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Inter-Format Competition among Retailers - The Role of Private Label Products in Market Delineation

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Abstract

Given various recent antitrust investigations on the retail sector, we deal with uncovering demand systems substitution patterns for a particular market (diapers) to investigate the inter-format competition (supermarkets vs. discounters vs. drugstores). Using the uncovered demand system we compute retail and manufacturer margins and combine those with standard market delineation techniques, showing that the strongest substitution patterns are between the leading brand as well as private labels sold at drugstores and discounters. This result is important given controversies among competition authorities, firms and academic researchers.

Keywords: Discrete Choice, Demand Estimation, Market Delineation, Antitrust.
JEL Classification: L1, L4, L8, C5 .

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1. Introduction

The retail sector in Europe is under regular investigation of national antitrust authorities and by supranational institutions (e.g., Competition Commission 2000)¹. Studies and investigations claim an increasing level of concentration in the retail level as well as an increasing level of buyer power given fewer outside options producers of national brands have to face (Schlippenbach & Pavel 2011). However, any antitrust investigation, regardless of the country where it is conducted in, is based on a sound market definition.² The appropriate a-priori definition is not as trivial as it may appear because consumers may buy the same kind of products from different outlets in different variations all over formats, preferring particular brands' strongly or reacting very sensitive to the price.

A major issue, as can be seen at the example of the German antitrust authority is to determine the degree of competition between discounters, common supermarkets and hypermarkets.³ The antitrust authority concludes that there is very limited competition between discount, super- and hypermarkets due to the supply of very different groups of customers (Bundeskartellamt 2008). This view is justified by the argument of different category depths discounters and super- and hypermarkets have, which may differ from each other to a large extent (Bundeskartellamt 2008). That view is not undisputed and the German monopoly commission, for instance, claimed a certain higher degree of competition between these formats than the antitrust authority does (Monopolkommission 2012). The controversy already highlights the difficulties of defining appropriate market delineations and shows that market delineation may not be as trivial as it may appear.

Crucial in determining the degree of competition among retailers is the analysis of consumer's perception of private labels (main part of the discounters' assortment)⁴ respectively manufacturer labels in the same category, and their switching behaviour between those types of products. In contrast to the competition literature, the marketing literature analyzes the substitutability between these kind of brands, showing the important role of private label products, which are often seen to be reasonable substitutes for manufacturer brands (Sethuraman 1995, Raju et al. 1995, Dhar & Hoch 1997, see Ailawadi et al 2008).

The aim of this study is to uncover how intense the competition between private labels and manufacturer brands is.⁵ It aims at describing the role of different purchasing locations and retail formats for consumer decisions. Also, we use market definition techniques to delineate product-location specific markets to reveal that selling points offering a smaller category depth do practically compete with selling points offering a wider range of products. To uncover the intensity of inter-format competition we ex-

¹see www.competitioncommission.gov.uk/repub/reports/2000/446super.htm

²See for instance the standard textbook by Motta (2004).

³The issue of an appropriate market delineation and the role of inter format competition is highlighted in a merger case of retailers in the German market (Bundeskartellamt 2008).

⁴Clearly, private labels are also sold by super- and hypermarkets. Those can be part of a more sophisticated strategy, e.g., increasing customer loyalty (Hansen, Sing 2008, Ailawadi et al 2008).

⁵However, we do not take into account how issues like bargaining power towards manufacturers are affected (e.g. Mills 1995, Narashima und Wilcox 1998, Chintagunta et al. 2002, Draganska et al. 2010).

amine a specific product category (diapers) that is served by different retail formats. Using information of a household panel we estimate a random coefficient random utility discrete choice model⁶ (Petric & Train 2012) to obtain consumer substitution patterns and retailer respectively manufacturer margins (e.g., Bonnet & Dubois 2010, Drangska et al. 2010), which can be used for the standard SSNIP Test market delineation (Katz & Shapiro 2003, O’Brien & Wickelgren 2003). The particular idea is to use the information in a specific category with presumably very quality oriented customers (diapers) and investigate whether there are reasonable substitution pattern between those brands offered.

