# 0 Introduction to macroeconomics: Preliminaries

## 1. What is macroeconomics about?

Economies taken as a whole constitute the object of study of macroeconomics (or macroeconomic theory). Specifically, macroeconomics

(i) represents/describes the basic characteristics that define an economy;
(ii) explains the fundamental processes taking place in an economy; and
(iii) predicts the outcomes that the working of an economy generates.

## 2. Macroeconomics as a scientific discipline

> "… the hallmark of modern science is the search for mechanisms behind facts, rather than the mindless search for data and statistical correlations among them."
> Mario Bunge (2006): *Chasing Reality: Strife over Realism*, University of Toronto Press, p. 19.

Adherence to Bunge's view implies that the essence of macroeconomics consists in discovering, understanding, and investigating the mechanisms lying behind the working of economies and producing the macroeconomic outcomes considered most relevant.

## 3. Macroeconomics as a mathematical discipline

Macroeconomics studies economies by means of mathematical models. These models are simplified or idealized versions of real economies. The presumed mechanisms that are supposed to operate in real economies are made precise and investigated by means of a mathematical representation of the mechanisms. The aim of the model is to understand how an economy works. The following sketch summarizes the steps (ideally) followed in this methodological strategy.

| Step 1 | Step 2 | Step 3 | Step 4 | Step 5 | Step 6 |
|---|---|---|---|---|---|
| Observation of "reality" | Inference of basic elements, problems, stylized facts, and regularities from step 1 | Construction of a mathematical model from the basic elements | Analysis and study of the model | Identification of the predictions made by the model | Link of the predictions with stylized facts and regularities, and directly with "reality" |

## 4. The central concerns of macroeconomics

The workings of an economy are summarized by the expression "economic activity". Macroeconomics is then, in practice, concerned with investigating the dynamics of economic activity both in the short run (the business cycle) and in the long run (economic development). This course will focus on the short run: economic activity taking place up to a few years.

**5. A first difficulty: what is the "economic reality" and which are the "facts"?**

Physicists face the problem that the act of knowing reality changes reality: "seeing" a particle requires interacting with it, and the interaction alters the characteristics of the particle.

The understanding economic reality presumes a conceptual framework that guides our interaction with reality and within which reality is interpreted. The same reality may be interpreted differently in alternative frameworks. What is "actually" depicted on Fig. 1, 2, and 3? And as for the hidden figure in Fig. 4, is it "really" there or are we making it up?

Fig. 1. Old woman or young lady?
Steven Mark Cohn (2006): *Reintroducing macroeconomics*, p. 5

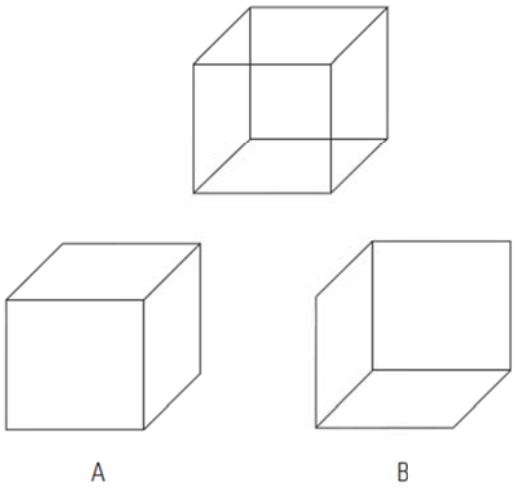



Fig. 2. The Necker cube
Daniel Reisberg (2009): *Exploring the science of mind*, p. 62
Is the top cube the transparent version of A or B?

Fig. 3. The vase/profile figure
Daniel Reisberg (2009): *Exploring the science of mind*, p. 63

Fig. 4. A hidden figure?
Daniel Reisberg (2009): *Exploring the science of mind*, p. 64

**6. A problem: strategic use of data**

It is not obvious to establish which are the facts. Facts rarely speak for themselves. The strategic use of data refers to the possibility of creating different facts from the same empirical information.

