

## 1. National accounts and IOT (20 points)

### 1.1 (3 points) Which case(s) affects Dutch GDP? (multiple-choice question)

- A French tourist pays €1500 to rent an apartment while traveling in Amsterdam.
  - You buy a new iPhone from the Apple store in Amsterdam.
  - You buy €5000 of IBM stock
  - CBS measures the output more accurately.
- You buy a new iPhone from the Apple store in Amsterdam has a NET-ZERO effect on Dutch GDP. Your expenditure adds to household expenditure but brings down the exports by the same amount.
  - You buy €5000 of IBM stock DOES NOT affect (Dutch) GDP. Implicitly, you are buying the €5000 IBM stock from someone else, nothing new was made. In everyday language, we refer to buying stocks as 'investments', yet in national accounting investment means firms buying capital goods (e.g., machines, software, intellectual properties) to build up their productive capacities.

### 1.2 (12 points) Convert the following SUTs to IOTs based on a fixed product sales structure assumption).

- Here we need to reallocate the Agriculture sector's secondary products: 20 million euros of manufactured products.
- The 'fixed product sales structure assumption' indicates that we'd reallocate the manufactured product following its sales/distribution pattern shown in the Use table (i.e., the second row in the use matrix).
- See the Excel spreadsheet for the detailed results and calculation steps.

### 1.3 (5 points). Name two differences of the hybrid vs. monetary SUTs in recording capital goods.

- HSUTs contain capital stock accounts while MSUTs don't.
- The capital formation accounted for in MSUTs is limited to capital goods used by economic sectors for further production, while HSUTs' capital accounts include all durable goods, including those that are not used by economic sectors, such as household appliances and vehicles.
- MSUTs typically neglect capital goods of smaller monetary values (e.g., <1 million USD), whilst HSUTs attempt to record all durable goods regardless of their monetary values.
- MSUTs' capital accounts are recorded in the monetary unit only, whilst HSUTs' capital accounts are measured in various (physical) units.

## 2. Interindustry linkages (32 points)

### 2.1 (4 points) Backward/Forward-linkage. Sort the following sectors into the correct place in the table below based on their expected

backward and forward linkage:

- A. Wheat sector
- B. Hospital sector
- C. Livestock sector
- D. Online banking sector

	Low Backward Linkage	High Backward Linkage
Low Forward Linkage	D	C
High Forward Linkage	A	B

Activities of sectors with a high backward linkage impose a large demand across multiple sectors of the economy (mostly secondary and tertiary sectors). Activities of sectors with a high forward linkage influence the supply/inputs across multiple sectors of the economy (mostly primary sectors). As such, the following order of sectors is correct:

- Low BL, low FL= online banking sector, as demand for this sector creates a low level of demand for other sectors of the economy and it does not serve as an input to other sectors
- Low BL, high FL = wheat, as it is a key input to other sectors (e.g. livestock, bread, processed food, etc.) but demand for wheat does not create a significant demand for output from other sectors
- Low FL, high BL = hospital sector, as demand for hospital services creates demand across lots of other sectors (food, textiles, metals, glass, etc.) but is not an important input to other sectors
- High FL, high BL = livestock sector, as it is a key input to other sectors (restaurants, hospitals, schools, etc.) and also creates a large demand for output from other sectors of the economy (crops for animal feed, fertiliser, animal housing, etc.)

**2.2 (12 points)** Calculate the **normalized** direct backward linkage and total forward linkage strengths for the 4 sector-region pairs. Please round the results to 1 decimal place.

- You could calculate/measure the strengths of the interindustry linkages either with or without accounting for the self-linkage.
- See the Excel spreadsheet for the detailed results and calculation steps.

**2.3 (16 points)** The cost-push price model is generally used to measure the impact on prices throughout the economy of new primary-input costs in one or more sectors. Suppose we implement a 30 €/ton carbon price across all sectors, what are the relative price impacts of all sectors (**8 points**). Propose another carbon pricing scheme and assess the effects of the new scheme (**8 points**).

- The impact of carbon pricing on a sector's value added depends on its emissions – the price is 30 €/ton. As such, you'd obtain the changes in value added based on the GHG extension accounts given in the Dataset.