Our approach has several advantages. First, it allows for a differentiated analysis as retailers’ margins are recovered based on a sophisticated structural approach. Second, estimation relies on a large representative data set and on actual transaction prices including discounts and promotion. Third, due to a random coefficients approach, we are able to take into account the heterogeneity of customer decisions. Fourth, and most important, we are able to uncover real substitution patterns of individual consumers that describe whether private labels really have an impact on the pricing decisions of manufacturer brands.

Results show that the relevant market comprises manufacturer brands as well as private labels, sold by all types of formats. The strongest substitution patterns between the leading manufacturer and other products are found to be with private labels sold at discounters and drugstores as well as those sold at discounters, whereas the only other national brand manufacturer is not part of the relevant market. Hence, the hypothesis of a weak competitive interaction, as similarly claimed by the German antitrust authority, cannot be supported and the argument of varying product depth is not sufficient to exclude either private labels or discounters from the relevant market for diapers. However, as the market for diaper is subject to presumably qualitative sensitive customers, one could expect that private labels are not considered to be adequate substitutes for manufacturer brands. This underpins the strength of the results. However, it cannot, a priori identify how competition in other categories works exactly, but delivers results for this particular category.

The remainder of the paper is organized as follows. section 2 describes the empirical strategy, section 3 provides the empirical analysis, while section 4 concludes.

2. Data and Empirical Strategy

2.1. Data

We use consumer level data on the German diaper market. Data is obtained from the GFK (Gesellschaft für Konsumforschung), a German market research company, which monitors members of a representative consumer panel. The data set contains information on actual transactions of 40.000 individuals over a time period of 2 years from 2003 to

⁶Such models are widely used in the literature, for the derivation see e.g. BLP 1994, Nevo 2001, Train 2003 and for examples of application e.g. Villas Boas 2007, Draganska et al 2010, Bonnet & Dubois 2010, Bonnet & Dubois 2012

2004. The information includes data on place and time of the transaction, quantity purchased and the actual price paid at the checkout counter (accounting for discounts and promotion activity). From the European Energy Exchange (EEX), the European Commission and the German Statistical Office data for the supply side, namely energy prices, oil prices and wages are collected.

In contrast to other studies (e.g. Draganska et al. 2010, Bonnet et al 2012), we do not exclude private labels or any retail format a-priori. Based on existing data five types of retailing vehicles are defined: Discounter, drugstore, specialized shops, full-line distributor, department stores (see Figure 1(a)). Most of the sold diapers are purchased in discounters and in drugstores and market shares of both formats add up to around two thirds of the total market. Similar is true for the share of private label products which is above 50%. Not considering discounters/ drugstore or private labels would presumably lead to unrealistic switching patterns and consequently to not representative results. We exclude special types of products, such as fleece or swimming diapers and training pants, which are not considered to be adequate substitutes. Estimation is based on top 40 retailer-product bundles to exclude niche products.⁷ The estimation of the random

Table 1: **Descriptive Statistics**

variable	mean	sd	min	max
Total Bill (in Euro)	36.47	27.49	0.49	639.23
Purchasing Value (in Euro)	13.01	9.17	0.01	149.88
Size	56.61	23.79	1.00	168.00
Quantitiy Purchased	1.26	0.65	1.00	10.00
Quantitiy Purchased = 1	0.81	0.40	0.00	1.00
Price (in Cent)	17.09	6.60	0.00	53.29
Share of Promotion	0.28	0.45	0.00	1.00
Share of Privat Label	0.55	0.50	0.00	1.00
Share of Market Leader	0.34	0.47	0.00	1.00

coefficient model is conducted in a manner that requires some simplifying assumptions regarding the specification of product types, assessment of a reasonable time frame for the choice set and the definition of an outside good.

