

# Trade of Nonmetallic Minerals

## Worked Examples

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Version –December 19<sup>th</sup>, 2023

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### Instructions

We recommend you first watch the tutorial videos on the trade of nonmetallic minerals before using this workbook. You should then try to complete the example tasks using what you have learned there, before checking against the solutions provided. These examples are intended as reinforcement learning rather than the primary instruction tool.

For the following exercise, use any or all the data provided to calculate the trade account elements you can derive from the information given. The methods described in the solution section are not necessarily prescriptive but illustrate a reasonable way to proceed.

We provide here an example based on trade data that we retrieved from the UN Comtrade database. Ideally, you would collect these data from your local sources.

It is fundamental that you first attempt to solve the exercise without looking at the solution. By doing so, you will maximize your learning experience and be ready to apply this knowledge to your country data.

## Exercise #1: UN Comtrade data on trade of nonmetallic minerals

In this exercise, we will focus on those materials that need to be recorded in categories B.3 and its subcategories and C.3 and its subcategories. These two categories record imports and exports of nonmetallic minerals.

As a reminder, there are several tabs in the compiler that can aid you in preparing the trade data of nonmetallic minerals. First, you can use the Compiler's tab 'Corresp HS2017\_Trade' to look at the correspondence between the HS2017 trade codes and the economy-wide MFA codes, and the 'Corresp SITC Rev.4\_Trade' tab to check the correspondence between the SITC Revision 4 codes and the economy-wide MFA codes. Note that, in this exercise, we will use the HS2017 codes. Furthermore, the tab 'ConvFact Non-Met Minerals' contains factors to help you convert volumetric data of various nonmetallic mineral categories into mass data. Moreover, the tab 'ConvFact Clays\_DE' reports factors to convert to mass various clay-related products, such as clay roofing tiles (measured in number of items) or non-refractory clay building bricks (measured in m<sup>3</sup>).

The data presented below is pulled from two countries: Italy and Spain. We choose data from two different countries because they showcase different scenarios that you might encounter. For the sake of this exercise, ignore that these tables refer to two different countries and pretend that they belong to the same country.

We will focus on various trade categories. First, we will look at the trade of marble, specifically at codes 251511, 251512, and 251520. Note that category 251511 is 'marble and travertine, crude or roughly trimmed,' category 251512 is 'marble and travertine, merely cut, by sawing or otherwise, into blocks or slabs of a rectangular (including square) shape,' and category 251520 is 'caussine and other calcareous monumental or building stone; alabaster.' Import and export data for these categories are reported in Table 1. Remember that the notation in the 'Trade flow' column uses 'M' to indicate imports and 'X' to indicate exports.

Table 1 – Trade data for Italy in 2020 for HS2017 categories 251511, 251512, and 251520.

| Period | Trade Flow | Reporter | Partner | 2nd Partner | Customs Desc | Transport Mode | Commodity Code | Trade Value (US\$) | Net Weight(kg) | Gross Weight | Qty Unit | Qty       | Alternate Quantity unit | Alternate Quantity |
|--------|------------|----------|---------|-------------|--------------|----------------|----------------|--------------------|----------------|--------------|----------|-----------|-------------------------|--------------------|
| 2020   | M          | Italy    | World   | World       | TOTAL CPC    | TOTAL MOT      | 251511         | \$51,414,774       | 116499167      |              | kg       | 116499167 | kg                      | 116499167          |
| 2020   | M          | Italy    | World   | World       | TOTAL CPC    | TOTAL MOT      | 251512         | \$19,226,675       | 42385100       |              | kg       | 42385100  | kg                      | 42385100           |
| 2020   | M          | Italy    | World   | World       | TOTAL CPC    | TOTAL MOT      | 251520         | \$4,598,967        | 217933631      |              | kg       | 217933631 | kg                      | 217933631          |
| 2020   | X          | Italy    | World   | World       | TOTAL CPC    | TOTAL MOT      | 251511         | \$184,477,000      | 523814651      |              | kg       | 523814651 | kg                      | 523814651          |
| 2020   | X          | Italy    | World   | World       | TOTAL CPC    | TOTAL MOT      | 251512         | \$103,782,665      | 253850924      |              | kg       | 253850924 | kg                      | 253850924          |
| 2020   | X          | Italy    | World   | World       | TOTAL CPC    | TOTAL MOT      | 251520         | \$535,149          | 708105         |              | kg       | 708105    | kg                      | 708105             |

