South East Asian Financial Linkages and the Changing Role of China: Insights from a Global VAR

Simon Rudkin[1] and Sen Min Wong[2]

Abstract:

As major financial crises, and the rise of China have shaped the new world order, so it is inevitable that those nations, especially in South East Asia, that once looked west for stability need to reappraise their situation. With the markets so intertwined in events, studying the propagation of equity price shocks within the wider set of macroeconomic variables allows us to say more about how relations are changing, and the likely impacts of any future crash. With data reaching into 2014, this paper is better able to reflect the post global financial crisis period. Using a Global Vector Autoregressive (GVAR) model we analyse these changes and what lies in store for South East Asia, and the ASEAN 4 in particular. Isolating three distinct trade patterns in our weight matrices responses to crises are clearly identifiable, and the opening up of China readily chartable. Indirect effects of China's rise are highlighted; impacts on the ASEAN 4 being via other nations to date, but direct impact is appearing.

Keywords: Financial Linkages, Global VAR, Equity Prices

JEL Classification: C51, F15, F36

[1] – School of Management, University of Bradford, Emm Lane, Bradford, United Kingdom, BD9 4YY. Email: s.rudkin@bradford.ac.uk (Corresponding Author)

[2] – Statistical Services Department, Bank Negara Malaysia, Jalan Dato' Onn, 50480, Kuala Lumpur, Malaysia. Email: wongsm@bnm.gov.my

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Both the Asian Financial Crisis (AFC) of 1998, and the Global Financial Crisis (GFC) of 2007-2008 have had profound impacts on the ASEAN nations. Meanwhile the geographically proximate China has expanded its' global influence and overtaken Japan to become the second largest economy[1]. Traditionally it has been Singapore which has been the major trading post of the region, with deep rooted equity markets and status as a global business hub. Each and every one of the events which has rocked the region will have shaped the way that future shocks will propagate through the area, and governments and business alike will benefit from getting a better understanding about how that is likely to occur. Our capture of this is achieved through a Global Vector Autoregressive (GVAR) framework with relationships between nations captured by IMF Direction of Trade statistics. Identifying three periods, pre AFC, pre GFC and post GFC, we can see exactly how the models predictions change as the linkages have evolved.

One of the developments in local opinion has been the treatment of Singapore as a conduit for foreign shocks, and so we talk here of the ASEAN 4 and treat Singapore separately. Three research questions emerge. Firstly, how has the growth of China changed its' economic power in the ASEAN 4 region, especially given trade opening up. Secondly, what role does America now play in South Asia, and has the desire to protect against the worst of western crises seen this change dramatically? Finally, has there been any change in the Singaporean influence? We show that China is having a much greater say in ASEAN 4 economic performance, but that much of this is driven indirectly through America, Europe and others. Singapore is shown to play an insignificant role in this, despite the concerns raised. Whilst our major contributions of distinct period trade weights and study of equity prices focus on a subset of potential questions from this wide ranging framework, there are clear implications on those issues that cannot get detailed attention here.

Section 1 offers a review of the literature on regional policy, adoption of the GVAR framework, and likely role of China in the future. Data is summarised in section 2 with an early look at the changing trade patterns exposited in section 3. Model assumptions are presented as section 4, giving the theoretical underpinning to the analysis that follows. Our principal evaluative tools are generalised impulse response functions (GIRFs), and part 5 offers these for shocks to Chinese, United States and Singaporean equity prices as well as making wider reference to Chinese GDP as representative of other shocks. Mixed evidence on the success of isolation policy emerges. Section 6 then concludes.

1 Background

An areas success at dealing with financial crises is linked strongly to the extent of policy convergence amongst groups of states (Aizenman and Ito, 2014). Through their respective rapid developments to the AFC each nation attempted to cope with the classic economic trilemma of monetary independence, exchange rate stability and financial openness in its own way. Only Malaysia opted to achieve exchange rate stability through fixing of its dollar conversion rates during the AFC. Nevertheless, all countries agree on financial openness, hence having learned to “surf the waves of financial globalisation rather than run away from them” (Aizenman and Ito, 2014, p47). With growing

[1] China overtook Japan as the world’s second largest economy in dollar terms during 2010, as confirmed by Japanese Data (FT.Com, 2011)

alignment of policy, despite national interests limiting the extent thereof (Kim, 2014), much greater co-movement of exchange rates is noted (Sheng et al, 2012). However co-production of goods for export to the developed world has been a constraint on isolationism and indeed we show China has simply replaced the USA on trade volume meaning isolation has not occurred. A single currency has been touted for the area (Lee et al, 2013) and further integration a la Europe is supported by Kim (2015), but whether this will happen is unclear, and as we show the wisdom of such a move is unclear. Our distinct period approach brings through these changes clearly.

As the globe's largest economy America will undoubtedly hold influence across the region, its debts are held by many of the ASEAN nations and the United States is a target market of South Asian exporters. Equity markets are also equally interlinked. China has seen greater integration following opening up, but others have shown consistent high levels (Frijns et al, 2012). Whilst the magnitude of the US impact on ASEAN stock markets changes in period of crisis and non-crisis (Tam, 2014) there is a sense that markets have reacted to the GFC on interlinkage (Raghavan and Dungey, 2015). Data still shows that US monetary policy can affect ASEAN equity markets, Yang and Hamori (2014) identifying this in a Markov switching model for Thailand and Indonesia. America has though lost much of its influence and seeks to establish greater participation through the Trans-Pacific Partnership, but only Malaysia has signed up to the agreement. Our other nations have focused on the ASEAN free trade area (Deardorff, 2014). Whether the trade partnership happens is debated, but America undoubtedly seeks to redress its declining role, a decline our GIRF analysis shows particularly well.

Chinese reform and opening up has fundamentally changed the global order, enabling access to an enormous potential market, and unleashing a wave of cheap to produce products into established trade nations. Proximity to China means that the ASEAN 4 can be seen as complementary to the new power and have chance to ride the coat-tails. Free trade agreements ensure that all are looking to work together on entrenching their positions (Deardorff, 2014). Capital market liberalisation is reviewed extensively in Bayomi and Ohnsorge (2013) study of the likely consequences of further control relaxation. Non-Chinese investors were granted greater access to Chinese equity markets in early 2000, with unfettered access to foreign exchange for trade having begun in 1996. Dreger and Zhang (2014) is one of the limited number of papers to analyse how these Chinese changes have translated into the wider economy. Though the majority of beneficiaries have been western nations, our ASEAN 4 group are impacted as our analysis will show. That published works focus on the west leaves the gap for this work to fill.

One unique feature of our analysis is the extension of the time period covered to mid 2014, adding five years of post GFC data compared to studies which have considered equity prices, or the ASEAN 4. Hence our dataset extends beyond the latest liberalisations executed under the 12th Five Year Plan, which has seen the reinvestment of offshore Renminbi in China by domestic firms raised to $270 billion and outward investment to $86bn. Such adjustments are large and likely to bring about big changes in the way China interacts with the rest of the world. For our model the effects will be small, as the last trade matrix is calculated on an average of 2011-2013. However, the analysis of section 3 supports the larger opening up impact and shows the importance of the 2000 initial changes in propelling Chinese trade shares upward. Bayoumi and Ohnsorge (2013) quantify the events and early consequences, providing a valuable backdrop to our work. From all the contrast with America's contracting influence could not be clearer.

As a trading post Singapore has a long history and it remains a key financial centre. By comparison to the other ASEAN 5 members, the equity markets of Singapore are very well developed. Hwa (2012) notes that the small territory is seen as the conduit for the GFC in the region, leading to a much greater spread than would have been felt based on trade alone. By contrast the westward outlook of Singapore had helped it absorb the worst of the AFC without the major losses of others. Inevitably the impact of Singaporean shocks is smaller than those of China or the USA. However, it is still of interest to understand how shocks propagate through the area, and indeed whether countries have been able to reduce their exposure to Singapore in light of their belief it is a conduit.

GVAR models, following the framework proposed by Pesaran et al (2004), have gained great traction for its ability to handle "complex high-dimensional systems" and capture systemic risk (Chudik and Pesaran, 2014). Linking economies using a weighted average of foreign variables ensures no spill-over is lost, and permits analysis of both shocks and changes to those weights. Commonly trade flows are used, as here, but they too are dynamic and linked to economic performance leading authors to either choose a single representative period, as in most studies, a set of distinct periods like here and Cesa-Bianchi et al (2012), or adopt continuously updated moving averages as in Feldkircher and Korhonen (2014). A major choice in the framework is selecting which nation plays the dominant role, traditionally this has been the USA, but our addition of extra years of data begins to question the wisdom thereof, with China displaying some signs of endogeneity of foreign variables. However, as yet many Chinese impacts are indirect, and hence the USA remains the large economy here. Chudik and Pesaran (2014) represents an invaluable review of the benefits of the GVAR framework and its application, a solid based on which to provide our contributions of more up to date data, regional coverage, and exploration of China's growth impact on the ASEAN 4.

Our focus is on equity prices, and particularly the role that potential negative shocks to the major trading partners of the ASEAN 4 may have. First we show how much the reactions to Chinese equity prices have changes based on trading patterns pre AFC, between AFC and GFC and post GFC. These dates also falling in key periods of Chinese opening up identified above. Simultaneously the USA shows greater effects from China too, as identified in Dreger and Zhang (2014) also, albeit in the opposite direction to the ASEAN 4. Glick and Hutchison (2013) and Li (2012) both show strong correlations between equity prices in China and the ASEAN 4 in recent years, using very different modelling frameworks to focus solely on the stock market aspects. Meanwhile the reactions of the ASEAN 4 to a negative USA tremor reduce in magnitude, with China also showing a slightly reduced impact. Attention is paid to Singapore, with a general insignificance of effect emerging under all matrices. Combining equity price changes with a wider set of macroeconomic variables offers more insight for policymakers and the wider region alike. It is then against this backdrop that we paint our GVAR inspired picture.

2 Data

Whilst our focus is on the ASEAN 4 and the way they interact with China, the United States and Singapore, it is still important to include all of the major trading partners for each nation. There is also obvious merit in achieving a relatively complete European Union block as collectively even the smallest European nations represent part of a big market for goods. Our collection of 38 countries is thus influenced by regional policy and the size of markets. Many countries are left out in order to preserve degrees of freedom within the model, or because there is insufficient data available to

Major Economies:	**Euro Area:**	**South America:**
China	Austria	Argentina
Japan	Belgium	Brazil
United Kingdom	Finland	Chile
United States	France	Mexico
	Germany	Peru
ASEAN 4:	Greece	
Indonesia	Ireland	**Other European:**
Malaysia	Italy	Czech Republic
Philippines	Netherlands	Denmark
Thailand	Portugal	Hungary
	Spain	Norway
Other Asian:		Sweden
Korea	**Others:**	Switzerland
Russia	Canada	
Singapore	Australia	
Turkey	India	
	New Zealand	

Table 1: Countries included in the GVAR model

allow us to construct a meaningful analysis. For example it would be optimal to include other South Asian nations, such as Myanmar, Cambodia and Vietnam as these lie on the trading route from China, but data is severely limited to date[2]. Bloomberg and the International Monetary Fund IFS database are used, with required seasonal adjustments performed in R using the X12 package. Appendix A gives a full set of details on data sources and the necessary processing carried out. Table 1 lists the countries included in our model.Since the Euro is the only common currency area in formal operation within our dataset, it is only those nations that carry the Euro that are combined into a larger region for a purpose of the analysis. All other nations are included individually, and hence summarised individually in Tables 2 and 3. The set of countries subsumed within the Euro group is as described in Table 1.

Six country specific variables are used. First the real GDP $y_{i,t} = \ln\left(GDP_{i,t}/CPI_{i,t}\right)$ and the rate of inflation determined from the consumer price index as $\pi_{i,t} = \ln(CPI_{i,t}) - \ln(CPI_{i,t-1})$ represent the macroeconomic situation. Both GDP and CPI are index variables rebased such that 2010=100. Exchange rates are included to capture each nations relationship with the United States Dollar and are constructed as $e_{i,t} = \ln\left(E_{i,t}\right)$. Interest rates are split according to short and long run, calculated as $\rho_{i,t}^S = 0.25\ln\left(1 + R_{i,t}^S/100\right)$ and $\rho_{i,t}^L = 0.25\ln\left(1 + R_{i,t}^L/100\right)$ respectively. In these expressions $R_{i,t}^S$ would be the short run interest rate, with $R_{i,t}^L$ being the long term version. Finally we have our variable of interest, equity prices $q_{,it} = \ln\left(EQ_{i,t}/CPI_{i,t}\right)$. Owing to its crucial role in almost all areas of business oil prices must be taken into account, so these are our seventh variable and are treated as endogenous only in the United States model. Foreign variables have an additional * added to the label, in keeping with GVAR literature nomenculture.

[2] There is now regular data collection in these nations and in future years it will be possible to construct a representative GVAR with limited back-casting.

	y_{it}	π_{it}	e_{it}	q_{it}	ρ_{it}^{S}	ρ_{it}^{L}	p_t^{O}
Argentina	0.2390 (0.2508)	4.1113 (0.4384)	-4.0476 (0.3841)	-0.6724 (0.5118)	0.0253 (0.0178)		
Australia	-0.0232 (0.0476)	4.4163 (0.1707)	-4.0916 (0.1440)	-0.1093 (0.2023)	0.0128 (0.0030)	0.0144 (0.0036)	
Brazil	0.3712 (0.9528)	3.9820 (1.0936)	-3.8169 (0.7313)	-2.9579 (0.5068)	0.0448 (0.0186)		
Canada	-0.0210 (0.0516)	4.4783 (0.1221)	-4.3801 (0.1806)	-0.2922 (0.3539)	0.0078 (0.0045)	0.0126 (0.0042)	
Chile	-0.7095 (0.6018)	4.3708 (0.2345)	-1.6627 (0.2100)	-0.5763 (0.5177)	0.0181 (0.0118)		
China	-0.7870 (0.6672)	4.4483 (0.1788)	-3.5702 (0.2026)	-0.2074 (0.5908)	0.0104 (0.0072)		
Czech Republic	0.0001 (0.0774)	4.3864 (0.2348)	-2.9827 (0.3139)	-0.4808 (0.4859)	0.0112 (0.0093)		
Denmark	-0.1348 (0.1469)	4.4650 (0.1312)	-3.6737 (0.1684)	-0.3277 (0.4723)	0.0088 (0.0056)	0.0113 (0.0046)	
Euro Area	0.0302 (0.0392)	4.4785 (0.1240)	-4.4200 (0.0837)	0.0852 (0.3123)	0.0084 (0.0053)	0.0242 (0.0063)	
Hungary	0.3574 (0.3757)	4.1284 (0.5130)	-1.8427 (0.4342)	-0.1477 (0.7468)	0.0286 (0.0166)		
India	-0.0347 (0.0839)	4.1548 (0.4113)	-2.5120 (0.3480)	-0.5616 (0.4311)	0.0291 (0.0253)		
Indonesia	0.3737 (0.4826)	3.9600 (0.6500)	-0.1301 (0.4403)	-0.4796 (0.5485)	0.0285 (0.0258)		
Japan	-0.0604 (0.0598)	4.6172 (0.0118)	-2.5923 (0.0548)	0.2860 (0.2436)	0.0009 (0.0013)	0.0041 (0.0020)	
Korea	0.1604 (0.1265)	4.3867 (0.2065)	-1.3636 (0.1810)	-0.4550 (0.4284)	0.0148 (0.0067)	0.0173 (0.0079)	
Malaysia	-0.1437 (0.1337)	4.4446 (0.1540)	-3.9267 (0.1429)	-0.1825 (0.2855)	0.0091 (0.0037)	0.0111 (0.0034)	
Mexico	0.3053 (0.3819)	4.1423 (0.5378)	-3.1734 (0.3798)	-0.6051 (0.5268)	0.0291 (0.0230)		
Norway	-0.1667 (0.1775)	4.4611 (0.1251)	-3.6337 (0.1663)	-0.1739 (0.3401)	0.0108 (0.0049)	0.0112 (0.0041)	
New Zealand	-0.0061 (0.0562)	4.4405 (0.1447)	-4.6409 (0.1117)	0.4001 (0.2345)	0.0137 (0.0051)	0.0144 (0.0033)	
Peru	-0.1353 (0.1333)	4.3868 (0.2509)	-3.9242 (0.2180)	-1.2358 (1.0002)	0.0145 (0.0098)		
Philippines	0.2122 (0.1696)	4.2791 (0.3029)	-2.6650 (0.2415)	-0.0291 (0.4492)	0.0171 (0.0106)		
Russia	0.9188 (1.3148)	3.4141 (1.4975)	-2.2081 (1.0631)	0.2872 (0.6103)	0.0211 (0.0130)		
Singapore	-0.1985 (0.1760)	4.5029 (0.1068)	-4.3206 (0.1489)	-0.1776 (0.2174)	0.0031 (0.0022)		
Sweden	-0.3228 (0.2659)	4.5191 (0.0812)	-3.6407 (0.1200)	-0.3257 (0.4888)	0.0086 (0.0057)	0.0137 (0.0054)	
Switzerland	-0.0720 (0.0745)	4.5435 (0.0499)	-4.4478 (0.1247)	-0.0905 (0.3457)	0.0034 (0.0035)	0.0070 (0.0054)	
Thailand	0.0328 (0.0484)	4.4131 (0.1916)	-2.8834 (0.1840)	-0.0277 (0.5382)	0.0108 (0.0102)		
Turkey	1.2613 (1.6582)	3.0944 (1.8398)	-3.3518 (1.1828)	-0.2633 (0.3280)	0.0805 (0.0636)		
United Kingdom	0.0253 (0.0370)	4.4478 (0.1524)	-4.2545 (0.1276)	0.0641 (0.2865)	0.0068 (0.0052)	0.0113 (0.0036)	
United States	0.0191 (0.0618)	4.4682 (0.1277)		0.0510 (0.1815)	0.0096 (0.0054)	0.0123 (0.0043)	3.6449 (0.7471)

Table 2: Domestic variable summary statistics

	y_{it}	π_{it}	e_{it}	q_{it}	ρ_{it}^{S}	ρ_{it}^{L}
Argentina	0.0142 (0.2810)	4.2636 (0.4713)	`-3.5668 (0.3628)	-1.0125 0.2561	0.0224 (0.0102)	0.0172 (0.0047)
Australia	-0.2183 (0.1859)	4.4402 (0.1667)	-3.2719 (0.1617)	-0.0933 (0.2354)	0.0102 (0.0053)	0.0126 (0.0038)
Brazil	-0.1197 (0.0987)	4.3828 (0.2176)	-3.5786 (0.2015)	-0.1611 (0.2063)	0.00128 (0.0056)	0.0166 (0.0047)
Canada	-0.0334 (0.0554)	4.4407 (0.1608)	-3.5267 (0.1909)	-0.0394 (0.1570)	0.0108 (0.0057)	0.0129 (0.0042)
Chile	-0.1296 (0.1198)	4.3903 (0.2362)	-3.5226 (0.2153)	-0.3509 (0.2175)	0.0139 (0.0063)	0.0147 (0.0044)
China	0.0653 (0.0905)	4.3799 (0.2368)	-3.1669 (0.1907)	-0.1642 (0.1750)	0.0125 (0.0060)	0.0141 (0.0043)
Czech Republic	0.0521 (0.0741)	4.3900 (0.2283)	-4.0509 (0.1658)	0.0253 (0.2516)	0.0108 (0.0062)	0.0220 (0.0057)
Denmark	-0.0491 (0.0447)	4.4336 (0.1744)	-3.9876 (0.1401)	-0.0711 (0.2592)	0.0103 (0.0057)	0.0185 (0.0051)
Euro Area	0.0221 (0.1286)	4.2871 (0.3534)	-3.4229 (0.3075)	-0.1859 (0.2060)	0.0147 (0.0081)	0.0110 (0.0037)
Hungary	0.0639 (0.1016)	4.3624 (0.2642)	-3.9929 (0.1963)	0.0112 (0.2254)	0.0111 (0.0065)	0.0221 (0.0058)
India	-0.0845 (0.0764)	4.3965 (0.2173)	-3.5475 (0.1829)	-0.1596 (0.1805)	0.0118 (0.0059)	0.0151 (0.0043)
Indonesia	-0.1313 (0.1121)	4.4325 (0.1747)	-3.3216 (0.1593)	-0.1311 (0.2083)	0.0103 (0.0050)	0.0124 (0.0039)
Japan	-0.1553 (0.1309)	4.3786 (0.2334)	-3.2679 (0.2021)	-0.1833 (0.2326)	0.0126 (0.0062)	0.0155 (0.0046)
Korea	-0.1876 (0.1564)	4.3910 (0.2290)	-3.3283 (0.2004)	-0.1454 (0.2367)	0.0118 (0.0060)	0.0123 (0.0035)
Malaysia	-0.1277 (0.1078)	4.4226 (0.1823)	-3.2517 (0.1627)	-0.1228 (0.2146)	0.0105 (0.0054)	0.0131 (0.0040)
Mexico	-0.0536 (0.0728)	4.4515 (0.1494)	-3.5341 (0.1784)	-0.0506 (0.1519)	0.0103 (0.0052)	0.0131 (0.0043)
Norway	-0.0309 (0.0344)	4.4391 (0.1684)	-4.0251 (0.1356)	-0.0604 (0.2524)	0.0095 (0.0054)	0.0175 (0.0048)
New Zealand	-0.1398 (0.1216)	4.4212 (0.1821)	-3.5364 (0.1166)	-0.1017 (0.1833)	0.0109 (0.0047)	0.0141 (0.0039)
Peru	-0.1387 (0.1228)	4.4014 (0.2185)	-3.5311 (0.2079)	-0.2854 (0.1906)	0.0131 (0.0062)	0.0143 (0.0043)
Philippines	-0.0980 (0.0858)	4.4374 (0.1693)	-3.1558 (0.1566)	-0.0713 (0.1912)	0.0095 (0.0048)	0.0125 (0.0039)
Russia	-0.0309 (0.0443)	4.3813 (0.2383)	-3.8034 (0.1839)	-0.0814 (0.2004)	0.0136 (0.0080)	0.0197 (0.0053)
Singapore	-0.0707 (0.0636)	4.3730 (0.2300)	-2.9971 (0.1890)	-0.1622 (0.2290)	0.0130 (0.0070)	0.0137 (0.0040)
Sweden	0.0079 (0.0401)	4.3999 (0.2134)	-3.9641 (0.1685)	-0.0458 (0.2366)	0.0108 (0.0058)	0.0186 (0.0049)
Switzerland	0.0031 (0.0254)	4.4380 (0.1699)	-4.1145 (0.1264)	-0.0035 (0.2337)	0.0101 (0.0056)	0.0208 (0.0054)
Thailand	-0.1184 (0.1004)	4.4205 (0.1887)	-3.2253 (0.1623)	-0.1071 (0.1994)	0.0105 (0.0052)	0.0114 (0.0034)
Turkey	0.0544 (0.1318)	4.3137 (0.3230)	-3.6945 (0.2542)	-0.0310 (0.1931)	0.0117 (0.0062)	0.0194 (0.0051)
United Kingdom	-0.0173 (0.0296)	4.4224 (0.1870)	-4.0295 (0.1491)	-0.0468 (0.2257)	0.0108 (0.0059)	0.0193 (0.0051)
United States	-0.0684 (0.0744)	4.3751 (0.2484)	-3.6332 (0.2065)	-0.2798 (0.2371)	0.0138 (0.0079)	0.0149 (0.0043)

Table 3: Foreign variable summary statistics

Non-US Models	Domestic	y_{it}	π_{it}	q_{it}	ρ_{it}^{S}	ρ_{it}^{L}	ex_{it}	
	Foreign	y_{it}^{*}	π_{it}^{*}	q_{it}^{*}	ρ_{it}^{S*}	ρ_{it}^{L*}		p_t^O
US Model	Domestic	y_{0t}^{*}	π_{0t}	q_{0t}	ρ_{0t}^{S}	ρ_{0t}^{L}		p_t^O
	Foreign	y_{0t}^{*}	π_{0t}^{*}				ex_{0t}^{*}	

Table 4: Model Specifications. Note: Inclusion in Non-US Models depends on availability.

