3 Labour Market And Inflation

Inflation Will Be Subdued In 2015 But Cost Pressures Could Mount

Inflation continued to ease in recent months, in line with expectations, mostly reflecting the impact of lower global oil prices and enhanced medical subsidies. MAS Core Inflation moderated to 1.1% y-o-y in Q1 2015, from 1.6% in Q4 2014. CPI-All Items inflation was further dampened by lower housing rentals, coming in at −0.3% in Q1 2015, compared to 0% in Q4 2014.

External sources of inflation are likely to be benign given ample supply buffers for major commodities and only a modest pickup expected for global economic activity. While there is considerable uncertainty over the outlook for global oil prices, for 2015 as a whole, they should remain significantly below their 2014 levels.

On the domestic front, the labour market will be tight as firm manpower demand, especially in the domestic-oriented services sectors, runs up against increasingly binding labour supply constraints. Aggregate wage growth is, therefore, expected to rise modestly in 2015. Unit labour cost (ULC) may increase further, given relatively weak productivity growth, but the degree of cost pass-through this year is likely to be tempered by the moderate economic environment and the suite of budgetary measures announced recently. Taking these influences into account, food and services inflation should be lower in 2015, although they are likely to be higher than the overall rate of inflation.

Both MAS Core Inflation and CPI-All Items inflation should ease further in Q2–Q3 2015 as the plunge in global oil prices filters through more significantly to domestic prices. For the whole year, MAS Core Inflation is expected to average 0.5–1.5% in 2015, compared to 1.9% in 2014, while CPI All-Items inflation could fall to −0.5–0.5% in 2015, from 1.0% in 2014. While CPI All-Items inflation could be negative on a y-o-y basis for some consecutive months, this largely reflects falling car prices, housing rentals, and costs of oil-related items, which together constitute around a third of the CPI basket. More than half of the items in the CPI basket will continue to see price increases.

The anticipated moderation in core inflation in 2015 comes on the back of stronger-than-average outturns over the past few years. However, the labour market remains tight and underlying cost pressures could mount and pass through more significantly to consumer prices, especially if economic conditions become more supportive. Along with some pickup in global oil prices and the dissipation of the effects of budgetary measures, inflation is expected to rise going into 2016.
3.1 Labour Market

The Labour Market Will Remain Tight

Job creation was robust in H2 2014, underpinned by strong labour demand in the domestic-oriented services sectors. Locals accounted for the bulk of the employment gains, as inflows of foreign labour eased. However, overall resident wage growth was dampened by the weak economic environment and productivity performance, as well as compositional shifts in employment towards the lower-paying non-tradable sectors and part-time work. It is, however, expected to pick up this year, given the tight labour market, although unlikely to exceed the 10-year historical average. Wages could rise more rapidly in 2016, especially if economic conditions improve.

Employment gains remained firm in H2 2014 amid robust labour demand in domestic-oriented services.

Total employment expanded by 74,100 in H2 2014, comparable to the 73,700 in the corresponding period in 2013. For 2014 as a whole, overall job gains came in at 130,100, easing slightly from 136,200 a year earlier.

Job creation in H2 2014 was led by the domestic-oriented services sectors. (Chart 3.1) Notably, the community, social & personal services (CSP) sector increased hiring significantly, given ongoing initiatives to build long-term capacity in healthcare, education and other social services. (Chart 3.2) Meanwhile, the opening of a number of suburban malls, including One KM, Seletar Mall, Eastpoint Mall, and Big Box at Jurong, led to a pickup in demand for workers in retail trade, food services and cleaning services (under administrative & support services). Headcount increases in retail trade and food services were considerably higher than the seasonal step-up in hiring for the festive holidays in the same period a year ago. Likewise, the information & communications sector created more jobs to meet strong demand for data security and the adoption of emerging technologies, such as cloud computing.

The external-oriented services sectors also saw stronger employment gains in H2 2014. Headcount expanded at a faster pace in the wholesale trade sector, given the growth pickup in the transport equipment cluster, as well as some improvement in electronics re-exports. At the same time, job creation in financial and insurance services was bolstered by increased activity in the fund management and insurance segments.
In the manufacturing sector, job losses eased as the electronics segment resumed hiring, while retrenchments in the transport equipment cluster slowed. Construction continued to expand headcount at a more moderate pace in H2 2014, given the softening residential market. (Chart 3.1)

Residents accounted for the bulk of the employment gains.

