

Balance Sheets, Bail-Outs and Deut 5:19

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1 Introduction

Bail-outs, such as those provided to banks in 2007-9 and to the Greek government on multiple occasions, are a response to insolvency, a response which I argue in this paper could be seen as a subtle form of stealing. Insolvency is certainly a serious problem. When a person (meaning, in this paper, either a natural person or a corporation) is insolvent, there are as a consequence other people who, as things stand, will not be paid what they are owed; and if they feel confident in their position, then their confidence is misplaced.

Insolvency is not a state of flows, the primary area of study in economics, but of stocks, and specifically of debt. Therefore, it is essential to have a reliable economic model of stocks as well as flows, in order to understand the implications of insolvency and possible policy responses. This paper presents a model of both stocks and flows in the economy, which works as a macroeconomic model and does not suffer from the fallacy of composition – the effects at the macroeconomic scale are simply the sum of the effects at the individual scale. The model is then used to analyse the effects of the bail-out of an insolvent corporation.

2 Balance Sheets

We start with balance sheets. Every person, **P**, has:

- a collection of tangible things which they own¹, $\langle T_i^P \rangle$ ²,
- a collection of things which they are owed, $\langle A_i^P \rangle$ ³, and
- a collection of things which they owe, $\langle L_i^P \rangle$ ⁴.

1 Those sceptical of the concept of ownership can treat “ownership of a good” as meaning “having stewardship responsibility” for it. The important point is that the good exists, and that there is a person who has control over how it is used.

2 Angle brackets here represent a list: T_1^P, T_2^P, \dots e.g. P’s car, P’s house, P’s wristwatch, etc.

3 *A* for debt *Asset*.

4 *L* for *Liability*.

In principle we could make a list of all these things for each person in the economy.

$\langle T_i^P \rangle$ and $\langle A_i^P \rangle$ together are P's *assets*, and $\langle L_i^P \rangle$ are P's *liabilities*. They can be shown on a balance sheet for person P, thus:

<i>Balance Sheet for P</i>	
Assets	Liabilities
T_1^P	L_1^P
⋮	⋮
$T_{n_T}^P$	$L_{n_L}^P$
A_1^P	
⋮	
$A_{n_A}^P$	
	Net Worth = $\sum_i T_i^P + \sum_j A_j^P - \sum_k L_k^P$
Total $\sum_i T_i^P + \sum_j A_j^P$	Total $\sum_i T_i^P + \sum_j A_j^P$

This simply lists all of P's assets on one side, and all of P's liabilities on the other. By convention, the totals on both sides of the balance sheet are made equal by adding an entry called *Net Worth* to the liabilities side. Net worth is thus the total assets minus the total liabilities⁵, and shows what the person would be left with if everyone paid all of their debts. I argue in this paper that net worth is a fundamental, and sadly neglected, concept in economics.

Balance sheets usually show an *estimated* money value for each asset and liability, but the model of this paper does not require it. It is the actual assets and liabilities themselves (and the net worth expressed in terms of them) which are essential, and provide the most useful insights.

2.1 A Corporation's Balance Sheet

One of the primary features of a corporation is its ability to own things, be owed things, and owe things, just like a natural person. A corporation, then, has its own balance sheet, and this can generally be found in the corporation's annual report.

The only type of corporation considered in this paper is a limited liability company⁶, which will be abbreviated to just *company* for the remainder of this paper. A company has owners – its shareholders – and once its liabilities are paid, any assets remaining on the company's balance sheet

5 When a person owes only things which they own, their net worth can be simplified e.g. if someone owns a house and two bags of sugar, and owes a bag of sugar to a neighbour, their net worth is a house and *one* bag of sugar. When they owe things which they do not currently own, their net worth cannot be fully simplified until they have acquired what they actually owe – through production, trade, or some other means.

6 Other types of corporation can be modelled too, but there are some differences which would be a distraction here.

belong to them, to be distributed in proportion to the number of shares which each owner holds. This remainder is known as *shareholder equity*, and is modelled here as a debt from the company to its shareholders. It is a liability of the company, and an asset of the shareholders, and it is exactly this which gives the shares their value. Shareholder equity is a constantly changing debt.

Since shareholder equity is a liability of the company which is equal to total assets minus all other liabilities, the net worth of a (solvent) company is always zero⁷.

2.2 Insolvency

A person is *insolvent* if they do not have enough assets to pay all of their liabilities⁸. For example, if a person owns a bicycle and is owed one loaf of bread, but owes a bicycle and three loaves of bread to other people, they are certainly insolvent.

Note that it is impossible for a person to be insolvent without having liabilities, so *any model of the economy which does not take debt into account cannot model the effects of insolvency*. For example, an economic model which ignores debt will not be able to identify a financial bubble in which many people are borrowing in order to buy assets which they need to sell at a higher price in order to repay the loan.

It is not always clear if a person is solvent or insolvent. If they owe things which they do not own, their solvency depends on whether they are able to exchange their current assets for what they owe, which further depends on many factors, such as current market prices, the person's negotiating skills, and chance. This is a complex area, but fortunately the model of this paper provides valuable insights without needing to consider these factors.

In the case of a company, it was stated above that the net worth of a *solvent* company in the model is always zero. However, since the shareholders have limited liability, the shareholder equity can never fall below zero – they cannot be forced to pay any extra into the company to meet the company's liabilities. Since the shareholder equity cannot fall below zero, the net worth of an *insolvent* company is negative.