Recognising the large nation status of the United States we exclude the equity price and interest rates from the foreign equation specification, and then remove the exchange rate as being foreign to all other variables. Our full model specification is provided by Table 4. Our GVAR framework benefits enormously for having so many small open economies and so we test for weak exogeneity of all of the variables in each equation, finding no compelling reason to be concerned. Although China is starting to exhibit signs that it is becoming a dominant economy we do not yet feel statistically duty bound to accord it the same treatment as the USA.

Estimation of GVAR models requires careful consideration of a large set of parameter tests, stability tests and yields a wealth of information on variable interdependence. For expediency of exposition the full reporting of these is included as Appendix B to this paper. Two key features are necessary for the successful operation of any GVAR model, the weak exogeneity outlined and parameter stability. On the former we have seen that only the USA remains a truly global economy while on the latter there are breaks within all of the country models. Most breaks occur around the time of either the AFC or the GFC, as might be expected, but there are some exceptions. For Latin America the regional crisis of 1996 is a common appearance in the table, whilst many nations have breaks around the bursting of the tech bubble in 2002. Hwa (2012) points out that this can be overstated as a crisis as affecting only a low number of series displaying such breaks. Bootstrapping the confidence intervals and covariance matrix helps resolve concerns about structural breaks and allows us to continue with our estimations. Models resulting can be seen as robust to the potential problems identified here.

3 Changing Trade Picture and the ASEAN 4 Region

China opening up has dramatically changed the trading landscape for the globe, not least the ASEAN 4 countries our study focuses upon. To capture such developments our GVAR model uses three distinct time periods for its trade weights, timed around the various crises. Motivation for this treatment comes from the dynamic pattern of trade changes in the region, changes that are easily illustrated using time series plots of trade proportions. Figure 1 plots the proportion of trade in each of the ASEAN 4 that links to China. It is very clear that all four nations have seen similar large rises in their Chinese share. From between 2% and 4% of trade being with China through the pre AFC period, including our first trade weights matrix, to around 10% in 2004 and the time of our second matrix, the share has risen to more than 15% in all nations by the time of the final matrix calculation. Increases like this show how much influence China is gaining in the region.

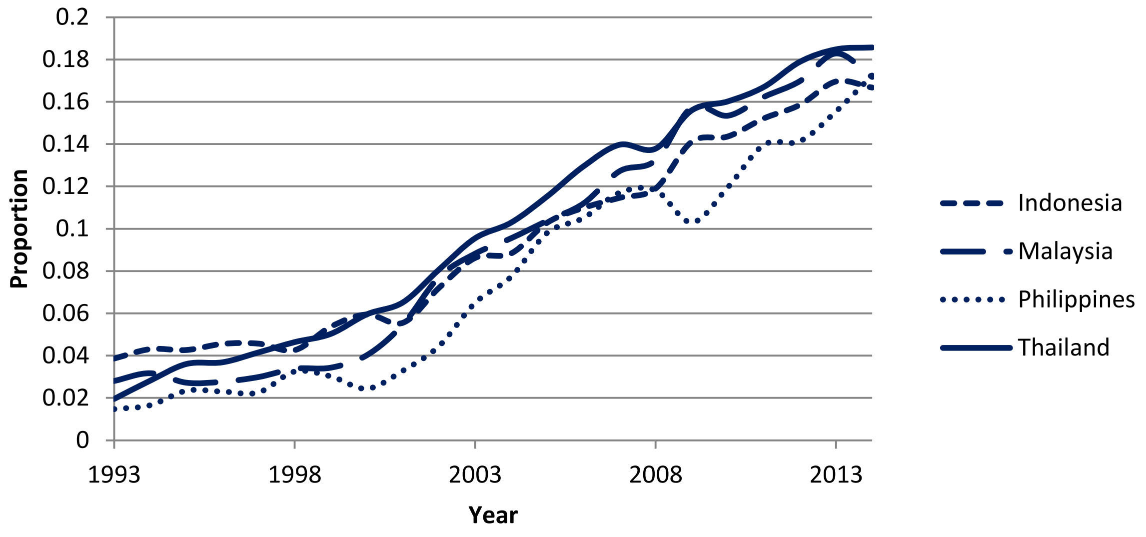

Figure 1: Trade proportions of ASEAN 4 nations with China between 1993 and 2014. (Source: Own Calculations on IMF Direction of Trade Statistics)

Contrasting with the story of expanded Chinese share is the contraction in the proportion of trade from the ASEAN 4 that is linked to the United States of America. Figure 2 displays plots of the way in which proportions have fallen from more than 20% in the pre AFC times, to between 10% and 20% in the middle of the crises, with the post GFC levels being between 8% in Malaysia and 14% in Philippines. Reduced American trade shares tallies with the story emerging from ASEAN4 policymakers about reducing exposure to western originated shocks. Hence when we construct the trade weight matrices in the GVAR that follows the proportions for USA and China are as provided in Table 6[3].

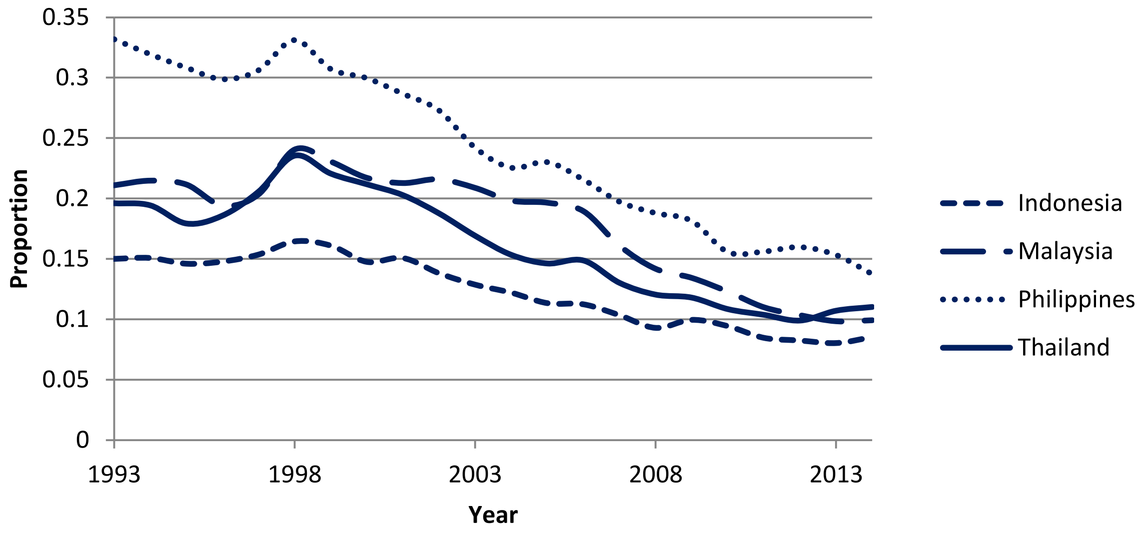

Figure 2: Trade proportions of ASEAN 4 nations with the United States of America between 1993 and 2014. (Source: Own Calculations on IMF Direction of Trade Statistics)

[3] The trade matrices are calculated as the average of three observations, the year in question and the years immediately preceding and proceeding that year. Hence these figures will disagree slightly with our graphs.

	1996		2004		2012	
	China	USA	China	USA	China	USA
Indonesia	0.0447	0.1492	0.0937	0.1202	0.1600	0.0824
Malaysia	0.0283	0.2030	0.0966	0.2005	0.1718	0.1038
Philippines	0.0230	0.3043	0.0810	0.2321	0.1457	0.1563
Thailand	0.0381	0.1899	0.1057	0.1549	0.1770	0.1032

Table 6: Trade Proportions for the ASEAN 4 members with China and USA. (Source: Own calculations on IMF Direction of Trade Statistics)

From this brief study it is very clear that the role of the world's two major economies will vary depending what set of trade weights we use. While Feldkircher et al (2014) opt to capture this using trade weights appropriate to each year, our aim here is to illustrate precisely how developments have altered economic relations. Our structure of estimating three distinct models permits comparisons between time periods and solution to "what if?" questions without introducing excessive variation from trade.

4 Global VAR Models

Global Vector Autoregressive (GVAR) models are constructed from N small open economies and one larger globally dominant nation, numbered as 0. Hence we describe country i with $i \in [0, N]$. Our exposition of this model follows the seminal paper on its use by Pesaran et al (2004). A first order dynamic framework is constructed linking a $k_i \times 1$ vector of country specific variables $\mathbf{x}_{it}$ with an equally sized vector, $\mathbf{x}_{it}^*$ representing foreign variables and forging links between countries. k_i in all that follows is the number of variables for country i, which may vary due to data availability. Thus lag polymonials $\boldsymbol{\Phi}(L, p_i)$, $\boldsymbol{\Lambda_i}(L, q_i)$ and $\boldsymbol{\Upsilon_i}(L, q_i)$ are constructed for domestic, foreign and global variables respectively. $\mathbf{a_{i0}}$ and $\mathbf{a_{i1}}$ are $k_i \times 1$ vectors of fixed intercepts and deterministic time trends. Finally $\boldsymbol{\varepsilon_{it}}$captures the serially uncorrelated idiosyncratic shocks and has $\boldsymbol{\varepsilon_{it}} \sim iid(0, \Sigma_{ii})$[4]. Hence:

$$\boldsymbol{\Phi}(L, p_i)\mathbf{x_{it}} = \mathbf{a_{i,0}} + \mathbf{a_{i1}}t + \boldsymbol{\Lambda_i}(L, q_i)\mathbf{x_{it}^*} + \boldsymbol{\Upsilon_i}(L, q_i)\mathbf{d_t} + \boldsymbol{\varepsilon_{it}} \quad (\mathbf{1})$$

For this paper $\mathbf{x_{it}} = \left(y_{it}, \pi_{it}, q_{it}, e_{it}, \rho_{it}^S, \rho_{it}^L\right)'$, while $\mathbf{d_t} = p_t^O$. Assuming foreign variables are weakly exogenous this allows the estimation to proceed.

Grouping the variables in the vector $\mathbf{z}_{it}$ allows the simplification of (1):

$$\mathbf{z}_{it} = \begin{pmatrix} \mathbf{x}_{it} \\ \mathbf{x}_{it}^* \end{pmatrix} \quad (2)$$

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

Where $\mathbf{A}_i = \boldsymbol{I}_{k_i} - \boldsymbol{\Lambda}_{i0}$ and $\mathbf{B}_i = (\Phi_i, \Lambda_{i1})$. We group all variables to form $\mathbf{x}_t = (\mathbf{x}_{0t}', \mathbf{x}_{it}', \dots, \mathbf{x}_{Nt}')$ which has $k = \sum_{i=0}^{N} k_i$ endogenous variables.

[4] Pesaran et al (2004) note, that while this restriction could be relaxed, it is not overly restrictive on quarterly data of the type used here. Hence we maintain this assumption here.

To account for factors which might influence the linkages between countries a weight matrix $\boldsymbol{W}_{it}$ is included. This will be estimated as a time invariant matrix, W_i, in our paper, but can be adjusted to take different values in each time period.

$$\mathbf{z}_{it} = W_i \mathbf{x}_t \tag{4}$$

From (3) and (4):

$$\mathrm{A}_i W_i \mathbf{x}_t = \mathbf{a}_{i0} + \mathbf{a}_{i1} t + \mathrm{B}_i W_i \mathbf{x}_{t-1} + \boldsymbol{\varepsilon}_{it}$$

These can then be stacked to yield:

$$\mathrm{G}\mathbf{x}_t = \mathbf{a}_0 + \mathbf{a}_1 t + \mathrm{H}\mathbf{x}_{t-1} + \boldsymbol{\varepsilon}_t \tag{5}$$

Where:

$$\mathrm{G}=\begin{pmatrix} \mathrm{A}_0 \boldsymbol{W}_0 \\ \mathrm{A}_1 \boldsymbol{W}_1 \\ \vdots \\ \mathrm{A}_N \boldsymbol{W}_N \end{pmatrix},\ \mathrm{H}=\begin{pmatrix} \mathrm{B}_0 \boldsymbol{W}_0 \\ \mathrm{B}_1 \boldsymbol{W}_1 \\ \vdots \\ \mathrm{B}_N \boldsymbol{W}_N \end{pmatrix},\ \mathbf{a}_0 = \begin{pmatrix} \mathbf{a}_{00} \\ \mathbf{a}_{10} \\ \vdots \\ \mathbf{a}_{N0} \end{pmatrix} \text{ and } \boldsymbol{\varepsilon}_t = \begin{pmatrix} \varepsilon_{0,t} \\ \varepsilon_{1,t} \\ \vdots \\ \varepsilon_{N,t} \end{pmatrix}$$

G is nonsingular and allows the whole model to be solved for $\mathbf{x}_t$. Based on these assumptions, and as noted by Pesaran and Shin (1998) this solution is invariant to the order of the countries.

5 Responses to Shocks

Our contribution explores how China has potentially changed its role in the ASEAN 4 region over the past twenty years. With so many nations and seven key variables it is possible to create an enormous number of potential shocks, all of which could tell a story linked into our key narrative. However, we maintain a narrow approach here asking what are the main shocks that can illustrate our analysis best? To this end equity prices predominate, being shocked from both China, America and Singapore. From that initial story it emerges that majority of the Chinese effect is still indirect, impacting ASEAN nations via trade links with Europe and America, just as much as it does through the direct effect of changing the Chinese trade weight. With GDP, and for USA GDP and equity prices very similar pictures appear, confirming contagion as an important spreading mechanism.

GIRFs for the GVAR model have the advantage of making visualising impacts straightforward, and here are plotted based on the Smith and Galesi (2014) code and following Pesaran and Shin (1998). Hence we use this method to illustrate what happens in the aftermath of each of the studied perturbunces. In all cases the results are based on 1000 replications of the bootstrapping for confidence intervals and 95% confidence intervals are plotted. These choices are motivated by a desire to achieve accuracy of fit and to provide conclusions with reasonable certainty.

5.1 Chinese Equity Price Shock

China's increasing influence within the ASEAN4 study area can be illustrated perfectly by consideration of the impact of Chinese equity price shocks. Growth in the sector in China means that there are more profound impacts globally, as Figure 3 below plots for China and the USA. Three graphs illustrate the situation using our 1996, 2004 and 2012 weights, with confidence bands added to show how the length of significant change has been extended over time. Immediately the change towards significance in America is very apparent, with the initial shock having a positive effect under 1996 weightings, but an almost significant negative effect under 2012 links. All changes are small, and there is as yet no statistical significance of note, but slowly the long run impact has been getting stronger. Also clear is the increased size of the importance of the Chinese market domestically, from an initial 9% loss in 1996 to a loss of almost 15% in 2012, and from a stabilisation 7% down in 1996 to a 9% reduction in 2012. Undoubtedly this pattern is likely to have repercussions in other nations, with the extent linked to whether America, or China, is driving their economy more.

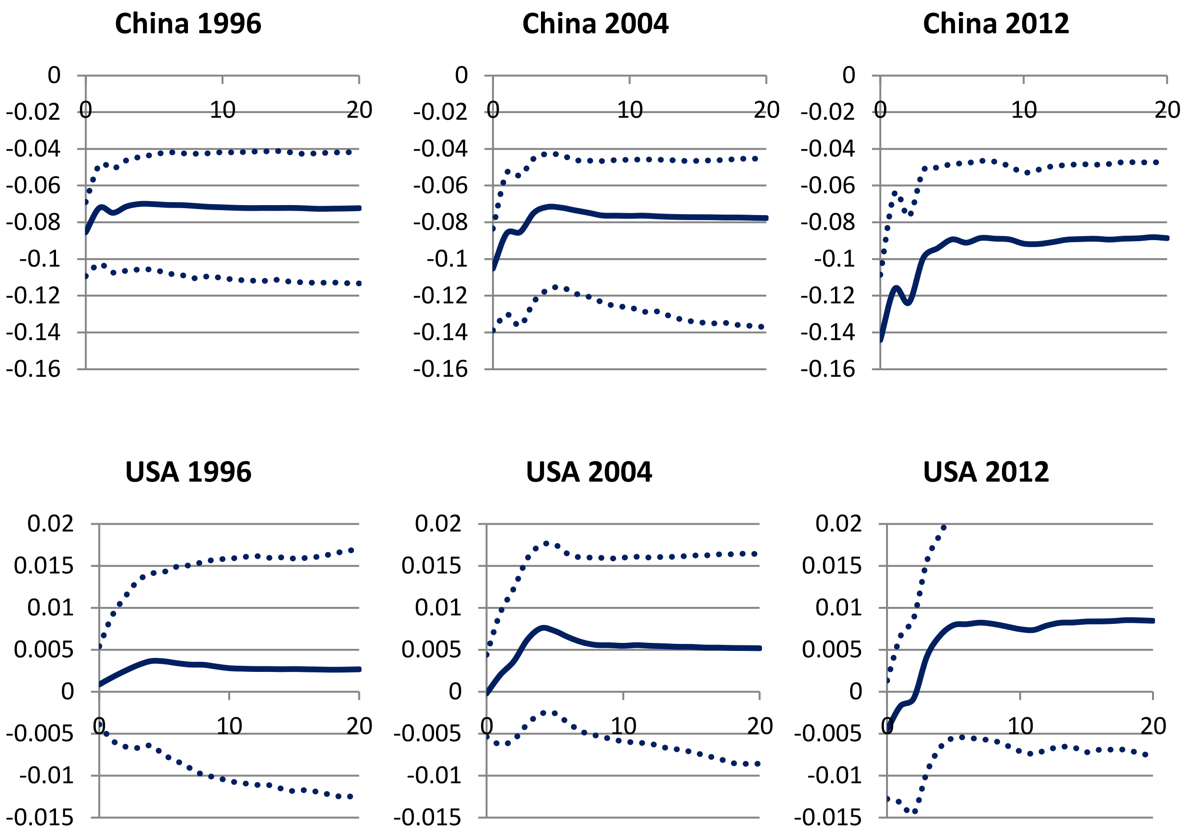

Figure 3: Impact of 1 Standard Error shock to Chinese equity prices using trade weights from 1996, 2004 and 2012. Solid lines represent median estimates and dashed lines represent 95% confidence bands. (Source: Own Calculations)

Our study begins by looking at the unadjusted impact of the Chinese negative equity price shock on the four ASEAN nations of interest. Figure 4 plots the GIRFs generated under the three weighting systems for the first 5 years (20 quarters) following the shock. In each case the increasing role of China in the region is very clear, with the shocks being barely significant under 1996 weightings, but being both larger and significant for more periods under 2012 values. Indeed, both Indonesia and Philippines maintain a significant impact once the initial shock has settled down of 4% and 3% respectively. For Malaysia and Thailand the impact lasts around one year, but is still greater than it had been under earlier weightings. Consistently there is a growing influence, but is this being passed on through the American effect seen above, or directly from China to the countries?