As foreign labour inflows continued to ease amid foreign worker tightening measures, firms increasingly turned to resident workers to meet their manpower needs. At the same time, with increased job opportunities and flexible work options, more locals—particularly women and older workers—were drawn into the workforce, pushing up the resident labour force participation rate to a record high of 67% last year. The resident share in total employment gains thus rose to a multi-year high of 74% in H2 2014. (Chart 3.3)

Overall, the labour market tightened further.

Despite more workers entering the labour force, unmet labour demand remained elevated, as shown by the high vacancy rate in Q4 2014, at well above its 10-year historical average. (Chart 3.4) At the same time, the seasonally adjusted overall and resident unemployment rates edged down to 1.9% and 2.6% respectively, from an average of 2.0% and 2.8% in the first three quarters of the year. The redundancy rate also fell, possibly due to firms holding on to their workers in view of the difficulty of finding suitable replacements in a tight labour market. Up to 68% of the residents made redundant in the first three quarters of 2014 found employment by December 2014, compared to the 66% over the same period in 2013. Notably, about half of these workers took a relatively short period of a month or less to rejoin the workforce.

Accordingly, EPG’s Labour Market Pressure Indicator (LMPI)—a summary statistic that captures a wide range of labour market information1—increased in H2 2014, implying a further tightening of the labour market. (Chart 3.5)

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1 Using Principal Components Analysis, the LMPI is derived from a large set of variables relating to labour demand and supply, including retrenchment rates, overtime hours worked, vacancy rates, labour force participation rates and unemployment rates. More details and the complete list of variables can be found in Box B of the October 2014 issue of the Review.
Nevertheless, wage growth eased in H2 2014. Aggregate nominal resident wage growth moderated to 1.6% in H2 2014, considerably lower than the 3.0% in H1 2014 and the 10-year historical average of 3.7%. (Chart 3.6) This slowdown was due to a number of factors.

First, the steady rise in the share of part-time workers in the resident workforce, from 6.8% in 2008 to 10.5% in 2014, has lowered average wage levels and economy-wide wage growth despite the fact that wages of part-time workers have increased recently. Given that the monthly pay of part-time workers is typically about a quarter that of their full-time counterparts, overall wage growth could have been 0.4% point higher if the proportion of part-time workers in the labour force had remained the same as in 2013.

Second, job gains for residents have been concentrated in the domestic-oriented sectors, such as construction, retail trade, administrative & support and food services, for which the average pay is typically lower than that in the export-oriented sectors. Manufacturing, wholesale trade, transport & storage have accounted for an increasingly smaller proportion of the workforce since 2010.

Third, wage gains could have been dampened by sluggish economic conditions. Salary adjustments in the export-oriented sectors have been capped by uncertainties and weak growth in the external economies, while firms in some domestic services sectors have also not been able to raise wages significantly, given their difficulty in passing on higher costs to consumers.

Fourth, the continued sluggishness in labour productivity has reduced the extent to which firms are able to increase wages for workers. Labour productivity fell by a further 1.2% y-o-y in H2 2014, led by a drop in the construction and services sectors. (Chart 3.7) As a result, overall ULC rose by 4.0%, following the 3.2% gain in H1.
Firm labour demand will come up against increasingly binding labour supply constraints.

Tight labour market conditions are expected to persist in light of the continuing manpower needs of the economy and the constrained labour supply. Indeed, the latest results from the ManpowerGroup Employment Outlook Survey for Q2 2015 show that the majority of employers plan to raise headcount. (Chart 3.8)

Labour demand will be supported by healthy hiring in the domestic-oriented services sectors, given the ongoing expansion in education, health and other social services. In particular, the scheduled opening of the Ng Teng Fong Hospital and Jurong Community Hospital in 2015 will boost job creation in the health & social services sectors. Meanwhile, the upcoming launch of a new large-scale indoor entertainment theme park, KidZania, will increase job openings in the food, retail and cleaning services clusters.

Firms in the financial & insurance services industry are also expected to expand headcount—especially in risk management, compliance and regulation—in order to meet new regulatory requirements arising from international reforms.

