World Economic Vulnerability Monitor (WEVUM)

Trade shock analysis

Measuring the impact of the global shocks on trade balances via price and demand effects

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1.   Non-technical description

Trade shocks are defined here as net gains or losses from trade caused by changes in international prices and in the volume of goods and services that are traded internationally. It relates to shifts in global markets typically outside of the influence of individual countries. Observed data to measure the impact of world market shifts on trade balances of individual countries typically become available with important time lags. Information on important changes in world market prices for major commodities and on trends in the volume of world trade is typically available with higher frequency and much shorter time lags. Policy makers, especially in developing countries whose economic welfare is heavily dependent on world trading conditions, will be interested in having more real-time assessments of trade shocks on their economy. The methodology proposed in the below attempts to do so, using aggregate information on global trade and prices and links that to the composition of trade of individual countries. This way, it is possible to assess the vulnerability of countries to specific kinds of price and global demand shocks.

Trade shocks are decomposed into price and volume effects. The net earnings from trade equal export revenue minus import expenditure and changes therein are influenced by both price and volume effects. Consequently, the analysis of trade shocks entails estimation of four components (plus interaction terms, which for sake of simplicity have been omitted in this non-technical section):

(i)   the effect of a change in international prices of exported goods

(ii)   the effect of a change in the international prices of imported goods

(iii)   the effect of a change in the volume (quantities) of exports demanded by the rest of the world

(iv)   the effect of a change in the volume of imports demanded from the rest of the world.

The net sum of the first two components, (i) and (ii), will be called the ***terms-of-trade shock***. For example, if the prices of a country's exports rise and the prices of a country's imports fall, the country would experience an unambiguous positive terms-of-trade shock. At the other extreme, if prices of exports fall and prices of import rise, the country will experience an unambiguously negative terms-of-trade shock. In other combinations of price changes the sign of the terms-of-trade shock will depend on the magnitude of the changes in world market prices and the relative importance of the corresponding products in the trade balance.

The other two components (iii) and (iv) are not aggregated into one single category as the 'terms of trade' shock mentioned above. This is because generally policy-makers tend to interpret the changes in export demand from the rest of the world as an exogenous event (a true 'shock'), while change in the demand for imports are endogenous to incomes and behaviour of domestic economic agents which can be directly influenced by government policy. In this sense, the change in the demand for exports (component iii) is seen as a true 'external shock' and will be labelled as the 'demand component of the trade shock', or ***demand shock*** for short.

2.   Disaggregation and data sources

The four components of the trade shocks described above (and interaction effects explained in the technical note below) are estimated for 164 countries of the UN system which have reliable data. The analysis covers all goods traded among these 164 countries (services are excluded for lack of data) and a reasonable degree of disaggregation is used (3 digits of the standard classification). Thus, there can be found about 250 product categories in the system, of which about 60 are commodities and the rest manufactures. For certain aspects of the analysis, these 250 products are further aggregated into the five main sectors: agricultural raw materials, food, energy, minerals and manufactures.

The data available is obtained from the following sources:

√   UNCTAD and IMF commodity price statistics for almost all primary commodities. For a few product categories whose prices were not available in these datasets, two complementary sources are used: the World Bank Commodity Price Data ('pink sheets') and the U.S. Bureau of Labor Statistics' Import and Export Price Indeces.

√   Central Planning Bureau of the Netherlands (CPB) for series on volume changes per region, and international price index for manufacturing products.

√   UN Comtrade values of exports and imports per country and category (250 products)

√   IFS for nominal GDP (US $), current account balances and consumer price inflation.

√   UN/DESA' GEMU estimates of real GDP growth and domestic price inflation.

Among the listed types of data, information about commodity prices, volume changes per region, and Comtrade values of exports and imports are minimally required to apply the trade shock decomposition methodology. Other data are used for comparisons, validation and complementary analysis of correlations between the trade shocks and other factors.