We then report the trade of all materials related to HS2017 code 2523 ‘portland cement, aluminous cement, slag cement, supersulphate cement and similar hydraulic cements, whether or not coloured or in the form of clinkers’ (Table 2). There are five six-digit codes that refer to code 2523: 252310 (cement clinkers), 252321 (Portland cement; white cement, whether or not artificially coloured), 252329 (Portland cement; other), 252330 (aluminous cement), and 252390 (Other hydraulic cements).

Table 2 – Trade data for Italy in 2020 for HS2017 categories 252310, 252321, 252329, 252330, and 252390.

| Period | Trade Flow | Reporter | Partner | 2nd Partner | Customs Desc | Transport Mode | Commodity Code | Trade Value (US\$) | Net Weight(kg) | Gross Weight | Qty Unit | Qty        | Alternate Quantity unit | Alternate Quantity |
|--------|------------|----------|---------|-------------|--------------|----------------|----------------|--------------------|----------------|--------------|----------|------------|-------------------------|--------------------|
| 2020   | M          | Italy    | World   | World       | TOTAL CPC    | TOTAL MOT      | 252310         | \$36,953,018       |                |              | N/A      |            | kg                      | 679316913          |
| 2020   | M          | Italy    | World   | World       | TOTAL CPC    | TOTAL MOT      | 252321         | \$14,978,030       | 147883869      |              | kg       | 147883869  | kg                      | 147883869          |
| 2020   | M          | Italy    | World   | World       | TOTAL CPC    | TOTAL MOT      | 252329         | \$52,609,978       | 904392746      |              | kg       | 904392746  | kg                      | 904392746          |
| 2020   | M          | Italy    | World   | World       | TOTAL CPC    | TOTAL MOT      | 252330         | \$29,113,618       | 62078913       |              | kg       | 62078913   | kg                      | 62078913           |
| 2020   | M          | Italy    | World   | World       | TOTAL CPC    | TOTAL MOT      | 252390         | \$9,362,001        | 32154448       |              | kg       | 32154448   | kg                      | 32154448           |
| 2020   | X          | Italy    | World   | World       | TOTAL CPC    | TOTAL MOT      | 252310         | \$9,264,510        | 177010169      |              | kg       | 177010169  | kg                      | 177010169          |
| 2020   | X          | Italy    | World   | World       | TOTAL CPC    | TOTAL MOT      | 252321         | \$10,888,634       |                |              | N/A      |            | kg                      | 80869740           |
| 2020   | X          | Italy    | World   | World       | TOTAL CPC    | TOTAL MOT      | 252329         | \$100,671,722      | 1485143990     |              | kg       | 1485143990 | kg                      | 1485143990         |
| 2020   | X          | Italy    | World   | World       | TOTAL CPC    | TOTAL MOT      | 252330         | \$966,624          | 2321894        |              | kg       | 2321894    | kg                      | 2321894            |
| 2020   | X          | Italy    | World   | World       | TOTAL CPC    | TOTAL MOT      | 252390         | \$25,336,333       | 220667184      |              | kg       | 220667184  | kg                      | 220667184          |

We then focus our attention on bricks, and specifically category 6904 ‘ceramic building bricks, flooring blocks, support or filler tiles and the like’ (Table 3). Category 6904 has two subcategories, category 690410 ‘ceramic building bricks,’ and category 690490 ‘ceramic flooring blocks, support or filler tiles and the like (excluding building bricks).’