In comparison, hiring sentiment in the construction sector will likely be dampened by weakness in the residential property market and the deferment of some public sector projects. Employment gains should also be muted in manufacturing, given the expectation of only a modest pickup in global economic activity.

Overall, firm labour demand could come up against increasingly binding labour supply constraints. Foreign labour inflows could slow further in light of tightening measures, while growth in the resident labour force may be limited by the already record-high labour force participation rate.

Wage growth will be moderate in the near term but could pick up into 2016.

Short-term wage dynamics in the economy appears to have been buffeted by opposing macroeconomic forces. While the constraints on labour supply ought to have led to a stronger wage response to increased hiring, moderate economic activity and a weak productivity performance in the near term could have dampened wage expectations.
Hence, although wage growth is expected to pick up in 2015 amid the tight labour market, it is unlikely to exceed the historical average of 3.7%. Wages could, however, rise more sharply in 2016, especially if economic conditions improve and the unemployment rate falls further.

Wage gains will remain uneven across sectors and generally stronger in the non-tradable sectors, such as accommodation & food services, retail trade and administrative & support services, where vacancy rates have been comparatively high. (Chart 3.9)

A New Keynesian Wage Phillips Curve reveals further insights into wage outcomes in the short term.

To gain further insights into the recent wage dynamics in the Singapore labour market, EPG estimated a New Keynesian Wage Phillips Curve (NKWPC) based on the methodology in Galí (2011)\(^2\), which models a structural micro-founded relationship between the wage inflation rate \((\pi^w_t)\) and the unemployment rate \((u_t)\) under a sticky wage regime as follows:

\[
\pi^w_t = \alpha - \delta u_t - \psi_1 \Delta u_t + \epsilon_t
\]

where \(\alpha\) is affected by the steady-state price inflation and the growth rate of labour productivity, and \(\epsilon_t\) is a white noise error term.

The estimated coefficient for the current unemployment rate, \(\delta\), is statistically significant. (Table 3.1) In addition, the recursive estimates of \(\delta\) have risen in recent years, suggesting that Singapore’s short-term NKWPC is likely to have steepened, possibly due to the several rounds of foreign labour tightening measures. (Chart 3.10) This indicates upward wage pressure as well as increased volatility in wage growth for any given change in the unemployment rate.

At the same time, the recursive estimates of \(\alpha\) have fallen since 2012, pointing to a downward shift in the NKWPC schedule in the near term in line with the recent decline in inflation rates as well as weak economic growth and economy-wide productivity performance. (Chart 3.11)

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Overall, these findings imply that, while wage growth could in the short term still be constrained by weak growth and labour productivity as well as compositional shifts in employment, it could pick up more sharply if economic conditions improve.

Workers will need to be equipped with the right skills as the economy restructures.

Taking a longer-term perspective, wages have risen significantly over the last 50 years, in tandem with the improvement in the education and skill profile of the workforce. (See Special Feature A.) As businesses restructure and move up the value chain, job requirements will change and workers will have to ensure that their skill set stays competitive and relevant. In this regard, Budget 2015 announced a host of initiatives under SkillsFuture, such as the SkillsFuture Mid-Career Enhanced Subsidy for Singaporeans aged 40 and above, the SkillsFuture Study Awards for Singaporeans to acquire specialist skills and competencies, and the SkillsFuture Credit scheme to develop workers’ skills through continuous education and lifelong learning.3

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3 SkillsFuture was launched in 2014 by the SkillsFuture Council chaired by DPM Tharman Shanmugaratnam. It is a national initiative to provide Singaporeans with opportunities to develop their fullest potential throughout their lives.
3.2 Consumer Price Developments

Inflation Will Ease Further Before Rising Towards Year-end

Domestic inflation fell in recent months, reflecting lower oil prices, enhanced medical subsidies and softer housing rentals. Going forward, external price influences are likely to be benign, given the supply buffers in the commodity markets and the expected modest pickup in global economic activity. While underlying cost pressures remain, the degree of pass-through to consumer prices could be tempered by the moderate growth environment and the budgetary measures announced recently. Inflation is projected to fall in the next few months when the base effects from oil prices are most pronounced. It could then rise towards the end of the year and into 2016, as oil prices pick up and the impact of the reduction in healthcare costs fades.

