

FEATURE ARTICLE

IS SMOOTHER ALWAYS BETTER?

UNDERSTANDING SINGAPORE'S VOLATILITY-GROWTH RELATIONSHIP

Is Smoother Always Better? Understanding Singapore's Volatility-Growth Relationship

The views expressed in this paper are solely those of the authors and do not necessarily reflect those of the Ministry of Trade and Industry or the Government of Singapore.

INTRODUCTION

As a small open economy, economic growth in Singapore has been volatile over the past four decades. Business cycle fluctuations appear to have become more pronounced, with Singapore experiencing three recessions (1998, 2001 and 2009) in the past 15 years, in contrast to only one recession (1985) between 1965 and 1995. This perceived increase in growth volatility has led to discussions on two fronts.

The first concerns the sources of volatility. Several analysts have suggested that the high observed volatility in Singapore is indicative of a structural imbalance due to an over-reliance on exports (with a correspondingly small source of domestic demand).¹ This argument implies that efforts to reduce Singapore's growth volatility should focus on boosting Singapore's domestic demand, in particular private consumption expenditure (PCE) which is deemed to be more stable. Our analysis indicates that no clear relationship between volatility and the share of PCE exists, especially for a small open economy like Singapore. Economic volatility in Singapore is better explained by our economic openness and outward orientation.

The second concern is the relationship between volatility and growth. A positive relationship would imply a trade-off where any attempt by policy makers to lower volatility would imply lower growth. On the other hand, if volatility is detrimental to growth (a negative relationship), policy makers should aim to reduce volatility to foster growth. This would imply more policy attention to either macroeconomic stabilization, or the active use of industrial policy to reduce growth volatility.

While the theoretical evidence on the link between volatility and growth suggests that the relationship is ambiguous, international empirical evidence indicates that higher volatility is associated with lower growth. However, this has to be weighed against the considerable benefits of economic openness, which, according to empirical evidence, outweighs the negative impact of volatility on growth. Hence, any negative welfare effects arising from economic volatility may be best mitigated through other policy measures, rather than altering the structure of the economy to reduce volatility.

SOURCES OF VOLATILITY

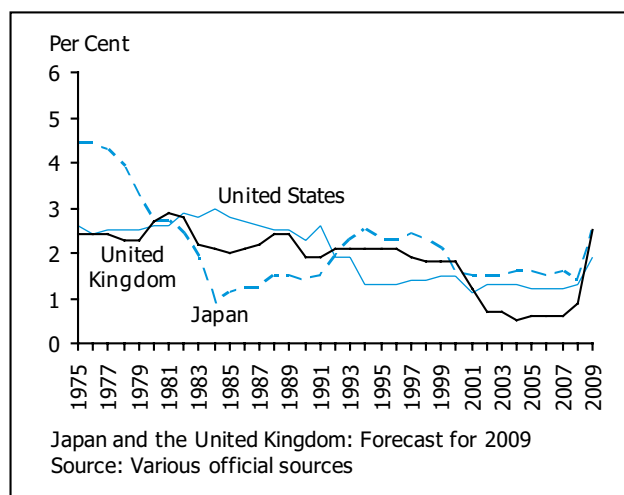
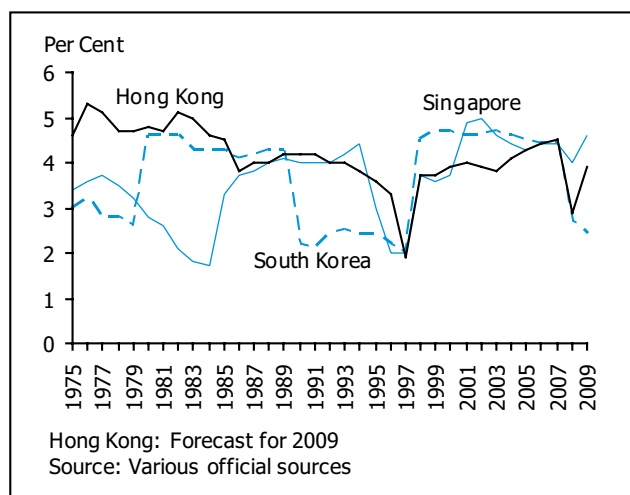
We first present the 10-year rolling standard deviation of Singapore's GDP growth relative to other selected economies in Exhibit 1.² We see that Singapore's GDP growth volatility is similar to that of other open Asian economies like Hong Kong and South Korea, but much higher than that of advanced economies. The two smallest and most open economies, Singapore and Hong Kong, have the highest GDP growth standard deviations.³ This relationship between openness and volatility is consistent with empirical research (Easterly and Kraay, 1999).

