TiVA 2015 indicators - definitions

How to read this document and interpret the indicator values

- The indicators are calculated for N = 62 economies and K = 34 industries.
- The indicators are expressed in USD million (in current prices) or as percentages.
- The TiVA indicators are printed in blue in the equations to clearly show the relation between the indicators. The variables representing the ICIO system are printed in black.

Tables from OECD’s Inter-Country Input-Output (ICIO) system

The OECD’s ICIO system consists of a set of symmetric industry by industry global input-output tables. For each year, several matrices can be generated from the ICIO to calculate TiVA indicators:

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Further notes on notation:

$EXGR_{cp}$ represents a K x 1 vector of gross exports from country c to country p for all K industries, where $c \neq p$. $EXGR_c$ is a K x 1 vector of total exports of country c.

$V_c = [v_{c1} \cdots v_{cK}]$ is a 1 x K row vector with domestic value added shares of output for each industry i, while $V_p$ generally represents value added shares of the partner country. $\tilde{V}_c$ denotes the diagonalized matrix of vector $V_c$, i.e. a K x K matrix with elements $v_{c1} \cdots v_{cK}$ on the diagonal and 0 elsewhere.

$B = (I - A)^{-1}$, is the global Leontief inverse matrix with NK x NK dimensions, where A is the global I-O coefficient matrix. $B_{cc}$ is a K x K diagonal block matrix of B representing total domestic gross output required for one unit increase of country c’s demand. $B_{pc}$ is also a K x K block matrix, and it represents the total gross output from country p required for a one unit increase in country c’s demand.

1. Geographical coverage of the TiVA indicators: [www.oecd.org/sti/ind/TiVA_2015_Country_Region_List.pdf](http://www.oecd.org/sti/ind/TiVA_2015_Country_Region_List.pdf). Note that indicators are provided for regional aggregates. Once USD million measures have been calculated for the 62 economies, aggregation to various regional groupings is carried out before ratios and shares are derived.

2. Industry coverage of the TiVA indicators: [www.oecd.org/sti/ind/TiVA_2015_Industry_List.pdf](http://www.oecd.org/sti/ind/TiVA_2015_Industry_List.pdf). Note that indicators are provided for aggregate sectors. Once USD million measures have been calculated for the 34 unique industries, summing to aggregate industry sectors is carried before ratios and shares are derived.

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INDICATOR LIST

BASIC MEASURES FROM THE OECD INTER-COUNTRY INPUT-OUTPUT (ICIO) DATABASE

- Gross exports, by industry and by partner country, USD million (f.o.b.)
- Gross imports, by industry and by partner country, USD million (f.o.b.)
- Gross exports, partner shares %, by industry
- Gross imports, partner shares %, by industry
- Gross trade balance, by partner country
- Value added as a share of Gross Output, by industry

VALUE ADDED CONTENT OF GROSS EXPORTS AND IMPORTS

- Domestic value added embodied in gross exports, by industry and by partner country
- Foreign value added content of gross exports, by industry
- Domestic value added share of gross exports, percentage
- Foreign value added share of gross exports, percentage
- Industry domestic value added contribution to gross exports, as a percentage of total gross exports
- Industry foreign value added contribution to gross exports, as a percentage of total gross exports
- Domestic value added in exports of final products as a share of total gross exports
- Domestic value added in exports of intermediate products as a share of total gross exports
- Domestic value added in gross exports, partner shares

DECOMPOSITION OF DOMESTIC VALUE ADDED (DVA) IN GROSS EXPORTS - 3 DOMESTIC ORIGINS

- Direct domestic industry value added content of gross exports
- Indirect domestic content of gross exports (originating from domestic intermediates)
- Re-imported domestic value added content of gross exports

FINAL DEMAND MEASURES (ORIGINS OF VALUE ADDED)

- Domestic value added embodied in foreign final demand
- Domestic value added embodied in foreign final demand, partner shares
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BASIC MEASURES FROM THE OECD INTER-COUNTRY INPUT-OUTPUT (ICIO) DATABASE

Notes:
Total gross exports and imports in the ICIO, and hence TiVA, differ from official National Accounts statistics due to removal of estimates of re-exports and re-imports, conversion to a Basic Price valuation and reconciliation of bilateral asymmetries via balancing under output constraints.

