	(0.035)	(0.037)
Labor	0.201 **	-0.042	-0.089 **	0.022	0.104 ***	0.057
	(0.089)	(0.094)	(0.036)	(0.060)	(0.032)	(0.036)
Compete	0.166 *	-0.077	0.001	-0.005	0.039	-0.035
	(0.096)	(0.101)	(0.039)	(0.059)	(0.034)	(0.039)
Demand	-0.200	0.151	-0.025	-0.066	-0.105 ***	0.101 **
	(0.123)	(0.105)	(0.046)	(0.070)	(0.040)	(0.047)
HPI	-0.006	0.005	0.003 *	-0.003	0.004 ***	-0.004 **
	(0.004)	(0.004)	(0.002)	(0.004)	(0.001)	(0.002)
Constant	-4.593 ***	-6.386 **	-1.507 ***	-5.620 ***	-1.359 ***	-1.331 ***
	(0.928)	(0.834)	(0.371)	(0.687)	(0.290)	(0.336)
No. of Observations	3,154	3,154	3,154	3,154	3,154	3,154
Log pseudo likelihood	-330.293	-293.545	-1220.490	-396.014	-1535.938	-1323.902
AIC	0.239	0.216	0.804	0.281	1.003	0.869
BIC	-24540.13	-24631.22	-23459.53	-24566.27	-23049.13	-23331.45

Variable	Mass	Home Centers	Single	Multiple	Landscaper	Re-wholesaler	Direct-to-
	Merchandiser		location GC	location GC			Consumer
	Coefficients	Coefficients	Coefficients	Coefficients	Coefficients	Coefficients	Coefficients
PG1	-0.008	-0.006	0.006	-0.006 **	0.004	0.008	-0.010 *
	(0.015)	(0.013)	(0.006)	(0.012)	(0.004)	(0.005)	(0.005)
PG2	-0.007	0.014	-0.014	0.022	0.023 **	-0.014	-0.007
	(0.040)	(0.016)	(0.016)	(0.017)	(0.009)	(0.015)	(0.011)
PG3	-0.014	0.010	0.024 ***	0.013	0.008	0.004	-0.028 ***
	(0.029)	(0.018)	(0.007)	(0.017)	(0.005)	(0.006)	(0.008)
PG4	0.011	-0.021	0.003	-0.003	0.023 **	0.007	-0.028 ***
	(0.029)	(0.022)	(0.010)	(0.025)	(0.011)	(0.010)	(0.009)
PG5	-0.290	-0.027	0.008	0.006	0.006	0.002	-0.009 *
	(0.180)	(0.017)	(0.007)	(0.015)	(0.005)	(0.006)	(0.005)
PG6	-0.039	0.022	0.002	-0.033	0.020 ***	-0.014	-0.006
	(0.062)	(0.018)	(0.010)	(0.039)	(0.006)	(0.012)	(0.007)
PG7	-0.166 **	0.012	0.006	0.018	-0.006	-0.038	0.000
	(0.082)	(0.039)	(0.021)	(0.028)	(0.018)	(0.030)	(0.020)
PG8	-0.041 *	-0.004	0.009	0.010	-0.001	0.002	-0.005
	(0.023)	(0.009)	(0.006)	(0.016)	(0.005)	(0.005)	(0.004)
PG9	-0.004	0.020	0.006	0.022	0.002	0.000	-0.005
	(0.012)	(0.013)	(0.006)	(0.014)	(0.005)	(0.007)	(0.005)
PG10	0.003	0.011	0.013 **	-0.021	-0.036 ***	-0.019	0.013 **
	(0.017)	(0.010)	(0.006)	(0.021)	(0.009)	(0.013)	(0.006)
PG11	0.019	0.013	0.010 *	-0.006	-0.019 ***	0.011	-0.005
	(0.012)	(0.011)	(0.006)	(0.013)	(0.006)	(0.007)	(0.005)
PG12	0.018	0.018	0.007	0.017	0.005	-0.016 **	-0.006
	(0.017)	(0.011)	(0.009)	(0.016)	(0.008)	(0.008)	(0.008)
PG13	0.033	0.022	-0.018	-0.037 *	0.003	0.008	-0.001
	(0.024)	(0.009)	(0.012)	(0.022)	(0.008)	(0.010)	(0.009)
PG14	0.021	0.015	0.008	0.018 *	-0.020	0.022 ***	-0.029 ***
