

Trade Linkages and Business Cycle Transmissions in Small Open East-Asian Markets

By

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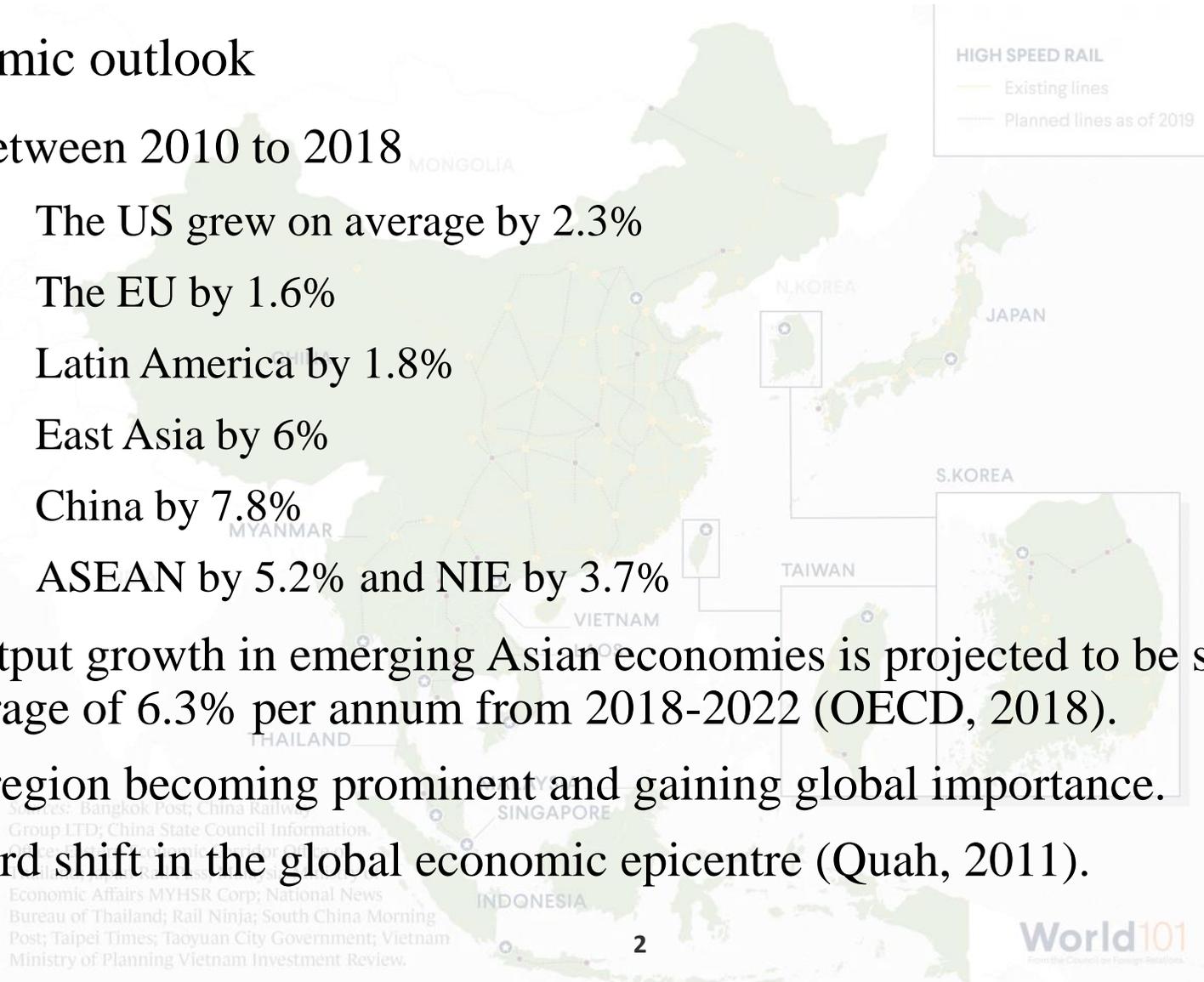
Presenter

Mala Raghavan



The East Asian Markets

- Economic outlook
 - Between 2010 to 2018
 - The US grew on average by 2.3%
 - The EU by 1.6%
 - Latin America by 1.8%
 - East Asia by 6%
 - China by 7.8%
 - ASEAN by 5.2% and NIE by 3.7%
 - The output growth in emerging Asian economies is projected to be strong with an average of 6.3% per annum from 2018-2022 (OECD, 2018).
 - Asian region becoming prominent and gaining global importance.
 - Eastward shift in the global economic epicentre (Quah, 2011).