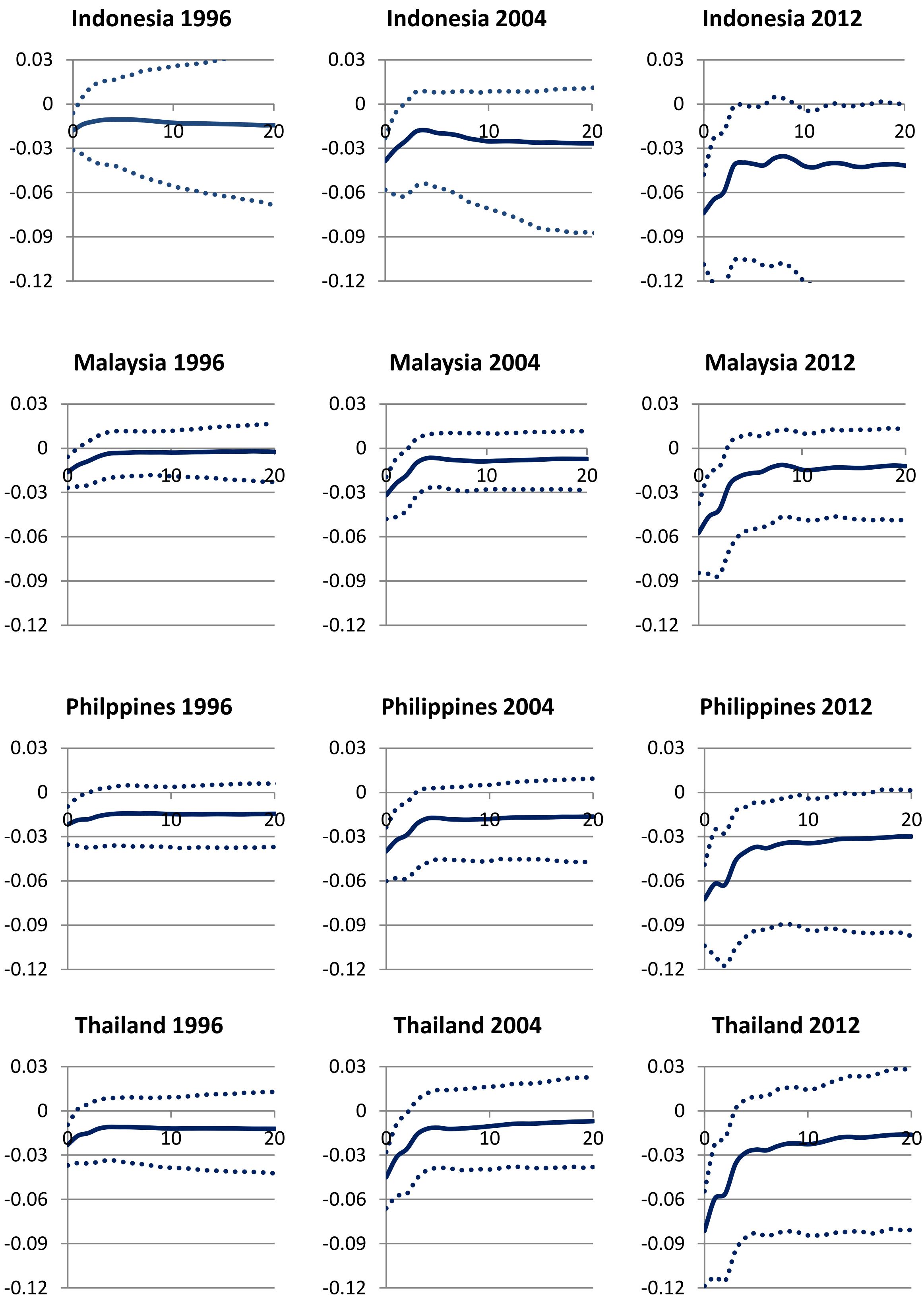

Figure 4: Impact of 1 Standard Error shock to Chinese equity prices using trade weights from 1996, 2004 and 2012. Solid lines represent median estimates and dashed lines represent 95% confidence bands. (Source: Own Calculations)

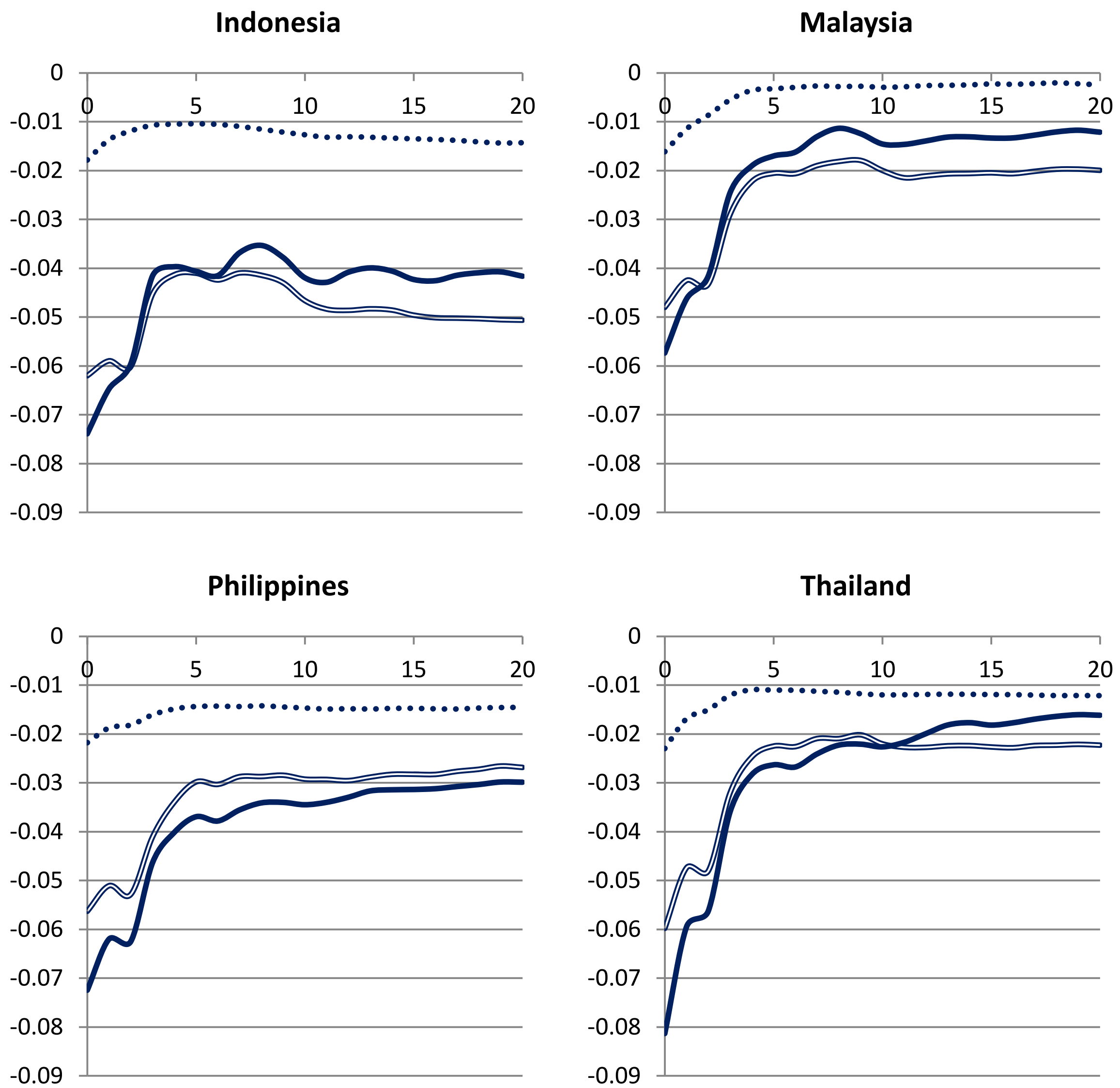

Figure 5: Impact of 1 Standard Error shock to Chinese equity prices using trade weights from 1996, and 2012 plus the indirect effect 2012 weight matrix. Solid lines represent 2012, dashed lines 1996 and the hollow lines show indirect effects. (Source: Own Calculations)

To extract the effect that comes from China we employ a similar methodology to Cesa-Bianchi et al (2012), who remove the role that trade agreements between America and Mexico have on mediating the impact of China on Latin America, producing figure 5. Immediately it is very clear that the indirect effects, represented by a hollow line, are very similar to the combined effect which is the solid line on each figure. Large gaps also appear between the 1996 values, the dashed line, and the indirect plot. Hence we can conclude that the vast majority of China's impact in the region is actually being driven by effects on other countries, such as America and Europe, rather than affecting the ASEAN 4 directly. An interesting feature from the Indonesian, Malaysian and Thai plots is that the indirect effect is actually larger than the 2012 suggestion such that the direct impact of China is actually to raise the MSCI index. Although seemingly counter-intuitive this can be motivated by the ease of moving investments from China to these other nations by investors keen to avoid the worst of the changes in China. Such effects are regularly noted for the USA and its' smaller neighbours.

5.2 United States Equity Price Shock

Opposite the China impact there is also the role of America in the region. As the world's major economy the influence it held was large, but as the AFC hit there was a desire to insulate domestic economies from the worst contagion. Whilst the highlighted issue was the role of Singapore as a transit mechanism, the direct effect of America is explored here. Again though, we begin with a look at the comparative plot of China and the United States. Figure 6 shows the comparison and when contrasting with figure 3 it can be seen that the impacts from the USA on China are far greater than the reverse. By 2012 China sees a stabilisation at 8% below its old value, where earlier years show a reducing effect over time which finally settles around 4% down. America has a 5% reduction throughout, and the initial shock is 4% for all years.

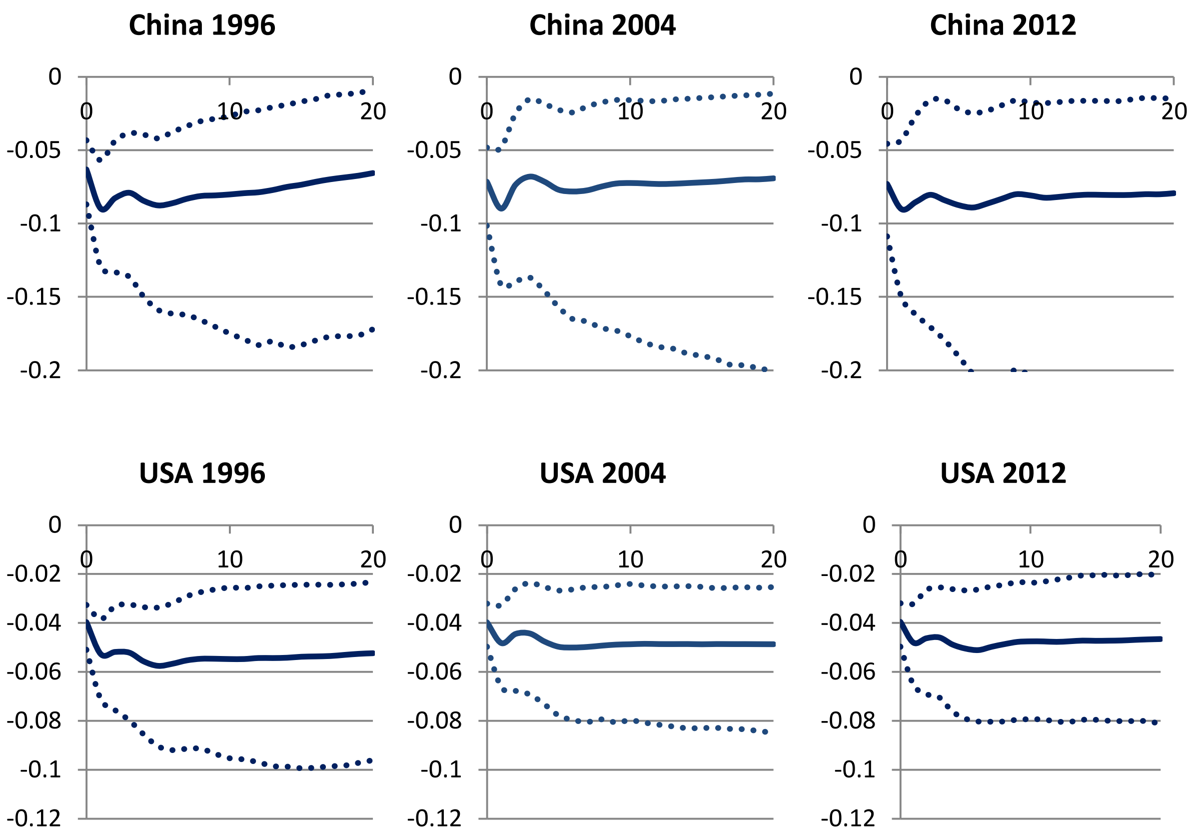

Figure 6: Impact of 1 Standard Error shock to United States equity prices using trade weights from 1996, 2004 and 2012. Solid lines represent median estimates and dashed lines represent 95% confidence bands. (Source: Own Calculations)

Figure 7 contrasts Malaysia, which has successfully seen the impact of American equity prices become insignificant under 2012 weightings, with Indonesia and the Philippines who both maintain significant impacts at the same level under all three weights. Both of these nations show losses in their own equity markets of more than 5%. Thailand continues to suffer losses, but these are only shown to remain significant for up to four years, pointing to partial success in insulating themselves from the worst of American fluctuations.

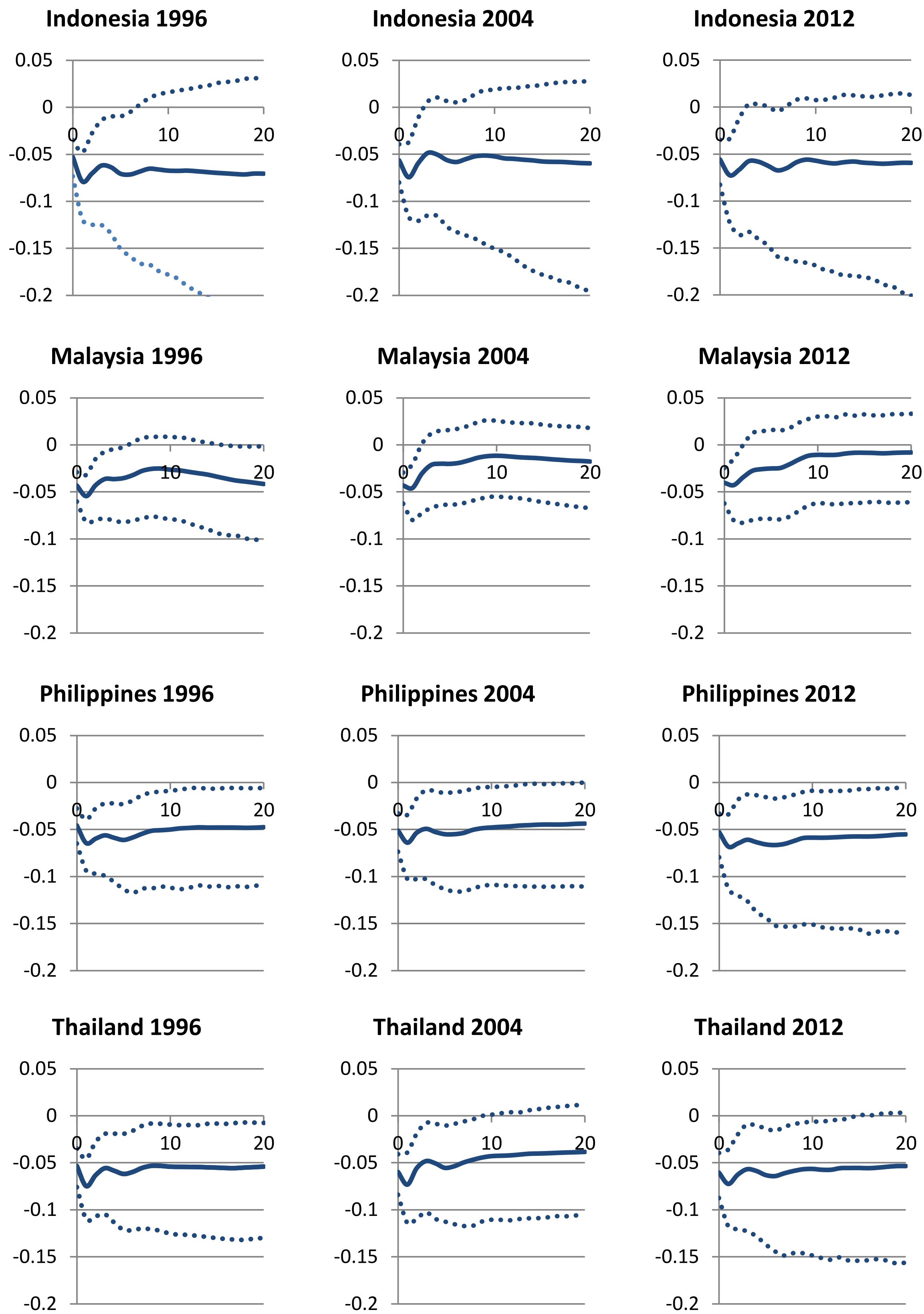

Figure 7: Impact of 1 Standard Error shock to American equity prices using trade weights from 1996, 2004 and 2012. Solid lines represent median estimates and dashed lines represent 95% confidence bands. (Source: Own Calculations)

5.3 Singapore Equity Price Shock

As stated the aim of the ASEAN4 was to insulate themselves from shocks which were transmitted via Singapore, thus it will be necessary to keep the effects of domestic Singapore perturbations to a minimum. Using our GVAR model we can perform similar analysis to above, using the GIRFs to illustrate change, however none of the shocks are significant as Appendix C presents. Figure 8 below shows the Philippines by way of an example. In fact, what can be seen is that there is very little difference between the periods, if anything there is a stronger impact in more recent times, the initial shock being 1.2% and the long run change at a similar level.

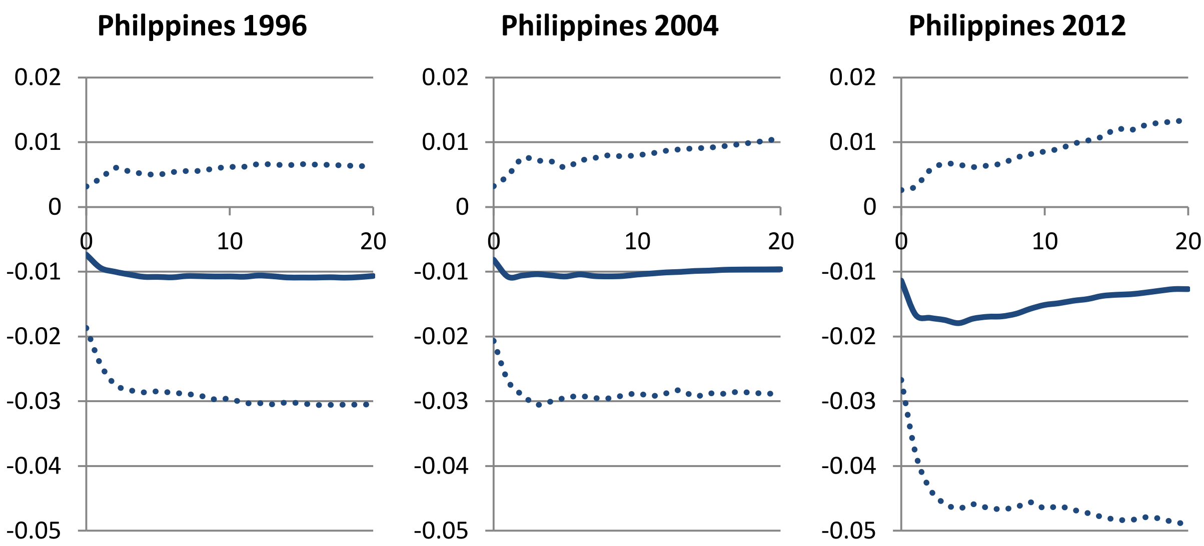

Figure 8: Impact of 1 Standard Error shock to Singapore equity prices using trade weights from 1996, 2004 and 2012. Solid lines represent median estimates and dashed lines represent 95% confidence bands. (Source: Own Calculations)

It is a straightforward exercise to verify that the upper bound of the 95% confidence interval is positive for all ASEAN4 members, whilst the lower bound is negative throughout. Hence there are no significant impacts of Singapore equity price shock on equity price index values under any of the weighting systems.

5.4 Chinese GDP Direct Effects?

To contextualise the highlighting of indirect effects on the equity market we briefly turn to GDP and ask whether there is indeed a major impact of China directly into the performance of the ASEAN 4. Whilst trade is focusing more towards China, it is not clear that this will lead to direct spill-over should there be a shock reduction in the Chinese GDP. Using the same hypothetical GVAR with 1996 trade weighting for China in the 2012 model, we seek to separate the direct impact from that which is transmitted via other nations.

Figure 9 shows the four plots for each of our nations. Unlike the equity prices there is some variation in the responses, with Indonesia clearly experiencing large impacts, while Thailand and particularly the Philippines do not. Generally the impact of the indirect effect is not as pronounced as the overall, and so we can conclude that the direct impact of a negative Chinese GDP shock will be a negative one in each of the nations. Whilst Indonesia sees the largest fall in national income it is Malaysia that has the most direct effect from China, a result which follows from the fact that Malaysia has long kept itself open and has a higher trade percentage than others. Comparing the indirect plot with that for the 1996 weights it is clear that there is a large role for spill overs, as there was for equity prices. However, there is a little stronger argument that China is having direct effects here, particularly in the earlier periods following the shock. Long run, Malaysia aside, the indirect and 2012 lines close in after around three years meaning that only indirect effects remain to explain persistent differences with 1996. This changing picture, but ultimate reversion to second hand effects will be of great importance for policymakers, especially those seeking to insulate against major financial problems, those who are mindful of past crises.