3 Balance Sheet Aggregation

It can be useful at times to aggregate people into a group, for example when analysing the circular flow of income in the economy. The assets of the group are the aggregate of the individuals' assets, and similarly the liabilities of the group are the aggregate of the individuals' liabilities. It is straightforward to show that the net worth of the group is equal to the sum of the net worths of the individuals. This can be expressed mathematically as:

$$NW(\{P_i\}) = \sum_i NW(P_i)$$

⁷ Because total liabilities, *including* shareholder equity, of a solvent company is equal to total assets.

⁸ Another term for being insolvent is having a negative net worth.

4 Changes in Balance Sheets

The next thing to consider is how and when a person's assets and liabilities are added to, or removed from, their balance sheet. There are exactly seven atomic economic actions⁹ in which these changes to balance sheets occur, three of which relate to the essential economic activities of production, distribution and consumption. The remaining four relate to debts, which are of huge importance in understanding a modern economy, but have not traditionally been as well studied.

Note in particular how each person's net worth changes for each of these actions.

4.1 Produce

Production creates a new good, which is added as an owned asset to the producer's balance sheet.

4.1.1 Example

A farmer harvests some wheat.

4.1.2 Net Worth

The **producer's** net worth **increases** by the good produced.

4.2 Consume

Consumption destroys an existing good, which is removed from the owned assets of the consumer's balance sheet.

4.2.1 Example

A person uses up petrol while driving to the shops.

4.2.2 Net Worth

The **consumer's** net worth **decreases** by the good consumed.

4.3 Transfer Goods

One person, the giver, gives a good to another person, the receiver. The good is removed from the owned assets of the giver's balance sheet, and added to the owned assets of the receiver's balance sheet.

4.3.1 Example

A carpenter, who has made a table, gives it to a shop. (This would usually be part of a transaction in which the shop gives money to the carpenter).

⁹ These actions are the building blocks of all economic activity, but a typical economic transaction consists of two or more of the atomic actions. For example, a debt is usually not written off in isolation, but in exchange for the debtor giving the creditor what was promised.

4.3.2 Net Worth

The **giver's** net worth **decreases** by the good transferred, and the **receiver's** net worth **increases** by the good transferred.

4.4 Create Debt

One person, the debtor, promises to give a good or provide a service to another person, the creditor, in the future. The debt is added to both the liabilities of the debtor and the assets of the creditor.

4.4.1 Example

One person promises to give a bag of sugar to a neighbour next week. (This may be part of a transaction in which the neighbour gives a bag of sugar to the first person today).

4.4.2 Net Worth

The **debtor's** net worth **decreases** by the debt, and the **creditor's** net worth **increases** by the debt.

4.5 Write Off Debt

One person, the creditor, agrees that a debt which was owed to them by another person, the debtor, no longer has to be paid.

4.5.1 Example

A lender agrees to write off half of a borrower's debt as a gesture of goodwill.

4.5.2 Net Worth

The **debtor's** net worth **increases** by the debt, and the **creditor's** net worth **decreases** by the debt.

4.6 Transfer Debt Asset

A debtor owes a debt to a person, the giver. The giver transfers this asset to another person, the receiver. The debt is removed from the assets of the giver, and added to the assets of the receiver.

4.6.1 Example

One person gives a book token to a friend as a present.

4.6.2 Net Worth

The **giver's** net worth **decreases** by the debt, and the **receiver's** net worth **increases** by the debt. The debtor's net worth is unchanged.

4.7 Transfer Liability

One person, the giver, owes a debt to a creditor. Another person, the receiver, agrees to become the debtor of this debt instead of the giver. The debt is removed from the liabilities of the giver, and added to the liabilities of the receiver.

4.7.1 Example

One person takes a friend to a restaurant, offering to pay for both. After they have ordered a meal, the first person is in debt to the restaurant. The first person then realises that they have left their wallet at home and can't pay their debt. The friend agrees to pay the bill.

4.7.2 Net Worth

The **giver's** net worth **increases** by the debt, and the **receiver's** net worth **decreases** by the debt. The creditor's net worth is unchanged.

4.8 Summary of Atomic Economic Actions

This table summarises the 7 atomic economic actions, showing the change in net worth for each person.

Action	ΔNW_A	ΔNW_B	ΔNW_{Total}
Produce good x	+X	-	+X
Consume good x	-X	-	-X
Transfer good x from A to B	-X	+X	0
Create debt x owed by A to B	-X	+X	0
Write off debt x owed by A to B	+X	-X	0
Transfer debt asset x from A to B	-X	+X	0
Transfer liability x from A to B	+X	-X	0

Every transaction which affects any person's balance sheet is composed of a number of these atomic actions. Furthermore, the effects of a transaction on people's balance sheets and net worths is simply the sum of the effects of the individual actions from which it is composed.

4.9 Conclusions

The analysis above provides the following important insights:

1. Total net worth is increased by production;
2. Total net worth is decreased by consumption;
3. *Everything else* leaves total net worth unchanged.

4. Total debt assets are always equal to total liabilities in a closed economy (such as the whole world). There is no such thing as a one-sided debt.

4.10 Changes in Aggregate Balance Sheets

If an economic transaction changes the balance sheets of some individual members of a group, the change in the aggregate balance sheet and net worth for the group is *identical* to the sum of the changes to the individuals' balance sheets and net worths, respectively.

