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FORECASTING WORLD OUTPUT: THE RISING IMPORTANCE OF EMERGING ASIAN ECONOMIES

by

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Workshop

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AIM and MOTIVATION

Our *AIM:* develop tools for the timely assessment of world economic outlook

Motivation: why do we think this issue requires some thoughts now?

- Deep changes due to rapid growth of Emerging Markets (EM), East Asia in particular
  - G7 shrinking share of world output and trade
  - Breakdown of once reliable relations/instruments
  - Interest in developments in previously marginal areas to gauge growth prospect for the world at large

Roadmap:

- Show the qualitative and quantitative changes in the world economy that we deem most relevant (➔ *changing landscape*)
- Show that these changes have indeed affected previously reliable relationships (➔ *changing links*)
- Introduce simple *bridge models (*BMs) for main economic areas (to forecast the world growth, WBM)
- Pseudo real time assessment of BMs (AR)
- Comparing BM forecasts with IMF's predictions
- The 2007-09 crisis: tracking performance of WBM, WEO and Consensus

Changing landscape 1/3

The rapid growth of the *emerging markets (EM)* and *China* in particular changed the economic landscape:

- The aggregate **share in world output** (PPP) of *Japan, EU and US (JEU)* decreased from 56% in 1990 to 46% in 2008. *China's* weight **alone** grew from 3.6% to 11.4%
- Over the last decade about 2/3 of **world output growth** *originated in EM* (their contribution was around 40% on average during the nineties)

tab. GDP *graph GDP contrib.*

Changing landscape 2/3

- From 1990 to 2008 ***China*** *share on world exports* **grew six-folds** (from 1.5% to 9%) while the *JEU* share **shrunk** from 64% to 44.5%.
- *China's shares have increased in most destination markets*. In 2008 they accounted for the 18.8% of Japanese imports and for the 10.9% in the other G7 economies (G6)
- *China gained importance also as an importer*, accounting for 16% of Japanese exports in 2008 and for about 20% of shipments from Asian exporters

Changing landscape 3/3

- The international fragmentation of production processes among Asian partners has intensified, while *China* has become the central hub of this regional production network (especially in assembling parts and components)

- Linkages among China, other East Asia dynamic economies and Japan have strengthened.

Changing links 1/3

The rise of a new center of gravity may have changed the interdependencies among economies within and across country groups ➔ GDP correlations

- principal diagonal: average pairwise correlation within each country group
- remaining figures measure the correlation across the aggregates
- focus on the G6, East Asian dynamic economies (ASE); surge in correlation between WORLD - ASE
- Higher correlation within the ASE, and in particular with Chinese GDP

Changing links 2/3

To what extent *emerging countries GDP matters to forecast world GDP*?

➔ again focus on EMERGING ASIA (ASE)

➔ starting point: how each country group concurs to explain world GDP growth

$$\Delta y_t^W = \alpha + w^{JEU}\Delta y_t^{JEU} + w^{ASE}\Delta y_t^{ASE} + w^{BRRU}\Delta y_t^{BRRU} + u_t$$

W	= World
JEU	= Japan, Europe, USA
ASE	= China, India, Indonesia, Malaysia, Thailand, Philippines, Hong Kong, Singapore, Korea, Taiwan;
BRRU	= Brazil, Russia ;

→ IV estimates (lagged variables as instruments), to take into account endogeneity issues

***tab*: explaining world GDP growth**

Changing links 3/3

Dynamic relationship among the country groups in the long run → data-congruent VAR (1):

$$\begin{pmatrix} \Delta y_t^{JEU} \\ \Delta y_t^{ASE} \\ \Delta y_t^{BRRU} \end{pmatrix} = \begin{pmatrix} \alpha^{JEU} \\ \alpha^{ASE} \\ \alpha^{BRRU} \end{pmatrix} + \begin{pmatrix} w_{11} & w_{12} & w_{13} \\ w_{21} & w_{22} & w_{23} \\ w_{31} & w_{32} & w_{33} \end{pmatrix} \begin{pmatrix} \Delta y_{t-1}^{JEU} \\ \Delta y_{t-1}^{ASE} \\ \Delta y_{t-1}^{BRRU} \end{pmatrix} + \begin{pmatrix} \nu_t^{JEU} \\ \nu_t^{ASE} \\ \nu_t^{BRRU} \end{pmatrix}$$

➔ growing interrelationship across country groups (increasing correlation among the equation residuals): "*globalization effect*"

➔ growing relevance of **ASE** in predicting the JEU and BRRU GDP growth

➔ emerging economies (especially ASE) should be taken into account in forecasting world GDP growth → "bridge model"

tab **VAR (1) results** | ***G-IRF* 1979-1993** | ***G-IRF* 1994-2010**

TOOLS for short term analysis

Two fundamental steps in short term analysis:

- Assessment of large flow of data (stock mkts, Interest rates, IP, Unempl, etc. etc.): different markets, frequencies and countries, varying reliability, noise…

- Tools, either formal or judgmental, to derive a coherent picture from the selected information

  - *Synthetic indicators*: €-coin, OECD, Conference Board, *Factor models*

  - "*Bridge models*"

What is a bridge model (BM)?

Tool that '*translates*' the info content of short run indicators of single countries/areas *(c)* into the more coherent and complete '*language*' of GDP and national accounts:

$$\Delta GDP_t^c = \alpha + \beta(L) \cdot \Delta GDP_t^c + \underset{(1\times K)}{\Gamma(L)} \cdot \underset{(Kx1)}{X_t^c} + u_t$$

where X_t^c *are the short run variables (Industrial Production* is usually the most relevant coincident variable)

1. *RHS variables* are released much earlier than GDP and are monthly or higher in frequency, while GDP is quarterly or annual.
2. *BM is a "bridge"* that goes from more timely info to GDP (RHS ➔ **LHS**);
3. *map higher frequency data into quarterly figures* (averaging, MIDAS, etc.) and *forecasts to "complete the qtrs…"* (RHS ➔ **RHS**)

Why to use a bridge model (BM)?

- BM is a relatively simple tool to be implemented → new forecasts can be easily produced as updated information become available
- BM often produce reliable forecasts based on a limited set of timely, high frequency variables

  →BM are transparent instruments (e.g. allow to trace developments and changes in forecasts to the behaviour of definite variables)

  →BM can be applied also when large dataset are not available (relevant for *emerging markets* where only a limited number of short term indicators is available).

Countries' BM and the WBM

- For each country of interest (JEU, ASE and BRRU), we build very simple BM regressing GDP growth on its own past, IP growth and its own past and level terms lagged 1 (4th order autoregressive distributed lags):

$$\Delta y_t^i = \alpha^i + \sum_{j=1}^{4} \beta_j^i \Delta y_{t-j}^i + \sum_{j=0}^{4} \gamma_j^i \Delta x_{t-j}^i + \pi_y^i y_{t-1}^i + \pi_x^i x_{t-1}^i + \varepsilon_t^i$$

  - robust *w.r.t.* critique of selecting artificially good models and indicators just because our knowledge of the "future" creeps in BM specification contaminating the reliability of the pseudo out-of-sample predictions.
  - country by country – based on *Schwartz criterion* – we choose the "best" performing model among a range of 4 alternatives.
  - aggregator equation to derive forecasts for country groups (Golinelli and Parigi 2007)

Forecasting performance of the BMs 1/3

- Pseudo forecasting exercise lasts 10 years: 2000-10
- October 1999 is the month in which we start to simulate the behavior of a forecaster who has to predict world/country GDP *(IP available till 2 months before, GDP till 2nd qrt)*
- We obtain predictions over the next two years (*e.g.* 2000-2001), forecasting IP 28 months ahead and GDP 10 quarters ahead
- Steps are repeated for the next 119 months, results are compared with a simple benchmark (AR)

tab. Timing of forecasting exercise

Forecasting performance of the BMs 2/3

Results can be summarized as follows:

- BIAS: short run BM forecast are unbiased, medium run ones are biased upward for *JEU* and downward for *BRRU,* while for *ASE* the mean error is close to zero.
- RMSE: *JEU* countries have lower RMSE than *ASE*
- ratios of BM RMSE over the *benchmark* (AR) are **always below one over horizons up to one year** and very often significantly better than the benchmark
- BM provides a more noticeable improvement in predicting China's GDP with respect to the other ASE countries

Forecasting performance of the BMs 2/3

The relevance of emerging markets (EM):

- comparing the WBM predictions of the world output growth either including or excluding the groups of ASE and BRRU in the aggregator equation
- RMSE ratios between the two models (with EM/without EM) for the different forecasting horizons are computed over two sample periods (2000-2003, histograms in grey, and 2004-2009 in black)

Results:

- the ratios of WBM RMSE are all lower than one → more accurate forecasts using information on ASE and BRRU
- the gain in precision is greater for short term forecasts
- RMSE ratios computed over the second part of the sample (2004-2009) are lower → increasing importance of EM in recent years

graph emerging markets' relevance for WBM forecasts

Evaluating WBM: other forecasters

Our simple WBM is not designed to forecast GDP at the horizons typical of the IMF's WEO and *Consensus*, nor it can compare with them in terms of model complexity and completeness of the information set.