For gross exports (EXGR) related indicators, values for ‘partner’ World may not be equal to the sum over all individual partner countries due to the presence of a discrepancy (or ‘unspecified partner’) in partner World. Discrepancies are residuals from inconsistencies in global trade data, which could not be allocated to any particular country. For gross imports (IMGR) there is no discrepancy.

The USD million gross trade and output measures are in current prices with a basic price valuation

Gross exports, by industry and by partner country, USD million (f.o.b.)

Country c’s total gross exports for a given industry i can be directly calculated from the ICIO system by summing up exports in intermediate goods and services and exports of final demand goods and services.

\[ \text{EXGR}_{c,i} = \sum_p \text{EXGR}_{c,p,i} = \sum_p \left( \text{EXGR\_INT}_{c,p,i} + \text{EXGR\_FNL}_{c,p,i} \right) \]

where \( \text{EXGR\_INT}_{c,p,i} \) represents gross exports of intermediate goods and services from domestic industry i in country c to country p; and \( \text{EXGR\_FNL}_{c,p,i} \) is gross exports of final demand goods and services, where \( c, p \in [1,..,N] \) and \( c \neq p \). They can be calculated from the gross trade matrices as:

\[ \text{EXGR\_INT}_{c,p,i} = \text{GRTR\_INT}_{(c-1)\times N+i,p} \]
\[ \text{EXGR\_FNL}_{c,p,i} = \text{GRTR\_FNL}_{(p-1)\times N+i,c} \]

Gross imports, by industry and by partner country, USD million (f.o.b.)

Total imports of country c are measured as:

\[ \text{IMGR}_{c,i} = \sum_p \text{IMGR}_{c,p,i} = \sum_p \left( \text{IMGR\_INT}_{c,p,i} + \text{IMGR\_FNL}_{c,p,i} \right) \]

where \( \text{IMGR\_INT}_{c,p,i} \) is gross imports of intermediates by country c from industry i in country p; and \( \text{IMGR\_FNL}_{c,p,i} \) is gross imports of final demand goods and services. They can be calculated from the gross trade matrices as:

\[ \text{IMGR\_INT}_{c,p,i} = \text{GRTR\_INT}_{(p-1)\times N+i,c} \]
\[ \text{IMGR\_FNL}_{c,p,i} = \text{GRTR\_FNL}_{(p-1)\times N+i,c} \]
**Gross exports, partner shares %, by industry**

The partner shares are calculated for each country, industry and partner country by dividing by total exports of the industry and country. The industry is the exporting industry.

\[
EXGR_{c,p,i}^{SH} = \frac{EXGR_{c,p,i}}{\sum_p EXGR_{c,p,i}} \times 100
\]

**Gross imports, partner shares %, by industry**

The partner shares are calculated for each country, industry and partner country by dividing by total imports of the industry and country. The industry refers to the exporting industry (i.e. from country c’s perspective, the industry of origin of the imports).

\[
IMGR_{c,p,i}^{SH} = \frac{IMGR_{c,p,i}}{\sum_p IMGR_{c,p,i}} \times 100
\]

**Gross trade balance, by partner country**, USD million (f.o.b.)

The gross trade balance is given for each country and partner combination.

\[
BALGR_{c,p} = EXGR_{c,p} - IMGR_{c,p}
\]

**Value added as a share of Gross Output, by industry**

The value added share is given for each industry in each country.

\[
PROD\_VAS{SH}_{c,i} = \frac{VALU_{c,i}}{PROD_{c,j}}
\]
VALUE ADDED CONTENT OF GROSS EXPORTS AND IMPORTS

The USD million gross trade measures are in current prices with a basic price valuation

Domestic value added embodied in gross exports, by industry and by partner country, USD million

Domestic value added content of gross exports includes the value added generated by the exporting industry during its production processes as well as any value added coming from upstream domestic suppliers that is embodied in the exports.

\[ \text{EXGR}_\text{DVA}_{c,p,i} = V_c B_{cc} \text{EXGR}_{c,p,i} \]

Where \( \text{EXGR}_{c,p,i} \) is a Kx1 vector with all entries equal to zero except the one corresponding to industry \( i \).