5 A Fundamental Principle of Economics

It is worth emphasising point 3 from above:

In the absence of production and consumption,
Economics is a zero-sum game.

One particularly important example of this is that when prices change solely due to people's changes in willingness to offer one thing for another, there is no change to the world's aggregate net worth. Some people may subsequently be able to get more of what they want in exchange for what they have than they would have before, but the other side of the coin is that the people with whom they trade have to give more of what they have for what they want *by exactly the same amount*.

Similarly, monetary and fiscal policy have no inherent effect on the aggregate net worth of the people in the economy. Decisions on the levels of government taxation and/or spending, on the policy interest rate of the central bank, on what level of reserves commercial banks should keep, and on performing quantitative easing all have a zero-sum effect on the aggregate economy's balance sheet and net worth.

All of these other factors can only affect the aggregate net worth of the whole economy indirectly, by encouraging people to change how much they decide to produce and/or consume.

6 The Model

This paper's model of the economy, then, simply consists of the balance sheets of all people (including corporations). Since it encompasses all actors involved in economic activity, it is a macroeconomic model.

The linearity of both:

- aggregation of balance sheets, and
- composition of actions which change balance sheets

means that *this model does not suffer from a fallacy of composition*: valid conclusions about the whole can be drawn from the individual scale.

7 The Subtle but Crucial Complication of Insolvency

If everyone were always solvent, people could be confident that their net worth represented what they would actually be left with if everyone attempted to settle their debts.

Unfortunately, in reality, people sometimes become insolvent, meaning that some of their promises will not be kept, and people relying on these promises will in fact be worse off than their net worth implies.

7.1.1 Example

Suppose there are three people, called Adam, Bella and Charles.

Adam has 10kg of wheat, and 3 loaves of bread.

He is owed 4 loaves of bread by Charles.

$$\text{Net worth} = 10\text{kg of wheat} + 7 \text{ loaves of bread.}$$

Bella has 5kg of wheat, and 4 loaves of bread.

She is owed 2kg of wheat by Charles.

She owes 1 loaf of bread to Charles.

$$\text{Net worth} = 7\text{kg of wheat} + 3 \text{ loaves of bread.}$$

Charles has 1kg of wheat and 1 loaf of bread.

He is owed 1 loaf of bread by Bella.

He owes 4 loaves of bread to Adam and 2kg of wheat to Bella.

$$\text{Net worth} = -1\text{kg of wheat} - 2 \text{ loaves of bread.}$$

The total resources in this scenario are 16kg of wheat (10 + 5 + 1) and 8 loaves of bread (3 + 4 + 1). Therefore, it is not possible for Adam to be able to have 10 kg of wheat and for Bella to have 7kg of wheat, as suggested by their net worths. It is also not possible for Adam to have 7 loaves of bread and for Bella to have 3 loaves of bread. There simply are not enough resources currently for Adam and Bella to have what their respective net worths imply are due to them. The reason for this is that Charles is insolvent.

7.2 Durability of Insolvency

A person can remain insolvent, perhaps even extraordinarily insolvent, for a very long period of time. If the person's creditors never demand that the debts are repaid, the insolvency can continue in perpetuity. Or if the insolvent person is able to borrow from new people in order to pay existing creditors, the insolvency can continue.

Ultimately, insolvency is only exposed when enough creditors demand that the debts owed to them are paid, and no new creditors can be found.

7.2.1 Paying Debts while Insolvent

A person who is insolvent is typically still able to pay *some* of their debts. They only need to have enough assets to pay those creditors who are demanding payment.

Until a debt is paid, the creditor only has the debtor's promise to pay. After the debt is paid, the creditor is no longer exposed to the risk that the debtor will fail to pay them.

However, while the debtor has fewer liabilities after paying a debt, they also have fewer assets with which to pay their remaining creditors¹⁰. So those creditors who are first to demand payment from an insolvent person will be most likely to get what they were promised, and those who are slowest to demand payment may get nothing, since by that stage the insolvent debtor still has liabilities but no assets with which to pay them.

7.2.2 Example

Continuing the above example, we will see the different outcomes depending on whether Adam or Bella demands payment from Charles first. This table shows the starting point, with tangible assets **T**, debt assets **A**, liabilities **L**, and net worth **NW**.

Person	T	A	L	NW
Adam	10kg wheat 3 loaves	4 loaves (Charles)		10kg wheat 7 loaves
Bella	5kg wheat 4 loaves	2kg wheat (Charles)	1 loaf (Charles)	7kg wheat 3 loaves
Charles	1kg wheat 1 loaf	1 loaf (Bella)	2kg wheat (Bella) 4 loaves (Adam)	-1kg wheat -2 loaves

If Adam demands payment first, Charles cannot pay the 4 loaves because he only has one. He could ask Bella to pay her debt to him to get one more. Suppose also that Adam agrees to take 1kg of wheat instead of 2 loaves. We now have this situation:

Person	T	A	L	NW
Adam	11kg wheat 5 loaves	4 loaves (Charles)		11kg wheat 5 loaves
Bella	5kg wheat 3 loaves	2kg wheat (Charles)	1 loaf (Charles)	7kg wheat 3 loaves
Charles	1kg wheat 1 loaf	1 loaf (Bella)	2kg wheat (Bella) 4 loaves (Adam)	-2kg wheat

Adam ends up with 11kg of wheat and 5 loaves, which he considers a fair exchange for his original net worth of 10kg of wheat and 7 loaves.

