

# Introduction to Macroeconomics

## First Homework Exercise

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1. We start from the model economy introduced by Ana Ania-Martinez. There are two firms A and B. Firm A produces steel and sells it for a basic price of 100 € plus 10% value added tax (VAT) to firm B. Firm B uses steel as its input to produce three cars at a basic price of 70 € each and sells them including 20% VAT to domestic consumer households. Firm A pays wages to its employees of 80 € and retains the profits (operating surplus) of 20 €. Firm B pays 70 € of wages and retains the 40 € of its operating surplus. Firm A is owned by foreigners, so the 20 € of profits are transferred abroad. Households have an additional wage income of 50 € from the rest-of-the-world. We know that *gross domestic product* is 252 € (it includes VAT), and that *gross national income* is 282 € (note that Ana's page 5 does not account for taxes, which explains the slight discrepancy to her figures; also we do not have any depreciation here, see point # 5 for that). As in all following points, check the *account of identity*  $GDP = C + I + G + X - IM$  by determining all components and the *saving identity*  $I = S_H + S_F + S_P + S_{RoW}$ . Note that  $I = 0$ , so saving components must add to zero likewise. Also determine *personal disposable income*, which is the households' disposable income, i.e. their income minus possible taxes. Here, of course, households do not face direct taxes, so their disposable income is just the sum of all wage incomes.
2. You recognize that this economy is not very realistic, as government simply saves its revenues without doing anything useful. We now assume that it

imports goods for its revenues of 42 € and uses these imports to generate a public good that is free to be used collectively (maybe food, as cars do not have any nutritional value). This good is assumed to be consumed by the public sector but the value should be a market value though it is a non-market good. We know the costs of 42 €, to which VAT should be added, say 8 €, arbitrariness justified as there are apparently different tax rates in this economy. Clearly, GDP increases to 260 € and GNI to 290 €, so the activities of import (negative) and public good production do not cancel entirely. Again check account 0 and saving identities. Particularly, note that government now has zero saving, having spent its revenues and consumed the public good at market prices, while the rest-of-the-world contributes 12 €, government imports plus firm A profits minus wage payments. The households still have their deficit of -52 €, as before. Also their personal disposable income should not change.

3.  $I = 0$  is a bit boring. For this reason, we now assume that the car manufacturer is unable to sell one of its three cars (this is why I convened that it produces three cars). This unsold car is treated as inventory investment, so  $I = 84$  € now (yes, the car must be there at market prices, including VAT). Thus, GDP cannot change but its decomposition does. Households now spend only 168 € and have a positive saving of 32 €. For simplicity, let us treat the fictitious 14 € of VAT as having been transferred already to government (in the real world, this point is a bit complex but this is OK for our example), so firms saving does not change. Again determine both basic identities and personal disposable income.
4. Real governments are much greedier than the role-model one. For example, they incur taxes on profits and wages. We assume that profits remain untaxed but wages are taxed at a rate of 10%. This is a direct tax, just a transfer, so it does not cause any change in GNI and GDP. However, it modifies the distribution, as households' income shrinks, while government income increases. Again determine both basic identities and personal disposable income.
5. If there is a capital stock, in the real world depreciation (=consumption of

fixed capital) will demand its toll. In our model economy, we now assume that the firm B capital stock (the unsold car) depreciates at 10 €. We know that GDP and GNI start with a capitalized ‘G’ for ‘gross’, so they will not change. However, NDP and NNI will decrease, and so will national disposable income. Show that net saving (you just have to decrease firms saving) equals net investment (investment minus depreciation).