Minsky's financial instability hypothesis

Maria Nikolaidi[a]

[a] *Department of Economics and International Business, University of Greenwich, UK*

Abstract: Since the Global Financial Crisis, Minsky's Financial Instability Hypothesis (FIH) has been receiving a growing attention in macroeconomic analyses and policy making. In this contribution I discuss the key dimensions and extensions of Minsky's FIH, focusing on how Minskyan frameworks have analysed the drivers of endogenous instability and cycles associated with corporate, household and external debt. I cover recent theoretical and empirical developments in the Minskyan literature and emphasise the unique evolutionary macrofinancial aspects of Minsky's approach. I also analyse the policy implications of Minsky's FIH and explain how Minsky's analysis can be used for our understanding of climate-induced financial instability, in light of the recent developments in the area of climate-related financial risks.

Keywords*:* Minsky, financial instability, post-Keynesian economics, climate change

JEL Codes: E12, E32, E44, Q54

December 2021

Published in d'Apice, V. and Ferri, G. (eds.) A Modern Guide to Financial Shocks, Edward Elgar, Cheltenham, UK and Northampton, MA.

Acknowledgements: I am grateful to the participants of the Online Workshop on 'A Modern Guide to Financial Shocks', Università di Roma LUMSA (May 2020) for useful comments. The usual disclaimers apply.

Address for correspondence*:* Maria Nikolaidi, University of Greenwich, London, Old Royal Naval College, Park Row, London SE10 9LS, email: M.Nikolaidi@greenwich.ac.uk

1. INTRODUCTION

Since the Global Financial Crisis, Minsky's financial instability hypothesis (FIH) has been receiving growing attention in macroeconomic analyses and policy making. Many commentators termed the Global Financial Crisis a 'Minsky moment' (e.g. The Economist, 2016). More recently, the former Governor of the Bank of England, Mark Carney (2015), talked about the possibility of a 'climate Minsky moment' as a result of an abrupt transition to a low-carbon economy.

Minsky developed his FIH primarily in the 1970s and the 1980s. A key aim of Minsky was to conceptualise the inherent instability of the economic system that stems from debt relationships and continuous institutional change. By doing so he departed from conventional approaches that analyse economic and financial issues through an 'equilibrium' lens. Since the 1980s, many economists have modelled different dimensions of the FIH and have further developed the theoretical underpinnings of Minsky's framework, taking into account the transformations and developments in the global financial system that we have seen over the last decades. More recently, research has attempted to examine empirically specific aspects of the FIH, while the interest in climate-induced financial instability à la Minsky is constantly increasing.

The aim of this chapter is to discuss Minsky's FIH based on Minsky's original writings and the rich Minskyan literature. I first explain the key perspectives of the FIH (Section 2) as well as the different aspects of financial fragility and the factors that can lead to an endogenous increase in this fragility (Section 3). I then focus on how policy interventions can tame (or not) financial instability (Section 4) and I explain how Minsky's framework can be useful for understanding the financial instability that might emerge from climate change (Section 5). Section 6 outlines avenues for future research on Minsky's FIH.

2. 'STABILITY IS DESTABILISING'

Minsky's FIH can be summarised by the phrase 'stability is destabilising' (see Minsky, 1975, 1982, 1986 [2008], 1992; Wray and Tymoigne, 2009). There are two reasons why stability can be a source of instability. The first one is linked to the way that financial agents form expectations during boom periods. During boom periods, when economic growth is high and the economy is perceived to be stable, both banks and firms tend to have euphoric

expectations that induce them to participate in more debt contracts. This can result in higher indebtedness.

Minsky captured this by making a distinction between three finance regimes: hedge, speculative and Ponzi. A hedge finance regime refers to the case in which an economic unit has monetary inflows that are expected to be higher than the sum of the interest payments and principal repayments. As a result, debt financing is not necessary for the repayment of the accumulated debt – this is why the hedge regime is considered to be the more stable one. A speculative unit has expected inflows that can cover the interest payments but not the principal repayment. As a result, a speculative unit is expected to take on new debt in order to cover part of its repayment commitments. A Ponzi unit is a unit that can fulfil neither the interest nor the principal repayment commitments. Such a unit is therefore the most financially fragile one.