Table 3 – Trade data for Italy in 2020 for HS2017 categories 690410 and 690490.

| Period | Trade Flow | Reporter | Partner | 2nd Partner | Customs Desc | Transport Mode | Commodity Code | Trade Value (US\$) | Net Weight(kg) | Gross Weight | Qty Unit | Qty      | Alternate Quantity unit | Alternate Quantity |
|--------|------------|----------|---------|-------------|--------------|----------------|----------------|--------------------|----------------|--------------|----------|----------|-------------------------|--------------------|
| 2020   | M          | Italy    | World   | World       | TOTAL CPC    | TOTAL MOT      | 690410         | \$4,600,599        |                |              | 1000u    | 5534     | u                       | 5534883            |
| 2020   | M          | Italy    | World   | World       | TOTAL CPC    | TOTAL MOT      | 690490         | \$288,763          | 1050029        |              | kg       | 1050029  | kg                      | 1050029            |
| 2020   | X          | Italy    | World   | World       | TOTAL CPC    | TOTAL MOT      | 690410         | \$20,305,963       |                |              | 1000u    | 28612    | u                       | 28612383           |
| 2020   | X          | Italy    | World   | World       | TOTAL CPC    | TOTAL MOT      | 690490         | \$3,705,589        | 18642289       |              | kg       | 18642289 | kg                      | 18642289           |

We then move our attention to category 6910 ‘Ceramic sinks, wash basins, wash basin pedestals, baths, bidets, water closet pans, flushing cisterns, urinals and similar sanitary fixtures’ (Table 4). Category 6910 is comprised of two subcategories: category 691010 ‘Ceramic sinks, wash basins, wash basin pedestals, baths, bidets, water closet pans, flushing cisterns, urinals and similar sanitary fixture’ of porcelain or china,’ and category 691090 ‘Ceramic sinks, wash basins, wash basin pedestals, baths, bidets, water closet pans, flushing cisterns, urinals and similar sanitary fixture’ of other than porcelain or china.’

Table 4 – Trade data for Spain in 2020 for HS2017 categories 690410 and 690490.

| Period | Trade Flow | Reporter | Partner | 2nd Partner | Customs Desc | Transport Mode | Commodity Code | Trade Value (US\$) | Net Weight(kg) | Gross Weight | Qty Unit | Qty | Alternate Quantity unit | Alternate Quantity |
|--------|------------|----------|---------|-------------|--------------|----------------|----------------|--------------------|----------------|--------------|----------|-----|-------------------------|--------------------|
| 2020   | M          | Spain    | World   | World       | TOTAL CPC    | TOTAL MOT      | 691010         | \$112,501,964      |                |              | N/A      | N/A | N/A                     | N/A                |
| 2020   | M          | Spain    | World   | World       | TOTAL CPC    | TOTAL MOT      | 691090         | \$54,645,273       | 27793471       |              | N/A      | N/A | N/A                     | N/A                |
| 2020   | X          | Spain    | World   | World       | TOTAL CPC    | TOTAL MOT      | 691010         | \$54,324,802       | 13609788       |              | N/A      | N/A | N/A                     | N/A                |
| 2020   | X          | Spain    | World   | World       | TOTAL CPC    | TOTAL MOT      | 691090         | \$25,898,218       | 6217755        |              | N/A      | N/A | N/A                     | N/A                |

Your final goal is to use all trade data present in Table 1, Table 2, Table 3, and Table 4 to estimate the imports and exports of nonmetallic minerals in these tables (i.e., fill in the trade data in ‘Table\_B’ and ‘Table\_C’ of the compiler. Once again, for the sake of this exercise, pretend that these tables refer to the same country, so there is no need to split the data between Italy and Spain. Also note that we report here only a very small subset of all the categories of nonmetallic mineral trade. In reality, you will encounter many more categories that need to be reported.

## Solution to Exercise #1

Let us calculate the imports and exports one table at a time, starting with Table 1.

### Table 1

Table 1 is very straightforward in that it already reports mass data, albeit in kilograms. To convert kilograms to metric tons, we only need to divide these data by 1000. We then sum together all the imports and exports.

|  |     |
|--|-----|
| $import_{Table\ 1} = \frac{116,499,167 + 42,385,100 + 217,933,631}{1000} = 376,817.898\ t$ | (1) |
|--|-----|

|   |     |
|---|-----|
| $export_{Table\ 1} = \frac{523,814,651 + 253,850,924 + 708,105}{1000} = 778,373.680\ t$ | (2) |
|---|-----|

As we see in Equations 1 and 2, the (rounded) imports related to Table 1 are 376,818 t, and the (rounded) exports are 778,374 t.

