



End-to-End Business Intelligence Case Study

Titanium Dioxide Exposure & Regulatory Risk Intelligence

U.S. Cosmetics Industry

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Business Intelligence | Data Analytics

Power BI • SQL • Python • Data Modeling • DAX

Executive Summary

Problem

Titanium Dioxide is a widely used cosmetic ingredient under increasing regulatory scrutiny, but the industry's actual dependency is poorly understood.



What I Built

A full end-to-end BI solution to quantify Titanium exposure across products, categories, and companies.

Why It Matters

Any regulatory restriction would cause industry-wide disruption, not isolated impact.

Key Result

- **86.6%** of cosmetic products contain Titanium
- **75%** of companies are exposed
- Largest brands carry the highest absolute risk

Business Context & Objective



Industry Context

- Cosmetics rely heavily on chemical additives
- Titanium Dioxide used for pigmentation, opacity, and UV protection
- Increasing global regulatory and ESG pressure

Objective

Answer four business questions:

1. How widespread is Titanium usage?
2. Which product categories are most dependent?
3. Which companies face the highest risk?
4. Where is regulatory exposure concentrated?

Data Source

California Safe Cosmetics Program (CSCP)

Data Scale

- 36,972 cosmetic products
- 604 companies
- 123 regulated chemicals
- Reporting period: 2009-2020

Data Grain

Each record represents **one chemical used in one product**

Dataset





Data Preparation & Validation

Steps Performed

- Raw CSV ingestion
- Python-based data audit and cleaning
- Standardized dates, chemical identifiers, and categories
- SQL-based KPI validation
- Ensured consistency across Python, SQL, and Power BI

Why This Matters

Guarantees **trustworthy metrics** for business decision-making.

Data Model (Star Schema)

Why Star Schema

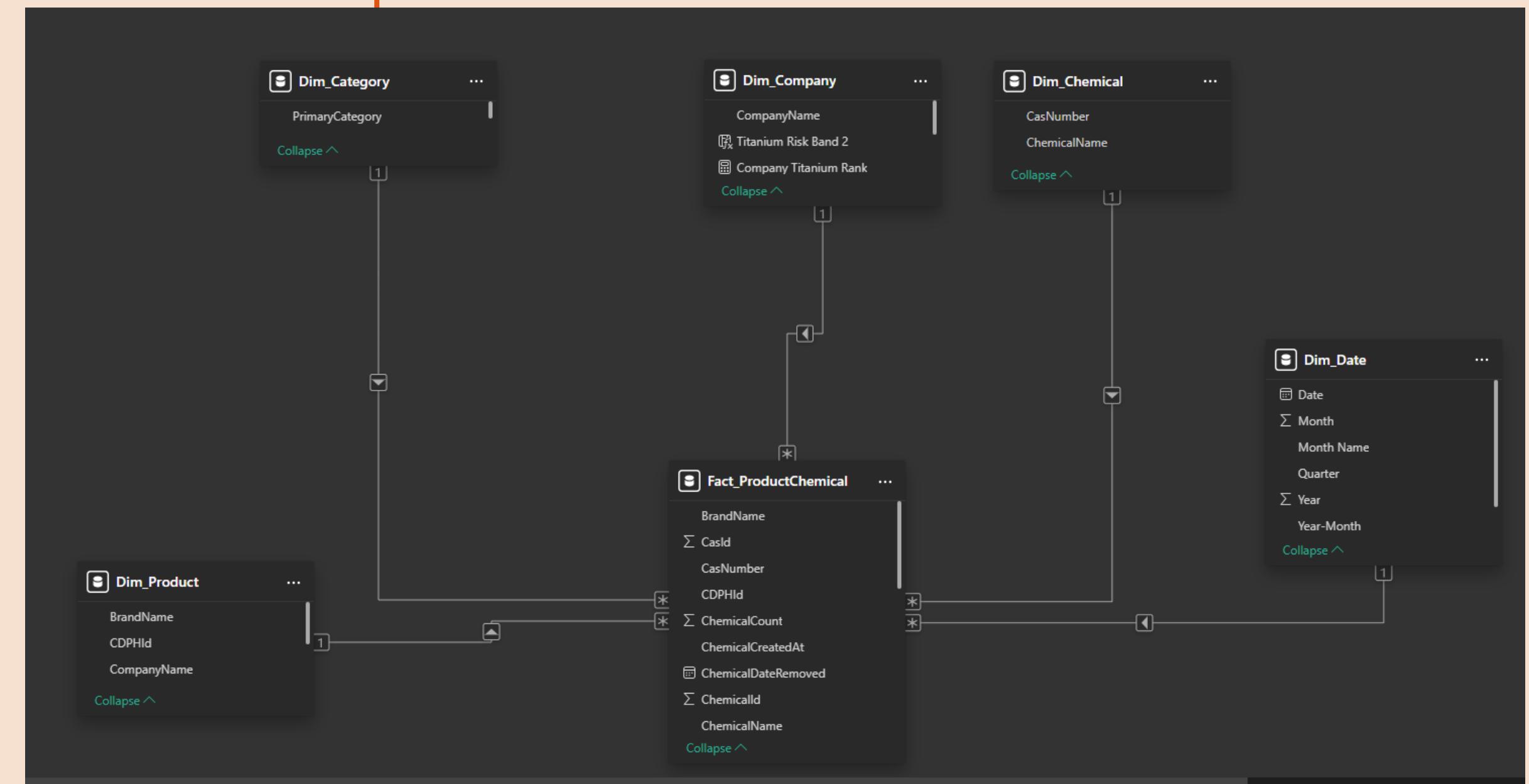
- Accurate aggregations
- Scalable BI design
- Reliable DAX calculations
- Supports time intelligence and drill-downs