Inflation fell in recent months in line with expectations, largely reflecting the impact of lower global oil prices and the increase in medication subsidies.\(^4\) (Chart 3.12) The recent step-down in aggregate price increases has to be seen in the context of stronger-than-usual outturns over the past few years.

MAS Core Inflation, which excludes the costs of accommodation and private road transport, came in at 1.1% y-o-y in Q1 2015, compared to 1.6% in Q4 2014 and 2.0% in Q3 2014. CPI All-Items inflation was also dampened by the decline in housing rentals and fell to −0.3% in Q1 2015, from 0% in Q4 2014 and 1.0% in Q3 2014. (Chart 3.13)

... driven by sharp price declines for certain consumer items.

On a sequential basis, the CPI fell for the second consecutive quarter. However, detailed data shows that this was not due to more widespread price declines. Rather, it reflected the plunge in global oil prices and the increase in medication subsidies, the effects of which are shown by the more negative price change at the 25\(^{th}\) percentile of the distribution of quarter-on-quarter movements of the 231 categories in the CPI basket. (Chart 3.14) At the same time, prices of non-core CPI items, which account for about a third of the basket, continued to soften. Notwithstanding these drags on the CPI, the weighted median inflation rate remained close to 0% in Q1 2015, with half of the basket still registering price increases. In particular, the

\(^4\) Government subsidies for medication in polyclinics and Specialist Outpatient Clinics have been increased since January 2015, following the step-up in subsidies for medical and dental services in September 2014.
inflation rate at the 75th percentile ticked higher, given continuing cost pressures in some non-tradable services.

External sources of inflation were generally benign.

Global commodity prices have remained weak since January. The West Texas Intermediate (WTI) oil price benchmark stayed below US$60 per barrel, due to the supply overhang in the oil market. Meanwhile, global food commodity prices continued to fall on account of bumper crop harvests in the Northern Hemisphere which raised the stock-to-use ratio for cereals to the highest level since 2001. Weak commodity prices (especially oil), along with excess production capacity in Singapore’s major trading partners, led to the decline in foreign wholesale price inflation. (Chart 3.15)

Accordingly, Singapore’s overall import prices came under strong downward pressure in Jan–Feb 2015, falling at around twice the rate of Q4 2014. (Chart 3.15) In particular, the sharp correction in the import price of fuel was passed through and resulted in lower petrol pump prices and electricity tariffs. Overall, domestic prices of oil-related items were 11.2% lower on a year-ago basis in Q1 2015, extending the 4.4% drop in Q4 2014.

Import cost of food stabilised following some dissipation of upward pressures on regional food prices as a result of weather-related supply disruptions. Reflecting this, domestic food inflation eased to 2.3% in Q1 2015, from 2.7% in Q4 2014.

Domestic cost pass-through to consumer prices remained moderate.

ULC rose further due to the decline in productivity, even as wage growth slowed in H2 2014. On the whole, the pass-through of domestic costs to consumer prices has been moderate. Led by higher costs, some non-tradable services, in particular, refuse collection5, communication and bus/train services, experienced sharp price increases. (Chart 3.16) However, the retail industry continued to face intense competition, not only from new entrants, but also from online shopping. As such, retail prices of clothing & footwear and

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5 As part of the National Environment Agency’s (NEA) move to consolidate the waste collection sector, households across different parts of Singapore have been moving to a uniform fee (UF) for waste collection services. The UF scheme, which will initially result in an increase in domestic refuse collection charges, is aimed at helping the public waste sector realise efficiency gains and raise standards.
personal care items fell further in Q1 2015. At the same time, holiday travel cost was dampened by weak consumer sentiment. Healthcare costs were also lower, reflecting the increased medication subsidies introduced since January 2015. Overall, services inflation eased to 1.4% in Q1 2015, from 1.6% in the last quarter of 2014.

**Prices of non-core CPI items declined further.**

Housing rentals continued to come under downward pressure owing to the significant number of new residential units in the market. Correspondingly, imputed rentals on owner-occupied accommodation fell further, lowering overall inflation by 0.5% point in Q1 2015, after shaving off 0.1% point and 0.3% point in Q3 and Q4 2014 respectively.