¹ Vikram Khanna, "Retooling the economy for a post-crisis world", *Business Times*, 1 Jun 2009. Manu Bhaskaran, "Re-assessing Singapore's economic future" *The Edge S'pore*, 27 Jul 2009. "Out-of-the-box ideas to remake Singapore's Economy" *Straits Times*, 28 Oct 2009.

² The rolling standard deviation is used by economists as a tool to analyse volatility over a period of time [see for example Blanchard and Simon (2001), and Gordon (2005)]. A higher 10-year rolling standard deviation would be indicative of higher volatility in the preceding 10-year period. As the standard deviation is affected by scaling, the coefficient of variation (CV) which adjusts for the average growth rate is an alternative measure for volatility. However, the CV requires the denominator to be sufficiently large, otherwise it tends to infinity for countries with average GDP growth near zero (such as Japan in recent periods). We have therefore used the rolling standard deviation as our main measure of volatility.

³ For this paper, an economy's total trade (exports plus imports) as a ratio of GDP is used as a proxy for its openness. However, we note that this may not be a complete reflection of economic openness, as it does not account for capital/financial flows or immigration. According to this measure, both Singapore and Hong Kong are highly open. Hong Kong's trade as a ratio of GDP is 2.2, similar to Singapore's 3.0 (1975-2008 average).

Exhibit 1: Annual Real GDP Growth in Selected Economies⁴
(10-Year Rolling Standard Deviations)



Gross Domestic Expenditure Components

In this section, we focus our analysis on the share of PCE in Singapore's economy. Most analysts argue that a larger PCE share may reduce volatility. [Exhibit 2A](#) presents the relative volatility of various Gross Domestic Expenditure (GDE) components in Singapore over time, while [Exhibit 2B](#) shows the correlation between these components. Although PCE is the least volatile of all demand components, it is sometimes more volatile than GDP, especially in recent periods.⁵

We present three different perspectives on why raising the share of PCE to GDP does not necessarily imply lower growth volatility. First, we observe that there is a high correlation between PCE and other, more volatile components of GDP such as exports and GFCF ([Exhibit 2B](#)). Hence, for a small open economy like Singapore, it should not be assumed that increasing the share of PCE to GDP *ceteris paribus* would result in a reduction in economic volatility.

Second, there are other small open economies that have a high share of PCE to GDP, but are still subject to high growth volatility. Hong Kong is a case in point. Between 1975 and 2008, Hong Kong's PCE as a share of GDP averaged around 60 per cent, which is comparable to advanced economies' such as the US and Japan. Despite Hong Kong's relatively large PCE share, its volatility was noticeably higher than advanced economies', and not much different from Singapore's with PCE at 46 per cent share of GDP ([Exhibit 1](#)).

⁴ In [Annex A](#), we present the standard deviation of each economy's per capita GDP growth. Similar trends in GDP per capita growth are observed even when we account for population growth.

⁵ In terms of domestic demand components, we observe that gross fixed capital formation (GFCF) is extremely volatile, often even more so than external demand. Hence, raising the share of domestic demand, which includes GFCF, may not imply lower volatility.

Third, the volatility of PCE itself is quite large in Singapore, sometimes larger than the volatility of GDP. This could be driven by factors other than volatility of income. Conceptually, for small, open economies, negative external shocks will be quickly transmitted through channels such as capital or financial flows, asset prices movement or even sentiments. These channels could ultimately lead to significant volatility in consumption. Increasing the share of PCE in GDP may therefore not necessarily lower the volatility of GDP.

More importantly, even if an increase in PCE share were to effectively dampen volatility, such an increase would imply a fall in the share of external demand. In subsequent sections, we will show that lowering the share of external demand in order to lower volatility will result in a loss of benefits arising from trade, which is not an optimal outcome for open economies.