**Example 1.** Suppose the following numbers represent the amount of a certain economic variable (for instance, production or employment) generated during a quarter in a given economy.

| quarter | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| value | 10 | 10 | 10 | 10 | 9 | 12 | 7 | 14 | 4 | 18 | 3 | 19 |

The sum of the values of four consecutive quarters provides the annual value of the variable. Call this annual value $V$. Imagine that the government decides to make public the value of $V$ and claims that, for technical or whatever reasons, $V$ can only be announced every two quarters. Thus, the government informs about $V$ at the beginning of quarter $t$, $t+2$, $t+4$, $t+6$, and so on. The following table shows the value of $V$ at the beginning of each quarter (the value of $V$ appearing in the box corresponding to quarter $t$ is the sum of the values in quarters $t-1$, $t-2$, $t-3$, and $t-4$).

| quarter | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| value | 10 | 10 | 10 | 10 | 9 | 12 | 7 | 14 | 4 | 18 | 3 | 19 | |
| $V$ | | | | | 40 | 39 | 41 | 38 | 42 | 37 | 43 | 36 | 44 |

Though the value of $V$ oscillates, the government may induce people to believe that $V$ grows by choosing to report the value of $V$ in an odd quarter. In this case, the government would announce values 40, 41, 42, 43, 44, which clearly suggests that $V$ is increasing.

The opposition may reply that the government is lying and may sustain the claim that $V$ is actually declining by reporting instead the values of $V$ in an even quarter: 39, 38, 37, 36, …

Even if data manipulation is not intentional, there remains the possibility that the way data are collected determines the way reality is perceived. In other words, the measurement procedures or techniques might actually create the "facts".

**Example 2.** "El ministro de Industria, Energía y Turismo, José Manuel Soria, ha señalado que las variaciones del precio de la luz son 'imposibles' de valorar sin tener en cuenta el contexto de un año completo." Yes: but who says when a year starts or ends?
http://www.expansion.com/2015/02/01/economia/1422804127.html

**7. Another problem: ambiguity of macroeconomic outcomes**

The outcomes of an economy are always subject to assessment: is it "good" or "bad" to have a certain outcome, like a higher interest rate or a lower exchange rate? There is in general no clear-cut answer: some outcomes may be favourable to some people and, simultaneously, detrimental to other people.

A high interest rate is more beneficial to lenders than a lower one, as they receive more for lending money. Yet, borrowers are worse off with a higher than with a lower interest rate, since they have

to pay more for getting a loan of money. The verdict on whether is the better a high or a low rate depends on the importance of each group.

It is easier for European exporters to export to the US the lower the exchange rate (expressed in \$/€ units), since the lower the rate, the more euros Americans get from one dollar. But the lower the rate, the fewer the dollars Europeans consumers obtain from one euro, so the more costs (in euros) buying American goods.

## 8. More difficulties: informal fallacies in macroeconomics

### 8.1. Formal versus informal fallacies

Fallaciousness in an informal fallacy depends on the content of the argument. In a formal fallacy, the error of the argument can be directly seen in the form of the argument. Each formal fallacies is a non sequitur ("does not follow"): the conclusion does not logically follow from the premises.

Affirming the consequent is an example of logical fallacy. The structure of the fallacy is as follows: (i) A true implies B true (if A holds, then B holds); (ii) B is true; (iii) therefore, A is true.

**Example 1.** Illustration of affirming the consequent fallacy: (i) a bad macroeconomics teacher causes students to fail; (ii) students have failed; (iii) therefore, the teacher is bad.

**Example 2.** Another illustration of affirming the consequent fallacy: (i) each Monday there is a macroeconomics class; (ii) we have had a macroeconomics class today; (iii) therefore, today is Monday.

Denying the antecedent also constitutes a logical fallacy. The structure of the fallacy is the following: (i) A true implies B true; (ii) A is false; (iii) therefore, B is false.

**Example 3.** Illustration of denying the antecedent fallacy: (i) a bad macroeconomics teacher causes students to fail; (ii) the macroeconomics teacher is a good teacher; (iii) therefore, students will pass the macroeconomics course.

**Example 4.** More on denying the antecedent: (i) each Monday there is a macroeconomics class; (ii) today is not Monday; (iii) therefore, there is no macroeconomics class today.

### 8.2. The fallacy of composition

**Definition.** The fallacy of composition occurs when it is automatically presumed that what is true at a certain scale (the individual level) is true at a larger scale (the group, or economy, level).

The presumption on which the fallacy of composition relies (what holds for a part also holds for the whole) is not necessarily true, as the following examples testify.

**Example 1.** A seller reducing prices may sell more products. But if every seller reduces prices, it is not true that all of them would sell more products.

**Example 2.** If everybody leaves home earlier to avoid a traffic jam, the jam is no avoided but merely brought forward.