Fact Table

- Product × Chemical relationships

Dimension Tables

- Product
- Company
- Chemical
- Category
- Date



Core KPIs

- Total Products
- Titanium Products
- Titanium Penetration %
- Companies Using Titanium

Risk Innovation

Instead of ranking companies by percentage alone, I created:

**Titanium Risk Score =
Number of Titanium
Products per Company**

This surfaces **true exposure**, not misleading ratios.



Key Metrics & Logic

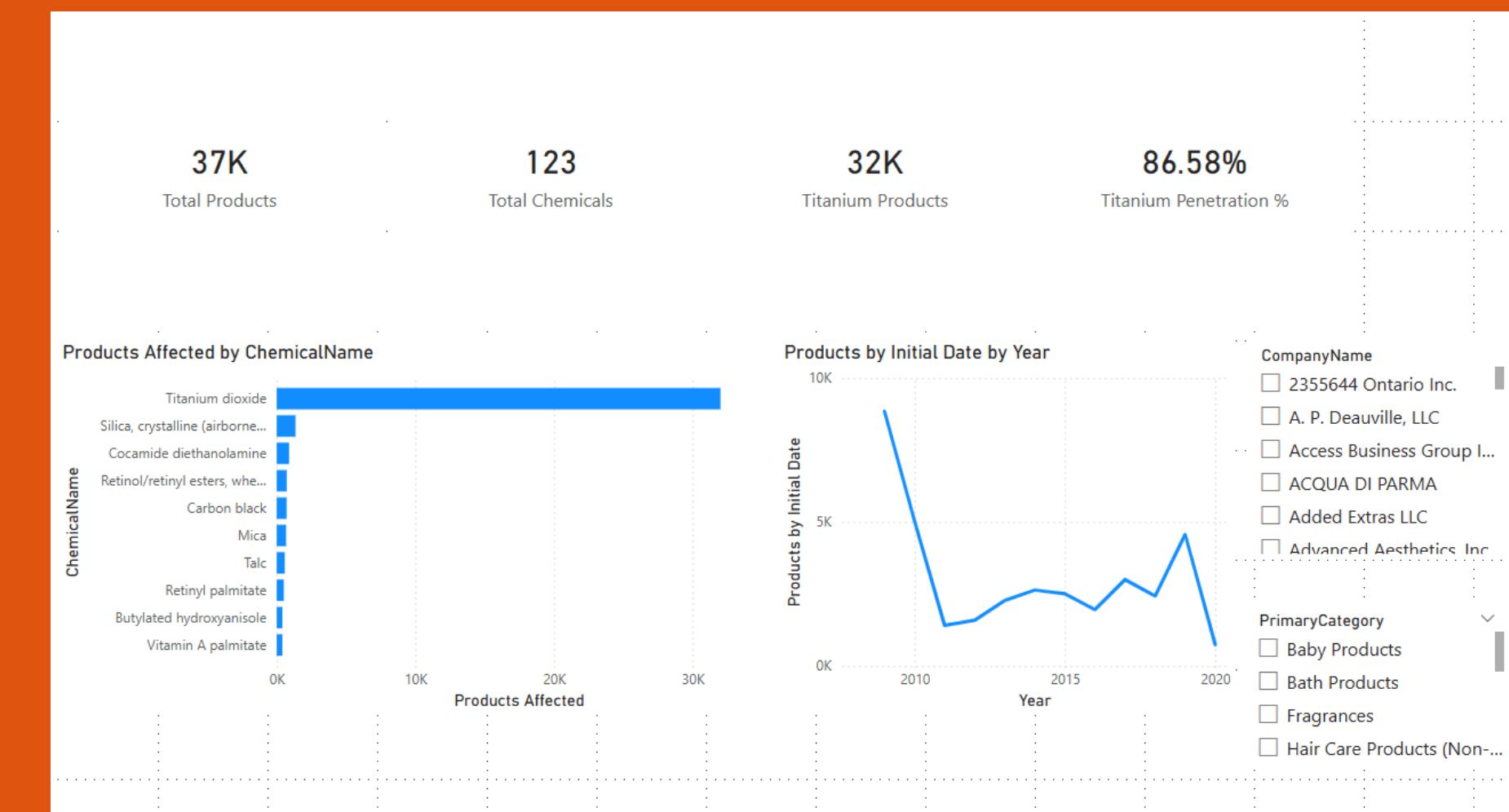
Market-level Insights

Findings

- 86.6% of cosmetic products contain Titanium
- Dependency remains high over 12 years
- No meaningful shift away from Titanium

Business Interpretation

Titanium is a **structural dependency**, making regulatory action highly disruptive.