These datasets have four limitations. First, it should be noted that the use of international prices is only a rough approximation for the specific prices experienced by each country. This could be a serious limitation in few cases but overall there are no evidences of significant miss-matches. Second, the data on volume changes is recorded by region and aggregated across all categories. This is a more serious limitation because volume changes are not necessarily the same for all countries in a region and, moreover, some categories of products like manufactures change more drastically than energy or food in the event of global demand shocks. Auxiliary estimates have been generated to overcome this limitation, but such solutions are still to be fully integrated into the system. A third problem refers to availability of data on price and volume changes for the current year. The statistical sets include monthly series with a lag of about two months. Thus, for the previous years the full series of annual data can be generated but for the current year extrapolation is necessary to obtain the annual figure. Thus, the current year is always partly historic and partly estimated on standard assumptions. The system allows variations of such assumptions but the default assumption is to roll over three-month averages that give a greater weight to the last available month. The fourth problem is that there may be gaps in the data series for imports and exports in the Comtrade database. In the application, these gaps are "filled" by applying the same trade shock decomposition

methodology as discussed above. For example, if a particular country misses a data point for the value of exports of a certain product in a certain year, an estimate is generated by taking the previous year's value of exports and add the projected change in the exports of that product based on changes in global demand and the world market price for the product in the missing year.

There are several ways to check the reliability of this method to estimate the magnitude of trade shocks at country level. First, it should be recalled that changes in the trade balance result necessarily from the addition of the four components referred above, (i) to (iv), plus interaction terms. Thus, for the historic period where observed country-level trade data are available it is possible to compare changes in trade balance as derived directly from the Comtrade statistics, and the changes in trade balance that can be calculated by the net additions of the components calculated by the system. These two series should track closely each other and results show that this is generally the case. A second way to corroborate this analysis is by comparing the obtained results with reports of a similar kind that could be in some countries published sporadically or with research papers. So far no contradiction has been found with any such studies. Another test is to aggregate the sum of all trade shocks on exports and imports for the world as a whole, which should in principle identical to zero. Also in this case, the results show a close match for each and every year.

3.   Technical description of the accounting relations and decomposition analysis

The impact of the financial crisis, and more generally global shocks, on the economic performance of a particular country can be traced in first instance by a static decomposition of the current account.[1] The standard definition of the current account is well-known:

$$CA \equiv \sum_i P_{x_i} X_i - \sum_j P_{m_j} M_i + NFI + NTI + OT \qquad [1]$$

where CA stands for the current account surplus measured in US dollars, P_x and P_m stand, respectively, for dollar prices of exports and imports; X is the volume of exports, M is the volume of imports, NFI is net factor income, NTI is net transfer income excluding official transfers, OT, which

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[1]   By 'static' decomposition it is implied that feedbacks between prices and quantities of exports and imports, as well as feedbacks through the domestic economy, are assumed away and the analysis is limited to observed ex-post data.

will be considered separately.[2] Sums are defined over the entire set of exports (i) and imports (j) of good and services. The prices should be those applicable for each country and commodity, but in this case the international prices are used.

Changes in the external balance induced by trade shocks, on the static assumptions mentioned above, are as follows:

$$\Delta CA \equiv \sum_i \left(\Delta P_{x_i} X_i + P_{x_i} \Delta X_i + \Delta P_{x_i} \Delta X_i \right)_i - \sum_j \left(\Delta P_{m_j} M_j + P_{m_j} \Delta M_j + \Delta P_{m_j} \Delta M_j \right) + \Delta NFI + \Delta NTI + \Delta OT \qquad [2]$$

(interaction effects, like $\Delta P_x . \Delta X$ will not be discarded a priori but may in some cases be too small).

For sake of simplicity, period suffices are omitted. 'Deltas' refer to the period "t – (t-1)" and variables alone like P, X, M, etc are those of period (t-1).