¹⁰ This is known as *shrinking the balance sheet*.

Bella, on the other hand, has 5kg of wheat and 3 loaves. She is also owed 2kg of wheat by Charles, but Charles has no assets left, so if Bella demands the wheat, she has no way to obtain it. Even though her net worth implies that she should be given a further 2kg of wheat, there is nothing she can do to make that happen, and she may well have to write off the debt from Charles, leaving her net worth reduced from its original level.

However, if Bella, rather than Adam, demands payment first, the outcome is different. Charles is unable to pay Bella the 2kg of wheat because he only has one. Suppose that Bella agrees to accept 2 loaves instead of 1kg of wheat. Now Charles can pay by giving Bella 1kg of wheat and 1 loaf, and agreeing to write off the debt of 1 loaf from Bella.

Person	T	A	L	NW
Adam	10kg wheat 3 loaves	4 loaves (Charles)		10kg wheat 7 loaves
Bella	6kg wheat 5 loaves	2kg wheat (Charles)	1 loaf (Charles)	6kg wheat 5 loaves
Charles	1kg wheat 1 loaf	1 loaf (Bella)	2kg wheat (Bella) 4 loaves (Adam)	-4 loaves

Now, Bella ends up with 6kg of wheat and 5 loaves, which she considers a fair exchange for her original net worth of 7kg of wheat and 3 loaves.

Adam, on the other hand, has 10kg of wheat and 3 loaves. He is also owed 4 loaves by Charles, but Charles has no assets left, so if Adam demands the loaves, he has no way to obtain them. Even though his net worth implies that he should be given a further 4 loaves, there is nothing he can do to make that happen, and he may well have to write off the debt from Charles, leaving his net worth reduced from its original level.

This example illustrates how creditors of an insolvent person who delay demanding payment of the debts are left with a greater reduction to their net worth than those who demand payment promptly.

7.3 Loss of Confidence and Bankruptcy

An insolvent debtor can continue to operate as though solvent for as long as creditors (or potential creditors) have sufficient *confidence* in being able to receive payment from the debtor.

When a creditor loses confidence in the debtor's solvency, this benefit of being first to demand payment gives them an incentive to do so, particularly if they have reason to believe that *other* creditors are also not confident in the debtor's solvency. This can lead to a rush by creditors to demand payment, which *tests* the debtor's solvency, although it does not actually affect whether they have enough assets to pay their liabilities¹¹.

11 It can affect the debtor's solvency to *some* extent, because they have less time to obtain a good deal on obtaining what they owe in terms of their existing assets. This situation is known as a *fire sale*. The more liquid the market for their assets, the less likely they are to become insolvent as a result of a fire sale.

If the debtor was in fact solvent, they will prove their solvency by paying all of the creditors. But if the debtor was insolvent, as the creditors suspected, those creditors who demanded payment last will not get paid what they were owed.

Bankruptcy law may affect how the assets of the debtor are distributed amongst the creditors. For example, a creditor who receives payment in full *shortly before* the debtor becomes bankrupt may have to return some of what they were paid, so that the assets are distributed according to the applicable laws. Bankruptcy law may also prevent the creditors from receiving a distribution for a limited time, allowing the debtor's assets to be exchanged for what is owed to the creditors at a better rate. Under bankruptcy law, it may also be that when the debtor has paid as much of their total liabilities as they can from their existing assets, the debts are written off at the creditors' expense.

However, if a creditor receives payment substantially before the debtor becomes bankrupt, it is likely that they will retain the complete amount.

In summary, loss of confidence in a debtor causes shrinking of the debtor's balance sheet, and demonstrates whether the debtor was solvent or not, and therefore whether the creditors will be paid in full or not. Bankruptcy laws may prevent creditors from receiving what was owed to them either for some time, or ever. But creditors who manage to receive payment early will not suffer any losses i.e. their net worth is maintained. The remaining creditors will have the losses shared amongst them.

8 Bailing Out an Insolvent Corporation

This final section uses a fictional example of a bank becoming insolvent in the fictional country of Woodlia (population 20,000) to show the effects on different groups' aggregate balance sheets and net worths at each stage, including when various alternative approaches are used to bail out the bank¹².

The first subsection will show how the insolvency occurs, then each subsequent subsection will show the results of either leaving the bankruptcy process to occur or of a different government bail-out approach.

8.1 Up to Insolvency

Arthur Tophat decides to set up First Bank of Woodlia to specialise in lending for speculative buying. Tulips are particularly popular in this scenario.

Typical tulips have risen in price from £5,000 to £10,000 in recent years, as more people have been joining in the speculation.

There are 2,000 people who want to borrow to buy tulips, and 2,000 people who want to sell. 20 of the sellers (group S1) are well-connected politically. The other 1,980 (group S2) are not. 1,000 of

¹² In order to save space, at each stage, only those groups whose balance sheets have changed will be shown.

the buyers, group BAR, are asset-rich (they own houses worth over £10,000 each), and the other 1,000, group BAP, are asset-poor (they have no other assets).

The other groups to be considered are the government, and everyone else.

8.1.1 Setting up the Bank

Mr Tophat invests £2,000,000 of cash in his new bank¹³.