Foreign value added content of gross exports, by industry, USD million

Foreign value added content of gross exports captures the value of imported intermediate goods and services that are embodied in a domestic industry’s exports. The value added can come from any foreign industry upstream in the production chain.

\[ \text{EXGR}_\text{FVA}_c = V \ B_{(c),c} \text{EXGR}_{c,1} \]

With \( B_{(c),c} \) being the column block of B corresponding to country \( c \), with the row block corresponding to \( c \) being zero.

Domestic value added share of gross exports, percentage

The share of domestic value added in gross exports is available by industry for partner world.

\[ \text{EXGR}_\text{DVASH}_{c,i} = \frac{\sum_p \text{EXGR}_\text{DVA}_{c,p,i}}{\sum_p \text{EXGR}_{c,p,i}} \times 100 \]

Foreign value added share of gross exports, percentage

The share of foreign value added in gross exports is available by industry for partner world.

\[ \text{EXGR}_\text{FVASH}_{c,i} = \frac{\sum_p \text{EXGR}_\text{FVA}_{c,p,i}}{\sum_p \text{EXGR}_{c,p,i}} \times 100 \]
Industry domestic value added contribution to gross exports, as a percentage of total gross exports

This indicator reflects the share, in total gross exports, of domestic value added in an industry’s exports. The sum over all industries is the total domestic value added share of gross exports (EXGR_DVASH)

\[
EXGR_{TDVAIND} = \frac{\sum_{p,i} EXGR_{DVA_{c,p,i}}}{\sum_{p,i} EXGR_{c,p,i}} \times 100
\]

Industry foreign value added contribution to gross exports, as a percentage of total gross exports

This indicator reflects the share, in total gross exports, of foreign value added in an industry’s exports. The sum over all industries is the total foreign value added share of gross exports (EXGR_FVASH)

\[
EXGR_{TFVAIND} = \frac{\sum_{p,i} EXGR_{FVA_{c,p,i}}}{\sum_{p,i} EXGR_{c,p,i}} \times 100
\]

Domestic value added in exports of final products as a share of total gross exports, percentage

This indicator shows the share of domestic value added in exports of final goods and services as a share of total gross exports. The indicator is available by country and industry.

\[
EXGR_{FNLDVASH} = \frac{\sum_{p} EXGR_{FNLDVA_{c,p,i}}}{\sum_{p} EXGR_{c,p,i}} \times 100
\]

Domestic value added in exports of intermediate products as a share of total gross exports, percentage

This indicator shows the share of domestic value added in exports of intermediate goods and services as a share of total gross exports. The indicator is available by country and industry.

\[
EXGR_{INTDVASH} = \frac{\sum_{p} EXGR_{INTDVA_{c,p,i}}}{\sum_{p} EXGR_{c,p,i}} \times 100
\]

Domestic value added in gross exports, partner shares, percentage

For each country and industry, this indicator shows the importing partner distribution of domestic value added in gross exports.

\[
EXGR_{DVApSH_{c,p,i}} = \frac{EXGR_{DVA_{c,p,i}}}{\sum_{p} EXGR_{DVA_{c,p,i}}} \times 100
\]
DECOMPOSITION OF DOMESTIC VALUE ADDED (DVA) IN GROSS EXPORTS - 3 DOMESTIC ORIGINS.

Domestic value added content of gross exports can be split further into three components, direct domestic industry value added, indirect domestic value added and re-imports.