In Minsky's framework periods of stability lead both borrowers and lenders to take more risks. Consequently, hedge units are gradually transformed into speculative or Ponzi ones. The higher the proportion of speculative and Ponzi units in the economy, the more financially fragile such an economy can be. Once the level of indebtedness has been sufficiently high, some borrowers might be unable to repay their debt triggering a period of financial instability. During this period asset prices are declining, default rates are increasing and economic activity is contracting. Without proper government intervention, this period of financial instability can be transformed into a prolonged recession.

The second reason why stability is destabilising is institutional transformation. Stability can bring about instability not only because of behaviour-driven credit expansions, but also because it can cause institutional and policy changes that might render the system more fragile. For example, Minsky focused a lot of attention on how the post-World War II stability led to a gradual transformation of the global financial system towards 'money manager capitalism' whereby private financial institutions (like investment banks, hedge funds and money market funds) are the dominant actors in the economic system and tend to destabilise it through activities that seek high financial returns (Palley, 2011; Wray, 2011).

Such institutional transformations can be analysed with reference to what Minsky termed 'thwarting mechanisms': government interventions, policy regimes and customs that intend to stabilise the macrofinancial system (see Ferri and Minsky, 1992; Palley, 2011; Dafermos et al., 2020). Thwarting mechanisms include counter-cyclical fiscal policy, financial regulation, wage policies or policy frameworks that are meant to control inflation. Although these thwarting mechanisms can initially be successful in achieving stability, they

might gradually be eroded for example because of innovations made by profit-seeking economic agents or because the designers of these institutions decide to make the institutions and policy interventions less strict due to the general sense of 'stability'.

Dafermos et al. (2020) argue that the endogenous change in the effectiveness of thwarting mechanisms can give rise to institutional supercycles. At the initial phase of a supercycle, the institutional and policy setting is able to prevent a significant increase in macrofinancial fragility and can ensure that recessions caused by real or financial factors do not lead to depressions. However, as thwarting mechanisms become less effective, it is more likely that economies will experience a severe economic and financial crisis. After such a crisis, a new supercycle might kick off if a new set of thwarting mechanisms is established.

There are three key features in Minsky's FIH that make it unique compared to conventional approaches to the causes of financial crises. First, Minsky views the financial system as a network of interconnected balance sheets that interact dynamically with macroeconomic factors within a non-equilibrium setting (see also Gabor, 2020 and Chapters 5 and 7). Financial instability is the endogenous result of this dynamic interaction. Although exogenous shocks can play a role in triggering financial instability, in the Minskyan framework financial crises are primarily explained by the endogenous increase in financial fragility. This, for example, departs from the way that financial issues have been analysed in Dynamic Stochastic General equilibrium (DSGE) models, which represent the dominant way of thinking about the macroeconomy. In a recent review of the DSGE literature Galí (2018, p. 107) pointed out that:

"none of the extensions of the New Keynesian model proposed in recent years seem to capture an important aspect of most financial crises – namely, a gradual build-up of financial imbalances leading to an eventual 'crash' characterized by defaults, sudden-stops of credit flows, asset price declines, and a large contraction in aggregate demand, output, and employment. Most of the extensions found in the literature share with their predecessors a focus on equilibria that take the form of stationary fluctuations driven by exogenous shocks."

Second, in Minsky's framework money is endogenous (see Wray, 2015). In other words, banks endogenously create money whenever they decide to provide credit to creditworthy borrowers (see Lavoie, 2014; McLeay et al., 2014). In a world of endogenous money, financial fluctuations are much stronger since the changes in the willingness of

borrowers and lenders to enter into new debt contracts has strong effects on consumption and investment. This is not the case in conventional accounts of money and finance where banks are viewed as financial intermediaries – this by definition restricts their impact on economic activity (see Jakab and Kumhof, 2019 for a discussion on this).