**Example 3.** If one individual steals one million euros from the Spanish *Fábrica Nacional de Moneda y Timbre* (http://www.fnmt.es/home), the individual has more purchasing power. If every Spaniard steals the million, does each Spaniard possess more purchasing power?

One may incur in the fallacy of composition when ignoring negative feedback effects.

**Example 4. The paradox of saving (or paradox of thrift).** According to this paradox, total savings in an economy may diminish when all individuals decide to save more. If one individual saves a larger part of his or her income, his or her wealth will increase in the future. If all individuals attempt to save more, aggregate consumption by those individuals will decrease and, accordingly, production and income may decrease. With lower incomes, the amount of funds for saving decline. As a result, an increase in the individuals' saving rate (proportion of income that is saved) may lead to a reduction in total savings because a higher saving rate may contract the source of savings: aggregate income.

### 8.3. The fallacy of composition in action: explaining a banking crisis

The following is a stylized version of the explanation of the financial crisis that started in 2007-08.

• Banks extend loans with assets as collateral. If the borrower cannot service the loan, the bank seizes the asset (this occurs, for instance, with mortgages).

• A great deal of such loans are used to finance the purchase of real estate. If many banks engage in that lending, the prices of real estate will tend to rise.

• The expectation of higher prices may attract more real estate investors. More investors lead to a higher demand for loans, probably at a higher interest. The banks would be happy to grant collateralizing loans since the value of the collateral (real estate) is booming.

• As the entry of new investors slows down, the value of real state tends to fall. This damages the last round of investors. When they fail to repay the loans, the banks' lending becomes more prudent.

• The credit contraction reduces the value of real state further. More default occurs. Banks turn risk adverse to lending. More bankruptcies follow. When banks finally seize the collateral, it is a depreciating asset that risks the banks' solvency.

• The fallacy: when banks engaged in collateralization, each presumed that what they were doing did not affect the price of the collateral asset. This presumption turned out to be false in the aggregate.

**8.4. The fallacy of division**

**Definition.** It is the opposite of the fallacy of composition, as it occurs when it is automatically presumed that what is true at a larger scale (the group, or economy, level) is true at some smaller scale (the individual level).

The presumption on which the fallacy of division relies (what holds for the whole also holds for some part of the whole) is not necessarily true. This presumption is contradicted by the existence of emergent properties. A property is emergent when a whole (a system) has the property yet none of its components enjoys the property.

**Example 1.** Is the mind (and, specifically, consciousness) an emergent property of the physical brain?

**Example 2.** Is the existence of banks (or corporations) that are "too big to fail" an emergent property of the complex network that constitutes a modern economy?

**Example 3.** Was the Industrial Revolution (or the industrial nature of modern economies or "the wealth of nations") an emergent property of a sufficiently advanced economy?

**Example 4.** Whirlwind is a physical emergent property of hot air.

**Example 5.** Being alive is an emergent property: cells are made of molecules but molecules are not living beings.

**Example 6.** "Because the coordinated macroeconomy is an emergent characteristic of uncoordinated micro behaviour, macro outcomes that are unexpected can emerge (in the sense that the outcomes are not consistent with the objectives of individuals). The most obvious example emphasized by classical and neoclassical economists is that the unconstrained pursuit of maximal profits by individuals operating in a competitive setting ends up reducing their profits to zero. The tragedy of the commons is another example well known to economists." Richard G. Lipsey, Kenneth I. Carlaw, Clifford T. Bekar (2006): *Economic Transformations: General Purpose Technologies and Long-Term Economic Growth*, Oxford University Press, p. 37.

### 8.5. Scale effects

Such effects could be regarded as expression of emergent properties.

**Example 1.** If one firm suffers losses, then the firm has a problem. If all the firms of an economy incur losses, then it is the economy that has a problem.

**Example 2.** If one student of a macroeconomics class fails, the student has a problem. If all the students in the class fail, then the teacher has a problem.

### 8.6. Simpson's paradox (or reversal paradox)

Simpson's paradox is related to the fallacy of division.

