

## Solving the Feldstein-Horioka puzzle

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### *Abstract*

In 1980, Feldstein and Horioka showed that domestic saving and domestic investment were highly correlated in many countries. But they argued that under perfect capital mobility this correlation should be close to zero as domestic savings would search the most profitable investment opportunities around the world and should not be confined to domestic investment projects. This finding, the so-called Feldstein-Horioka puzzle, inspired a large literature trying to find the reasons for the close correlation of domestic saving and domestic investment.

This paper makes the case that a large part of the discussion about the Feldstein-Horioka puzzle is beside the point. On the one hand, the meaning of “saving” in theoretical models and its relation to statistical data often is not made clear, which leads to wrong conclusions when interpreting data and empirical evidence. On the other hand, in nearly all contributions to the debate there is no differentiation between “saving” and “financing”.

When a clear distinction is made between saving and financing and, consequently, real resource flows are distinguished from financial flows the paper shows that the alleged puzzle can be quite easily solved.

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## 1. Introduction

In 1980, MARTIN FELDSTEIN and CHARLES HORIOKA published a paper (FELDSTEIN/HORIOKA 1980) investigating the connection/correlation between saving and investment in different countries. They started with the supposition that – given an unhampered international movement of capital – investors are able to search world-wide for the most profitable investment opportunities in different countries. Therefore, the argument goes, the saving and investment ratios of countries should not show a high degree of correlation. But this hypothesis was not supported by the data: Saving and investment were highly correlated in the observed countries, so that the authors concluded that international capital mobility is not as high as normally assumed. This result was confirmed by several other studies and is – among others – considered as one of the major puzzles in international macroeconomics (OBSTFELD/ROGOFF 2000).

In the aftermath, the puzzle was intensively investigated – the latest survey of the literature (APERGIS/TSOUMAS 2009) lists 199 entries – but a roundly satisfying solution of this puzzle has not been found so far. Still, empirical studies find a high correlation between saving and investment, although often not as large as in the original paper by FELDSTEIN/HORIOKA. Several suggestions for solving the puzzle have been brought forward; but these sometimes cause other explanatory problems.

This paper gives a completely other explanation for the FELDSTEIN-HORIOKA-Puzzle: it is a pseudo problem that came into existence due to several factors that will be described below in greater detail. The bottom line is: the relations between certain economic variables described by the so-called “balance mechanics” have not been taken into account sufficiently and there has been no clear-cut differentiation between “saving” and “financing”.

The paper is structured as follows: in the second section the basic puzzle formulated by FELDSTEIN and HORIOKA is described and illustrated by newer data. In the third section, the building blocs are presented that, on the one hand, help to understand how the puzzle came into existence in the first place and, on the other hand, offer the tools to solve it. By building on them, the fourth section explains why the puzzle is a pseudo problem and clears the way for the real problems that are hidden by it. In the fifth section some remarks are given on previous attempts to solve the puzzle, and the sixth section concludes.

## 2. The FELDSTEIN-HORIOKA puzzle

The starting point of the FELDSTEIN-HORIOKA puzzle is the supposition that in times of a nearly perfect international capital mobility it is possible to look for the worldwide best investment opportunities for profit-seeking capital – which FELDSTEIN/HORIOKA see as synonymous with “savings”. Whereas savings must necessarily be equal to investment in a closed economy, they do no longer have to be so in an open economy.

Therefore, FELDSTEIN/HORIOKA investigated whether savings and investment are correlated in open economies. To do this, they estimated the following equation:

$$\left(\frac{I}{Y}\right)_i = \alpha + \beta \left(\frac{S}{Y}\right)_i$$

The data they used were taken from 16 OECD countries<sup>1</sup> within the period 1960-74; for each country they took the respective average saving and investment ratios. When using gross saving and investment ratios FELDSTEIN/HORIOKA estimated a value for  $\beta$  amounting to 0.89; when using net saving and investment, it was 0.94. This result contradicted the expectation of a low correlation.

The left-hand side of figure 1 illustrates the original result FELDSTEIN/HORIOKA estimated; the right-hand side shows what they expected: a low or non-existent correlation between saving and investment (which, of course, implied high positive and negative balances in the current accounts of the countries). To create the graph on the right-hand side random numbers between 0.18 and 0.38 – the range of values for the saving and investment ratios in the data used by FELDSTEIN/HORIOKA – were generated.

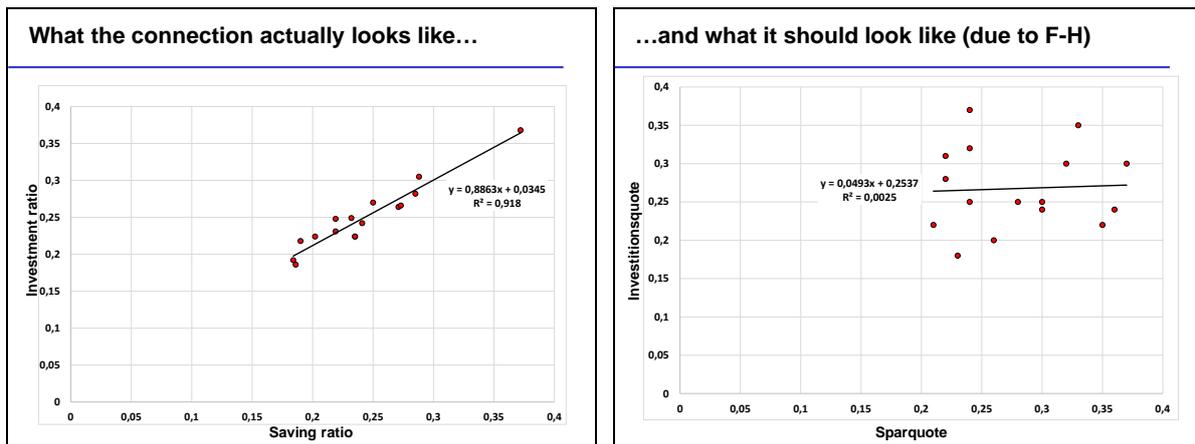


Figure 1: The FELDSTEIN-HORIOKA result and the authors' expectations

Source: own presentation, on the left based on data by FELDSTEIN/HORIOKA (1980), p. 319

From these results – whose substance did not change when they made modifications by introducing control variables to account for the size of a country and the share of trade in GDP as a measure of the openness of the country – FELDSTEIN/HORIOKA concluded that the effective capital mobility is much lower than often assumed, despite the legal impediments to capital mobility may be small or even non-existing.

In dependence on a paper by BLANCHARD/GIAVAZZI (2002) I again made a simple OLS regression to estimate the  $\beta$  coefficients using more recent data. BLANCHARD/GIAVAZZI used four different samples (the terms in italics were introduced by BLANCHARD/GIAVAZZI):

- *OECD minus*: 22 OECD countries (Australia, Belgium, Denmark, Germany, Finland, France, Greece, Ireland, Iceland, Italy, Japan, Canada, New Zealand, Netherlands, Norway, Austria, Portugal, Sweden, Switzerland, Spain, United Kingdom, USA)
- *The European Union*: 14 EU countries (Belgium, Denmark, Germany, Finland, France, Greece, Ireland, Italy, Netherlands, Austria, Portugal, Sweden, Spain, United Kingdom)

<sup>1</sup> Australia, Austria, Belgium, Canada, Denmark, Finland, Germany, Greece, Ireland, Italy, Japan, Netherlands, New Zealand, Sweden, United Kingdom, USA.