- The Leontief price model is 'driven' by the unitary changes of value added, i.e., changes of value added per output.
- See the Excel spreadsheet for the detailed results and calculation steps.
- You could propose and investigate alternative carbon pricing schemes that, e.g., has a different unit price level (e.g., 100 €/ton), penalizes sectors with higher carbon intensity (e.g., higher GHG emissions per output or value added) with higher carbon prices, etc.

### 3. Footprint accounting (14 points).

**3.1 (14 points)** The government in **Region A** would like to boost the low-carbon economy by stimulating investment. The government needs to know the environmental and employment effects, respectively, driven by the same amount of investment spending on each product-country pair. Calculate the GHG multiplier and the employment multiplier to assess the environmental and employment effects (**8 points**). Which sector shall the government target? Offer two reasons to support your suggestion (**6 points**).

- This question is about calculating the supply-chain wide emissions and employment multiplier arising from a marginal change in the final demand of a given economy.
- The purpose of this question was two-fold. First, to test your ability to construct a basic IOA model with satellite accounts to calculate and compare the employment and emissions impacts of final expenditure – in this case, investment spending. Second, to use insights from this IOA model to comment on the preferred sector and region investment option of the government to boost the low-carbon economy.
- A common mistake made was to calculate the total environmental or employment footprint (i.e. fLy or emLy) of regions and not the multiplier effect which assumes a unit change in final demand. Such error would prevent cross-comparison of investment choices in country and region pairs as the results are a product of different final demand values.
- See the Excel spreadsheet for the detailed results and calculations of the multipliers.
- Reasonable arguments based on the calculated results deserve some marks (refer to the Ans grading criteria as a guideline)

### 4. 'Emissions' embodied in trade (28 points)

**4.1 (14 points)** Calculate the emissions embodied in international trade as a percentage of global total emissions and the employment in international trade as a percentage of global total employment (**8 points**). Based on the two percentage numbers and other data you have, what can you say about international trade's influences on global or local environmental externalities and employment? Describe two main observations (**6 points**).

- This question is about calculating the emissions and other factors (i.e., employment) embodied in trade.
- The purpose of this question was two-fold. First, to test your ability to obtain 'emissions' embodied in trade using the Leontief demand-driven model and by bringing out the country origins of the production sectors. Second, to reflect on the global vs. local, environmental inputs vs. social inputs (e.g., think about productivities), undesirable environmental externalities vs. socioeconomic desirables, etc. aspects from this MRIO results.
- Quite a few of you neglected calculating the emissions and employment coefficients from the given extension accounts. See the Excel spreadsheet for the detailed results and calculations of the emissions and employment embodied in trade.
- Reasonable arguments based on the calculated results deserve some marks.

**4.2 (14 points)** Calculate **Region A's** trade balance according to the conventional metric, i.e., the balance of trade (BOT), and the improved metric, i.e., trade in value added (TiVA) (**8 points**). Analyze **Region A's** trade performance based on the two trade balance results (**6 points**).

- This is the Challenging question designed for this midterm exam. The purpose of this question was to test your understanding of trade balance and the ability to quantify them as 'gross' or as net 'value added' using MRIO tables.
- The conventional metric of trade balance, BOT, is calculated based on gross trade accounts. Such accounts include the imports and exports of intermediate products and finished products recorded in Z and Y, respectively.
- TiVA differs from BOT in two respects: (1) it focuses on value added rather than the gross transaction amounts, and (2) it assesses the value added effects of gross trade throughout the supply chains.
- For (1), you'll need to calculate V and v based on the variables given in the Dataset (hint: you can obtain Z from A and x, and then obtain V from Z and x).
- For (2), you use the Leontief inversion to capture the supply chain-wide effects. When exploring the supply chain-wide effects of the gross trade, it is critical to describe the gross trade accounts in vector/matrix forms, i.e., specifying the type and geographic origin of the products (think about the matrix/vector of the final demand variable in the demand-driven model). A common mistake was to construct the gross trade variables as a scalar and multiplied it with L.

## 5. EEIOA Semantic literature (6 points)

**(6 points)** Wiedmann et al. (2015) calculated the material footprint (i.e., embodied materials in final demand) of multiple countries in 2008, where the researchers distinguished between 4 material types. Based on the figure, what are the main differences between the material footprint of the U.S. and China? Explain with two main observations.

- Reasonable arguments based on the figures deserve some marks (refer to the Ans grading criteria)

