Robert Eller Associates, Inc.

CONSULTANTS TO THE PLASTICS AND RUBBER INDUSTRIES

GLOBAL DEVELOPMENTS IN TPE's & THEIR POTENTIAL IMPACT ON CHINA

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R/mydox/Roger Attachments/Shanghai CMT Nov 08 Global Market Outlook.ppt

Robert Eller Associates, Inc.
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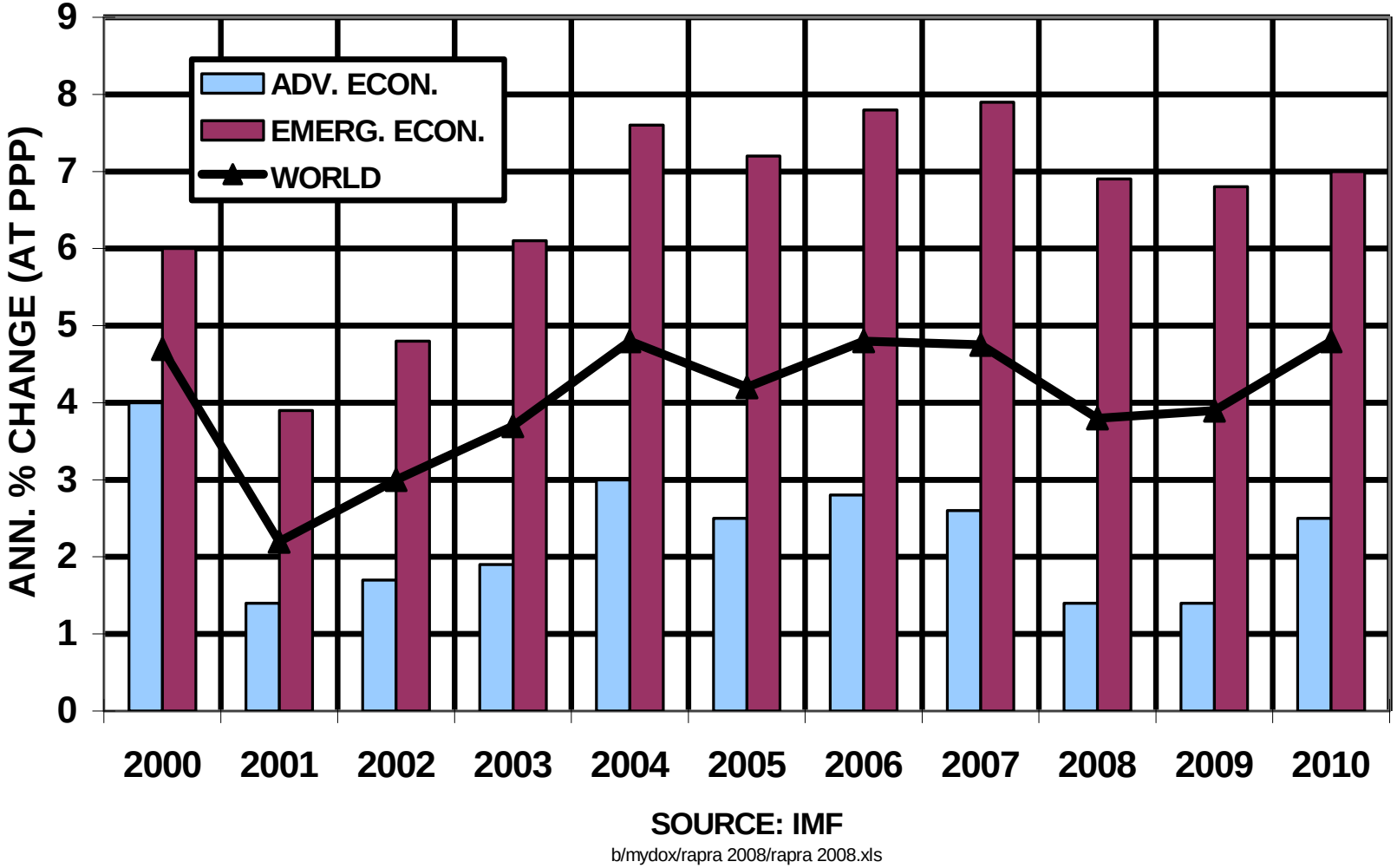
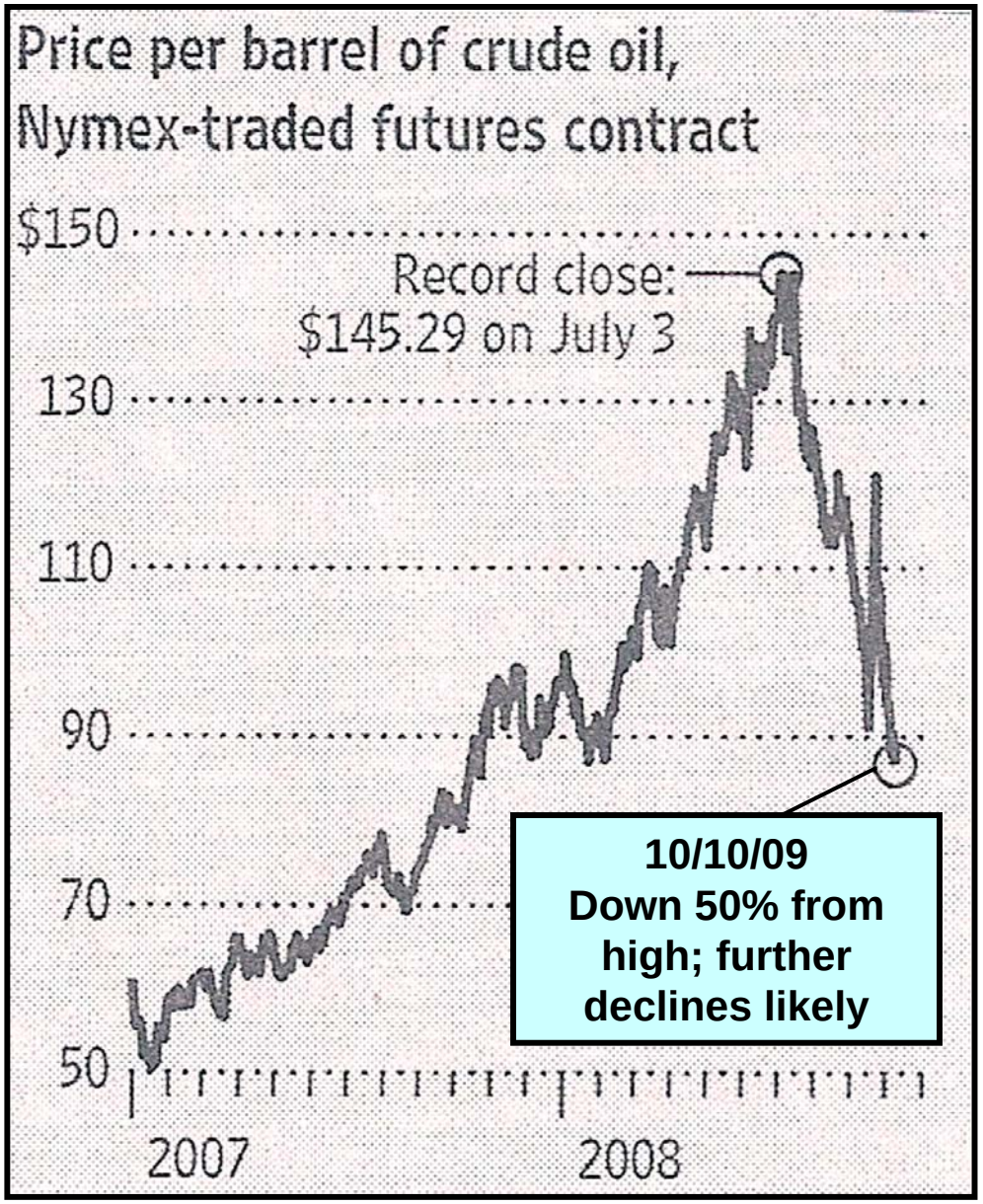
- Robert Eller Associates is a 15 year-old global plastics consulting company helping companies analyze technical, marketing and economic implications for their business to facilitate management in strategic decision making
- Offices in Akron, Ohio (home office), Paris, Shanghai, New Zealand
- Asia: Active in China, India, Middle East
- 5 Key Focus areas: TPE's, ETP's, Automotive, Compounding and Foams
- Multi-client studies:
  - China TPE Market: 2006
  - North America/Europe TPE: 2006
- Single client studies
- Mergers and acquisitions:
  - Complete management service for small acquisitions
  - Due diligence
  - Technical Advisors