## Table 2

Table 2 refers to cement products. One important thing to remember is that, while you can estimate nonmetallic mineral use based on cement consumption, you should treat the import and export of cement as is. In other words, you do not need to convert cement into nonmetallic mineral requirements.

Looking at Table 2, we see that a couple of values are empty under the column labeled ‘Net weight (kg).’ Luckily for us, the column ‘Alternate quantity’ reports data in kilograms also for the two cases where the net weight trade data is absent. So, in this case, we can simply rely on that. Like we did for Table 1, the calculation of imports and exports is simple as we can simply add together all the flows. We just need to remember to convert kilograms to metric tons, which we do so by dividing the results by 1000.

|  |     |
|--|-----|
| $import_{Table\ 2} = \frac{679,316,913 + 147,883,869 + 904,392,746 + 62,078,913 + 32,154,448}{1000}$ $= 1,825,826.889\ t$  | (3) |
| $export_{Table\ 2} = \frac{177,010,169 + 80,869,740 + 1,485,143,990 + 2,321,894 + 220,667,184}{1000}$ $= 1,966,012.977\ t$ | (4) |

Through Equations 3 and 4, we calculate that the imports of Table 2 are 1,825,827 t and the exports are 1,966,013 t.

## Table 3

In Table 3 we find one type of data gap: there is no mass reported for category 690410. Luckily, aside from their monetary values, the data is reported in 1000-units (column ‘Qty’) and in units (column ‘Alternate quantity’). The best way to proceed is then to estimate the mass of one unit. Category 690410 refers to ‘ceramic building bricks.’ There are multiple types of ceramic building bricks (see, for example, <https://doi.org/10.1111/jiec.13208>), so you need to estimate what an ‘average’ ceramic building brick is for your country.

You can explore the internet and find that, on average, a ceramic building block weighs around 10 kg. Alternatively, you can explore trade data for previous years or for similar countries and see if they report both the total weight and the total number of blocks to that you can infer the mass of one block. In this case, let’s proceed with this section option.

Looking at trade data for 2019 on Comtrade (Table 5), we find that the average unit weight of

imports was 9.76 kg/unit and the average unit weight of exports was 3.34 kg/unit. (Note that to calculate these values we divided the value reported in ‘Net Weight’ with that of ‘Alternate Quantity.’)

Table 5 – Trade data for Italy in 2019 for category 690410 ‘ceramic building blocks.’

| Period | Trade Flow | Reporter | Partner | 2nd Partner | Customs Desc | Transport Mode | Commodity Code | Trade Value (US\$) | Net Weight(kg) | Gross Weight | Qty Unit | Qty   | Alternate Quantity unit | Alternate Quantity |
|--------|------------|----------|---------|-------------|--------------|----------------|----------------|--------------------|----------------|--------------|----------|-------|-------------------------|--------------------|
| 2019   | M          | Italy    | World   | World       | TOTAL CPC    | TOTAL MOT      | 690410         | \$5,151,171        | 58926876       |              | 1000u    | 6038  | u                       | 6038982            |
| 2019   | X          | Italy    | World   | World       | TOTAL CPC    | TOTAL MOT      | 690410         | \$16,524,881       | 93441247       |              | 1000u    | 27946 | u                       | 27946240           |

Using these ‘mass per unit’ values, we can calculate the mass of imports and exports for 2020 (Equation 5 and Equation 6).

|  |     |
|--|-----|
| $import_{Table\ 3;\ code\ 690410} = 9.76 \times 5,534,883 = 54,020,458\ kg$  | (5) |
| $export_{Table\ 3;\ code\ 690410} = 3.34 \times 28,612,383 = 95,565,359\ kg$ | (6) |

Now that we have all the mass for all traded products, we can proceed as usual.

|   |     |
|---|-----|
| $import_{Table\ 3} = \frac{54,020,458 + 1,050,029}{1000} = 55,070.487\ t$   | (7) |
| $export_{Table\ 3} = \frac{95,565,359 + 18,642,289}{1000} = 114,207.648\ t$ | (8) |

Through Equations 7 and 8, we calculate that the imports of Table 3 are 55,070 t and the exports are 114,208 t.