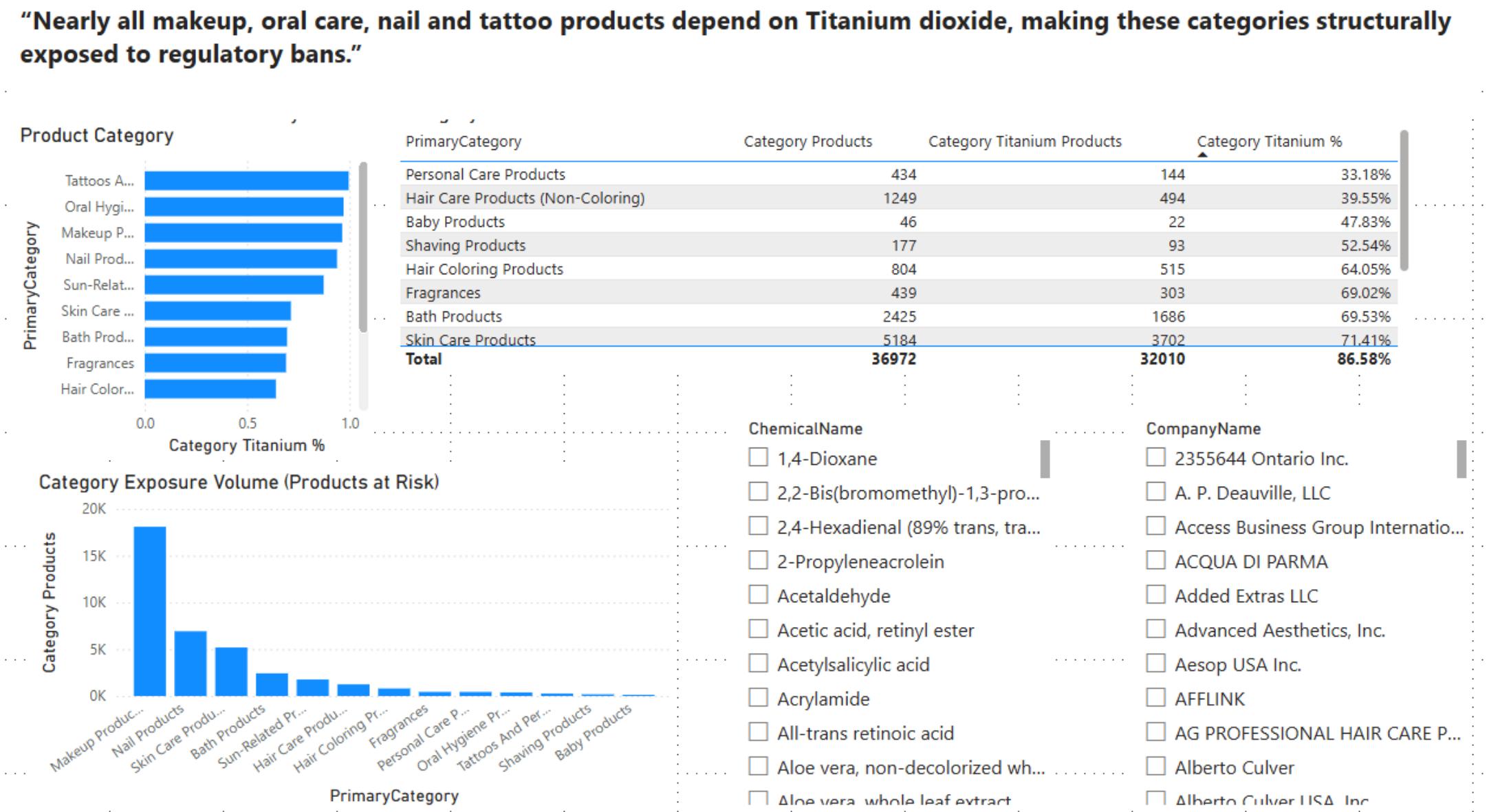
Category-level Risk Insights

Highest Risk Categories

- Makeup (Non-Permanent)
- Nail Products
- Oral Hygiene
- Tattoos & Permanent Makeup

Key Insight

These categories are **chemically