We define product-retailer bundles as possible choice for consumers. In other words, the same product at two different retailers is treated as two two different alternatives and consumers may not only switch from product A sold by retailer 1 to product B (either sold by retailer 1 or retailer 2), but also to product A sold by retailer 2. The same brand may be perceived differently at different retailers. However, on the supply side, manufacturers' bargaining about margins for a product is different with every retailer depending on relative bargaining power and position of the retailer (see also Villas-Boas 2007, Draganska et al 2010, Bonnet & Dubois 2012). It is not distinguished between

⁷Including more bundles also lead to several complementary relationships.

generic private labels and premium private labels because this would be not reasonable for the diaper market as only one big discounter markets part of its product range as premium quality products. It can at least be doubted whether consumers perceive a difference between these generic and premium private label products.

Next, the specified time frame is as follows: The data set is split into four two-year periods which replicates the product life cycle for each household. Weekly purchases are assumed within each subsample of two years, given that most household buy on average one package of diapers a week (see table 1), while an average package consists of around 56.6 pieces (giving the consumption of 8.1 diapers a day, which seems reasonable) (see Table 1). This is supported by the fact that over 81% of people buy one package each purchase. Since data is collapsed on a weekly level, we take weekly means of the explanatory variables⁸.

Regarding a possible outside good, one can imagine four options for the diaper market: Cotton diapers, diapers sold in pharmacies, the potty and not to buy due to storage. Regarding the first two options, market shares of both opportunities are so small that they are negligible as reasonable alternatives⁹. Going to the toilet as possible outside option is eliminated since all observations before the first and after the last observed purchase are dropped.

Justifying that people do not store is quite more complicating, but based on the summary statistics, we have some indication that storage is not a big issue for diapers. Nonetheless, the specific market characteristics allow one more convenient simplifying assumption. One-stop-shopping activity can be excluded since around 30% of the products are bought in drugstores, which indicates that consumers choose their shopping location deliberately. This is supported by the relative high share of the purchases with regards to the total bill (around one third). In general, the statistics also reveal that competition parameters (price and promotion) vary among retailers and brands. The price per diaper is on average around 2 cents higher for manufacturer brands than for private labels. Whereas over 60% of the manufacturer brands are sold within any kind of promotional activity, private labels are seldomly promoted (Figures 1(c) and 1(d)).

2.2. Empirical Strategy

2.2.1. Estimation

Our empirical strategy consists of three steps: In a first step, we estimate a random coefficients discrete choice model for disaggregated consumer level data à la Train (2003), which has been widely used in the literature (for models using disaggregated data also see Train 1998, Bonnet & Réquillart 2011, Petric & Train 2012).¹⁰ The model has convenient advantages in comparison to standard logit models (see Train 2003), which

⁸where this is not possible, i.e. for dummy variables, a threshold is specified

⁹Although we do not observe the market shares, anecdotic evidence tells us that market shares are very low.

¹⁰see Nevo 2001, Villas Boas 2007, Draganska et al 2010, Bonnet & Dubois 2010, Bonnet et al. 2012 for models with aggregated data

