Preliminary. Comments welcome.

Resilience, Debt, and Net Worth: Has Resilience Increased with Higher Debt-to-Income Ratios?*

Lars E.O. Svensson

SIFR – The Institute for Financial Research, Swedish House of Finance,
Stockholm School of Economics
and
The Institute for International Economic Studies, Stockholm University

Web: larseosvensson.se

First draft: November 2012
This version: January 2014

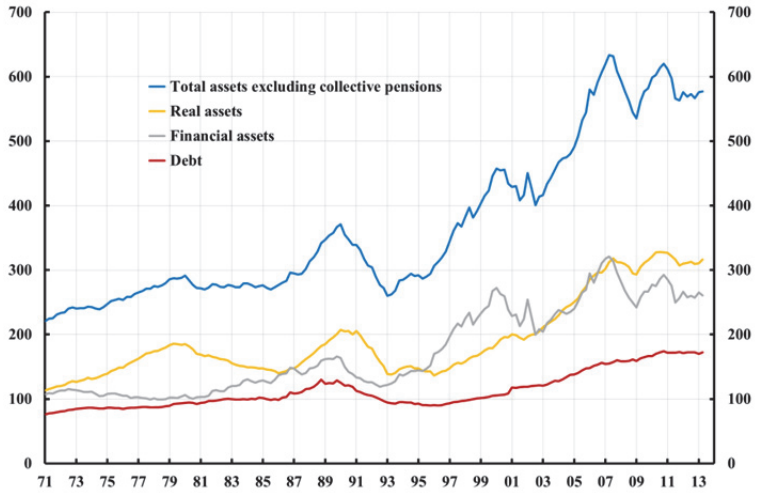
Abstract

Since 1995, Swedish households' debt has risen from about 90 percent of disposable income to about 170 percent and hence almost doubled. Many, including the Riksbank, conclude that this has made the households more vulnerable to disturbances. But at the same time, real and financial assets and net worth have approximately doubled. Total assets and net worth are now about 580 percent and 410 percent of disposable income, respectively. This doubling of assets and net worth should contribute to households' being more resilient to disturbances. This short paper argues that a doubling of the average Swedish household's balance sheets actually increases resilience, rather than reduces it. Generally, a richer household is more resilient than a poorer one.

* I thank Robert Boije, Kerstin Hallsten, Per Jansson, Martin W. Johansson, Kristian Jönsson, Anil Kashyap, Anders Vredin, and Staffan Viotti for helpful comments and discussions. The views expressed and any errors are my own responsibility.

Since 1995, Swedish households' debt-to-income ratio has risen substantially, as seen in figure 1, from about 90 percent in the mid-1990s to about 170 percent in 2013. Many, including the Riksbank in its publications, but also the IMF and the OECD, conclude that this has made Swedish households' more vulnerable and less resilient towards various disturbances. However, as also seen in figure 1, households' real assets (owner-occupied houses, condominiums, and summer homes), financial assets (excluding collective pensions), and total assets (the sum of real and financial assets, hence excluding collective pensions) have risen roughly in proportion to the debt.

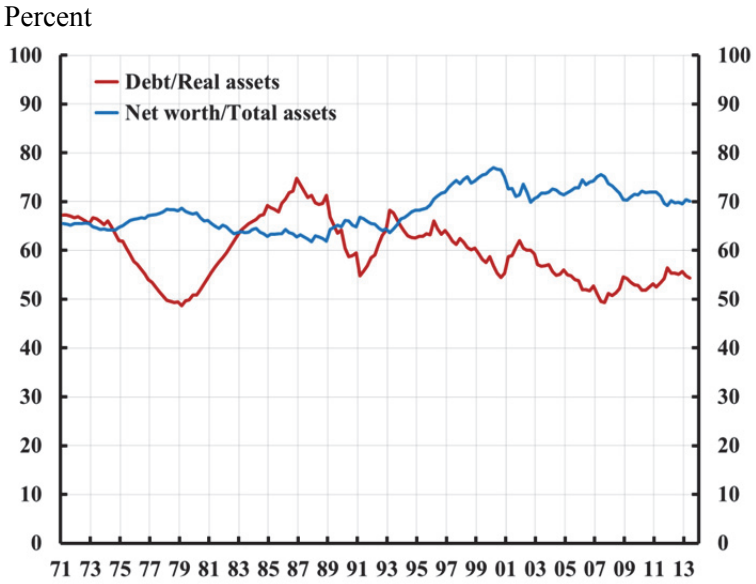
Figure 1. Household assets and debt, ratio to disposable income
Percent