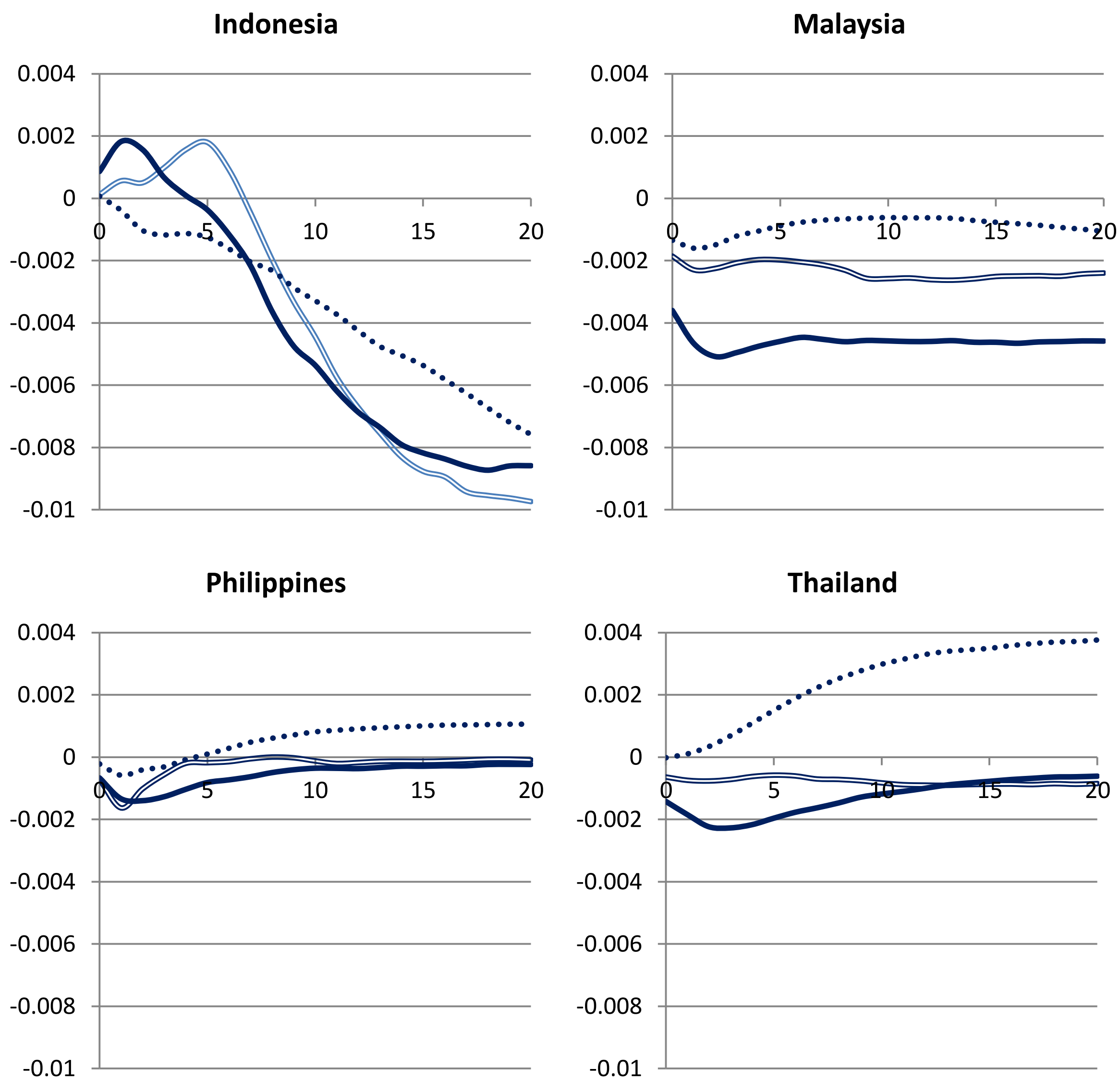

Figure 9: Impact of 1 Standard Error shock to Chinese GDP using trade weights from 1996, and 2012 plus the indirect effect 2012 weight matrix. Solid lines represent 2012, dashed lines 1996 and the hollow lines show indirect effects. (Source: Own Calculations)

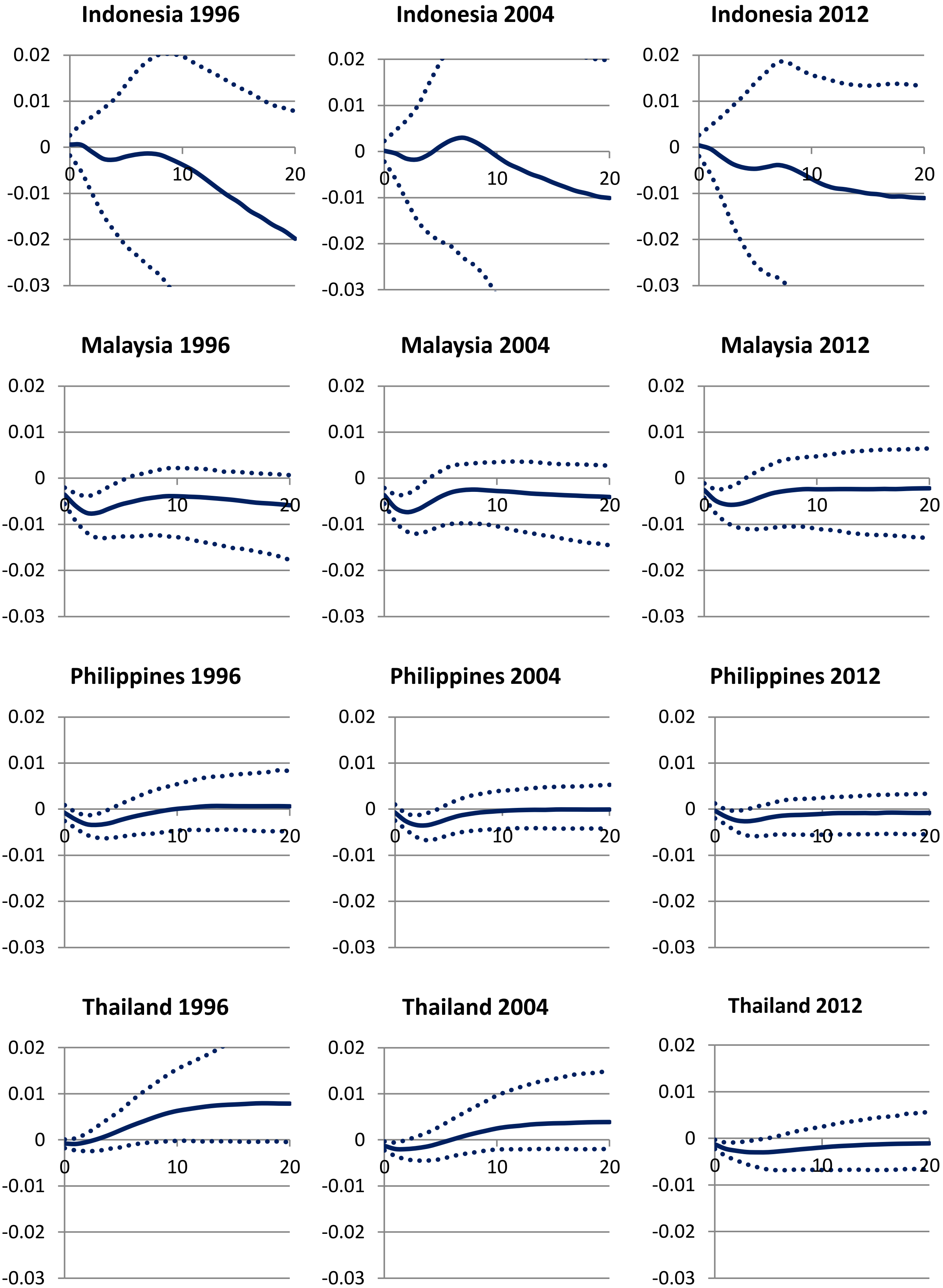

Figure 10: Impact of 1 Standard Error shock to American GDP using trade weights from 1996, 2004 and 2012. Solid lines represent median estimates and dashed lines represent 95% confidence bands. (Source: Own Calculations)

5.5 United States GDP Shock

Equity price shocks emanating from the United States have been having a reduced impact in the ASEAN region over the three distinct periods covered, but as we showed above this evolution is a slow one, proceeding at a pace that does not match the rapid march towards isolationism that the trade statistics would suggest. To evaluate the extent to which this is an equity price only issue a negative GDP shock is modelled here, with the response GIRFs illustrating the effect. Figure 10 shows clearly that Indonesia has much larger impacts than any of the other nations, indeed it has been necessary to fix the boundaries of the plot to exclude parts of the confidence interval in order that other nations can be plotted meaningfully on the same scale. What we see on a few occasions is that the time taken to return to a new stable level is longer than the twenty periods plotted, this is especially true of Indonesia where the levels actually take around 30 quarters to level off in both 1996 and 2004. The other three are much more stable, with the impact of the shocks being insignificant after around 5 quarters under 1996 weights but reducing to 3 quarters in 2012.

Thailand displays an interesting pattern, in that initially the reaction of a negative shock is to raise Thai GDP, but this changes round to being a reduction in GDP under the 2012 trade weights. On a smaller scale the Philippines shows a lower impact on the more recent weightings and post-crisis responses in Malaysia are closer to zero than they were before the AFC hit. There is some evidence therefore that the countries have indeed become immune to the worst of shocks from the USA, but the extent to which this is a consequence of the reduced trade weights needs analysis. To this question we turn next.

5.6 USA Direct Effects?

Following a similar methodology to the Chinese case we construct a new trade matrix based on the USA maintaining its 1996 levels of trade with the ASEAN4. A new run of the GVAR model is then undertaken, with shocks processed for both GDP and equity prices. Across previous parts we have seen that the large majority of Chinese impacts have been indirect, rather than driven by changing trading relationships. As Figures 11 and 12 illustrate, for equity prices and GDP respectively, a similar tale can be told about the USA and its evolving presence. Although not the variable under investigation it is clear that in some cases the USA indirect impact is actually stronger than the one which is observed under 2012 weights, a suggestion there that insulation against America has been broadly successful in reducing the negative impact compared to that which would have been felt.

An immediate observation from the analysis of equity prices in Figure 11 is that Malaysia feels a much smaller impact from the USA than the other three nations. Further we see the closest tracking of the 2012 GIRF by the indirect effect line amongst the set, confirming that the Malaysians have been successful in insulating their share index well against the American stock market. It is of course true though that the shock does have an initial significant impact, as figure yy showed earlier. For Indonesia there has been a reduction in the downside, of which indirect effects explain the majority, but the lost value from a negative USA movement is still large. Both the Philippines and Thailand display the curious result of the indirect effect being stronger than the direct one. Hence we can see that for these two policies to mitigate the worst of a further financial crisis have been successful to the extent that the new trade matrix actually would see a USA negative shock have a positive impact.

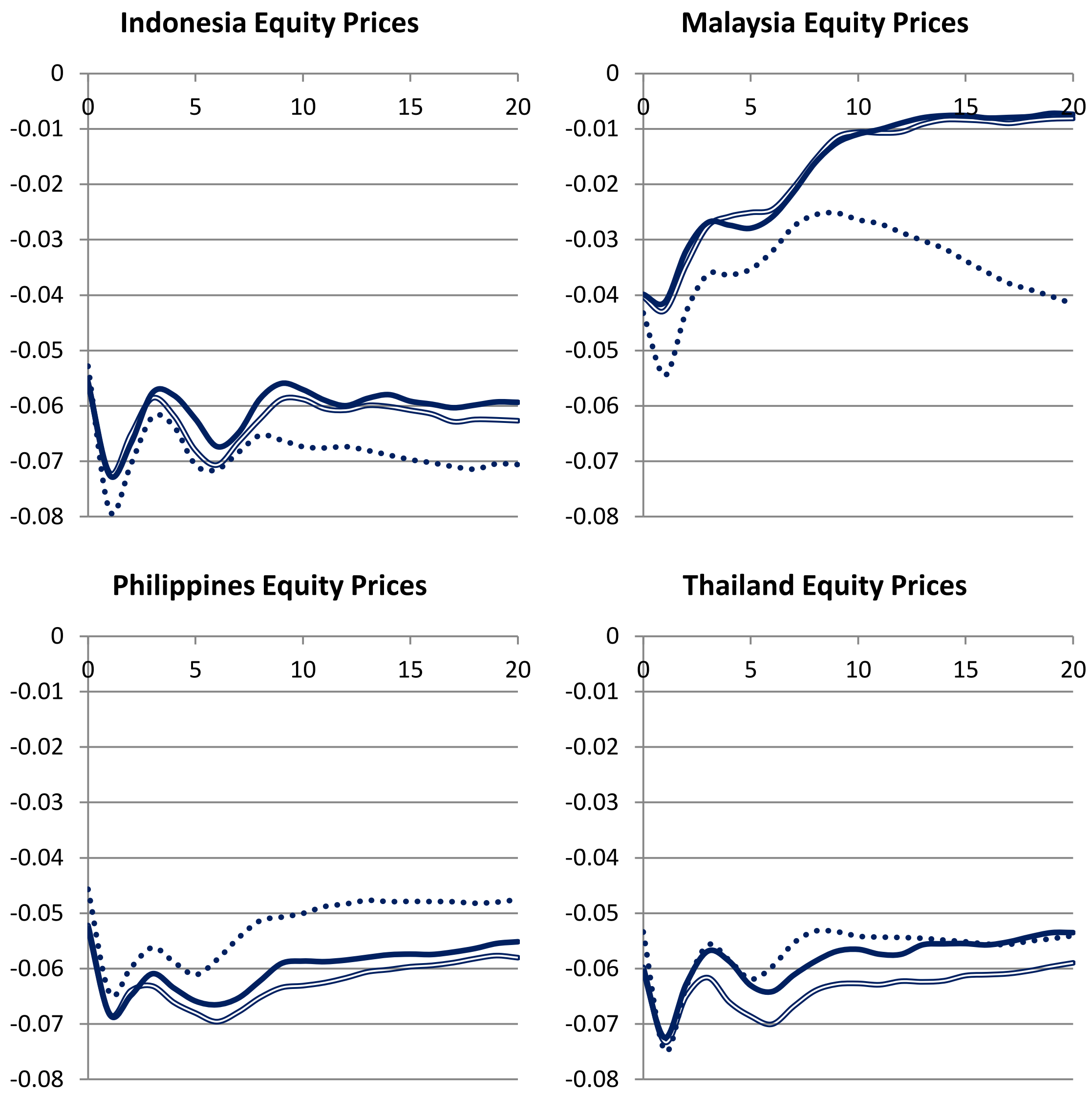

Figure 11: Impact of 1 Standard Error shock to USA equity prices using trade weights from 1996, and 2012 plus the indirect effect 2012 weight matrix. Solid lines represent 2012, dashed lines 1996 and the hollow lines show indirect effects. (Source: Own Calculations)

When we switch focus to GDP there a very similar results, with Malaysia having almost all of its GDP impact explained by indirect effects in 2012. However, unlike the equity price case there is no evidence of overshooting negative impacts on any of the economies. What we do see is that Indonesia has indirect effects which would paint a better picture than the actual 2012 plot. Where stabilisation occurs at -0.5% under the indirect effect the plot using true weights stabilises below 1% down. In the Indonesian case the reduction of trade share with America has actually left it more susceptible to losses from American shocks than it might otherwise have been. For the Philippines and Thailand there is a much more familiar pattern, indirect effects sitting between the 1996 and 2012 lines. In Thailand almost all of the change is explained by impacts on Thai trading partners that are then transmitted on to the Thai economy. In the Philippines by contrast almost exactly half of the changes in GDP can be explained by direct effects.

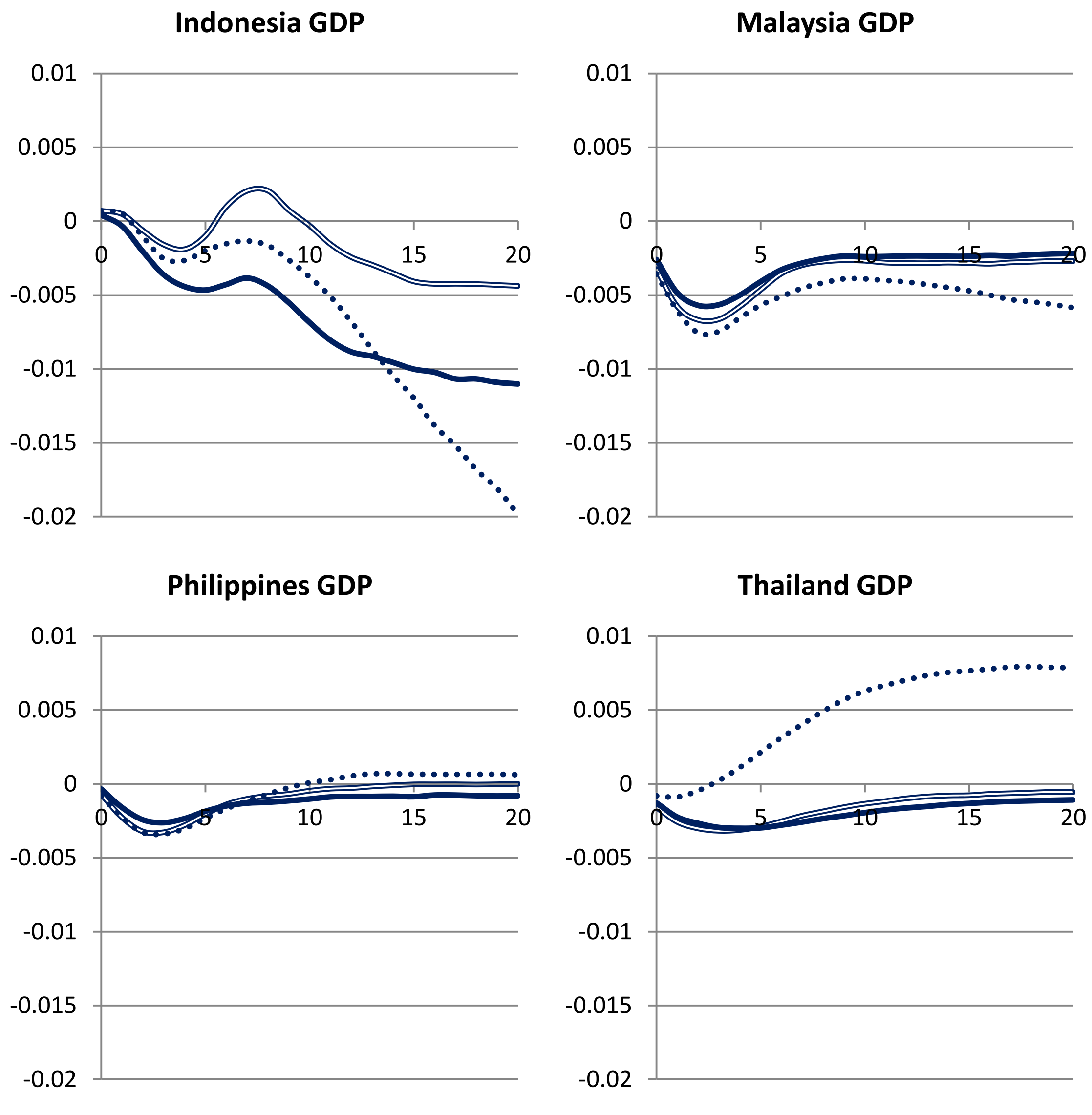

Figure 12: Impact of 1 Standard Error shock to USA GDP using trade weights from 1996, and 2012 plus the indirect effect 2012 weight matrix. Solid lines represent 2012, dashed lines 1996 and the hollow lines show indirect effects. (Source: Own Calculations)

This brief review of the USA's role over time has shown how the ASEAN nations have become increasingly influenced indirectly rather than from direct shocks. Given the desire to insulate against the worst of bad financial news from America this is an encouraging reflection. However, there is clearly still some work to do to remove all of the impact, as these indirect effects will need to be cut off too.

6 Conclusions

China's influence on the global stage is undoubtedly growing, our more contemporary dataset serving to highlight that fact more. As yet though for the ASEAN 4 shocks continue to transmit via others, rather than directly from China, a result the GVAR framework allows us to bring through clearly. There has been a concerted effort by ASEAN members to limit the impact of precisely this kind of contagion from regional and global shocks following the Asian Financial Crisis of the late 1990s. Meanwhile China has shown rapid growth and opening up, bringing about a much more important role in shaping world economies. We have shown that there is indeed a significant increase in the effect that a shock to Chinese equity prices would have across the ASEAN region and in America. Meanwhile the role of an American shock in shaping the performance of ASEAN equity prices has diminished. By presenting three weighting matrices for our estimation this transition appears quickly and conveniently. Illustrating the impact of shocks using Generalised Impulse Response Functions brings home just how much greater traction China has taken on. Whilst there is comparability between the four members studied, differences in reaction remain entrenched, supporting the suggestion in Lee et a (2013) and others, that the region lacks sufficient economic unity for a collective response let alone a single currency.

Our decision to use equity prices offers a key extension to the literature, and is motivated by the roles the stock markets had in the major financial crises of recent times. However, similar impacts can be found for all other variables, especially GDP shocks and changes to the consumer price index. As data becomes increasingly available for the post Global Financial Crisis period, it is possible to get a better understanding of what the longer term effects will be. Certainly nations are insulating themselves against American dominance, and policy continues to be shaped in that way, but an inadvertent consequence of this is greater exposure to other powers, such as China. GVAR methodologies and their advances are well poised to allow researchers to capture precisely how the world is changing. Further, with more countries in the region now having reliable data for 10 years, a threshold whereby more ASEAN nations can be modelled is only a few years away. The changes plotted in this study represent both useful signposts for further work and a valuable extension to the existing literature on the changing role of China, and power in the ASEAN region.

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Appendix A: Data Sources

Preparation of data draws many times on the work of previous studies, both Cesa-Bianchi et al ("012) and the accompanying documentation to GVAR Toolbox 2.0 by Smith and Galesi (2014). Our innovations come in the extension of the model into 2014 and the subsequent removal of earlier years where a large number of variables had to be backward computed. Consequently there are some differences in the precise ways in which data are derived. Feldkircher and Kohonen (2014) opt to start their dataset in 1995, however we maintain the 8 observations that would otherwise be lost and in so doing allow ourselves to present a pre Asian Financial Crisis (AFC) world. In what follows we detail the sources of our data and the processes that ready it for GVAR analysis. A final summary of data sources is provided in section A9.

A1 Real Gross Domestic Product

For all but China the Gross Domestic Product (GDP) data is taken from the IFS dataset. Within this there are two groups, those which are already seasonally adjusted and those which require our consideration on seasonality. For China the source of the data is the Chinese National Bureau of Statistics (NBS) sourced using datastream and the seasonal adjustment is required. Further the data provided is nominal GDP and accounting for inflation is undertaken using the methodology detailed below:

$$\log(RGDP_1) = log\left(\frac{GDP_1}{CPI_1}\right)$$

$$\log(RGDP_t) = log(RGDP_1) + log\left(\frac{GDP_t}{GDP_{t-1}}\right) - \log\left(\frac{CPI_t}{CPI_{t-1}}\right)$$

This then provides us with the real GDP to compare with other countries. Since we are beginning our study in 1993 there are no countries that have missing GDP to calculate. All Series are finally adjusted to ensure that the index takes the value of 100 in 2010.

A2 Consumer Price Index

Once again the primary source for data is the IFS, with the exception of China where year on year change data is acquired from the NBS. All series are tested for seasonality using the R package X12, and the adjusted series used where tests indicate that is appropriate. As with GDP it is necessary to ensure that all series take the index value of 100 in 2010. Resulting is the CPI_{it} series used throughout the paper and in the adjustment of Chinese GDP detailed above.

A3 Exchange Rates

Like the majority of recent works our exchange rate data is drawn from Bloomberg and the appropriate CURNCY ticker. As data here is daily we take the average of the values on the last Wednesday of each month in the quarter. Seasonal adjustment is not performed. Because all currencies are based against the Dollar the USA value is unity throughout and the variables is not included in any of the regressions.

A4 Equity Price Index

We use the MSCI equity price index from datastream and rebase it such that 2010=100. To construct the quarterly data the closing value from Wednesday of any given month and then averaged over the three months of each quarter. Choosing Wednesday over the last day will minimise the day of the week effects, which may otherwise have generated inconsistency in our results. Once again no seasonal adjustment is applied.

A5 Short Term Interest Rates

Wherever possible data comes from the IFS database, but for some countries (Denmark, India, Germany, Portugal, Russia, Thailand and Turkey) datastream is required to get a better range of observations. Brazil, the Czech Republic and Russia require calculation of early period observations. This is done using the package forecast to reverse the time series and then apply a forecasting auto ARIMA with lag lengths selected to obtain the best estimates. Finally, a second reversal of the time series produces the series for use in the model.

A6 Long Term Interest Rates

Many nations do not report their long run interest rates and as such we only have a limited subset. Only data which can be found in the IFS dataset is used here, other nations being left as short term only. We have long run rates for Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Japan, Korea, Malaysia, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom and the United States of America. Many of these then combine to contribute to the Euro area rate.

A7 Oil Prices

Datastream ticker CO1 Comdty is used to construct the oil price, again using the final Wednesday of each month to form a quarterly average. An index is then formed with 2010 being set equal to 100.