locked-in**, making reformulation costly and complex.



Company-level Risk Insights

Risk Concentration

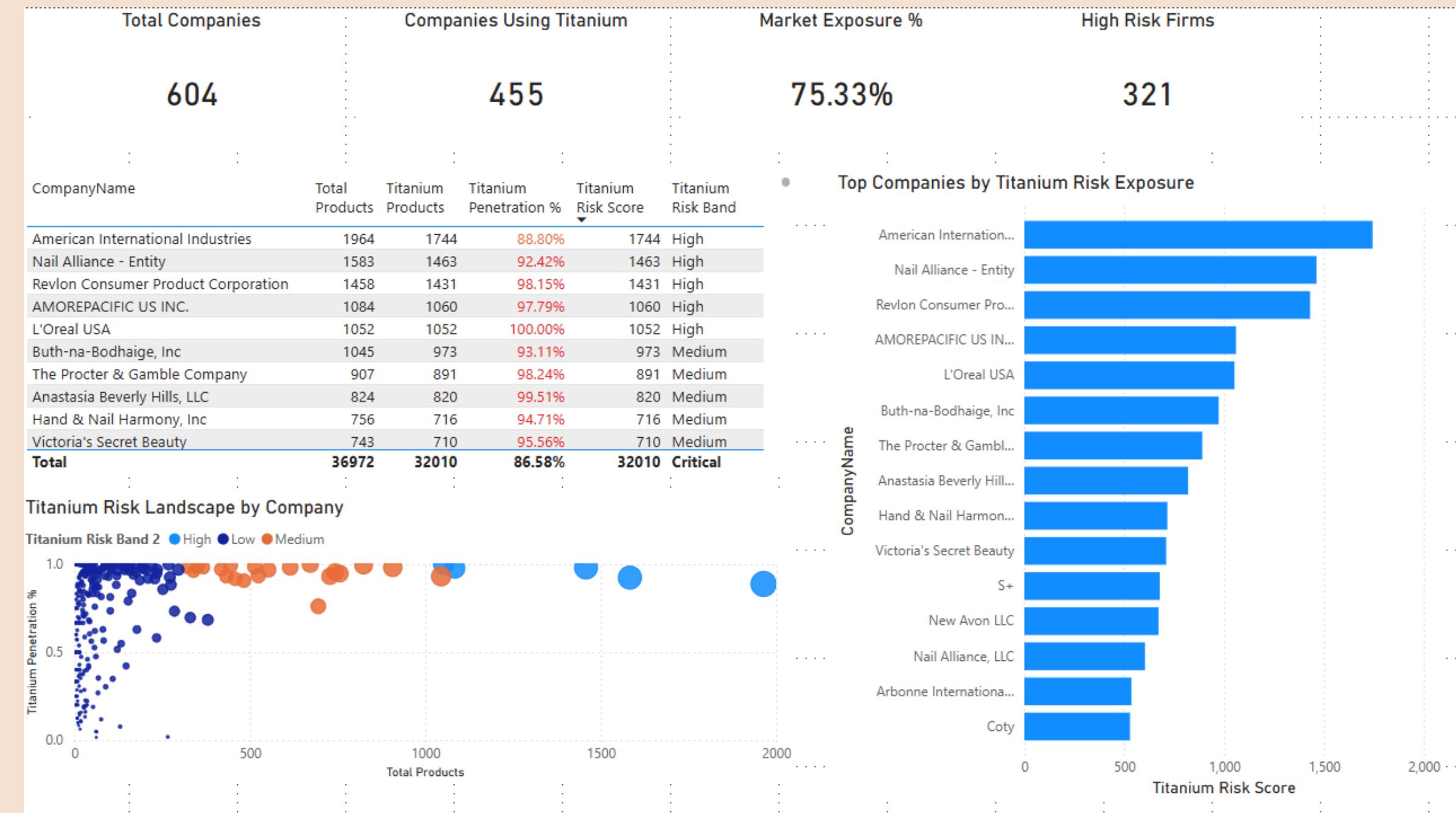
- Large companies dominate Titanium exposure
- High dependency × large portfolios = extreme risk