**Definition.** Simpson's paradox occurs when something true for different groups is false for the combined group.

**Example.** In Table 1 below there are three groups, two periods, and the tax rate (taxes paid in relation to income) of each group. The tax rate of each group diminishes from $t = 1$ to $t = 2$, but, in the aggregate, the tax rate increases from $t = 1$ to $t = 2$.

| | period $t = 1$ | | | period $t = 2$ | | |
|---|---|---|---|---|---|---|
| | taxes | income | tax rate | taxes | income | tax rate |
| group 1 | 5 | 100 | **5%** | 2 | 50 | 4% |
| group 2 | 150 | 1,000 | **15%** | 63 | 450 | 14% |
| group 3 | 40 | 200 | **20%** | 255 | 1,500 | 17% |
| all groups | 195 | 1,300 | 15% | 320 | 2,000 | **16%** |

Table 1. Example of Simpson's paradox

### 8.7. The *cum hoc ergo propter hoc* fallacy

**Definition.** The *cum hoc ergo propter hoc* (= "with this, therefore because of this") fallacy consists in inferring causality from the proximity of events.

One commits this fallacy when the presence of a statistical association between two variables is considered enough to declare a causal connection between them. Statitiscal correlation does not imply (proves) causality.

**Example 1.** Observing low inflation rates under an independent central bank is not enough to conclude that the bank's independence caused low inflation.

### 8.8. The *post hoc ergo propter hoc* fallacy

**Definition.** The *post hoc ergo propter hoc* (= "after this, therefore because of this") fallacy is also known as the false causality fallacy and consists in attributing causality to the order of events.

This fallacy presumes that, if event $A$ precedes event $B$, then $A$ causes $B$. To sustain the causal claim, one needs to explain which is the connection leading from $A$ to $B$.

**Example 1.** A reduction in the unemployment rate following a change in the law regulating labour contracts does not allow one to reach the conclusion that the legal reform caused less unemployment.

**Example 2.** An increase in the inflation rate following a rise in M1 does not entitle to jump to the conclusion that more M1 caused more inflation (massive injections of liquidity by the European Central Bank in the recent years have not generated an upsurge in the inflation rate: rather the opposite seems to have happened).

**Example 3. Chicken-egg problems.** It is very likely that, in a developed economy, everything eventually affects everything. This makes it difficult to ascertain what is a cause and what is an effect. Are there more workers hired because firms sell more or firms sell more because more workers have been hired? Are prices going up because consumers spend more now or consumers spend more now because prices are going up (and they expect them to rise further in the future)?

### 8.9. The *petitio principii* fallacy

**Definition.** The *petitio principii* (= "begging the question" or "assuming the initial point") fallacy is committed when a proposition that has to be proved is (implicitly or explicitly) assumed without proof.

**Example 1.** In standard textbooks demand side policies turn out to be ineffective to increase GDP in the medium run. But this conclusion has actually been assumed because one of the premises of the model is that medium run GDP remains constant.

## 9. Still more difficulties: unintended consequences

Macroeconomic outcomes are the result of the aggregation of people's decisions. But people may make certain choices aiming at some consequence, result, or outcome and, in the end, the opposite of what was intended may come out. This creates a serious problem: how could one explain a result no one intended to achieve? Moreover, from the standpoint of the design of economic policy, how could one prevent the occurrence of unintended events?

**Example. Prisoner's dilemma.** This dilemma illustrates the difficulties of trying to reduce macroeconomics to microeconomics and the limits of presuming that all macroeconomic outcomes can be explained in terms of the behaviour of self-interested individuals. The game displayed in Fig. 5 represents a prisoner's dilemma type-situation.

| | | **player 2** | |
|---|---|---|---|
| | | $a$ | $b$ |
| **player 1** | $a$ | 2 2 | 0 3 |
| | $b$ | 3 0 | 1 1 |

Fig. 5. Prisoner's dilemma game

For each player, option $b$ is a strongly dominant option: by choosing $b$, no matter what the opponent chooses, the player gets a higher payoff. Consider, for instance, player 1. If player 2 chooses $a$, the best for player 1 is to choose $b$; and if player 2 chooses $b$, the best for player 1 is also to choose $b$. Therefore, $b$ is a dominant strategy. Now, if both players choose their dominant strategies, the outcome is (1, 1). Yet, there is an outcome which is better for both players: the outcome that results when both pick $a$ instead of $b$.

A lesson of the example is that, by trying to get their best result, players end obtaining a bad result (bad in the sense that there is another result that both players prefer to the bad result). The example also represents a serious objection to the claim that the collective outcome of self-interested decisions is collectively desirable. Guided by their self-interest, players generate outcome (1, 1). But from a collective point of view, outcome (2, 2) is more desirable than (1, 1).