- *The euro area*: 11 countries (Belgium, Germany, Finland, France, Greece, Ireland, Italy, Netherlands, Austria, Portugal, Spain)
- *Euro minus*: 9 countries (Belgium, Germany, Finland, France, Ireland, Italy, Netherlands, Austria, Spain)

The reason for using these different samples was to look whether countries with closer integration ties like the European Union or the Euro area show smaller FELDSTEIN-HORIOKA coefficients than the larger sample of OECD countries. In the last sample, Portugal and Greece were left out because in these two countries there were large differences between saving and investment; therefore BLANCHARD/GIAVAZZI wanted to check “whether the results obtained for the euro area are due to these two countries or hold in the rest of the euro area as well” (BLANCHARD/GIAVAZZI 2002, p. 156)

Other countries were left out of the sample either due to lack of data (data for central and eastern European countries exist only from 1990 on) or because the mechanism behind current account changes in very poor countries might differ from those in richer OECD countries; Luxembourg was left out because its economy was considered highly idiosyncratic and was said to report current account surpluses of about 30 percent of GDP (BLANCHARD/GIAVAZZI 2002, p. 156). Although I could not find this in the data, I nevertheless followed them in their sample selection.

The following equation was estimated:

$$\left(\frac{I}{Y}\right)_{it} = \alpha + \beta \left(\frac{S}{Y}\right)_{it}$$

Other than FELDSTEIN/HORIOKA but in accordance with BLANCHARD/GIAVAZZI I did not use average values for the saving and investment ratios, but regressed the matrix of investment ratios in country  $i$  and year  $t$  on the matrix of the respective saving ratios. Whereas BLANCHARD/GIAVAZZI used the period from 1975 to 2001 (they estimated the coefficients also for the sub-periods 1975-1990 and 1991-2001), I calculated the coefficients for the five ten-year periods 1960-69, 1970-79, 1980-89, 1990-99 and 2000-09 and also for the six-year period 2010-15. The results are summarised in the following table:

<b>Feldstein-Horioka coefficients</b>				
	<b>OECD minus (22 countries)</b>	<b>European Union (14 countries)</b>	<b>Euro area (11 countries)</b>	<b>Euro minus (9 countries)</b>
<b>1960-69</b>	<b>0,757</b>	<b>0,698</b>	<b>0,58</b>	<b>0,625</b>
<b>1970-79</b>	<b>0,767</b>	<b>0,708</b>	<b>0,69</b>	<b>0,458</b>
<b>1980-89</b>	<b>0,536</b>	<b>0,446</b>	<b>0,439</b>	<b>0,446</b>
<b>1990-99</b>	<b>0,365</b>	<b>0,151</b>	<b>0,135</b>	<b>0,391</b>
<b>2000-09</b>	<b>0,035</b>	<b>0,061</b>	<b>-0,015</b>	<b>0,046</b>
<b>2010-15</b>	<b>0,349</b>	<b>0,337</b>	<b>0,34</b>	<b>0,092</b>

*Figure 2: FELDSTEIN-HORIOKA coefficients  
Source: AMECO database, own calculations*

Since the 1970s, the coefficients have declined until the 2000s, and then increased quite sharply again, at least in the OECD in general and the European Union. So between 2000 and 2009 the results resemble what FELDSTEIN/HORIOKA saw as the general situation in case of capital mobility. But after the outbreak of the financial crisis, the coefficients went up again. It could also be seen that the coefficients are smaller for the European Union and, in general, still smaller for the Euro area. But much of this seems indeed to be caused by the situation of Greece and Portugal, as the coefficients are (except the latest period) higher again for the Euro minus sample. Due to the fact that the yearly values (instead of period averages) were used for the estimation it is not surprising that the coefficients are smaller: in case of (small) yearly current account balances (with alternating signs) the estimated correlation is smaller than in the case of averages where those balances cancel out and suggest a higher correlation.

Therefore, the central question seems to be how a (more or less) unlimited mobility of capital can be reconciled with the observation that investors overwhelmingly seem to prefer an investment in domestic assets – which is what the correlation of saving and investment seems to reveal. But in the following it shall be shown that this problem is a pseudo problem and can be ascribed to several obscurities in the argumentation.

These obscurities are:

- There is no distinction between relations that are only valid for a single subject (or a group of subjects) and relations that are valid for the whole economy.
- The characteristics of a monetary economy are not taken into account, especially there is no distinction between transactions that change the participants' amount of net financial assets and pure financial transactions that do not.

- The different meanings of ‘saving’ are not distinguished or simply equalized; furthermore, the empirical parameter ‘saving’ in national income accounting – which conforms to only one of these meanings – is also seen as the empirical counterpart of the other meanings. Above all, there is no distinction between ‘saving’ and ‘financing’ in the literature that deals with the FELDSTEIN-HORIOKA puzzle<sup>2</sup> – but this distinction is of great importance.
- The equality of the difference between domestic saving and domestic investment on the one hand and the current account balance on the other hand is causally interpreted in a way that is not meaningful empirically in a monetary economy.

The point is: There is absolutely no contradiction between the statement that capital is highly mobile internationally (and is in search of the best investment opportunities) and that domestic saving and investment are highly correlated. The contradiction is only apparent, not real; and it results from disregarding basic logical macroeconomic relationships.

### **3. The building blocks for solving the puzzle: balance mechanics**

To solve the puzzle one has to make clear the macroeconomic relationships that are described by “balance mechanics”, a term coined by the German economist WOLFGANG STÜTZEL who analysed these relations in depth (STÜTZEL 1978, 1979) and used them to investigate economic models and policy proposals; doing that he showed that these relations very often are not taken into account in a sufficient manner. SCHMIDT (2011, 2012) has analysed the importance of balance mechanics for macroeconomic theory and policy and has made the case for a thorough treatment of these relationships within the undergraduate macroeconomics curriculum (SCHMIDT 2016); LINDNER (2012, 2015) has developed a more formal presentation.

In this section the elements of balance mechanics that are important for solving the FELDSTEIN-HORIOKA puzzle are presented.

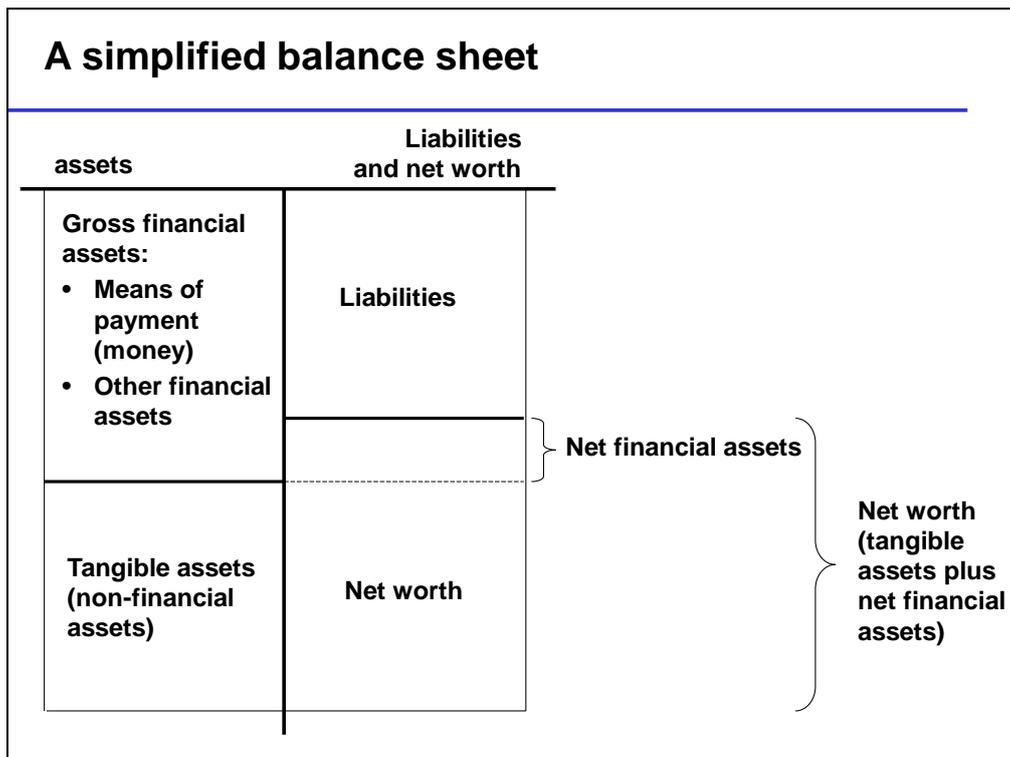
#### **3.1 The Accounting Relationships**

Economic units use two accounting frameworks for recording their transactions with the rest of the world: a balance sheet and an income statement.