In a first exercise, the sources of shocks to be considered are changes in international prices and changes in volume of goods only[3]. Thus, the basic relation to estimate will be changes in the trade balance of goods (*ΔTBg*):

$$\Delta TBg \equiv \sum_i \left(\Delta P_{x_i} X_i + P_{x_i} \Delta X_i + \Delta P_{x_i} \Delta X_i \right)_i - \sum_j \left(\Delta P_{m_j} M_j + P_{m_j} \Delta M_j + \Delta P_{m_j} \Delta M_j \right) \qquad [3]$$

The terms due to price changes ($\Delta P.X$ or $\Delta P.M$) will be usually referred as (export or import) 'price component', those due to volume changes ($P. \Delta X$ or $P. \Delta M$) will be referred as (export or import) 'volume component' and the rest are 'interaction components'.

The 'terms-of-trade' shock and the 'demand shock' mentioned in the previous section will be:

$$totshk \equiv \sum_i \Delta P_{x_i} X_{ii} - \sum_j \Delta P_{m_j} M_j \qquad [4]$$

$$demshk \equiv \sum_i P_{x_i} \Delta X_{ii} \qquad [5]$$

Finally, the term 'shock' will refer to the sum of terms-of-trade and the demand shock:

$$shk \equiv totshk + demshk \qquad [6]$$

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[2]   Official transfers (OT) is the component of total (net) aid flows (grants) that is recorded in the current account.
[3]   Forthcoming analyses will expand to consider changes in international service markets, in factor payments (of which remittances and interest payments on debt may be critical ones for some countries) and in official transfers.

The approximation used for the estimation of price components will be:

$$\Delta Px_t . X_{t-1} \approx \Delta Px_t . \frac{\hat{X}_{t-1}}{Px_{t-1}}$$

[7]

$$\Delta Pm_t . M_{t-1} \approx \Delta Pm_t . \frac{\hat{M}_{t-1}}{Pm_{t-1}}$$

where the 'hats' on X and M denote values reported by Comtrade and when non-available such values will be calculated iteratively as:

$$\hat{X}_{t-1} \equiv \hat{X}_{t-2} + \Delta \hat{X}_{t-1} \quad \equiv \quad \hat{X}_{t-2} + \Delta P_{x_{t-1}} X_{t-2} + P_{x_{t-2}} \Delta X_{t-1} + \Delta P_{x_{t-2}} \Delta X_{t-2}$$

[8]

$$\hat{M}_{t-1} \equiv \hat{M}_{t-2} + \Delta \hat{M}_{t-1} \quad \equiv \quad \hat{M}_{t-2} + \Delta P_{m_{t-1}} M_{t-2} + P_{m_{t-2}} \Delta M_{t-1} + \Delta P_{m_{t-2}} \Delta M_{t-2}$$

Price changes per category of commodity in the historic period are known. Price changes in the current year will be estimated on basis of simple assumptions to extrapolate available monthly figures towards the end of the year. These assumptions will work for all commodities and will be programmed as 'parametric switches' that allow the researcher to choose what is more appropriate. Some of these assumptions could be:

➢ Price of last month is preserved towards the end of the year
➢ Moving averages (say, 3-months) are scrolled over towards the end of the year, with more weight being given to last observed price
➢ The pattern of price rises over the known months of the year with respect to the same period the year earlier is imposed on the remaining months over the same period last year.

The approximation used for the estimation of the volume components will be:

$$Px.\Delta X \approx Px.\Delta X_{reg}$$

[9]

$$Pm.\Delta M \approx Pm.\Delta M_{reg}$$

where the suffix 'reg' denotes that the 'regional' volume changes for the country are used, and for all commodity categories alike. This assumption, which is unavoidable because of lack of data for

on volume changes for each country and commodity, may introduce significant errors in some cases and therefore an auxiliary programme is used to take country and commodity patterns into account. Finally, like with price changes, the figures for changes in volume are also monthly, thus providing full coverage for the previous years while for the current year similar extrapolations as those of price changes (see above) are used.