GLOBAL ECONOMIC GROWTH: 2 YEAR TROUGH



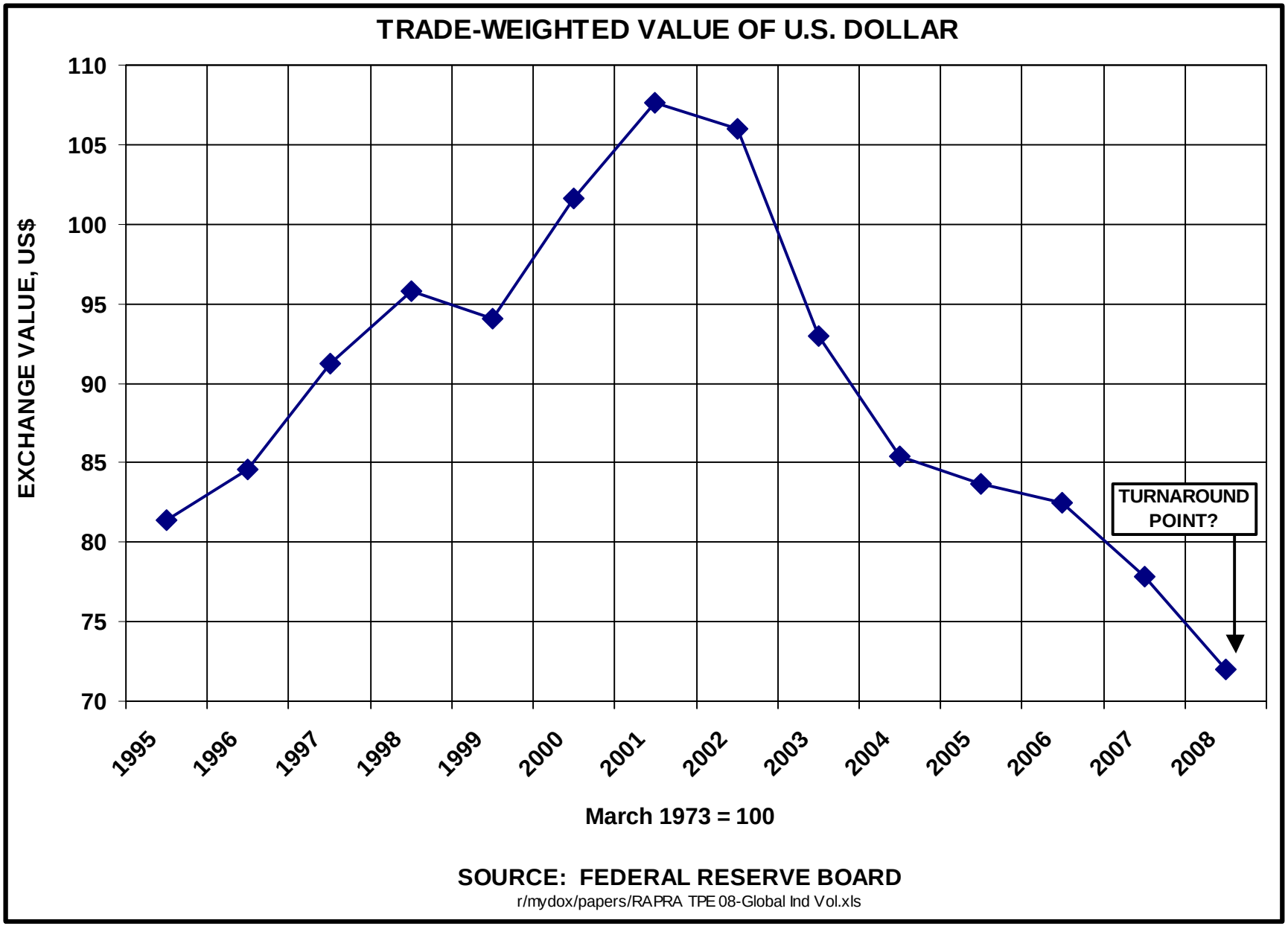
SOURCE: IMF

b/mydox/rapra 2008/rapra 2008.xls

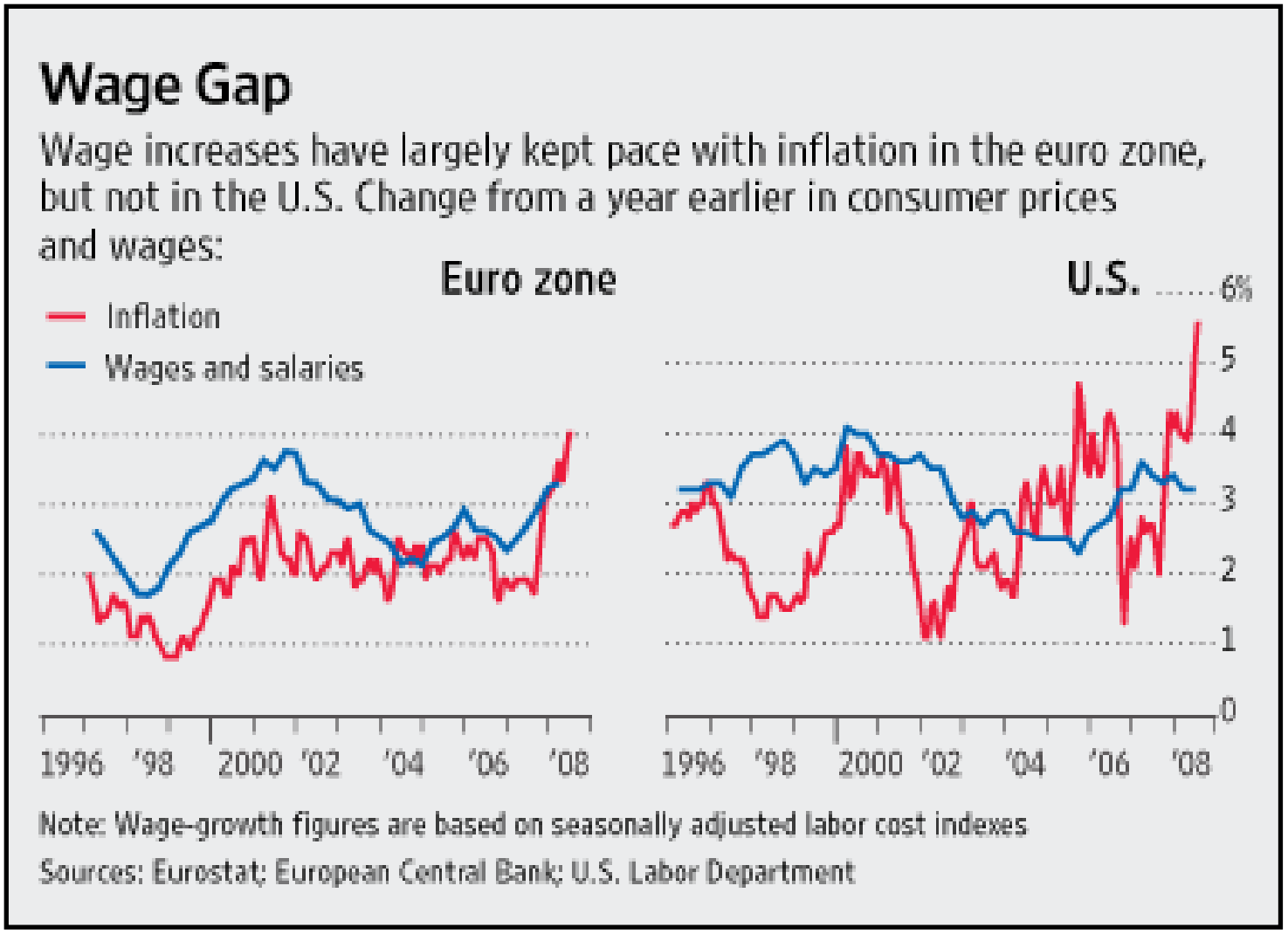


Source: Thomson Reuters

DOLLAR VALUE DECLINE



EUROPE/U.S. WAGE IMPACTS DIFFER



MACROECONOMIC IMPACTS ON GLOBAL TPE MARKETS

- **Shift of a substantial portion of non-automotive manufacturing base served by TPEs to Asia (especially China and India)**