Third, in Minsky's FIH, institutional change and policies interact with macroeconomic and financial factors. Typically, models of financial instability confine their attention to how financial crises might happen within a given institutional setting. On the contrary, Minsky provides a much deeper understanding of financial instability that takes explicitly into account evolutionary changes that affect the stabilising role of institutions and the profit-seeking behaviour of economic agents (see Wray, 2011; Argitis, 2019; Dafermos et al., 2020).

3. THE DIFFERENT SHADES OF FINANCIAL FRAGILITY

How can economies become financially fragile? Financial fragility is connected with the accumulation of debt. The Minskyan literature has focused on three types of debt: (i) corporate debt; (ii) household debt; and (iii) external debt.[1] I will explain what can drive the rise in each of these types of debt and how debt accumulation can lead to instability.[2]

3.1 Corporate Debt

Most Minskyan macroeconomic models have analysed the fragility that stems from corporate debt using this setting as a starting point: Firms undertake investment driven primarily by expected sales and profitability. The part of investment spending that is not covered by retained profits is financed through loans. Banks typically provide these loans on demand. Households consume part of their income without taking on consumer debt.

Why do firms over-accumulate debt in this setting and how can this over-accumulation lead to financial instability? Consider first the case in which the interest rate is constant. In a period in which there is high perceived economic stability and the default rate

[1] From a Minskyan perspective, public debt is not in general a significant source of financial fragility. Actually, a high public debt is often considered necessary to stabilise economies that undergo a recession (see e.g. Wray, 2006). However, the analysis of the financial fragility of the government sector makes sense for countries that are not monetarily sovereign. Ferrari-Filho et al. (2010), Argitis and Nikolaidi (2014) and Terra and Ferrari-Filho (2020) have developed Minsky-inspired indices that analyse the financial fragility of the government sectors in Brazil and Greece.

[2] Part of the analysis of Chapter 2 relies on Nikolaidi (2017) and Nikolaidi and Stockhammer (2017).

is relatively low, firms have a tendency to increase their debt-financed investment.[3] This can cause an increase in firms' leverage, which is a proxy of financial fragility. Once the leverage ratio has reached a sufficiently high level, there is a negative impact on investment which causes a reduction in economic activity. This dynamic interaction between leverage and investment can give rise to instability (see e.g. Jarsulic, 1990; Dutt, 1995; Lavoie, 1995; Charles, 2016) and real-financial cycles (see e.g. Foley, 1987; Semmler, 1987; Jarsulic, 1989; Skott, 1994; Yilmaz and Stockhammer, 2019).

In the Minskyan literature, the fragility of firms has not only been analysed through firm leverage ratios. Many macro models have made an explicit distinction between hedge, speculative and Ponzi finance regimes using either aggregate macro models (see e.g. Lima and Meirelles, 2007; Charles, 2008a; Ferri and Variato, 2010; Nishi, 2012; Sasaki and Fujita, 2012) or agent-based models (see e.g. Michell, 2014; Caiani et al., 2016; Di Guilmi and Carvalho, 2017; Jump et al., 2017; Pedrosa and Lang, 2018; Reissl, 2020).

The Minskyan theoretical framework about corporate debt-driven financial fragility raises three empirical questions: (i) is the leverage ratio of firms pro-cyclical?; (ii) does firm leverage have a negative impact on investment?; (iii) can we observe cycles that are driven by corporate debt?

The pro-cyclicality or not of the leverage ratio (or proxies of it) has been the subject of many empirical studies. The results are quite mixed. Wolfson (1990) showed that ahead of the US stock market crash in 1987 there was an increase in the corporate net interest payments to gross capital income. However, Lavoie and Secarrecia (2001) did not find any supportive evidence for an increasing leverage ratio for the G-7 countries over the period 1971–97, while Pedrosa (2019) showed that there was no increase in the aggregate leverage ratio for the US between 1970 and 2014. Similarly, Isenberg (1989) did not find any evidence of increasing financial fragility (which was measured by various debt ratios) at the aggregate level for the US for the period ahead of the Great Depression, but found some supportive evidence of Minsky's FIH for small firms. The lack of a pro-cyclical leverage in some empirical studies has often been linked with the 'paradox of debt': although firms increase their debt-financed investment, the positive macroeconomic impact of higher investment on the sales of firms can actually reduce firm's indebtedness (see Lavoie and Seccareccia, 2001; Toporowski, 2008; Passarella, 2012; Lavoie, 2014).