Nonetheless it can be seen as a quick way to update/anticipate the bi-annual WEO's forecasts or as a tool to gauge the changes in the *Consensus* monthly predictions.

Evaluating WBM: **updating** WEO

- from *October of year t to March of year t+1* we "**update**" the WEO October's projection (for years *t+1* and *t+2*);
- from *April till September of year t+1* we "**update**" the WEO April's projection (for years *t+1* and *t+2*);

tab. WBM-WEO - UPDATING

Evaluating WBM: **anticipating** WEO

- from *October of year t to March of year t+1* we "**anticipate**" the WEO April's projection (for years *t+1* and *t+2*);
- from *April till September of year t+1* we "**anticipate**" the WEO October's projection (for years *t+1* and *t+2*);

tab. WBM-WEO ANTICIPATING

Evaluating WBM: **encompassing** WEO

We use a simple forecast encompassing test based on the p-values of λ (Clements, 2005; Fair and Shiller 1990):

$$e_{m,t}^{WBM} = \lambda\,(e_{m,t}^{WBM} - e_{i,t}^{WEO}) + e_{m,t}^{C}$$

$e_{m,t+1}^{WBM} = y_{t+1}^{final} - \hat{y}_{m,t+1}^{WBM}$ is the WBM forecast error in month *m*

$e_{i,t+1}^{WEO} = y_{t+1}^{final} - \hat{y}_{i,t+1}^{WEO}$ is the WEO forecast error in release *i*

Encompassing tests are performed only for year t+1 both w.r.t. previous WEO (*updating*) and next-nearby WEO (*anticipating*)

tab. WBM-WEO ENCOMPASSING

Main results in benchmarking with WEO

- Updating WEO: **WBM** useful tool to update existing forecasts (previous WEO's release)
  - in many cases lower RMSE
  - WBM encompasses previous WEO except in the months when WEO is released
  - the improvement in forecasting precision w.r.t. previous WEO is more remarkable for emerging markets (ASE and BRRU)
- Anticipating next-nearby WEO: WBM moves in line with *next-nearby* WEO:
  - at the beginning of the forecast round, when insufficient high freq info is available, WBM never encompasses *next-nearby* WEO
  - by the end of the year (since September) the WBM's forecasting accuracy is indistinguishable from WEO's
  - in the case of ASE, BM starts encompassing next-nearby WEO forecasts since June

Evaluating WBM: *the Crisis*

- We monitor evolution of forecast for year 2009, produced over the period 2008-2009 by WBM, WEO and *Consensus.* Why 2009?

WEO's release	Forecast for year t+1	Final	Error
Apr. 2006 (*Target: 2007*)	4.7	5.2	0.5
Apr. 2007 (*Target: 2008*)	4.9	3.0	-1.9
Apr. 2008 (*Target: 2009*)	3.8	-0.6	**-4.4**

Graphs Crisis

Main results in tracking the crisis

- WBM's timeliness in predicting the crisis is in line with WEO's updates and *Consensus* forecasts
- WBM's predictions undershoot the final growth rate of 2009 for the world and the advanced countries (until the second half of that year were still almost 1pp below). This compares unfavourably with *Consensus* (WEO under predicted till the last 2009 release).
- For ASE countries (China in particular) the WBM provides a superior forecast in comparison to WEO.

Conclusions

- Emerging Asia has broken the link between advanced economies' growth and world GDP
- Simple *bridge models* for main countries/areas are reasonably good predictors of growth:
  - Compared to benchmark (AR)
  - In updating or anticipating (by the end of the year) WEO, especially for emerging markets
  - In tracking the effects of crisis on growth (WEO, *Consensus*)
- Way forward: construct "real" bridge models for the main areas and use them to obtain a timely and reliable outlook on the world-wide economic situation.

Thank you!

APPENDIX GRAPHS AND TABLES

Gross Domestic Product

(based on purchasing-power-parity (PPP) valuation of country GDP)

	1990	1995	2000	2005	2008
World	*25,626.1*	*32,290.2*	*42,116.0*	*56,504.7*	*69,569.4*
(Billions of US Dollars based on PPP)					
	share of world total				
Japan	9.0	8.7	7.6	6.9	6.2
EU 15	24.2	23.5	22.6	20.6	19.3
United States	22.6	23.0	23.6	22.4	20.8
China	3.6	5.7	7.2	9.4	11.5
NIEs(1)	2.7	3.4	3.6	3.8	3.8
Other Developing Asian Economies(2)	5.5	6.6	6.7	7.5	8.2
Russia	5.6	3.0	2.7	3.0	3.3
Brazil	3.1	3.2	2.9	2.8	2.9

(1) It includes Hong Kong, Rep. of Korea, Singapore, Taiwan.

(2) It includes India, Indonesia, Malaysia, Philippines, Thailand and Viet Nam.

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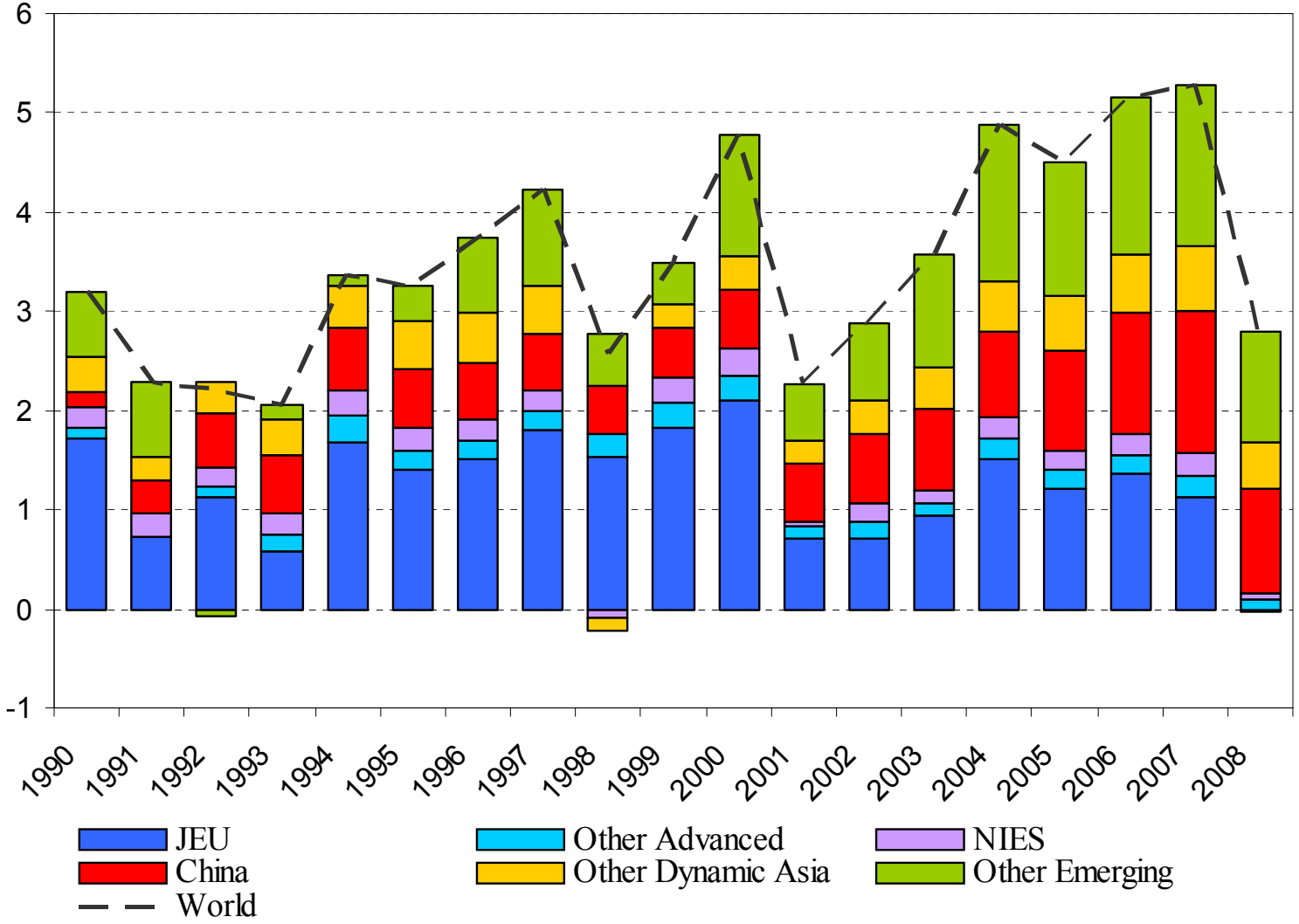
Contributions to world real GDP growth