The balance sheet shows the stock of assets and liabilities of an economic unit and their balance – the unit’s net worth. A (simplified) balance sheet of an economic unit looks like this:

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<sup>2</sup> This is also mentioned by BORIO/DISYATAT (2011), p. 12.



*Figure 3: A simplified balance sheet*  
*Source: author's presentation*

The first part of gross financial assets are means of payment, usually called “money”; under normal circumstances, money consists of currency and checkable accounts, but what exactly constitutes a means of payment depends on the circumstances of time and space (STÜTZEL 1978, p. 65 f.). The second part consists of financial claims on other economic units (open bills resulting from sales of goods, bonds entitling the owner to interest payments, creditors’ claims on their debtors due to loans handed out etc.) which are called “other financial assets”. As money also constitutes a financial claim (against the central bank in the case of currency<sup>3</sup> and against a commercial bank in the case of checkable deposits, i.e. the promise of a bank to deliver cash) each means of payment is a financial asset but not the other way round.

Liabilities, on the other hand, encompass every obligation to pay: liabilities due to the purchase of goods, due to loans taken out, due to issued bonds etc. It is important to see the strict symmetry of financial assets and liabilities: each financial assets corresponds to a liability of equal size: a person possessing a bond with a face value of \$ 10,000 due on December 31<sup>st</sup>, 2016, possesses the claim for receiving \$ 10,000 from the emitting firm on December 31<sup>st</sup>, 2016. The firm has a liability of equal size.

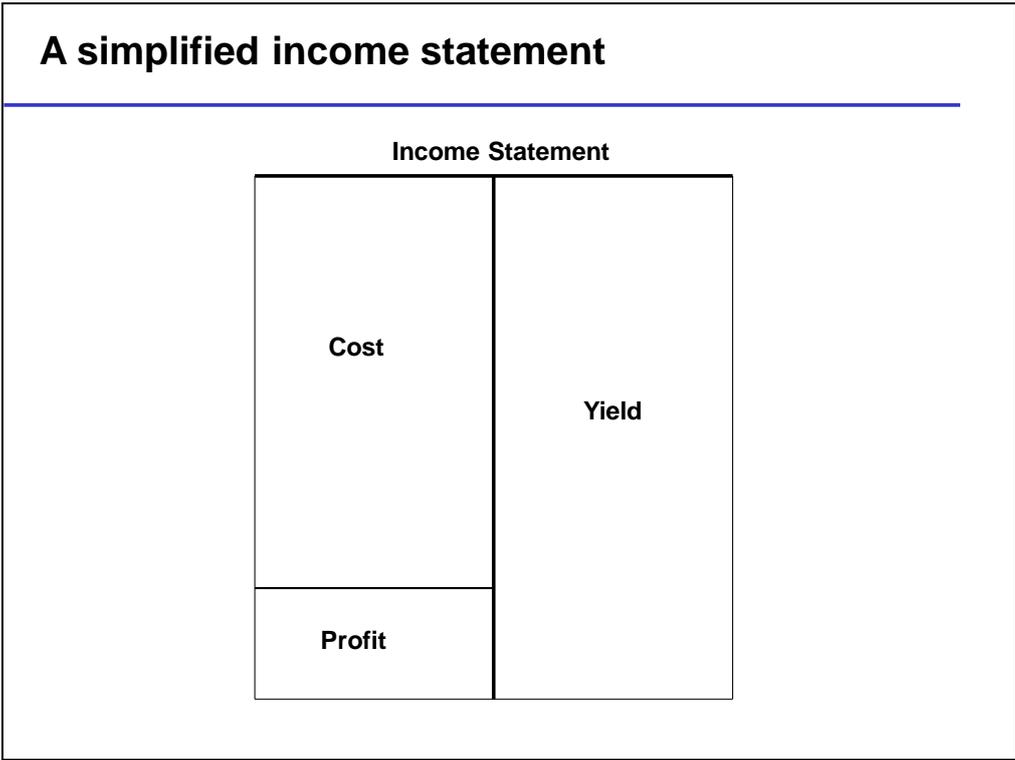
Gross financial assets minus liabilities give a person’s net financial assets.

Tangible assets or non-financial assets are goods of any kind that are used over a longer period: properties, houses, machines, but also the stock of finished or half-finished products. Immaterial assets like patents or the so-called ‘goodwill’ of a firm shall also fall into that category

<sup>3</sup> Today, this “claim” has only historical significance, as there is no longer any right to exchange currency for a certain amount of gold (via an exchange for dollars), as it was the case until the collapse of Bretton Woods; but nevertheless, the currency issued by a central bank still appears as liability on its balance sheet.

although they are not tangible in a literal sense. The purchase or the production of such a tangible asset is called (net) investment. In macroeconomics, only the formation of tangible assets counts as net investment, in contrast to the acquisition of financial assets which is sometimes called financial investment.

The income statement shows the difference between a unit's yields and its costs (in case of a firm) or between its income and (consumption) expenditures (in case of a household). The difference between yield and cost or between income and (consumption) expenditure shows the positive or negative outcome of a period, that is profit or loss which in turn increases or diminishes the unit's net worth. The reason for additionally introducing the term 'yield' in case of a firm is that in national income accounting a firm's profit (in the above-mentioned sense) is called the firm's income. Therefore, it would be mistakable to say that a firm's profit is the difference between its income and its expenditures.



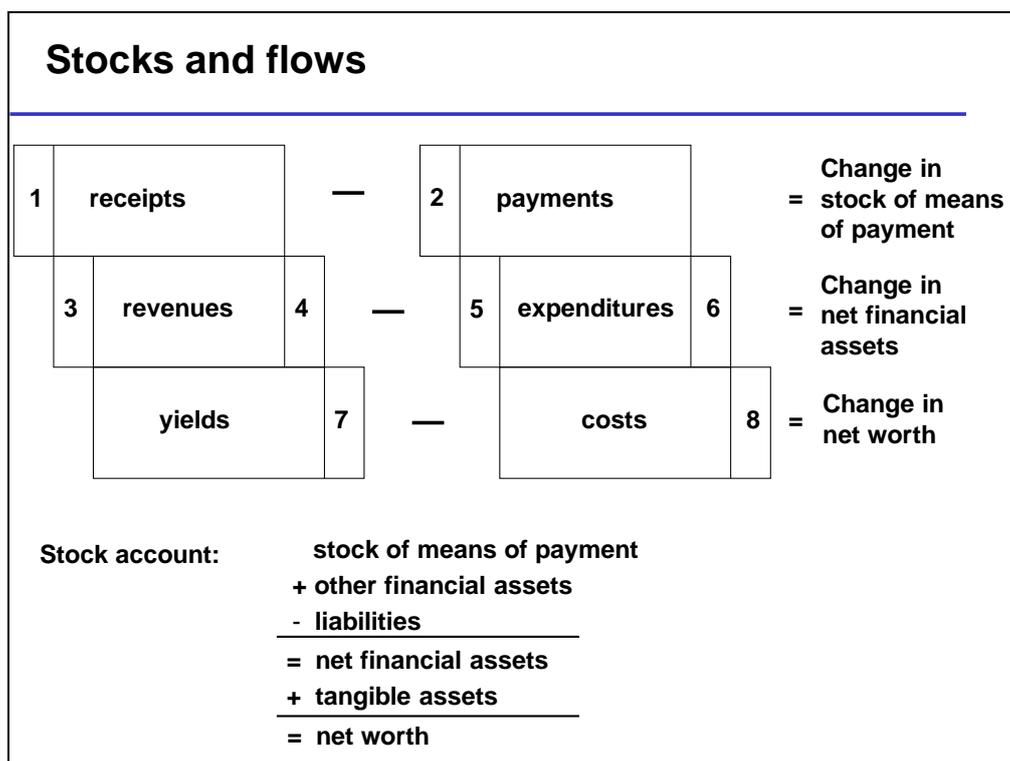
*Figure 4: A Simplified Income Statement*  
*Source: author's presentation*

On the right-hand side of an income statement, all yields are registered: these are the revenues due to the sale of goods and services as well as other yields resulting from, e.g., a higher market valuation of assets. The left-hand side records all costs resulting from the production of goods and services (wages, purchases of material, depreciation etc.). Profit is the difference between the two; the unappropriated part of it increases the net worth of the firm (or decreases it in case of a loss).