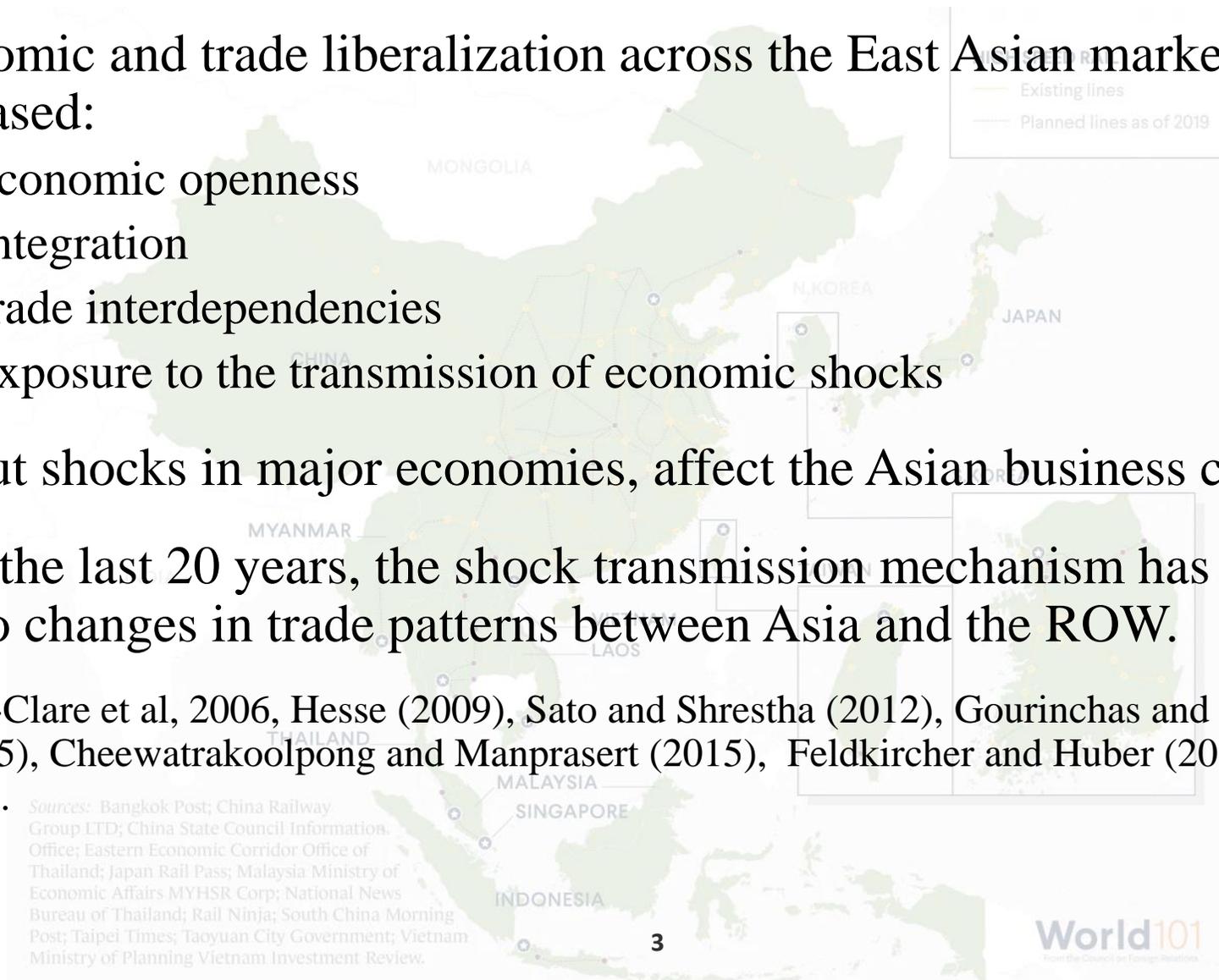


The East Asian Markets

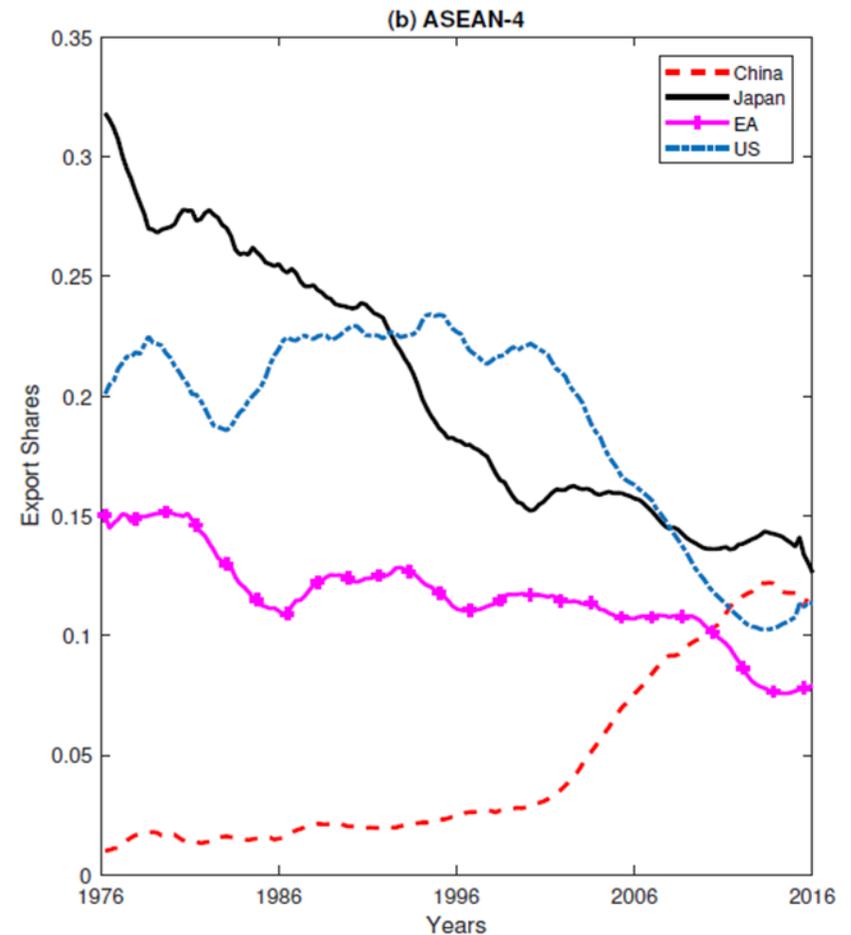
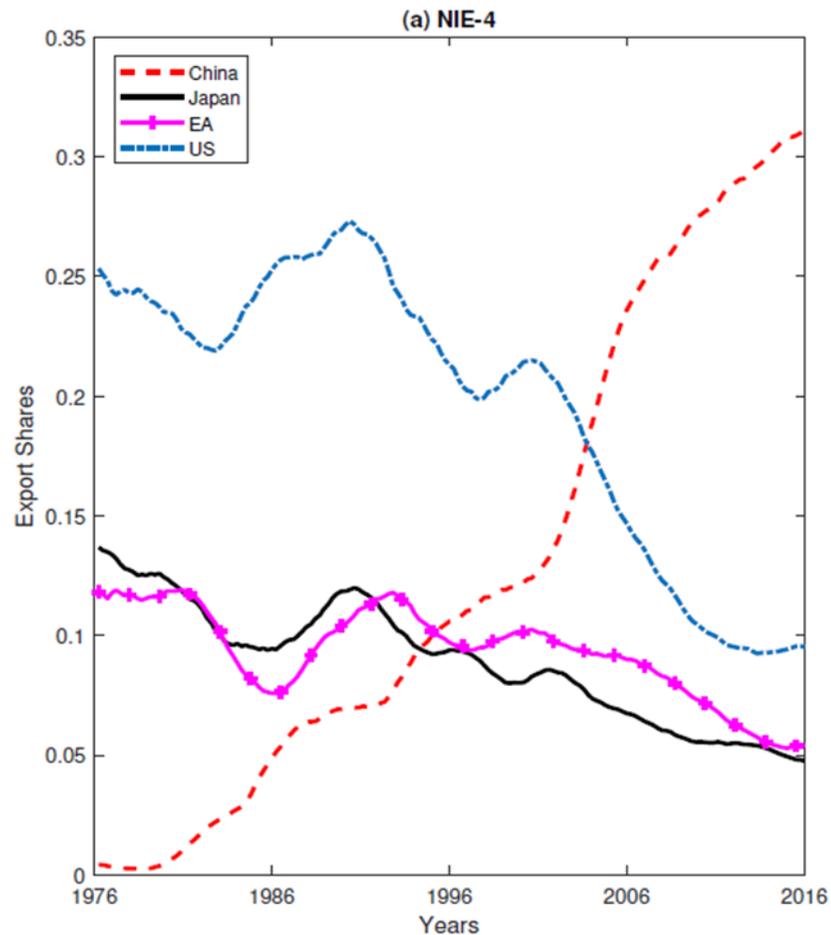
- Economic and trade liberalization across the East Asian markets have increased:
 - economic openness
 - integration
 - trade interdependencies
 - exposure to the transmission of economic shocks
- Output shocks in major economies, affect the Asian business cycles.
- Over the last 20 years, the shock transmission mechanism has evolved due to changes in trade patterns between Asia and the ROW.

Rodriguez-Clare et al, 2006, Hesse (2009), Sato and Shrestha (2012), Gourinchas and Rey (2014,) Tan et al. (2015), Cheewatrakoolpong and Manprasert (2015), Feldkircher and Huber (2016), Dungey et al., (2018).

Sources: Bangkok Post; China Railway Group LTD; China State Council Information Office; Eastern Economic Corridor Office of Thailand; Japan Rail Pass; Malaysia Ministry of Economic Affairs MYHSR Corp; National News Bureau of Thailand; Rail Ninja; South China Morning Post; Taipei Times; Taoyuan City Government; Vietnam Ministry of Planning Vietnam Investment Review.



The East Asian Markets –Export Linkages

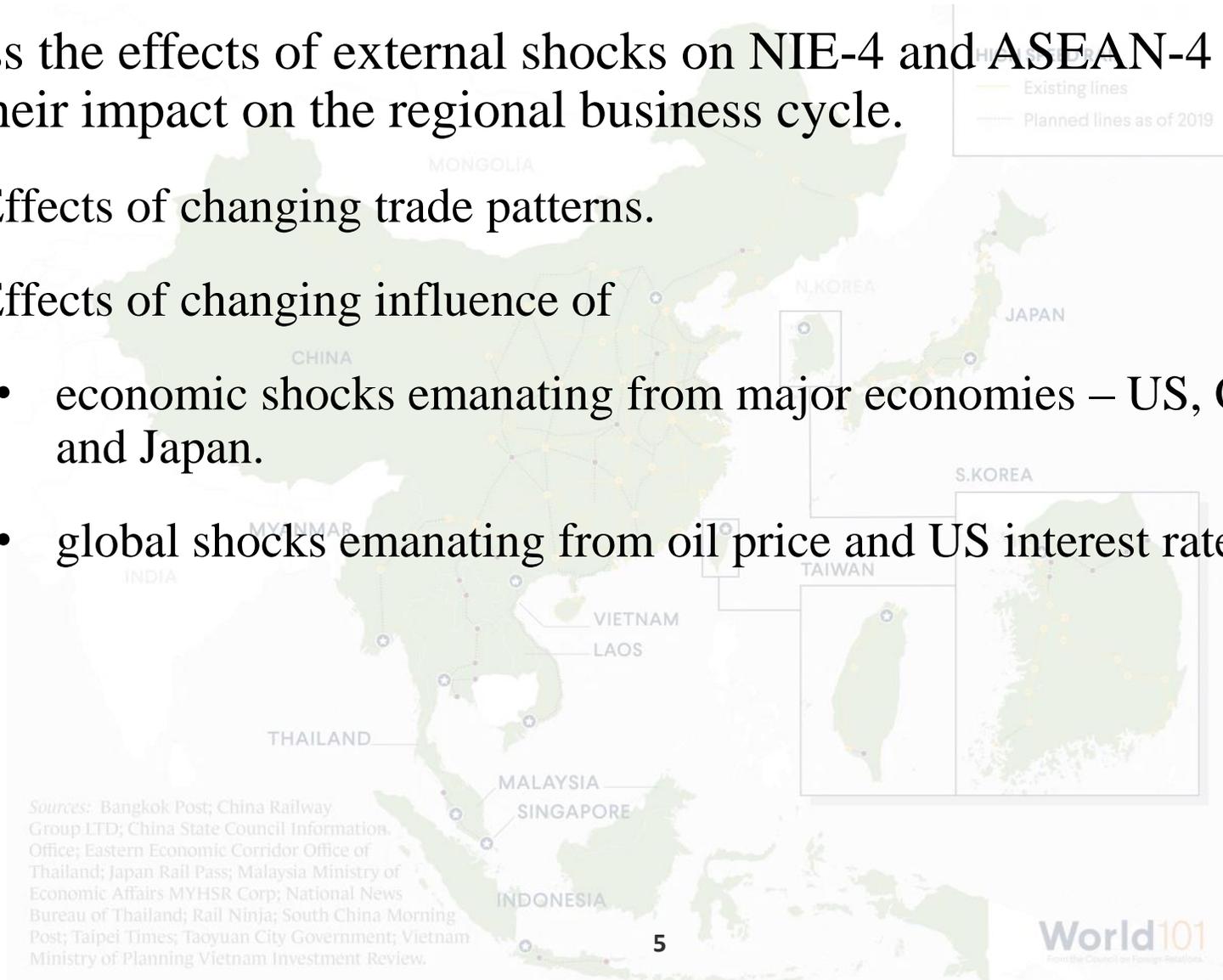


NIE-4: Hong Kong, Singapore, South Korea and Taiwan.