Group	ΔT	ΔA	ΔL	ΔNW
Mr Tophat	-	-£2M cash +£2M equity	-	+£2M equity -£2M cash
Bank	-	+£2M cash	+£2M equity	+£2M cash -£2M equity

8.1.2 New Loans

The bank lends £10,000 to each of the buyers, for a total of £20 million¹⁴.

Group	ΔT	ΔA	ΔL	ΔNW
Bank		+£20M loans	+£20M deposits	+£20M loans -£20M deposits (≈ 0)
BAR		+£10M deposits	+£10M loans	+£10M deposits -£10M loans (≈ 0)
BAP		+£10M deposits	+£10M loans	+£10M deposits -£10M loans (≈ 0)

8.1.3 Borrowers Buy Tulips

The borrowers write cheques to the tulip sellers for the tulips, and the sellers, who also have accounts with First Bank of Woodlia, pay in the cheques. The £20 million of deposits now belong to the sellers.

Group	ΔT	ΔA	ΔL	ΔNW
BAR	+1,000 tulips	-£10M deposits		+1,000 tulips -£10M deposits
BAP	+1,000 tulips	-£10M deposits		+1,000 tulips -£10M deposits

¹³ This is loss-absorbing capital. It ensures that losses up to this value only affect shareholders, not creditors.

¹⁴ A bank does not need all of this amount in cash in order to make a loan. It creates a deposit entry in the borrower's account, which the borrower can exchange for cash if they desire. The deposit is a debt from the bank to the deposit holder.

Group	ΔT	ΔA	ΔL	ΔNW
S1	-20 tulips	+\pounds200K deposits		+\pounds200K deposits -20 tulips
S2	-1,980 tulips	+\pounds19.8M deposits		+\pounds19.8M deposits -1,980 tulips

8.1.4 Tulip Bubble Pops

At this point, nobody is prepared to pay \pounds10,000 for tulips any more, and the price drops back to \pounds5,000.

Group	ΔT	ΔA	ΔL	ΔNW
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Notice that a change in price has no effect on anybody's net worth. Everybody owns, owes, and is owed exactly the same as before the change in price.

However, some people will find that they can get more of what they want in exchange for what they have, and others may get less. This can therefore affect people's solvency, and in this case does have a dramatic effect on the solvency of the borrowers in group BAP.

The asset-poor borrowers, in group BAP, started with no assets and no liabilities. Here is their aggregate balance sheet at this point:

Aggregate Balance Sheet for group BAP

Assets	Liabilities
1,000 tulips	\pounds10M loans
	Net Worth = \pounds10M loans - 1,000 tulips
Total 1,000 tulips	Total 1,000 tulips

Each has 1 tulip, and owes \pounds10,000 to the bank. But the tulip can now only be exchanged for \pounds5,000. Having no other assets, they are unable to pay all of their liabilities and are therefore insolvent.

As we saw in section 7, when a person is insolvent, someone else will be worse off than their net worth implies. The remainder of this section examines how these losses are allocated depending on the results of different government actions or inaction.

8.2 Option 1 – Hands Off Policy

In this case, the government just allows normal bankruptcy proceedings to occur, in order to decide the result.

8.2.1 Borrowers Go Through Bankruptcy

The borrowers go through bankruptcy proceedings. They are required to sell their assets, pay as many of their debts as possible, and their remaining debts are written off.

Assume that they sell their tulips to people in group S2, each in exchange for £5,000 of bank deposits.

Group	ΔT	ΔA	ΔL	ΔNW
BAP	-1,000 tulips	+£5M deposits		+£5M deposits -1,000 tulips
S2	+1,000 tulips	-£5M deposits		+1,000 tulips -£5M deposits

They then pay what they can to the bank:

Group	ΔT	ΔA	ΔL	ΔNW
Bank		-£5M loans	-£5M deposits	+£5M deposits -£5M loans
BAP		-£5M deposits	-£5M loans	+£5M loans -£5M deposits

Finally, their remaining debts are written off:

Group	ΔT	ΔA	ΔL	ΔNW
Mr Tophat		-£2M equity		-£2M equity
Bank		-£5M loans	-£2M equity	+£2M equity -£5M loans
BAP			-£5M loans	+£5M loans

This stage is clearly an unambiguous loss for the bank. Here is the bank's balance sheet before the debts are written off:

Balance Sheet for First Bank of Woodlia (before loan write-off)

Assets	Liabilities
£2M cash £15M loans	£15M deposits Shareholder equity \approx £2M¹⁵ Net Worth = 0
Total £2M cash + £15M loans	Total £2M cash + £15M loans

And here is the bank's balance sheet after the debts are written off:

Balance Sheet for First Bank of Woodlia (after loan write-off)

Assets	Liabilities
£2M cash £10M loans	£15M deposits Shareholder equity = 0 Net Worth \approx -£3M¹⁶
Total £2M cash + £10M loans	Total £2M cash + £10M loans

Shareholder equity has reduced from £2 million to 0, so this is a loss of £2 million to Mr Tophat, whose shares, previously worth £2 million, are now worthless.

However, since the bank only had £2 million of capital (equity) to absorb losses, and the losses exceeded this, the bank itself is now insolvent, and must be resolved.

8.2.2 Bank Goes Through Bankruptcy

The bank goes through bankruptcy proceedings. It is required to sell off its assets, pay as many of its debts as possible, and its remaining debts are written off. If the bank cannot sell off its assets immediately, for example if no other bank is prepared to buy the loans owed to it, then an administrator appointed by the bankruptcy court can run a shell of the bank with a very small staff until all the debts are finally settled. The administrator may give the bank's creditors an indication of how much of what the bank owes them they should expect to receive.