[3] Euphoric expectations are modelled either explicitly or implicitly. For models that formalise euphoric expectations explicitly see Nasica and Raybaut (2005), Ferri and Variato (2010), Lojak (2018) and Cafferata et al. (2020).

How about empirical studies that have used Minsky's distinction between hedge, speculative and Ponzi firms? Their results are mixed as well.[4] Focusing on the US, Mulligan (2013) found that between 2001 and 2009 the proportion of speculative and Ponzi firms increased over the upturn and declined over the downturn of the business cycle in some industries, like mining, manufacturing and transportation, but not in other industries, like agriculture, utilities and real estate. Davis et al. (2019) analysed the US economy over the period 1970–2014 and did not find a strong relationship between aggregate downturns and the probability of being Ponzi. This is broadly corroborated by Pedrosa (2019) who also used data for the US over the same period. However, it is interesting that Davis et al. (2019) documented a secular increase of Ponzi firms since the 1970s. In the case of Japan (1975–2015), Nishi (2019) did not find evidence of a pro-cyclical increase in Ponzi finance.

Regarding the impact of indebtedness on investment, Ndikumana (1999) showed that the debt service ratio negatively affected investment in the US over the period 1972–91. Arza and Español (2008) found that sufficiently high leverage ratios had a negative impact on investment in Argentina over the period 1992–2001. Similarly, Caldentey et al. (2019), whose empirical analysis covered large Latin American countries over the period 2009–16, showed that the leverage ratio had a negative effect on investment once the leverage ratio passes a threshold.

Stockhammer et al. (2019a) investigated simultaneously the pro-cyclicality of the leverage ratio and the effects of the leverage ratio on investment, in an attempt to identify whether corporate debt cycles have emerged in seven Organisation for Economic Co-operation and Development (OECD) economies. They found evidence in favour of such cycles in Canada and the UK over the period 1970–2015. In a similar study, Stockhammer et al. (2019b) focused on the US (1889–2015) and the UK (1882–2010), finding supportive evidence of corporate debt cycles only for the US.

How does the story about corporate debt-driven financial fragility change when an endogenous interest rate is considered? An endogenous interest rate can act as an additional source of financial fragility since it can increase the interest payments of firms during the upturn of the economic cycle. Minskyan models have assumed that the interest rate is a

[4] There are other papers that have employed the hedge, speculative and Ponzi finance regime but without focusing explicitly on the pro-cyclicality of financial fragility. Schroeder (2009) documented a shift from hedge and speculative to Ponzi finance in the New Zealand firm sector during the period 1990–2007. Torres Filho et al. (2019) showed that the number of Ponzi Brazilian electricity distribution firms increased over the period 2008–13. Caldentey et al. (2019) found that there was a rise of speculative and Ponzi firms and a decline in hedge firms in Latin American countries between 2009 and 2016.

positive function of the leverage ratio of firms (e.g. Keen, 1995; Asada, 2001; Charles, 2008a; Lojak, 2018; Giri et al., 2019; Reissl, 2020), of economic activity (e.g. Lima and Meirelles, 2007; Fazzari et al., 2008) or of the financial position of both the lenders and the borrowers (Delli Gatti et al., 2010). Stockhammer et al. (2019a) have found evidence in favour of real-financial cycles between GDP and interest rate for Australia and the US over the period 1970–2015.

Interest rate-driven economic fluctuations in a Minskyan framework share some similarities with the ones that can be found in the financial accelerator literature (see e.g. Bernanke and Gertler, 1990; see also Chapter 3). In the financial accelerator framework changes in the external finance premium can amplify and propagate shocks to the macroeconomy.[5] This is so because the external finance premium depends inversely on the net worth of borrowers. Since borrowers' net worth is pro-cyclical, the external finance premium goes down during upswings and goes up during downturns. Although the financial accelerator framework has been developed within New Keynesian models where output is supply-driven and money is not endogenous, financial accelerator-type mechanisms can also be found in Minskyan demand-side models (see e.g. Delli Gatti et al., 2010; Giri et al., 2019; Reissl, 2020).