A8 Trade Matrices

We collect IMF direction of trade statistics for all countries over the full period of the dataset. As some values are missing this requires the backward imputation of these values using the forecast method in R. Clear discrimination is made between those nations who have zero trade and genuine missing data before any adjustments are performed. MATLAB then constructs our weight matrices from the average of a three year period specified in the GVAR toolbox. Three distinct periods are used as well as the potential 2012 matrices, which maintain the 1996 values for China and America independently. Table A1 thus explains the weighting matrices used in our analyses. As a base for the "what if?" analysis the average matrices constructed by the programme are used with adjustments made manually.

Matrix Reference	Average Of	Use
1996	1995 – 1997	Pre AFC trade situation. Also for pre China opening up
2004	2003-2005	Between the AFC and GFC.
2012	2011-2013	Captures post GFC world and has the much stronger China
2012 China	2011-2013	Measures the indirect effects of Chinese shocks by holding China at its' 1996 levels and distributing the changed share amongst smaller nations
2012 USA	2011-2013	Measures the indirect effects of the USA contraction in the region by holding the United States at its' 1996 level.

Table A1: Summary of Trade Weights Matrices used in Construction of the GVAR models.

A9 Summary of Data Sources

To provide fuller details of the sources of our data we collate the discussion of this appendix into a single table. These are then the base's on which the appropriate seasonal adjustments and calculations are performed. For the equity prices the MSCI index is used as noted above, and for the exchange rate against the US Dollar the Bloomberg CURNCY code is used. Since these are identical for all they are omitted from the table that follows.

One feature of the IFS dataset used is that all series begin with a three digit prefix and rather than repeat this in each column a separate column is given for these.

Where data is sourced from Bloomberg or Datastream then the appropriate ticker information is given in capitals. In the case of Chinese Gross Domestic Product the relevant ticker is CHGDPA, for example.

Country	Prefix	Real GDP	CPI	Short Term Interest Rate	Long Term Interest Rate
Argentina	213	99bvpzf	64azf	60lzf	60bzf
Australia	193	99bvrzf	64zf	AUINTER3	61zf
Austria	122	99bvpzf	64zf	60bzf	61zf
Belgium	124	99bvpzf	64zf	60czf	61zf
Brazil	223	99bvpzf	64zf	60czf	
Canada	156	99bvrzf	64zf	60czf	61zf
Chile	228	99bvpzf	64zf	60lzf	
China	924	CHGDPA	CHCONPR%F	64lzf	
Czech Republic	935	99bvpzf	64zf	60czf	
Denmark	128	99bvpzf	64zf	DKINTER	61zf
Finland	172	99bvpzf	64zf	60bzf	61zf
France	132	99bvrzf	64zf	60czf	61zf
Germany	134	99bvrzf	64zf	DLINTER3	61zf
Greece	174	GRGDPA	64zf	60czf	61zf
India	534	99bvpzf	64zf	ININTER3	
Indonesia	536	99bvpzf	64zf	60bzf	
Ireland	178	99bvpzf	64zf	60czf	61zf
Italy	136	99bvrzf	64zf	60czf	61zf
Japan	158	99bvrzf	64zf	60czf	61zf
Korea	542	99bvpzf	64zf	60lzf	61zf
Malaysia	548	99bvpzf	64zf	60czf	61zf
Mexico	273	99bvpzf	64zf	60czf	
Netherlands	138	99bvrzf	64zf	60lzf	61zf
New Zealand	196	99bvrzf	64zf	60czf	61zf
Norway	142	99bvpzf	64zf	60zbzf	61zf
Peru	293	99bvpzf	64zf	60lzf	
Philippines	566	99bvpzf	64zf	60czf	
Portugal	182	99bvrzf	64zf	POINTER3	61zf
Russia	922	99bcpzf	64zf	60czf	
Singapore	576	99bvpzf	64zf	60czf	61zf
Spain	184	99bvrzf	64zf	60czf	
Sweden	144	99bvpzf	64zf	60czf	
Switzerland	146	99bvrzf	64zf	60czf	
Thailand	578	99bvpzf	64zf	THINTER3	
Turkey	186	99bvpzf	64zf	TUINTER3	
United States	111	99bvrzf	64zf	60czf	61zf
United Kingdom	112	99bvrzf	64zf	60czf	61czf

Table A2: Summary of data sources. Numbered sources are from the IFS data set. Capital letters denote source from Bloomberg and Datastream.

Appendix B: Full Estimation Results

Informing our Global Vector Autoregressive (GVAR) specification is a large amount of testing and regression outputs. Here we collate that which is most relevant as background to the Generalised Impulse Response Function (GIRF) analysis that is applied in section 5 of the main paper. All statistics are taken from the output from our 2012 model that is generated by GVAR Toolbox 2.0 (Smith and Galesi, 2014), with our other matrices generating similar conclusions. Further for many tests and values identical results emerge whichever trade matrix is used.

B1 Unit Root Tests

From Nelson and Plosser (1982) onwards it has been established that the vast majority of macroeconomic time series are integrated to at least order 1. Hence, as in Dees et al (2007), Cesa-Bianchi (2012) and the vast majority of the literatures it is not unreasonable to proceed on the assumption that our series are also $I(1)$. Unit root tests for the domestic and foreign variables are reported in Tables B4 and B5 respectively. Nations are ordered according to the groupings of Table 1 in the main paper.

With such a large dataset it is unsurprising that there is a rejection of the unit root in some countries, and indeed that does happen here. Only short term interest rates show any suggestions that more than 10% of the countries have an $I(0)$ process and this can be linked to the post GFC values. Removing trends from domestic variables removes many of the rejections. A very similar story appears for foreign variables, where inflation and exchange rates could be seen as a concern. However, when trends are removed there are very few rejections of a unit root within the level series. In almost every case first differences and second differences are found to be stationary. Oil prices feature a unit root when there is no trend as Table B6 shows.

Whilst the picture is not as perfect as might be desired there is no strong evidence that any one country should be considered for exclusion, nor is there that the model is likely to suffer at the estimation stage because of unit roots, or the lack thereof.

B2 Lag Orders and Cointegrating Ranks

Initially all models are limited to a domestic lag order, p_i, of 2 and a foreign lag order, q_i, of 1 for each country i. This ensures the necessary stability in the model and is common with all major papers in this field. Based on the assumptions of parameter stability and weakly exogenous foreign variables, which are fundamental to the GVAR model, we first allow the programme to select p_i for each country for each of the three trade weight matrices. Similarly the cointegrating ranks are also left to GVAR Toolbox 2.0 (Smith and Galesi, 2014). From this we take the minimum lag order, and minimum number of cointegrating relationships, to start a process of reducing the model towards stability. Where real volatility is visible in the GIRFs p_i is reduced to 1. This helps to reduce the more volatile behaviour that can follow shocks. Second we reduce cointegrating ranks to ensure that convergence is relatively quick. For the 2012 matrix we do find that some nations do not tend to their new long run values as quickly as we would like, but the overall model is still sufficiently stable.

Table B1 reports the lag orders and cointegrating ranks selected virtually by the programme, as well as the values used in the final regression. Immediately apparent is just how much some countries are

	1996		2004		2012		Minimum		Used in Model		
	p_i	q_i	p_i	q_i	p_i	q_i	p_i	q_i	p_i	q_i	
Argentina	2	1	2	1	2	1	2	1	2	1	1
Australia	2	3	2	4	2	2	2	2	2	1	2
Brazil	2	3	2	2	2	3	2	2	1	1	2
Canada	2	3	2	3	2	2	2	2	1	1	2
Chile	2	3	2	3	2	3	2	3	1	1	1
China	2	3	2	3	2	3	2	3	2	1	1
Czech Republic	2	4	2	4	2	3	2	3	1	1	1
Denmark	2	4	2	4	2	4	2	4	1	1	1
Euro	2	4	2	4	2	4	2	4	1	1	1
Hungary	2	3	1	3	1	4	1	3	1	1	1
India	1	3	1	4	1	4	1	3	1	1	1
Indonesia	2	4	2	4	2	4	2	4	2	1	1
Japan	1	4	1	3	1	2	1	2	1	1	1
Korea	2	3	2	3	2	2	2	2	1	1	1
Malaysia	2	4	2	4	2	5	2	4	1	1	2
Mexico	2	3	2	2	2	2	2	2	1	1	2
Norway	1	3	1	3	1	3	1	3	1	1	1
New Zealand	2	2	2	3	2	3	2	2	2	1	2
Peru	2	4	2	4	2	4	2	4	1	1	1
Philippines	2	2	2	1	2	2	2	1	1	1	2
Russia	2	4	2	4	2	4	2	4	2	1	1
Singapore	1	2	1	2	1	2	1	2	1	1	1
Sweden	2	2	2	3	2	3	2	2	1	1	1
Switzerland	2	4	2	4	2	4	2	4	2	1	1
Thailand	2	4	2	4	2	4	2	4	1	1	1
Turkey	2	4	2	4	2	4	2	4	1	1	1
UK	2	4	2	5	2	5	2	4	1	1	1
USA	2	2	2	2	2	2	2	2	2	1	2

Table B1: Lag Order Selection and Cointegrating Rank selections (Source: GVAR Toolbox 2.0, Smith and Galesi (2014))

reduced. However this is not unusual in the GVAR literature and similar strong reduction is clear in Cesa-Bianchi et al (2012) amongst others. By way of an example of how the initial number of cointegrating is calculated Tables B7 and B8 report the trace test statistics used in the determining of initial orders and the corresponding critical values.

B3 Weak Exogeneity Tests

There are 16 combinations of variables and countries which fail the weak exogeneity test, representing about 12% of the total number. Many of these are marginal rejections. For equity prices the two countries Affected are Brazil and Chile, neither of whom are major trading partners of the ASEAN 4. As an oil producing country Indonesia is found to have influence from the oil price, but this is not a variable we shock in this paper. Table B9 reports the full results.

B4 Parameter Stability Tests

It is essential to the modelling that parameters are as stable as possible and the GVAR toolbox (Smith and Galesi, 2014) provides a series of tests to check precisely that. Following Dees et al (2007) and Cesa-Bianchi et al (2012) we present here only the number of rejections of stability for each variable and each test. First of the tests is the Ploberger and Kramer (1992) maximal OLS cumulative sum test statistics PK_{sup} and PK_{msq} are studied, being the standard tests and the mean square error versions respectively. For each there is a comparatively low number of rejections. Second is the Nyblom (1989) parameter stability test, which is represented by $\mathfrak{R}$. For this and the following tests a second version is presented with errors which are robust to heteroskedasticity. A higher number of rejections is recorded, particularly for inflation and the exchange rate, but many of the rejections disappear as robust errors are considered. Third we include the Quandt Likelihood Ratio proposed in Quandt (1960), which is a sequential Wald style test statistic. This also produces a large number of rejections, but the count reduces heavily in the robust version. Hansen (2002) mean Wald statistic produces similar results as once more the robust version has fewer rejections. Short run interest rates may be viewed as a slight concern here, but the number of rejections is still acceptable. Finally the exponential average errors are used to construct the APW test, which also shows similar results to the others.

Test	y	π	ex	q	ρ_i^S	ρ^L	p^O	Total
PK_{sup}	11	4	4	6	4	2	1	33
PK_{msq}	10	3	4	3	2	1	0	23
$\mathfrak{R}$	10	15	12	4	9	4	1	55
Robust $\mathfrak{R}$	2	10	6	3	5	6	0	31
QLR	12	16	19	14	22	9	1	95
Robust QLR	3	10	9	1	6	2	1	32
MW	12	17	14	7	18	6	1	75
Robust MW	4	11	15	2	8	1	0	40
APW	12	17	18	12	20	10	1	90
Robust APW	5	9	11	2	7	1	1	37

Table B2: Numbers of Rejections of Parameter Stability (Source: Own Calculations)

In all tests there are rejections of parameter stability and so it is essential that we allow for structural breaks to promote stability in the final model. It is to this issue that attention turns next.

B5 Structural Break Dates

Having identified that there are breaks within the data it is important to identify where these occur and whether that makes sense within the context of the study. Table B3 lists all of the break dates identified by GVAR Toolbox 2.0 (Smith and Galesi, 2014) and shows how they primarily cluster on crises such as the Asian Financial Crisis (AFC), the GFC and that in South America in 1996. There is also a group of breaks co-inciding with the bursting of the technology sector bubble in 2002.

By utilising bootstrapping in the construction of the GIRFs and the covariance matrix we are able to work around the problems that might otherwise be caused by the presence of these breaks and the issues so many failed stability tests bring.

	y_{it}	π_{it}	e_{it}	q_{it}	ρ_{it}^{S}	ρ_{it}^{L}
Argentina	1996Q3	2001Q4	2004Q4	2011Q1	2002Q3	
Australia	2008Q2	2000Q2	2002Q2	2004Q2	2007Q1	1997Q4
Brazil	1996Q2	1996Q3	1996Q3	1996Q2	2002Q1	
Canada	1996Q2	2007Q1	1999Q2	2000Q3	1996Q4	1997Q4
Chile	2006Q2	2003Q1	1999Q2	1996Q2	1996Q3	
China	2004Q1	1996Q3	19996Q3	1999Q2	1998Q1	
Czech Republic	1997Q3	1999Q1	2007Q3	2009Q1	1999Q1	
Denmark	1998Q1	2002Q3	2002Q3	2011Q1	1996Q4	2009Q1
Euro Area	2001Q1	1999Q4	2000Q4	1999Q3	2001Q4	2009Q2
Hungary	2006Q2	1998Q1	2003Q1	1998Q1	1996Q4	
India	1998Q2	1998Q2	2005Q3	2000Q3	1999Q3	
Indonesia	1999Q1	1996Q2	1998Q2	2001Q2	1999Q3	
Japan	2008Q4	2011Q2	1998Q3	2011Q2	1996Q2	1999Q3
Korea	2004Q3	1998Q1	1998Q1	1998Q2	1998Q1	1998Q1
Malaysia	1998Q1	2008Q1	1999Q1	1998Q4	1998Q2	1998Q1
Mexico	1999Q2	1996Q2	1996Q2	2000Q4	1996Q2	
New Zealand	1999Q1	2003Q1	2008Q2	1999Q1	1996Q3	2006Q2
Norway	2002Q2	2009Q3	2000Q4	2000Q1	1999Q1	1997Q3
Peru	2001Q1	1998Q3	1999Q1	2003Q3	2000Q1	
Philippines	2009Q1	1999Q4	1998Q1	1997Q4	1996Q2	
Russia	1996Q3	1996Q3	1996Q3	1997Q3	1999Q2	
Singapore	2008Q4	2007Q2	1998Q4	2006Q3	1997Q2	
Sweden	2001Q3	2001Q1	2000Q3	2000Q1	1996Q2	2011Q1
Switzerland	1996Q4	2008Q4	2009Q4	2000Q4	2000Q2	2005Q4
Thailand	2000Q4	1998Q2	1998Q2	1998Q3	1997Q3	
Turkey	2011Q2	1996Q4	1996Q4	1997Q2	1996Q2	
United Kingdom	2005Q2	2001Q1	2007Q2	2006Q2	2000Q3	1996Q2
United States	2008Q1	2008Q1		1998Q2	2008Q1	2011Q1

Table B3: Structural Break Dates (Source: GVAR Toolbox 2.0 calculations)

B6 Contemporaneous Effects on Domestic Variables from Foreign Counterparts

Table B10 provides the contemporaneous effects that foreign variables have upon their respective domestic equivalents in each of our countries. Values here work like elasticities, meaning values above 1 show a higher reaction would be expected.

Positive changes in GDP lead to higher GDP effects in many countries, including Malaysia, while Indonesia shows a correlation below -0.5. this movement in the opposite direction is of interest and supplements the picture that GVAR models bring into the paper. There are a large number of above 1 effects amongst the equity prices, including for Philippines and Thailand, representing the extent to which shocks have propagated in the past. Interest rates in India and Indonesia show very strong elasticity.

B7 Pairwise Cross-Section Correlations in Variables and Residuals

In order for the GVAR to be operate successfully the cross-difference variance of shocks to specific variables must tend to zero over time.

$$\frac{1}{N}\sum_{j=1}^{N}\sigma_{ij,ls} \to 0 \; as \; N \to \infty \; \forall i, l, s$$

Table B11 shows how no variable produces a correlation amongst the residuals of greater than 0.2 in absolute value. Amongst the level series there are some which range between 0.6 and 0.7, particularly in interest rates and equity prices. Higher values are observed for inflation and long run interest rates, with some correlations over 0.8. Strong negative correlations are seen for Argentina equity prices, Australian exchange rates and Japanese inflation. The latter result linked to the long lasting deflation that country has experienced.

Table B4: Unit Root Tests for Domestic Variables

Variable	Test	Critical Value	China	Japan	UK	US	EURO	Canada	Australia	New Zealand
y with trend	ADF	-3.45	-2.4731	-2.5222	-1.8091	-1.3807	-1.7049	-2.0899	-1.9357	-2.1154
	WS	-3.24	-1.8761	-2.7191	-1.1937	-1.7185	-1.8828	-0.7873	-1.3896	-1.0885
y with no trend	ADF	-2.89	0.5196	-1.4870	-1.6872	-1.6897	-1.0056	-2.8929	-2.3438	-2.6717
	WS	-2.55	0.1276	-1.0516	-1.2119	-1.7099	-1.3562	0.5782	-0.0250	-0.1659
Dy	ADF	-2.89	-2.6957	-5.6520	-4.3774	-2.9983	-3.4696	-4.4515	-5.0661	-4.1192
	WS	-2.55	-2.7807	-5.5278	-4.5669	-3.4275	-3.5942	-4.3702	-5.2412	-3.6758
DDy	ADF	-2.89	-11.2965	-10.0597	-7.5365	-8.6181	-8.9454	-7.1823	-8.3496	-8.3504
	WS	-2.55	-11.2641	-10.1122	-7.8985	-8.4724	-9.1643	-7.1655	-8.6402	-8.6732
π with trend	ADF	-3.45	-5.2423	-2.1646	-2.4949	-1.0729	-2.9274	-2.9323	-2.3611	-1.9091
	WS	-3.24	-1.8990	-1.9471	-2.7098	-1.7425	-2.0985	-2.2343	-2.2723	-1.9522
π with no trend	ADF	-2.89	-1.8739	-2.3425	-0.9100	1.4582	-1.4794	0.1772	0.1346	0.0152
	WS	-2.55	0.6893	-2.4200	1.6026	0.3693	0.6955	1.5567	1.5115	1.4266
$D\pi$	ADF	-2.89	-4.4603	-2.4922	-6.1534	-2.6793	-3.9077	-5.8014	-5.3320	-5.8328
	WS	-2.55	-0.8556	-2.6274	-6.3469	-3.2759	-3.7739	-5.7779	-5.4811	-6.0244
$DD\pi$	ADF	-2.89	-5.4058	-10.8532	-7.7134	-15.6951	-6.5411	-7.4692	-8.4498	-7.2997
	WS	-2.55	-5.2905	-10.8485	-7.9726	-15.4593	-6.8402	-7.7175	-8.7218	-7.5726
$(e-p)$ with trend	ADF	-3.45	-1.9528	-2.7514	-1.5791		-2.5147	-2.6481	-2.6446	-2.5420
	WS	-3.24	-1.2175	-3.0006	-1.8581		-2.4384	-1.6563	-2.6267	-2.7803
$(e-p)$ with no trend	ADF	-2.89	-1.0682	-2.2653	-0.1108		-1.6555	0.0542	-1.3382	-1.7048
	WS	-2.55	2.0112	-2.4099	0.9625		-0.2926	0.1077	-1.6008	-1.4083
$D(e-p)$	ADF	-2.89	-2.2328	-4.1547	-6.3870		-5.9353	-6.5387	-6.1286	-5.5208
	WS	-2.55	-2.8773	-4.1161	-5.7371		-6.1125	-6.6647	-6.3158	-5.6807
$DD(e-p)$	ADF	-2.89	-7.9505	-14.0322	-9.4034		-8.7828	-6.9819	-7.6296	-7.0009
	WS	-2.55	-7.1593	-13.9470	-8.6577		-8.9594	-7.1159	-7.9404	-7.3002
ρ^s with trend	ADF	-3.45	-1.5334	-2.6959	-4.4208	-3.1779	-3.2046	-5.0100	-3.8893	-3.3571
	WS	-3.24	-1.7522	-0.4674	-4.0563	-2.9730	-1.8595	-5.1453	-3.9912	-3.3034
ρ^s with no trend	ADF	-2.89	-2.5529	-3.0743	-1.5468	-0.6735	-1.9564	-1.4484	-3.0630	-1.4114
	WS	-2.55	-1.5274	0.7587	-1.8720	-0.9823	0.5240	-1.4095	-3.2658	-1.6690
$D\rho^s$	ADF	-2.89	-6.5422	-7.6757	-3.9454	-5.5026	-5.0248	-4.8259	-5.6069	-5.8551
	WS	-2.55	-4.4053	-6.9010	-4.2019	-5.6787	-3.9210	-4.5773	-5.7294	-5.9053
$DD\rho^s$	ADF	-2.89	-7.8542	-7.2598	-5.1388	-9.7734	-8.3959	-6.8037	-6.2558	-6.9798
	WS	-2.55	-7.3030	-6.7747	-5.1814	-10.0056	-8.3431	-5.4163	-6.4182	-6.7904
ρ^L with trend	ADF	-3.45		-2.0412	-5.1055	-2.6036	-1.7012	-3.4226	-2.5711	-3.7533
	WS	-3.24		-1.4426	-4.6850	-2.8258	-1.5275	-3.6109	-2.7656	-3.6026
ρ^L with no trend	ADF	-2.89		-1.8150	-0.5427	-0.8976	-1.4578	-0.7947	-0.8537	-0.7034
	WS	-2.55		0.3911	-0.6316	-0.3844	-0.0156	0.0498	-0.8217	-1.0265
$D\rho^L$	ADF	-2.89		-5.9375	-5.7945	-7.1598	-5.5175	-6.8750	-5.8741	-6.5569
	WS	-2.55		-6.1487	-6.0602	-7.1569	-5.3902	-6.8465	-6.1002	-6.5666
$DD\rho^L$	ADF	-2.89		-9.6973	-6.5806	-8.0438	-6.6638	-8.0073	-7.6188	-8.6034
	WS	-2.55		-9.6766	-6.4056	-7.2034	-6.3916	-7.3335	-6.8715	-8.2740
q with trend	ADF	-3.45	-2.4982	-2.8215	-2.1812	-2.5625	-2.2755	-2.7297	-2.8603	-2.8194
	WS	-3.24	-1.3100	-3.0318	-1.8542	-2.0945	-1.8713	-2.5576	-2.7499	-1.9244
q with no trend	ADF	-2.89	-2.8218	-2.5686	-2.1396	-2.6434	-2.3779	-1.9136	-2.3983	-1.5943
	WS	-2.55	-0.9909	-2.7196	-1.0873	-1.9807	-1.7184	-0.4897	-1.4894	-1.9314
Dq	ADF	-2.89	-4.3975	-6.2659	-5.1502	-5.3025	-5.4351	-6.2527	-5.7685	-5.5817
	WS	-2.55	-4.6170	-6.2644	-5.3402	-5.4708	-5.5395	-6.4321	-5.7946	-5.0813
DDq	ADF	-2.89	-11.6784	-8.3688	-7.0137	-7.5054	-8.2178	-7.1897	-6.3607	-6.8724
	WS	-2.55	-11.4413	-8.4828	-7.2958	-7.7083	-8.4856	-7.4315	-6.5840	-7.0071