Source: The Riksbank and Statistics Sweden

Figure 2 shows that debt to real assets has fallen since the mid-1980s and fluctuated in the 50-60 percent range in the last 15 years. The figure also shows that net worth to total assets has increased somewhat since the mid-1990s and has fluctuated in the 70-75 percent range in the last 15 years. The strongest listed companies in Sweden have a capital-to-assets ratio of around 60-70 percent. The Swedish banks have capital-to-assets ratios of around 3-4 percent.

Figure 2. Household debt, ratio to real assets



Source: The Riksbank and Statistics Sweden

We would probably all agree that, when debt rises and assets are unchanged, so net worth falls, households' resilience to disturbances falls. We would also probably agree that, when debt is unchanged but assets rise, so net worth rises, households' resilience increases. It follows that, when households' assets and net worth rise in proportion to their debt, it is not obvious that resilience falls. When net worth rises relative to disposable income, might not resilience increase? This note looks into this issue and concludes that an increase of the balance sheets of Swedish households in the form of a proportional increase of debt, assets and net worth relative to disposable income probably *increases* rather than decreases resilience to disturbances – at least for the two disturbances considered here, namely a fall in housing prices and a temporary fall in disposable income.

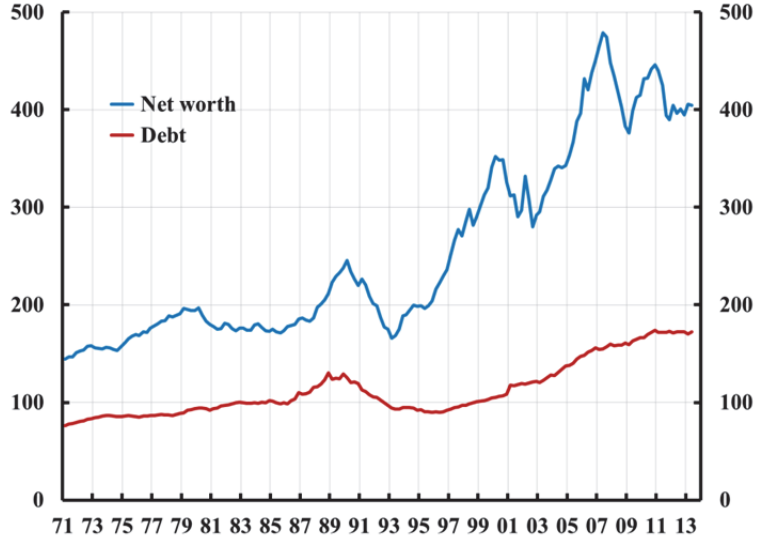
A possible resilience index

Let the *total-assets ratio* denote the ratio of households' total assets to disposable income, let the *debt ratio* denote the ratio of households' debt to disposable income, and let the *net-worth ratio* denote the ratio of households' net worth to disposable income (where, as specified above, net worth is total assets less debt). Let *resilience* denote households' resilience to various disturbances. One might assume that resilience falls if, for a constant total-assets ratio, the debt ratio rises, and that resilience rises if, for a constant debt ratio, the total-assets ratio rises. Then one might conclude that the net-worth ratio could be an appropriate measure of resilience, putting a weight of plus 1 on the total-assets ratio and a weight of minus 1 on the debt ratio. However, let me be more conservative and assume that resilience falls if, for a constant net-worth ratio (rather than for a constant total-assets ratio), the debt ratio rises. That is, if the debt ratio rises, resilience falls even if total assets rise to keep the net-worth ratio constant.

