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Is U.S. Growth Sensitive to Foreign Growth?

Executive Summary

Since exiting recession in Q3-2009, the sequential rate of U.S. real GDP growth has averaged only 2.3 percent (annualized rate) per quarter, which has been a disappointing performance to many observers. Could the U.S. economy be boosted if foreign economies grew faster?

Our statistical analysis suggests that a one percentage point increase in economic growth rates in the Eurozone, China and Japan would have only a limited effect on U.S. real GDP growth. The underlying reason for the low sensitivity of U.S. real GDP growth to economic fluctuations in the rest of the world is the relatively low exports-to-GDP ratio—only 13 percent—of the U.S. economy. Therefore, it would take significantly stronger economic growth in the rest of the world, which does not seem likely anytime soon, to have a marked effect on U.S. real GDP growth. In other words, the United States will essentially need to rely on its own means if it want to realize stronger economic growth in the foreseeable future.

The U.S. Economy Is Not an Island Anymore

We are often asked how much effect stronger or weaker growth in a particular foreign economy would have on the U.S. economy. At one time, we could have laconically answered "not much" because the economic and financial ties that the United States had with the rest of the world were rather limited. However, as the collapse in American exports in the wake of the global financial crisis clearly demonstrates, the U.S. economy is no longer insulated from economic and financial events in the rest of the world.[1]

Moreover, the global economy has become more integrated over the past few decades. Although this statement may sound trite, a few statistics will illustrate the increasing integration of the world. Total global exports were equivalent to 17 percent of global GDP in 1980. Today, that ratio stands at 25 percent. Daily turnover in the foreign exchange market rose nearly tenfold from 1989, the first year in which the Bank for International Settlements conducted its triennial survey, to more than $5 trillion per `day in early 2013. At the same time, more countries are making a larger contribution to global GDP. In purchasing power parity (PPP) terms the United States and the Eurozone have seen their combined share of global GDP fall from more than 40 percent about twenty year ago to 33 percent today. Meanwhile, China's share has risen from less than 5 percent to 15 percent over that period.[2]

Real GDP in the United States has been expanding for more than four years, but the strength of the upturn still lacks vigor. Stronger growth in exports would help to boost overall GDP growth in the United States, but the Eurozone economy is struggling to gain traction and double-digit growth rates in China no longer appear viable. So, let's return to the initial question. How much effect would stronger economic growth in the rest of the world have on the U.S. economy?

The U.S. economy is no longer insulated from economic and financial events in the rest of the world.

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[1] **In Q2-2009 real exports of goods and services had plunged 14 percent on a year-over-year basis.**
[2] **PPP exchange rates tend to overweight Chinese GDP. If global GDP is aggregated using market exchange rates, then China's share of global GDP has risen from 2 percent to 11 percent over the past twenty years.**

Together we'll go far

Eurozone: Modest Effect on U.S. GDP Growth

How would stronger economic growth in the rest of the world impact the U.S. economy?

To answer this question, we turn to the vector autoregression (VAR) modeling methodology.[3] The beauty of VARs is that they are simple statistical representations of economic systems as they rely only on the variables that comprise the system and a few lagged values of those variables. In addition, VARs can be "shocked" to show how all the variables respond to a change in one of the other variables. The way the variables respond over time to a change in the "shocked" variable are called impulse response functions. (We refer interested readers to the appendix for more detail on VARs and impulse response functions.)