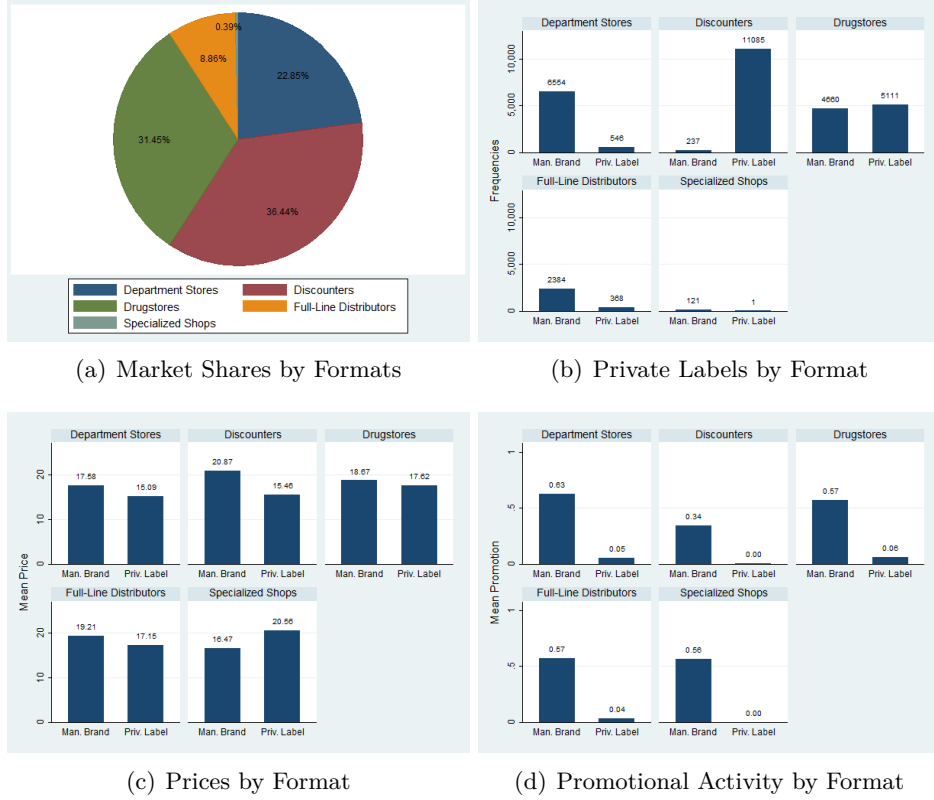


Figure 1: Descriptive Statistics

allow more realistic estimation of consumer behavior. Since we use consumer-level data, we are able to model consumer heterogeneity by allowing for random taste variation over consumers. This has the advantage that for every consumer and product, we are able to depict the individual's actual sensitivity to price increases. Next, product heterogeneity is accounted for, which gives more flexible substitution patterns and hence more realistic elasticities. Finally, it can better handle panel data by allowing for correlation in unobserved factors over time.

Following Petrin & Train (2012) we estimate the following equation:

$$U_{njt} = \alpha_j - \beta_n p_{jt} + X_{jt} \beta + \lambda \mu_{jt} + \tilde{\epsilon}_{njt}, \quad (1)$$

where α_j is a product-fixed effect, p_{jt} is the endogenous variable, which coefficient varies over individuals n , X_{jt} contains product characteristics and μ is the calculated control function with λ as the corresponding parameters. The error term $\tilde{\epsilon}_{njt}$ is an independently and identically drawn from GEV distribution of type I (see Petric & Train 2012). The idea behind the control function approach is to derive a proxy for the part of the price which is correlated with unobserved factors (e.g. supply shocks) to solve the problem of simultaneous causality. The endogenous variable is regressed on on observed charac-

teristics and cost shifters, before the residuals are used to obtain the control function which enters as an extra variable in the original regression equation (see Petric & Train 2012).

2.2.2. Calculation of Margins

The second step is concerned with using the estimated parameters to recover price-cost margins, which are related to demand estimates. We proceed according to (Bonnet & Dubois & Simioni (2006) who derive first order conditions for several structural models to recover price-cost margins. The presented equations are for the Follower-Leader (Nash-Bertrand) case, where manufacturers set their prices first.¹¹ The retailers share is then (Bonnet & Dubois & Simioni 2006, p. 8):

$$\gamma \equiv p - w - c = - (I_r S_p I_r)^{-1} I_r s(p), \quad (2)$$

where S_p is the market share response matrix (first derivatives of the market share with respect to the price), I_r is the retailer identity matrix and $s(p)$ are market shares. Note that retailers, as follower, observe the wholesale price, which is the difference to the simultaneous price setting equilibrium.