ASEAN-4: Indonesia, Malaysia, the Philippines and Thailand

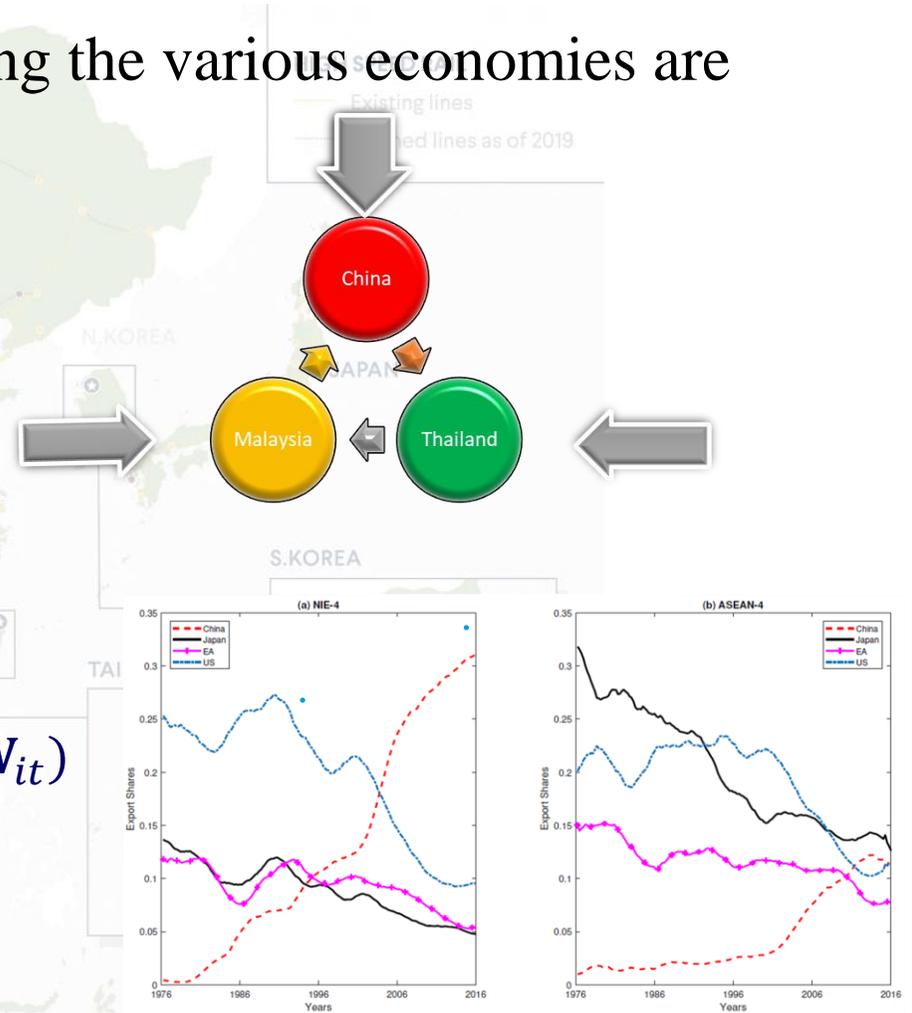
Objective

- Assess the effects of external shocks on NIE-4 and ASEAN-4 economies and their impact on the regional business cycle.
 - Effects of changing trade patterns.
 - Effects of changing influence of
 - economic shocks emanating from major economies – US, China, EA and Japan.
 - global shocks emanating from oil price and US interest rate.



Challenges and Innovation

- The macroeconomic relationships among the various economies are complex.
 - Third market effects:
 - Implement a GVAR framework (Pesaran et al., 2004, Dees et al., 2007 and Cesa-Bianchi et al., 2012).
 - Export shares – weights (W_i)
 - Due to changing trade patterns:
 - our identification mechanism - (W_{it})



Sources: Bangkok Post; China Railway Group LTD; China State Council Information Office; Eastern Economic Corridor Office of Thailand; Japan Rail Pass; Malaysia Ministry of Economic Affairs MYHSR Corp; National News Bureau of Thailand; Rail Ninja; South China Morning Post; Taipei Times; Taoyuan City Government; Vietnam Ministry of Planning Vietnam Investment Review.

Modelling Framework

- Focus Countries
 - NIE-4
 - ASEAN-4
 - G4 – growth driver economies
 - ROW
- Sample period
 - 1980Q1 – 2016Q4
- *W_{it}*
 - Direction of Trade Statistics, IMF Data
 - National Statistics Republic of China (Taiwan), Taiwan economic Data Center and Bureau of Foreign Trade.
 - OECD Economic Indicators, Eurostat, CEIC Data

List of countries and regions

ASEAN-4	EA	ROW
Indonesia	Austria	Argentina
Malaysia	Belgium	Australia
Philippines	Finland	Brazil
Thailand	France	Canada
	Germany	Chile
	Italy	India
NIE-4		
S.Korea	Netherlands	Mexico
Singapore	Spain	New Zealand
Taiwan		Norway
Hong Kong		Peru
		Saudi Arabia
		South Africa
G4		
Japan		Sweden
China		Switzerland
Euro area		United Kingdom
United States		

Group Ltd; China State Council Information Group; Economic Corridor Office of Thailand; Japan Rail Pass; Malaysia Ministry of Economic Affairs MYHSR Corp; National News Bureau of Thailand; Rail Ninja; South China Morning Post; Taipei Times; Taoyuan City Government; Vietnam Ministry of Planning Vietnam Investment Review.

Economic Variables and Data Sources

Table 1: Variables Description

Variables	Abbreviations	Construction	Data Source
GDP	y_{it}	$y_{it} = \ln(GDP_{it})$	International Financial Statistics (IFS), OECD, DataStream, Eurostat and CEIC databases
Equity prices	ep_{it}	$ep_{it} = \ln(\frac{EP_{it}}{CPI_{it}})$	DataStream and CEIC databases
Inflation rate	Δp_{it}	$\Delta p_{it} = p_{it} - p_{it-1}$ $p_{it} = \ln(CPI_{it})$	IFS, CEIC and DataStream databases
Exchange rate	ex_{it}	$ex_{it} = e_{it} - p_{it}$ $e_{it} = \ln(EX_{it})$	IFS
Short term interest rate	r_{it}	$r_{it} = 0.25 \ln(1 + \frac{R_{it}^s}{100})$	IFS, DataStream
Oil prices	d_t^{oil}	$d_t^{oil} = \ln(P_t^{oil})$	IFS

Global Vector Autoregressive (GVAR) Model

- VARX*(p_i, q_i) for $(n+ 1)$ countries i ($i = 0, 1, \dots, n$);

$$\mathbf{x}_{it} = \alpha_{i0} + \alpha_{i1}t + \sum_{j=1}^p \phi_{ij}\mathbf{x}_{it-j} + \sum_{j=0}^q \Lambda_{ij}\mathbf{x}_{it-j}^* + \sum_{j=0}^q \gamma_{ij}\mathbf{d}_{t-j} + \mathbf{u}_{it} \quad (1)$$

- \mathbf{X}_{it} is $(k_i \times 1)$ vector of domestic (endogenous) variables
- \mathbf{X}_{it}^* is $(k_i^* \times 1)$ vector of foreign (exogenous) factors
- ϕ_i ($k_i \times k_i$) and Λ_i ($k_i \times k_i^*$) are unknown parameter matrices
- \mathbf{d}_t is $(k_d \times 1)$ set of observed common variables
- \mathbf{u}_{it} is $(k_i \times 1)$ vector of country specific shock
- α_{i0} is $(k_i \times 1)$ vector of constants (intercepts) and $\alpha_{i1}t$ is $(k_i \times 1)$ vector of deterministic time trend.