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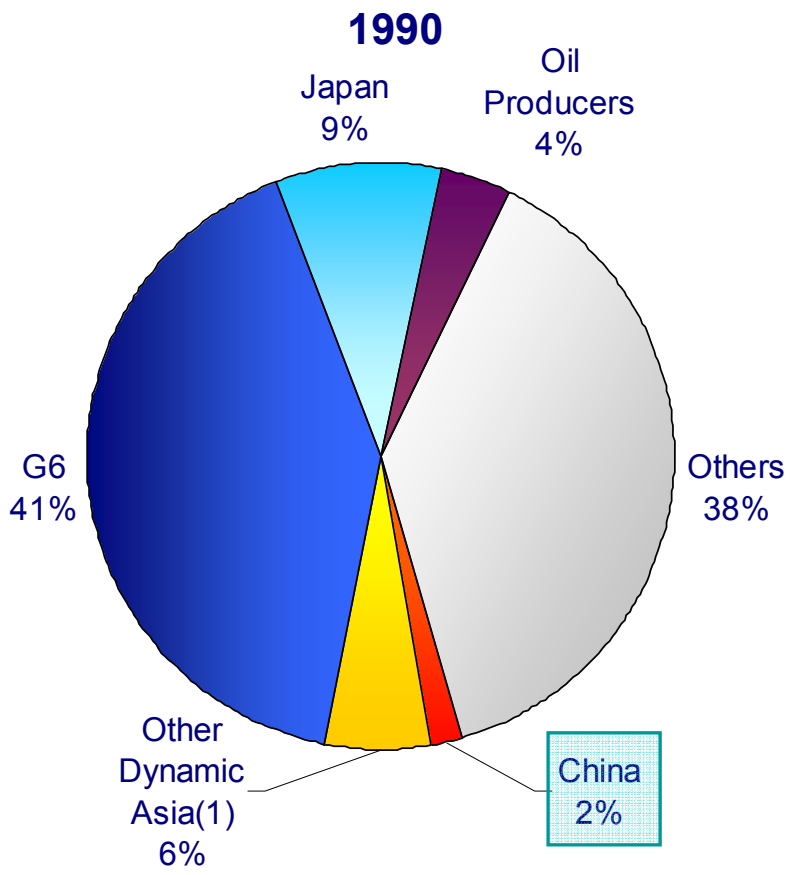
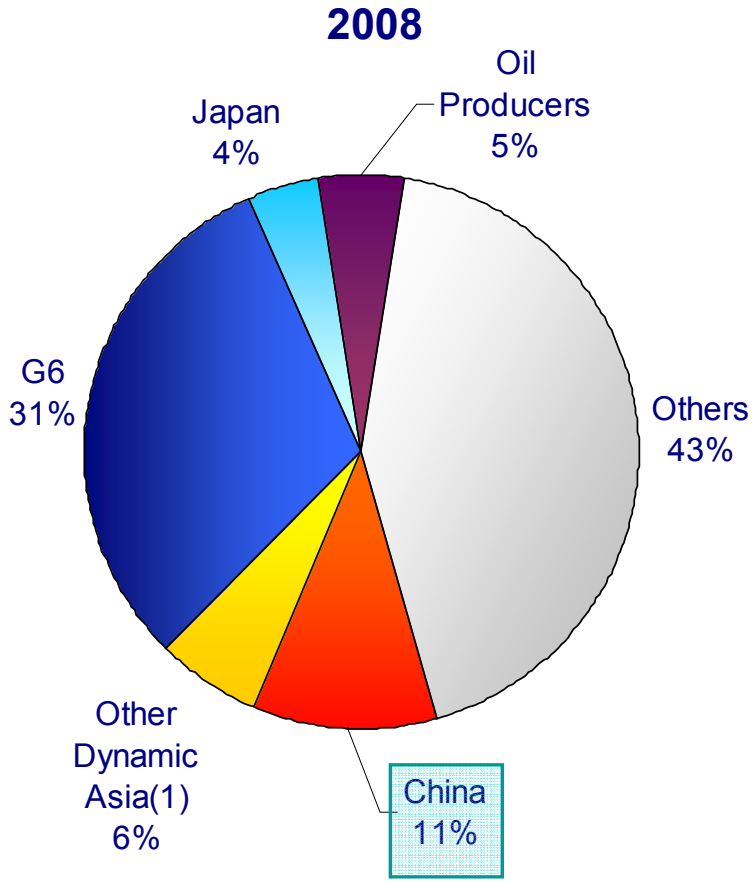
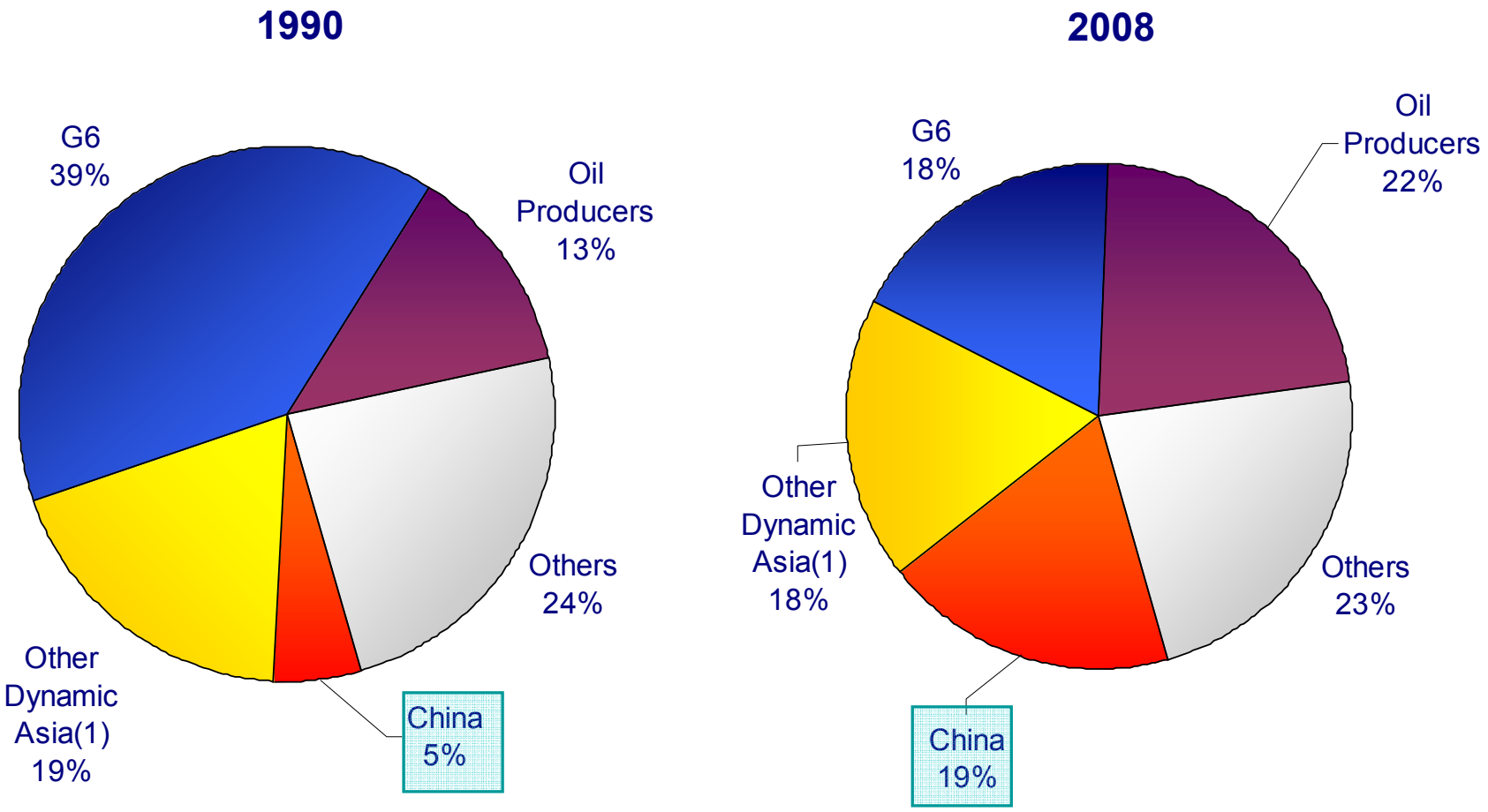
Composition of G6 (EU5+US) imports by origin