Exhibit 2A: Volatility of Demand Components of Singapore's GDP

(10-Year Rolling Standard Deviations)

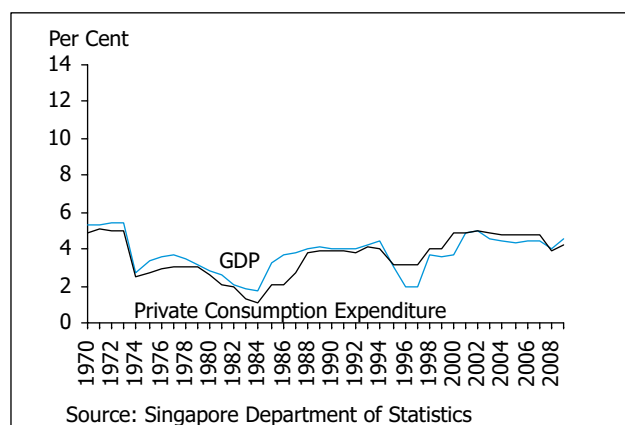
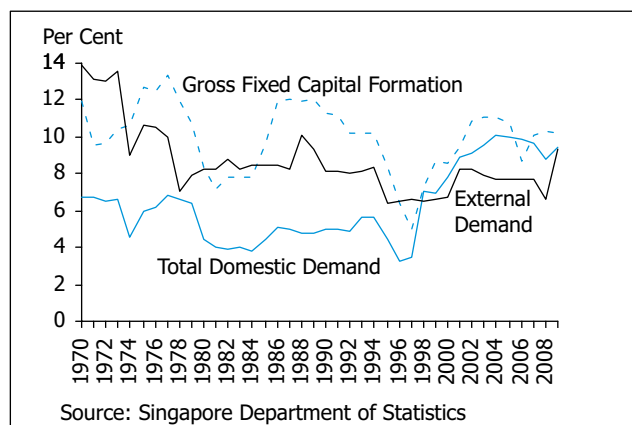


Exhibit 2B: Growth Correlation of Singapore's Real Gross Domestic Expenditure Components (1Q 1976 – 4Q 2009)

1Q 1976 – 4Q 2009 (Correlation Coefficients)	GDP	PCE	GCE	GFCF	Exports
GDP	1.00	0.71**	-0.14	0.53**	0.76**
PCE	0.71**	1.00	-0.10	0.30**	0.60**
GCE	-0.14	-0.10	1.00	0.06	-0.20*
GFCF	0.53**	0.30**	0.06	1.00	0.32**
Exports	0.76**	0.60**	-0.20*	0.32**	1.00

** indicates statistical significance at the 1% level

* indicates statistical significance at the 5% level

Sectoral Growth Volatility

Besides GDE components, we also investigate the sources of volatility from the production side, and seek to shed light on the sectors that contribute to Singapore's observed volatility. [Exhibit 3A](#) presents growth volatilities of manufacturing, construction and services.

First, we observe that the services sector on the whole has relatively low volatility, as a significant component of services cater to the domestic market and are not tradable. [Annex A](#) shows that international services such as financial services, and trade-related services such as wholesale and retail trade are more volatile than domestically oriented services.

Second, [Exhibit 3A](#) shows that post-2000, a large part of the increase in volatility in Singapore has stemmed from the manufacturing sector, in part due to the growing Biomedical Manufacturing (BMS) cluster.⁷ [Exhibit 3B](#) suggests that BMS is by far the most volatile of the various manufacturing clusters. However, the quarterly swings in BMS by and large even out over the year. In [Annex A](#), we observe that on an annual basis, clusters such as electronics and precision engineering are often no less volatile than BMS. Hence, the BMS cluster is not the only contributor to economic volatility on an annual basis.⁸

Exhibit 3A: Volatility of Manufacturing, Construction and Services Industries
(8-Quarter Rolling Standard Deviations)