	(0.016)	(0.013)	(0.007)	(0.011)	(0.008)	(0.006)	(0.007)

Table A2. Impacts on shares of major wholesale market channels: estimated coefficients from fractional logit model (2019)

PG15	-0.076		0.020		-0.001		-0.005		0.021 *	***	-0.025		-0.014	**
	(0.115)		(0.014)		(0.009)		(0.015)		(0.006)		(0.015)		(0.006)	
PG16	-0.003		0.000		0.001		-0.032	*	-0.013 *	**	0.023	***	-0.012	*
	(0.014)		(0.020)		(0.008)		(0.016)		(0.007)		(0.006)		(0.007)	
Age	0.024	*	0.010		0.001		0.007		0.004		-0.001		-0.007	
	(0.013)		(0.011)		(0.004)		(0.007)		(0.004)		(0.005)		(0.006)	
Perm	-0.050		-0.012		0.000		-0.001		0.007		0.016	***	-0.025	**
	(0.036)		(0.012)		(0.006)		(0.010)		(0.005)		(0.005)		(0.011)	
Temp	-0.076	***	0.019	***	-0.005		0.008		-0.005		-0.009	**	0.019	***
	(0.028)		(0.007)		(0.005)		(0.009)		(0.007)		(0.005)		(0.007)	
Sale	0.059	***	-0.001		0.003		-0.009		-0.002		-0.010	**	-0.002	
	(0.019)		(0.005)		(0.004)		(0.005)		(0.004)		(0.004)		(0.006)	
Sale_contract	0.011		-0.018	**	-0.007		-0.007		0.001		0.001		0.002	
	(0.013)		(0.009)		(0.005)		(0.009)		(0.005)		(0.005)		(0.005)	
D_COP	-0.535		0.799		-0.636	**	0.607		-0.423		1.357	***	-1.005	**
	(0.857)		(0.693)		(0.325)		(0.520)		(0.255) *	k	(0.296)		(0.425)	
D_CGC	-0.607		0.792		1.356	***	1.563	***	-0.851		-0.704	**	-0.413	
	(0.839)		(0.631)		(0.334)		(0.587)		(0.366) *	**	(0.347)		(0.461)	
D_CMM	0.351		0.351		-1.550	***	1.776	***	-0.153		-0.252		-0.619	
	(0.924)		(0.725)		(0.595)		(0.625)		(0.902)		(0.622)		(0.636)	
Sale_nego	0.013		0.010		-0.001		-0.002		-0.002		0.007	**	-0.006	*
	(0.010)		(0.006)		(0.004)		(0.005)		(0.003)		(0.003)		(0.003)	
Sale_repeat	0.059	*	-0.008		0.013	**	0.016		0.000		0.009		-0.014	***
	(0.035)		(0.013)		(0.006)		(0.016)		(0.004)		(0.006)		(0.004)	
Tradeshow	-0.433		-0.009		-0.010		-0.035		-0.039		0.033	***	-0.010	
	(0.283)		(0.017)		(0.017)		(0.548)		(0.029)		(0.014)		(0.016)	
Ad_internet	(0.283) 2.546		(0.017) -0.718		(0.017) 0.372		(0.548) 0.680		(0.029) 0.318		(0.014) -0.112		(0.016) 0.111	
Ad_internet	$ \begin{array}{r} (0.283) \\ 2.546 \\ (1.611) \end{array} $		(0.017) -0.718 (0.899)		(0.017) 0.372 (0.372)		$\begin{array}{r} (0.548) \\ 0.680 \\ (0.548) \end{array}$		(0.029) 0.318 (0.260)		(0.014) -0.112 (0.293)		$ \begin{array}{r} (0.016) \\ 0.111 \\ (0.365) \end{array} $	
Ad_internet Ad_tradeshow	(0.283) 2.546 (1.611) -2.218		(0.017) -0.718 (0.899) -0.528		(0.017) 0.372 (0.372) -0.176		(0.548) 0.680 (0.548) -0.208		(0.029) 0.318 (0.260) -0.060		(0.014) -0.112 (0.293) 0.252	**	$(0.016) \\ 0.111 \\ (0.365) \\ 0.027$	