Sources: Bangkok Post; China Railway Office; Eastern Economic Corridor Office of Thailand; Japan Rail Pass; Malaysia Ministry of Economic Affairs MYHSR Corp; National News Bureau of Thailand; Rail Ninja; South China Morning Post; Taipei Times; Taoyuan City Government; Vietnam Ministry of Planning Vietnam Investment Review.

Global Vector Autoregressive (GVAR) Model

- In our GVAR model, for all countries ($i = 1, 2, \dots, n$) the VARX* models consist of the same set of domestic and foreign variables as given:

$$\mathbf{x}_{it} = (y_{it}, ep_{it}, \Delta p_{it}, ex_{it}, r_{it})' \text{ and } \mathbf{x}_{it}^* = (y_{it}^*, ep_{it}^*, \Delta p_{it}^*, ex_{it}^*, r_{it}^*, d_t^{oil})'$$

- The US economy ($i = 0$) is considered a reference country and includes the following variables:

$$\mathbf{x}_{0t} = (y_{0t}, ep_{0t}, \Delta p_{0t}, r_{0t}, \Delta d_t^{*oil})' \text{ and } \mathbf{x}_{0t}^* = (y_{0t}^*, \Delta p_{0t}^*, ex_{0t}^*)'$$

- (ex_{0t}) is treated as a weakly exogenous as in Dees et al. (2007)
- (ep_{0t}^*) and (r_{0t}^*) are not included in the US model.
- Similarly (d_t^{oil}) is treated as an endogenous variable.

Sources: Bangkok Post; China Railway Group LTD; China State Council Information Office; Eastern Economic Corridor Office of Thailand; Japan Rail Pass; Malaysia Ministry of Economic Affairs MYHSR Corp; National News Bureau of Thailand; Rail Ninja; South China Morning Post; Taipei Times; Taoyuan City Government; Vietnam Ministry of Planning Vietnam Investment Review.

Global Vector Autoregressive (GVAR) Model

$$\mathbf{x}_{it}^* = \sum_{j=0}^n \mathbf{w}_{ijt} \mathbf{x}_{jt}$$

Where

$\mathbf{w}_{ijt} = \mathbf{x}_{ijt} / \mathbf{x}_{it}$ is export shares from “ i ” to “ j ” over the total exports of “ i ”; and $\sum_{j=1}^n \mathbf{w}_{ijt} = 1$ and $\mathbf{w}_{ii} = 0$

Eq 1 can be written more generally as:

$$\phi_i(L, p_i) \mathbf{x}_{it} = \alpha_{i0} + \alpha_{i1} t + \Lambda_i(L, q_i) \mathbf{x}_{it}^* + \mathbf{u}_{it} \quad (2)$$

Sources: Bangkok Post; China Railway Group LTD; China State Council Information Office; Eastern Economic Corridor Office of Thailand; Japan Rail Pass; Malaysia Ministry of Economic Affairs MYHSR Corp; National News Bureau of Thailand; Rail Ninja; South China Morning Post; Taipei Times; Taoyuan City Government; Vietnam Ministry of Planning Vietnam Investment Review.

Global Vector Autoregressive (GVAR) Model

Eq 2 can be written as:

$$\mathbf{B}_i \mathbf{z}_{it} = \alpha_{i0} + \alpha_{i1} t + \mathbf{A}_i \mathbf{z}_{i,t-1} + \mathbf{u}_{it} \quad (3)$$

where $\mathbf{z}_{it} = (\mathbf{x}_{it}, \mathbf{x}_{it}^*)$, $\mathbf{B}_i = (\mathbf{I}_{ki}, -\Lambda_{i0})$ and $\mathbf{A}_i = (\Phi_i, \Lambda_{i1})$

- The domestic variables for all countries are combined in the global vector (\mathbf{x}_t) i.e. $(\mathbf{x}_t = \tilde{\mathbf{x}}'_{0t}, \tilde{\mathbf{x}}'_{1t}, \tilde{\mathbf{x}}'_{2t}, \dots, \tilde{\mathbf{x}}'_{nt})'$
- In terms of \mathbf{x}_t , the individual country model can be written as;

$$\mathbf{z}_{it} = \mathbf{W}_i \mathbf{x}_t \quad \forall i = 0, 1, 2, \dots, n \quad (4)$$

Sources: Bangkok Post; China Railway Group LTD; China State Council Information Office; Eastern Economic Corridor Office of Thailand; Japan Rail Pass; Malaysia Ministry of Economic Affairs MYHSR Corp; National News Bureau of Thailand; Rail Ninja; South China Morning Post; Taipei Times; Taoyuan City Government; Vietnam Ministry of Planning Vietnam Investment Review.

Global Vector Autoregressive (GVAR) Model

Substituting z_{it} into (4), we get;

$$B_i W_i x_t = \alpha_{i0} + \alpha_{i1} t + A_i W_i x_{t-1} + u_{it} \quad (5)$$

Stacking equation (5) for $i = 0, \dots, n$;

$$G x_t = \alpha_0 + \alpha_1 t + H x_{t-1} + u_t \quad (6)$$

with $G = B_i W_i$ and $H = A_i W_i$

$$G = \begin{bmatrix} B_0 W_0 \\ B_1 W_1 \\ \vdots \\ B_n W_n \end{bmatrix}; H = \begin{bmatrix} A_0 W_0 \\ A_1 W_1 \\ \vdots \\ A_n W_n \end{bmatrix}; \alpha_0 = \begin{bmatrix} \alpha_{00} \\ \alpha_{10} \\ \vdots \\ \alpha_{n0} \end{bmatrix}; \alpha_1 = \begin{bmatrix} \alpha_{01} \\ \alpha_{11} \\ \vdots \\ \alpha_{1n} \end{bmatrix}; u_t = \begin{bmatrix} u_{0t} \\ u_{1t} \\ \vdots \\ u_{nt} \end{bmatrix}$$

Source: World Bank; China Railway Group LTD; China State Council Information Office; Eastern Economic Corridor Office of Thailand; Japan Rail Pass; Malaysia Ministry of Economic Affairs MYHSR Corp; National News Bureau of Thailand; Rail Ninja; South China Morning Post; Taipei Times; Taoyuan City Government; Vietnam Ministry of Planning Vietnam Investment Review.

Impulse Response Analysis

Eq (6) can be expressed in reduced form as:

$$\mathbf{x}_t = \mathbf{G}^{-1}\alpha_0 + \mathbf{G}^{-1}\alpha_1 t + \mathbf{G}^{-1}\mathbf{H}\mathbf{x}_{t-1} + \mathbf{G}^{-1}\mathbf{u}_t \quad (7)$$

or

$$\mathbf{x}_t = \mathbf{b}_0 + \mathbf{b}_1 t + \mathbf{F}\mathbf{x}_{t-1} + \varepsilon_t \quad (8)$$

with $\mathbf{b}_0 = \mathbf{G}^{-1}\alpha_0$, $\mathbf{b}_1 = \mathbf{G}^{-1}\alpha_1$, $\mathbf{F} = \mathbf{G}^{-1}\mathbf{H}$ and $\varepsilon_t = \mathbf{G}^{-1}\mathbf{u}_t$

Also, $\Psi(L) = \mathbf{F}(L)^{-1}$.