Direct domestic industry value added content of gross exports, USD million

\[ EXGR_{DDCc} = \hat{V}_c \text{diag} B_c \cdot EXGR_c \]

Indirect domestic content of gross exports (originating from domestic intermediates), USD million

\[ EXGR_{IDCc} = \hat{V}_c \text{offdiag} B_c \cdot EXGR_c - EXGR_{DDCc} \]

Re-imported domestic value added content of gross exports, USD million

\[ EXGR_{RIMc} = \hat{V}_c B_{cc} \cdot EXGR_c - EXGR_{DDCc} - EXGR_{IDCc} \]

where \( EXGR_{DDCc}, \) \( EXGR_{IDCc}, \) and \( EXGR_{RIMc} \) are \( K \times 1 \) vectors representing the industry dimension and \( A_c \) is a local I-O coefficient matrix from country c’s single Input-Output table and \( B_c = (I - A_c)^{-1} \) is the local Leontief inverse. Matrix \( \text{diag} B_c \) consists of the diagonal elements of the local Leontief inverse, i.e. those entries of the matrix displaying the direct requirements, while matrix \( \text{offdiag} B_c \) is the local Leontief inverse with all diagonal elements set to zero, thus representing the indirect requirements.

\( EXGR_{DDCc,i} \) is the i-th element of the \( K \times 1 \) vector \( EXGR_{DDCc} \), and gives direct domestic value added context of gross export of a given industry i. Same rule applies to indirect domestic value added and re-import shares of gross exports. Foreign value added share of gross exports is summed for all partners.
FINAL DEMAND MEASURES (ORIGINS OF VALUE ADDED)

Discrepancies and changes in inventories are only considered in the world total, not at partner level.

Domestic value added embodied in foreign final demand, USD million

\[ \text{FFD}_\text{DVA}_\text{c,p} = (\hat{\mathbf{V}} \mathbf{B} \mathbf{FD})_{c,p} \]

\( \text{FFD}_\text{DVA}_\text{c,p} \) is a \( K \times 1 \) vector. Matrix \( \hat{\mathbf{V}} \mathbf{B} \mathbf{FD} \) is of size \( (KN \times K) \) and calculated from multiplying the three global matrices \( \hat{\mathbf{V}} \), the diagonalized value added share of production \( \text{PROD}_\text{VASH} \), \( \mathbf{B} \) the global Leontief inverse and \( \mathbf{FD} \) the global final demand matrix showing the demand of country \( p \) (in column) for goods and services from industry \( i \) in country \( c \) (rows), and \( (\hat{\mathbf{V}} \mathbf{B} \mathbf{FD})_{c,p} \) is the part of the matrix with \( K \) rows (one for each industry) corresponding to country \( c \) and column corresponding to country \( p \). This is only available for \( p \neq c \). \( \text{FFD}_\text{DVA} \) is available by value added country, value added industry, and partner country.

\( \text{FFD}_\text{DVA}_\text{c,p,i} \) is the \( i \)-th element of the \( K \times 1 \) vector \( \text{FFD}_\text{DVA}_\text{c,p} \)

Domestic value added embodied in foreign final demand, partner shares, percentage

\[ \text{FFD}_\text{DVApSH}_\text{c,p,i} = \frac{\text{FFD}_\text{DVA}_\text{c,p,i}}{\sum_p \text{FFD}_\text{DVA}_\text{c,p,i}} \times 100 \]

\( \text{FFD}_\text{DVApSH} \) is available by country and industry origin of value added and final demand partner country.

Domestic value added embodied in foreign final demand as a % of total value added

\[ \text{VALUx}_\text{FFDDVA}_\text{c,i} = \frac{\sum_p \text{FFD}_\text{DVA}_\text{c,p,i}}{\text{VALUx}_\text{c,i}} \times 100 \]

Where \( \text{VALUx} \) is value added adjusted to be consistent with final demand (both domestic and foreign) which excludes "changes in inventories" (which captures goods produced in previous periods and, possibly, of non-domestic origin). This is available by country and industry origin of value added.

Foreign value added embodied in domestic final demand, USD million

\[ \text{DFD}_\text{FVA}_\text{c,p} = (\hat{\mathbf{V}} \mathbf{B} \mathbf{FD})_{p,c} \]

\( \text{DFD}_\text{FVA}_\text{c,p} \) is the part of matrix \( \hat{\mathbf{V}} \mathbf{B} \mathbf{FD} \) with rows corresponding to country \( p \)'s industries and column \( c \) of domestic consumption. This is only available for \( p \neq c \). \( \text{DFD}_\text{FVApSH} \) is available by country, partner country (where the value is added) and value added industry in the partner country.