## Table 4

One other scenario you might encounter is that described in Table 4, where the imports for category 691010 are reported solely in monetary terms. It is very important that you do not fall to the temptation of using the average mass per dollar of exports, as they tend to be very different. So how can you estimate the mass of this category. Similarly to what described for Table 3, the best way to proceed is to either look at past data and see if there was a recent year where both monetary value and mass were reported (beware of the effect of inflation though), or you could look at a similar country for which you have both monetary value and mass (the country should be similar both in what these objects of category 691010 are, and in terms of economy).

Luckily, Spain reports complete data for category 691010 in 2019 (Table 6). From Table 6 we can calculate that the average value for each kilogram of imports was 1.71 \$/kg (Equation 9).

Assuming that this 2019 value is applicable to 2020, we can calculate the mass of 2020 imports (Equation 10).

Table 6 – Trade data for Spain in 2019 for category 691010.

| Period | Trade Flow | Reporter | Partner | 2nd Partner | Customs Desc | Transport Mode | Commodity Code | Trade Value (US\$) | Net Weight(kg) | Gross Weight | Qty Unit | Qty | Alternate Quantity unit | Alternate Quantity |
|--------|------------|----------|---------|-------------|--------------|----------------|----------------|--------------------|----------------|--------------|----------|-----|-------------------------|--------------------|
| 2019   | M          | Spain    | World   | World       | TOTAL CPC    | TOTAL MOT      | 691010         | \$137,392,864      | 80392953       |              | N/A      |     | N/A                     |                    |
| 2019   | X          | Spain    | World   | World       | TOTAL CPC    | TOTAL MOT      | 691010         | \$69,802,189       | 18523833       |              | N/A      |     | N/A                     |                    |

|  |      |
|--|------|
| $value\ of\ 2019\ imports = \frac{137,392,864}{80,392,953} = 1.71 \frac{\$}{kg}$ | (9)  |
| $imports_{Table\ 4; code\ 691010} = \frac{112,501,964}{1.71} = 65,828,434\ kg$   | (10) |

We can now proceed as usual to estimate the imports and exports of Table 4.

|  |      |
|--|------|
| $import_{Table\ 4} = \frac{65,828,434 + 27,793,471}{1000} = 93,621.905\ t$ | (11) |
| $export_{Table\ 4} = \frac{13,609,788 + 6,217,755}{1000} = 19,827.543\ t$  | (12) |

Through Equations 11 and 12, we calculate that the imports of Table 4 are 93,622 t and the exports are 19,828 t.

## Filling the Compiler

We now have all the data we need to fill in the compiler. Remember, ‘Table\_B’ is used to report imports, and ‘Table\_C’ is used to report exports. But first, we need to associate the HS2017 codes with the MFA categories you find in Table\_B and Table\_C. You can do this by consulting the Compiler’s tab labeled ‘Corresp HS2017\_Trade.’ The correspondence for the codes reported in Table 1, Table 2, Table 3, and Table 4 are:

1. HS2017 codes 251511, 251512, and 251520 are reported in categories B.3.1 and C.3.1.
2. HS2017 codes 252310, 252321, 252329, 252330, and 252390 are reported in categories B.3.2.4 and C.3.2.4.
3. HS2017 codes 690410 and 690490 are reported in B.3.compound and C.3.compound.
4. HS2017 codes 691010 and 691090 are reported in B.3.compound and C.3.compound.

Keeping this information in mind, we can now fill in Table\_B and Table\_C. The resulting imports are displayed in Table 7. Exports are reported in Table 8.

