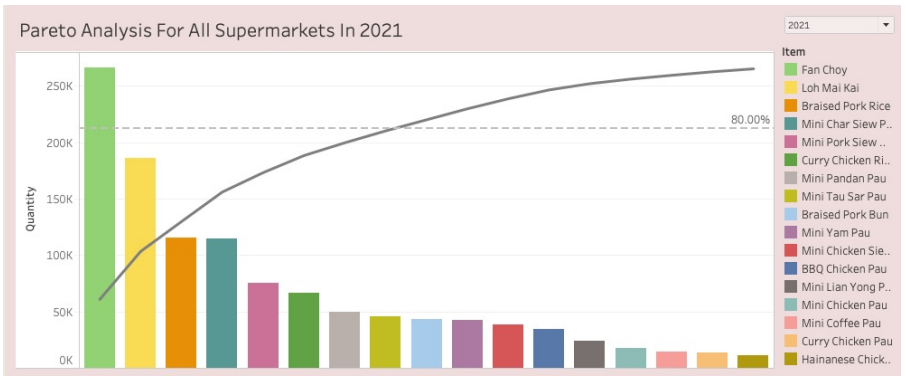
SMU SINGAPORE MANAGEMENT UNIVERSITY
SMU-X

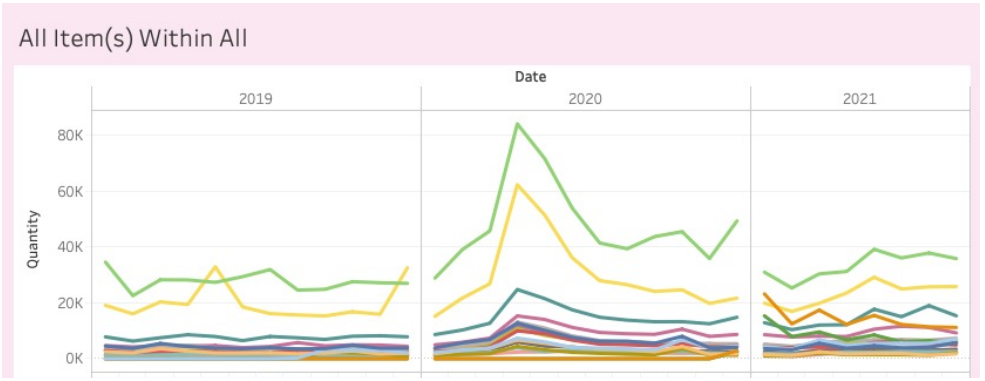
林記飽點 LIM KEE

PROJECT BRIEF

Lim Kee Food Manufacturing (LKFM) manufactures and sells steam buns and dim sums. Its retail sector sells frozen goods to major supermarket chains. However, it does not fully understand the impacts of the monthly supermarket promotions it is obligated to run. Therefore our project aims to quantify the effects of the promotions in terms of effectiveness and propose an optimal promotion schedule, while considering constraints including production limit, storage capacity, shelf-lives of products and a Just-In-Time production philosophy. We aim to select the most efficient and effective promotions to schedule without exceeding supply-side constraints.

DATA VISUALISATION





Prior to our data analysis, we used Tableau to spot any general patterns or trends. Based on Tableau, a few points we took note of were: (1) the consistent best-sellers were Fan Choy, Loh Mai Kai and Char Siew Pau, (2) there were peaks in demand that coincided with stricter government regulations imposed for COVID-19, suggesting correlation with COVID-19, (3) sustained increase in demand after 2020.

DATA ANALYSIS

Programmes such as Microsoft Excel and R studio were utilised to analyse demand for LKFM's items. Multiple types of models were tested to acquire the best accuracy of forecasted values. Ultimately, it boiled down to 3 models – multivariate linear regression using dummy variables, stepwise regression and lasso regression. MAPE, R^2, Adjusted R^2 and the concept of parsimony were criteria which suggested the appropriateness and accuracy of the models.

```
Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)    1860.9      468.2   3.974 0.000562 ***
promo          2037.9      588.5   3.463 0.002019 **
lockdown       5240.3     1155.0   4.537 0.000135 ***
covid          2164.9      586.7   3.690 0.001149 **
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Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1478 on 24 degrees of freedom
Multiple R-squared:  0.7626,    Adjusted R-squared:  0.7329
F-statistic: 25.69 on 3 and 24 DF,  p-value: 1.143e-07
```

DASHBOARD

Individual Promotion Bundle Forecasting

Selection Fields (Forecast Promotion Bundles)

