Structural Equations Models

Multivariate Solutions

Basics of Structural Equation Models

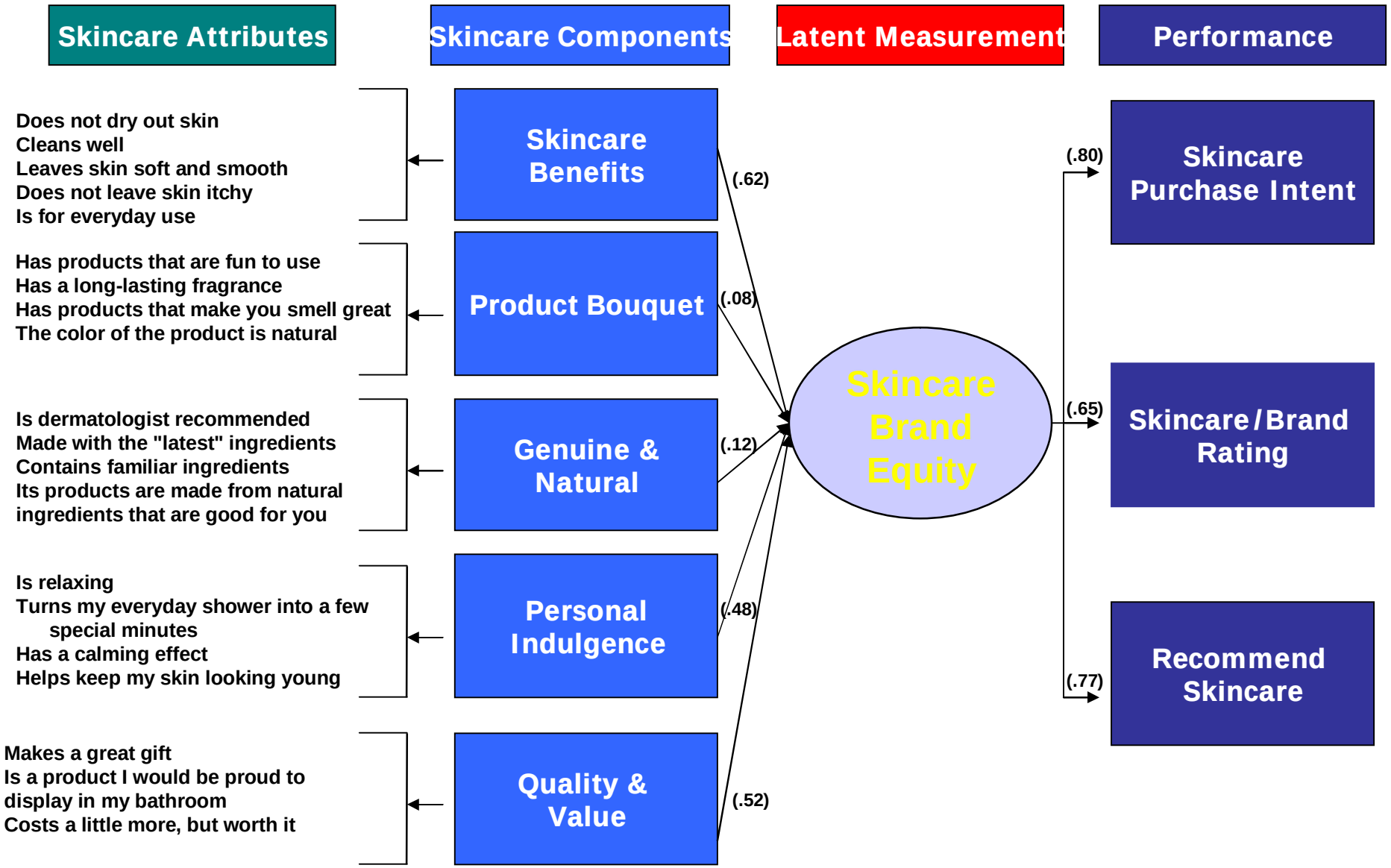
- Structural equation modeling (SEM) is a statistical technique for building and testing statistical models, which are often causal models. It is a hybrid technique that encompasses aspects of confirmatory factor analysis, path analysis and regression, which can be seen as special cases of SEM.