Table 7 – Imports of nonmetallic minerals used in this exercise. Note that several rows and columns are hidden for convenience.

|    | A                                     | B   | M       |
|----|---------------------------------------|---|---------|
| 1  | <b>Table_B - Imports of materials</b> |   |         |
| 2  | <b>(tonnes)</b>                       |   |         |
| 3  | Material category                     | Description   | 2020    |
| 47 | <b>B.3</b>                            | <b>NON-METALLIC MINERALS</b>  | 2351336 |
| 48 | <b>B.3.1</b>                          | <b>Ornamental or building stone</b>                                 | 376818  |
| 49 | <b>B.3.2</b>                          | <b>Carbonate minerals important in cement</b>                       | 1825827 |
| 50 | B.3.2.1                               | Chalk   |         |
| 51 | B.3.2.2                               | Dolomite  |         |
| 52 | B.3.2.3                               | Limestone   |         |
| 53 | B.3.2.4                               | Cement and its products   | 1825827 |
| 54 | <b>B.3.4</b>                          | <b>Chemical and fertilizer minerals</b>                             |         |
| 55 | <b>B.3.5</b>                          | <b>Salt</b>   |         |
| 56 | <b>B.3.6</b>                          | <b>Gypsum and its products</b>                                      |         |
| 57 | <b>B.3.7</b>                          | <b>Clays</b>  | 0       |
| 58 | B.3.7.1                               | Structural clays and their products                                 |         |
| 59 | B.3.7.2                               | Specialty clays   |         |
| 60 | <b>B.3.8</b>                          | <b>Sand and gravel</b>  | 0       |
| 61 | B.3.8.1                               | Industrial sand and gravel  |         |
| 62 | B.3.8.2                               | Sand and gravel for construction                                    |         |
| 63 | <b>B.3.9</b>                          | <b>Other non-metallic minerals n.e.c.</b>                           |         |
| 64 | <b>B.3.compound</b>                   | <b>Mixed / compounded products mainly from non-metallic mineral</b> | 148691  |

Table 8 – Exports of nonmetallic minerals used in this exercise. Note that several rows and columns are hidden for convenience.

|    | A                                     | B   | M       |
|----|---------------------------------------|---|---------|
| 1  | <b>Table_C - Exports of materials</b> |   |         |
| 2  | <b>(tonnes)</b>                       |   |         |
| 3  | Material category                     | Description   | 2020    |
| 47 | <b>C.3</b>                            | <b>NON-METALLIC MINERALS</b>  | 2878423 |
| 48 | <b>C.3.1</b>                          | <b>Ornamental or building stone</b>                                 | 778374  |
| 49 | <b>C.3.2</b>                          | <b>Carbonate minerals important in cement</b>                       | 1966013 |
| 50 | C.3.2.1                               | Chalk   |         |
| 51 | C.3.2.2                               | Dolomite  |         |
| 52 | C.3.2.3                               | Limestone   |         |
| 53 | C.3.2.4                               | Cement and its products   | 1966013 |
| 54 | <b>C.3.4</b>                          | <b>Chemical and fertilizer minerals</b>                             |         |
| 55 | <b>C.3.5</b>                          | <b>Salt</b>   |         |
| 56 | <b>C.3.6</b>                          | <b>Gypsum and its products</b>                                      |         |
| 57 | <b>C.3.7</b>                          | <b>Clays</b>  | 0       |
| 58 | C.3.7.1                               | Structural clays and their products                                 |         |
| 59 | C.3.7.2                               | Specialty clays   |         |
| 60 | <b>C.3.8</b>                          | <b>Sand and gravel</b>  | 0       |
| 61 | C.3.8.1                               | Industrial sand and gravel  |         |
| 62 | C.3.8.2                               | Sand and gravel for construction                                    |         |
| 63 | <b>C.3.9</b>                          | <b>Other non-metallic minerals n.e.c.</b>                           |         |
| 64 | <b>C.3.compound</b>                   | <b>Mixed / compounded products mainly from non-metallic mineral</b> | 134036  |

Note that categories B.3.compound and C.3.compound are calculated by summing the results for Table 3 and Table 4. Whenever you encounter data that belong to the same MFA category, you should add them all together. You might also notice that several cells are left



black in Table 7 and Table 8. They are empty because this is just a simple exercise with few streams of materials. In reality, your table should have most, if not all, the cells filled.

Ultimately, we see that this country imported 2,351,336 t and exported 2,878,423 t of nonmetallic minerals in 2020.