The manufacturers' profits are similarly derived except that wholesale prices are part of the manufacturer's maximization problem (Bonnet & Dubois & Simioni 2006, p. 9):

$$\Gamma \equiv p - \mu = - (I_f P_w S_p I_f)^{-1} I_f s(p), \quad (3)$$

where I_f is the manufacturers' identity matrix. The wholesale price, though not observed, can be derived from the information of the demand curve (Bonnet & Dubois & Simioni 2006, p. 9):

$$P_w \equiv I_r S_p (I_r - \tilde{I}_r) [S_p I_r + I_r S_p' I_r + (S_p^{p1} I_r \gamma | \dots | + (S_p^{pJ} I_r \gamma))]^{-1}. \quad (4)$$

2.2.3. Market Delineation

In the third and final step, we use the recovered price cost margins and the cross-price elasticities of the first two steps to delineate the market for diapers. This task is difficult and should be derived by reasonable substitution patterns (e.g., Katz & Shapiro 2003). We use a variant of the SSNIP test presented in Katz & Shapiro (2003) and O'Brien & Wickelgren (2003), which explicitly takes into account the switching behavior of consumers. The general idea behind the test is to find a threshold for the loss in sales where a 5-10% price increase becomes unprofitable for the hypothetical monopolist (O'Brien & Wickelgren 2003). Of particular interest is whether private label products of the retailers belong to the same competitive market as the manufacturer brands. Conveniently, our

¹¹We also calculated for simultaneous price setting and Nash-Collusion Models, but the follower-leader model fits better. Non-linear in pricing models, so-called two-part tariff models are still to be done. All models usually are tested against each other using the non-nested Rivers-Vuong-Test (2002) and the price-cost-margins of the most suitable model selected.

specification also allows to determine the degree of competition between retail formats. Intuitively, the SSNIP algorithm goes as follows (compare Werden 2003): 1. Find the market leader, 2. Sort all products according to their closeness to the market leader, 3. determine the threshold where actual loss equals critical loss, 4. if critical loss exceeds the actual loss a price increase is profitable for the hypothetical monopolist and the market is defined. If not, then add a substitute and continue till 4. holds.

We follow the criterion of Katz & Shapiro (2003) and (O’Brien & Wickelgren 2003, p. 174):

$$Actual\ Loss \equiv X \left[\frac{1}{m} - E^{Cross} \right] = \frac{X}{X + m} \equiv Critical\ Loss, \quad (5)$$

where X is the amount of the price increase, m is the margin and E^{Cross} are the cross-price elasticities. The relevant market is, according to the authors, found, when the actual loss is no larger than the critical loss. In other words, when $Actual\ Loss \leq Critical\ Loss$, the algorithm stops and the market is defined. When, instead, the Actual Loss exceeds the Critical Loss, a price increase is not profitable due to a too narrow market definition (O’Brien & Wickelgren 2003).

Rearranging (5) yields that the Actual Loss exceeds the Critical Loss if and only if (O’Brien & Wickelgren 2003, p. 175):

$$\frac{X}{m(X + m)} = \frac{Critical\ Loss}{m} > E^{Cross} \quad (6)$$

3. Results

Table 2: Estimation results : Random Coefficients Logit

Variable	Coefficient	(Std. Err.)
Mean		
Control Function	0.155	(0.003)
Promotion	-0.666	(0.017)
Price	-1.993	(0.036)
SD		
Price	1.204	(0.031)

The main point of the analysis is whether private labels offered by hard discounters are strong substitutes to common brands. All Own-Price elasticities are negative and all cross-effects positive. Own-Price elasticities are on average around 3% (hence above the 1% threshold), which means that for neither retailer nor manufacturer, there are incentives for further price increases because a 1% price increase would lead to a 3% reduction in quantity. Own- and cross-elasticities of private labels and manufacturer brands indicate that both types of products are very similar.

Table 3: Own- and Cross Price Elasticities

Elasticities	mean	sd
Total		
Own-Elasticity Private Label	-2.975	0.154
Own-Elasticity Manufacturer Brand	-3.075	0.213
Own-Elasticity Department Store	-2.996	0.113
Own-Elasticity Discounters	-3.077	0.069
Own-Elasticity Drugstores	-3.000	0.084
Own-Elasticity Full-Line Distributor	-2.989	0.093
Cross-Elasticity Private Label	0.076	0.032
Cross-Elasticity Manufacturer Brand	0.070	0.028
Cross-Elasticity Department Store	0.056	0.029
Cross-Elasticity Discounters	0.124	0.030
Cross-Elasticity Drugstores	0.061	0.034
Cross-Elasticity Full-Line Distributor	0.070	0.045