In this case, since the bank owes its creditors £15 million, but it only has assets of £12 million, the administrator would tell creditors to expect to receive 80% of what is owed to them. £3 million of the deposits are written off:

¹⁵ The true shareholder equity is £2M cash + £15M loans - £15M deposits.

¹⁶ The true net worth is £2M cash + £10M loans - £15M deposits

Group	ΔT	ΔA	ΔL	ΔNW
Bank			-£3M deposits	+£3M deposits
S1		-£40K deposits		-£40K deposits
S2		-£2.96M deposits		-£2.96M deposits

The bank, in administration, now has just enough assets to pay its liabilities, and we assume that this eventually happens.

8.2.3 Option 1 Summary

As a result of the hands off approach by government, the losses are distributed as follows:

- Mr Tophat's net worth is reduced by £2 million of shareholder equity
- Group S1's net worth is reduced by £40,000 of deposits (£2,000 each).
- Group S2's net worth is reduced by £2.96 million (~£1,494 each).

8.3 Option 2 – Government Donation to Bank

For this option, the government simply donates £3 million of cash to the bank before the borrowers default, so that the bank remains (just) solvent, and so all of the bank's creditors can be paid in full. This table shows the effects of the government donating £3 million of cash to the bank:

Group	ΔT	ΔA	ΔL	ΔNW
Bank		+£3M cash		+£3M cash
Government		-£3M cash		-£3M cash

This is a loss for the government, which now has £3 million less to spend on public services.

8.3.1 Option 2 Summary

Compared to the "hands off" option 1, the differences are:

- The creditors of the bank, who would have lost 20% of their deposits, receive the full amount.
- The government has £3 million less to spend on public services.

The decision by the government to transfer £3 million of cash to the bank in order to prop it up ends up being a simple transfer of £3 million to the creditors of the bank.

8.4 Option 3 – Buy Shares in Bank

Instead of donating £3 million cash to the bank, the government could use £3 million cash to buy shares in the bank instead. Since the bank originally had £2 million of equity, the government might obtain an equity share equal to:

$$\frac{3 \text{ million}}{2 \text{ million} + 3 \text{ million}} \times 100\% = 60\%$$

Consider the effects on the various groups' balance sheets before the borrowers default:

Group	ΔT	ΔA	ΔL	ΔNW
Bank		+£3M cash	+£3M equity	+£3M cash -£3M equity
Government		-£3M cash +£3M equity		+£3M equity -£3M cash

When the borrowers default, the changes to balance sheets are as follows:

Group	ΔT	ΔA	ΔL	ΔNW
Mr Tophat		-£2M equity		-£2M equity
Bank		-£5M loans	-£5M equity	+£5M equity -£5M loans (≈ 0)
BAP			-£5M loans	+£5M loans
Government		-£3M equity		-£3M equity

The result is *identical* to option 2. The government exchanged £3 million of cash for £3 million of equity in the bank, but the equity was then wiped out by the defaults, leaving the government with nothing in exchange for the £3 million of cash provided to the bank. The bank is (just) solvent, so it can pay all of its liabilities.

8.4.1 Option 3 Summary

Compared to the “hands off” option 1, the differences are:

- The creditors of the bank, who would have lost £3 million (20% of their deposits), receive the full amount.
- The government has £3 million less to spend on public services.

The decision by the government to buy £3 million of equity in the bank in order to prop it up ends up being a simple transfer of £3 million to the creditors of the bank.

8.5 Option 4 – Good Bank / Bad Bank Split

Before the borrowers go through bankruptcy, the government could split the bank into two banks, putting the impaired loans into the “bad bank”, so that the original bank can continue with a healthy balance sheet. The government gives initial capital to the bad bank in exchange for equity, and the bad bank buys the loans at below face value so that the good bank takes a pre-determined, but limited, share in the eventual losses.

8.5.1 Government Sets up Bad Bank

Suppose that the government gives £10 million to the bad bank in exchange for equity:

Group	ΔT	ΔA	ΔL	ΔNW
Bad Bank		+£10M cash	+£10M equity	+£10M cash -£10M equity
Government		+£10M equity -£10M cash		+£10M equity -£10M cash

This is almost identical to Mr Tophat capitalising First Bank of Woodlia.

8.5.2 Bad Bank Buys Impaired Loans from Good Bank

Here is the balance sheet of the bank before the borrowers go through bankruptcy.

Balance Sheet for First Bank of Woodlia (before borrowers' bankruptcy)

Assets	Liabilities
£2M cash	£20M deposits
£10M loans (BAR)	
£10M loans (BAP)	
	Shareholder equity \approx £2M¹⁷
	Net Worth = 0
Total £2M cash + £20M loans	Total £2M cash + £20M loans

The bad bank buys the loans to group BAP, who owe £10 million to First Bank, for £9 million.

¹⁷ The true shareholder equity is £2M cash + £15M loans - £15M deposits.

Group	ΔT	ΔA	ΔL	ΔNW
Mr Tophat		-£1M equity		-£1M equity
Bank		+£9M cash -£10M loans	-£1M equity	+£9M cash +£1M equity -£10M loans
Bad Bank		+£10M loans -£9M cash	+£1M equity ^(*)	+£10M loans -£9M cash -£1M equity ^(*)
Government		+£1M equity ^(*)		+£1M equity ^(*)

^(*) The shareholder equity in the bad bank is shown as having increased by £1 million, but strictly speaking, it has decreased by £9 million of *cash* and increased by £10 million of (*impaired*) *loans*. Since these loans are not expected to be paid in full, the increase of £1 million is misleading.