Variable	Test	Critical Value	Indonesia	Malaysia	Philippines	Thailand	Korea	Russia	Singapore	Turkey	India
y with trend	ADF	-3.45	-1.1840	-2.6677	-2.0835	-1.7378	-1.7990	-4.3522	-2.3092	-2.9273	-2.0079
	WS	-3.24	-0.8745	-2.7515	-2.3514	-2.0525	-1.8637	1.5153	-2.5027	-1.0219	-0.9539
y with no trend	ADF	-2.89	-2.4723	-1.4666	-0.2818	-1.1849	0.5753	-3.7164	-0.1083	-4.2143	-1.9987
	WS	-2.55	0.3509	0.0586	1.8260	-0.9887	1.3376	2.3506	0.8508	0.0266	-0.7538
Dy	ADF	-2.89	-4.6418	-5.4020	-7.3193	-4.1945	-5.5118	-4.8730	-4.2464	-1.6988	-2.2494
	WS	-2.55	-4.8333	-5.6296	-7.5142	-4.4423	-5.6212	2.4612	-4.4657	-1.9215	-2.1957
DDy	ADF	-2.89	-7.4736	-8.1692	-7.2805	-10.9507	-11.7840	-6.6453	-8.2340	-8.7911	-7.9547
	WS	-2.55	-7.7287	-8.4239	-7.5800	-10.9575	-11.7022	-3.4709	-8.4861	-6.6482	-8.2364
π with trend	ADF	-3.45	-1.2131	-2.7973	-2.7103	-2.8772	-2.6539	-3.8069	-1.0227	-4.0148	-0.9927
	WS	-3.24	-1.3402	-2.1746	-1.2641	-1.8127	-0.6667	1.3980	-1.4619	-1.0629	-1.0467
π with no trend	ADF	-2.89	-1.8456	-1.3179	-2.1071	-1.6277	-2.7217	-2.9251	1.1354	-5.4064	0.1952
	WS	-2.55	0.8370	1.9521	1.1942	1.3860	2.3944	2.0459	1.4268	-0.0477	1.9909
$D\pi$	ADF	-2.89	-5.0337	-4.6011	-4.3209	-5.0577	-3.8117	-5.2284	-3.8854	-1.5694	-3.8201
	WS	-2.55	-5.2479	-4.6396	-4.4049	-5.2195	-3.5779	2.5046	-4.0814	-1.5559	-4.0090
$DD\pi$	ADF	-2.89	-6.7968	-6.7968	-6.3072	-7.5815	-11.0563	-6.3969	-8.6263	-10.9719	-7.7994
	WS	-2.55	-7.0372	-7.0765	-6.5805	-7.9328	-11.3305	-3.5905	-8.8379	-5.9969	-8.0793
$(e-p)$ with trend	ADF	-3.45	-3.7994	-1.8839	-1.5844	-1.4994	-2.7644	-5.7516	-0.7824	-1.9371	-1.6018
	WS	-3.24	-3.9119	-2.0797	-1.8937	-1.8381	-2.9892	1.8373	-1.2180	-0.1796	-1.8791
$(e-p)$ with no trend	ADF	-2.89	-0.6298	-0.1093	-0.4669	0.1033	-0.4251	-3.1210	0.7407	-5.5234	0.0049
	WS	-2.55	0.6659	0.2323	0.8508	0.8185	0.6429	1.8896	0.8696	0.5528	1.9235
$D(e-p)$	ADF	-2.89	-6.9826	-5.5888	-4.7974	-6.4885	-7.0138	-3.8387	-4.0978	-1.9048	-5.9748
	WS	-2.55	-7.2304	-5.7510	-4.9122	-6.7189	-7.2113	1.8119	-4.2702	-2.1807	-6.1265
$DD(e-p)$	ADF	-2.89	-7.8512	-6.9529	-7.0268	-7.0091	-6.9487	-13.7078	-7.1780	-6.0477	-6.8472
	WS	-2.55	-8.1716	-7.2486	-6.7959	-7.3131	-7.2097	-2.4558	-7.4323	-5.9609	-6.9742
ρ^s with trend	ADF	-3.45	-3.9883	-2.5225	-3.7828	-3.2343	-2.7032	-1.9212	-3.1867	-4.6661	-4.3713
	WS	-3.24	-3.9515	-2.5679	-3.9806	-3.4467	-2.8459	-2.1044	-3.0851	-4.0909	-4.3151
ρ^s with no trend	ADF	-2.89	-3.2231	-2.0743	-1.0473	-2.7232	-1.1579	-1.8076	-2.6886	-1.3804	-3.4382
	WS	-2.55	-3.4419	-1.5856	-0.5586	-2.7800	-1.2312	-1.0037	-2.8750	-1.6042	-3.6541
$D\rho^s$	ADF	-2.89	-5.2504	-6.2452	-6.9350	-5.7690	-8.2154	-7.7694	-8.7974	-8.3196	-5.2126
	WS	-2.55	-5.5313	-5.2123	-7.0723	-5.9662	-8.4267	-7.9782	-8.9997	-6.5441	-5.4589
$DD\rho^s$	ADF	-2.89	-8.9227	-6.2508	-7.4470	-7.3271	-7.7580	-7.7859	-10.0850	-8.8734	-8.9608
	WS	-2.55	-9.1383	-6.4588	-7.0893	-7.4590	-8.0865	-8.1139	-10.1151	-9.1739	-9.1775
ρ^L with trend	ADF	-3.45		-1.8357			-1.9135				
	WS	-3.24		-2.0633			-2.2308				
ρ^L with no trend	ADF	-2.89		-1.2250			-1.0447				
	WS	-2.55		-1.0206			-0.2272				
$D\rho^L$	ADF	-2.89		-6.7349			-7.8595				
	WS	-2.55		-6.1177			-8.1007				
$DD\rho^L$	ADF	-2.89		-6.7927			-8.1443				
	WS	-2.55		-7.0311			-8.5154				
q with trend	ADF	-3.45	-1.9012	-3.2167	-1.2068	-1.9885	-3.0841	-2.9701	-3.7057	-3.6750	-2.5340
	WS	-3.24	-2.0729	-3.3883	-1.1624	-1.8094	-3.1915	-2.8265	-3.8671	-3.9017	-2.7281
q with no trend	ADF	-2.89	-1.6626	-2.8433	-1.5685	-2.2581	-1.7194	-2.7600	-3.5125	-3.3562	-1.8243
	WS	-2.55	-1.9472	-3.0915	-1.1754	-1.7729	-1.8306	-2.0230	-3.5419	-3.1740	-1.9186
Dq	ADF	-2.89	-5.9163	-4.9153	-5.8909	-4.7216	-5.6572	-5.0426	-5.9066	-5.5506	-6.4316
	WS	-2.55	-5.9476	-4.8211	-6.0847	-4.7487	-5.8381	-5.2957	-6.0413	-5.3467	-6.6197
DDq	ADF	-2.89	-7.3093	-10.9964	-7.8578	-7.6552	-10.2487	-10.5487	-7.1473	-6.8238	-8.9273
	WS	-2.55	-7.4520	-11.2220	-8.3174	-7.9558	-10.4849	-10.7474	-7.4293	-5.9082	-8.7420

Variable	Test	Critical Value	Argentina	Brazil	Chile	Mexico	Peru	Czech Republic	Denmark	Hungary	Norway	Sweden	Switz
y with trend	ADF	-3.45	-2.4697	-13.1514	-2.6553	-3.2280	-2.4841	-2.0633	-2.6716	-2.7888	-3.2753	-3.6079	-3.9971
	WS	-3.24	-1.9439	-1.5503	-2.7280	-1.6896	1.0762	-2.2137	-1.9415	-1.4093	-2.8639	-3.4919	-3.6700
y with no trend	ADF	-2.89	0.2500	-9.9164	-0.2604	-3.5995	-0.6030	-2.1553	-1.6346	-3.0232	-1.0586	-0.8280	-0.0986
	WS	-2.55	0.3022	0.3769	0.3946	-0.2188	-0.1576	-1.9972	1.6148	0.1397	1.1764	1.4135	-0.1226
Dy	ADF	-2.89	-6.5660	-7.0126	-2.7152	-3.1392	-4.3699	-2.7333	-5.2756	-1.4396	-5.0749	-5.6470	-4.0903
	WS	-2.55	-6.2361	-1.8689	-1.7566	-3.5743	-2.9077	-2.8958	-5.4552	-1.5993	-5.2255	-5.6624	-4.3830
DDy	ADF	-2.89	-6.8657	-6.8438	-9.5509	-5.4913	-6.0323	-8.1506	-7.6691	-6.9019	-6.5154	-7.6727	-5.8752
	WS	-2.55	-7.1999	-3.8533	-9.8222	-5.6577	-4.8189	-8.3953	-7.9554	-7.1274	-6.9631	-7.9647	-6.1996
π with trend	ADF	-3.45	-1.6298	-15.3116	-3.9116	-2.5942	-3.1297	-3.2062	-1.6233	-3.2570	-2.1409	-3.4407	-1.2442
	WS	-3.24	-0.9645	-1.5736	-0.0717	-1.0051	1.1712	0.1460	-1.9579	-1.3979	-2.4076	-3.6892	-1.6360
π with no trend	ADF	-2.89	1.5490	-5.6658	-1.9682	-3.7473	-1.5575	-4.1450	-1.3661	-3.4362	-0.6434	-0.7036	-1.4723
	WS	-2.55	1.1061	1.2530	1.7999	0.3470	1.8529	1.0384	0.8219	-0.4592	2.2151	0.2632	0.6166
$D\pi$	ADF	-2.89	-5.3582	-8.0514	-4.2778	-2.4428	-5.3896	-2.5977	-4.7543	-1.3481	-6.9899	-4.2381	-4.6067
	WS	-2.55	-5.5399	-1.8165	-2.4993	-2.6514	2.4807	-2.0660	-4.9407	-1.3125	-7.1838	-4.6355	-4.4841
$DD\pi$	ADF	-2.89	-9.0883	-5.9639	-6.0936	-5.9429	-5.6111	-6.6043	-9.8026	-4.3634	-7.3230	-6.2744	-7.0165
	WS	-2.55	-9.2753	-2.8678	-6.2578	-6.5354	-1.5749	-6.9242	-10.0123	-5.2231	-7.4725	-6.6911	-6.9268
$(e-p)$ with trend	ADF	-3.45	-1.3345	-6.1098	-2.3476	-1.3304	-3.3080	-1.9537	-1.8395	-1.2517	-2.8337	-2.0669	-1.9623
	WS	-3.24	-1.1406	-1.5660	-1.9319	-0.8458	-0.0253	-1.1729	-2.1016	-0.1691	-2.8322	-2.3333	-2.2122
$(e-p)$ with no trend	ADF	-2.89	1.3492	-3.6688	-1.4494	-2.4567	-1.6501	-2.1768	-0.6358	-3.0384	-0.2947	-0.9708	-0.5118
	WS	-2.55	1.2753	1.4146	1.2042	1.5966	2.4523	1.4403	0.2757	1.5866	0.6975	-0.6137	-0.0804
$D(e-p)$	ADF	-2.89	-5.8836	-6.6463	-6.0804	-4.2417	-4.4024	-6.6388	-6.4290	-6.8528	-6.6425	-6.2034	-5.9270
	WS	-2.55	-6.0753	0.4799	-6.1903	-4.4245	-1.4853	-6.7880	-6.4795	-7.0388	-6.8599	-6.3067	-6.0987
$DD(e-p)$	ADF	-2.89	-7.0889	-6.3816	-6.8793	-9.6169	-6.5895	-7.8409	-8.3496	-9.2111	-8.7393	-7.6907	-8.0973
	WS	-2.55	-7.2450	-6.4720	-7.1305	-9.8897	-6.8286	-8.0592	-8.4112	-9.5258	-8.9515	-8.0997	-8.2196
ρ^s with trend	ADF	-3.45	-3.4476	-3.8249	-2.4310	-4.4303	-3.0050	-2.9185	-2.3177	-2.7793	-3.3804	-2.6497	-3.2807
	WS	-3.24	-3.6867	-4.0368	-2.5332	-4.2025	-2.4411	-3.0019	-2.0471	-3.0190	-3.3530	-2.4042	-2.5605
ρ^s with no trend	ADF	-2.89	-3.4248	-1.1878	-2.7866	-1.6689	-1.9958	-1.1240	-1.2874	-1.8516	-2.3694	-1.7201	-2.4863
	WS	-2.55	-3.6754	-0.2708	-1.4591	-1.9705	-0.1336	-0.9961	0.1552	-1.7327	-1.7974	0.0309	-0.5522
$D\rho^s$	ADF	-2.89	-5.2987	-6.8184	-4.6963	-5.0509	-5.1082	-5.1882	-6.4035	-4.2310	-5.6289	-5.3263	-4.1946
	WS	-2.55	-5.3949	-7.1132	-4.7956	-5.2398	-5.1264	-5.3781	-4.0219	-3.6647	-4.8575	-5.3935	-4.1675
$DD\rho^s$	ADF	-2.89	-7.7699	-7.6485	-12.4752	-15.3733	-7.3951	-6.7364	-6.0966	-7.8572	-7.6904	-6.1997	-5.9484
	WS	-2.55	-8.0388	-7.9669	-8.7639	-15.6955	-7.6097	-7.0610	-5.9306	-8.0394	-7.6768	-6.3632	-6.0901
ρ^L with trend	ADF	-3.45							-4.0175		-3.0673	-1.9028	-3.7560
	WS	-3.24							-4.1760		-3.2187	-1.8404	-3.9562
ρ^L with no trend	ADF	-2.89							-0.7382		-0.9615	-1.4626	-0.9375
	WS	-2.55							-0.0081		-0.5108	-0.3849	-0.4980
$D\rho^L$	ADF	-2.89							-6.2489		-6.0492	-5.5166	-7.0874
	WS	-2.55							-5.4975		-4.7744	-5.0709	-7.2627
$DD\rho^L$	ADF	-2.89							-7.1970		-8.6341	-7.9575	-7.5298
	WS	-2.55							-5.9937		-6.3383	-7.1150	-7.4896
q with trend	ADF	-3.45	-2.3418	-2.3689	-2.9145	-2.3834	-1.8348	-1.4443	-2.9506	-2.6707	-2.9453	-2.7263	-2.4405
	WS	-3.24	-2.5847	-2.3486	-1.0525	-2.4141	-2.0662	-1.6488	-2.9707	0.1760	-2.8598	-2.0268	-1.6077
q with no trend	ADF	-2.89	-2.0638	-1.9226	-2.7607	-0.9288	-1.0748	-1.1681	-1.3721	-3.3185	-2.2633	-2.3852	-2.4430
	WS	-2.55	-1.9550	-0.6168	-1.0843	-0.9375	-0.6333	-1.3645	-0.2823	1.1763	-1.3553	-0.4643	-0.4094
Dq	ADF	-2.89	-6.4532	-5.7809	-6.0805	-6.0308	-6.0837	-5.8143	-5.5283	-5.7523	-4.9675	-5.1169	-5.1240
	WS	-2.55	-6.6327	-4.7468	-6.2565	-6.2226	-5.8652	-6.0044	-5.6695	-4.3935	-4.9259	-5.0662	-5.1670
DDq	ADF	-2.89	-9.3007	-6.8123	-7.8487	-6.9925	-6.5652	-8.3721	-5.8292	-8.3477	-7.6365	-9.3188	-6.9485
	WS	-2.55	-9.5493	-6.8791	-8.1615	-7.2772	-6.6202	-8.6448	-6.0123	-8.5978	-7.8996	-9.5370	-7.0346

Table B5: Unit Root Tests for Foreign Variables

Variable	Test	Critical Value	China	Japan	UK	US	EURO	Canada	Australia	New Zealand
y with trend	ADF	-3.45	-3.7849	-3.2028	-2.9713	-3.2607	-3.0766	-1.1215	-2.3839	-2.6789
	WS	-3.24	0.8223	0.6945	-0.1778	-0.3368	1.2004	-1.3384	-1.4908	-0.4282
y with no trend	ADF	-2.89	-2.6236	-0.1852	-2.1331	-1.3500	-2.6534	-1.3013	-0.1923	0.0395
	WS	-2.55	2.5696	-1.2403	-0.9352	-1.1564	2.2948	-1.4999	0.0056	-0.3113
Dy	ADF	-2.89	-5.8220	-4.7060	-4.7717	-3.4141	-3.2761	-4.0361	-3.8637	-4.3842
	WS	-2.55	0.6284	-0.8284	-1.4506	-1.4414	1.9931	-3.7046	-3.8876	-3.8063
DDy	ADF	-2.89	-3.5652	-7.5193	-6.2739	-4.9734	-4.4900	-8.1054	-7.5173	-7.4630
	WS	-2.55	-3.1949	-6.7421	-5.2943	-5.0988	-2.4763	-8.0083	-7.7629	-7.1573
π with trend	ADF	-3.45	-4.1311	-5.3995	-4.0210	-5.0343	-2.8279	-2.5336	-4.8448	-5.0808
	WS	-3.24	0.0693	0.2373	0.9868	-0.3010	1.0003	-1.3356	-0.6238	0.2091
π with no trend	ADF	-2.89	-0.5128	-0.3989	-1.3059	-0.8892	-1.9992	0.2103	-1.2281	-1.4146
	WS	-2.55	1.6730	1.5205	1.4482	1.8524	1.6511	1.2565	1.8767	1.8422
$D\pi$	ADF	-2.89	-6.3954	-4.9927	-4.5424	-4.9039	-5.0482	-3.4992	-4.3664	-3.8769
	WS	-2.55	2.5653	2.1331	2.5722	1.8658	3.3393	0.5463	-0.1368	0.2756
$DD\pi$	ADF	-2.89	-3.1113	-5.1290	-4.9009	-9.6546	-4.5562	-5.3412	-5.8497	-9.1887
	WS	-2.55	-2.0875	-4.1912	-3.9154	-9.8101	-0.6956	-5.5381	-6.0967	-8.0695
$(e-p)$ with trend	ADF	-3.45	-3.6202	-3.0060	-3.5673	-4.2169	-4.2912	-3.9244	-1.9555	-2.6041
	WS	-3.24	-1.2461	-0.1157	-0.5354	0.8720	1.8618	1.1254	-1.3806	-1.7896
$(e-p)$ with no trend	ADF	-2.89	-0.5820	-1.6003	-2.2936	-1.7184	-1.4965	-0.8831	-0.6997	-1.6042
	WS	-2.55	1.2878	2.2293	2.5574	1.7963	1.3937	1.0466	2.0712	0.7523
$D(e-p)$	ADF	-2.89	-4.1243	-2.3130	-4.4560	-2.8923	-3.4635	-2.1984	-2.8591	-3.2796
	WS	-2.55	0.8117	-1.2036	-3.4021	-1.4342	1.5767	-0.3783	-3.0174	-3.3515
$DD(e-p)$	ADF	-2.89	-8.3050	-6.4730	-6.8568	-10.6420	-11.6105	-6.1043	-6.9483	-6.6391
	WS	-2.55	-7.0035	-6.4531	-6.1750	-9.0497	-5.4158	-4.7241	-6.7471	-6.8869
ρ^s with trend	ADF	-3.45	-3.7246	-2.6801	-3.2164	-3.6614	-2.9293	-3.9149	-3.2352	-2.9494
	WS	-3.24	-3.8451	-2.8646	-3.0243	-3.7428	-2.8124	-3.7066	-3.4663	-3.1387
ρ^s with no trend	ADF	-2.89	-1.2257	-1.3681	-1.3977	-1.0463	-0.7263	-0.5850	-1.7666	-1.3363
	WS	-2.55	-0.9179	-1.1378	0.1488	-0.9905	-0.4863	-0.6922	-1.5245	-1.0695
$D\rho^s$	ADF	-2.89	-5.6331	-6.0875	-4.1332	-5.0827	-5.2733	-4.7604	-6.5863	-6.0205
	WS	-2.55	-5.8971	-6.4022	-4.3377	-5.2865	-4.6929	-5.0058	-6.9496	-6.3135
$DD\rho^s$	ADF	-2.89	-5.7545	-6.2015	-8.0889	-13.9525	-7.2276	-9.8235	-5.7143	-6.3136
	WS	-2.55	-6.0228	-6.4671	-7.3289	-14.2511	-7.4294	-10.0578	-6.0048	-6.5582
ρ^L with trend	ADF	-3.45	-1.3147	-1.4274	-1.7417	-1.4261	-3.1808	-2.4545	-1.3115	-1.6248
	WS	-3.24	-1.5304	-1.7595	-1.6224	-1.5084	-3.3965	-2.7126	-1.4785	-1.9354
ρ^L with no trend	ADF	-2.89	-1.0656	-0.8560	-1.3314	-1.1319	-0.4723	-0.9260	-1.1409	-0.7670
	WS	-2.55	0.8995	0.6556	0.2718	0.9708	0.2493	-0.1451	1.0249	0.4213
$D\rho^L$	ADF	-2.89	-6.6426	-6.7106	-6.1563	-6.0578	-6.1175	-7.2582	-7.0196	-6.3959
	WS	-2.55	-6.8080	-6.8356	-5.9692	-6.1920	-6.2994	-7.2221	-7.1946	-6.5607
$DD\rho^L$	ADF	-2.89	-8.2947	-8.0134	-7.0439	-8.3284	-7.2634	-7.9799	-8.8352	-7.9452
	WS	-2.55	-8.1410	-7.7616	-6.6625	-7.9609	-6.8153	-7.2063	-8.7615	-7.5162
q with trend	ADF	-3.45	-3.4675	-2.4493	-2.7849	-2.9136	-3.2181	-2.9568	-2.4363	-2.8229
	WS	-3.24	-3.5898	-2.4656	-2.6543	-3.0907	-3.4245	-2.9748	-2.4769	-2.9973
q with no trend	ADF	-2.89	-2.9782	-2.3780	-2.7672	-2.1100	-2.7431	-2.9315	-2.4894	-2.7203
	WS	-2.55	-2.7887	-2.4764	-2.2578	-2.2636	-2.7793	-2.7313	-2.4801	-2.9397
Dq	ADF	-2.89	-6.2005	-5.4091	-5.7831	-5.9981	-6.0017	-5.7245	-5.9763	-6.0404
	WS	-2.55	-6.3202	-5.6249	-5.9186	-6.1882	-6.1813	-5.9058	-6.1687	-6.2280
DDq	ADF	-2.89	-6.9917	-6.9491	-10.1100	-6.8744	-10.1242	-6.4570	-10.3773	-6.9705
	WS	-2.55	-7.2134	-7.2114	-10.3357	-7.1335	-10.3433	-6.7765	-10.4914	-7.2196