- **U.S. GDP slowdown spread to other global regions starting in mid-2008, accelerating in 4Q/08**
- **Impact of high (recently declining) raw material costs on profitability of TPE supply chain**
- **Dollar deflation effects**
- **Petrodollar exports**
- **TPE supply chain structure shifts**

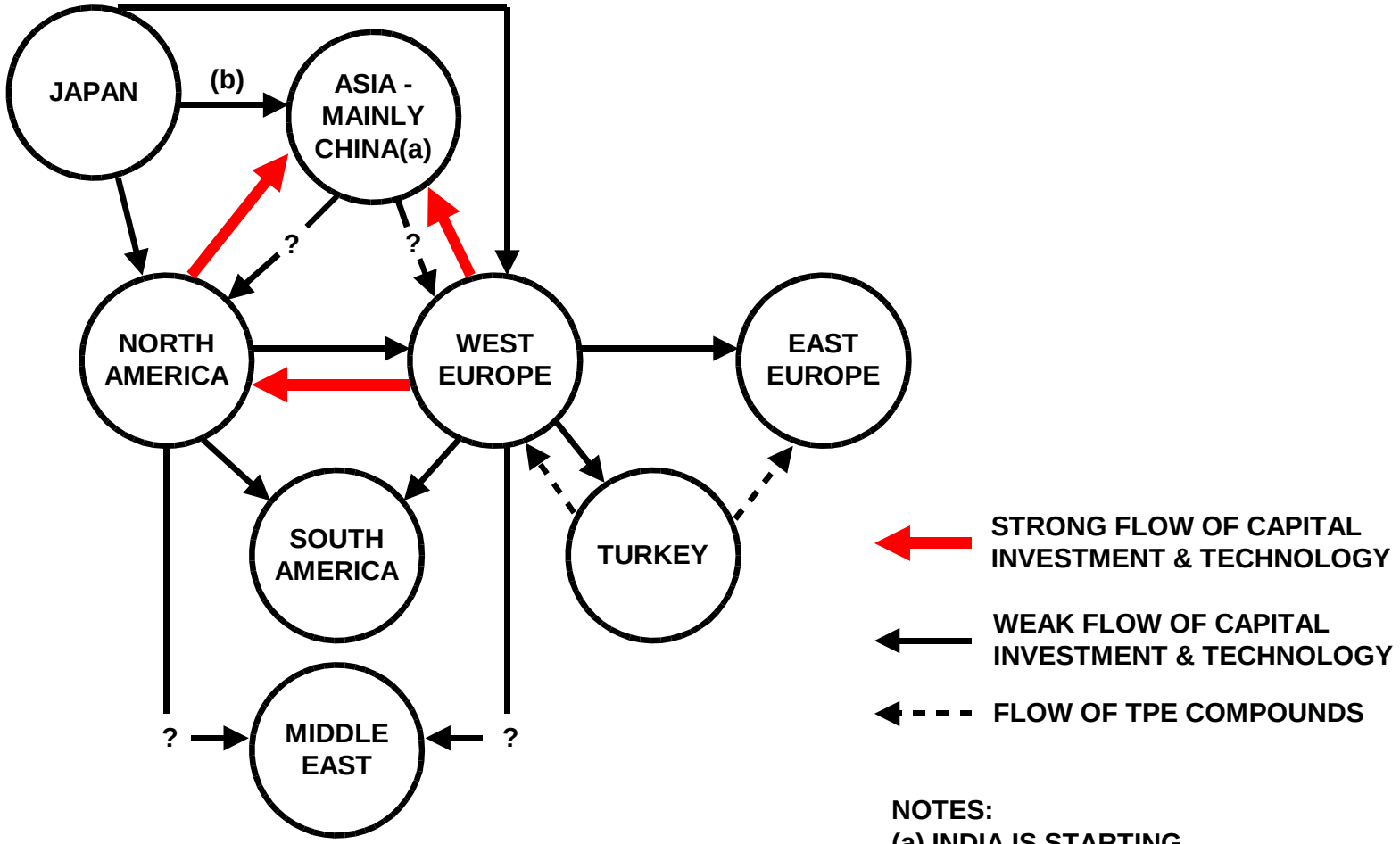
SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