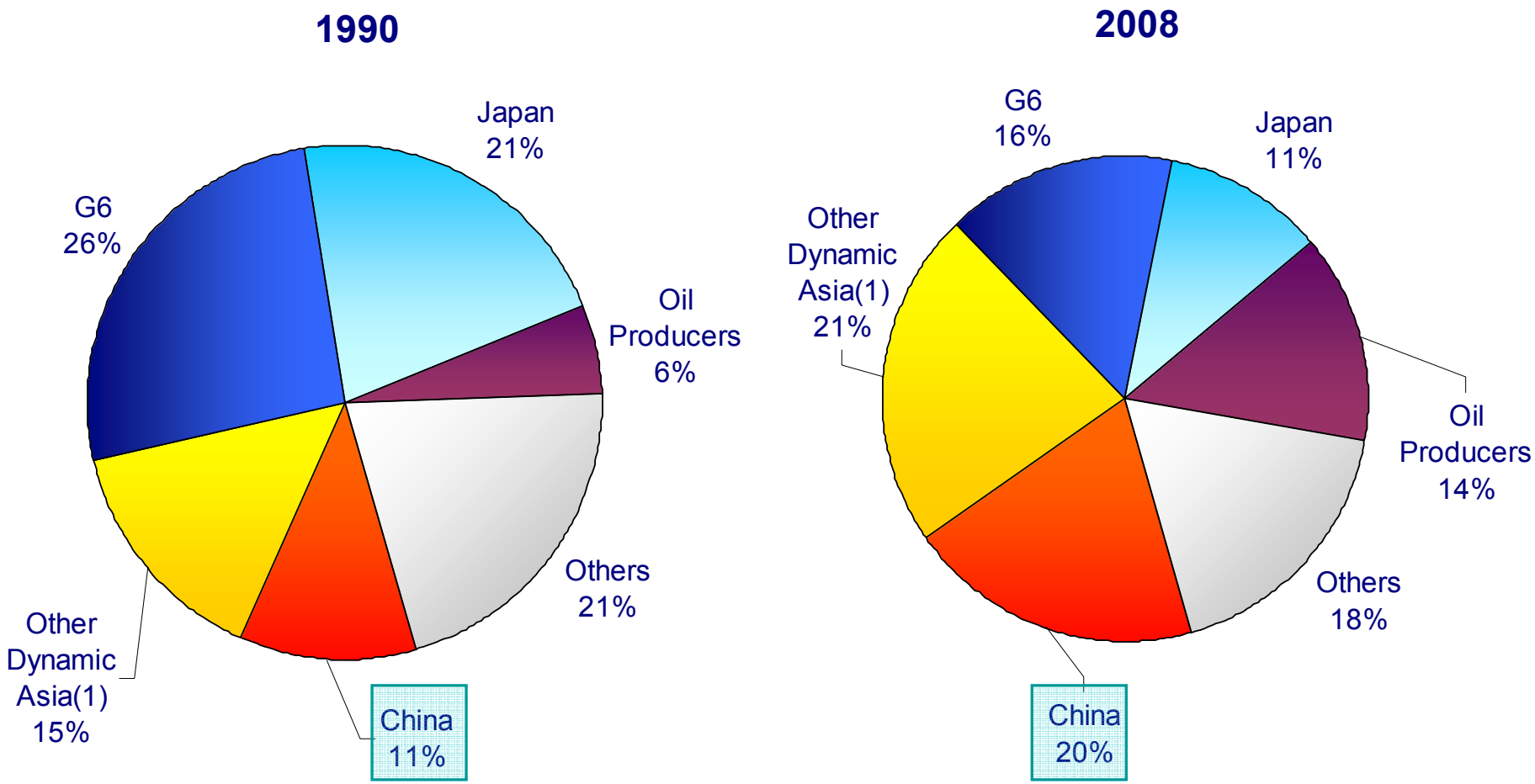
back Japan oth. ASIA

Composition of Japanese imports by origin



back G6 oth. ASIA

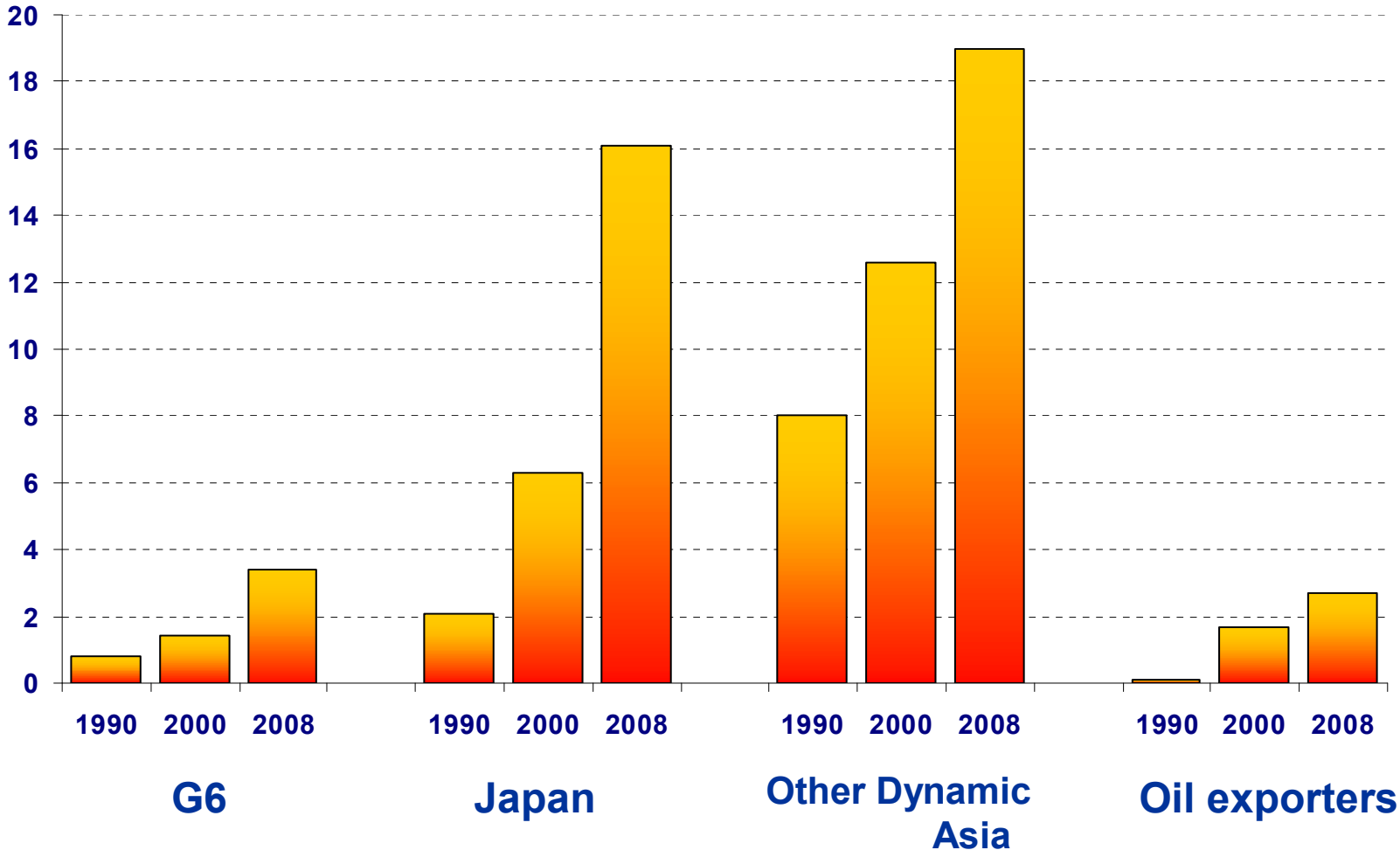
Composition of ASE (excl. China) imports by origin



back G6 Japan

China as a destination market (2)

China's weight in total export from each county/group



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Contemporaneous correlations yearly GDP growth 1/3

(yearly data; intra group average correlation on the principal diagonal)

1951-1970

	WORLD	G6(1)	Japan	China	Oth. Dev. Asia. (2)	NIEs(3)	Russia	Brazil
G6(1)	**0.72**	0.14						
Japan	**0.42**	0.31	1					
China	0.37	0.04	-0.29	1				
Other Developing Asia(2)	0.15	-0.22	**0.44**	-0.10	-0.04			
NIEs(3)	0.05	-0.10	-0.15	0.05	0.20	0.16		
Russia	0.32	-0.18	0.08	0.04	0.24	-0.02	1.00	
Brazil	-0.14	-0.23	0.25	-0.27	0.23	0.02	0.02	1.00

Values greater than 0.4 in bold scripts.

(1) It includes Canada, France, Germany Italy, U.K., U.S.A. (2) It includes India, Indonesia, Malaysia, Philippines, Thailand and Viet Nam. (3) It includes Hong Kong, Rep. of Korea, Singapore, Taiwan.

back | tab. 1951-1970 | tab. 1971-1990 | tab. 1991-2008 | China-Asia

Contemporaneous correlations yearly GDP growth 2/3

(yearly data; intra group average correlation on the principal diagonal)

1971-1990

	WORLD	G6(1)	Japan	China	Oth. Dev. Asia. (2)	NIEs(3)	Russia	Brazil
G6(1)	**0.93**	**0.54**						
Japan	**0.63**	**0.63**	1					
China	0.05	0.23	0.21	1				
Other Developing Asia(2)	0.11	0.11	0.21	-0.03	0.24			
NIEs(3)	**0.80**	**0.76**	**0.41**	0.08	0.16	0.39		
Russia	**0.50**	0.37	0.00	0.00	0.21	**0.61**	1.00	
Brazil	**0.53**	0.31	0.12	-0.21	-0.31	0.25	**0.42**	1.00

Values greater than 0.4 in bold scripts.

(1) It includes Canada, France, Germany Italy, U.K., U.S.A. (2) It includes India, Indonesia, Malaysia, Philippines, Thailand and Viet Nam. (3) It includes Hong Kong, Rep. of Korea, Singapore, Taiwan.

back | tab. 1951-1970 | tab. 1971-1990 | tab. 1991-2008 | China-Asia

Contemporaneous correlations yearly GDP growth 3/3

(yearly data; intra group average correlation on the principal diagonal)

1991-2008

	WORLD	G6(1)	Japan	China	Oth. Dev. Asia. (2)	NIEs(3)	Russia	Brazil
G6(1)	**0.49**	**0.46**						
Japan	**0.45**	0.01	1					
China	-0.01	-0.10	0.18	1				
Other Developing Asia(2)	**0.52**	-0.10	**0.62**	**0.51**	**0.45**			
NIEs(3)	0.15	0.13	**0.67**	**0.40**	**0.63**	**0.61**		
Russia	**0.65**	0.00	0.21	-0.51	0.20	-0.16	1.00	
Brazil	**0.52**	0.00	**0.30**	0.35	**0.59**	0.29	0.20	1.00

Values greater than 0.4 in bold scripts.