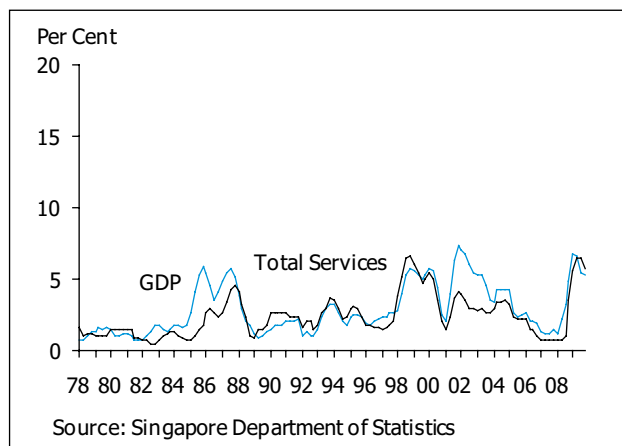
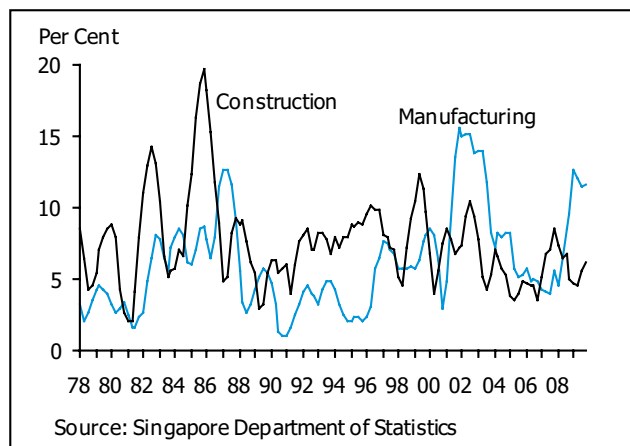
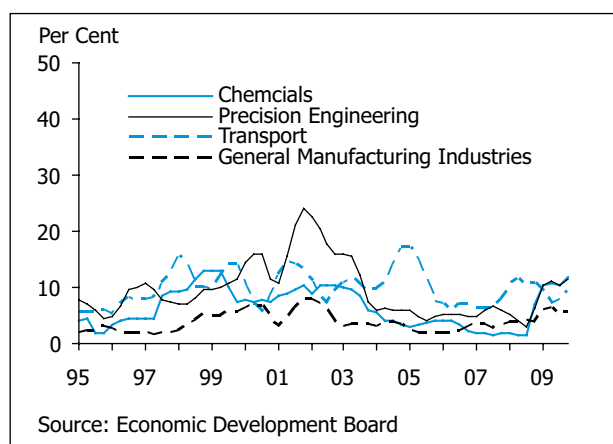
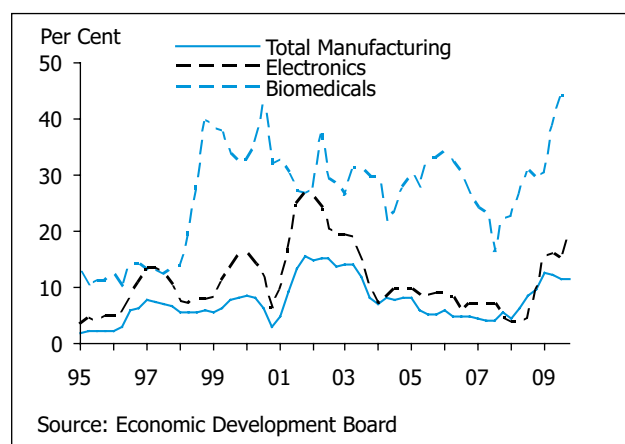


Exhibit 3B: Volatility of Manufacturing, Construction and Services Industries
(8-Quarter Rolling Standard Deviations)



⁷ Prior to 2000, construction exhibited higher growth volatility.

⁸ In fact, the correlation between the growth rates of BMS and GDP (excluding BMS) over the 2000-2009 period is close to zero, suggesting that the BMS cycle may even be independent of the larger business cycle.

Although Singapore's growth is volatile, we go one step further to argue that Singapore's economic volatility need not be seen as a source of weakness. Cunat and Melitz (2007) show that growth volatility could reflect a country's comparative advantage in having greater institutional capability to cope with volatility. For example, countries with more flexible labour markets would tend to attract industries that need flexibility to hire and shed workers in response to volatile demand conditions. In other words, industries and firms that are more likely to experience volatility will be attracted to countries that allow them to adjust more nimbly to rapidly changing business conditions, and will ultimately export products and services of these flexible firms. Any observed economic volatility could therefore represent an endogenous response to a country's flexible labour markets.⁹

This argument is particularly relevant to Singapore. According to the World Bank's Ease of Doing Business ranking, Singapore is ranked first out of 183 economies in overall "Ease of Doing Business" and "Employing Workers" in the 2008-2009 period.¹⁰ This ranking implies a high degree of flexibility in Singapore's business and labour frameworks. Also, Singapore's tax laws allow firms to use losses incurred in the current year to reduce profits assessed for income tax in the prior three years, effectively providing firms with a refund of past taxes that have been paid. Such flexible tax policies would attract companies whose profits are more volatile. Singapore's observed volatility may therefore reflect its attractiveness to firms and industries that are, by their nature, more exposed to the business cycle.

IMPACT OF VOLATILITY ON ECONOMIC GROWTH

Theoretical Background

We now turn to the second issue on the impact of volatility on economic growth.¹¹ The body of economic theory suggests that this impact is ambiguous. There are two main strands of literature on this relationship, one dealing with the investment channel and the other with the productivity channel. We will see that economic volatility increases growth through some aspects of each channel, but dampens growth through other aspects. We discuss each in turn.