For our purposes, it is necessary to differentiate strictly between change in net worth (profit or loss), change in net financial assets, and change in the stock of means of payment. To do this, one has to differentiate between payments, expenditures and cost or between receipts, revenues and yields, respectively. Via the income statement, the difference between yields and costs is

calculated; but this is not necessarily equivalent to the difference between revenues and expenditures, and not equivalent to the difference between receipts and payments either.

The following scheme is helpful for a proper understanding:



*Figure 5: Stocks and flows*  
 Source: in dependence on BOFINGER (2015), p. 288

The three terms can coincide with one another but that is by no means necessary. If a firm sells a product on cash terms, this sale is at the same time a yield, a revenue and a receipt for the firm. If a firm purchases inputs and pays cash or debits a checkable account immediately, this is at the same time a cost, an expenditure and a payment. But this is not a necessary connection and the examples in the appendix show this.

### 3.2 Transactions

All transactions are about transferring goods (incl. services) or financial assets. Apart from pure transfers (gifts) and barter of goods, two kinds of transactions are especially important: transactions that change the participants' net financial assets and pure financial transactions that do not.

The participants' net financial assets change whenever a good is exchanged with a financial asset, e.g. when selling a commodity. The buyer gets the commodity; the seller gets a claim against the buyer, documented by writing a bill. Even if the seller is payed directly, she receives a claim: Either the amount on her giro account – a claim against the bank – increases or she gets cash – a claim against the central bank. So the seller's net financial assets increase, the buyer's decrease. The participants' *net worth* can increase, decrease or stay the same. If a consumption good is bought and used up the buyers' net worth decreases; if a tangible asset is

bought the buyer's net financial assets decrease but as the stock of tangible assets increase her net worth stays the same.

In contrast, *pure financial transactions* do not change participants' *amount* of net financial assets but only their *structure*. Three examples are:

- *Buying governments bonds by charging your saving account*: the amount of the buyer's net financial assets is the same as before the acquisition but instead of a claim against the bank (saving account) he now possesses a claim against the state; it is an asset exchange on his balance sheet. The government's net financial assets also stay the same: by issuing the bond it receives means of payment but also its liabilities increase by the amount of the issued bond – that is, the government's balance sheet is extended.
- *Taking out a loan*: At the same time the borrower gets a claim (the bank credits her giro account with the amount of the loan) and also a liability (she has to pay back the loan when it is due). When taking out the loan, assets and liabilities increase by the same amount, net financial assets stay the same, the borrower's balance sheet is extended. This applies inversely to the bank granting the loan.
- *Paying back a loan* by charging one's giro account is also a pure financial transaction as the net financial assets of both participants stay the same: the borrower decreases as well his bank balance as his liabilities; inversely, the bank's claims against the borrower and the bank's liability (the giro account) decrease. Both balance sheets contract.

### 3.3 Partial and global statements

The third important building block of balance mechanics is the division of an aggregate economy (a closed economy or the world as a whole) into a group and a complementary group. A group can be a single economic unit, a sector of the economy or any other relevant subset, depending on the problem at hand. The central message of balance mechanics is the fact that many economic statements are only true for single economic units or a group of economic units but not for the aggregate economy. An – at first sight – trivial example is the difference between revenues and expenditures (in the above mentioned sense): the revenues of an economic unit (or a group of units) can differ from its expenditures; for example, a private household can have revenues to the amount of \$ 5,000 and expenditures to the amount of \$ 4,000. But as the revenues of one unit are the expenditures of another unit, a single unit or a group can only then succeed in achieving a *surplus* (a positive difference between revenues and expenditures) if the complementary group is willing to accept (or is trying to achieve) a commensurate *deficit* (a negative difference between revenues and expenditures). For the aggregate economy revenues and expenditures are necessarily identical. For every economic unit (that is: for every single economic unit) revenues and expenditures can differ, for all economic units (that is: for all economic units together or for the aggregate economy as a whole) revenues and expenditures are necessarily the same.<sup>4</sup>

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<sup>4</sup> This does neither apply to yield and cost nor to receipts and payments. One unit's cost is not necessarily another unit's yield (take depreciation as the most important example). Furthermore, if a bank grants a loan to a customer, the customer's account is simply credited with the amount of the loan; therefore, his/her stock of money (means of payment) increases, that is, he/she gets a receipt. But when crediting the customer's account the bank newly creates these means of payment so that there is no decrease of money on the bank's side.

The statement which is valid only for a single economic unit or a group is called *partial statement*; the statement which is valid only for the aggregate economy is called *global statement*; and the *relational statement* makes clear how the apparently paradoxical relation between the other two statements can be resolved.<sup>5</sup>

Concerning the relation between revenues and expenditure one can formulate the following

*Partial statement:* For each economic unit and each group of economic units an increase in expenditures means a decrease of net financial assets, an increase in revenues means an increase of net financial assets. (STÜTZEL 1978, p. 72)

For a (group of) single economic unit(s) it is perfectly possible to decrease its net financial assets, be it by increasing its expenditures with unchanged revenues or by decreasing its revenues with unchanged expenditures. But then you can formulate the following

*Relational statement:* An economic unit or a group of economic units can achieve a decrease of its net financial assets by increasing its expenditures only if the complementary group achieves (or accepts) an increase of its net financial assets. (STÜTZEL 1978, p. 73)

One has to take into account that one unit's expenditures are necessarily another unit's revenues; analogously, the one unit's deficit is another person's (or several other units') surplus. The increase of one person's net financial assets is therefore necessarily the decrease of another person's net financial assets. Therefore we have the following

*Global statement:* The aggregate economy (the collectivity of all economic units) can never change its net financial assets by an increase or decrease of revenues or expenditures. (STÜTZEL 1978, p. 73)

In the aggregate economy, net financial assets can never be increased, but only shifted between economic units. Furthermore: As net financial assets are defined as gross financial assets minus liabilities and as one person's financial asset is another person's financial liability, an adding-up of all net financial assets of all economic units must necessarily lead to the result that net financial assets of the economy are zero in the aggregate.<sup>6</sup>

One important qualification is the idea of "behaviour in lockstep" (STÜTZEL 1978, p. 29 and 50): that leads to the peculiar result that the global statement applies also to each single economic unit. Referring to revenues and expenditures that means that every economic unit has exactly the same amount of revenues as of expenditures, so that there are no balances (or already existing balances stay the same). If all economic units increase their expenditures in lockstep the initial amount of each person's net financial assets is no brake for increasing expenditures as it does not change. If, for example, a unit possesses net financial assets of \$ 1,000 at a certain point in time, that does not hinder it from making expenditures of \$ 100,000 – as long as it receives revenues of \$ 100,000 at the same time. As long as expenditures and revenues move in perfect lockstep there is no limit to expenditures. Therefore the stock of net financial assets

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<sup>5</sup> The terms are LINDNER's, introduced in LINDNER (2012), p. 5, to translate STÜTZEL's *Partialsatz*, *Globalsatz* and *Satz zur Größenmechanik*.