In line with this, let the *resilience index* denote the difference between the net-worth ratio and the debt ratio. The resilience index then equals the total-assets ratio less twice the debt ratio, putting a weight of minus 2 on the debt ratio against the weight of plus 1 on the total-assets ratio. Figure 3 shows

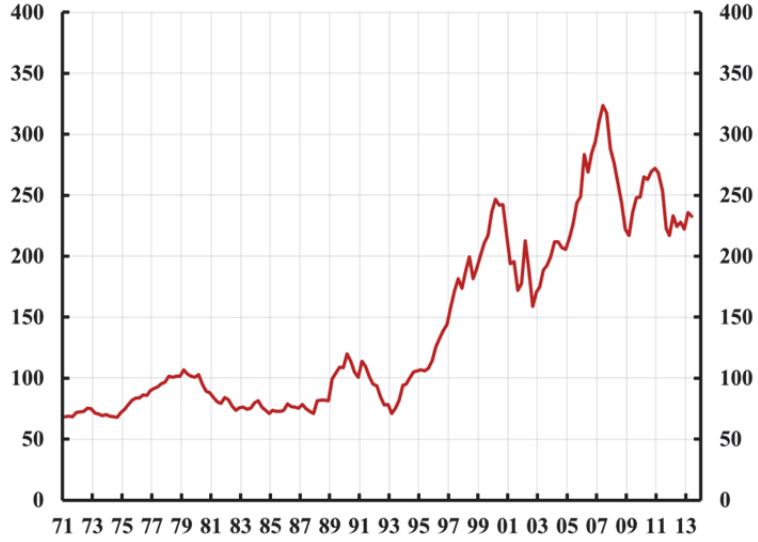
Swedish households' net-worth and debt ratios, and figure 4 shows households' the resilience index – their net-worth ratio less the debt ratio.

Figure 3. Households' net worth and debt, ratios to disposable income
Percent



Source: The Riksbank and Statistics Sweden

Figure 4. Households' resilience index – the net-worth ratio less the debt ratio
Percent



Source: The Riksbank and Statistics Sweden

Consider now a first household, called household 1, an average household with a balance sheet, expressed in terms of ratios to disposable income, approximately equal to the average balance sheet of Swedish households today according to figure 1. Household 1 then has debt equal to 1.7 times disposable income, real assets equal to 3.2 times disposable income, almost double the debt, financial assets at about 2.6 times disposable income, and total assets about 5.8 times disposable income. The balance sheet is shown in table 1.

Table 1. Balance sheet of household 1, an average Swedish household today, ratio to disposable income

Assets		Liabilities	
Real assets	3.2	Debt	1.7
Financial assets	2.6	Net worth	4.1
Total	5.8	Total	5.8

Consider also a second household, called household 2, with a balance sheet in which all items have doubled relative to disposable income; see table 2.

Table 2. Balance sheet of household 2, with double-sized balance sheet, ratio to disposable income

Assets		Liabilities	
Real assets	6.4	Debt	3.4
Financial assets	5.2	Net worth	8.2
Total	11.6	Total	11.6

Which of these households is more resilient? Household 1 has a resilience index equal to the net-worth ratio 4.1 minus the debt ratio 1.7, that is, a resilience index of 2.4. Household 2 has a resilience index equal to the net-worth ratio 8.2 less the debt ratio 3.4, that is, a resilience index of 4.8. According to the resilience indices, household 2 is more resilient to disturbances than household 1. Does this make sense?

Intuitively, it makes sense to say that a household is more resilient than another household, if it is better off than the other household, when both households are subject to the same disturbance. Let us examine which of the two households is better off after a given disturbance.

A disturbance in form of a fall in housing prices

Let the disturbance be a fall in housing prices by about 20 percent, such that there is a fall of the real-assets ratio for household 1 from 3.2 to 2.6 and for household 2 from 6.4 to 5.2. Consider the balance sheets of the two households after such a fall in the value of real assets (tables 3 and 4).

Table 3. Balance sheet of household 1, after fall in value of real assets, ratio to disposable income (bold numbers indicate numbers that differ from those in table 1)

Assets		Liabilities	
Real assets	**2.6**	Debt	1.7
Financial assets	2.6	Net worth	**3.5**
Total	**5.2**	Total	**5.2**

Table 4. Balance sheet of household 2, after a 20 percent fall in value of real assets, ratio to disposable income (bold numbers indicate numbers that differ from those in table 2)

Assets		Liabilities	
Real assets	**5.2**	Debt	3.4
Financial assets	5.2	Net worth	**7.0**
Total	**10.4**	Total	**10.4**

After the fall in real assets, the balance sheet of household 2 remains double that of household 1 in all items. In particular, the net-worth ratio is 7.0 for household 2, against 3.5 for household 1. The resilience index is 7.0 - 3.4 = 3.6 for household 2, against 3.5 – 1.7 = 1.8 for household 1. In terms of the net-worth ratio and the resilience index, household 2 is better off than household 1 after the fall in housing prices.