Investment

Economic theory suggests that increased volatility will likely lower the quantity as well as quality of investment. Dixit and Pindyck (1994) show that the irreversible nature of most investments would significantly alter standard Net Present Value (NPV) considerations. A firm's opportunity to invest is analogous to a financial call option, and can be interpreted as the right for the firm to buy an asset at a given point in time. In going ahead with any irreversible investment today, a firm effectively loses the option to invest in the future should market conditions change considerably. The value of this option is an opportunity cost that should be taken into account in a firm's investment decision. Therefore, before investing the firm should consider the standard calculation of expected net present value, as well as the option value α_t . In effect, the firm will invest only if:

$$\text{Expected NPV}_t > \alpha_t$$

⁹ In fact, the authors also show that the country with more flexibility will gain in terms of absolute productivity, as output can be more efficiently reallocated across firms when ex-post shocks occur.

¹⁰ Full rankings available at <http://www.doingbusiness.org/economyrankings/>. This ranking was one of the variables used by Cunat and Melitz (2007) to determine an economy's economic flexibility.

¹¹ At this stage, we only examine any impact that volatility may have on economic growth, not on the broader measure of economic welfare.

As volatility increases, the opportunity cost of making a wrong investment becomes larger. Hence, the effect of economic volatility would be to increase the value of the option of investing in the future instead of now (α_t). *Ceteris paribus*, this implies a higher NPV before investing. As a result, higher volatility would lead to firms reducing or delaying their investments.¹²

Wolf (2005) takes this argument a step further and considers the impact of volatility on the quality of investment. Under a volatile environment, firms are likely to tilt investment towards less specialized, and less efficient, capital goods, which can be re-allocated more easily at the time of a shock. Therefore, increased volatility may reduce the diffusion rate of new technology, which results in lost output.¹³ Similarly, Aysan (2006) links greater volatility to increased capital market fluctuations, which translates into higher borrowing costs. This raises the cost of financing investment, and forces individual firms to adopt lower productivity investment (which are cheaper), thereby dampening output.¹⁴

In similar vein, Aghion et al. (2005) argue that volatility impacts the composition of investments. When faced with imperfect credit markets, firms' long-term investments, which contribute more to productivity growth, become pro-cyclical. This is because tighter credit constraints imply a higher risk that long-term investment will be interrupted by some liquidity shock in the future. Entrepreneurs are therefore less inclined to make long-term investments, particularly during recessions, when liquidity is expected to be scarce. Instead firms make short-term investments that are less oriented towards long-term growth. Tighter credit therefore amplifies volatility, and leads to lower mean growth for a given total investment rate.

Productivity

In general, theory suggests that growth volatility has a positive impact on productivity in the medium to long term. The seminal argument by Schumpeter (1934) is that recessions may be desirable, as they serve as a "cleansing" mechanism which encourages productive firms to innovate while eliminating unproductive firms. Recessions are also opportunities for firms to liquidate unprofitable investments that may be redeployed more efficiently. More recent studies have built on this original argument. Caballero and Hammour (1994) find that job destruction is much more responsive than creation to the business cycle, affirming Schumpeter's view that recessions may be a time of "cleansing" of unproductive firms or labour.¹⁵

A related, but distinct idea is the "pit-stop" view of recessions, where firms use the "low opportunity costs" of R&D (as the demand for goods are lower) to reallocate resources from production to productivity-improving activities such as R&D investments (Aghion and Saint-Paul, 1993). All these arguments depend on firms having flexible access to credit, especially during recessions. They also depend on full labour flexibility and mobility.

Overall, theoretical results are ambiguous. On one hand, volatility could be positive for growth due to improved productivity (if institutions are sufficiently flexible). On the other hand, it could be negative for growth due to reduced quality and perhaps quantity of investment. The lack of clear theoretical predictions means that the weight of evidence has to be borne by empirical analysis.

¹² There is another more subtle consideration here. If investment decisions are reversible – i.e., firms are able to resell the investment – the effect of investment delay or investment reduction will not be so strong.

¹³ Hassett and Metcalf (1993) for example argue that consumers are slow to invest in energy efficiency due to highly uncertain cost savings from these investments.

¹⁴ This is also related to the credit rationing literature of Stiglitz and Weiss (1981). A more volatile environment could introduce greater information asymmetry where lenders find it more difficult to assess the quality of borrowers. As a result, there is equilibrium credit rationing. Some economically valuable projects will not receive investment.