**10. Another difficulty: silent evidence (and the importance of selection effects)**

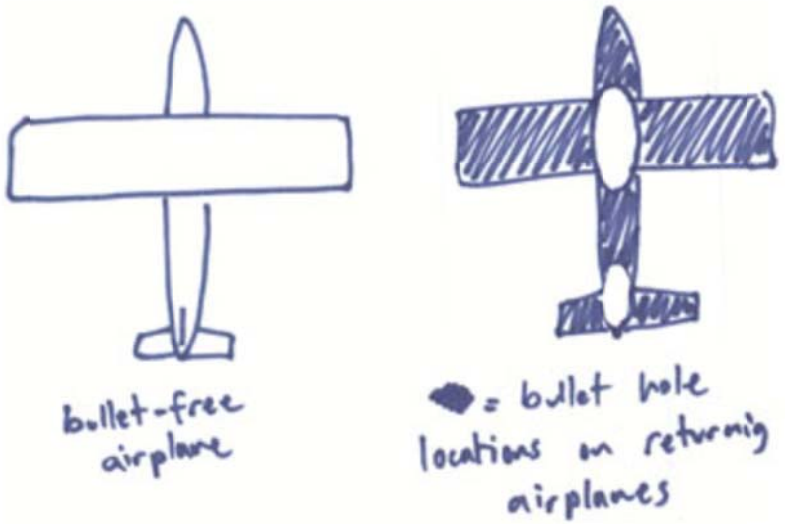
It is natural to make inferences from what is observed. The problem with this approach is that one should also take into account what is not observed.

**Example 1. Explaining professional success.** It is customary to explain the success of very rich people by listing the characteristics and behaviour of those people: they are hard-working, never give up, attempt new ways of doing things… The point is that millions of other individuals do the same but do not end rich: that is the silent evidence. Consequently, one cannot ascribe success to those traits: it simply happened that, among the millions of individuals having those characteristics, a handful became rich. At the most, the characteristics could regarded as necessary conditions for success and not as sufficient conditions.

**Example 2. Abraham Wald.** "During WWII, Hungarian-born mathematician Abraham Wald undertook a study with the British Air Ministry to use statistical analysis to help protect bombers flying over enemy territory. The data to be crunched included the number and location of bullet

holes on returning aircraft, and the goal was to use this information to determine where to best add armor to the plane's structure.

A nifty little chart was created to show where the maximum number of bullet holes were located on returning aircraft. This chart showed the greatest damage not on the main wing and tail spars, engines, and core fuselage areas, but rather on the aircraft extremities. Based on this, the Air Ministry suggested adding armor to those extremities. Wald suggested they were dead wrong.




Wald said more armor should go on the places that had the least holes. Huh? What was he thinking? Wald was keeping the Air Ministry from falling into the "survivorship bias": they were forgetting the their data did not include the planes that had been lost. If the returning planes had no holes in their wing spars and engines, the better assumption to make is that even a few holes in those places were deadly: no damage was recorded in those areas because those planes were the ones that had crashed. Wald recommended more armor in those data-free areas. The lesson: the data that isn't there may tell as important a story as the data that is."
http://digitalroam.typepad.com/digital_roam/2006/03/the_hole_story_.html

**11. Dependence of social context: El Farol bar problem**

A view among some (most?) macroeconomists is that macroeconomic models should actually be microeconomic models, the difference between macroeconomics and microeconomics being just the aggregation of individual behaviour. Since standard microeconomic analysis (and, specifically, game-theoretic analysis) tends to be independent of social context, the conclusion is that macroeconomic analysis need not take into account the social context. The so-called El Farol bar problem (suggested by William Brian Arthur, 1994) challenges this view.

**Example. El Farol bar problem.** 100 individuals are planning, simultaneously and independently, to go to a bar. The problem is that if more than 60 persons come to the bar, the experience is not enjoyable: to have fun requires than at most 60 persons attend. Hence, every individual would like to stay away if the bar is overcrowed (more than 60 persons attend) and would like to go to the bar otherwise.

The paradoxical nature of this problem is that if everyone chooses the same strategy, the strategy fails in the sense that everyone would prefer to have selected the other strategy. If all individuals decide to go, the bar is overcrowded and, hence, they would have been preferable not to come. If all individuals decide not to come, the bar is empty, so each individual would have liked to go.

Consequently, if there is a "natural" way of predicting what an individual will do, the prediction is self-defeating: if the prediction is that few will attend, then all will attend; if it is that all will attend, then no individual will attend.