<sup>6</sup> This is of course not the case for tangible assets which can be increased (or decreased) not only on an individual level, but also in the aggregate (via investment).

at a certain point in time does not limit expenditures as such but only the possibility of deviating from lockstep behaviour.

### 3.4 The different meanings of „saving“

‘Saving’ is a term that is used for quite different issues; many macroeconomic controversies arise because the different meanings of ‘saving’ are equated with one another, although they describe quite different processes. Therefore it is important to clear which meanings the term ‘saving’ can have in a macroeconomic context. There are four of them (GRASS/STÜTZEL 1988, p. 365):

- 1<sup>st</sup> meaning: *increase of net worth*  
If ‘saving’ is meant to denominate the increase of net worth, it is – for the private household and the state – the difference between (net) income in a period and consumption expenditures in the same period. For a firm, it denominates the firm’s retained earnings, that is the difference between yields and cost in the same period not distributed to the owners of the firm. Dissaving would mean that the amount a household spends for consumption is larger than his/her income, so his/her net worth decreases. For a firm, it is equivalent with a loss (disregarding personal drawings by the firm’s owners).
- 2<sup>nd</sup> meaning: *increase of net financial assets*  
If ‘saving’ is meant to denominate the increase of net financial assets, it is the difference between revenues and expenditures of the same period. If an economic unit has spent less than it has earned his/her stock of net financial assets has increased – but not necessarily his/her net worth, as the increase of net financial assets can be the result of selling a tangible asset.
- 3<sup>rd</sup> meaning: *decrease of consumption*  
‘Saving’ within the meaning of decrease of consumption means that an economic unit decreases his/her consumption expenditures compared to the consumption expenditures of the last period. This meaning is only applicable to private households and the state as firms do not consume by definition.
- 4<sup>th</sup> meaning: *shift to long-term assets*  
‘Saving’ is often meant to denominate not an *increase* of wealth but a *regrouping* of wealth, especially within the group of financial assets. ‘Saving’ in this sense means that already existing financial assets – e.g. means of payment or the deposits on savings accounts – are used to buy longer-term (financial) assets – long-term bonds, shares or tangible assets. The *stock* of wealth does not increase, only the *composition* of wealth – in the direction of less liquid assets with a higher expected return.

These different meanings of the term ‘saving’ must not be equated, even if they can coincide of course: if a household wants to have a larger increase of net worth out of his/her given income he/she has to decrease his/her consumption compared to an earlier period; and as households normally increase their net worth by increasing their stock of net financial assets the first three meanings of ‘saving’ coincide in this case. But if the household’s income increases between the first and the second period, he/she can realize a larger increase of net worth and of net financial assets (meaning 1 and 2) without decreasing his/her consumption expenditures (meaning 3).

He/she can save (= increase his/her net worth) without saving (= decrease his/her consumption expenditure).

In national income accounting ‘saving’ always means increase of net worth. Taking this into account it is quite simple to understand the famous equality of I and S, of investment and saving. I and S are always the same in a closed economy (or in the world). That is simply because each economic unit can increase his/her net worth by increasing the stock of net financial assets or by increasing the stock of tangible assets (= investment). But as, on an aggregate level in a closed economy or in the world, the stock of net financial assets is always equal to zero, the global increase in net worth, S, can only consist in an increase of tangible assets, I.

For a single country trading with other countries there is also the possibility to increase its net financial assets by realising a positive current account balance. Of course this has to be seen alongside negative current account balances (and a decrease of net financial assets) in one or more other countries. For a single open economy the formula is:

$$S_{domestic} = I_{domestic} + \Delta net\ financial\ assets$$

## 4. The Solution of the FELDSTEIN-HORIOKA Puzzle

The preceding sections have presented all building blocks that are necessary to solve the FELDSTEIN-HORIOKA puzzle.

### 4.1 Saving and Investment as Partial and Global Activities

FELDSTEIN/HORIOKA’s argument starts from the considerations of a single investor searching for a suitable (financial) investment for his savings. Even here, it is not clear whether it is about additional saving out of current income or a regrouping of an existing stock of (financial) assets. But as the FELDSTEIN-HORIOKA puzzle deals with flows one can assume that it is about additional saving, that is increase of net worth. And indeed it is clear that for a single economic unit there is no need for a connection between “increase of net worth” (1<sup>st</sup> meaning of saving and its meaning in national income accounting) and “increase of tangible assets” (investment in a macroeconomic sense).

- $S \neq 0, I = 0$ : A single economic unit can increase its net worth only by increasing its net financial assets. To do that one simply uses the unconsumed share of income to acquire securities or just to keep it on the giro account or as cash. In this case increase of net worth (saving) is positive, investment is zero. Net worth and net financial assets can even decrease if the unit’s consumption expenditures exceeds its income.
- $S \neq 0, I \neq 0, S = I$ : It is also possible that a unit uses a part of its income to acquire a tangible asset (machine, real estate, etc.). If all of the unconsumed income is used for acquiring the tangible asset, the increase of net worth is exactly equal to investment.
- $S \neq 0, I \neq 0, S > I$ : This happens if the unconsumed income is partially used for acquiring tangible assets and partially for acquiring financial assets.

- $S \neq 0, I \neq 0, S < I$ : In this case, the acquisition of the tangible asset is partially financed by using the unconsomed part of income, partially by taking out a loan (or decreasing the existing stock of financial assets).
- $S = 0, I \neq 0$ : Finally it is possible that the acquisition of a tangible asset is financed completely by reducing the stock of financial assets or by taking out a loan. In this case the increase of net worth is zero, the increase in tangible assets is positive.

On the level of a single economic units it would indeed be surprising to find a close correlation between increase in net worth (“saving”) and increase in tangible assets (“investment”). But this changes completely when you look at the global level. Normally, an individual decision to save does not lead to an increase of net worth of the economy as a whole. This can be understood if one initially assumes that the individual increase in net worth takes place as an increase of net financial assets – which is the case for most households. If a household increases its net financial assets – be it by reducing its consumption expenditures when income is given or by leaving its expenditures unchanged after an increase of income – its net worth increases but another unit’s net worth decreases, because the increase of a unit’s net financial assets necessarily means the decrease of another unit’s net financial assets. A single unit’s decision to increase its net worth leads to an economy-wide increase net worth only if the second of the above-mentioned cases is realised. On an economy-wide or global level the increase of net worth is determined by the increase of tangible assets, as all changes in net financial assets must sum up to zero.

That the increase of net worth in a closed economy (or in the world) is determined by the increase of tangible assets has nothing to do with using a Keynesian or a neoclassical model but is based on the distinction between a monetary economy and a barter economy. Therefore one has to distinguish strictly between “saving” and “finance”.

It can easily be shown that in a barter economy saving is indeed a precondition for investment. In an economy that does not use money the “investors” (people who acquire newly produced tangible assets) need resources, that is goods provided by “savers”. These goods are either directly used for the production of tangible assets or they are used to remunerate people working in the investment goods industry.

That can be made plain if one assumes the existence of only one good, e.g. corn, that can be both consumed (= eaten) and invested (= sown). In this case an investment, that is sowing of corn, can only be carried out if the firms retain a certain part of production – saving and investment would be identical in this case – or if they borrow a part of the corn that was sold to the consumers (or given to them as remuneration for work). Then households indeed would have to save, that is to restrain from consumption, and to provide the corn not consumed – “saved” – to the firms. But in this case it does not make much sense to say that investment is financed by saving – as financing, as it is understood normally, does not exist here.