¹⁵ Similarly, Thia (2010) shows that negative business cycle shocks (recessions) would result in the exit of the weakest firms in the setting where firms are productively heterogeneous. As a result, aggregate productivity would increase during recessions.

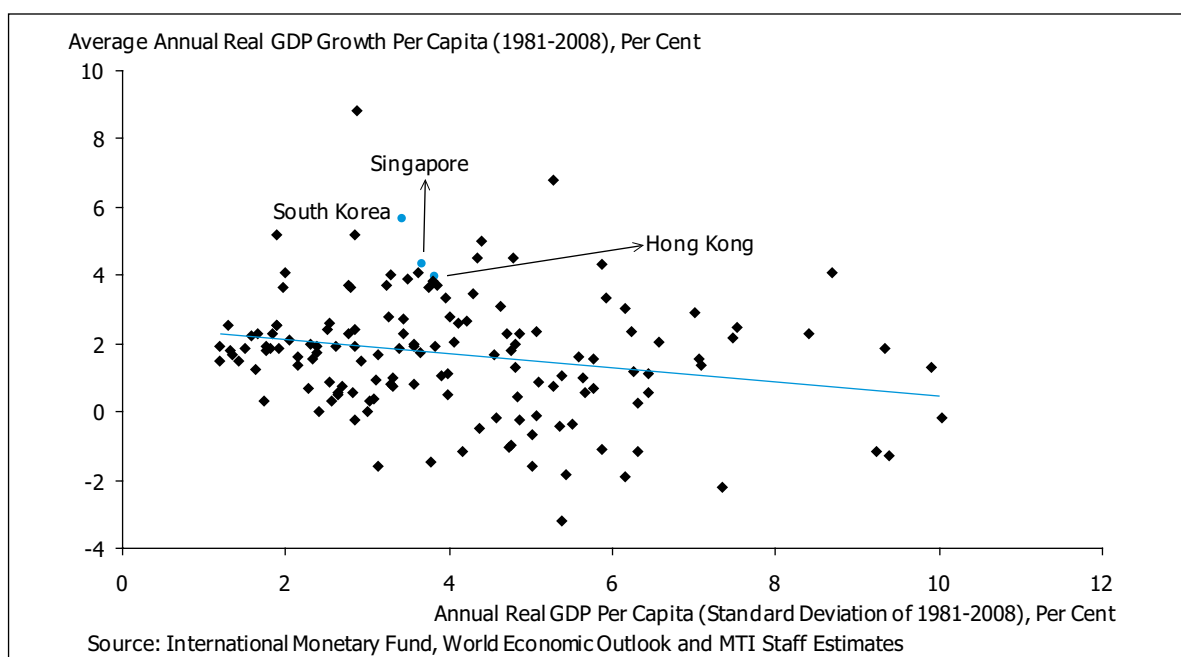
Empirical Evidence

Although theoretical results are ambiguous, most empirical evidence point to a negative relationship between growth and volatility, across countries and time periods. Ramey and Ramey (1995) demonstrated empirically that increased volatility of GDP growth is associated with lower GDP growth. The authors estimated the relationship between standard deviations of quarterly GDP per capita growth and GDP per capita growth rates, and found a negative and statistically significant association between volatility and growth across 92 economies between 1960 and 1985.

We have estimated Ramey and Ramey's baseline specification with updated GDP data for 145 economies across the 1980-2008 period ([Exhibit 4](#)). We observe that the negative relationship between volatility and growth continues to hold even when we consider more recent periods, and is statistically significant. This finding has been subjected to extensive econometric robustness checks and tests, and similar results have been presented in various studies including Martin and Rogers (2000), Fatas (2002), and Hnatkowska and Loayza (2005). These studies also find that the negative impact of volatility on growth is amplified in countries that are poor, institutionally underdeveloped, undergoing intermediate stages of financial development, or unable to conduct countercyclical fiscal policies.

As seen in [Exhibit 4](#), Singapore's volatility-adjusted average growth rate, as with other small open economies like Hong Kong and South Korea, is higher than what the regression model predicts. This provides some evidence that Singapore's growth rate has not been too affected by volatility.

Exhibit 4: The Cross-Country/Region Relationship between Volatility and Growth



As mentioned, small, open economies are inherently more volatile than larger economies. Other empirical studies have corroborated this finding. For instance, Easterly and Kraay (1999) find that the standard deviation of annual real per capita GDP growth is 1.4 percentage points higher in small states than in larger states. More importantly however, Easterly and Kraay's study shows that despite higher volatility, the net impact of increased openness on growth is positive for small open economies. Aghan and Kose (2006) also find that greater openness and financial integration weaken the negative relationship between growth and volatility. As such, even though open economies may experience higher growth volatility, this may not translate to a negative impact on growth. In Singapore's case, any attempt to lower volatility would involve a fall in external demand. In such a situation, the reduced benefits from trade may outweigh the gains from reduced volatility.