Car prices fell slightly in Q1 2015 compared to the preceding quarter as the new quota period kicked in with a 23% rise in COE supply on average. As a result, car prices continued to decline by 5.9% y-o-y after the 7.2% drop in Q4 2014.

**Oil prices are likely to recover only gradually from H2 2015 ...**

Going forward, external price influences should be benign. Commodity prices are only expected to rise gradually, while generalised price increases in Singapore’s major trading partners will likely be muted amid a modest pickup in economic activity. For 2015, global inflation is projected to be just over 3%, the lowest since the Global Financial Crisis.

Oil prices are expected to remain subdued in the near term amid the overhang in global oil supply as non-OPEC oil production continues to increase. According to the Energy Information Administration (EIA), global surplus production could rise from 0.9 million barrels per day (mbpd) in 2014 and hit a peak of 1.5 mbpd in Q2 2015, or nearly 2% of global supply. In addition, with OECD oil inventories at their highest level in decades, there are emerging concerns that oil storage might soon run into capacity constraints and surplus oil production would then be channelled to the market, thereby worsening the supply glut. (Chart 3.17)
Going into H2 2015, however, oil prices are generally expected to recover gradually, led by a slowdown in supply growth arising from the recent decline in oil investments. Lower oil prices are also expected to provide some boost to global economic activity and oil consumption eventually. The EIA currently projects the WTI oil price to increase to US$65 in December and average US$52 for the whole year. Direct oil-related items are therefore expected to dampen overall inflation by up to 1% point in 2015 after a negligible contribution last year. (See Box B for an econometric analysis of the impact of global oil shocks.)

Nevertheless, there remains considerable uncertainty about the outlook for oil prices, as indicated by the wide dispersion in market analysts’ forecasts. (Chart 3.18) Some analysts expect prices to fall to as low as US$40, should currently disrupted oil supply owing to international sanctions (such as from Iran) come back on-stream and exacerbate the glut. A minority in the market thinks that oil prices could rise to US$70–80 if supply disruptions surge on account of geopolitical strife. In previous episodes, sudden sharp corrections in global oil prices were usually accompanied by a significant rebound, although the market dynamics were not supply-driven. For instance, in the late 1990s, oil prices recovered strongly to surpass the previous peak, led by a sharp increase in demand from China and other emerging economies. (Chart 3.19)

... while imported food inflation should ease.

Meanwhile, the outlook for global food commodity prices remains benign. Stockpiles have risen substantially following last year’s bumper harvests, and crop harvests are expected to be similarly robust this year. Regional food prices could, however, see some upward pressure from the inflationary impact of administrative measures, including tax hikes and subsidy reductions. Taking all these factors into account, domestic price increases of non-cooked food items should moderate further while cooked food inflation could stabilise. For the whole of 2015, overall food inflation is expected to ease to around 2%, from 2.9% in 2014.
The pass-through of accumulated cost increases should remain moderate in the near term.

Given the tight labour market and weak productivity growth, underlying labour cost pressures will persist. However, the degree of cost pass-through is likely to stay moderate, constrained by the subdued economic environment. In particular, the retail and holiday travel segments—which have seen intense competitive pressures and are more influenced by economic sentiment—will be less able to raise prices.

Nonetheless, the non-tradable services sectors, such as education, healthcare and prepared meals, could pass on cost increases to consumers, given relatively firm demand. Indeed, these sectors (captured under CSP and accommodation & food services in Chart 3.20) are also more susceptible to a further rise in labour cost, given that their ratios of the resident wage bill to gross output have grown by a larger extent in recent years. However, some of the inflationary pressures will be alleviated by the suite of budgetary measures announced recently, notably the reduction in the concessionary foreign domestic helper levy, the one-year road tax rebates, and the abolition of national examination fees for Singaporeans. These are on top of the increase in medical subsidies, which will continue to dampen inflation on a y-o-y basis until early 2016.

As a whole, services inflation is expected to come in below 2% in 2015 after averaging 2.5% over the past three years.

Housing rentals and car prices could continue to dampen inflation.

Residential property rentals could decline further, given the slowdown in foreign worker inflows and the large number of newly-completed housing units expected to come on-stream.