Figure 1: Shock to Eurozone GDP Growth
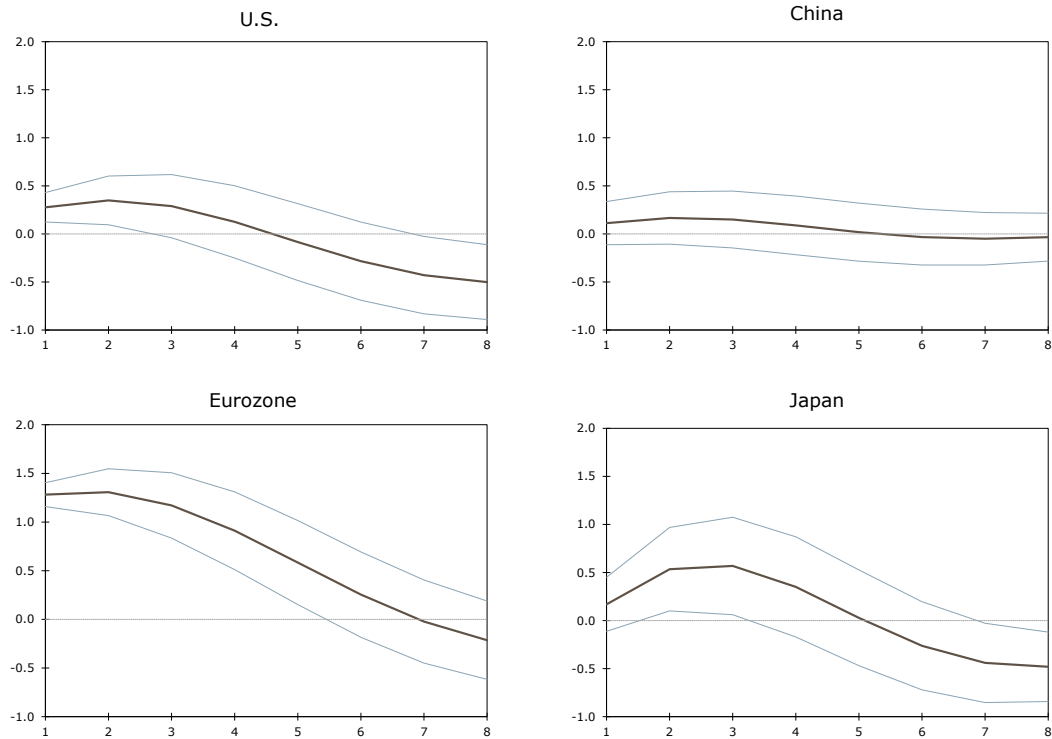
Source: Wells Fargo Securities, LLC

To illustrate how impulse response functions work, let's consider the effect that stronger economic growth in the Eurozone would have on the rest of the world, which we represent by the United States, China and Japan.[4] Figure 1 shows what happens when we raise the year-over-year rate of Eurozone real GDP growth by one percentage point for one quarter. After one quarter, we take the growth rate back to its baseline value. The thick black line in the bottom-left quadrant of Figure 1 shows how the year-over-year GDP growth rate in the Eurozone responds to the shock over time, and the thin blue lines denote the 95 percent confidence intervals around our point estimates.[5] The upper-left quadrant shows how the year-over-year GDP growth rate in the United States responds to the growth shock in the euro area.

One quarter after a one percentage point increase in the rate of real GDP growth in the euro area, U.S. real GDP growth rises by about 0.3 percentage points and remains at this higher rate through

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[3] **See Christopher Sims, "Macroeconomics and Reality,"** *Econometrica* **48 (1980), p. 1-48**
[4] **The Eurozone, the United States, China and Japan account for more than 50 percent of global GDP in PPP terms and about 60 percent of global GDP when market exchange rates are used to aggregate GDP of individual economies.**
[5] **The system represented by the impulse response functions is linear. That is, a two percentage point increase in U.S. GDP growth would have twice the effect that a one percentage point increase has. In addition the system is symmetric (i.e., a negative one percentage point shock would reduce growth by the same absolute amounts that are shown in Figure 1).**

roughly three quarters before dissipating. Last year, U.S. exports to the Eurozone totaled nearly $300 billion, which represented 13 percent of total American exports. However, because exports account for only 13 percent of U.S. GDP, American exports to the Eurozone are equivalent to just 1.5 percent of U.S. GDP. Little wonder then that a one percentage point increase in Eurozone economic growth has only a modest effect on U.S. real GDP growth. The impulse response functions suggest that the Eurozone has a slightly larger effect on the Japanese GDP growth (bottom-right quadrant) than on American GDP growth, but an insignificant effect, both literally and statistically, on the rate of economic growth in China (top-right quadrant).

China and Japan: Little Effect on U.S. GDP Growth

Figure 2 shows the impulse response functions for China. That is Figure 2 shows what effect a temporary one percentage point increase in real GDP growth in China has on economic growth rates in the United States, the Eurozone and Japan. Simply, a positive shock to Chinese real GDP growth has little effect on economic growth rates in these three other economies. Specifically, a one percentage point increase in Chinese economic growth lifts U.S. real GDP growth by less than 0.1 percentage point.