Empirical research has also identified factors that may mitigate the negative impact of volatility on growth with relatively reduced loss of trade benefits. Hesse (2008) finds that increased export concentration in a few sectors increased volatility of growth in several open economies. As such, he suggests that export diversification would be a desirable way of “dampening” the impact of terms of trade volatility on growth while retaining some of the benefits of trade to growth. Export diversification, which Singapore practices, has conceivably dampened the negative impact of growth volatility, and may also have been a factor contributing to Singapore’s higher than expected volatility adjusted growth (Exhibit 4).

CONCLUSION

Based on the analyses and findings presented above, we draw the following policy conclusions for Singapore:

- (a) In contrast to the suggestions by many analysts, raising the share of PCE in GDP may not reduce volatility, even though PCE is the least volatile of all demand components.
- (b) Although empirical evidence shows that volatility has a negative relationship with growth, it also suggests that the benefits from trade outweigh the costs due to volatility. Any attempts by policymakers to reduce volatility through a lower share of external demand are likely to be ultimately detrimental to growth.
- (c) Studies have shown that the negative impact of volatility on growth is more moderate for economies that are at an advanced stage of development, with stable socio-economic conditions and good quality institutions. Our analysis has also indicated that the negative impact of volatility on growth in Singapore has been more limited than in many other countries.
- (d) Finally, Singapore’s observed volatility may reflect its comparative advantage in labour market and institutional flexibility, as well as overall economic openness. Policy makers therefore need not view Singapore’s growth volatility as entirely negative.

To sum up, we find that for a small open economy like Singapore, volatility need not be viewed negatively. Moreover, deliberately adjusting Singapore’s outward orientation in order to avoid growth volatility may not lead to the most optimal growth outcome. From an economic growth perspective, policymakers need not be overly concerned with volatility to the point that counter-cyclicality becomes their topmost fiscal or monetary policy priority. Take care of the fundamentals, and the cycles will correct themselves.

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ANNEX A

Exhibit A1 presents the 10-year rolling standard deviations of annual Real GDP per capita. These trends are broadly similar to those presented in Exhibit 1. Open economies such as Singapore, Hong Kong and Korea experience higher GDP per capita volatility than the advanced economies.

Exhibit A1: Annual Real GDP per Capita Growth in Selected Economies
(10-Year Rolling Standard Deviations)

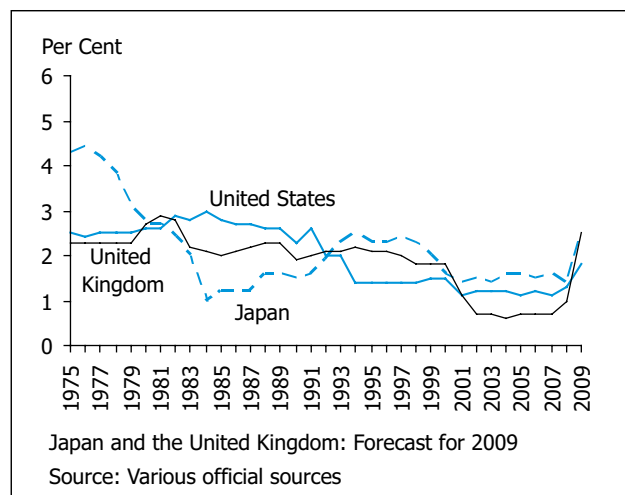
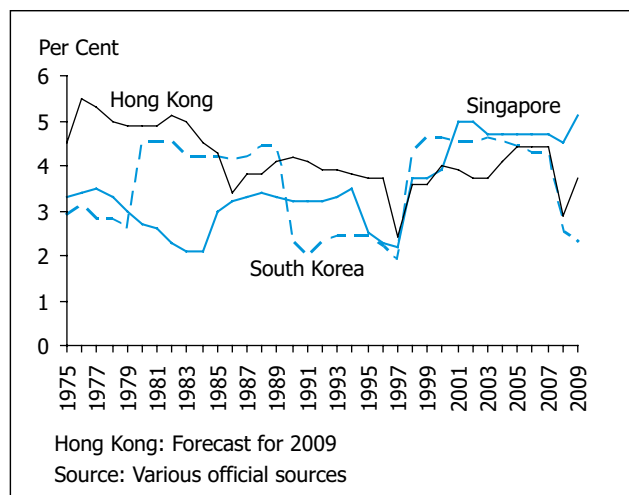


Exhibit A2 presents the annual volatility of key services clusters. We observe that international services such as financial services, and trade-related services such as wholesale and retail trade are often more volatile than domestically oriented services such as business services.