Ad_internet Ad_tradeshow	(0.283) 2.546 (1.611) -2.218 (2.029)		(0.017) -0.718 (0.899) -0.528 (0.872)		$\begin{array}{r} (0.017) \\ 0.372 \\ (0.372) \\ -0.176 \\ (0.188) \end{array}$		$\begin{array}{r} (0.548) \\ 0.680 \\ (0.548) \\ -0.208 \\ (0.466) \end{array}$		$\begin{array}{c} (0.029) \\ 0.318 \\ (0.260) \\ -0.060 \\ (0.076) \end{array}$		$\begin{array}{c} (0.014) \\ -0.112 \\ (0.293) \\ 0.252 \\ (0.109) \end{array}$	**	$\begin{array}{r} (0.016) \\ \hline 0.111 \\ (0.365) \\ \hline 0.027 \\ (0.087) \end{array}$	
Ad_internet Ad_tradeshow Unique	(0.283) 2.546 (1.611) -2.218 (2.029) 1.281	***	(0.017) -0.718 (0.899) -0.528 (0.872) 0.164		(0.017) 0.372 (0.372) -0.176 (0.188) 0.282	*	(0.548) 0.680 (0.548) -0.208 (0.466) -0.012		(0.029) 0.318 (0.260) -0.060 (0.076) -0.125		$\begin{array}{r} (0.014) \\ -0.112 \\ (0.293) \\ 0.252 \\ (0.109) \\ -0.051 \end{array}$	**	$\begin{array}{r} (0.016) \\ 0.111 \\ (0.365) \\ 0.027 \\ (0.087) \\ -0.064 \end{array}$	

Other_price	-0.388		-0.358		-0.376	**	0.088		0.051		0.037		0.128	
	(0.475)		(0.243)		(0.156)		(0.240)		(0.140)		(0.139)		(0.130)	
Cost	0.490		-0.139		0.087		0.294		-0.128		-0.052		0.034	
	(0.489)		(0.423)		(0.141)		(0.252)		(0.132)		(0.136)		(0.133)	
Labor	1.287	***	0.345		0.023		0.273		0.201	**	0.192		-0.283	***
	(0.474)		(0.282)		(0.125)		(0.182)		(0.102)		(0.120)		(0.102)	
Compete	1.325	***	0.070		0.365	***	0.199		-0.025		-0.084		-0.156	
	(0.412)		(0.262)		(0.132)		(0.214)		(0.106)		(0.111)		(0.111)	
Demand	-0.584		0.019		-0.072		-0.239		-0.018		-0.058		0.070	
	(0.511)		(0.307)		(0.147)		(0.235)		(0.127)		(0.143)		(0.127)	
HPI	-0.004		0.007		-0.006	*	0.002		0.000		-0.001		0.003	
	(0.011)		(0.005)		(0.003)		(0.004)		(0.002)		(0.003)		(0.003)	
Constant	-21.078	***	-7.539	***	-3.802	***	-7.953	***	-1.381		-2.293	**	2.101	
	(4.466)		(2.623)		(1.212)		(2.986)		(0.907)		(0.996)		(0.909)	
No. of	498		498		498		498		498		498		498	
Observations														
Log pseudo	-22.199		-28.222	2	-168.78	82	-33.86	53	-183.941		-169.09	98	-228.36	8
likelihood														
AIC	0.266		0	.290	0	0.855		0.313	0	.915	(0.856	1	.094
BIC	-2790.691	1	-2784	.514	-2578	3.248	-278	3.581	-2583	.848	-2592	2.086	-2455	.883

Variable	Mass	Home Centers	Single	Multiple	Landscaper	Re-wholesaler	Direct-to-
	Merchandiser		location GC	location GC			Consumer
	Coefficients	Coefficients	Coefficients	Coefficients	Coefficients	Coefficients	Coefficients
PG1	-0.0001	-0.0001	0.0007	-0.0001 **	0.0006	0.0010	-0.0017 *