Between 1996 and 2012, which is essentially the period over which our VAR was estimated, American exports to China accounted for only 0.5 percent of U.S. GDP. Therefore, it should come as little surprise that our statistical analysis shows that a strengthening in Chinese economic growth would have an imperceptible effect on the U.S. GDP growth, although stronger Chinese GDP growth today may have a slightly larger effect on the U.S. economy than our analysis suggests. In 2012, American exports to China were equivalent to 0.7 percent of U.S. GDP whereas the ratio in 1996, the beginning of our sample period, was only 0.2 percent. (As noted previously, the average over the entire estimation period was 0.5 percent).

A strengthening in Chinese economic growth would have an imperceptible effect on the U.S. GDP growth.

Figure 2: Shock to Chinese GDP Growth
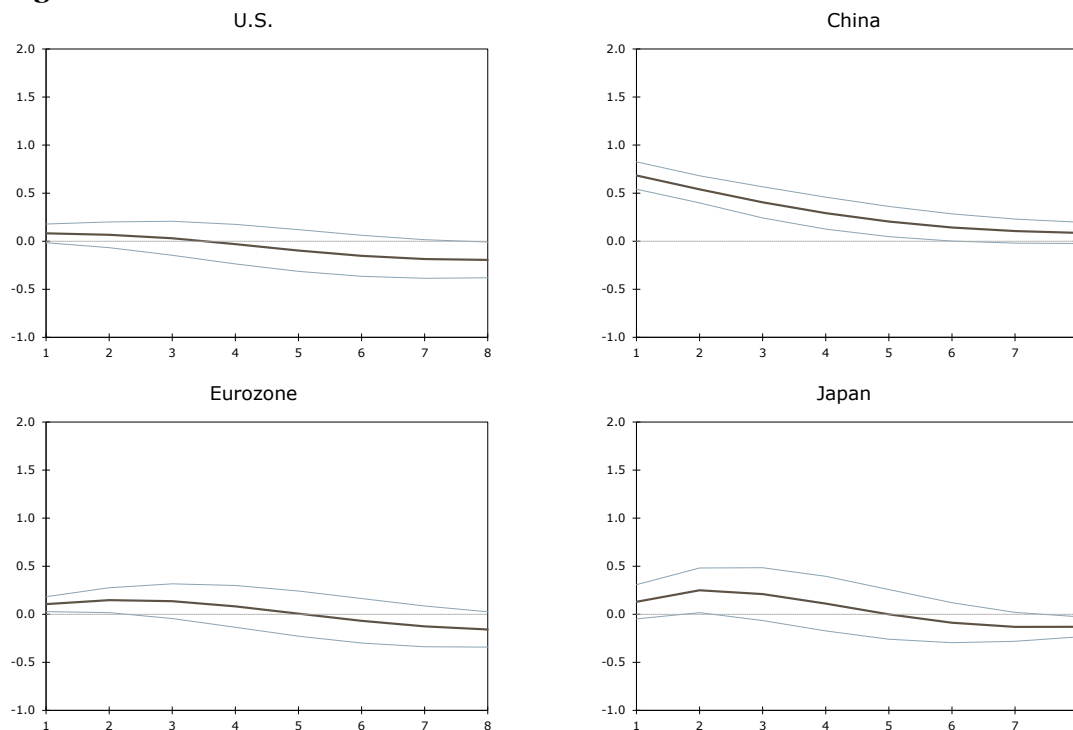
Source: Wells Fargo Securities, LLC

Likewise, a one percentage point increase in Japanese economic growth appears to have very little effect on real GDP growth rates in the United States, the Eurozone and China (Figure 3). Over the

1996-2012 estimation period, American exports to Japan were equivalent to only 0.7 percent of U.S. GDP. Moreover, the ratio trended down from 1 percent in 1996 to 0.6 percent in 2012.