Household 2 still has more debt, a debt ratio of 3.4 against a debt ratio of 1.7 for household 1. But household 2 can sell some of its financial assets and reduce its debt ratio to the same ratio as that of household 1. This would result in the new balance sheet in table 5.

Table 5. Balance sheet of household 2, after a 20 percent fall in value of real assets and after reduction of the debt ratio, ratio to disposable income (bold numbers indicate numbers that differ from those in table 4)

Assets		Liabilities	
Real assets	5.2	Debt	**1.7**
Financial assets	**3.5**	Net worth	7.0
Total	**8.7**	Total	**8.7**

We see in table 5 that now household 2 has the same debt ratio and the same financial-assets ratio as household 1 in table 3, but it has a higher real-assets ratio and a higher net-worth ratio. The difference between the balance sheets in table 5 and 3 is shown in table 6.

Table 6. Difference between the balance sheets of households 2 in table 5 and that of household 1 in table 3, ratio to disposable income

Assets		Liabilities	
Real assets	2.6	Debt	0.0
Financial assets	0.9	Net worth	3.5
Total	3.5	Total	3.5

Since household 2 has the same debt ratio as household 1 but larger real-assets, financial-assets, and net-worth ratios, we can say that household 2 is unambiguously better off than household 1 after the disturbance.

It seems safe to conclude that household 2, with its double-sized balance sheet, is more resilient to disturbances than household 1, at least for a disturbance in the form of a fall in housing prices of 20 percent. It follows that any proportional increase of a balance sheet, as long as the household has a positive net worth, implies that the household becomes more resilient, at least for this disturbance.

This conclusion also follows if the fall in real assets is very large, say 50 percent. Then tables 3-6 are replaced by tables 3a-6a as follows:

Table 3a. Balance sheet of household 1, after a 50 percent fall in value of real assets, ratio to disposable income (bold numbers indicate numbers that differ from those in table 1)

Assets		Liabilities	
Real assets	**1.6**	Debt	1.7
Financial assets	2.6	Net worth	**2.5**
Total	**4.2**	Total	**4.2**

Table 4a. Balance sheet of household 2, after a 50 percent fall in value of real assets, ratio to disposable income (bold numbers indicate numbers that differ from those in table 2)

Assets		Liabilities	
Real assets	**3.2**	Debt	3.4
Financial assets	5.2	Net worth	**5.0**
Total	**8.4**	Total	**8.4**

Table 5a. Balance sheet of household 2, after a 50 percent fall in value of real assets and after reduction of the debt ratio, ratio to disposable income (bold numbers indicate numbers that differ from those in table 4)

Assets		Liabilities	
Real assets	3.2	Debt	**1.7**
Financial assets	**3.5**	Net worth	5.0
Total	**6.7**	Total	**6.7**

Table 6a. Difference between balance sheets of household 2 in table 5a and that of household 1 in table 3a, ratio to disposable income

Assets		Liabilities	
Real assets	1.6	Debt	0.0
Financial assets	0.9	Net worth	2.5
Total	2.5	Total	2.5

After a fall in housing prices of 50 percent, household 2 still remains better off than household 1.

The debt service on debt that equals to 3.4 times disposable income

A possible objection to this analysis is that household 2 may have difficulties paying the debt service on its debt of 3.4 times disposable income. Assume a high pre-tax mortgage rate of 7 percent and an after-tax nominal rate of 5 percent (with deductible interest payments and a 30 percent capital-income tax, the after-tax rate is 0.7*5 = 4.9 percent, approximately 5 percent). With such a high after-tax mortgage rate, the mortgage interest to be paid is about 17 percent of disposable income. This is still much less than the average rents in rented housing, about 30 percent of disposable income (Statistics Sweden 2012, table 9.1.8). Relative to a disposable income rising by 4 percent per year (2 percent real and 2 percent inflation; for many young households, disposable income will rise faster), 80 percent of this interest payment, that is, 13.6 percent of disposable income, is actually amortization relative to disposable income. Expressed differently, the *net debt service*, defined as the debt service to keep the debt ratio constant, is the product of the difference between the after-tax nominal mortgage rate

(5 percent) and the nominal growth rate of disposable income (4 percent) times the debt ratio (3.4). That is, the net debt service is 1 percent of 3.4, which equals 3.4 percent of disposable income; this is quite a modest net debt service.