Analysis of cross price elasticities indicates that switching behaviour is quite similar for all brands meaning that a price increase for either private or manufacturer brand induces customers to switch nearly to the same extent (cross elasticity of around 0.07). Consumers are more sensitive regarding price increases of private labels because they switch more after price increase of private label than after a price increase of manufacturer brands, but they obviously think of them as substitutes since they switch to both types of brands nearly to the same extent (see Table 5 in appendix). Analysis of cross prices for the different formats reveals that biggest substitution effects are from discounters to other formats, which indicates that they should belong to the market, although consumers of discounters are in general more price sensitive.

The distribution of margins shows that manufacturers get more of the pie, but retailers are able to earn money with private labels and hence use them to enhance own position in the channel.

Based on the demand estimation of 40 relevant retailer-product combinations, the definition per SSNIP test of the 2003/2004 market for baby diapers shows that the relevant market consists of private label products and manufacturer brands, namely of the well-known market leader and six private label products¹². Interestingly, private labels are the closest substitutes to the market leader, whereas other manufacturer brands are not part of the market because their products are weak substitutes. The critical loss analysis also shows that discounters, as well as drugstores, are part of the relevant market¹³.

^{12**} indicates the last product of the relevant market after a 5% price increase, * the last product after 1% and *** after a 10% price increase

¹³The robustness test (reducing the choice set from 40 to 20 alternatives) shows another notable result: If the choice set is a-priori too narrow, margins will be over- and substitution behaviour underestimated. Resulting from this relation the degree of market power determined will be too high. Hence, the

Table 4: **SSNIP-Test with Top40 Products**

Brand	Cross-Elasticity	Agg.Elast.
Leader (MB)	.	.
PL Drugstore*	0.13	0.13
PL Department Store	0.13	0.26
PL Full-Line Distributor	0.12	0.38
PL Discount	0.12	0.50
PL Discount	0.12	0.62
PL Discount**	0.12	0.74
PL Discount	0.12	0.85
PL Full-Line Distributor	0.11	0.96
PL Discount	0.09	1.05
PL Discount	0.09	1.14
PL Department Store	0.08	1.22
PL Drugstore***	0.07	1.29
PL Drugstore	0.06	1.35
MB	0.04	1.39

4. Conclusion

We conducted a three-step analysis of the 2003/2004 diaper market. In particular, we were interested in consumers substitution behaviour between private label and manufacturer brands and the degree of competition among retail formats. After the estimation of the Random Coefficients Logit model using actual transaction prices to obtain realistic substitution patterns, which are the key for market delineation, margins of retailers and manufacturers were derived from information on the demand function. Finally, a SSNIP test was applied to delineate the relevant market. Steps one and three provide evidence on the degree of competition between products and formats. The relevant market comprises both types of products manufacturer brands and private labels sold by all types of formats. Surprisingly, strongest substitution behaviour is between the leading manufacturer and private labels sold at discounters and drugstores, whereas the only other national brand manufacturer is not part of the relevant market. The argument of different retailers' product category depths does not seem to be a sufficient argument for the exclusion of private labels and certain retail formats because a high degree of competition can be found. Notable is also that the distribution of margins show that manufacturers get more of the profit pie, but retailers are able to earn money with their own labels and consequently use them to enhance their own position in the channel.

Our results are highly relevant for competition authorities, firms and academic researchers. A too strict market delineation can lead to overestimation of market power.

standard instrument of market delineation has to be considerably applied. Results are not reported yet.

The application of the SSNIP-Test shows the importance of selecting an appropriate choice set. The a-priori exclusion of private label products will lead to an overestimation of retailers' market power because of a too narrow market definition. Furthermore, our analysis shows that the argument of different product depth should not be used to exclude discounters from the relevant market, which again will lead to an overestimation of market power.