Figure 3: Shock to Japanese GDP Growth
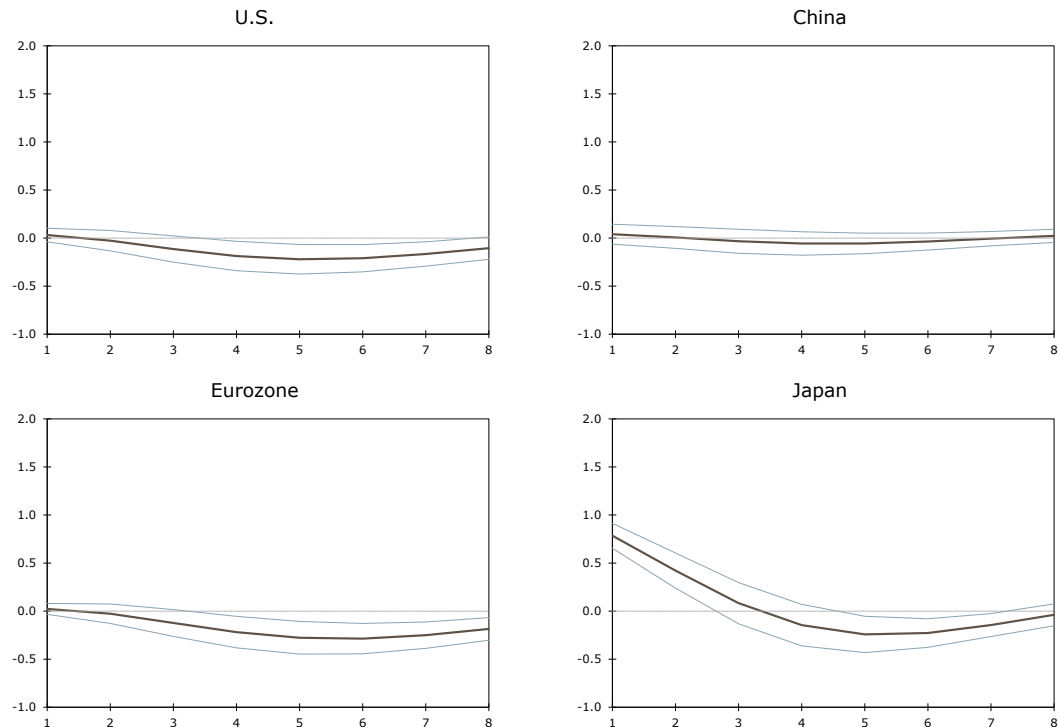
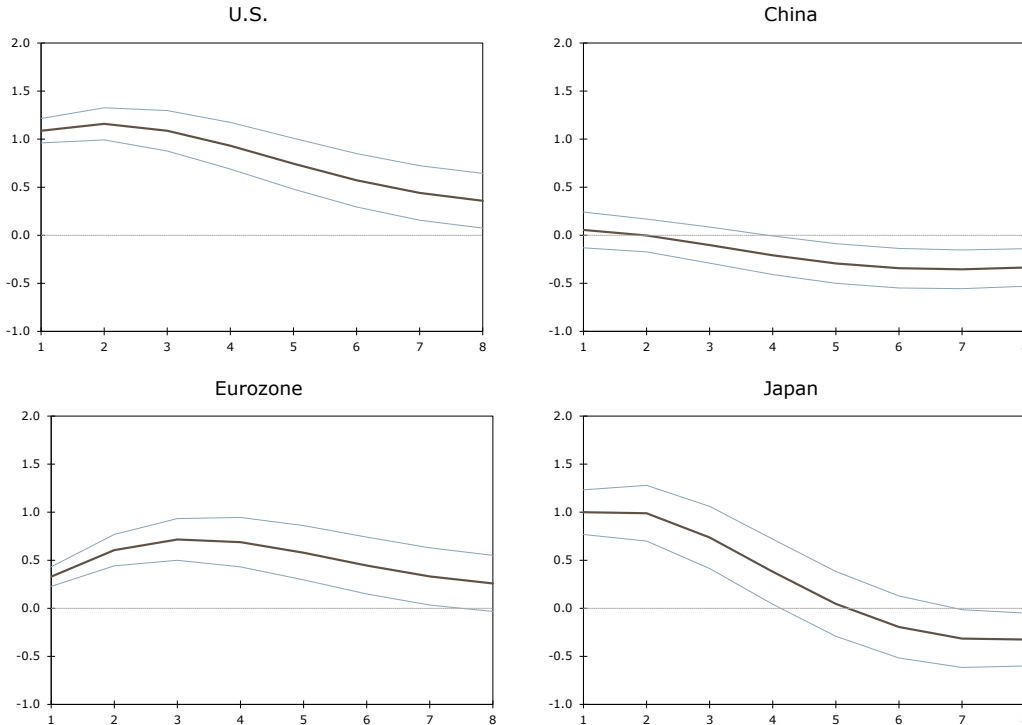
Source: Wells Fargo Securities, LLC

The focus of this report is the effect that economic growth in the rest of the world has on U.S. real GDP growth, but for completeness we will conclude by analyzing the effect that U.S. economic growth has on real GDP growth rates in the Eurozone, China and Japan. The bottom left chart in Figure 4 shows that a one percentage point increase in U.S. economic growth lifts the year-over-year rate of real GDP growth in the Eurozone by 0.3 percentage point one quarter after the "shock" to U.S. real GDP growth occurs. The effect builds to 0.7 percentage point three quarters after the shock occurs, and then it starts to dissipate. Stronger economic growth in the United States also produces a significant response in Japanese real GDP growth (bottom right panel). Over the entire Q1-1996 to Q2-2013 estimation period, the United States was by far Japan's largest export destination, accounting for one-quarter of total Japanese exports.[6]

Stronger economic growth in the United States appears to have little effect on real GDP growth in China.