MACROECONOMIC IMPACTS ON GLOBAL TPE MARKETS (Cont'd.)

- **GLOBAL CREDIT LOCKDOWN EFFECTS**
  - Erosion of consumer purchasing power
  - TPE demand decline: auto
    construction
    infrastructure
- **INFLATIONARY PRESSURES**
- **WAGE TRENDS**
  - U.S.: weak trade unions (7.5% of non-government workers) compared to Europe
  - U.S.: wage deflation/purchase power erosion
  - Europe: potential wage-price spiral?

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

GLOBAL TPE INVESTMENT FLOWS: ENLARGING THE FOOTPRINT



SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

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lg/myfiles/visio/RAPRA TPE 08-GlobalTPEinvest 08.vsd

SHIFT TO SMALLER, GLOBAL VEHICLES WILL AFFECT AUTO TPEs

PARAMETER	EFFECT ON AUTO TPO/PP COMPOUND DEMAND OR PROFITABILITY	
	INCREASE	DECREASE
Avg. part weight		Lower part wt. decreases TPO demand
OEM profit/vehicle	Lower OEM profit increases incentive to use TPOs	Increases pricing pressure on TPOs
PP/TPO penetration	Higher	
r-TPO(b) vs. c-TPO	Incr. OEM pressure to use r-TPO to reduce costs	
Parts integration	Incr. systems designs incr. profit pot'l.	
Rubber substitution	Higher (increases o-TPV use)(a)	
Higher quality req'mts.	Increase demand	Willing to pay for quality?
Increased global platforms	Global sales potential	- Non-global resin suppliers/ comp'drs./molders lose position - Global purchasing pressures from OEMs
Technology proliferation	Better mat'ls./fab. tech. via design imports leads to incr. profit pot'l.	

Notes: (a) Incr. o-TPV substitution for TSRs saves wt. & fabrication and systems costs
(b) Reactor TPOs have yet to satisfy their full potential.

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

EUROPEAN SMALL CARS ARE PP INTENSIVE

VEHICLE	PP (kg)	PP/PLASTICS (%)
Citroen C4	90	56
Toyota Aygo	47	52
Toyota Auris	71	51
Toyota Yaris	64	47
Opel Corsa	65	44
Ford Mondeo	72	41
Fiat 500	60	49
Mercedes C-Class	72	34

Source: Mavel

TPE DYNAMICS AND SUPPLY CHAIN RESPONSES

- **RAW MATERIAL PRICES**
  - Rapid 2008 price spike in all auto raw material prices ($600-900/vehicle)
  - TPE raw material cost increases:
    - resin production shift to Middle East (“asset light” strategy)
    - decreased resin supplier, Tier 1, Tier 2 profitability
    - legal disputes between OEMs and Tier 1s unable to meet contractual terms developed under a previous raw material cost scenario

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

TPE DYNAMICS AND SUPPLY CHAIN RESPONSES (Cont'd.)

- **TPE SUPPLY CHAIN RESTRUCTURING DRIVEN BY MFG. INEFFICIENCIES AND MACROECONOMIC PRESSURES WILL:**
  - Change path to market for TPEs, TPOs
  - Stimulate TPE substitution (TPOs gain share)
  - Encourage new resin/compound technologies
  - Encourage new fabrication technologies, especially those favoring system cost savings