However, perhaps more importantly, household 2 has financial assets that are larger than the debt ratio. Thus, taking these financial assets into account, the *net interest cost* is the difference between the after-tax mortgage rate and the after-tax return on the financial assets. Suppose the after-tax mortgage rate is 2 percent higher than the after-tax return on the financial assets; such a spread is probably on the high side.[1] Then the net interest cost is only 2 percent of 3.4 times disposable income, that is 6.8 percent of disposable income. This is not very high, in particular in comparison with average rents of around 30 percent of disposable income.

An important off-balance-sheet item – the households' human capital

Households also have an important off-balance-item, namely an asset in the form of their current and future disposable income. Since disposable income is largely wages and salary, the asset can be seen has their human capital. They also arguably have a "human liability," a reasonable minimum consumption and some fixed costs, including mortgage and amortization payments. Together these expenditures form their minimum current and future expenditure.

Let me assume that households expect to work for not more than 25 years, so as not to exaggerate the value of human capital (many young households may work for 30 years or more). Assume the same high pre-tax nominal interest rate of 7 percent as above, that is, an after-tax nominal rate of 5 percent. Furthermore, assume as above that nominal disposable income grows at a rate of 4 percent per year. With a nominal after-tax rate of 5 percent and a nominal growth rate of 4 percent, the present value of 25 years of disposable income, the value of the households' human capital, is about 22 times disposable income. (The present value of 30 years of disposable income is 26 times disposable income.)

As a liability, consider the average fixed costs and fairly generous minimum consumption levels assumed in mortgage issuers' left-to-live-on analysis for mortgage takers, which are on average 42 percent of disposable income. Approximate this by about 9.2 times disposable income (9.2 is about 42 percent of 22). The net value of human capital is then 12.8 times disposable income. One may also want to add collective pension claims, currently about 1.2 times disposable income. We can then add these items to the balance sheets of tables 1 and 2, in order to create consolidated balance sheets for households 1 and 2. This gives us tables 7 and 8.

[1] In January 2013, SBAB is paying 1.95 percent on its savings account. Its listed 3-month mortgage rate (before any discount) is 2.67 percent; thus the spread is only 0.76 percent before any discount (www.sbab.se).

Table 7. Consolidated balance sheet of household 1,
with assets and liabilities related to human capital added, ratio to disposable income
(bold numbers indicate numbers that differ from those in table 1)

Assets		**Liabilities**	
Real assets	3.2	Debt	1.7
Financial assets	2.6	Net worth including human capital	**18.1**
Present value of disposable income	**22.0**	Present value of minimum expenditure	**9.2**
Collective pensions	**1.2**		
Total	**29.0**	Total	**29.0**

Table 8. Consolidated balance sheet of household 2,
with assets and liabilities related to human capital added, ratio to disposable income
(bold numbers indicate numbers that differ from those in table 1)

Assets		**Liabilities**	
Real assets	6.4	Debt	3.4
Financial assets	5.2	Net worth including human capital	**22.2**
Present value of disposable income	**22.0**	Present value of minimum expenditure	**9.2**
Collective pensions	**1.2**		
Total	**34.8**	Total	**34.8**

With these expanded balance sheets that include assets and liabilities related to human capital, the resilience indices are 18.1 – 1.7 = 16.4 and 22.2 – 3.4 = 18.8 for households 1 and 2, respectively. They are considerably higher than without the human-capital related assets and liabilities. The difference is 2.4 as before, since the difference across households for the net-worth and the debt ratios are the same.

After the fall in housing prices and real assets by about 20 percent, the new consolidated balance sheets are shown in table 9 and 10, where the present values of disposable income and minimum expenditure and the collective pension have been added to the balance sheets in table 3 and 4.

Table 9. Consolidated balance sheet of household 1, with assets and liabilities related to human capital added, after fall in value of real assets, ratio to disposable income
(bold numbers indicate numbers that differ from those in table 1)

Assets		**Liabilities**	
Real assets	**1.6**	Debt	1.7
Financial assets	2.6	Net worth including human capital	**16.5**
Present value of disposable income	**22.0**	Present value of minimum expenditure	**9.2**
Collective pensions	**1.2**		
Total	**27.4**	Total	**27.4**

Table 10. Consolidated balance sheet of household 2, with assets and liabilities related to human capital added, after fall in value of real assets, ratio to disposable income
(bold numbers indicate numbers that differ from those in table 2)