Furthermore, in such a barter economy there is no coordination problem between saving and investment and the problem of insufficient aggregate demand due to saving – which is sometimes seen as a synonym for Keynesian thinking – does not exist either, as the households’ income consists of goods; the firm have “sold” these goods *uno actu* when remunerating their

workers. But in a monetary economy remuneration and selling of goods are separate acts, therefore saving in the sense of a reduction of consumption leads to a lower demand for goods. The investor (that is, again, the person producing or buying a newly built tangible asset) does not need resources, but means of payment he can use for buying the necessary inputs and for remunerating the workers. Therefore, the problem of finance consists of getting access to means of payment. This is a problem that has to be clearly distinguished from the problem of the origin of savings (BORIO/DISYATAT 2011, p. 7). But in this case the connections between saving, investment and finance change fundamentally and not only in the short term. This has to be emphasised because the supporters of the loanable fund theory know that we live in a monetary economy, but they limit problems of aggregate demand to the short term; whereas in the long run they argue as if the relations were the same as in a barter economy without the use of money: even if money is used as a medium of exchange it is only a veil covering the real economic processes without changing their essence.<sup>7</sup>

The central point is the following: Whereas in the loanable funds theory saving means the supply of resources the first three meanings that have been explained in section 3.4 do not involve a supply in any meaningful sense. Increase of net worth or increase in net financial assets do not need to imply an action of the unit in question as they can be simply the result of an increase of income with unchanged consumption expenditures. The restriction of consumption is a conscious decision of the unit but even in this case one cannot say that the firms are provided with additional financial means they can use for the financing of additional investment. One has to bear in mind that on a global level financial assets can only be shifted but never increased. A global increase of net worth cannot be effected that way. “Saving” in the sense of restraining consumption which increases the net financial assets of households does not mean that additional financial means are provided for the firms, on the contrary: they are withdrawn. Of course one can imagine that the households lend this financial means to the firms but that does not finance an additional investment but simply restores the firms’ liquidity status before the “saving” decision of households. The banking system does not receive additional means of payment either: if the households had not restrained their consumption, the means of payment would not have flown out of the banking system but simply transferred to the firms’ accounts. Decisions about consumption cannot change the liquidity of the banking system and therefore cannot change the possibilities of providing financial means either.

## 4.2 The Provision of Finance

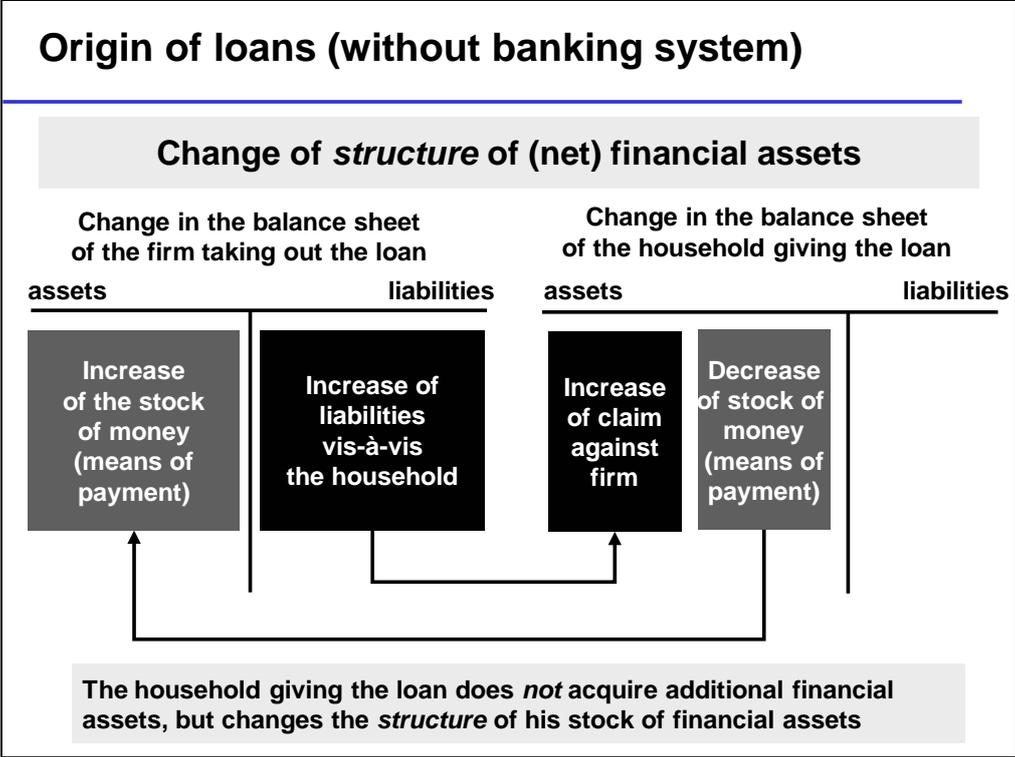
A firm demands additional finance just when other units (households, other firms) plan to increase their net financial assets. But how is this demand for finance (loans) satisfied? The loans given to the firms do not result from the revenue surpluses realised by the households by decreasing consumption (they just create the need for additional finance on the part of the firms) but from the *stock* of financial assets of households or the *creation of credit* by the banks.

Let’s look at the households first (fig. 6): If a household gives a loan to a firm, e.g. by buying a corporate bond, the wealth in the household’s portfolio is regrouped and the firm’s balance

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<sup>7</sup> By referring to several authors, LINDNER (2015, p. 21 f.) shows in his detailed critique of the loanable funds theory that their reference to the long run cannot be sustained and that the coordination problems in a monetary economy also exist in the long run.

sheet is extended. Within the household’s portfolio there is an asset exchange: the stock of currency or the amount of the giro account decreases, the stock of corporate bonds increases. On the part of the firm there is a balance sheet extension: the balance on the firm’s giro account increases but also the liabilities vis-à-vis the household. For both parties, the structure of net financial assets has changed but its level has stayed the same – it is a purely financial transaction.



*Figure 6: Loans by households*  
*Source: author’s presentation*

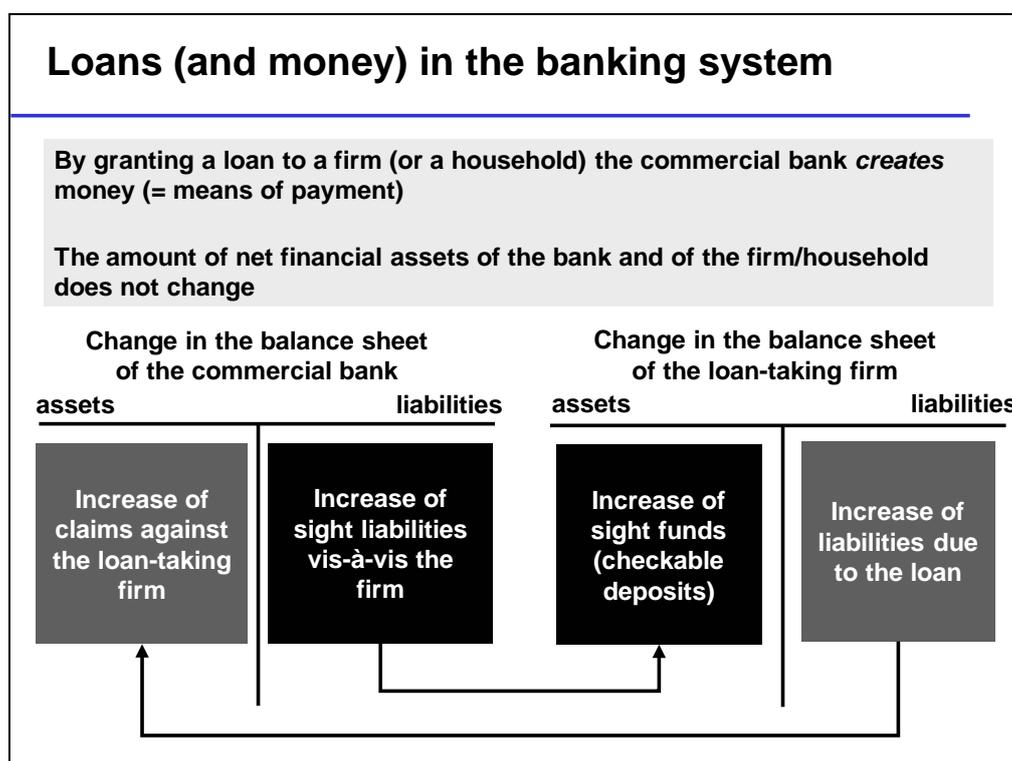
As soon as the firms spend the acquired means of payment for a capital good, ‘saving’ (in the sense of increase of net worth) comes into existence: at first instance as profit in the corporate sector as the purchase of the investment good is an expenditure, but not a cost for the purchasing firm; and for the producer of the investment good the sale is at the same time revenue and yield. Therefore the investment expenditure means a profit for the corporate sector as a whole and therefore – as the retained earnings are the increase of net worth of the corporate sector – corporate ‘saving’. This increase in net worth will not get lost when the producer of the investment good spends the revenues again, e.g. for wage payments.<sup>8</sup> At the moment of the wage payment the firm’s net worth decreases (wage payment is a cost for the firm) whereas the household’s net worth increases. If the household buys consumption goods with his/her income, his/her net worth will decrease while the net worth of the firm the consumption good is purchased from increases etc. All told, it is not ‘saving’ (decrease of consumption) that induces investment, but by carrying out an investment, ‘saving’ (increase of net worth) comes into existence at the same time. Saving of households in terms of increase of net worth or increase of net financial assets