Promotion	Fan Choi				
Channel	Cold Storage	Prime	Sheng Siong	Giant	NTUC
Month	May				
COVID-19 Scenario	Endemic				
Promo Period (Yes/No)	Yes	No	Yes	No	No
Forecasted Qty	436	1,230	16,596	4,323	18,119
Forecasted Revenue with Promo	$ 567	$ 2,454	$ 21,575	$ 5,620	$ 29,762
Forecasted Revenue without Promo	$ 654	$ 1,845	$ 16,142	$ 6,484	$ 27,178
Increase in Revenue due to Promo	No increase in quantity due to ineffective promo	609	5,433	No increase in quantity due to ineffective promo	2,584

Forecasted Production Capacity and Chiller

Month - May
COVID-19 Scenario - Endemic

Assumptions	
No. of working days in May	25
Adjustable % of maximum daily output	70%

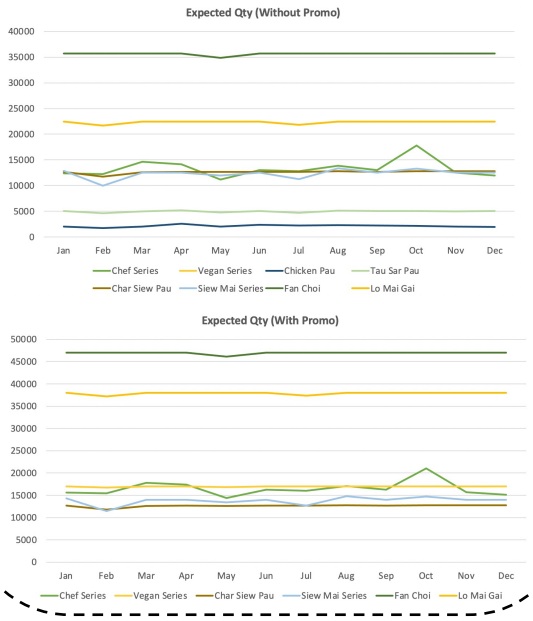
Production Capacity Constraints	Total forecasted MONTHLY Qty - Pau	45334	
	Total forecasted MONTHLY Qty - Siew Mai	11940	
	Total forecasted MONTHLY Qty - Rice	63182	
	Average forecasted DAILY Output - Pau	**1813**	**Within Limits**
	Average forecasted DAILY Output - Siew Mai	**478**	**Within Limits**
	Average forecasted DAILY Output - Rice	**2527**	**Within Limits**
Chiller Constraints	Basket Qty - Pau	100	
	Basket Qty - Siew Mai	15	
	Basket Qty - Rice (HFR + FC)	46	
	Basket Qty - Lo Mai Gai	19	
	Total forecasted DAILY Basket Qty Required	180	
	Maximum baskets per chiller	500	
	Total forecasted DAILY no. of chillers needed	**1**	**Within Limits**

Promotion Scheduling

Scenario: Endemic

Month	Supermarkets	Promo Bundle
Jan-22	Cold Storage	Wholemeal Bun (New Product)
	Prime	Wholemeal Bun (New Product)
	Sheng Siong	Wholemeal Bun (New Product)
	Giant	Wholemeal Bun (New Product)
	NTUC	Wholemeal Bun (New Product)
Feb-22	Cold Storage	Vegan Series
	Prime	Vegan Series
	Sheng Siong	Vegan Series
	Giant	Vegan Series
	NTUC	Vegan Series
Mar-22	Cold Storage	High Fiber Rice
	Prime	High Fiber Rice
	Sheng Siong	High Fiber Rice
	Giant	High Fiber Rice
	NTUC	High Fiber Rice
Apr-22	Cold Storage	Wholemeal Bun (New Product)
	Prime	Wholemeal Bun (New Product)
	Sheng Siong	Wholemeal Bun (New Product)
	Giant	Wholemeal Bun (New Product)
	NTUC	Wholemeal Bun (New Product)

Management Overview



KEY INSIGHTS

Some seasonality was observed in our data visualisation, for example in the month of February and during the COVID-19 period. After fitting the data and observations into regression models, most of the promotions were deemed as ineffective. Based on our analysis, we recommended LKFM to focus their promotions on the worst performing items rather than those that already sell well. LKFM should also continue to experiment with different promotion bundle sizes in order to find a bundle size that does not reduce promotion effectiveness. LKFM should also avoid doing similar promotions consecutively.

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