Current car COE premiums remain significantly higher than in early 2010 when quotas were at similar levels, partly owing to firm replacement demand. Thus, even with the expected surge in car COE quotas for the rest of the year, arising from the large number of cars due for de-registration, COE premiums could fall only moderately.

For the whole of 2015, both imputed rentals and car prices could each lower CPI-All Items inflation slightly, following the negligible contributions in 2014.
Inflation will ease further before rising towards the end of 2015 and into 2016.

In sum, the sharp correction in global oil prices is expected to further dampen domestic inflation, with possible second-round effects in terms of lower production costs. While the tightness in the labour market is likely to persist, cost pass-through should remain moderate, given the slow growth environment. As a result, price increases in food and services, while remaining higher than aggregate inflation, are projected to ease compared to the last three years.

Sequentially, core CPI could fall in Q2 as the plunge in global oil prices filters through more significantly to domestic prices and the recently announced budgetary measures lead to a reduction in the level of some services costs. (Chart 3.23) However, it should pick up in H2, in tandem with the expected recovery in global oil prices. On a year-ago basis, core inflation could moderate to around 0.4% in Q2–Q3 2015 when the base effects from oil prices are most pronounced, before rising towards the end of the year and into 2016. (Chart 3.24) For 2015 as a whole, MAS Core Inflation is expected to be 0.5–1.5%.

Overall CPI should continue to fall sequentially in Q2 and Q3, given the expected softening of COE premiums and housing rentals. It is then likely to increase modestly in Q4. On a y-o-y basis, CPI-All Items inflation could ease slightly in Q2 and Q3 2015 before edging up in Q4. While CPI All-Items inflation could be negative on a y-o-y basis for some consecutive months, this largely reflects falling car prices, housing rentals, and costs of oil-related items such as petrol and electricity tariffs, which together constitute around a third of the CPI basket. More than half of the items in the CPI basket would continue to see price increases. For the whole of 2015, CPI-All Items inflation is projected to come in at −0.5–0.5%. (Chart 3.25)

In 2016, inflation is expected to rise as global oil prices pick up and the effects of budgetary measures dissipate. At the same time, the labour market will be tight. The risk remains that underlying domestic cost pressures in the economy could mount, leading to stronger cost pass-through to consumer prices, especially if economic conditions improve.
Box B
The Impact Of Global Oil Shocks On The Singapore Economy

Introduction

Much of the literature on oil price shocks implicitly equates oil price innovations with supply shocks. More recent research in this area, however, has recognised that the global price of oil, like the price of any other commodity, is driven by distinct demand and supply shocks, with different dynamic effects over time. Global demand shocks, moreover, may have a direct impact on the domestic economy as well as an indirect effect through the prices of oil and other industrial commodities.1/

Kilian (2009) used a structural vector autoregressive (SVAR) methodology to identify the shocks determining the real price of oil. 2/ Correct identification is important, not just for explaining variations in price, but also for understanding the responses of the economy to global oil price fluctuations. The SVAR model decomposes movements in the real price of crude oil into three distinct components: crude oil supply shocks, shocks to the global demand for all industrial commodities, and demand shocks that are specific to the global crude oil market. This decomposition has particular relevance for a small open economy such as Singapore that is highly dependent on global trade. Accordingly, this Box applies Kilian’s (2009) two-step empirical approach for analysing the impact of oil price movements on the Singapore economy. The first step identifies the three structural shocks to global oil prices and the second analyses their impact on real GDP and CPI in Singapore.

Methodology

To identify the three distinct shocks to oil prices, the following three-variable SVAR model of the global crude oil market was estimated, using monthly data from Jan 1974 to Dec 2014:

\[
A_0 z_t = \alpha + \sum_{i=1}^{31} A_i z_{t-i} + \varepsilon_t
\]

(1)

The three variables in \( z_t \) comprise \( \Delta prod_t \), the percent change in global crude oil production3/; \( rea_t \), an index of real global economic activity4/; and \( rpo_t \), the real price of oil. \( \varepsilon_t \) is a vector of serially and mutually uncorrelated structural innovations, with the inverse matrix of \( A_0 \) assumed to have a recursive structure. Accordingly, the resulting reduced-form errors, \( e_t \), can be written as follows:

\[
e_t \equiv \begin{pmatrix} e^{prod}_t \\ e^{rea}_t \\ e^{rpo}_t \end{pmatrix} = \begin{pmatrix} a_{11} & 0 & 0 \\ a_{21} & a_{22} & 0 \\ a_{31} & a_{32} & a_{33} \end{pmatrix} \begin{pmatrix} e_{oil supply shock}^t \\ e_{aggregate demand shock}^t \\ e_{oil specific demand shock}^t \end{pmatrix}
\]

(2)

1/ Studies, such as Hamilton (2003), Barsky and Kilian (2004), and Blanchard and Galí (2009) show that the underlying causes of oil price movements matter for their impact on the domestic economy.