<sup>8</sup> To be sure, in the course of time depreciation will reduce the value of the tangible asset.

is an act concerning distribution. Saving does not decide about the amount of investment (increase of tangible assets) but only about the share the “saving” units economic units receive of the economy-wide increase of net worth coming into existence through investment (LAUTENBACH 1952, p. 34).

When banks give credit (fig. 7) the result is the same for the unit taking out the loan: there is an extension of its balance sheet, as on the one hand he receives additional means of payment and on the other hand he acquires the liability to pay back the loan. For the credit-giving bank there is an important difference to the credit-giving household: its balance sheet is also extended, as on the one hand its claims against the debtor increase, on the other hand its liabilities increase too as it has to credit the borrower’s giro account with the amount of the loan.

As the giro account is used as a means of payment, banks are able to “produce” means of payment that did not exist before giving out the loan. The crucial point is: prior deposits of other customers of the bank are not necessary for giving out loans – on the contrary: by giving credit the deposits arise that are used for payments.<sup>9</sup>



*Figure 7: Credit creation by banks*  
*Source: author’s presentation*

Conclusion: the alleged causality from savings financing investment rests on an equalisation – or better: confusion – of “saving” and “financing”. One has to drop the idea that a household that restrains from consuming part of his income and increases his net financial assets supplies something that is demanded by an investing firm. It is not “saving” in terms of increasing net

<sup>9</sup> MCLEAY/RADIA/KUMHOF (2015) give a detailed overview of the modern process of money creation. JAKAB/KUMHOF (2015) contrast the conventional model of the banking system being just an intermediary – where prior deposits are the precondition for granting loans – with a model where banks possess the power to create money – loans create deposits – and conclude that the latter model has a greater explanatory power for observed monetary developments, especially in connection with the financial crisis.

financial assets what finances investment, but saving CONSISTS OF (or comes into existence *uno actu* with) investment made possible by a financing operation. This financing operation itself is a purely financial transaction.

### 4.3 Saving and Investment in the Open Economy

How does the picture change if an open economy is taken into account? Here we have the following relation that is true by definition:

$$S - I = X - M$$

The difference between domestic saving and domestic investment is equal to the current account balance. This is simply due to the fact that a positive difference between domestic increase of net worth and domestic increase of tangible assets can only come into existence by an increase of domestic net financial assets. But this is possible only – apart from changes in valuation – via a positive current account balance. The question is how this identity is interpreted.

The FELDSTEIN-HORIOKA puzzle arises because the equation is interpreted from left to right: “Savings” arise in the domestic country that can be “invested” either at home or abroad. If domestic “savings” exceed domestic investment, the “savings” have been invested abroad, there is a net capital export and a current account surplus. If the legal or economic impediments to international capital movements are small, the argument goes, one should not observe a close correlation between domestic saving and domestic investment. As it is the case nevertheless – even if alleviated in recent decades – there seem to be strong impediments to international capital movements.

But this interpretation applies only to a barter economy without money or a monetary economy where the emergence or change of monetary balances is precluded by definition for each economic unit.<sup>10</sup> But if the existence of monetary balances is taken into account, the interpretation “from left to right” cannot be sustained.

This can be made clear if one considers the effects of a saving decision of a household. Let’s assume again that a household decides not to consume part of his income but to save it; furthermore, the saving is placed at the disposal of a foreign firm, e.g. by buying a bond of that firm. The firm is assumed to acquire a tangible asset (an investment good) with the proceeds of the issue of the bond. This setting constitutes the Feldstein-Horioka puzzle: the decision to increase its net worth, granting a loan to a foreign country and therefore an international capital movement. But the result of this process would be the following: In the home country, both domestic saving and domestic investment would not have changed, because the increase of net financial assets of one household did necessarily lead to the reduction of financial assets of another unit, e.g. a firm.<sup>11</sup> On a national level, saving in terms of an increase of net worth did not come into existence. The loan given to the foreign firm (= purchase of the foreign bond) did not change the net financial assets of the foreign country: the foreign firm possesses additional means of payment but has also contracted a liability vis-à-vis the domestic lender. Only the production/purchase of the investment good brings foreign investment into existence which is at the

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<sup>10</sup> That means that behavior in lockstep is assumed, as was mentioned in section 3.3

<sup>11</sup> It is assumed that the household does not decrease the consumption of imported goods but of domestic goods.

same time foreign saving – if the investment good has been produced abroad. But despite the international movement of capital (granting a loan to a foreign firm) saving and investment in both countries are perfectly correlated.

The result would be different if the foreign firm uses the loan from the domestic country to buy an investment good from the domestic country. With this purchase, a domestic current account surplus comes into existence that is equivalent with an increase of domestic net financial assets and therefore domestic “saving”. But the chain of causation is exactly reverse: it is not “saving” that comes into existence at first and is then “invested” abroad leading to a current account surplus, but granting the loan to a foreign firm (which is a purely financial transaction changing in no way domestic and foreign “savings”) might lead to a current account surplus; by definition, this current account surplus is part of domestic “savings” (increase of net worth). The central mistake of the FELDSTEIN-HORIOKA puzzle consists of starting with savings as an explanatory variable. On the contrary, the relevant question should be to ask why countries have small or large current account balances which are equivalent with a difference between domestic savings and domestic investment.

So the basic point is: the logic of balance mechanics leads to the conclusion that there is no necessary relation between the mobility of (financial) capital – or, more precisely, the possibility of granting credit and buying and selling securities internationally – and the amount of current account balances. The reason is that most international financial transactions are purely financial transactions that do not change the net worth of any party.

But international transactions, even of a purely financial sort, *can* lead to current account surpluses and deficits. That may also explain the development of the FELDSTEIN-HORIOKA coefficients in figure 2. As the liberalisation of the financial system has it made easier to give and take out loans and carry out financial transactions of any kind it has also become easier to incur and finance current account deficits – without recurring to “savings” in the first place. Within the Euro area several other factors facilitating the emergence current account imbalances might be added:

- the elimination of the nominal exchange rate risk by the introduction of the Euro;
- the misplaced perceptions of risk associated with lending freely to units in the Southern European countries;
- the wage moderation that increased Germany’s competitiveness and increased its export surpluses to so far unprecedented levels (Bofinger 2015a).

Especially the last point can easily be missed if one starts with “savings” and tries to analyse how they drive current account balances.<sup>12</sup>

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<sup>12</sup> That was the case, for example, in an – otherwise very commendable – paper that tries to state a consensus explanation of the crisis: “The current account is, by construction, the difference between the amounts a nation invests and saves. Looking at savings and investment thus provides hints as to the drivers of current account imbalances” (BALDWIN et al. 2015, p. 4).