\( \text{DFD}_\text{FVA}_\text{c,p,i} \) is the \( i \)-th element of the \( K \times 1 \) vector \( \text{DFD}_\text{FVA}_\text{c,p} \)
Foreign value added embodied in domestic final demand, partner shares, percentage

\[ \text{DFD}_c, \text{p}, \text{i} = \frac{\text{DFS}_c, \text{p}, \text{i}}{\sum_p \text{DFS}_c, \text{p}, \text{i}} \times 100 \]

DFD_FVApSH is available by country and partner country and industry origin of value added.

Value added embodied in final demand, balance, USD million

The balance is calculated as the difference between domestic value added embodied in foreign final demand and foreign value added in domestic final demand by value added origin industry.

\[ \text{BALVAFD}_c, \text{p}, \text{i} = \text{FFD} \text{DVA}_c, \text{p}, \text{i} - \text{DFD} \text{FVA}_c, \text{p}, \text{i} \]

Value added embodied in final demand, consumption and GFCF, USD million

Similarly, value added (in industry i of country p) in final demand FD, consumption (CONS) and gross fixed capital formation (GFCF) of country c are defined as the K x 1 vectors (representing the K industries)

\[ \text{FDVA}_c, \text{p} = (\hat{\nu} B \text{FD})_{p,c} \]

\[ \text{CONSVA}_c, \text{p} = (\hat{\nu} B \text{CONS})_{p,c} \]

\[ \text{GFCFVA}_c, \text{p} = (\hat{\nu} B \text{GFCF})_{p,c} \]

Here, the indicator includes domestic value added embodied in domestic demand, i.e. \( p = c \) is possible. The country shares (country of origin of value added) in the respective total demand (final demand, consumption, GFCF) are defined as

\[ \text{FDVASH}_c, \text{p}, \text{i} = \frac{\text{FDVA}_c, \text{p}, \text{i}}{\sum_p \text{FDVA}_c, \text{p}, \text{i}} \]

\[ \text{CONSVAH}_c, \text{p}, \text{i} = \frac{\text{CONSVA}_c, \text{p}, \text{i}}{\sum_p \text{CONSVA}_c, \text{p}, \text{i}} \]

\[ \text{GFCFVAH}_c, \text{p}, \text{i} = \frac{\text{GFCFVA}_c, \text{p}, \text{i}}{\sum_p \text{GFCFVA}_c, \text{p}, \text{i}} \]
RE-EXPORTED INTERMEDIATE IMPORTS

Re-exported intermediate imports, USD million

Imported products which are used as inputs into production processes and then exported again are referred to as re-exported intermediate products. This indicator is available by country and exporting industry.

\[ \text{REII}_{c,i} = \left( \sum_p A_{p,c} B_{c,c} \text{EXGR}_c \right)_i \]

\( A_{p,c} \) is a K x K off-diagonal block matrix of \( A \) giving \( c \)'s imported intermediate products sourced from country \( p \) required to produce one unit of output.

\( \text{EXGR}_c \) is K x 1 vector, represent exports of each industry \( i \) of country \( c \) to all other countries. \( A_{p,c} B_{c,c} \text{EXGR}_c \), is also a K x 1 vector and refers to intermediate goods and services absorbed in country \( c \) that originated from \( p \) for total exports by \( c \).

\( \left( \sum_p A_{p,c} B_{c,c} \text{EXGR}_c \right)_i \) refers to the \( i \)-th element of the vector, gives total intermediate goods and services absorbed by country \( c \) that originated from all foreign countries in industry \( i \).