Assets		Liabilities	
Real assets	**3.2**	Debt	3.4
Financial assets	5.2	Net worth including human capital	**19.0**
Present value of disposable income	**22.0**	Present value of minimum expenditure	**9.2**
Collective pensions	**1.2**		
Total	**31.6**	Total	**31.6**

The consumption response according to the permanent-income hypothesis

What is the change in consumption of households 1 and 2 from the fall in housing prices? According to the permanent-income hypothesis, consumption is proportional to the sum of net worth, the present value of disposable income, and collective pensions. This sum equals 27.3 and 26.7 times disposable income for households 1 and 2, respectively. For household 1, it falls from 27.3 to 26.7 times disposable income, a fall of 2.2 percent. For household 2, it falls from 31.4 to 30.2 times disposable income, a fall of 3.8 percent. If consumption falls in proportion, it follows that the elasticity of consumption with respect to real assets is about 2.2/20 = 0.11 and 3.8/20 = 0.19 for households 1 and 2, respectively.

The Riksbank has used a consumption function with an elasticity of consumption with respect to net worth equal to 0.1. With real assets (housing) equal to about 80 percent of net worth, this elasticity of 0.1 should not be very different from the above elasticity of consumption with respect to real assets, 0.11. Obviously, the approximate calculation in this short paper thus gives a consumption elasticity of similar magnitude as the Riksbank's empirical estimate.

The fall in consumption is for constant interest rates; expansionary monetary policy that results in a temporary lower interest rate and a higher consumption will moderate the consumption fall.

Another disturbance: a fall in disposable income

Consider another disturbance, a temporary fall in disposable income. Assume that households 1 and 2, with consolidated balance sheets corresponding to tables 7 and 8, respectively, both become unemployed and lose all their disposable income for the current year.

Such a disturbance means that the present value of 25 years of disposable income, given no disposable income during the first year, falls from 22 to 21 times (normal) disposable income. This results in the new consolidated balance sheets shown in table 11 and 12 for households 1 and 2, respectively.

Table 11. Consolidated balance sheet of household 1, after a loss of the current year's disposable income, ratio to (normal) disposable income
(bold numbers indicate numbers that differ from those in table 7)

Assets		Liabilities	
Real assets	3.2	Debt	1.7
Financial assets	2.6	Net worth including human capital	**17.1**
Present value of disposable income	**21.0**	Present value of minimum expenditure	9.2
Collective pensions	1.2		
Total	**28.0**	Total	**28.0**

Table 12. Consolidated balance sheet of household 2, after a loss the current year's disposable income, ratio to (normal) disposable income
(bold numbers indicate numbers that differ from those in table 8)

Assets		Liabilities	
Real assets	6.4	Debt	3.4
Financial assets	5.2	Net worth including human capital	**21.2**
Present value of disposable income	**21.0**	Present value of minimum expenditure	9.2
Collective pensions	1.2		
Total	**33.8**	Total	**33.8**

How do the two households adjust their consumption? According to the permanent-income hypothesis, if the households are not liquidity constrained and hence can freely smooth their consumption, they will adjust their consumption relative to (normal) disposable income in proportion to the fall in the sum of net worth, the present value of disposable income, and collective pensions. For household 1 this sum falls from 27.3 to 26.3 times disposable income, for household 2 from 31.4 to 30.4. The falls are equal to 3.7 and 3.2 percent, respectively. Assume for simplicity that both households reduce their consumption by 4 percent. Assume for simplicity also that both households normally consume all their disposable income. This assumption exaggerates the financing requirements during the year without disposable income. Then households need to finance consumption equal to 96 percent of normal disposable income during the year that they have no disposable income.

Household 1 has 260 percent of disposable income as financial assets that can be used to finance its expenditure. After the year, it then has about 166 percent of disposable income left as financial assets. Household 2 has 520 percent of disposable income as financial assets. After the year, it has then about 426 percent of disposable income as financial assets left. The approximate balance sheets of the two households after the year are shown in tables 13 and 14.[2]

[2] The present value of minimum expenditure of the remaining 24 years is 42 percent of one year's disposable income lower than the corresponding present value for 25 years and is lowered from 9.2 to 8.9 times disposable income.