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

TPE INDUSTRY STRUCTURE SHIFTS

- **SHIFT TO ASIAN PRODUCTION (SBCs, PP COMPOUNDS, o-TPVs?)**
- **MAJOR PP RESIN COMPANIES EXPAND**
  - Global PP compound and TPO footprint - Borealis, LyondellBasell, ExxonMobil, SABIC?
  - PP compound/TPO/o-TPV prod. line synergies
  - Japanese PP suppliers expand TPE product range and global footprint (JPP, Sumitomo, Mitsui, JSR)
  - Middle East presence
  - Asset Light: K-Dow (loss of synergy with elastomers?)
- **SUPPLY CHAIN CONSOLIDATION CONTINUES**
  - DSM spinoff to ?
  - PolyOne/GLS
  - LyondellBasell/SEP
  - Kraton the big “non-event”: no new plant in Asia, no new owner
- **PRODUCT LINE CONSOLIDATION/DISCONTINUATION**

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

SUPPLY CHAIN MOVEMENTS: CHINA IMPACTS

TPE Type	2007 "Was"	2008 "Became"	Impact
o-TPV	SK	Hyundai EP	•Minor, primarily with Korean car manufacturers
o-TPV TPO	Solvay Engineered Plastics	Lyondell Basell	•Business being managed out of the US/already discontinued 1000 Series •Minor China player who could play a bigger role?
o-TPV	DSM	Soon to be announced	•Asian buyer? •Emphasis shift?
SBC	Taiwan PP	LCY	•SBS Plant started in Huizhou •SEBS Technology in Taiwan •SBC Compounds
SBC's		Multibase CTS Kraiburg	•Increasing China activity pursuing their western customer base •Intermaterial competition in air bag doors increases

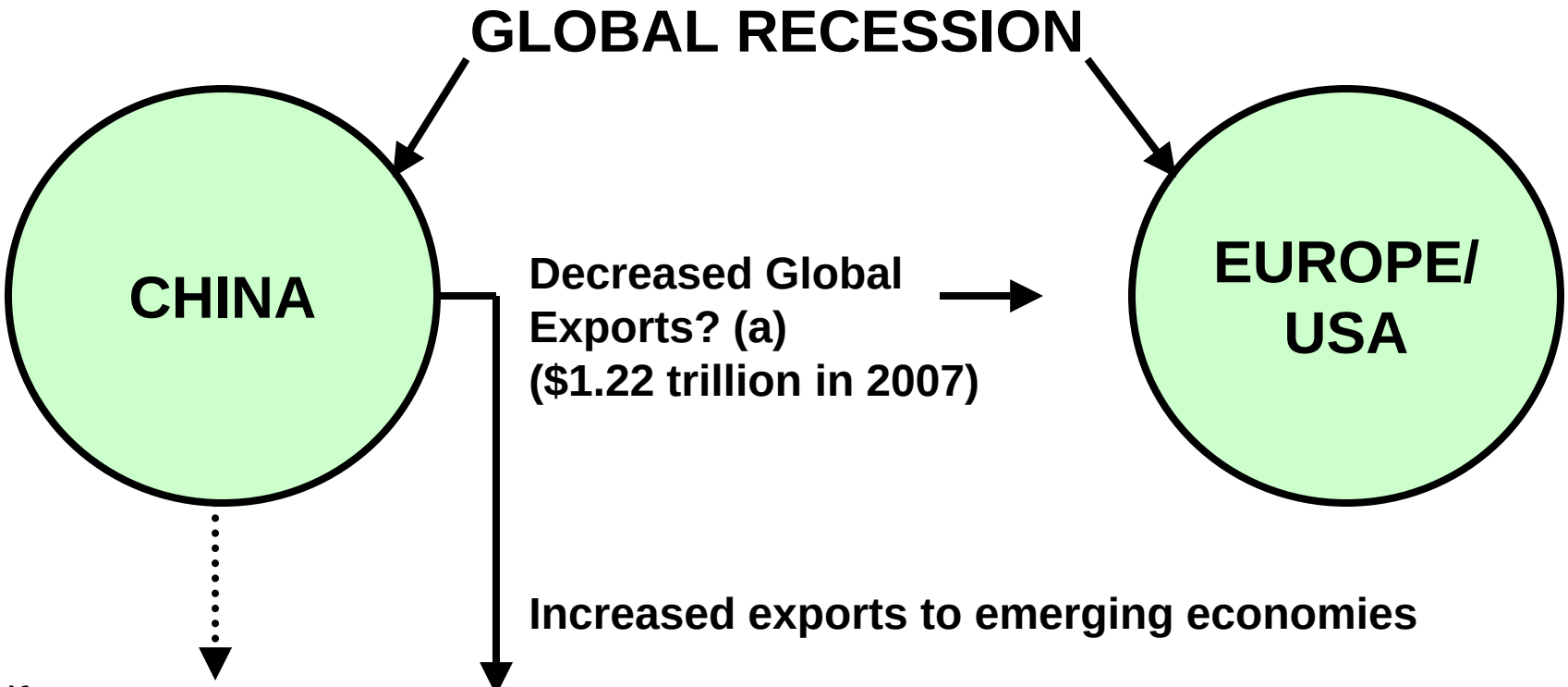
SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