This example illustrates the limitations of a common strategy in macroeconomic analysis: the use of representative agents models in which the behaviour of a whole collective (all consumers, all firms) is studied presuming that one can replace the collective by a single agent (the representative consumer, the representative firm). In El Farol bar problem this strategy is not appropriate, because the analysis demands the existence of heterogeneity: based on private information (their social context) some individuals will choose to go and some others will choose to stay away. One cannot adopt the rule "One size fits all" to analyze this sort of situation (which is very common: profits come from doing things others do not; who likes visiting crowded tourist destinations?).

**12. On the dangers of generalizing from partial equilibrium results**

In microeconomic models, demand functions are universally presumed to be decreasing. This property is justified on the basis of ceteris paribus ("other things being equal") clauses. When one defines an aggregate demand function, it is natural to just add up all microeconomic demand functions. The problem with this approach is that, at the macro level, it may not be legitimate to keep constant variables kept constant when the microeconomic functions were constructed.

**Example. Upward-sloping demand functions.** The following describes an extremely simple economy. There are two individuals, $A$ and $B$. Individual $A$ has exclusive access to a valuable resource $X$. Individual $B$ has exclusive access to a valuable resource $Y$. Individual $A$ would like to obtain $Y$ from $B$, and $B$ would like to obtain $X$ from $A$. Each individual sets the price of the respective resource in terms of some unit of account. Let $p_x$ designate the price for $X$ set by $A$ and by $p_y$ the price for $Y$ set by $B$. Suppose $A$ demands $Y_A$ units of $Y$ and $B$ demands $X_B$ units of $X$.

Assume that what each individual spends in buying the resource to which the individual has no access coincides with the income the individual obtains from selling the resource the individual owns. Formally, assume that

$$\underbrace{p_x \cdot X_B}_{B\text{'s expenditure}} = \underbrace{p_y \cdot Y_A}_{B\text{'s income}} .$$

($A$'s income: $p_x \cdot X_B$; $A$'s expenditure: $p_y \cdot Y_A$.)

By solving for, for instance, $X_B$, it follows that

$$X_B = \frac{p_y \cdot Y_A}{p_x} \ . \tag{1}$$

Apparently, (1) indicates that the demand for $X$ is a decreasing function of its own price $p_x$. But this conclusion depends on the presumption that income $p_y \cdot Y_A$ does not depend on $p_x$. Though that might be justifiable at a micro level, it is harder to sustain at a macro level.

Specifically, suppose that income $p_x \cdot X_B$ moves in the same direction as $p_x$ (a conventional justification could be that the demand for $X$ is inelastic). That is,

$$\uparrow p_x \ \Rightarrow \ \uparrow (p_x \cdot X_B) \tag{2}$$

and

$$\downarrow p_x \ \Rightarrow \ \downarrow (p_x \cdot X_B).$$

Assume as well that the demand for each resources increases with income (the resources are considered as normal goods). In particular,

$$\uparrow (p_x \cdot X_B) \ \Rightarrow \ \uparrow Y_A \tag{3}$$

and

$$\uparrow \left(p_y \cdot Y_A\right) \ \Rightarrow \ \uparrow X_B \ . \tag{4}$$

The chain below follows from the previous assumptions

$$\uparrow p_x \ \Rightarrow^{(2)} \ \uparrow (p_x \cdot X_B) \Rightarrow^{(3)} \ \uparrow Y_A \Rightarrow^{(*)} \ \uparrow p_y \cdot Y_A \ \Rightarrow^{(4)} \ \uparrow X_B$$

if step (*) is justified by the additional hypothesis that the price $p_y$ of $Y$ is not lowered when the price $p_x$ of $X$ is increased. The final conclusion is then that an increase in the price $p_x$ of $X$ leads to an increase in the demand for $X$ when the prices of the resources do not move in opposite directions (the resources are, to some extent, complementary), the demand for $X$ is sufficiently inelastic, and the resources constitute normal goods (have increasing Engel curves). If analogous postulates are made for $Y$, then all the demand functions in this simple economy are upward sloping.

What is the reason for having increasing demand functions despite the fact that (1) suggests that they are decreasing? Simply put: the price raise generates a multiplier effect, which increases income, which, in turn, stimulates demand so that a possible contraction in demand caused by the price raise is neutralized. This reasoning suggests that, rather than cutting prices and wages, a way to get out of an economic recession is to increase prices and wages.