Variable	Test	Critical Value	Indonesia	Malaysia	Philippines	Thailand	Korea	Russia	Singapore	Turkey	India
y with trend	ADF	-3.45	-2.7570	-2.9113	-2.7341	-3.0296	-3.2607	-2.8888	-2.5880	-4.4919	-3.8517
	WS	-3.24	-0.4672	-0.9243	-0.4249	0.0466	0.6681	-0.7736	-0.7513	1.6532	0.5135
y with no trend	ADF	-2.89	-0.6205	-0.2983	-0.4695	-0.2426	-0.1880	-2.1631	-0.4370	-4.5818	-0.6934
	WS	-2.55	-1.1473	-0.6609	-1.0383	-0.9732	-1.3669	-0.9398	-0.9534	3.0051	-1.0584
Dy	ADF	-2.89	-4.1078	-3.7836	-4.0092	-4.4067	-4.8584	-3.4085	-5.0380	-4.0071	-4.3000
	WS	-2.55	-2.3661	-3.3235	-3.1012	-2.4936	-0.4528	-3.1197	-4.9741	2.2343	-1.4084
DDy	ADF	-2.89	-7.6462	-7.4255	-7.3866	-6.8443	-6.9696	-6.1617	-7.2384	-5.7138	-7.1792
	WS	-2.55	-7.4709	-7.4755	-6.6857	-6.7758	-6.4592	-6.1415	-7.4462	-2.4023	-7.0599
π with trend	ADF	-3.45	-4.3181	-4.5323	-4.5507	-5.6367	-6.0177	-6.5695	-4.5372	-4.1061	-6.6035
	WS	-3.24	-0.5161	0.1447	0.6334	0.1571	-0.1739	-0.3029	0.6818	1.3634	-0.1936
π with no trend	ADF	-2.89	-0.2133	-1.2309	-0.6468	-0.5849	-0.0190	-2.4788	-2.1459	-1.9200	-0.7954
	WS	-2.55	1.6900	1.7269	1.7520	1.7755	1.7298	1.0291	1.7174	1.4508	1.5883
$D\pi$	ADF	-2.89	-4.9906	-4.4768	-4.4177	-5.0789	-5.6390	-3.6900	-4.2217	-4.9002	-5.7663
	WS	-2.55	0.2252	-1.1096	0.8427	0.7984	2.2061	-1.0720	-1.5554	2.8653	1.3055
$DD\pi$	ADF	-2.89	-5.6513	-6.1223	-9.5409	-8.7236	-4.5994	-7.2056	-5.7420	-9.2659	-8.3813
	WS	-2.55	-5.8666	-6.3420	-7.7588	-7.7214	-3.8123	-5.8856	-5.8965	-1.8393	-7.8714
$(e-p)$ with trend	ADF	-3.45	-2.0316	-1.9495	-2.2561	-2.5014	-3.2027	-3.3612	-2.6680	-3.9272	-3.0114
	WS	-3.24	-1.2529	-1.5921	-1.5027	-1.0185	0.4701	0.1000	-2.2625	1.7918	-0.3993
$(e-p)$ with no trend	ADF	-2.89	-0.7513	-0.6917	-0.7996	-1.1627	-1.3960	-2.6142	-0.8468	-2.2960	-1.1731
	WS	-2.55	1.9279	1.7683	1.8548	1.9788	2.0260	2.4504	1.5817	1.8663	1.7316
$D(e-p)$	ADF	-2.89	-4.9474	-4.7736	-5.3633	-2.8733	-2.2332	-2.6659	-5.4179	-3.3019	-2.5253
	WS	-2.55	-3.6072	-4.1067	-3.9828	-2.0837	-0.3730	-2.7594	-5.1030	2.0426	-0.7724
$DD(e-p)$	ADF	-2.89	-6.3214	-6.5398	-6.5979	-6.3093	-5.8835	-7.1108	-7.2949	-13.4869	-6.0163
	WS	-2.55	-6.3374	-6.5474	-6.4159	-6.1340	-5.3233	-6.8868	-7.5699	-3.9025	-5.9622
ρ^s with trend	ADF	-3.45	-3.4493	-3.9510	-3.0723	-3.7828	-2.8857	-2.6829	-4.1575	-2.4463	-3.0587
	WS	-3.24	-3.6429	-4.0738	-3.2785	-3.9667	-3.1028	-2.9371	-4.2743	-2.4248	-3.2640
ρ^s with no trend	ADF	-2.89	-1.6219	-1.9014	-1.5707	-1.6663	-1.2731	-1.0547	-2.2031	-1.3282	-1.2830
	WS	-2.55	-1.4607	-1.9358	-1.3077	-1.5205	-0.9310	-0.1328	-2.3081	0.3339	-0.8083
$D\rho^s$	ADF	-2.89	-6.5430	-6.3172	-6.2885	-6.3467	-5.6457	-5.9654	-6.3627	-5.6372	-5.4960
	WS	-2.55	-6.8323	-6.6364	-6.6105	-6.6706	-5.8887	-5.5245	-6.6550	-5.6322	-5.7524
$DD\rho^s$	ADF	-2.89	-5.7290	-5.1665	-6.1147	-5.4575	-9.0373	-8.0607	-5.3560	-6.3220	-9.5573
	WS	-2.55	-5.9923	-5.4056	-6.3756	-5.7443	-9.2425	-8.2827	-5.6012	-6.5319	-9.7879
ρ^L with trend	ADF	-3.45	-1.2069	-1.3766	-1.2799	-1.3434	-2.0746	-1.7255	-1.1805	-1.7277	-1.9560
	WS	-3.24	-1.3894	-1.5144	-1.4547	-1.4975	-2.1238	-1.5832	-1.4836	-1.6432	-2.0382
ρ^L with no trend	ADF	-2.89	-1.2299	-1.0929	-1.1496	-1.1054	-1.0044	-1.3914	-1.1117	-1.3285	-1.0401
	WS	-2.55	1.0636	0.8650	1.0113	1.0041	0.6888	0.2587	0.8529	0.2652	0.7503
$D\rho^L$	ADF	-2.89	-7.3480	-6.2635	-6.8111	-6.9242	-6.0576	-6.0275	-7.6994	-6.1978	-6.0608
	WS	-2.55	-7.4869	-6.4764	-6.9924	-7.0555	-6.1903	-5.9169	-7.6326	-6.0683	-6.1883
$DD\rho^L$	ADF	-2.89	-8.6848	-8.5162	-8.5722	-8.5800	-8.1171	-7.3344	-8.1895	-7.1813	-7.6601
	WS	-2.55	-8.6871	-8.3123	-8.4809	-8.3621	-7.7468	-7.1211	-8.1372	-6.9389	-7.4201
q with trend	ADF	-3.45	-2.7927	-2.6744	-2.8626	-2.7971	-2.4560	-3.0113	-2.5581	-3.2127	-3.0700
	WS	-3.24	-2.9581	-2.8418	-3.0513	-2.9794	-2.4776	-3.0884	-2.7313	-3.4054	-3.2860
q with no trend	ADF	-2.89	-2.7331	-2.6515	-2.8588	-2.7726	-2.5073	-2.9386	-2.4150	-3.2005	-2.8788
	WS	-2.55	-2.9369	-2.8439	-3.0578	-2.9742	-2.4773	-2.8095	-2.6454	-3.3548	-3.0563
Dq	ADF	-2.89	-5.9569	-5.9911	-6.0757	-5.8803	-5.8597	-5.9039	-5.4594	-6.1045	-6.0104
	WS	-2.55	-6.1365	-6.1733	-6.2515	-6.0473	-6.0516	-6.0518	-5.5875	-6.2950	-6.1848
DDq	ADF	-2.89	-7.0071	-7.0791	-7.1356	-6.9468	-10.233	-10.309	-7.1006	-10.3213	-7.0240
	WS	-2.55	-7.2750	-7.3459	-7.3957	-7.1787	-10.363	-10.519	-7.3415	-10.5553	-7.2515

Variable	Test	Crit	Argentina	Brazil	Chile	Mexico	Peru	Czech Republic	Denmark	Hungary	Norway	Sweden	Switz
y with trend	ADF	-3.45	-11.2211	-2.4636	-6.0296	-1.6551	-5.4374	-3.3783	-3.4001	-3.8498	-2.9778	-3.2526	-2.4308
	WS	-3.24	-1.2126	-0.8556	-0.5769	-1.9222	-0.2303	1.3183	-1.0848	1.6495	-1.3206	1.0526	-1.5867
y with no trend	ADF	-2.89	-8.0917	-0.2752	-1.1928	-1.7273	-1.0043	-2.5720	-1.3308	-3.3632	-1.8333	-3.2953	-2.4344
	WS	-2.55	-0.5829	-0.6446	-1.5473	-1.7052	-1.5015	2.5694	-1.6780	2.7145	-2.0410	1.8982	-1.3517
Dy	ADF	-2.89	-6.9313	-3.4795	-5.5050	-3.2058	-5.0607	-3.2705	-4.7577	-3.3800	-4.6071	-6.5063	-4.2838
	WS	-2.55	-1.5445	-3.5940	-1.7979	-3.1642	-1.8673	0.8707	-2.8421	1.4291	-2.2227	0.1793	-1.8108
DDy	ADF	-2.89	-6.5333	-7.4171	-5.4015	-4.7354	-5.1663	-8.4286	-5.8287	-9.6545	-7.6701	-7.5290	-7.5789
	WS	-2.55	-4.1832	-6.2859	-4.8989	-4.9760	-4.7728	-3.0923	-5.8128	-2.7819	-7.3980	-4.2206	-7.4235
π with trend	ADF	-3.45	-15.7573	-4.1636	-9.9099	-2.9852	-9.4370	-3.8404	-5.1981	-3.7690	-4.9978	-3.1072	-5.5880
	WS	-3.24	-1.3969	0.5278	-1.5727	-1.9232	-1.2301	1.4547	1.8167	1.4008	1.5046	1.2605	1.4809
π with no trend	ADF	-2.89	-2.6508	-1.1676	-0.7247	0.7403	-0.6664	-2.3723	-1.2789	-2.5544	-1.3636	-2.1683	-1.6977
	WS	-2.55	1.3169	1.7970	1.5039	1.2158	1.5592	1.4042	1.3937	1.4852	1.4714	1.3790	1.5338
$D\pi$	ADF	-2.89	-8.1343	-3.6156	-7.8237	-4.6587	-7.0626	-3.8877	-4.4220	-4.3104	-4.4225	-4.3458	-4.4388
	WS	-2.55	-1.4825	0.4079	-0.4934	1.2541	0.4879	2.4893	2.0745	2.6992	0.9743	2.8349	1.4960
$DD\pi$	ADF	-2.89	-5.2745	-8.9340	-5.3473	-4.7851	-4.2702	-9.5589	-5.0021	-9.7074	-8.8115	-8.3488	-8.7389
	WS	-2.55	-5.0620	-7.3014	-5.2391	-5.0332	-4.8431	-3.1050	-4.2255	-2.5424	-8.2125	-2.5497	-8.1491
$(e-p)$ with trend	ADF	-3.45	-5.2265	-2.4180	-2.9091	-2.6793	-2.7709	-3.5046	-4.0154	-3.9281	-3.0596	-3.8505	-2.9233
	WS	-3.24	-1.8012	-0.8036	-2.0787	-0.4844	-1.8640	0.8226	-2.3906	1.6283	-0.8441	1.3578	-0.8612
$(e-p)$ with no trend	ADF	-2.89	-1.0583	-0.9241	0.2246	-0.8658	-0.1021	-2.6142	-1.4882	-2.7812	-1.2482	-1.7505	-1.9604
	WS	-2.55	1.4371	2.4845	0.9680	1.6810	1.0572	2.6801	1.6568	2.7425	1.7725	1.9699	2.0117
$D(e-p)$	ADF	-2.89	-5.9108	-2.5394	-3.9999	-2.3087	-3.2916	-5.4191	-2.3926	-2.8790	-4.6082	-2.5225	-5.0975
	WS	-2.55	1.4474	-2.5224	2.0770	-0.0927	1.1241	-3.0240	-1.5766	-0.2401	-3.0245	-0.3729	-4.7785
$DD(e-p)$	ADF	-2.89	-2.8246	-7.3653	-4.1286	-5.1986	-4.8786	-7.5627	-6.3358	-9.8092	-9.3657	-10.1544	-7.9541
	WS	-2.55	-2.6113	-6.3683	-4.0489	-5.2405	-4.8199	-6.8413	-5.4845	-6.4781	-8.2696	-7.3222	-8.0831
ρ^s with trend	ADF	-3.45	-3.3070	-3.3958	-3.3717	-3.7082	-2.7598	-2.6145	-3.3712	-2.7164	-3.1384	-2.9658	-3.3026
	WS	-3.24	-3.5286	-3.6629	-3.6428	-3.6834	-2.9958	-2.1761	-3.1526	-2.2493	-3.1082	-2.6022	-2.9986
ρ^s with no trend	ADF	-2.89	-1.0538	-1.7104	-1.2090	-0.6136	-1.4262	-1.3771	-1.4057	-1.5335	-1.2078	-1.2902	-1.4137
	WS	-2.55	-0.1172	-1.2430	-0.4148	-0.5979	-0.7485	0.5753	0.0404	0.5491	0.0280	0.4362	0.1632
$D\rho^s$	ADF	-2.89	-6.1383	-4.6674	-5.3826	-4.8471	-5.2222	-5.4907	-5.3640	-4.0166	-4.3060	-4.1163	-5.3760
	WS	-2.55	-6.4160	-4.8211	-5.6520	-5.1005	-5.5902	-5.0408	-4.9249	-4.1472	-4.3794	-4.0651	-4.9258
$DD\rho^s$	ADF	-2.89	-6.7743	-13.6607	-12.6964	-9.2173	-10.8033	-7.9069	-7.0162	-8.6605	-6.5997	-7.7362	-7.1932
	WS	-2.55	-7.1432	-13.9547	-12.9746	-9.4438	-10.9946	-7.1863	-6.5148	-7.9271	-6.0759	-6.9343	-6.7723
ρ^L with trend	ADF	-3.45	-1.7741	-1.8019	-1.9240	-2.3849	-1.9982	-1.7040	-1.7683	-1.7020	-1.8033	-1.8580	-1.6964
	WS	-3.24	-1.7698	-1.8050	-1.9844	-2.6457	-2.1134	-1.5587	-1.6698	-1.5550	-1.8097	-1.7669	-1.5770
ρ^L with no trend	ADF	-2.89	-1.2471	-1.2481	-1.0780	-0.9355	-1.1108	-1.4067	-1.3177	-1.4103	-1.2241	-1.2510	-1.3731
	WS	-2.55	0.3762	0.3873	0.7949	-0.0843	0.3811	0.1025	0.1970	0.0987	0.2451	0.3425	0.1785
$D\rho^L$	ADF	-2.89	-6.6429	-6.7089	-6.0053	-7.2367	-7.0512	-5.7672	-6.1539	-5.7537	-6.4605	-6.4442	-5.9926
	WS	-2.55	-6.5168	-6.6104	-6.1656	-7.2054	-7.0082	-5.6268	-5.8837	-5.6154	-6.2776	-6.1737	-5.8427
$DD\rho^L$	ADF	-2.89	-7.4576	-7.5606	-7.8507	-8.0172	-7.5468	-6.8582	-6.9520	-6.8610	-7.1491	-7.2158	-7.0073
	WS	-2.55	-7.2029	-7.3343	-7.6571	-7.2630	-7.3068	-6.5890	-6.4517	-6.5963	-6.8039	-6.6653	-6.7256
q with trend	ADF	-3.45	-2.9412	-2.8532	-2.7423	-2.9714	-2.8740	-2.6145	-2.7091	-2.7332	-2.6347	-2.8128	-2.6181
	WS	-3.24	-3.1593	-3.0319	-2.9240	-2.9980	-3.0487	-2.3748	-2.4467	-2.7659	-2.4158	-2.7301	-2.4230
q with no trend	ADF	-2.89	-2.1462	-2.6605	-2.4602	-2.9761	-2.5642	-2.6872	-2.6570	-2.7542	-2.5425	-2.6997	-2.6750
	WS	-2.55	-2.1310	-2.8902	-2.6942	-2.8445	-2.7921	-2.1794	-1.8178	-2.6144	-1.7259	-2.1765	-2.1867
Dq	ADF	-2.89	-5.9215	-6.1208	-6.1256	-5.7929	-5.9579	-5.8068	-5.6592	-5.9194	-5.6238	-5.8564	-5.7114
	WS	-2.55	-6.0388	-6.3134	-6.3144	-5.9752	-6.1486	-5.9347	-5.7746	-6.0880	-5.7687	-6.0040	-5.8475
DDq	ADF	-2.89	-6.6263	-6.9496	-6.8288	-6.5363	-6.8441	-10.2327	-10.1010	-10.3116	-10.0208	-10.2109	-10.0961
	WS	-2.55	-6.7811	-7.2128	-7.0719	-6.8372	-7.0827	-10.4716	-10.3370	-10.5524	-10.2556	-10.4488	-10.3281

Table B6: Unit Root Tests for Global Variables

Variable	p^O with trend		p^O with no trend		Dp^O		DDp^O	
Test	ADF	WS	ADF	WS	ADF	WS	ADF	WS
Critical Value	-3.45	-3.24	-2.89	-2.55	-2.89	-2.55	-2.89	-2.55
Statistic	-3.6836	-3.4290	-0.9351	-0.8362	-7.1839	-7.3458	-6.7455	-7.0545

Table B7: Trace Test Statistics for Individual Country Model Testing

Country	No. of endog	No. of foreign	r=0	r=1	r=2	r=3	r=4	r=5
ARGENTINA	5	6	223.9275	105.5184	66.1394	34.0867	13.7323	
AUSTRALIA	6	6	242.2069	175.9612	127.8880	83.1865	46.4829	17.5027
BRAZIL	5	6	292.3238	152.6994	79.7017	40.6146	16.3811	
CANADA	6	6	249.8923	167.5804	105.1004	56.0744	30.8934	14.3229
CHILE	5	6	264.7721	179.4471	113.7735	59.7880	21.0739	
CHINA	5	6	240.0096	154.4167	92.2144	43.0460	15.3583	
CZECH REPUBLIC	5	6	215.5792	136.4245	86.1922	48.3776	20.2120	
DENMARK	6	6	312.5206	201.6551	139.6193	84.7116	46.0767	18.2460
EURO	6	6	311.3253	211.9172	145.7997	86.9308	47.1185	17.0799
HUNGARY	5	6	333.5868	155.8426	101.8180	53.2134	18.1452	
INDIA	5	6	233.0418	153.3546	86.6269	50.6905	15.9833	
INDONESIA	5	6	274.1241	172.5731	102.2308	60.7499	26.4861	
JAPAN	6	6	268.0042	184.2274	128.7109	87.3949	50.7854	19.4450
KOREA	6	6	269.3680	195.4821	132.3884	78.0443	39.8511	15.5506
MALAYSIA	6	6	310.0482	202.4074	141.2897	93.7218	51.9319	22.6874
MEXICO	5	6	458.8474	225.3281	99.6111	50.9154	21.3400	
NORWAY	6	6	304.1055	210.6067	140.8050	82.7206	38.8004	12.9553
NEW ZEALAND	6	6	253.3382	164.5965	113.7423	69.9263	41.9518	17.4049
PERU	5	6	220.5599	144.6512	83.2387	48.1146	21.3124	
PHILLIPINES	5	6	199.9042	119.4931	67.4012	35.4306	13.2992	
RUSSIA	5	6	266.9679	179.1140	113.1565	61.6515	25.1479	
SINGAPORE	5	6	187.7856	119.2134	69.5599	37.4392	8.0113	
SWEDEN	6	6	229.3480	164.2891	104.4354	63.8414	28.6814	10.4117
SWITZERLAND	6	6	281.9246	207.0379	144.2157	95.2240	54.2620	21.5225
THAILAND	5	6	270.0881	185.2761	109.3728	62.3371	20.5030	
TURKEY	5	6	339.7828	176.2922	117.1553	60.8901	21.1545	
UNITED KINGDOM	6	6	345.9760	248.7391	152.7574	94.9728	49.0867	19.9350
UNITED STATES	6	3	193.2117	125.2931	79.4538	44.6762	28.4118	12.6293

Table B8: Trace Test Critical Values for Individual Country Model Testing

Country	No. of endog	No. of foreign	r=0	r=1	r=2	r=3	r=4	r=5
ARGENTINA	5	6	156.44	119.03	85.44	55.5	28.81	
AUSTRALIA	6	6	197.7	156.44	119.03	85.44	55.5	28.81
BRAZIL	5	6	156.44	119.03	85.44	55.5	28.81	
CANADA	6	6	197.7	156.44	119.03	85.44	55.5	28.81
CHILE	5	6	156.44	119.03	85.44	55.5	28.81	
CHINA	5	6	156.44	119.03	85.44	55.5	28.81	
CZECH REPUBLIC	5	6	156.44	119.03	85.44	55.5	28.81	
DENMARK	6	6	197.7	156.44	119.03	85.44	55.5	28.81
EURO	6	6	197.7	156.44	119.03	85.44	55.5	28.81
HUNGARY	5	6	156.44	119.03	85.44	55.5	28.81	
INDIA	5	6	156.44	119.03	85.44	55.5	28.81	
INDONESIA	5	6	156.44	119.03	85.44	55.5	28.81	
JAPAN	6	6	197.7	156.44	119.03	85.44	55.5	28.81
KOREA	6	6	197.7	156.44	119.03	85.44	55.5	28.81
MALAYSIA	6	6	197.7	156.44	119.03	85.44	55.5	28.81
MEXICO	5	6	156.44	119.03	85.44	55.5	28.81	
NORWAY	6	6	197.7	156.44	119.03	85.44	55.5	28.81
NEW ZEALAND	6	6	197.7	156.44	119.03	85.44	55.5	28.81
PERU	5	6	156.44	119.03	85.44	55.5	28.81	
PHILLIPINES	5	6	156.44	119.03	85.44	55.5	28.81	
RUSSIA	5	6	156.44	119.03	85.44	55.5	28.81	
SINGAPORE	5	6	156.44	119.03	85.44	55.5	28.81	
SWEDEN	6	6	197.7	156.44	119.03	85.44	55.5	28.81
SWITZERLAND	6	6	197.7	156.44	119.03	85.44	55.5	28.81
THAILAND	5	6	156.44	119.03	85.44	55.5	28.81	
TURKEY	5	6	156.44	119.03	85.44	55.5	28.81	
UNITED KINGDOM	6	6	197.7	156.44	119.03	85.44	55.5	28.81
UNITED STATES	6	3	158.01	122.96	91.81	64.54	41.03	20.98