- Among its strengths is the ability to model constructs as latent variables — variables which are not measured directly, but are estimated in the model from measured variables which are assumed to 'tap into' the latent variables.
  - For example, a latent variable can be ‘Overall Satisfaction’, which is a composite of, say, three satisfaction variables, such as ‘Purchase Intent’, ‘Likelihood to Purchase’, and ‘Likelihood to Recommend’.

- SEM also allows the research to use a combination of more than one technique, such as regression analysis and factor analysis. These are interlaced within the path diagram.

Figure 4

Structural Equation Model
Skincare Brand Equity



SEM – Interpreting the Path Graphic

- Skincare is a generic cosmetic product on which a brand equity study was commissioned. A structural equations modeling was produced.

- The interpretation of Skincare Brand Equity is complete in the structural equations modeling output. It shows the strength of the five product categories that are driving the latent brand equity measure—for example, Skincare Benefits (.62), Quality and Value (.52), and Personal Indulgence (.48) are the main selling points for Skincare, more than five times more influential than Product Bouquet (.08) and Skincare's claim to Genuine & Natural Ingredients (.12).
  - These findings are *derived importance*, the same statistical inference from *brand equity regression analysis*.

- The structural equations modeling graphic also gives a numerical association with the *three general Skincare measures* that create the latent brand equity variable.
  - What this shows is that respondents' actions, such as purchase intent (.80) and recommending Skincare (.77) are more strongly related to brand equity than a simple, overall rating of Skincare (.65).

SEM – Confirmatory Factor Analysis

- It is possible that these categories can be pre-determined. However, in this case, Skincare ran a *confirmatory factor analysis*, an extension of factor analysis in which specific hypotheses about the structure of the factor loadings are tested. It is show in **Slide 6**.

- **Slide 7** shows a graphic representation of the factor coefficients for Skincare Benefits, the strongest brand equity factor.

- These coefficients from the Skincare Benefits factor provide a measure of the strength that a specific statement has in explaining the underlying construct or theme captured by the factor.
  - The higher the coefficient, the better the statement itself represents the factor's ideas. Additionally, the higher the coefficient, the bigger the driver that statement is on Overall Brand Equity (relative to the other statements in the factor).

Key Drivers Of Skincare Brand Equity

Skincare Factor Analysis

	Skincare Benefits	Product Bouquet	Genuine & Natural	Personal Indulgence	Quality & Value
Does not dry out skin	0.77	0.31	-0.05	-0.01	-0.16
Cleans well	0.73	-0.05	-0.05	0.20	0.13
Leaves skin soft and smooth	0.70	0.13	-0.07	0.15	0.12
Does not leave skin itchy	0.64	0.40	-0.03	0.11	-0.17
Is for everyday use rather than special occasions	0.63	0.05	0.05	0.02	0.29
Has products that are fun to use	0.05	0.62	0.12	0.12	0.31
Has a long-lasting fragrance	0.16	0.60	0.04	0.20	0.05
Has products that make you smell great	0.24	0.59	0.08	0.16	0.10
The color of the product is natural in appearance	-0.08	0.52	0.35	0.04	0.09
Is dermatologist recommended	0.06	-0.14	0.71	0.01	0.18
Made with the "latest" ingredients	-0.01	0.25	0.66	0.23	0.30
Contains familiar ingredients	0.08	0.02	0.65	0.09	0.26
Its products are made from natural ingredients that are good for you	0.06	0.23	0.56	-0.07	0.23
Is relaxing	0.00	0.22	0.08	0.70	0.29
Turns my everyday shower into a few special minutes for me	0.09	0.26	-0.13	0.62	0.18
Has a calming effect	-0.02	0.40	0.14	0.61	0.20
Helps keep my skin looking young	0.31	0.02	0.31	0.57	0.06
Makes a great gift	0.04	0.16	0.04	-0.01	0.72
Is a product I would be proud to display in my bathroom	0.16	0.18	0.22	0.19	0.58
Costs a little more, but worth it	0.16	0.12	0.14	0.22	0.51

Impact of each attribute comprising the “SkinCare Benefits” factor.