CHINA IMPACTS

- **THE "CHINA PRICE"**
  - Manufacturing in China remains advantageous but has been weakened by:
    - strengthening of the renminbi (6.5% in 2008)
    - increased labor costs (65-80% in 4 years)
    - higher shipping costs for exports
    - slower ship speeds (conserve fuel, add 20% to shipping time)
    - China growth slowing (to 9% from 11-12%/yr)
      - Sustained by exports to emerging economies
      - Turn toward domestic demand
      - Not decoupled from global economic conditions

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

GLOBAL RECESSION: TPE EFFECTS IN CHINA



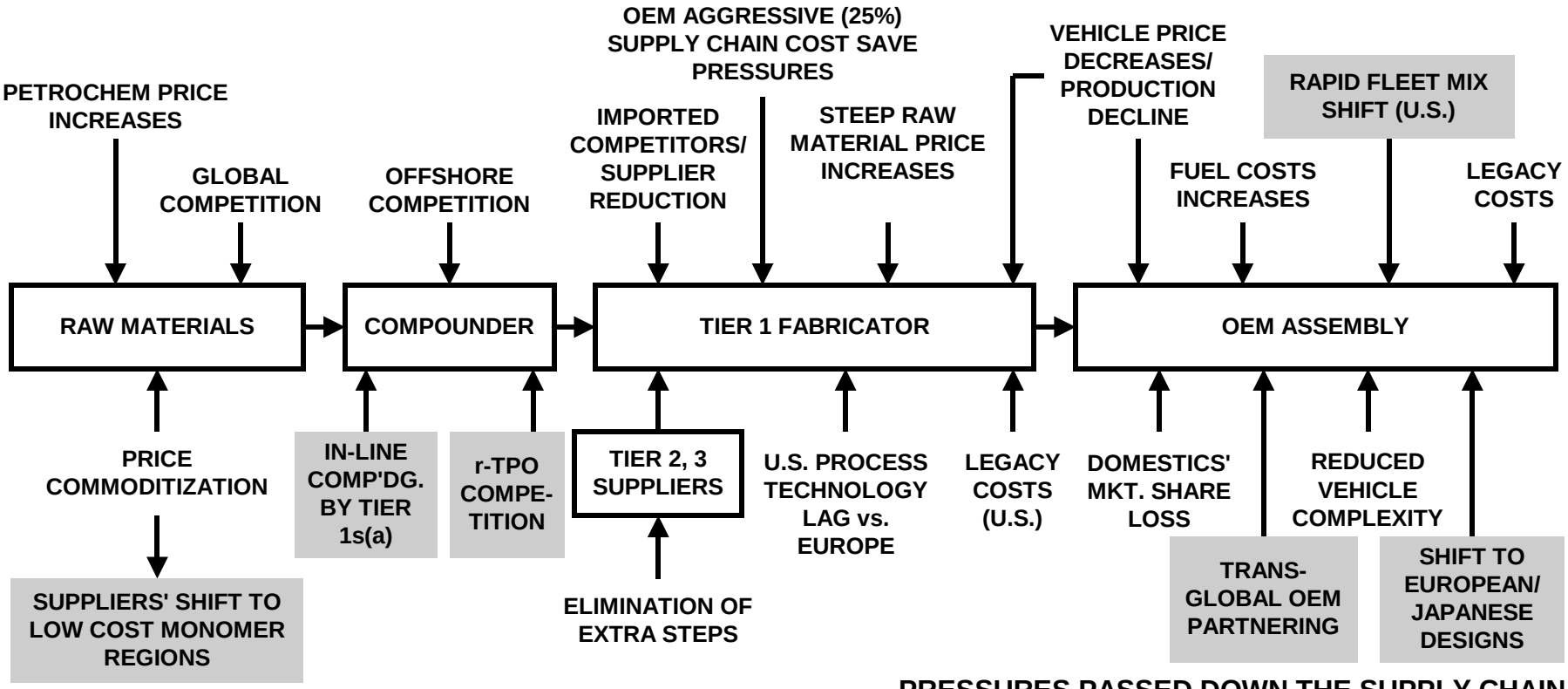
Shift to:

- Domestic TPE end-use markets
- Quality/tiering shift (global → glocal, local)
- Domestic TPE compounders gain share vs. transplant global compounders

NOTE: (a) Europe/US export decline offset by increased exports to emerging economies

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

AUTOPLASTIC SUPPLY CHAIN RESTRUCTURE PRESSURES



PRESSURES PASSED DOWN THE SUPPLY CHAIN

- ← PRICING PRESSURES
- ← SUPPLY CHAIN "MANAGEMENT"
- ← VEHICLE DEMAND SLOWDOWN
- ← REVISED SPECIFICATIONS
- ← GLOBALIZATION PRESSURES
- ← INCREASED EUROPEAN/ JAPANESE INFLUENCE

ELIMINATE/REDUCE THE INEFFICIENCIES:

- MULTIPLE STEPS
- EXCESSIVE LOGISTICS
- SCRAP GENERATION
- INEFFICIENT PROCESS TECHNOLOGIES
- SALES/MARKETING COSTS
- EXCESS LABOR COSTS
- OVER-GLOBALIZATION?