Re-exported intermediate imports as a % of total intermediate imports

Re-exported intermediate imports by exporting industry as a share of intermediate imports shows how much of the imports are exported.

\[ \text{IMGRINT}_\text{REII}_{c,i} = \frac{\left( \sum_p A_{p,c} B_{c,c} \text{EXGR}_c \right)_i}{\sum_p \text{IMGR\_INT}_{c,p,i}} \]

\( \sum_p \text{IMGR\_INT}_{c,p,i} \) is total intermediate imports of country \( c \) from each industry \( i \).
SERVICE VALUE ADDED CONTENT

The indicators dealing with service value added content consider only the service industries as a source of value added; export or final demand industries are all industries. If the value of the indicator is greater than zero then the industry’s exports include value added content generated in the service industries (ISIC Rev 3 50 to 95).

\( \mathbf{V}_c \) is the diagonal matrix \( \mathbf{V}_c \), with all entries corresponding to industry \( i \neq j \) equal to zero and the element corresponding to \( j \in S \) to the value added share of service industry \( j \) in country \( c \). \( S \) is the set of service industry indices. \( (\mathbf{B}_{c,c})_{ji} \) and \( (\mathbf{B}_{p,c})_{ji} \) are the ji-th element of \( \mathbf{B}_{c,c} \) and \( \mathbf{B}_{p,c} \) respectively.

**Domestic services value added content of gross exports**, USD million

\[
\text{EXGR}_{\text{SERV}_DVA}^{c,i} = \sum_{j \in S} \mathbf{V}_c \hat{\mathbf{B}}_{c,c}(\mathbf{B}_{c,c})_{ji} \text{EXGR}^{c,i}
\]

**Foreign services value added content of gross exports**, USD million

\[
\text{EXGR}_{\text{SERV}_FVA}^{c,i} = \sum_p \sum_{j \in S} \mathbf{V}_c \hat{\mathbf{B}}_{p,c}(\mathbf{B}_{p,c})_{ji} \text{EXGR}^{c,p,i}
\]

**Domestic services value added share in gross exports**, percentage

\[
\text{EXGR}_{\text{SERV}_DVASH}^{c,i} = \frac{\text{EXGR}_{\text{SERV}_DVA}^{c,i}}{\text{EXGR}^{c,i}} \times 100
\]

**Foreign services value added share in gross exports**, percentage

\[
\text{EXGR}_{\text{SERV}_FVASH}^{c,i} = \frac{\text{EXGR}_{\text{SERV}_FVA}^{c,i}}{\text{EXGR}^{c,i}} \times 100
\]
VALUE ADDED ORIGIN BY SOURCE COUNTRY AND INDUSTRY (BSCI) CUBES

Origin of value added in gross exports, USD million

Origin of value added in gross exports by source country and industry has four dimensions linking exports by industry $j$ in country $p$ and to value added generated by industry $i$ in country $c$:

- Country of value added origin $c$
- Industry of value added origin $i$
- Exporting country $p$
- Exporting industry $j$

$$\text{BSCL} \_ \text{EXGR}_{cipj} = (\hat{V} \text{B EXGR}_{pj})_{ci}$$

Where $\text{EXGR}_{pj}$ is a vector of size $KN \times 1$, with all entries being zero except the entry corresponding to exports by country $p$’s industry $j$. $\hat{V} \text{B EXGR}_{pj}$ is a vector of size $KN \times 1$ as well and $(\hat{V} \text{B EXGR}_{pj})_{ci}$ is the vector element corresponding to value adding country $c$’s industry $i$.

Origin of value added in final demand, USD million

Origin of value added in final demand by source country and industry has four dimensions linking demand for industry $j$ final goods in country $p$ to value added generated by industry $i$ in country $c$:

- Country of value added origin $c$
- Industry of value added origin $i$
- Final demand country $p$
- Final demand industry $j$

$$\text{BSCL} \_ \text{FDVA}_{cipj} = (\hat{V} \text{B FD}_{pj})_{ci}$$

Where $\text{FD}_{pj}$ is a vector of size $KN \times 1$, with all entries being zero except the entry corresponding to final demand for goods and services of industry $j$ in country $p$. $\hat{V} \text{B FD}_{pj}$ is a vector of size $KN \times 1$ as well and $(\hat{V} \text{B FD}_{pj})_{ci}$ is the vector element corresponding to value adding country $c$’s industry $i$. 