(1) It includes Canada, France, Germany Italy, U.K., U.S.A. (2) It includes India, Indonesia, Malaysia, Philippines, Thailand and Viet Nam. (3) It includes Hong Kong, Rep. of Korea, Singapore, Taiwan.

back | tab. 1951-1970 | tab. 1971-1990 | tab. 1991-2008 | China-Asia

China: contemporaneous correlations yearly GDP growth with other Asian economies

	1951-1970	1971-1990	1991-2008
Japan	-0.29	0.21	0.18
NIES	0.05	0.08	**0.40**
Hong Kong	*0.08*	*-0.08*	***0.50***
Korea	*0.01*	*0.16*	*0.22*
Singapore	*-0.18*	*-0.27*	***0.55***
Taiwan	*0.38*	*0.05*	***0.46***
Other Developing Asia(2)	-0.10	-0.03	**0.51**
India	*-0.05*	*0.24*	*0.17*
Indonesia	*-0.10*	*-0.36*	***0.49***
Malaysia	*-0.29*	*-0.37*	***0.49***
Thailand	*-0.12*	*0.02*	***0.55***
Philippines	*0.13*	*-0.62*	*0.08*
Vietnam	*0.13*	*-0.03*	***0.70***

Values greater than 0.4 in bold scripts.

(1) It includes Canada, France, Germany Italy, U.K., U.S.A. (2) It includes India, Indonesia, Malaysia, Philippines, Thailand and Viet Nam. (3) It includes Hong Kong, Rep. of Korea, Singapore, Taiwan.

back | tab. 1951-1970 | tab. 1971-1990 | tab. 1991-2008 | China-Asia

Explaining the World GDP growth

dependent variable: **World GDP growth**

	(1)
Sample period	**1979 Q1-2010 Q1**
observations	125
constant	0.0008
JEU GDP growth	0.5188 ***
ASE GDP growth	0.2150
BRRU GDP growth	0.1403 ***
sum of *w(i)*	0.8740

Godfrey AC (p-val):	
- 1st order	0.0851
- 4th order	0.2781
Andrews breakpoint:	
- Sup F-statistic ((p-val)	0.0000
Hausman test:	
- weak exogeneity	0.0267

- Hausman test: regressors are not exogenous → *IV*
- Godfrey AC test: no residuals autocorrelation → *lagged variables may be valid instruments*
- Evidence of parameter instability
- *Two estimation subperiods*

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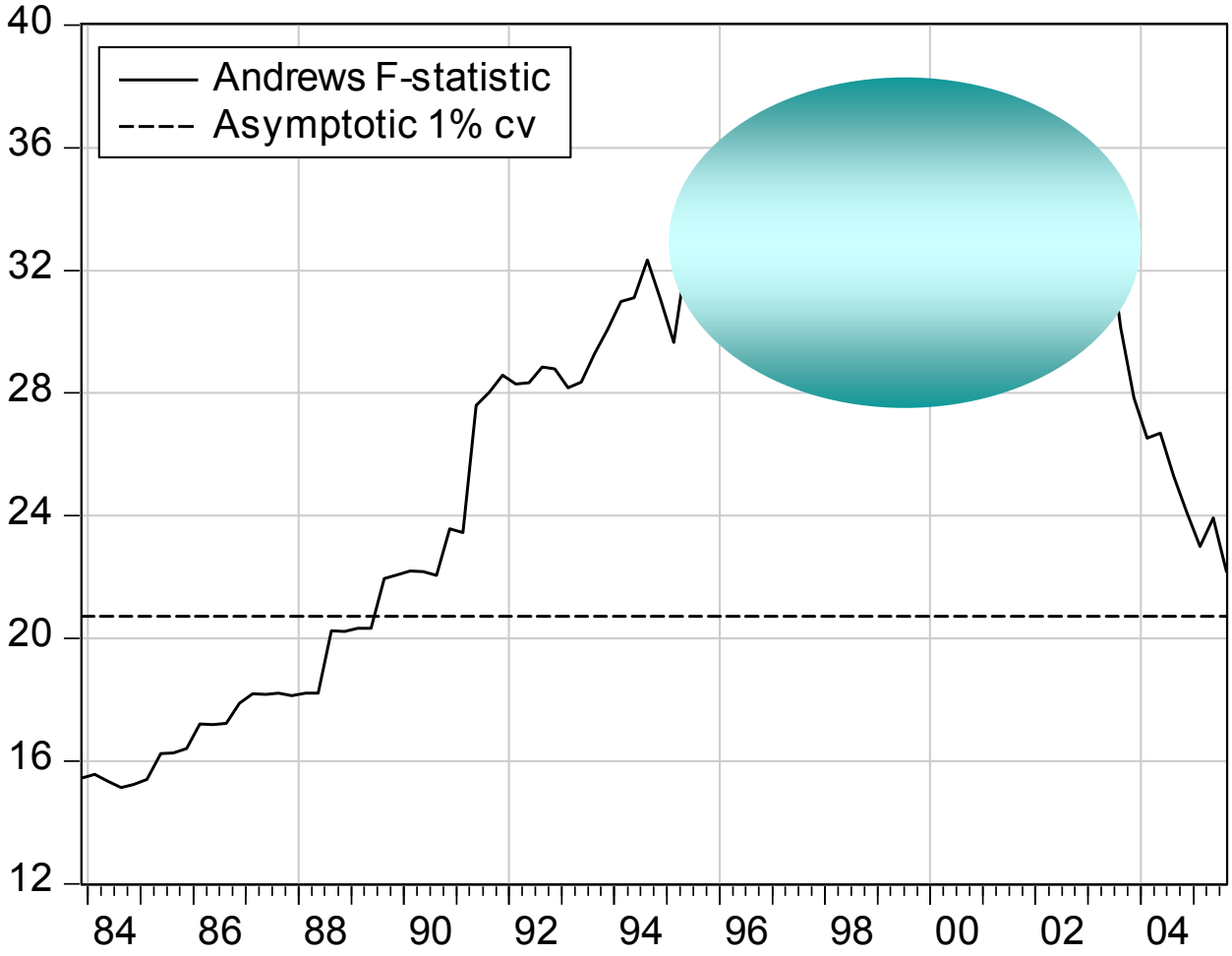
Explaining the World GDP growth: a change in the relationship

Results of the Andrews (1993) statistic for breaking points



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Explaining the World GDP growth

dependent variable: **World GDP growth**

	(1)	(2)	(3)
Sample period	**1979 Q1-2010 Q1**	**1979 Q1-1993 Q4**	**1994 Q1-2010 Q1**
observations	125	60	65
constant	0.0008	0.0019	-0.0016
JEU GDP growth	0.5188 ***	0.8214 ***	0.5376 ***
ASE GDP growth	0.2150	-0.0001	0.4186 ***
BRRU GDP growth	0.1403 ***	0.0683 *	0.0649 *
sum of *w(i)*	0.8740	0.8896	1.0210
Godfrey AC (p-val):			
- 1st order	0.0851	0.7470	0.6772
- 4th order	0.2781	0.8677	0.0773
Andrews breakpoint:			
- Sup F-statistic ((p-val)	0.0000		
Hausman test:			
- weak exogeneity	0.0267		

- **Strong reduction in the elasticity of world GDP to JEU growth, in favour of a growing importance of Asian countries, in the second subperiod (1994-2010) .**

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VAR (1) dynamic relationship among the country groups

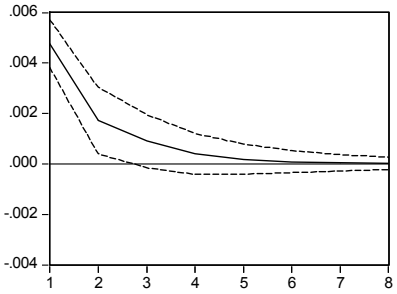
	(1)	(2)	(3)
Sample period	**1979 Q1 2010 Q1**	**1979 Q1 1993 Q4**	**1994 Q1 2010 Q1**
observations	125	60	65
Non Granger causality NGC (p-values)			
- ASE NGC JEU	**0.002**	0.147	**0.006**
- BRRU NGC JEU	0.280	0.886	**0.035**
- JEU NGC ASE	0.154	0.210	0.710
- BRRU NGC ASE	0.646	0.566	0.747
- JEU NGC BRRU	0.141	0.574	0.194
- ASE NGC BRRU	0.151	0.459	**0.001**
Correlation between VAR shocks			
- JEU, ASE	-0.027	-0.280	0.296
- JEU, BRRU	0.191	0.053	0.294
- ASE, BRRU	0.101	-0.054	0.131

- Relevant changes occurred in the second part of the sample (non-Granger causality and **correlation coefficients between VAR shocks**)
- In the second subperiod it clearly emerges a **significant role of Asean countries in predicting the GDP growth** of both JEU and BRRU countries.
- Increasing **simultaneous correlation** between JEU reduced-form shocks and both ASE and BRRU countries → "globalization effect"