Therefore, to compute the impulse responses we convert eq 8 into moving-average as;

$$\mathbf{x}_t = \mathbf{r}_t + \sum_{j=0}^{\infty} \Psi_j \varepsilon_{t-j} = \mathbf{r}_t + \sum_{j=0}^{\infty} \Psi_j (\mathbf{B}_i * \mathbf{W}_i) \mathbf{u}_{t-j} \quad (9)$$

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Trade Weights - $W_{ijt} = X_{ijt}/X_{it}$

Table 11: Export shares at Q1 1996

	ID	ML	PH	TH	SK	SP	TA	HK	JP	CH	EA	US
ID	-	0.019	0.010	0.013	0.062	0.092	0.038	0.031	0.279	0.035	0.118	0.139
ML	0.012	-	0.010	0.038	0.030	0.208	0.031	0.048	0.126	0.028	0.101	0.206
PH	0.006	0.017	-	0.026	0.022	0.049	0.032	0.048	0.159	0.013	0.124	0.372
TH	0.010	0.029	0.006	-	0.014	0.129	0.022	0.052	0.166	0.021	0.124	0.195
SK	0.024	0.019	0.012	0.019	-	0.043	0.028	0.079	0.132	0.063	0.096	0.199
SP	0.049	0.156	0.016	0.059	0.025	-	0.040	0.084	0.074	0.021	0.116	0.198
TA	0.016	0.023	0.014	0.026	0.019	0.037	-	0.225	0.112	0.002	0.117	0.256
HK	0.006	0.008	0.011	0.009	0.016	0.028	0.026	-	0.057	0.330	0.114	0.223
JP	0.020	0.032	0.015	0.039	0.062	0.049	0.062	0.063	-	0.048	0.123	0.289
CH	0.009	0.009	0.005	0.010	0.038	0.023	0.018	0.248	0.181	-	0.107	0.175
EA	0.004	0.004	0.001	0.005	0.008	0.006	0.007	0.009	0.020	0.010	-	0.063
US	0.006	0.014	0.008	0.010	0.037	0.026	0.033	0.022	0.106	0.019	0.155	-

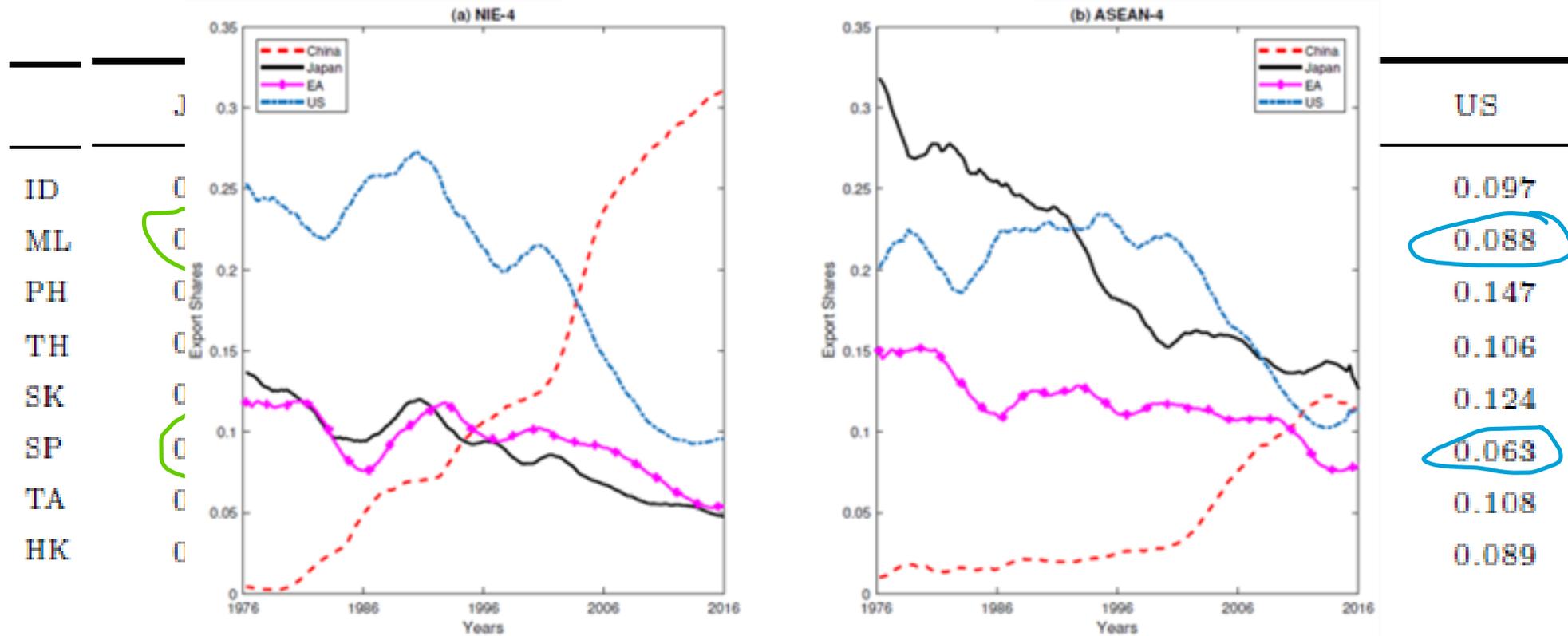
Note: Rows indicate the 12-Quarter moving average of export shares from focus economies to their trade-partners.

Table 12: Export shares at Q1 2016

	ID	ML	PH	TH	SK	SP	TA	HK	JP	CH	EA	US
ID	-	0.054	0.024	0.034	0.058	0.090	0.033	0.015	0.132	0.106	0.080	0.097
ML	0.041	-	0.015	0.055	0.035	0.140	0.030	0.046	0.104	0.127	0.078	0.088
PH	0.012	0.021	-	0.038	0.047	0.069	0.036	0.093	0.217	0.118	0.097	0.147
TH	0.042	0.053	0.026	-	0.020	0.045	0.016	0.056	0.096	0.112	0.071	0.106
SK	0.018	0.014	0.016	0.013	-	0.036	0.025	0.052	0.055	0.257	0.061	0.124
SP	0.091	0.116	0.017	0.038	0.041	-	0.039	0.113	0.043	0.127	0.068	0.063
TA	0.010	0.026	0.025	0.018	0.044	0.052	-	0.124	0.062	0.245	0.061	0.108
HK	0.006	0.008	0.006	0.015	0.017	0.017	0.021	-	0.035	0.544	0.065	0.089
JP	0.021	0.020	0.014	0.047	0.074	0.030	0.058	0.054	-	0.178	0.078	0.194
CH	0.016	0.020	0.010	0.016	0.043	0.022	0.019	0.156	0.064	-	0.112	0.172
EA	0.002	0.003	0.001	0.003	0.010	0.006	0.004	0.007	0.012	0.036	-	0.072
US	0.005	0.008	0.005	0.007	0.028	0.019	0.017	0.026	0.042	0.076	0.131	-

Note: Rows indicate the 12-Quarter moving average of export shares from focus economies to their trade-partners.

Trade Weights - $w_{ijt} = x_{ijt}/x_{it}$



Model Specification

- Unit root test – ADF and WS ADF tests.
- Lag order (p_i, q_i)
 - AIC criterion with maximum lags of 2, for both the domestic (p_i) and foreign (q_i) variables.
- Co-integration rank
 - Maximal eigenvalue and trace test statistics, using the 95% critical values from MacKinnon (1991),
 - (r_i) number of cointegrating relations

VARX* order and cointegrating relationships

	p_i	q_i	r_i
Indonesia	2	1	1
Malaysia	1	1	1
Philippines	2	1	1
Thailand	2	1	1
S.Korea	2	1	1
Singapore	1	1	1
Taiwan	2	1	1
Hong Kong	2	1	1
Japan	2	1	1
China	2	1	1
Euro area	2	1	1
United States	2	1	2

Bangkok Post; China Railway
 Information; China State Council Information
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Model Stability

- Weak exogeneity test
 - Johansen (1992) and Harbo et al. (1998) procedure
- Cross-section correlation of the variable-specific shocks
 - the variable-specific shocks yield weakly correlated residuals.
- Persistence profiles
 - the convergence of these profiles to zero over time indicates the stability of the global model
- Parameter stability
 - tests show a small number of rejections, implying that the instability is mainly due to error variances.

Sources: Bangkok Post; China Railway Group LTD; China State Council Information Office; Eastern Economic Corridor Office of Thailand; Japan Rail Pass; Malaysia Ministry of Economic Affairs MYHSR Corp; National News Bureau of Thailand; Rail Ninja; South China Morning Post; Taipei Times; Taoyuan City Government; Vietnam Ministry of Planning Vietnam Investment Review.