Exhibit A2: 8-Quarter Rolling Standard Deviations of Quarterly Services Growth

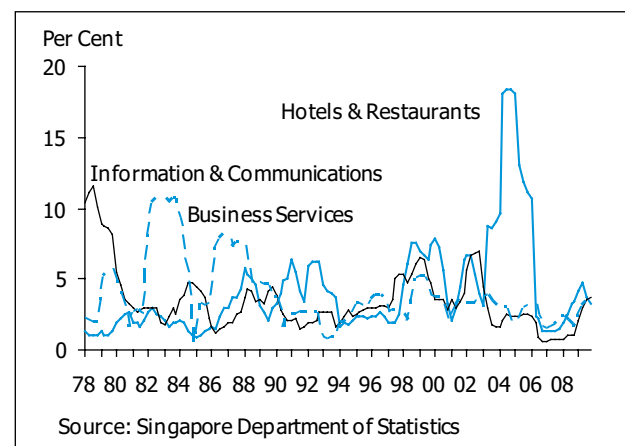
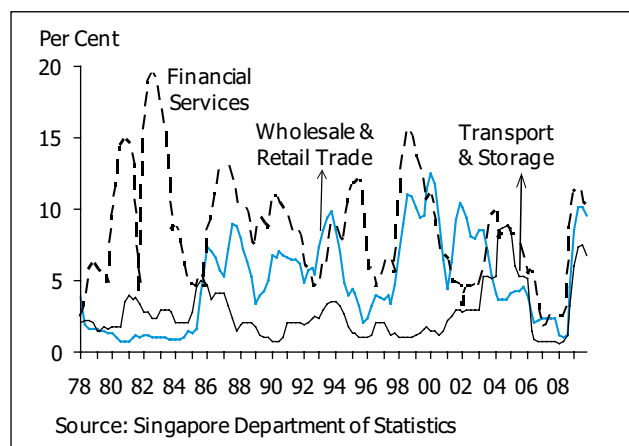
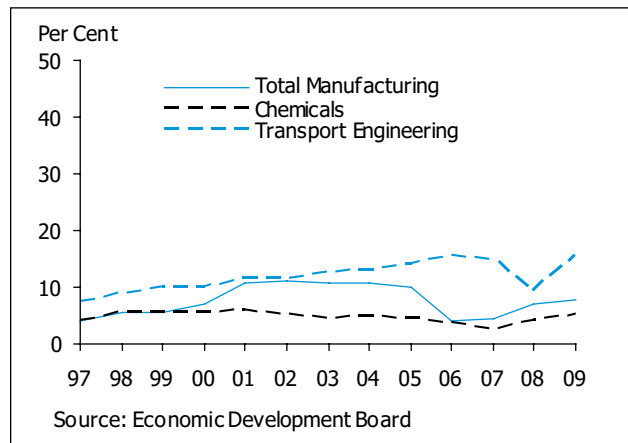
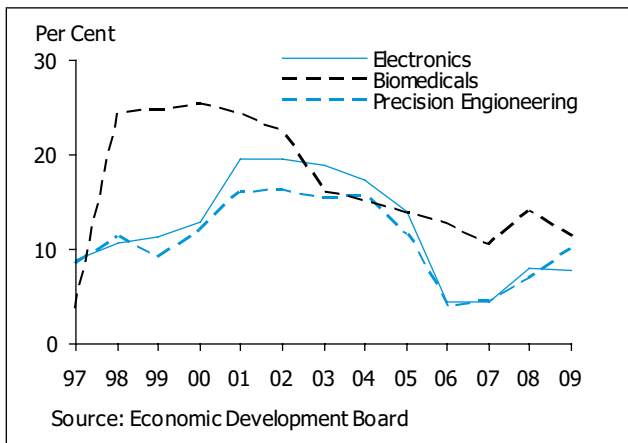


Exhibit A3 presents the annual volatility of key manufacturing clusters. We observe that on an annual basis, BMS is not significantly more volatile than clusters such as electronics and precision engineering.

Exhibit A3: 5-Year Rolling Standard Deviations of Annual Manufacturing Growth



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