Normally a bank would add a liability called a provision for bad debt, which accounts for the difference between the nominal value of the loan and the amount which the bank expects will actually be repaid. The provision is removed from the accounts when the debt is either paid or defaulted. The purpose of the provision is simply to give a more realistic estimated value for equity.

8.5.3 Borrowers Default

Now the borrowers in group BAP go through bankruptcy. As in section 8.2.1, they are required to sell their assets, pay as many of their debts as possible, and their remaining debts are written off.

Again, assume that they sell their tulips to people in group S2, each in exchange for £5,000 of bank deposits.

Group	ΔT	ΔA	ΔL	ΔNW
BAP	-1,000 tulips	+£5M deposits		+£5M deposits -1,000 tulips
S2	+1,000 tulips	-£5M deposits		+1,000 tulips -£5M deposits

Suppose that the bad bank doesn't have an account with the good bank, so the BAP group need to pay the bad bank's loans with cash. They first withdraw their desopits:

Group	ΔT	ΔA	ΔL	ΔNW
Bank		-£5M cash	-£5M deposits	+£5M deposits -£5M cash
BAP		+£5M cash -£5M deposits		+£5M cash -£5M deposits

They then pay the cash to the bad bank:

Group	ΔT	ΔA	ΔL	ΔNW
Bad Bank		+£5M cash -£5M loans		+£5M cash -£5M loans
BAP		-£5M cash	-£5M loans	+£5M loans -£5M cash

Finally, their remaining debts are written off:

Group	ΔT	ΔA	ΔL	ΔNW
Bad Bank		-£5M loans	+£5M equity	+£5M equity -£5M loans
BAP			-£5M loans	+£5M loans
Government		-£5M equity		-£5M equity

This stage is clearly an unambiguous loss for the bank, and therefore for the government. Here is the bad bank's balance sheet before the debts are written off:

Balance Sheet for Bad Bank of Woodlia (before loan write-off)

Assets	Liabilities
£6M cash £5M loans (BAP)	Shareholder equity \approx £11M¹⁸ Net Worth = 0
Total £6M cash + £5M loans	Total £6M cash + £5M loans

And here is the bank's balance sheet after the debts are written off:

Balance Sheet for Bad Bank of Woodlia (after loan write-off)

Assets	Liabilities
£6M cash	Shareholder equity = £6M Net Worth = 0
Total £6M cash	Total £6M cash

¹⁸ The true shareholder equity is £6M cash + £5M loans.

Shareholder equity was £10 million originally, so overall there has been a loss of £4 million to the government.

8.5.4 Option 4 – Summary

As a final result of option 4, the losses are distributed as follows:

- Mr Tophat’s net worth is reduced by £1 million of shareholder equity
- The government’s net worth is reduced by £4 million.

Compared to the “hands off” option 1, the differences are:

- Mr Tophat’s net worth is £1 million higher.
- The government’s net worth is £4 million lower.
- Group S1’s net worth is increased by £40,000 of deposits (£2,000 each).
- Group S2’s net worth is increased by £2.96 million of deposits (~£1,494 each).

8.6 Option 5 – Lend to the Bank

In an attempt to restore people’s *feeling* of confidence in the bank, the government could make a £3 million loan to the bank for a period of time, say 2 years, giving itself the highest priority for repayment in bankruptcy¹⁹.

The immediate effects of the loan are as follows:

Group	ΔT	ΔA	ΔL	ΔNW
Bank		+£3M cash	+£3M senior debt	+£3M cash -£3M senior debt
Government		-£3M cash +£3M senior debt		+£3M senior debt -£3M cash

When the borrowers default, the changes to balance sheets are as follows:

Group	ΔT	ΔA	ΔL	ΔNW
Mr Tophat		-£2M equity		-£2M equity
Bank		-£5M loans	-£2M equity	+£2M equity -£5M loans
BAP			-£5M loans	+£5M loans

Here is the bank’s balance sheet before the debts are written off:

¹⁹ In practice, this is very similar to guaranteeing the bank’s liabilities for a period of time.

Balance Sheet for First Bank of Woodlia (before loan write-off)

Assets	Liabilities
£5M cash	£15M deposits
£15M loans	£3M senior debt
	Shareholder equity \approx £2M²⁰
	Net Worth = 0
Total £5M cash + £15M loans	Total £5M cash + £15M loans

And here is the bank's balance sheet after the debts are written off:

Balance Sheet for First Bank of Woodlia (after loan write-off)

Assets	Liabilities
£5M cash	£15M deposits
£10M loans	£3M senior debt
	Shareholder equity = 0
	Net Worth \approx -£3M²¹
Total £5M cash + £10M loans	Total £5M cash + £10M loans

The bank is insolvent. However, the government hopes that the additional £3 million of cash placed in the bank will give the bank's creditors a *feeling* of confidence so that they do not demand withdrawals of their deposits, and there will not be enough pressure to force the bank through bankruptcy. The bank is allowed to continue to operate while insolvent, in the hope that the bank will become solvent again later²².