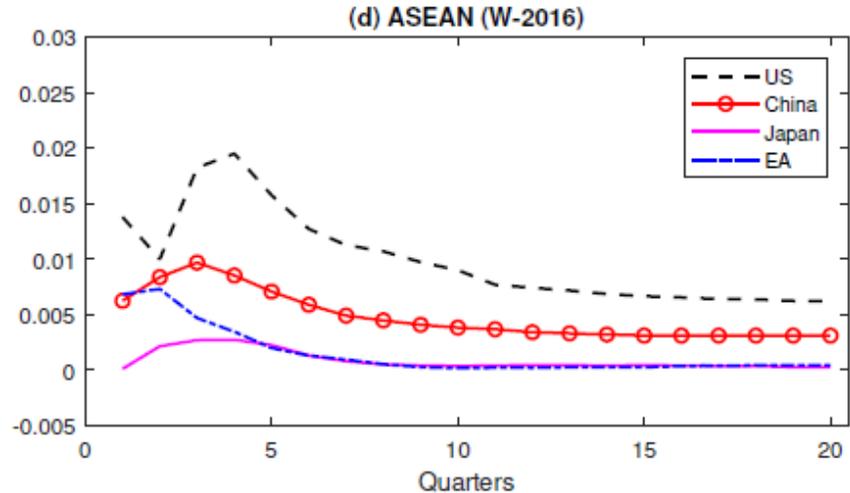
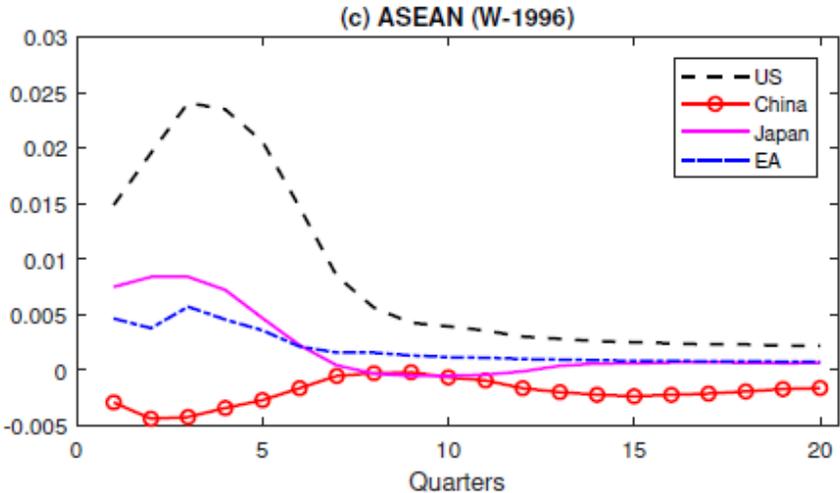
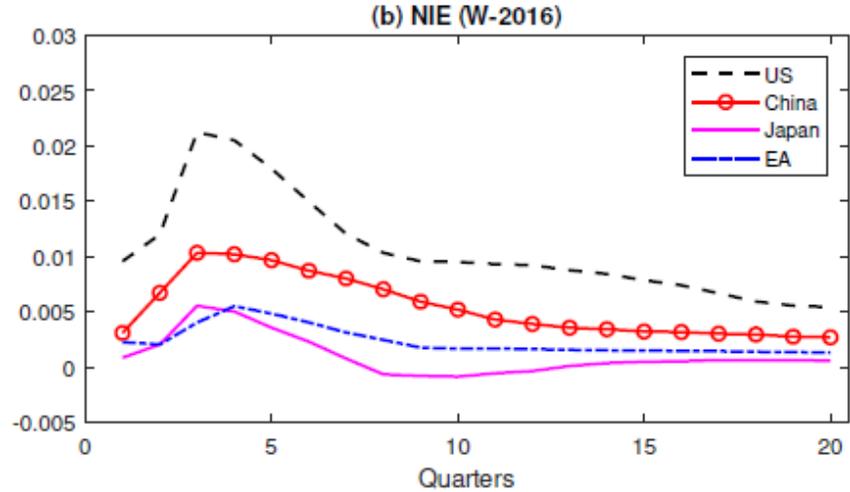
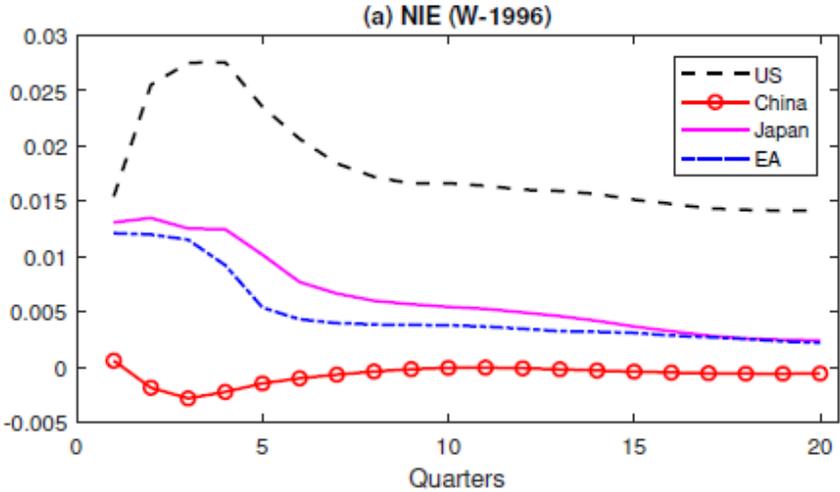
Impact Elasticities

ASEAN-4	y	Δp	ep	r	NIE-4	y	Δp	ep	r
Indonesia	0.682 (0.22)	0.726 (0.48)	0.971 (0.15)	0.736 (0.46)	S.Korea	0.489 (0.18)	0.617 (0.22)	0.912 (0.15)	-0.159 (0.16)
Malaysia	0.926 (0.17)	0.741 (0.16)	1.147 (0.14)	0.011 (0.07)	Singapore	0.956 (0.21)	0.402 (0.13)	1.245 (0.09)	0.371 (0.11)
Philippines	0.315 (0.19)	0.524 (0.43)	1.124 (0.16)	0.276 (0.21)	Taiwan	0.916 (0.24)	0.585 (0.35)	1.202 (0.26)	0.356 (0.38)
Thailand	0.774 (0.26)	0.801 (0.23)	0.903 (0.14)	0.441 (0.22)	Hong Kong	0.853 (0.27)	0.635 (0.31)	0.982 (0.20)	0.413 (0.15)

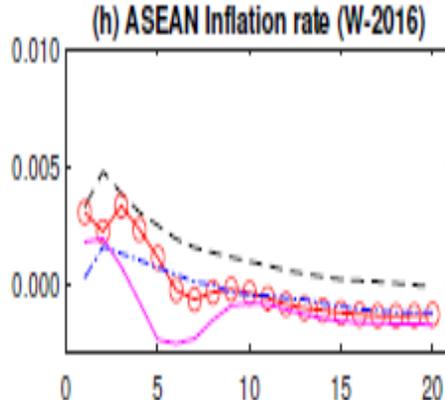
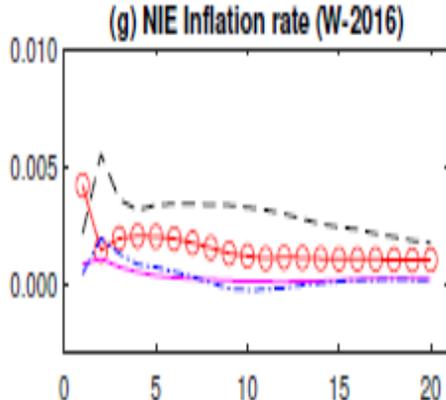
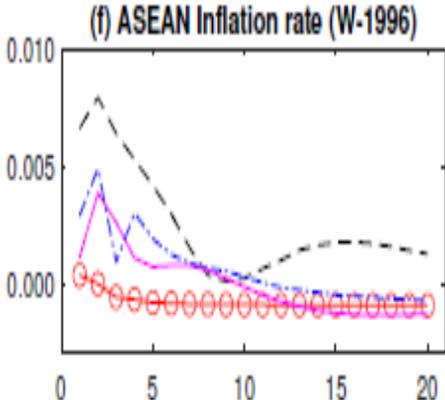
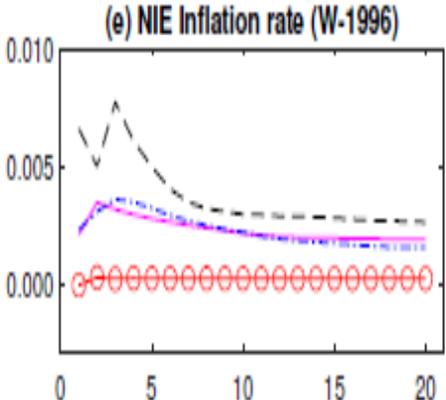
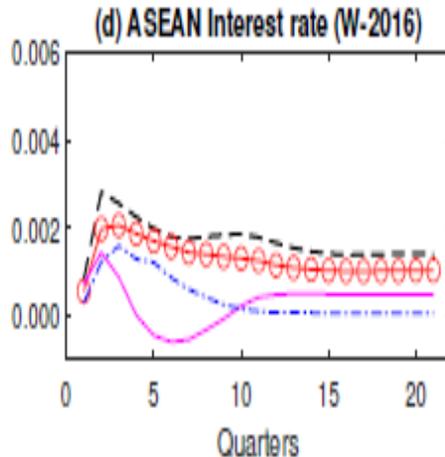
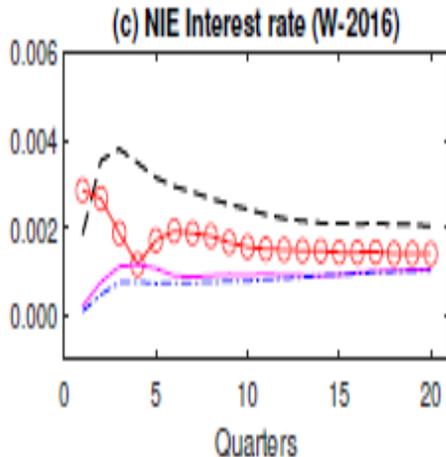
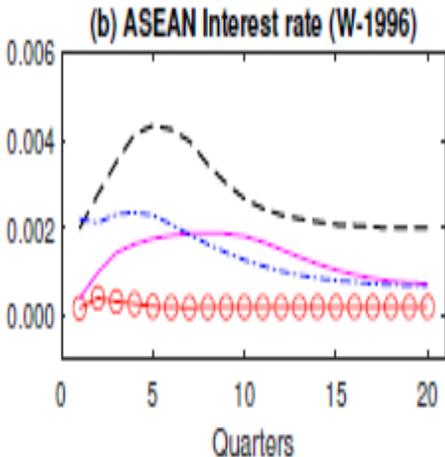
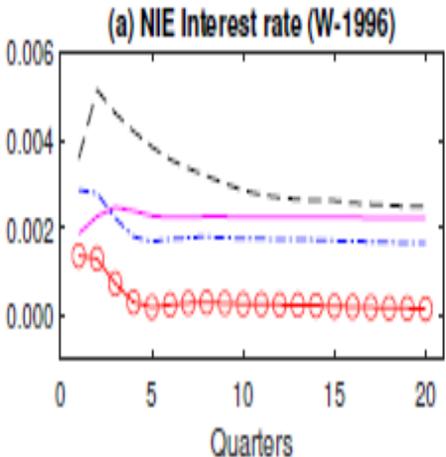
G-4	y	Δp	ep	r
China	0.681 (0.19)	0.569 (0.23)	-	0.031 (0.02)
Japan	0.201 (0.14)	0.052 (0.11)	0.761 (0.09)	-0.026 (0.03)
EA	0.374 (0.06)	0.163 (0.05)	1.184 (0.05)	0.114 (0.01)
US	0.609 (0.09)	0.382 (0.07)	-	-