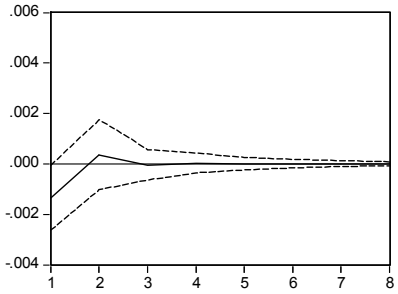
back | *G-IRF* 1979-1993 | *G-IRF* 1994-2010

Generalized IRF 1979-1993

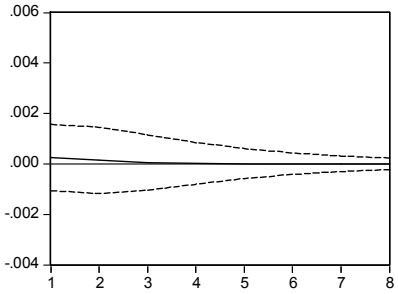
JEU → JEU



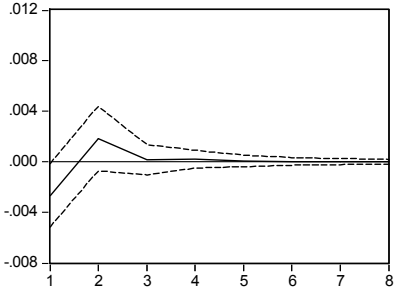
ASEAN → JEU



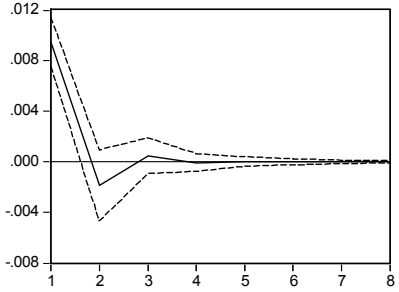
RES→ JEU



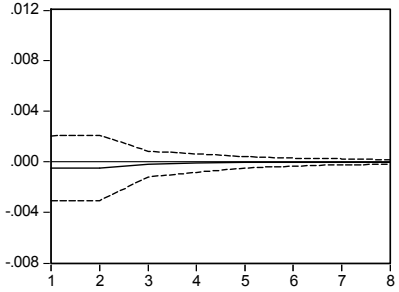
JEU → ASEAN



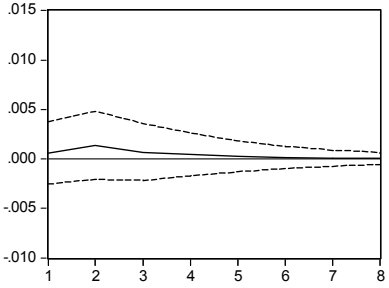
ASEAN→ ASEAN



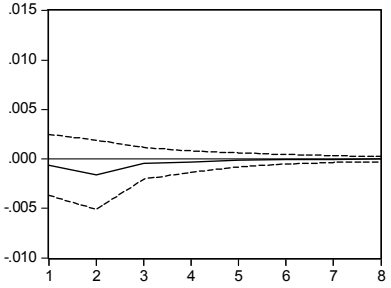
RES→ ASEAN



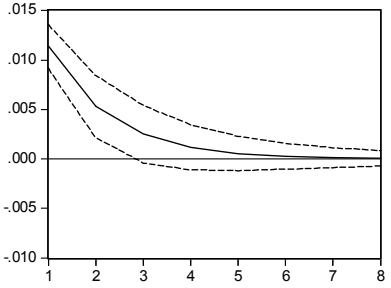
JEU → RES



ASEAN→ RES

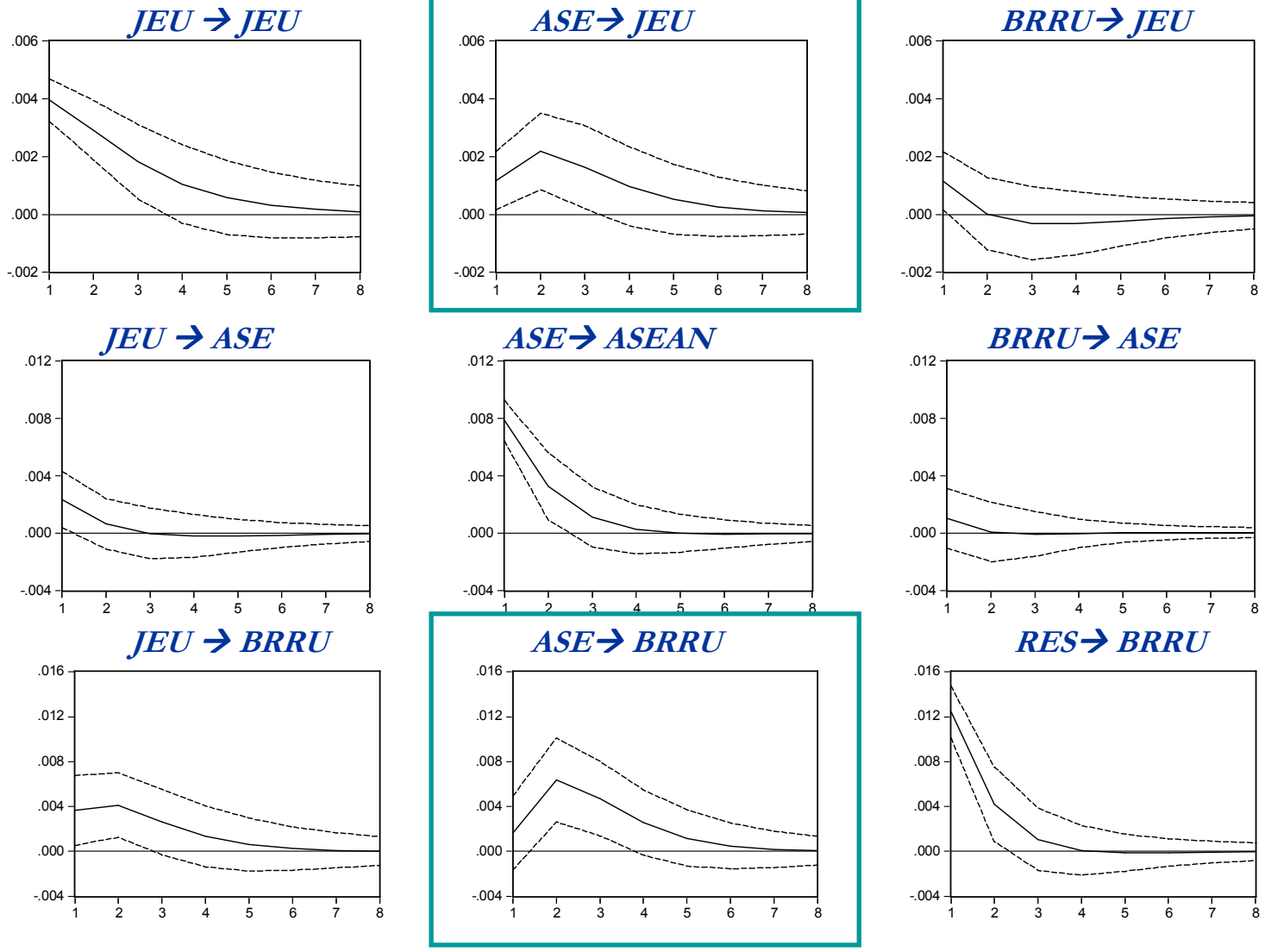


RES→ RES



back | *G-IRF* 1979-1993 | *G-IRF* 1994-2010

Generalized IRF 1994-2010



back | G-IRF 1979-1993 | G-IRF 1994-2010

Timing of forecasting exercise:

Month of forecast for WBM	***IP***		***GDP***		***Years predicted***
	Last available month	*forecast horizon (in months)*	*data availability*	*Last available quarter*	
October (t)	**m8**	**28**	**q2**	**10**	**t+1, t+2**
November(t)	m9	27	q2	10	t+1, t+2
December (t)	m10	26	q3	9	t+1, t+2
January (t+1)	m11	25	q3	9	t+1, t+2
February (t+1)	m12	24	q3	9	t+1, t+2
March (t+1)	m1	23	q4	8	t+1, t+2
April (t+1)	**m2**	**22**	**q4**	**8**	t+1, t+2
May (t+1)	m3	21	q4	8	t+1, t+2
June (t+1)	m4	20	q1	7	t+1, t+2
July (t+1)	m5	19	q1	7	t+1, t+2
August (t+1)	m6	18	q1	7	t+1, t+2
September (t+1)	m7	17	q2	6	t+1, t+2

back

Assessment of the GDP forecasting ability of the BM 1/3

	GDP forecast horizon					
	1 qrt			*2 qrts*	*4 qrts*	*6 qrts*
	with 1m	*with 2m*	*with 3m*			
World						
ME	0.150	0.170	0.184	0.325	0.513	0.463
RMSE	0.463	0.405	0.380	0.736	1.762	2.436
ratio to AR	**0.715** a	**0.635** b	**0.596** b	**0.612** a	**0.854** a	1.010 a
JEU						
ME	-0.039	-0.005	0.015	-0.053	-0.336	-0.987
RMSE	0.335	0.275	0.241	0.593	1.834	2.666
- ratio to AR	**0.563** a	**0.466** a	**0.408** a	**0.494** b	0.774 b	0.896
ASEAN						
ME	-0.060	-0.067	-0.065	-0.102	-0.047	-0.035
RMSE	0.544	0.497	0.480	0.821	1.628	2.379
- ratio to AR	0.727 a	0.664 a	0.642 a	0.647 a	0.827 a	1.046
BRRU						
ME	0.097	0.112	0.083	0.266	0.774	1.227
RMSE	0.738	0.717	0.718	1.216	3.220	4.377
- ratio to AR	0.545 b	**0.533** a	**0.534** a	**0.493** a	0.745 a	0.770 a