Financial fragility has also been analysed within more sophisticated Minskyan frameworks in which stock prices change in an endogenous way, wages change during the economic cycle, the retention rate of firms is endogenous and banks play a more active role in the provision of credit. I briefly describe these additional sources of financial fragility in turn.

Some Minskyan models have focused explicitly on the role of stock prices and the interaction of stock prices with corporate debt (see e.g. Franke and Semmler, 1989; Delli Gatti and Galegatti, 1990; Delli Gatti et al., 1994; Ryoo, 2010, 2013a; Chiarella and di Guilmi, 2011).[6] During boom periods, investors might increase their demand for stocks given that they expect that prices will go up. This boosts stock prices, working as a self-fulfilling prophecy. Higher stock prices have macroeconomic effects since they can positively affect the consumption of households via a wealth channel and they can increase investment via Tobin's Q. Moreover, higher stock prices can induce more corporate debt expansion.

[5] The external finance premium is equal to the cost of the borrower of raising funds externally minus the opportunity cost of internal funds.

[6] Taylor and O'Connell (1985) have developed a Minskyan model without corporate debt in which stock prices is the only cause of financial fragility. See also Bhattacharya et al. (2015) for a model which analyses more broadly how investors' strategies in the financial markets are driven by expectations formation à la Minsky.

Many Minskyan models have investigated the way that corporate debt might interact with endogenous changes in income distribution, in particular the distribution of income between wages and profits (see e.g. Keen, 1995; Grasselli and Costa Lima, 2012; Sordi and Vercelli, 2014; Stockhammer and Michell, 2017; Bastidas et al., 2019). In line with the analysis of Goodwin (1967), cycles might arise because of the impact that economic activity and employment might have on wages. For example, during the upturn of the economic cycle, a relatively low unemployment rate induces workers to demand higher wages, putting a downward pressure on the profits of firms, on top of the pressure placed by higher interest payments.

The dividend policies of firms can be an additional source of financial fragility. In some Minskyan models firms are portrayed to increase the dividends that they provide to shareholders when their profitability is high and/or their indebtedness is low (see e.g. Charles, 2008b; Yilmaz and Stockhammer, 2019; Reissl, 2020). By doing so they can gradually increase their reliance on debt, contributing to the rise of financial fragility. The pro-cyclicality of dividends is in line with the findings of empirical studies (see e.g. Benito and Young, 2003; Abdulkadir et al., 2016).

In other Minskyan models the behaviour of banks plays a prominent role (see Ryoo, 2013b; Nikolaidi, 2014). The key argument is that banks affect in an active way the accumulation of corporate debt. During periods of perceived stability, credit supply increases because banks feel more confident about both their own and the borrowers' financial position. The opposite holds when the economy undergoes a recession. This endogenous change in the quantity credit rationing of banks can amplify economic cycles.

3.2 Household Debt

Minsky did not analyse household debt in his FIH. However, household debt has been the focus of many Minskyan models. To begin with, there are Minskyan models that analyse the way through which household debt interacts with income distribution (see Palley, 1994, 1997; Dutt, 2006; Charpe et al., 2009; Kapeller and Schütz, 2014; Ryoo and Kim, 2014; Kapeller et al., 2018; Giraud and Grasselli, 2021). In these models it is typically assumed that low-income households take on debt to increase their spending. They do so since they wish to emulate the consumption of high-income households.[7] Although this has initially a positive

[7] For the links between emulation and inequality see, for example, Palley (2010).

effect on aggregate consumption (since low-income households have a higher propensity to consume out of income), the accumulation of debt and the increase in the interest payments of low-income households increases financial fragility. Interestingly, the more low-income households take on debt to cover consumption expenditures, the higher *ceteris paribus* is the reduction in their disposable income due to interest payments. At the same time, the interest paid on consumer debt might increase the income of high-income households (since the high-income households might receive the distributed profits of banks). This increases income inequality, inducing a further increase in the propensity of low-income households to take on debt. Once the indebtedness of low-income households has reached a sufficiently high level, economic activity starts going down, for example because banks might decide to reduce the provision of new consumer loans or because the interest rate charged to households might start increasing.[8]