Sources: Bangkok Post; China Railway Group LTD; China State Council Information Office; Eastern Economic Corridor Office of Thailand; Japan Rail Pass; Malaysia Ministry of Economic Affairs MYHSR Corp; National News Bureau of Thailand; Rail Ninja; South China Morning Post; Taipei Times; Taoyuan City Government; Vietnam Ministry of Planning Vietnam Investment Review.

Impulse Responses - Output Shocks to G4 on ASEAN-4 and NIE-4



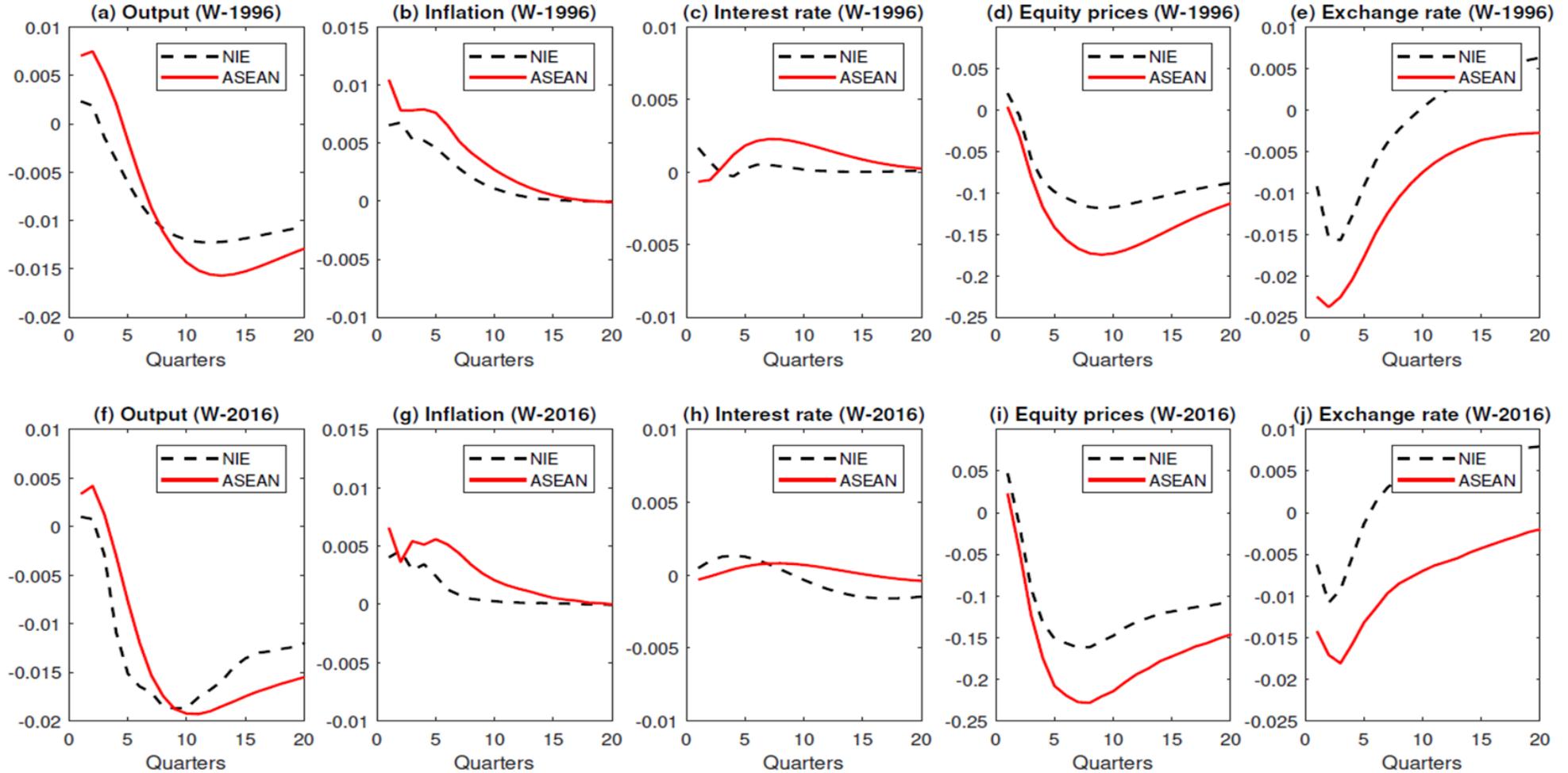
Impulse Responses - Output Shocks to G4 on ASEAN-4 and NIE-4