(1) Ratios are reported in italic when GW is significant at 10%, in bold when it is significant at 5%; further, a means that BM parameter in FS equation is 5% significant while AR is not, b both parameters are significant. For GW test, we use the test function ht = (1, ΔLt-τ).

back JEU ASEAN

Assessment of the GDP forecasting ability of the BM 2/3
JEU

	GDP forecast horizon					
	1 qrt			*2 qrts*	*4 qrts*	*6 qrts*
	with 1m	*with 2m*	*with 3m*			
US						
ME	-0.034	0.006	0.041	-0.020	-0.337	-1.147
RMSE	0.510	0.486	0.462	0.817	2.096	2.734
ratio to AR	*0.759* [a]	**0.736** [a]	**0.699** [a]	**0.724** [a]	0.956 [a]	0.963
EU						
ME	0.353	0.364	0.364	0.719	1.462	2.016
RMSE	-0.105	-0.070	-0.062	-0.197	-0.590	-1.253
- ratio to AR	**0.563** [b]	**0.423** [a]	**0.385** [a]	**0.424** [b]	**0.734** [a]	0.950
Japan						
ME	0.166	0.185	0.197	0.334	0.539	0.478
RMSE	0.760	0.690	0.648	1.269	2.881	3.938
- ratio to AR	**0.608** [a]	**0.553** [a]	**0.519** [a]	**0.612** [a]	0.817 [a]	0.995

(1) Ratios are reported in italic when GW is significant at 10%, in bold when it is significant at 5%; further, a means that BM parameter in FS equation is 5% significant while AR is not, b both parameters are significant. For GW test, we use the test function ht = (1, ΔLt-τ).

back WORLD ASEAN

Assessment of the GDP forecasting ability of the BM 3/3

ASEAN (selected countries)

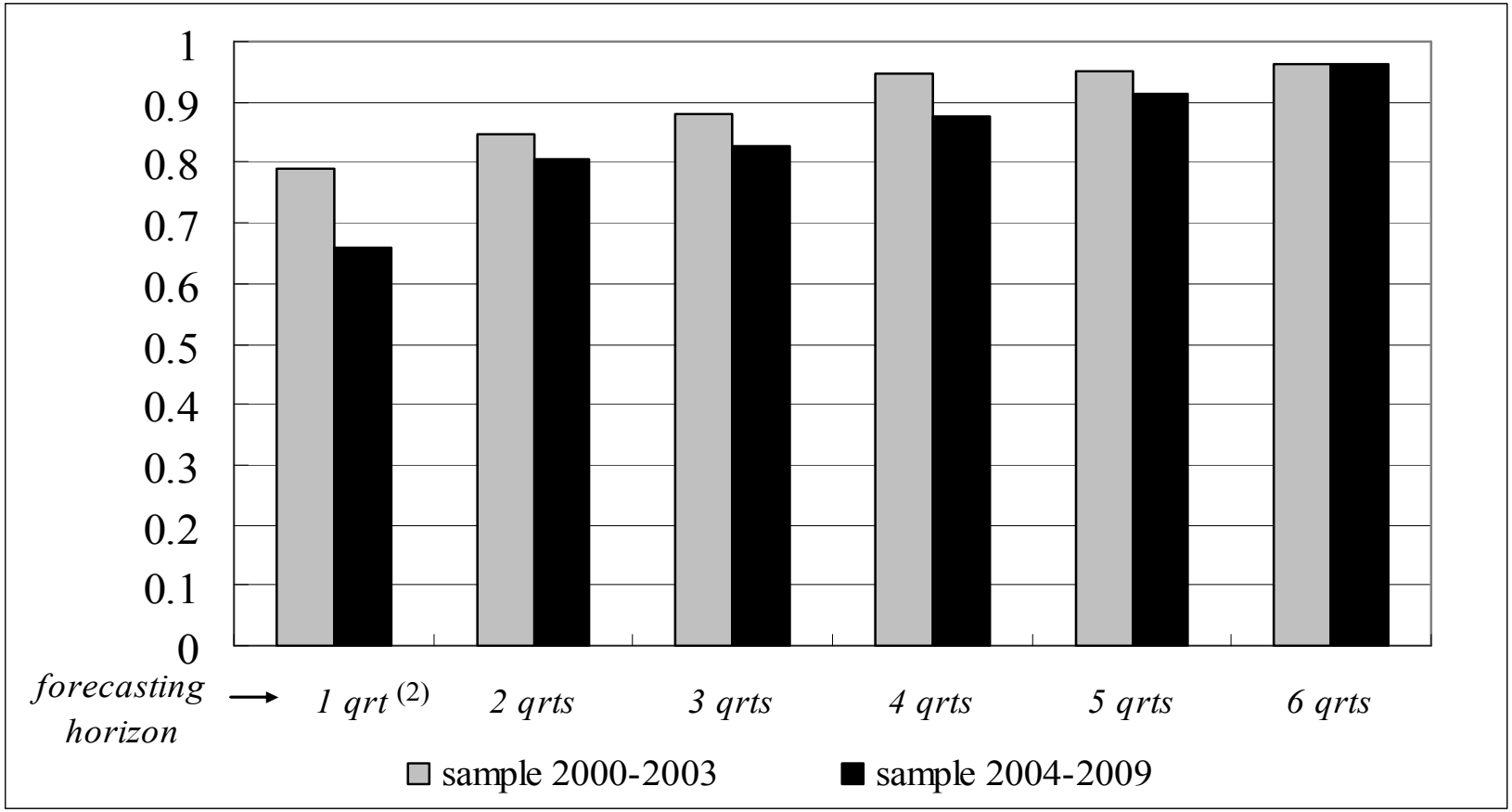
	GDP forecast horizon					
	1 qrt			*2 qrts*	*4 qrts*	*6 qrts*
	with 1m	*with 2m*	*with 3m*			
China						
ME	-0.199	-0.202	-0.209	-0.339	-0.358	-0.337
RMSE	0.774	0.739	0.731	1.019	1.286	2.091
ratio to AR	**0.893** [a]	*0.848* [a]	0.838 [a]	**0.767** [a]	0.842 [a]	1.057
India						
ME	0.230	0.238	0.218	0.407	0.911	1.467
RMSE	1.162	1.154	1.099	1.549	2.529	3.427
ratio to AR	0.976 [a]	0.968 [a]	0.922 [a]	0.934 [a]	0.958 [a]	1.006
Indonesia						
ME	0.292	0.269	0.271	0.641	1.432	2.308
RMSE	0.990	0.990	0.992	1.433	2.127	2.933
ratio to AR	0.985	0.987	0.989	1.068	*1.238*	*1.359*
Korea						
ME	-0.197	-0.306	-0.245	-0.495	-1.287	-2.122
RMSE	1.311	0.979	0.918	1.662	3.100	3.948
ratio to AR	0.999 [a]	0.758 [a]	0.711 [a]	**0.754** [a]	0.925 [a]	0.955 [a]

(1) Ratios are reported in italic when GW is significant at 10%, in bold when it is significant at 5%; further, a means that BM parameter in FS equation is 5% significant while AR is not, b both parameters are significant. For GW test, we use the test function ht = (1, ΔLt-τ).

back WORLD JEU

Emerging markets' relevance for WBM forecasts

Ratios between WBM that include or exclude emerging countries(1)



(1) Bars represents the ratios of the RMSE incurred when predicting world GDP with a bridge model that includes emerging economies (ASE and BRRU) and the RMSE computed when the bridge model includes only advanced economies (JEU). (2) Results refer to the case in which the conditioning IP is known for all three months of the quarter (nowcast).

