



IMPROVING SECURITY THROUGH VISIBILITY Business Intelligence for Improving Supply Chain Risk Management

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- General Overview on Risk based Approach
- A Case: Information Quality Control for Freight Forwarder
- Role of Business Intelligence
 - Data Analysis for Detecting and Explaining Business Exceptions







Risk Management Cycle











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Relation of Control aspect and Operational aspect of Administrative Organization

















Risk or exceptions:	Non-complianc	e of customs dec	claration	Risk owner:	FFco, its client
Business activity:	<i>Customs</i> <i>declaration</i>	Impact	High/Medium/	Probability	High/Medium/Low
Risk Indicator(s):	Incorrect information provided by the client and used for the customs declaration	Party(-ies) involved in the transaction:	FFco, its client, government agencies	Party(-ies) to be notified (in case of exception)	 ex-ante: consult with the client to verify the info ex-post: notify government agencies of errors, and re-submit a corrected declaration
Required normative doc / info	brokerage knowledge: 1. regulations 2. knowledge on the client's (historical) business	Current practice of check / control (using what info/doc as	Manual check: 1. ex-ante verification (using brokerage knowledge)	Suggested practice of check / control (using what	Manual checks supported by data analysis tools: Suggestions on possible errors using the normal patterns of the
Required monitor measure(s), or check / control	Check correctness of information on each declaration	norm?)	2. ex-post audit (feedback from gov.)	info/doc as norm?)	client's business (Inferred from historical transactions using data mining)











Event $\langle a, F, r \rangle$ because C^+ , despite C^-

• 3-place relation with:

- 1. actual object *a*: e.g. profit(august 2006, all countries, all-products).
- 2. reference object *r*: e.g. average profit(months, all-countries, all-Products).
- 3. property *F*: e.g. profit in august 2006 low compared to profit months july 2006june 2007.
- 4. C^+ contributing causes, C^- counteracting causes





• We have actual values and reference values



• For example profit (august 2006,....) is actual value and average july 2006 June 2007 is reference value.

• The reference values are determined by the normative model

• If
$$\Delta y = y^a - y^r$$
 is large then y^a is exceptional.

• In the next step we explain the difference using business equations





0.90 0.95 0.99

Product	Road Bikes											
	Country									Total	Total	Total
	France			Germany			United Kingdom			Profit	Sales	Cost
Period	Profit	Sales	Cost	Profit	Sales	Cost	Profit	Sales	Cost			
Jul 2006	\$11.59	\$70.26	\$58.67	\$12.89	\$33.10	\$20.21	\$3.73	\$80.17	\$76.44	\$28.21	\$183.53	\$155.32
Aug 2006	(\$2.77)	\$155.45	\$158.22	\$10.83	\$28.08	\$17.25	\$18.82	\$98.53	\$79.71	\$26.89	\$282.06	\$255.17
Sep 2006	\$9.00	\$153.57	\$144.57	\$12.40	\$32.02	\$19.62	\$13.55	\$82.73	\$69.18	\$34.96	\$268.32	\$233.37
Oct 2006	\$10.90	\$44.12	\$33.23	\$12.02	\$31.27	\$19.24	\$11.36	\$86.24	\$74.88	\$34.29	\$161.63	\$127.34
Nov 2006	\$7.13	\$103.89	\$96.76	\$11.54	\$29.70	\$18.16	\$13.13	\$90.74	\$77.61	\$31.80	\$224.32	\$192.52
Dec 2006	\$20.71	\$119.98	\$99.27	\$13.93	\$35.87	\$21.93	\$17.56	\$93.18	\$75.63	\$52.20	\$249.03	\$196.83
Jan 2007	\$10.04	\$29.11	\$19.07	\$12.22	\$31.70	\$19.48	\$15.24	\$73.00	\$57.76	\$37.50	\$133.81	\$96.31
Feb 2007	\$9.21	\$84.03	\$74.81	\$15.16	\$39.43	\$24.26	\$15.98	\$94.52	\$78.54	\$40.35	\$217.98	\$177.62
Mar 2007	\$18.42	\$96.46	\$78.04	\$14.03	\$36.36	\$22.33	\$15.60	\$89.69	\$74.10	\$48.05	\$222.51	\$174.46
Apr 2007	\$18.05	\$52.21	\$34.16	\$19.73	\$50.76	\$31.03	\$10.54	\$67.23	\$56.69	\$48.32	\$170.20	\$121.88
May 2007	\$9.36	\$116.73	\$107.37	\$15.15	\$38.96	\$23.80	\$20.90	\$100.86	\$79.96	\$45.41	\$256.55	\$211.13
Jun 2007	\$18.62	\$117.23	\$98.61	\$16.00	\$41.08	\$25.08	\$11.45	\$76.78	\$65.33	\$46.08	\$235.09	\$189.01
Grand Total	\$140.27	\$1,143.05	\$1,002.78	\$165.92	\$428.31	\$262.39	\$167.86	\$1,033.67	\$865.80	\$474.05	\$2,605.03	\$2,130.98

Explanation with business equation (red arrows): contributing cause: cost, counteracting cause: sales. Here actual compared with average.





Column effect Main effect Anova models: $\hat{y}_{ij} = \mu + a_i + b_j + \varepsilon_{ij}$ Row effect •Exception if : $abs(\frac{y-y}{\sigma}) \ge \theta$

Here in the example only overall average and country effect taken into account.





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Grand Total	\$140.27	\$1,143.05	\$1,002.78	\$165.92	\$428.31	\$262.39	\$167.86	\$1,033.67	\$865.80	\$474.05	\$2,605.03	\$2,130.98

Explanation with business equation (red arrows): contributing cause: cost, counteracting cause: sales.







• Explanations are based on relations between variables:

 $y = f(x_1, x_2, \dots, x_n)$

- In this case two posibilities:
- Business Equation: profit = sales cost
- OLAP Equation: $profit(august2006) = \sum_{contries} profit(country, august2006)$





• x_i is a potential cause of Δy and:

$$\inf(x_i, y) = f(\mathbf{x}_{-i}^r, x_i^a) - y^r$$

Indicates what the difference between the actual and norm value of y would have been if <u>only x_i </u> has actual value and all others reference value

• If f is linear and reference values consistent (true is the example) then:

$$\Delta y = y^a - y^r = \sum_i \inf(x_i, y)$$





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Explanation with OLAP equation black arrows: profit France august 2006 contributing cause. Then business equation.







• *Contributing causes:* Set of contributing causes C^+ consists of the variables x_i of $\{x_1, \ldots, x_n\}$ with

 $\inf(x_i, y) \times \Delta y > 0$

• Counteracting causes:

 $\inf(x_i, y) \times \Delta y < 0$

Explanation can be continued by explaining contributing causes further generating a *tree*









- **1.** Choose measure: choose the variable which is important for decision.
- 2. Establish context: specify the information structure. The context is usually the information from which the business report was generated. Sometimes external sources need to be included to enlarge the context.
- **3. Identify normative model:** choose appropriate reference class, estimate the norm. The derivation of the norm remains an interactive subjective process in which several practical aspects demand I background knowledge from the analyst.
- **4. Derive exceptions:** compare the actual values with norm to find exceptional values..
- **5. Generate explanations:** find the explanations for the exceptions using the business model, e.g. accounting equations or drill-down equations. What are the underlying causes?























Thank you for your attention. Any questions?

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