8.6.1 Some Creditors Withdraw Deposits

Assume that the people in group S2 feel confident enough to leave their deposits in place, but that the people in group S1, who understand the situation better, use this opportunity to withdraw their deposits as cash:

²⁰ The true shareholder equity is £2M cash + £15M loans - £15M deposits.

²¹ The true net worth is £2M cash + £10M loans - £15M deposits

²² This approach is sometimes known as "extend and pretend", or "delay and pray".

Group	ΔT	ΔA	ΔL	ΔNW
Bank		-£200K cash	-£200K deposits	-£200K cash +£200K deposits (≈ 0)
S1		+£200K cash -£200K deposits		+£200K cash -£200K deposits (≈ 0)

8.6.2 Government Loan is Withdrawn

Suppose, two years later, when the loan is due to the government, that nothing has changed to the bank's situation. The loan to the government is repaid:

Group	ΔT	ΔA	ΔL	ΔNW
Bank		-£3M cash	-£3M senior debt	-£3M cash +£3M senior debt
Government		+£3M cash -£3M senior debt		-£3M senior debt +£3M cash

Now, the balance sheet of the bank looks like this:

Balance Sheet for First Bank of Woodlia (after repaying government)

Assets	Liabilities
£1.8M cash £10M loans	£14.8M deposits Shareholder equity = 0 Net Worth \approx -£3M²³
Total £1.8M cash + £10M loans	Total £1.8M cash + £10M loans

The government now uses a hands-off approach, and a run on the bank ensues, leading to bankruptcy. As in option 1, the administrator gives the bank's creditors an indication of how much of what the bank owes them they should expect to receive.

In this case, since the bank owes its creditors £14.8 million, but it only has assets of £11.8 million, the administrator would tell creditors to expect to receive about 79.7% of what is owed to them. £3 million of the deposits are written off:

²³ The true net worth is £2M cash + £10M loans - £15M deposits

Group	ΔT	ΔA	ΔL	ΔNW
Bank			-£3M deposits	+£3M deposits
S2		-£3M deposits		-£3M deposits

The bank, in administration, now has just enough assets to pay its liabilities, and we assume that this eventually happens.

8.6.3 Option 5 Summary

As a final result of option 5, the losses are distributed as follows:

- Mr Tophat's net worth is reduced by £2 million of shareholder equity
- Group S2's net worth is reduced by £3 million (~£1,515 each).

Compared to the "hands off" option 1, the only differences are:

- Group S1's net worth is £40,000 higher (£2,000 each).
- Group S2's net worth is £40,000 lower (~£20 each).

By delaying the recognition of the bank's insolvency, it allowed one group of creditors to avoid the losses which they would otherwise have incurred, and this was at the expense of the other creditors. Since the debts owed to them were paid long before bankruptcy, they are unlikely to be clawed back.

8.7 Summary of All Approaches

It is important to note that, whatever approach was taken by government, there was a loss of £5 million to be distributed when the BAP group did not have the ability to pay their debts. The government does not have the ability to make these debts be paid – it can only decide or influence who will suffer the losses.

If the government chooses to do something other than following bankruptcy law when a corporation is insolvent, it is therefore effectively taking wealth from one group of people in order to give it to another group.

9 Thou Shalt Not Steal

Deuteronomy 5:19 is the commandment not to steal. The Collins English Dictionary defines the word *steal* this way:

steal (...) vb. 1. to take (something) from (someone, etc.) without permission or unlawfully, esp. in a secret manner. (...)

Compare this to any decision by a government to bail out a corporation instead of following bankruptcy law:

1. As we have seen, it effectively takes from one group of people to give to another group.
2. It is done without the permission of those whose wealth will suffer as a result.
3. It is not following the laws enacted for this situation.
4. It is done in such a way that very few people can understand what is happening i.e. in a secret manner.

I therefore conclude that the bail-out of banks in 2008-9 was a clear example of the breach of God's commandment, "Thou shalt not steal".

The situation is particularly suspect if the beneficiaries of a bail-out were influential in advising the government on its bail-out policies.

9.1 Sovereign Bail-Outs

In a sovereign bail-out, a group of nations' governments, together with institutions which they control, typically makes loans to another nation's insolvent government. This is very similar to bank bail-out options 3 or 4. In effect, the lending governments reduce their own net worth, thereby decreasing their ability to provide public services, in order to increase the net worth of the creditors of the insolvent government, such as banks and hedge funds which bought government bonds from the insolvent governments. The insolvent government simply acts as a conduit for the transfer of wealth from the bailing-out governments to the existing creditors of the insolvent government.

10 Summary

This paper set out to demonstrate the attractive features of a novel macroeconomic model, consisting of the balance sheets of all people (including corporations) in the economy, particularly its linearity and therefore its ability to analyse complex scenarios. The hope is that it will be developed and used by other economists to gain insights into a number of economic questions.

The model demonstrates clearly that production adds to net worth, consumption subtracts from net worth, and *anything else*, including changes in prices, tastes, and policies, is a zero-sum game.

One key illustration of the model is that it is a person's *net worth* which allows them to trade with other people. In exchange for what they want, they can offer:

- something which they own,
- something which they are owed, or
- a new debt.

Finally, as one example, the model was used to analyse a number of different options available to governments in response to actual or pending insolvency, and to demonstrate through examining the changes in the participants' balance sheets that any decision by government not to follow bankruptcy law amounted to a secretive redistribution of wealth, which I conclude amounts to stealing.