**Summary:**

By aggregating the Online Retail data at product level and showing an interactive scatter of average price (x-axis) vs. quantity (y-axis)—color‑coded by country, sized by revenue, and switchable to totalSales (y-axis) or RFM metrics (y-axis)—users can brush and hover to spot high‑price‑low‑volume vs. low‑price‑high‑volume items, compare country patterns, and quantify price‑sensitivity via purchase frequency .

1. **Data preprocessing**

* Load the Online Retail dataset and drop return rows (Quantity < 0).
* Aggregate by StockCode and compute:  
  • avgPrice = mean(UnitPrice)  
  • totalQty = sum(Quantity)  
  • totalSales = sum(Quantity × UnitPrice)  
  • mainCountry = mode(Country)

1. **Visual design**

* x‑axis: avgPrice (average unit price)
* y‑axis: totalQty (total quantity sold) with a dropdown to switch to totalSales, Recency, Frequency, or Monetary
* Color: mainCountry
* Point size: totalSales (sqrt scale)

1. **User interaction**

* Brush selection  
  Drag a rectangular brush to select points; selected product IDs are dispatched to the table, which filters in real time. Press Esc or click blank space to clear the brush and restore the full table.
* Hover  
  On hover the point enlarges and a tooltip shows StockCode, avgPrice, totalQty, mainCountry, etc.; the matching row in the table is highlighted and scrolled into view.

1. **Analytical questions**

Price‑quantity plane (avgPrice × totalQty)

* Identify high‑price‑low‑volume versus low‑price‑high‑volume items for pricing and promotion.
* Contrast country‑wise clouds to infer market preferences.

Price‑Recency view (avgPrice × Recency)

Recency measures days since the last purchase—smaller means more recent—and quickly tells whether an item is still in demand.

* Upper‑left: low price, long recency → outdated items.
* Upper‑right: high price, long recency → pricey niche, consider markdown or limited editions.
* Lower‑left: low price, recent sales → staples; bundle or cross‑sell.
* Lower‑right: high price, recent sales → premium stars; exploit exclusivity or FOMO.

Price‑Frequency view (avgPrice × Frequency)

Frequency is the number of purchases in the period; high values signal staples, and its slope versus price quantifies price sensitivity.

* High frequency & low price: replenishment staples, good for subscriptions.
* High frequency & high price: customers rely on pricey essentials, enhance VIP perks.
* Low frequency: occasional purchases, target with seasonal or event promotions.

Price‑Monetary view (avgPrice × Monetary)  
 Monetary is total revenue (or spend per customer); large values indicate major income sources and, together with price, highlight mass winners, luxury cash cowsLow price, high revenue: mass‑market winners.

* High price, high revenue: luxury cash cows requiring inventory and experience management.  
  Customer level
* Lower‑right: high price but low spend → one‑off splurges.
* Upper‑left: low price but high spend → steady accumulators.

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透過將 Online Retail 資料按 StockCode 彙總並繪製「平均單價 (x軸) × 銷量 (y軸)」散點圖，y軸再動態切換 totalSales 或 RFM 指標、以國家上色和營收定點大小，配合 Brush 與 Hover 互動，可快速辨識高價低量與低價高量商品、比較各國市場偏好，並在 RFM 模式中觀察價格對購買頻次的敏感度。

資料前處理

* 讀取 Online Retail 資料集，排除退貨列 (Quantity < 0)。
* 以 StockCode 彙總計算：  
  • avgPrice = 平均 UnitPrice  
  • totalQty = Quantity 總和  
  • totalSales = Quantity × UnitPrice 總和  
  • mainCountry = Country 眾數

視覺化設計

* x 軸：avgPrice (平均單價)
* y 軸：totalQty (總銷量)，可下拉切換 totalSales、Recency、Frequency、Monetary
* 顏色：mainCountry
* 點大小：totalSales (sqrt 對映)

使用者互動

1. 框選 Brush  
   拖曳矩形選取散點；選區內產品 ID 透過自訂事件 dispatch 傳給右側 table，table 立即過濾並顯示相同序列。按 Esc 或點空白處可清除選取並恢復全表。
2. 懸停 Hover  
   滑鼠停留時放大圓點並顯示 tooltip（StockCode、avgPrice、totalQty、mainCountry 等）；同時突顯 table 對應列並捲動至可見。

分析重點

價格‑銷量 (avgPrice × totalQty)

* 找出高單價低銷量與低單價高銷量產品，作為定價與促銷策略依據。
* 比較各國分佈差異，判斷市場偏好。

價格‑Recency (avgPrice × Recency)

Recency：距離最近一次成交的天數，數字越小代表越新鮮；能快速判斷商品目前是否仍受到關注。

* 左上：低價且久未購買 → 可能淘汰品。
* 右上：高價且久未購買 → 小眾高價品，可考慮降價或限量。
* 左下：低價且近期熱賣 → 日常暢銷品，可包裝量販或交叉促銷。
* 右下：高價且近期熱賣 → 高端明星商品，可用會員專享／FOMO。

價格‑Frequency (avgPrice × Frequency)

Frequency：在觀測期間內被購買的次數，高頻表示常用或必備；價格‑頻次關係揭示消費者對價格的敏感度。

* 高頻低價：補貨型日用品，可推訂閱或定期購方案。
* 高頻高價：顧客依賴的高價常備品，可強化 VIP 福利。
* 低頻：節日或情境行銷刺激購買。

價格‑Monetary (avgPrice × Monetary)  
Monetary：總營收或顧客總花費，數字大說明帶來更多收入；結合價格可分辨薄利多銷與高價高利品。

* 低價高營收：薄利多銷暢銷品。
* 高價高營收：豪華利潤點，需維持體驗與庫存。  
  顧客層級
* 右下：高價但花費少 → 一次性奢侈購。
* 左上：低價但花費高 → 長期小額累積型顧客。