2/ EPG, MAS gratefully acknowledges Lutz Kilian’s help in clarifying some of the data-related issues.

3/ Data on global crude oil production is available up to Oct 2014. To extend the analysis to December 2014, values for the remaining two months were extrapolated using the trend in global petroleum & other liquid fuels supply, which tracks crude oil production well.

4/ The index of real economic activity follows Kilian (2009), based on dry cargo bulk freight rates. It provides a measure of worldwide real economic activity that drives demand for industrial commodities. The data is available on Lutz Kilian’s website at http://www-personal.umich/~lkilian.
In the model, changes in the real price of oil can be due to either supply or demand shocks. The latter would be caused by fluctuations in the global business cycle (global aggregate demand shocks) and disturbances that are specific to the oil market, such as weather-related factors or shifts in preferences for holding oil inventories (oil market-specific demand shock). The recursive structure of the SVAR assumes that there is no immediate (within the same month) supply response to oil demand shocks. Moreover, oil market-specific demand shocks that increase the price of oil can only lower global real economic activity after a delay of one month.

**Time Paths of Demand and Supply Shocks**

After the reduced-form VAR corresponding to the model in equation (1) is estimated by ordinary least squares, it is used to derive the SVAR representation. Based on these estimates, time series of the three structural shocks are generated. Charts B1a to B1c plot the time path of the annual averages of the estimated structural shocks and show that the real price of oil has been impacted by different combinations of all three types of shocks over the sample period. In particular, there was a sharp disruption in oil supply in 1980 associated with the outbreak of the Iran-Iraq war and a positive oil demand shock unrelated to economic activity in 1999. There was also a negative global aggregate demand shock in 2008 occurring alongside a negative shock specific to the oil market. The charts also show that shocks driving the recent oil price decline in 2014 are likely the result of a positive supply-side shock and negative demand shocks, with an increasing contribution by global aggregate demand shocks to movements in the real price of oil.5/6

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5/ The cumulative contribution of each oil demand and supply shock to the real price of oil, based on a historical decomposition of the data, shows that the global aggregate demand and oil market-specific demand shocks are the most important. Moreover, in H2 2014, the contribution of the oil market-specific demand shock fell, while that of the global aggregate demand shock almost doubled over the six-month period.

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*Source: EPG, MAS estimates*
Accordingly, the responses of real GDP and the CPI to the demand and supply shocks identified by the SVAR were estimated using quarterly data over the period Q1 1991 – Q4 2014. To match the real GDP data that are only available quarterly, the monthly structural shocks from the first stage are averaged in each quarter as follows:

$$\hat{\epsilon}_{jt} = \frac{1}{3} \sum_{i=1}^{3} \hat{\epsilon}_{j,i,t}, \quad j = 1, 2, 3$$  \hspace{1cm} (3)

where $\hat{\epsilon}_{j,i,t}$ is the estimated residual for the $j$-th structural shock in the $i$-th month of the $t$-th quarter. Assuming that these shocks are exogenous with respect to real GDP and CPI, response estimates are obtained from regressions of real GDP growth and inflation on a constant and a distributed lag of the shock in question, as follows:

$$\Delta y_t = \alpha_j + \sum_{i=0}^{12} \phi_i \hat{\epsilon}_{j-i,t} + u_t, \quad j = 1, 2, 3$$  \hspace{1cm} (4)

$$\pi_t = \delta_j + \sum_{i=0}^{12} \psi_i \hat{\epsilon}_{j-i,t} + v_t, \quad j = 1, 2, 3$$  \hspace{1cm} (5)

$\Delta y_t$, $\pi_t$, and $\hat{\epsilon}_{j-i,t}$ refer to real GDP growth, CPI inflation, and the lags of the shocks, respectively. The response coefficients for real GDP growth and inflation at a given time horizon correspond to $\phi_i$ and $\psi_i$, with the maximum horizon set at 12 quarters.