	(0.0002)	(0.0002)	(0.0008)	(0.0002)	(0.0006)	(0.0006)	(0.0009)
PG2	-0.0001	0.0002	-0.0017	0.0004	0.0032 **	-0.0017	-0.0012
	(0.0006)	(0.0002)	(0.0019)	(0.0003)	(0.0013)	(0.0018)	(0.0018)
PG3	-0.0002	0.0001	0.0028 ***	0.0002	0.0011	0.0005	-0.0047 ***
	(0.0004)	(0.0003)	(0.0008)	(0.0003)	(0.0007)	(0.0007)	(0.0012)
PG4	0.0002	-0.0003	0.0003	-0.0001	0.0032 **	0.0009	-0.0047 ***
	(0.0002)	(0.0003)	(0.0012)	(0.0005)	(0.0015)	(0.0012)	(0.0015)
PG5	-0.0043	-0.0004	0.0010	0.0001	0.0008	0.0002	-0.0015 *
	(0.0027)	(0.0003)	(0.0008)	(0.0003)	(0.0007)	(0.0007)	(0.0009)
PG6	-0.0006	0.0003	0.0002	-0.0006	0.0027 ***	-0.0016	-0.0010
	(0.0009)	(0.0003)	0.0012)	(0.0008)	(0.0008)	(0.0014)	(0.0011)
PG7	-0.0024 **	0.0002	0.0007	0.0004	-0.0008	-0.0046	0.0001
	(0.0012)	(0.0006)	(0.0025)	(0.0005)	(0.0025)	(0.0036)	(0.0034)
PG8	-0.0006 *	-0.0001	0.0011	0.0002	-0.0001	0.0002	-0.0008
	(0.0004)	(0.0001)	(0.0007)	(0.0003)	(0.0007)	(0.0006)	(0.0007)
PG9	-0.0001	0.0003	0.0007	0.0004	0.0003	0.0000	-0.0008
	(0.0002)	(0.0002)	(0.0007)	(0.0003)	(0.0007)	(0.0008)	(0.0009)
PG10	0.0000	0.0002	0.0015 **	-0.0004	-0.0050 ***	-0.0023	0.0023 **
	(0.0003)	(0.0002)	(0.0008)	(0.0004)	(0.0013)	(0.0016)	(0.0010)
PG11	0.0003	0.0002	0.0012 *	-0.0001	-0.0026 ***	0.0013	-0.0008
	(0.0002)	(0.0002)	(0.0007)	(0.0003)	(0.0008)	(0.0008)	(0.0009)
PG12	0.0005	0.0003	0.0009	0.0003	0.0006	-0.0019 **	-0.0009
	(0.0002)	(0.0002)	(0.0010)	(0.0003)	(0.0011)	(0.0009)	(0.0014)
PG13	0.0003	0.0003	-0.0021	-0.0007	0.0004	0.0009	-0.0002
	(0.0002)	(0.0002)	(0.0015)	(0.0005)	(0.0011)	(0.0012)	(0.0014)
PG14	-0.0011	0.0002	0.0009	0.0004 *	-0.0028	0.0026 ***	-0.0049 ***
	(0.0002)	(0.0002)	(0.0008)	(0.0001)	(0.0011)	(0.0007)	(0.0012)

Table A3. Impacts on shares of major wholesale market channels: marginal effects from fractional logit model (2019)

PG15	0.0000		0.0003		-0.0001		-0.0001		0.0029	***	-0.0030		-0.0023	**
	(0.0017)		(0.0002)		(0.0011)		(0.0003)		(0.0008)		(0.0019)		(0.0010)	
PG16	0.0000		0.0000		0.0001		-0.0001	*	-0.0019	**	0.0027	***	-0.0020	*
	(0.0002)		(0.0003)		(0.0010)		(0.0003)		(0.0009)		(0.0007)		(0.0012)	
Age	0.0003	*	0.0001		0.0001		0.0001		0.0005		-0.0002		-0.0012	
	(0.0002)		(0.0002)		(0.0005)		(0.0001)		(0.0006)		(0.0006)		(0.0009)	
Perm	-0.0007		-0.0002		0.0000		0.0000		0.0010		0.0019	***	-0.0042	**
	(0.0005)		(0.0002)		(0.0007)		(0.0002)		(0.0006)		(0.0006)		(0.0018)	
Temp	-0.0011	***	0.0003	**	-0.0006		0.0002		0.0008		-0.0011	***	0.0032	***
	(0.0004)		(0.0001)		(0.0006)		(0.0002)		(0.0010)		(0.0006)		(0.0011)	