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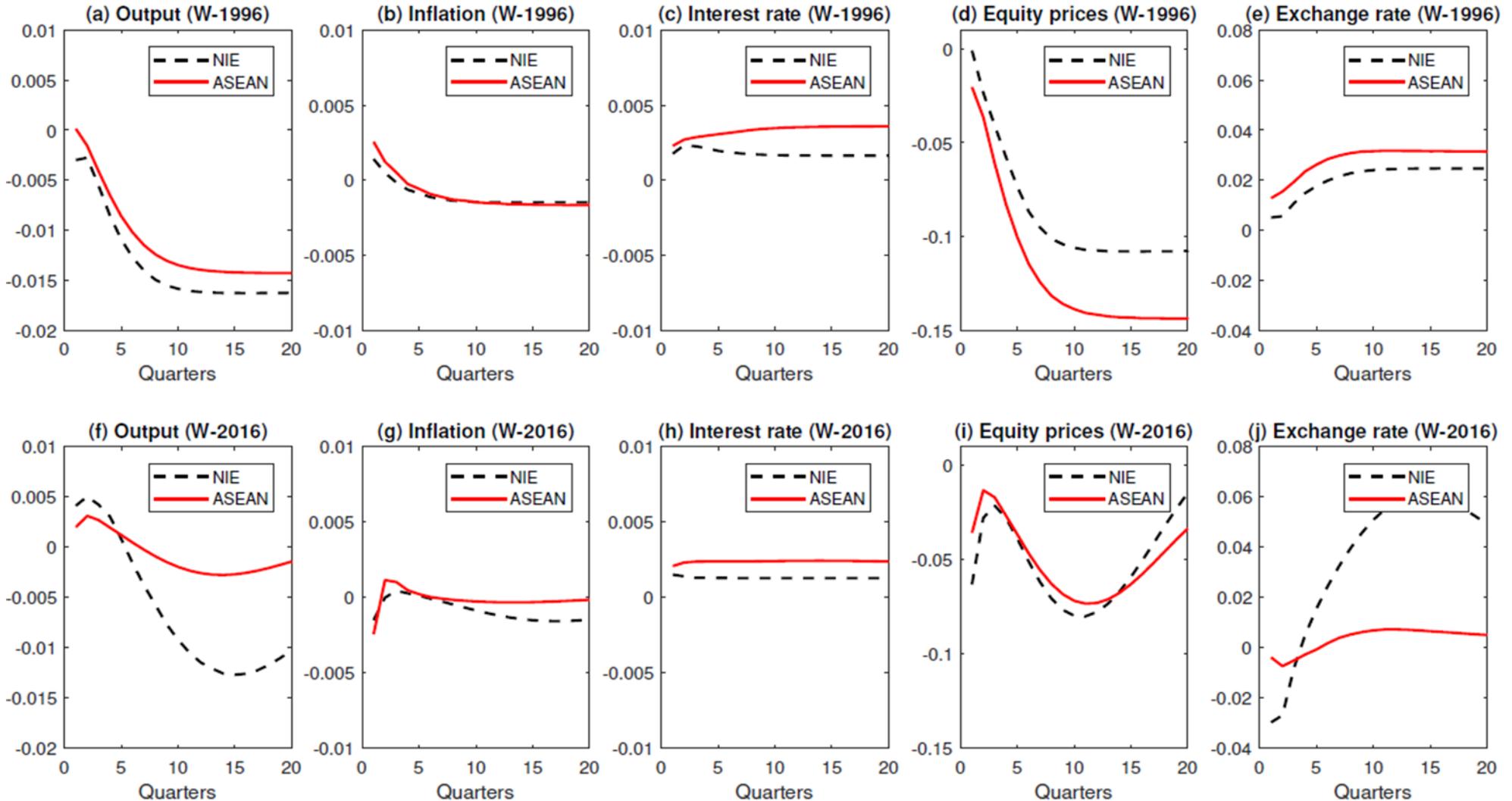
Impulse Responses – Oil Price Shocks



Thailand; Japan Rail Pass; Malaysia Ministry of Economic Affairs MYHSR Corp; National News Bureau of Thailand; Rail Ninja; South China Morning Post; Taipei Times; Taoyuan City Government; Vietnam Ministry of Planning Vietnam Investment Review.

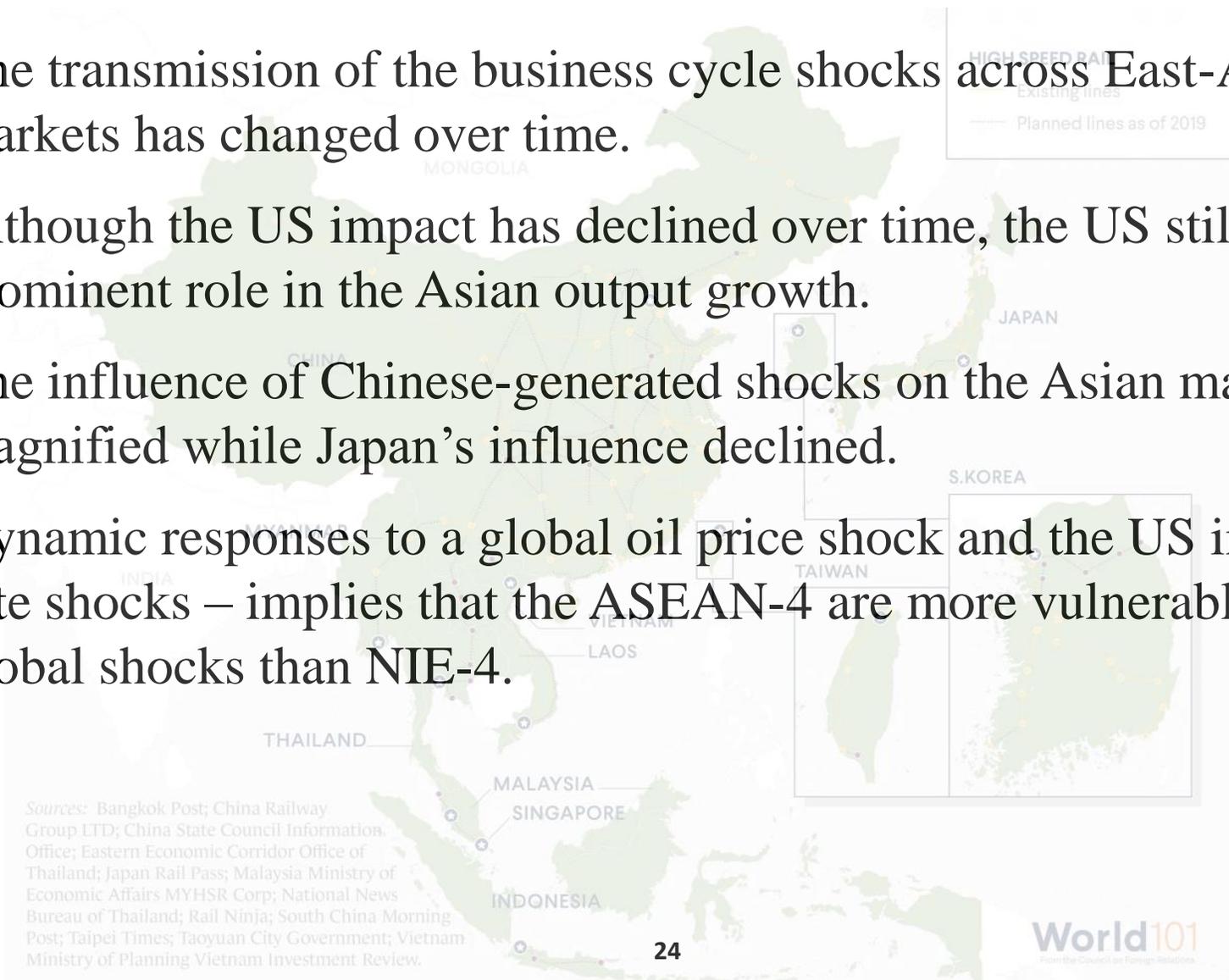


Impulse Responses – US Interest Rate Shocks



Key Findings

- The transmission of the business cycle shocks across East-Asian markets has changed over time.
- Although the US impact has declined over time, the US still plays a prominent role in the Asian output growth.
- The influence of Chinese-generated shocks on the Asian markets has magnified while Japan's influence declined.
- Dynamic responses to a global oil price shock and the US interest rate shocks – implies that the ASEAN-4 are more vulnerable to global shocks than NIE-4.



Sources: Bangkok Post; China Railway Group LTD; China State Council Information Office; Eastern Economic Corridor Office of Thailand; Japan Rail Pass; Malaysia Ministry of Economic Affairs MYHSR Corp; National News Bureau of Thailand; Rail Ninja; South China Morning Post; Taipei Times; Taoyuan City Government; Vietnam Ministry of Planning Vietnam Investment Review.

Conclusions

- Modelling the macroeconomic relationships in the small open Asian economies is complex.
- Existing empirical studies, focus on the influences of the US and Euro area using a small open economy framework.
- Using a time-varying GVAR framework, we identify the evolution of output shocks from traditional growth engines in emerging Asian economies over the period 1980 to 2016.

Sources: Bangkok Post; China Railway Group LTD; China State Council Information Office; Eastern Economic Corridor Office of Thailand; Japan Rail Pass; Malaysia Ministry of Economic Affairs MYHSR Corp; National News Bureau of Thailand; Rail Ninja; South China Morning Post; Taipei Times; Taoyuan City Government; Vietnam Ministry of Planning Vietnam Investment Review.

Conclusions

- Identifying the channels via which shocks dissipate internationally is essential for policymakers.
 - For instance, whilst designing policies to eliminate undesirable disturbances, both the origin of shocks and channels via which these shocks propagate are important.
 - We show how the changing trade patterns have influenced the propagation mechanism and illustrate the significance of trade in disseminating economic shocks.

Sources: Bangkok Post; China Railway Group LTD; China State Council Information Office; Eastern Economic Corridor Office of Thailand; Japan Rail Pass; Malaysia Ministry of Economic Affairs MYHSR Corp; National News Bureau of Thailand; Rail Ninja; South China Morning Post; Taipei Times; Taoyuan City Government; Vietnam Ministry of Planning Vietnam Investment Review.

Thank You