**Impact on Singapore’s Growth and Inflation**

Charts B2 and B3 show the responses of the levels of Singapore’s real GDP and CPI to the three structural shocks. The charts confirm that each structural shock in the global crude oil market generates a unique pattern of responses. In Chart B2a the response of Singapore’s real GDP to an unexpected increase in global crude oil supply is largely flat and statistically insignificant. One-standard error bands are shown by the dashed lines and are generated from a block bootstrap method that is robust to serial correlation in the errors.\(^6\)

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**Chart B2a**

**Response of Singapore’s GDP to a Crude Oil Supply Shock**

**Chart B2b**

**Response of Singapore’s GDP to a Global Aggregate Demand Shock**

**Chart B2c**

**Response of Singapore’s GDP to an Oil Market-Specific Demand Shock**

Source: EPG, MAS estimates

Note: Real GDP is at 2010 Market Prices. Dashed lines represent one-standard error bands.

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\(^6\) For the empirical analysis, Matlab codes on Lutz Kilian’s website are used to carry out the block bootstrap, based on a block size of 4 and 20,000 repetitions. This block bootstrap method improves the accuracy of the bootstrap applied to time series data by dividing the data into several blocks, thus preserving the original time series structure of the data.
In contrast, an unanticipated fall in global aggregate demand for industrial commodities leads to a statistically significant contraction in real GDP, followed by a gradual decline that troughs in the third year. This pattern is consistent with the view that such a shock has both direct and indirect effects on the Singapore economy that work in opposite directions. In the short run, an unanticipated contraction of the business cycle in global commodity markets directly dampens Singapore’s GDP growth. However, it also lowers the real price of oil, thereby indirectly supporting domestic growth. The direct negative income effect is large enough to dominate the positive price effect working through lower oil prices and lower industrial commodity prices more generally. In the third year, the dampening income effect from the global economy dissipates and the growth-stimulating effects working through lower oil prices and other commodity prices begin to strengthen, such that the level of real GDP begins to rise. Finally, oil market-specific demand shocks, such as an increase in precautionary demand for crude oil, have an insignificant impact on real GDP for the first two years, but become statistically significant thereafter. This suggests that initially traders expect that oil prices will remain lower over the next few years. Accordingly, there is no significant impact on real GDP over this period. However, after two years of low oil prices, traders begin to anticipate that oil prices will begin to rise and they increase their precautionary demand, resulting in the gradual rise in real GDP.

Charts B3a to B3c show the corresponding responses of the CPI. Global aggregate demand shocks have a large impact and result in a sustained decrease in the price level that reaches a trough in the third year. An oil market-specific demand shock has a smaller impact, but also results in a sustained decrease in the price level that flattens out in the third year in tandem with the increase in precautionary demand that slows the decline in CPI. In contrast, the impact of a crude oil supply shock is small and insignificant.

**Sum-up**

The findings in this Box suggest that lower oil prices have a dampening effect on GDP growth in Singapore if this is due to a global aggregate demand shock, as the negative income effect dominates the positive price effect of lower oil prices. In the longer run, lower oil prices can also impact growth due to precautionary demand for higher inventory holdings, in part motivated by market concern about future oil supplies. In both cases, these shocks are associated with a gradual decrease in the price level.

Another important finding is that lower oil prices do not have a statistically significant or sustained impact on domestic growth or inflation, if the shock originates from the supply side. This has particular relevance for analysing the impact of the current global oil price decline which is due to a combination of both demand and supply side factors. Arezki and Blanchard (2014) view the recent decline in oil prices as being largely driven by supply factors, while demand-originated shocks also play role. Revisions of the International Energy Agency forecasts of demand in H2 2014, combined with estimates of the short-run elasticity
of oil supply, suggest that the unexpected lower demand can account for only 20 to 35 percent of the oil price decline. Our results from the first stage of the analysis confirm that, while a positive supply shock was clearly present in the global oil price market in 2014, demand effects were also relatively important.

**References**