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WBM: *updating WEO*

Month of forecast for WBM	***Month of WEO release used for comparison***	**TARGET YEAR *"t + 1"***	
		RMSE of last WEO predictions w.r.t."final" estimates	*RMSE of WBM predictions w.r.t."final" estimates*
October (t)	*October (t)*	1.53	1.76
November(t)			1.66
December (t)			1.46
January (t+1)			1.08
February (t+1)			0.99
March (t+1)			0.97
April (t+1)	*April (t+1)*	0.52	1.01
May (t+1)			0.87
June (t+1)			0.77
July (t+1)			0.72
August (t+1)			0.68
September (t+1)			0.38

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WBM: *anticipating WEO*

Month of forecast for WBM	***Month of WEO release used for comparison***	**TARGET YEAR "*t + 1*"**		
		RMSE of WBM w.r.t. "next-nearby" WEO predictions	*RMSE of "next-nearby" WEO predictions w.r.t."final" estimates*	*RMSE of WBM predictions w.r.t."final" estimates*
October (t)	April (t+1)	1.74	0.52	1.76
November(t)		1.62		1.66
December (t)		1.40		1.46
January (t+1)		0.89		1.08
February (t+1)		0.61		0.99
March (t+1)		0.51		0.97
April (t+1)	October (t+1)	0.73	0.37	1.01
May (t+1)		0.60		0.87
June (t+1)		0.54		0.77
July (t+1)		0.54		0.72
August (t+1)		0.55		0.68
September (t+1)		0.23		0.38

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WBM – WEO Encompassing *p-values*

2009 outlier effect

Month of forecast for WBM	*Month of WEO release used for comparison*	TARGET YEAR *"t + 1"*							
		World		JEU		ASE		BRRU	
		updating		updating		updating		updating	
October (t)	*October (t)*	0.10		0.08		0.67		0.30	
November(t)		0.28		0.21		0.94		0.45	
December (t)		0.50		0.45		0.71		0.82	
January (t+1)		0.48		0.90		0.21		0.00	
February (t+1)		0.71		0.17		0.00		0.98	
March (t+1)		0.04		0.03		0.02		0.89	
April (t+1)	*April (t+1)*	0.00		0.00		0.11		0.72	
May (t+1)		0.00		0.00		0.22		0.38	
June (t+1)		0.21		0.02		0.53		0.08	
July (t+1)		0.20		0.04		0.57		0.33	
August (t+1)		0.23		0.07		0.26		0.25	
September (t+1)		0.43		0.03		0.82		0.89	

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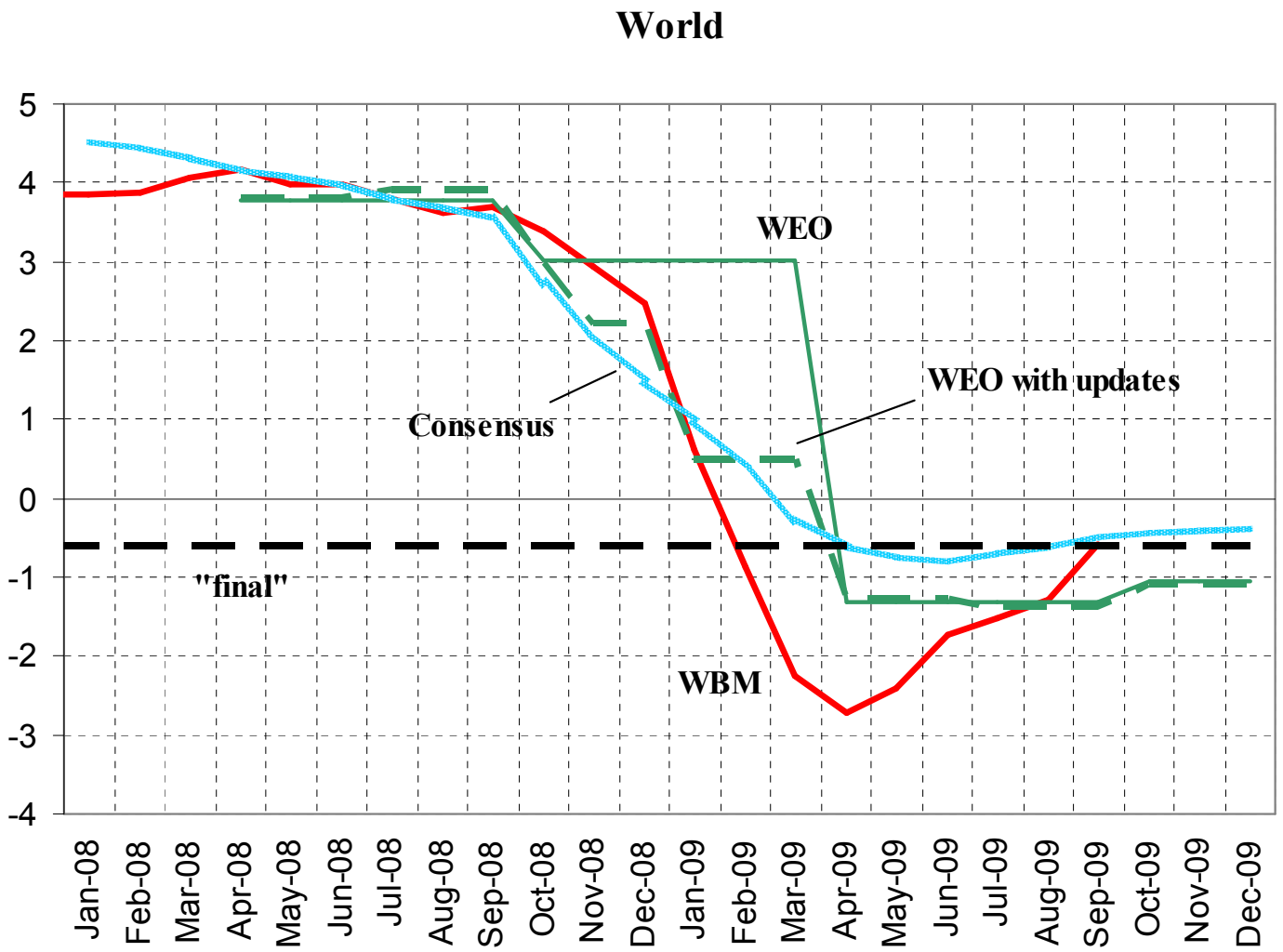
Graph crisis 1/2



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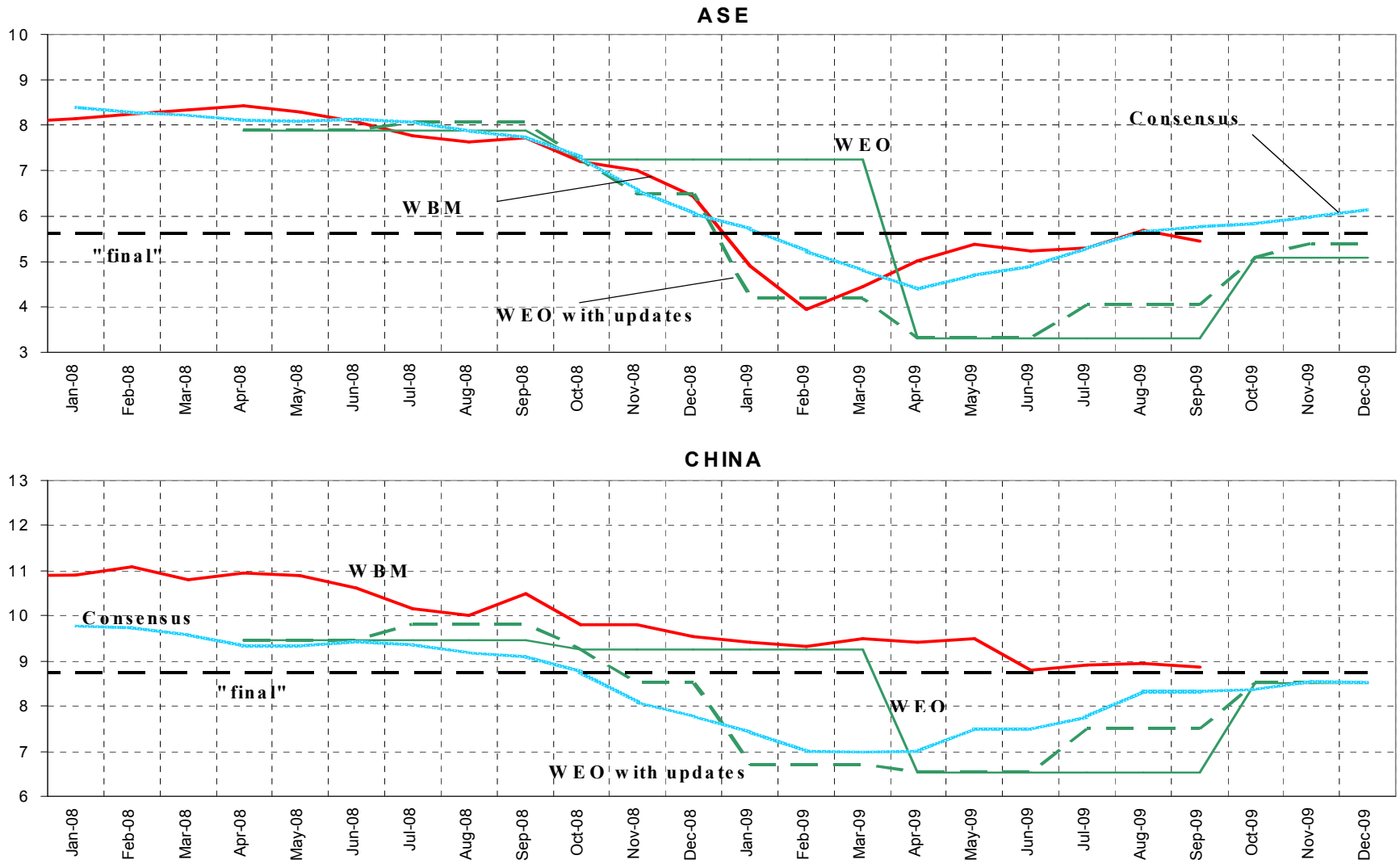
Graph crisis 2/2



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