Interestingly, however, stronger economic growth in the United States appears to have little effect on real GDP growth in China (top right panel). A one percentage point increase in U.S. real GDP growth raises Chinese real GDP growth by less than 0.1 percentage point. Moreover, we cannot statistically reject the hypothesis that U.S. real GDP growth has <u>no</u> effect on Chinese economic growth. This result seems particularly striking in view of the fact that Chinese exports to the United States totaled more than $350 billion last year.

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[6] **With the advent of the global financial crisis, which led to deep recessions in advanced economies, China surpassed the United States as Japan's largest export destination. In the 2009-2012 period, China accounted for 19 percent of Japanese exports versus the 16 percent share for the United States.**

Figure 4: Shock to U.S. GDP Growth

Source: Wells Fargo Securities, LLC

However, many Chinese factories simply assemble inputs into finished products and then ship the goods to the United States. Although the full invoice price of the goods are recorded as Chinese exports, there may be little value-added in the Chinese step of the production process. Indeed, a joint database that has been compiled by the WTO and the OECD shows that the exports that China sends for final consumption purposes to the United States accounts for only 4 percent of value-added in the Chinese economy.[7] Therefore, a modest temporary increase in the rate of real GDP growth in the United States really may not have that marked of an effect on the rate of Chinese economic growth.

Conclusion

Since exiting recession in Q3-2009, the sequential rate of U.S. real GDP growth has averaged only 2.3 percent (annualized rate) per quarter. Could U.S. GDP growth be boosted from this relatively slow rate if economic growth in the rest of the world strengthened? The analysis in this paper suggests that, unless foreign economies were to rocket significantly higher, stronger growth in the rest of the world would have a limited effect on the U.S. economy. The underlying reason for the low sensitivity of U.S. real GDP growth to economic fluctuations in the rest of the world is the relatively low exports-to-GDP ratio—only 13 percent—of the U.S. economy. Therefore, it would take significantly stronger economic growth in the rest of the world, which does not seem likely anytime soon, to have a marked effect on U.S. real GDP growth. In other words, the United States will essentially need to rely on its own means if it want to realize stronger economic growth in the foreseeable future.

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[7] **For a discussion of the effects of final consumption on value-added in foreign economies see our report entitled *"How Much Does Slower Chinese Growth Matter?"* (July 10, 2013), which is available upon request.**

APPENDIX

Sims (1980) introduced the vector autoregression (VAR) modeling methodology as an alternative to large-scale structural models, also known as macro-econometric models. The basic idea behind the VAR methodology is that instead of including hundreds of variables in a model, the modeler can use only a handful of variables to represent major sectors of an economy. The simple model can be utilized for forecasting and policy analysis.

A traditional VAR of n-variables will consist of n-equations, one equation for each variable. Each equation includes a constant and lag(s) of the n-variables, including lag(s) of the left-hand-side variable. The lag order, how many lags of a variable, is denoted by "P". Therefore, a VAR (P) of n-variables indicates up to p-lags of each variable are utilized in each equation.

A simple example of a two-variable VAR model which includes one lag of each variable is denoted as VAR(1) and can be written as

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 X_{t-1} + \varepsilon_{1t}$$

$$X_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 X_{t-1} + \varepsilon_{2t}$$

Impulse Response Function

In an n-variables VAR model, an impulse response function (IRF) shows the effect of a one percentage point increase in one variable in the current period on all variables in the model. The basic idea behind an IRF is that the modeler increases one of the VAR variables by one percentage point (or one unit) of in the current period, assuming that the increase will disappear in the subsequent periods. Furthermore, we keep the VAR errors for other (n-1) variables equal to zero, that is actual values are equal to estimated values. That would allow generating the effect of an increase in one variable on all others variables.

We used quarterly data from Q1-1996 through Q2-2013 on year-over-year real GDP growth rates in the United States, the Eurozone, China and Japan to estimate the VAR that is discussed in the body of this report.

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