Top Exposure Companies

- American International Industries
- Nail Alliance
- Revlon
- AMOREPACIFIC
- L'Oréal USA

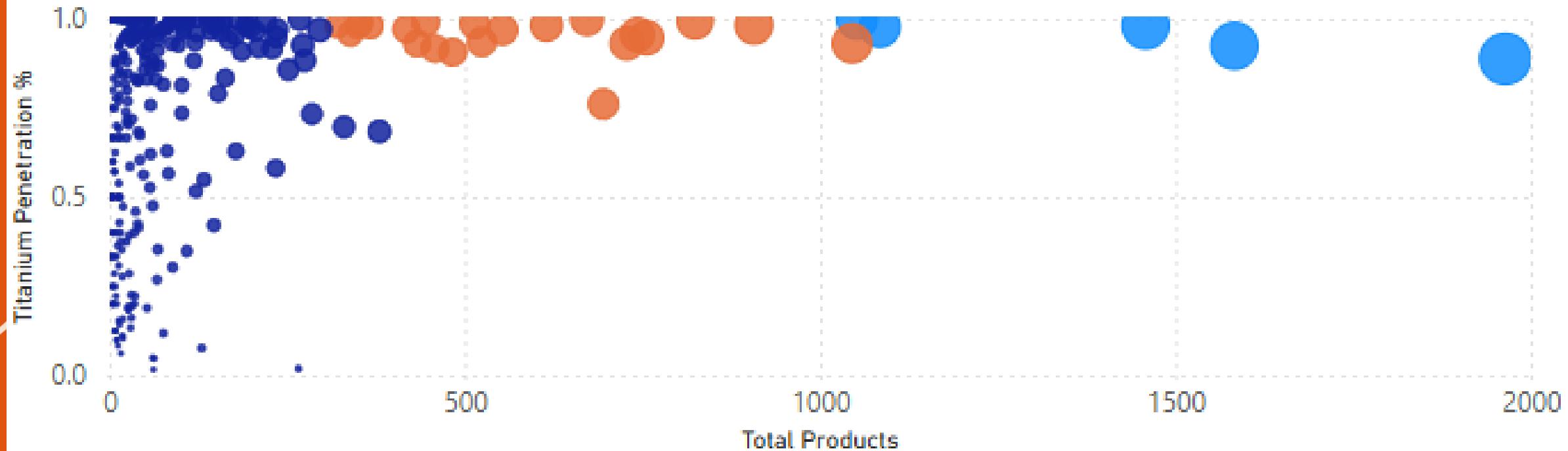
Insight

Regulatory action would impact **market leaders first**, not fringe brands.



Titanium Risk Landscape by Company

Titanium Risk Band 2 ● High ● Low ● Medium



Risk Landscape (Scatter Analysis)

What the Chart Shows

- X-axis: Company size (Total Products)
- Y-axis: Titanium dependency (%)
- Bubble size: Titanium exposure volume
- Color: Risk band (Low → Critical)

Why This Matters

Visually identifies **systemic risk clusters** in the industry.

Business & Regulatory Implications



For Regulators

Focus on high-impact companies and categories first

For Companies

- Prioritize reformulation in high-risk segments
- Diversify ingredient sourcing

For Investors

Titanium exposure is a hidden ESG and regulatory risk

Skills Demonstrated



What This Project Proves

- End-to-end BI ownership
- Strong data modeling fundamentals
- Advanced DAX & ranking logic
- Business-driven insight generation
- Dashboard design for decision-makers

FINAL TAKEAWAY



Regulatory risk in the cosmetics industry
is **not evenly distributed** – it is
concentrated in the **largest brands and**
most popular product categories.



Thank
you



This project demonstrates how bi can be used to **anticipate risk**, not just report numbers.