Table 13. Consolidated balance sheet of household 1 at the end of the year, after a loss of the current year's disposable income, ratio to (normal) disposable income
(bold numbers indicate numbers that differ from those in table 11)

Assets		Liabilities	
Real assets	3.2	Debt	1.7
Financial assets	**1.7**	Net worth including human capital	**16.5**
Present value of disposable income	**21.0**	Present value of minimum expenditure	**8.9**
Collective pensions	1.2		
Total	**27.1**	Total	**27.1**

Table 14. Consolidated balance sheet of household 2 at the end of the current year, after a loss the current year's disposable income, ratio to (normal) disposable income
(bold numbers indicate numbers that differ from those in table 12)

Assets		Liabilities	
Real assets	6.4	Debt	3.4
Financial assets	**4.3**	Net worth including human capital	**20.6**
Present value of disposable income	**21.0**	Present value of minimum expenditure	**8.9**
Collective pensions	1.2		
Total	**32.9**	Total	**32.9**

The two households' financial assets are sufficient to allow complete consumption smoothing. The bank collecting the mortgage payments may also agree to postpone interest payments during the year, in which case less financial assets have to be used to finance consumption smoothing during the year and debt increases by the same amount. The households may also choose to reduce their consumption more during the year, since as mentioned the average fixed costs and minimum consumption levels assumed in mortgage issuers' left-to-live-on analysis are 42 percent of disposable income, leaving a margin of 58 percent of disposable income.

It seems clear from tables 13 and 14 that, after the year, household 2 is in a better position than household 1. Household 2 has higher real and financial assets and higher net worth than household 1. On the other hand, it has higher debt. But, household 2 can use some of its financial assets to pay some of its debt and reduce it to the same level as household 1. This results in the balance sheet in table 15.

Table 15. Consolidated balance sheet of household 2, after a loss the current year's disposable income and after repayment of 1.7 of debt, ratio to (normal) disposable income
(bold numbers indicate numbers that differ from those in table 13)

Assets		Liabilities	
Real assets	**6.4**	Debt	1.7
Financial assets	**2.6**	Net worth including human capital	**20.6**
Present value of disposable income	21.0	Present value of minimum expenditure	8.9
Collective pensions	1.2		
Total	**31.2**	Total	**31.2**

Compared to the balance sheet of household 1 in table 13, household 2 has higher real and financial assets and higher net worth. The difference is shown in table 16.

Table 16. Difference between the balance sheets of household 2 in table 15 and household 1 in table 13, ratio to (normal) disposable income

Assets		Liabilities	
Real assets	3.2	Debt	0.0
Financial assets	0.9	Net worth including human capital	4.1
Present value of disposable income	0.0	Present value of minimum expenditure	0.0
Collective pensions	0.0		
Total	4.1	Total	4.1

Clearly, household 2 is better off than household 1. Thus, household 2 is more resilient than household 1 to both a disturbance in the form of a temporary fall in disposable income for a year as well as in the form of a 20 percent fall in housing prices.

Conclusions

It seems pretty clear that, when the net worth is positive, an increase of the balance sheet in the form of a proportional increase of debt, real and financial assets, and net worth relative to disposable income normally makes the household more resilient to disturbances.

Are there examples where this is not the case? As long as net worth (excluding human capital) is positive for both households after the disturbance, it seems clear that household 2 will in a reasonable sense be better off than household 1, after the disturbance. However, if the disturbance is so large that net worth becomes negative after the disturbance, household 2 may end up with a larger negative net worth than household 1 after the disturbance, and in this sense be worse off.[3] This requires net worth as a share of total assets before the disturbance to be smaller than the fall in total assets due to the disturbance. This can hardly happen for the two households examine here, since they like the average Swedish household have net worth as a share of total assets equal to about 70 percent. But it can of course happen for individual households that are much more leveraged.

More generally, as long as a households' net worth is positive, it would benefit from doubling its balance sheet relative to its disposable income, including doubling its debt relative to disposable income. Then the household can always adjust its balance sheet so as not have more debt than before the doubling. Then the household is definitely more resilient to any disturbance.

Even more generally, it is better to be rich than poor. And rich households are generally more resilient to disturbances than poor. In particular, rich households that are vulnerable have the possibility to adjust their balance sheet so as to become more resilient than poor households.

References

Statistics Sweden (2012), *Bostads- och byggnadsstatitistik – årsbok 2012* (*Yearbook of Housing and Building Statistics 2012*, in Swedish with parts in English), Statistiska centralbyrån.

[3] I thank Martin W. Johansson and Kristian Jönsson for pointing this out.