Sale	0.0009	***	0.0000		0.0004		-0.0002		-0.0003		-0.0012	**	-0.0003	
	(0.0003)		(0.0001)		(0.0005)		(0.0001)		(0.0006)		(0.0005)		(0.0010)	
Sale_contract	0.0002		-0.0003	*	-0.0009		-0.0001		0.0001		0.0004		0.0004	
	(0.0002)		(0.0001)		(0.0006)		(0.0002)		(0.0007)		(0.0006)		(0.0008)	
D_COP	-0.0079		0.0118		-0.0753	*	0.0118		-0.0590		0.1643	***	-0.1682	**
	(0.0126)		(0.0105)		(0.0385)		(0.0103)		(0.0358)	*	(0.0356)		(0.0709)	
D_CGC	-0.0089		0.0117		0.1606	***	0.0304	***	-0.1186		-0.0853	**	-0.0691	
	(0.0126)		(0.0092)		(0.0387)		(0.0120)		(0.0513)	**	(0.0425)		(0.0769)	
D_CMM	0.0052		0.0052		-0.1836	***	0.0345	***	-0.0213		-0.0305		-0.1036	
	(0.0136)		(0.0108)		(0.0712)		(0.0127)		(0.1256)		(0.0752)		(0.1068)	
Sale_nego	0.0002		0.0001		-0.0002		0.0000		-0.0002		0.0009	**	-0.0010	*
	(0.0001)		(0.0001)		(0.0005)		(0.0001)		(0.0004)		(0.0004)		(0.0005)	
Sale_repeat	0.0009	*	-0.0001		0.0016	**	0.0003		0.0000		0.0011		-0.0024	***
	(0.0005)		(0.0002)		(0.0007)		(0.0003)		(0.0006)		(0.0007)		(0.0007)	
Tradeshow	-0.0064		-0.0001		-0.0012		-0.0007		-0.0054		0.0040	***	-0.0017	
	(0.0042)		(0.0003)		(0.0020)		(0.0012)		(0.0040)		(0.0017)		(0.0027)	
Ad_internet	0.0375		-0.0106		0.0441		0.0132		0.0443		-0.0135		0.0186	
	(0.0241)		(0.0133)		(0.0443)		(0.0110)		(0.0362)		(0.0354)		(0.0611)	
Ad_tradeshow	-0.0326		-0.0078		-0.0208		-0.0041		-0.0083		0.0306	**	0.0045	
	(0.0299)		(0.0130)		(0.0224)		(0.0091)		(0.0107)		(0.10131)		$(\overline{0.0145})$	
Unique	0.0188	***	0.0024		0.0334	*	-0.0002		-0.0174		-0.0062		-0.0107	
	$(0.006\overline{9})$		$(0.006\overline{0})$		(0.0180)		(0.0046)		(0.0173)		$(0.016\overline{2})$		(0.0238)	

Other_price	-0.0057		-0.0053	-0.0445	**	0.0017	0.0071		0.0045	0.0215	
	(0.0070)		(0.0036)	(0.0184)		(0.0047)	(0.0195)		(0.0169)	(0.0218)	
Cost	0.0072		-0.0021	0.0103		0.0057	-0.0178		-0.0063	0.0057	
	(0.0072)		(0.0063)	(0.0167)		(0.0050)	(0.0184)		(0.0165)	(0.0223)	
Labor	0.0189	***	0.0051	0.0028		0.0053	0.0279	**	0.0232	-0.0474	***
	(0.0072)		(0.0043)	(0.0148)		(0.0037)	(0.0140)		(0.0145)	(0.0166)	
Compete	0.0195	***	0.0010	0.0432	***	0.0039	-0.0035		-0.0102	-0.0216	
	(0.0067)		(0.0039)	(0.0156)		(0.0042)	(0.0147)		(0.0135)	(0.0184)	
Demand	-0.0086		0.0003	-0.0085		-0.0047	-0.0025		-0.0070	0.0117	
	(0.0073)		(0.0045)	(0.0174)		(0.0047)	(0.0177)		(0.0173)	(0.0212)	
HPI	-0.0001		0.0001	-0.0007	*	0.0000	0.0000		-0.0002	0.0004	
	(0.0002)		(0.0001)	(0.0004)		(0.0001)	(0.0003)		(0.0004)	(0.0004)	
No. of	498		498	 498		498	 498		498	 498	
Observations											