Table B9: F-Statistics for Testing the Weak Exogeneity of the Country-specific Foreign Variables and Oil Prices at 5% Significance Level

Country	F test	Critical 5%	ex_{it}	ρ_{it}^{S}	ρ_{it}^{L}	q_{it}	π_{it}	y_{it}	p_{t}^{O}
ARGENTINA	F(1,70)	3.9778		0.0827	0.0010	0.6099	1.2799	2.5554	3.7916
AUSTRALIA	F(2,68)	3.1317		2.8015	0.0827	3.0580	7.0579	0.3152	0.6846
BRAZIL	F(2,69)	3.1296		0.3775	0.3149	3.1857	0.5501	0.6775	0.1849
CANADA	F(2,60)	3.1504		0.2545	0.4250	1.8360	2.9108	3.2757	0.6701
CHILE	F(1,70)	3.9778		0.0002	0.0118	4.3105	1.2003	1.1468	0.3915
CHINA	F(1,70)	3.9778		2.8839	8.4743	0.2410	4.3696	5.3649	0.7275
CZECH REPUBLIC	F(1,70)	3.9778		0.0110	1.6899	0.0393	0.0853	0.0139	0.2948
DENMARK	F(1,69)	3.9798		0.8665	1.2791	1.2765	1.0395	1.6839	0.6070
EURO	F(1,69)	3.9798		1.0144	0.0356	0.0459	0.0243	0.0688	2.4457
HUNGARY	F(1,70)	3.9778		1.3090	0.8044	0.5322	0.8490	1.5647	1.9229
INDIA	F(2,69)	3.1296		0.1391	2.7743	0.6227	0.6235	2.7498	1.6068
INDONESIA	F(1,70)	3.9778		2.5822	0.1833	2.1891	3.9213	3.9783	6.4608
JAPAN	F(1,69)	3.9798		3.3059	7.7655	1.4586	0.0287	0.0991	2.0236
KOREA	F(1,69)	3.9798		3.5955	4.7593	2.0343	5.4421	1.6983	0.0012
MALAYSIA	F(2,68)	3.1317		0.3683	0.4339	0.1609	1.2476	1.7784	0.5040
MEXICO	F(2,69)	3.1296		3.0393	0.0015	0.2280	0.0362	0.0214	0.1532
NORWAY	F(1,69)	3.9798		0.9950	0.0263	2.0871	5.0574	0.6794	0.1983
NEW ZEALAND	F(2,68)	3.1317		1.4773	5.0050	1.8078	2.2631	0.3336	0.4812
PERU	F(1,70)	3.9778		2.8652	0.0996	1.9255	1.8703	0.5229	1.0798
PHILLIPINES	F(2,69)	3.1296		0.5496	0.6291	1.8167	1.2542	0.0672	3.1472
RUSSIA	F(1,70)	3.9778		1.6979	0.0418	0.5425	5.5253	0.5811	0.2247
SINGAPORE	F(1,70)	3.9778		0.5183	1.7348	0.6820	0.1662	0.0859	0.1377
SWEDEN	F(1,69)	3.9798		1.9051	0.5299	1.7430	0.0006	0.5116	1.2824
SWITZERLAND	F(1,69)	3.9798		2.4563	1.8972	0.7814	0.2520	0.6752	0.3155
THAILAND	F(1,70)	3.9778		2.2672	11.0203	0.5096	2.2320	4.8623	0.0646
TURKEY	F(1,70)	3.9778		0.0164	3.2837	1.5159	11.9918	6.6800	0.2482
UNITED KINGDOM	F(1,55)	4.0162		0.9566	0.0286	0.8663	0.2738	0.1678	3.4448
UNITED STATES	F(2,62)	3.1453	0.0182				1.2790	0.0136	

Table B10: Contemporaneous Effects of Foreign Variables on Domestic Counterparts By Countries (Figures in parantheses are White's heteroskedastic-robust standard errors).

	y	π	q	ρ^S	ρ^L
ARGENTINA	-0.6888 (0.3509)	0.4493 (0.1788)	1.3619 (0.1588)	0.6566 (0.5897)	
AUSTRALIA	0.3728 (0.1767)	0.4839 (0.1065)	0.4934 (0.0690)	-0.0599 (0.1123)	1.1302 (0.1479
BRAZIL	-2.9798 (1.1674)	-7.1468 (2.2660)	0.9687 (0.1338)	0.3549 (0.3753)	
CANADA	0.3682 (0.0757)	-0.0398 (0.1281)	0.8664 (0.0763)	0.6203 (0.1755)	0.8485 (0.0626)
CHILE	1.5379 (0.3522)	0.4119 (0.1641)	-0.1625 (0.3684)	-0.6139 (0.4238)	
CHINA	0.8028 (0.3190)	0.4341 (0.1788)	1.4613 (0.2198)	0.0843 (0.1187)	
CZECH REPUBLIC	1.1255 (0.2474)	-0.1816 (0.2071)	0.6027 (0.1157)	1.0275 (0.3420)	
DENMARK	0.2877 (0.3006)	0.1469 (0.0577)	0.9270 (0.0664)	-0.2706 (0.2217)	0.7079 (0.0856)
EURO	0.3004 (0.1262)	0.1599 (0.0476)	0.9678 (0.0693)	0.1596 (0.0532)	0.9106 (0.1182)
HUNGARY	0.5605 (0.2251)	1.0945 (0.0476)	1.2356 (0.1275)	-0.0326 (0.3860)	
INDIA	0.0759 (0.3702)	0.1606 (0.2774)	0.9961 (0.0979)	8.9338 (1.5751)	
INDONESIA	-0.4824 (0.6092)	-0.0364 (0.2774)	1.1465 (0.1376)	8.3311 (1.3118)	
JAPAN	0.7562 (0.2135)	0.2131 (0.0749)	0.3742 (0.0890)	0.0532 (0.0500)	
KOREA	0.4365 (0.2164)	0.1739 (0.1179)	1.1746 (0.1520)	0.5297 (0.3774)	0.8811 (0.3638)
MALAYSIA	1.8533 (0.5075)	0.3037 (0.1729)	0.9119 (0.1341)	0.2639 (0.1105)	0.7098 (0.1413)
MEXICO	0.5003 (0.4120)	-0.4194 (0.3741)	1.1033 (0.1179)	2.5286 (2.3699)	
NORWAY	1.5001 (0.5175)	0.4018 (0.1864)	1.0274 (0.1112)	0.3794 (0.1979)	0.7757 (0.1177)
NEW ZEALAND	0.4565 (0.2056)	0.1508 (0.0729)	0.4636 (0.0608)	0.6741 (0.1225)	1.0807 (0.0986)
PERU	0.5792 (0.02491)	0.2419 (0.1280)	1.0053 (0.1621)	0.1492 (0.2366)	
PHILIPPINES	0.7304 (0.3274)	0.4132 (0.1696)	1.1344 (0.1913)	0.9083 (0.3996)	
RUSSIA	-0.8973 (0.8545)	4.5079 (1.4981)	1.7917 (0.3611)	-0.1306 (0.1612)	
SINGAPORE	0.3204 (0.2106)	0.4311 (0.1011)	0.8767 (0.0566)	0.0843 (0.1020)	
SWEDEN	1.4022 (0.3954)	0.3617 (0.1273)	1.0495 (0.0516)	0.6925 (0.1417)	1.0386 (0.0846)
SWITZERLAND	0.0667 (0.1602)	0.3100 (0.1420)	0.8281 (0.0532)	0.1976 (0.1164)	0.3448 (0.0601)
THAILAND	0.9849 (0.1685)	0.1778 (0.1252)	1.3431 (0.1490)	0.3989 (0.3395)	
TURKEY	2.8488 (0.5896)	0.3753 (0.4277)	1.2973 (0.1859)	-1.5726 (2.5594)	
UNITED KINGDOM	0.2559 (0.1456)	0.1505 (0.0859)	0.5932 (0.0386)	0.2972 (0.1343)	0.6484 (0.0933)
UNITED STATES	-0.0245 (0.0995)	0.5257 (0.1677)			

Table B11: Average Pairwise Cross-section Correlations of Real GDP, Inflation, Real Exchange Rate, Equity Prices, Short-Term and Long-Term Interest Rates and Associated Model's Residuals

	Real GDP			Inflation			Real Exchange Rate			Equity Price			Short-term Interest			Long-term Interest		
	Levels	1st Diff	VECMX * Res	Levels	1st Diff	VECMX * Res	Levels	1st Diff	VECMX * Res	Levels	1st Diff	VECMX * Res	Levels	1st Diff	VECMX * Res	Levels	1st Diff	VECMX * Res
ARGENTINA	-0.13	0.03	-0.03	0.85	-0.05	-0.05	0.83	-0.07	-0.06	0.46	0.53	-0.01	-0.13	0.05	-0.01			
AUSTRALIA	0.04	0.06	0.01	0.90	0.13	0.00	-0.60	0.04	0.02	0.46	0.61	0.00	0.42	0.18	0.02	0.84	0.61	0.08
BRAZIL	-0.04	0.00	0.00	0.74	0.15	-0.01	0.73	0.15	0.08	0.46	0.57	0.03	0.66	0.09	0.01			
CANADA	0.06	0.11	0.01	0.90	0.15	0.10	0.83	0.21	0.07	0.42	0.62	0.02	0.64	0.22	0.02	0.86	0.57	0.06
CHILE	0.04	0.14	-0.01	0.92	0.31	0.09	0.85	0.28	0.13	0.11	0.03	-0.03	0.63	0.08	0.00			
CHINA	0.05	0.13	-0.04	0.87	0.26	-0.05	0.84	0.17	0.04	0.15	0.52	-0.11	0.55	0.12	-0.04			
CZECH REPUBLIC	0.04	0.18	0.06	0.90	0.27	0.08	0.84	0.29	0.19	0.45	0.51	0.02	0.67	0.18	0.03			
DENMARK	0.05	0.10	0.03	0.91	0.20	0.09	0.83	0.27	0.19	0.43	0.59	0.03	0.60	0.17	-0.01	0.87	0.64	0.11
EURO	0.00	0.20	0.05	0.91	0.32	0.11	0.70	-0.13	-0.16	0.19	0.61	-0.05	0.67	0.27	0.05	0.69	0.46	-0.19
HUNGARY	-0.08	0.12	-0.03	0.90	0.25	0.02	0.82	0.26	0.14	0.31	0.54	0.05	0.65	0.00	0.02			
INDIA	0.11	0.10	0.03	0.90	0.09	0.04	0.85	0.20	0.09	0.50	0.57	0.03	0.43	0.12	-0.01			
INDONESIA	-0.11	0.14	0.03	0.90	0.06	0.04	0.83	0.18	0.11	0.32	0.55	0.01	0.42	0.16	-0.05			
JAPAN	0.09	0.14	-0.03	-0.46	0.11	0.04	0.45	0.10	0.06	0.09	0.52	-0.04	0.44	0.09	0.00	0.74	0.35	-0.01
KOREA	-0.08	0.20	0.06	0.91	0.21	0.09	0.82	0.25	0.10	0.40	0.48	-0.01	0.66	0.11	0.01	0.80	0.27	-0.08
MALAYSIA	0.08	0.20	0.02	0.91	0.24	0.04	0.82	0.27	0.14	0.28	0.46	-0.02	0.57	0.14	0.01	0.64	0.28	-0.05
MEXICO	-0.08	0.13	0.02	0.88	0.16	-0.01	0.76	0.08	0.02	0.47	0.61	0.08	0.60	0.11	-0.02			
NORWAY	0.06	0.19	0.00	0.91	0.12	0.05	0.83	0.27	0.15	0.53	0.63	-0.01	0.49	0.15	-0.02	0.77	0.55	0.03
NEW ZEALAND	0.09	0.09	0.03	0.90	0.17	0.01	0.66	-0.26	-0.12	-0.14	0.54	0.04	0.57	0.21	0.01	0.78	0.57	0.01
PERU	0.03	0.18	0.05	0.90	0.26	0.07	0.85	0.19	0.01	0.45	0.50	0.05	0.65	0.00	-0.01			
PHILLIPINES	-0.09	0.14	0.02	0.91	0.20	-0.04	0.84	0.22	0.13	0.17	0.44	-0.01	0.66	0.06	-0.02			
RUSSIA	-0.09	0.07	-0.02	0.87	0.20	-0.04	0.80	0.21	0.07	0.08	0.51	0.01	0.58	-0.04	0.00			
SINGAPORE	0.07	0.15	0.00	0.84	0.12	0.04	0.78	0.30	0.19	0.45	0.62	0.03	0.38	0.06	-0.02			
SWEDEN	0.05	0.19	0.01	0.89	0.21	0.04	0.78	0.27	0.14	0.38	0.59	0.05	0.66	0.22	-0.02	0.70	0.46	-0.03
SWITZERLAND	0.06	0.12	0.02	0.89	0.16	0.06	0.80	0.26	0.17	0.32	0.52	-0.05	0.59	0.15	0.00	0.83	0.46	0.02
THAILAND	0.05	0.22	0.06	0.91	0.28	0.07	0.83	0.27	0.15	0.08	0.47	0.00	0.50	0.10	0.00			
TURKEY	-0.11	0.09	-0.02	0.86	0.17	-0.03	0.76	0.10	0.05	0.44	0.47	0.03	0.60	-0.04	-0.08			
UNITED KINGDOM	0.01	0.10	0.05	0.91	0.25	0.12	0.79	-0.20	-0.14	0.23	0.57	0.00	0.62	0.16	0.04	0.84	0.59	0.08
UNITED STATES	0.10	0.14	0.03	0.89	0.13	0.00				0.21	0.59	0.03	0.64	0.25	0.03	0.87	0.61	0.09

Appendix C: Singapore Equity Price Shock

Many commentators see Singapore as playing a crucial role in transmitting economic perturbations from around the world into the ASEAN region. Not only that, following the Asian Financial Crisis (AFC) there was a concerted effort by Indonesia, Malaysia, Philippines and Thailand to distance themselves from their ASEAN-5 partner due to the major fall out that followed the end of the tiger bubble.

To understand whether this distancing is evident in our GVAR model we present an analysis of the impact of negative shocks to Singapore equity prices under the three weighting periods. Figure C2 gives the generalised impulse response function (GIRF) plots for the remaining members of the ASEAN-5, while figure C1 below shows Singapore itself. In each case plots are generated for the pre-AFC period using 1996 weights, the mid-crisis period between the AFC and global financial crisis (GFC) based on 2004 weights, and the post GFC period constructed with 2012 trading patterns.

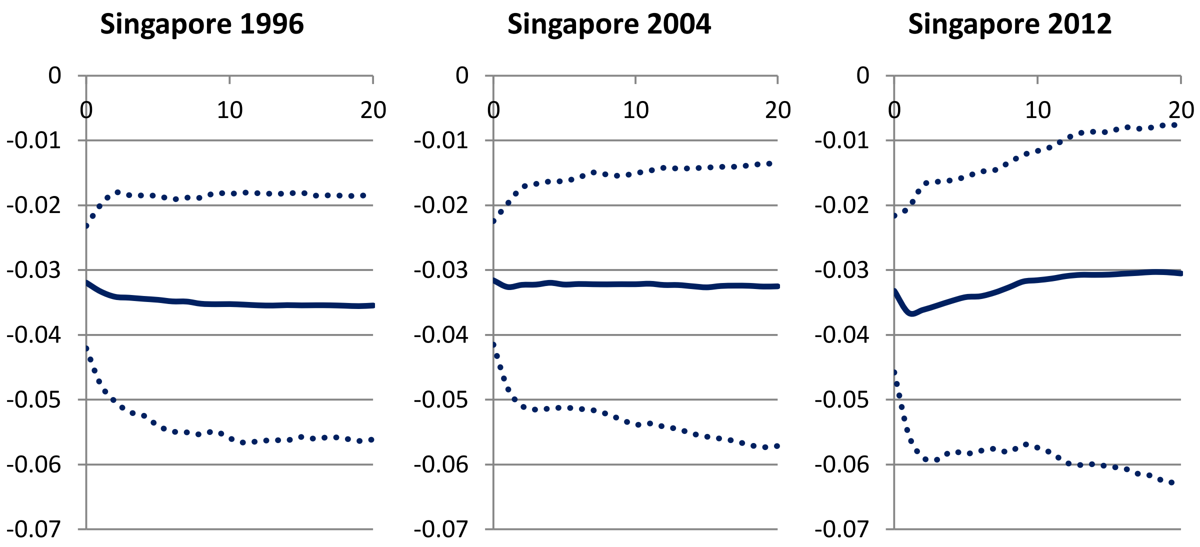

Figure C1 Impact of 1 Standard Error shock to Singapore equity prices on Singapore using trade weights from 1996, 2004 and 2012. Solid lines represent median estimates and dashed lines represent 95% confidence bands. (Source: Own Calculations)

For Singapore it is clear that very little changes between the periods, there is a negative impact of around 3.2% which then goes on to stabilise quite quickly. In 1996 the final level is suggested to be 3.6%, while in 2012 that is just 3%, but in each case the reduction is significant at the 5% level. When looking at the ASEAN 4 there is no significant shock under any combination of nation or weights matrix. There is also a great deal of similarity in terms of the 1% impact felt across the board. However, all nations show a bigger initial drop under 2012 weightings compared to other periods. Despite the correction taking levels back to 1%, and the impact not being significant, there is still tentative evidence that the aim of reducing the impact of Singapore has not been achieved.

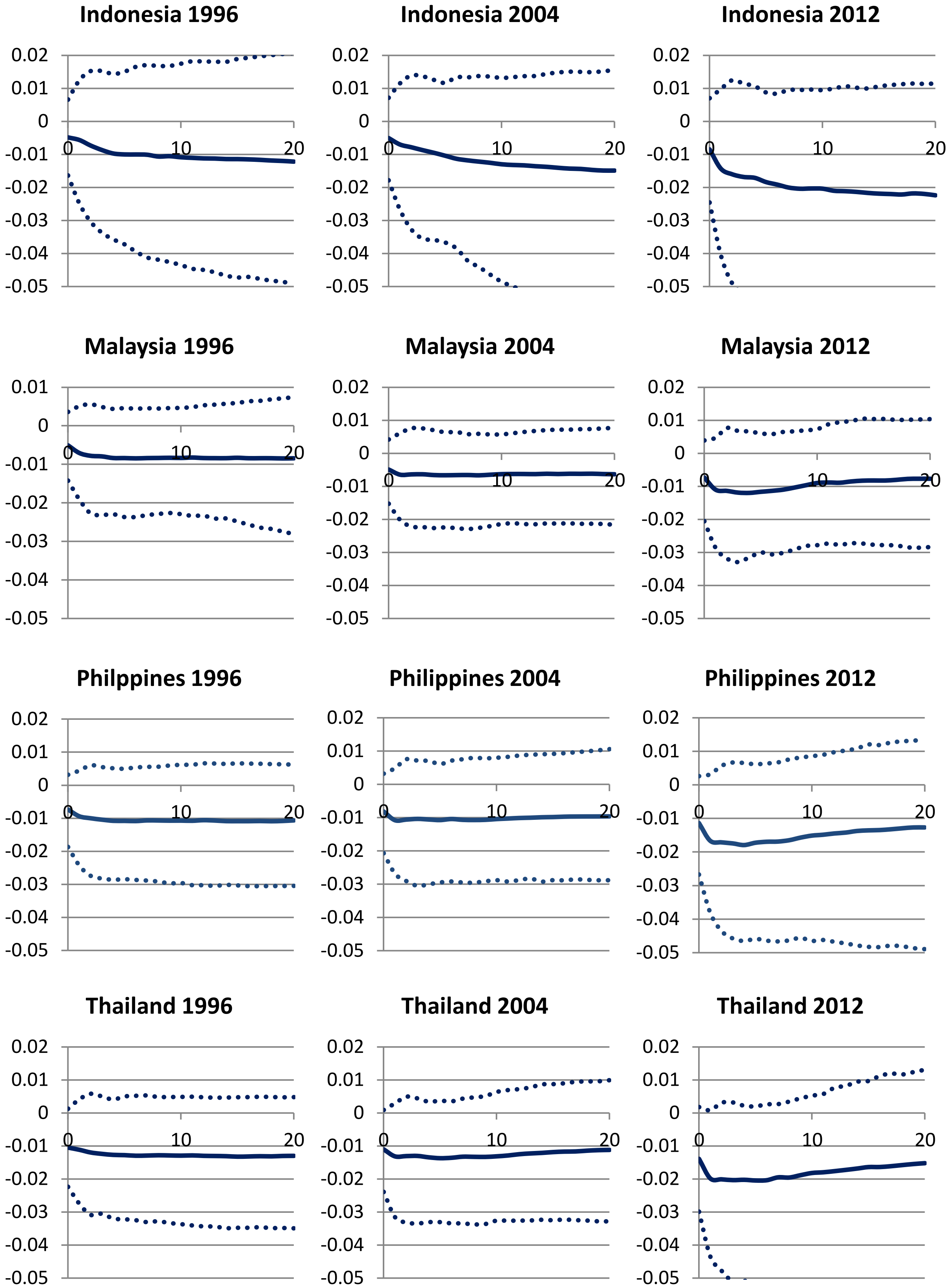

Figure C2 Impact of 1 Standard Error shock to Singapore equity prices using trade weights from 1996, 2004 and 2012. Solid lines represent median estimates and dashed lines represent 95% confidence bands. (Source: Own Calculations)