NOTE: (a) STARTING (VIA MASTERBATCH [FOR TPOs] AND GLASS ROVING [GF-PP COMPOUNDS])

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

EXAMPLES OF TPE AND PP TECHNOLOGY RESPONSES TO MARKETPLACE PARADIGM SHIFTS

- 2-shot molding
- In-line and at-press compounding of TPOs
- Increased use of reactor TPOs
- Interior semi-structural substitutions (e.g., elimination of the instrument panel crosscar beam)
- Wall thickness down-gauging
- Body seal systems substitution using o-TPV accelerates
- Growth of injection molded foams
- Multifunctional masterbatches
- Single compound for multiple interior and exterior components
- Increased use of micro-talc in TPO and PP formulations
- Increased use of molded-in color
- Elimination of coating on molded parts

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

TECHNOLOGY RESPONSES

- **2-SHOT MOLDING**
  - Multi-shot molding for small parts is well established to produce a:
    - 3-layer vertical multilayer (e.g., skin/foam/substrate)
    - 2-layer vertical multilayer (e.g., skin/substrate)
    - Side-by-side hard/soft combination (e.g., fan shrouds and cowl vent seals)
  - Current methods for making instrument panels and door trim panels are inefficient:
    - Multiple step process
    - Multi-materials vs. a compatible chemistry structure
    - Difficulty of recycling
    - High scrap rate
    - High labor content
    - Use of coatings

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

TECHNOLOGY RESPONSES (Cont'd.)

- **IN-LINE COMPOUNDING FOR HIGH VOLUME PART PRODUCTION**
  - Initially started with long-glass fiber reinforced thermo-plastics directly at the press
    - 2-stage machine combination
      - Stage 1 for incorporating glass (compounding extruder)
      - Stage 2 for injection molding
  - Shift to in-line TPO compounding (via masterbatch; Dow, ExxonMobil, LyondellBasell)
- **INCREASED USE OF REACTOR TPOs**
  - Resin polymerization technology to tailor molecular architecture and provide TPO directly from the reactor
  - Reactor TPOs + molded-in color = cost savings

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

TECHNOLOGY RESPONSES (Cont'd.)

- **GROWTH OF INJECTION MOLDED FOAMS**
  - The technology for injection molding of TPE foams has advanced slowly but is likely to be stimulated by the:
    - Drive for weight savings
    - Cost savings associated with process step reduction via 2-shot or other processes
    - Development of more sophisticated multifunctional masterbatches
    - Improved control of the pressure cycle during injection

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

TECHNOLOGY RESPONSES (Cont'd.)

- **BODY SEAL/GLAZING SYSTEMS SUBSTITUTION**
  - Manufacturing cost, weight, and energy savings
  - Recycling benefits
  - o-TPV, SEBS substitute for EPDM
  - Ability to co-extrude with rigid PP compounds
- **INCREASED USE OF MICRO-TALC IN TPO AND PP FORMULATIONS**
  - Improved stiffness/impact balance at a lower talc concentration
  - Improved surface quality → exterior panels
- **TRANSPARENCY**
  - Transparent TPEs have recently emerged and are finding applications in a broad range of automotive and non-automotive markets

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

TECHNOLOGY RESPONSES (Cont'd.)

- **"GREEN" PRESSURES**
  - Pressures for a reduced carbon footprint have shifted somewhat from materials selection to fuel economy
  - European materials and process selection have generally been more responsive to legislated environmental requirements (ELV)
  - Bio-based TPEs (especially TPUs)

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

SUMMARY

- **TPE GROWTH, PROFITABILITY, & REGIONAL POSITION ARE BEING AFFECTED BY:**
  - The global economic downturn, which has emphasized the globality and interconnected nature of the TPE marketplace
  - End markets shift to Asia-Pacific
  - Slowing of the China growth engine
  - Sharp global automotive downturn
  - E. Asian rapid growth/price commoditization of SBCs
  - Possible SEBS resin overcapacity risk in Asia
  - A shift in the economics of production in and export from China

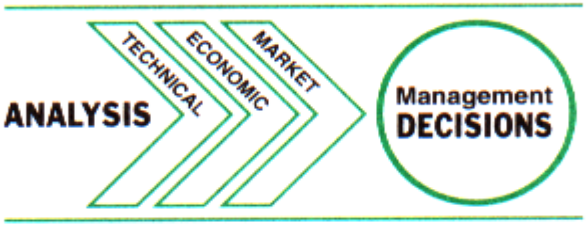
SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

SUMMARY (Cont'd.)

- **THESE CONDITIONS ARE STIMULATING:**
  - TPE investment flow into Asia and other low manufacturing cost regions
  - “Asset light” strategies stimulating investment in Middle East resin production
  - Accelerated shift to lower quality tiers in China
  - Systems cost reduction via TPEs
  - More direct paths to market from TPE compound to fabricated product
  - Further property enhancement to facilitate penetration of rubber markets
  - Competition between SBC-type TPEs & o-TPEs
  - Improvements in light-weighting techniques (foaming, metal substitution)

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

Thank You!



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