5. Literature

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A. Appendix

Table 5: **Cross-Price Analysis**

Cross-Effect	mean	sd
Manufacturer Brand on Private Label	0.052	0.010
Manufacturer Brand on Manufacturer Brand	0.049	0.009
Private Label on Private Label	0.101	0.032
Private Label on Manufacturer Brand	0.092	0.028
Discounter on Discounter	0.24	0.04
Discounter on Drugstore	0.18	0.05
Discounter on Department Store	0.20	0.06
Discounter on Full-Line Distributor	0.20	0.04
Drugstore on Discounter	0.13	0.08
Drugstore on Drugstore	0.10	0.05
Drugstore on Department Store	0.12	0.08
Drugstore on Full-Line Distributor	0.11	0.06
Department Store on Discounter	0.14	0.08
Department Store on Drugstore	0.11	0.06
Department Store on Department Store	0.12	0.07
Department Store on Full-Line Distributor	0.13	0.08
Full-Line Distributor on Discounter	0.11	0.02
Full-Line Distributor on Drugstore	0.08	0.02
Full-Line Distributor on Department Store	0.11	0.04
Full-Line Distributor on Full-Line Distributor	.	.

Table 6: Retailer and Manufacturer Margins plus Marginal Costs

Type	ID	PCM Retailer	PCM Manuf.	Retail Price	Total MC	Retailer Profit	Manuf. Profit
MB	2x05	3.17	16.29	18.88	15.21	0.60	3.08
MB	2x14	3.25	16.93	19.44	15.52	0.63	3.29
MB	2x24	2.00	7.92	16.48	14.85	0.33	1.31
MB	2x27	7.40	69.26	18.13	4.23	1.34	12.56
PL	3x27	4.35	0	20.61	14.03	0.90	0
PL	8x01	0.73	0	13.63	13.53	0.10	0
PL	9x01	10.70	0	15.32	13.68	1.64	0
PL	10x01	8.14	0	15.16	13.92	1.23	0
PL	11x01	12.11	0	17.04	14.98	2.06	0
PL	16x14	2.18	0	17.28	16.90	0.38	0
MB	22x03	7.55	71.88	17.71	3.64	1.34	12.73
MB	22x05	6.16	50.02	17.13	7.51	1.05	8.57
MB	22x06	1.44	4.93	15.33	14.35	0.22	0.75
MB	22x08	1.81	6.85	15.86	14.49	0.29	1.09
MB	22x14	7.21	66.21	17.32	4.60	1.25	11.47
MB	22x16	1.57	5.58	18.60	17.27	0.29	1.04
MB	22x17	3.09	15.60	19.42	15.79	0.60	3.03
MB	22x20	2.16	8.96	18.97	16.86	0.41	1.70
MB	22x25	2.63	12.11	19.05	16.24	0.50	2.31
MB	22x26	1.47	5.07	17.50	16.35	0.26	0.89
MB	22x29	1.81	6.84	17.42	15.91	0.31	1.19
MB	22x30	3.15	16.17	16.67	13.45	0.53	2.70
MB	24x24	5.52	41.41	18.31	9.71	1.01	7.58
PL	24x27	7.51	0	22.76	4.85	1.71	0
PL	28x27	5.15	0	15.03	14.25	0.77	0
PL	31x26	4.80	0	18.03	17.16	0.87	0
PL	32x03	35.95	0	18.82	12.05	6.77	0
PL	32x25	1.54	0	18.77	18.48	0.29	0
PL	34x22	2.23	0	16.47	16.10	0.37	0
PL	37x23	2.15	0	15.25	14.92	0.33	0
PL	38x15	8.07	0	15.12	13.90	1.22	0
PL	43x17	0.95	0	15.16	15.02	0.14	0
PL	44x22	2.01	0	17.52	17.17	0.35	0
PL	48x05	1.17	0	15.72	15.53	0.18	0
PL	49x24	2.10	0	14.96	14.64	0.31	0
PL	50x01	4.76	0	15.85	15.10	0.75	0
PL	51x01	8.74	0	14.70	13.42	1.29	0