## 4. Some Remarks Concerning Other Approaches to the Problem

Practically no approaches to the problem in the literature take into account the difference between “saving” and “finance”; furthermore, the saving-investment identity for the open economy is always interpreted causally from “saving” to “investment” and to the current account balance.

One interesting point is that most of the studies do not discuss the data of national income accounting that are used to test alternative hypotheses to explain the correlation. In many studies (e.g. OBSTFELD 1986, BAXTER/CRUCINI 1993) possible differences between the theoretical concept of saving and empirical data are discussed, and quite often one can find discussions of the endogeneity problem<sup>13</sup> that lead to a search for the common factors influencing saving and investment and bringing about the close correlation between the two. But practically never is there an explicit mentioning of the fact that domestic saving as measured by national income accounting *consists* of domestic investment and the current account balance. In the models, saving is always understood in terms of loanable funds or even as goods being available for investment; apparently it is assumed that the saving data of national income accounting conform to the meaning in the model.

NIEHANS (1992) ascribes the close correlation between saving and investment to different transport costs between domestic and foreign transactions. But as the paper’s title makes clear, his considerations also centre around the allocation of “savings” – which have to arise first – to different investment opportunities. OBSTFELD/ROGOFF (2000) rely on the transport costs in goods trade to explain the puzzle (and several other ones). But even if transport costs are relevant for explaining small current account deficits and therefore close saving-investment correlations it is difficult to see why these transport cost seem to have gone down until the 2000s (so that  $\beta$  has decreased) but then up again since 2010 (so that  $\beta$  has increased again since then).

Another attempt to solve the puzzle deals with the internal financing of investment via retained earnings (OBSTFELD/ROGOFF 1996, p. 163). If firms, the argument goes, use retained earnings for financing investment due to restricted access to the capital market then one should observe a close correlation between saving (in terms of retained earnings) and investment.<sup>14</sup> But this argument is dubious in several ways. First, it seems to confuse a partial and a global statement. Even if it true for a single firm that it aligns its investment with its profit (in the sense that the latter determines the former to large degree) this cannot be true as a global statement. Based on the considerations of KALECKI (2003, pp. 45 ff.) corporate profits are determined in the aggregate by corporate investment (and by the government deficit, the current account surplus and the increase of net financial assets on the part of households). Second, profits are not the same as cash flows or net financial assets. Even if the corporate sector reports profit that is not the

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<sup>13</sup> Consider for example DOOLEY/FRANKEL/MATHIESON (1987), p. 505: „Many of the difficulties in interpreting saving-investment correlations arise because national saving and investment ratios are endogenous variables. Thus, the finding in cross-section studies that relatively high saving ratios are associated with relatively high investment ratios may not mean that residents accept lower yields on domestic investments, but that factors that generate relatively high saving ratios in a given country also generate relatively high investment ratios.“

<sup>14</sup> FELDSTEIN/HORIOKA (1980, p. 326) already mentioned that “[g]ross corporate investment appears to most sensitive to gross corporate saving and substantially less sensitive to household and government saving”.

same as having an increase of net financial assets that can be used to finance investments. Positive profits can go hand in hand with a decrease of net financial assets.

Another attempt uses the intertemporal approach to the balance of payments. The basic idea is that a current account deficit cannot go on indefinitely as that would mean a permanently deteriorating net international investment position. Therefore in the short run the correlation between saving and investment might be low but in the long run it should be high, as the current account balance should be zero on average (SINN 1992, p. 1165). There is something to this argument but mobility also refers only to the net flows, not the gross flows. Furthermore, the approach has difficulties to explain why some countries are able to finance current account deficits for a much longer period than other countries, e.g. the USA. To explain that one has to take into account that some currencies are accepted internationally as means of payment so that these countries can use their own currency to finance imports, whereas other countries have to acquire foreign currencies via exports so that their saving and investment ratios are much more correlated than those of countries which enjoy this “exorbitant privilege”.

## 5. Conclusion

This paper has attempted to show that the FELDSTEIN-HORIOKA puzzle is a pseudo problem arising from an unclear conception concerning the differences between “saving” and “finance”. The central point is that there is no contradiction between (financial) capital being highly mobile internationally and a close correlation between domestic saving and domestic investment. A country could finance domestic investment completely by relying on foreign lenders and nevertheless have a balanced current account.

It is correct that a liberalisation of capital markets made it easier to take out loans internationally, and these loans might also be used to finance current account deficits or incur them in the first place. Furthermore, the introduction of the Euro has abolished the nominal exchange rate risk in Europe and might therefore increased international credit relationships; in connection with the misplaced perceptions of risk associated with lending to units in Southern European countries this might have made it easier to build up unsustainable international debtor positions. But it was the higher “elasticity” (BORIO/DISYATAT 2011, p. 24) of the international financial system that led to current account surpluses and deficits which, in turn, showed up as positive and negative differences between domestic saving and domestic investment. It is misplaced to start with savings and try to explain current account imbalances with them.

## Appendix

The following examples – taken slightly adapted from GRASS/STÜTZEL 1988, p. 59 ff. – show the differences between payments, expenditure and cost and between receipts, revenue and yield (seen always from the perspective of a firm; the numbers refer to the numbers in figure 3).

- (1) *Receipt, but no revenue*: This transaction increases the stock of money, but the stock of net financial assets stays the same. Either other financial assets decrease by the same amount as the stock of money increases (asset exchange) or the liabilities increase by the same amount (balance sheet extension). An asset exchange takes place if a firm's customer pays a bill due by bank transfer; this increases the firm's stock of money but the claim against the customer ceases to exist, so net financial assets do not increase. A balance sheet extension takes place if the firm takes out a loan: its stock of money increases as the firm's bank account gets credited with the amount of the loan but at the same time the liabilities of the firm increase by the same amount.
- (2) *Payment, but no expenditure*: This transaction decreases the stock of money, but net financial assets stay the same. That is the opposite of the first transaction: with the decrease of the stock of money other financial assets must increase (asset exchange) or liabilities must decrease by the same amount (balance sheet contraction). An asset exchange takes place if the firm hands out a loan to an employee: the stock of money of the firm decreases but other financial assets of the firm increase by the same amount (claim against the employee for repayment of the loan); a balance sheet contraction takes place if the firm repays a loan due.
- (3) *Revenue, but no yield*: This transaction increases net financial assets, but net worth stays the same. This is possible only by decreasing tangible assets by the same amount. An example would be the sale of a machine at the price it is assessed in the balance sheet (an asset exchange again).
- (4) *Revenue, but no receipt*: This transaction increases net financial assets, but the stock of money stays the same. The sale of a good on account is the classic example: the claims of the firm against the customer increase, but as he has not paid yet, the stock of money stays the same.
- (5) *Expenditure, but no cost*: Net financial assets decrease, but net worth stays the same. This is only possible if tangible assets increase by the same amount as net financial assets decrease, e. g. by purchasing a machine which shows up in the balance sheet at the purchasing price.
- (6) *Expenditure, but no payment*: Net financial assets decrease but the stock of money stays the same. An example is the purchase of inputs on account: the firm's liabilities increase but as there is no immediate payment, the stock of money stays the same.
- (7) *Yield, but no revenue*: Net financial assets stay the same, but net worth increases. This can take place only by an increase in (the value of) tangible assets. It can be the result of a bequest the firm receives or of an increase in the market value of a tangible asset the

firm already possesses, e. g. an increase in the value of property after a change in building laws.

- (8) *Cost, but no expenditure*: This transaction also leaves net financial assets unchanged, but net worth decreases. Therefore, this decrease must result from a decrease of tangible assets. The most important example is depreciation of existing equipment and machinery, which is also called “consumption of fixed capital” in the national accounts.

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