This story is in line with the empirical evidence provided by Palley (1994) and Kim (2013, 2016) which shows that a rise in household debt has initially a positive effect on economic activity, but this effect becomes subsequently negative. It is also in line with the analysis in Cynamon and Fazzari (2008, 2016) and Barba and Pivetti (2009) who argue that increasing income inequality contributed to the rise in the indebtedness of the US household sector (see also Chapter 4).

Moreover, Minskyan models have paid attention to the interaction between the housing market and household debt.[9] One such model has been developed by Ryoo (2016). In this model households' investment in the housing market is induced by the belief that housing prices will go up (see also Chapter 1 on how, in the run-up to the Global Financial Crisis, only the expectation of constantly rising housing prices could deliver mortgages to subprime clients, who may be viewed as Ponzi borrowers). As investment in the housing market increases, housing prices go up even further, increasing the value of houses that are used as a collateral for bank borrowing. As bank borrowing increases, the demand for houses increases even more. In that way, housing prices and household credit reinforce each other. Higher household indebtedness can be a source of financial fragility and cycles.

[8] In the New Keynesian-style models of Eggertsson and Krugman (2012) and Benigno et al. (2020), which formalise the debt relationships between 'patient' and 'impatient' households, the decline in economic activity, described as a 'Minsky moment', is triggered by an exogenous decline in the quantity of debt that impatient households can borrow.

[9] There is also some empirical research that has focused on the financial fragility associated with the interaction between housing prices and household debt. For example, Tymoigne (2014) developed an index of home finance fragility that he has applied to the US, the UK and France over the period before the Global Financial Crisis. The index clearly shows that growing financial fragility in the run-up to the crisis.

Nikolaidi (2015) has modelled the interaction between household debt, housing prices and income distribution, focusing on the role of securitisation. In this model an increase in the use of securitisation can kick off an endogenous process that makes the economy more financially fragile, leading ultimately to instability. More precisely, an increase in the securitisation of mortgage-backed securities (MBSs) induces banks to provide more loans to low-income households. At some point, the indebtedness of low-income households becomes sufficiently high, inducing banks to reduce their credit provision since the demand for MBSs goes down. Once this happens, housing and MBS prices start declining and economic activity becomes lower, triggering financial instability. When the increase in securitisation is accompanied by a decline in the wage share, the expansionary period is shorter and instability in reinforced. Botta et al. (2021) have also developed a similar model which shows that the securitisation of household debt can lead to both higher financial fragility and higher inequality.

3.3 External Debt

External debt, and especially foreign currency denominated debt, can be a significant source of financial fragility in an open economy framework. Many scholars have analysed this source of fragility by extending Minsky's closed economy framework to an open economy setting.

Kregel (1998) and Arestis and Glickman (2002) have explained that when a domestic economy, which is open to capital inflows, experiences an economic boom combined with domestic currency appreciation, both the domestic private sector and foreign lenders might reduce their desired margins of safety. This is so because there is an increasing confidence that the economy will continue to perform well, increasing the appetite for more risky credit expansion, a large proportion of which is in the form of foreign denominated debt.

However, as the economy expands, the current account balance deteriorates and external debt is accumulated, financial fragility increases and instability might emerge. For instance, at some point, the increasing external debt might raise doubts among lenders about the ability of borrowers to repay it. This can result in capital outflow that can lead to exchange rate depreciation. Moreover, as argued by Kaltenbrunner (2015), the accumulation of foreign denominated debt increases the demand of borrowers for the foreign currency since they need to ensure that they will manage to repay their debt without problems. This

can reinforce the depreciation forces especially in countries that have a subordinated position in the international monetary hierarchy.

Currency depreciation can reduce the ability of domestic borrowers to repay their foreign denominated debt. The situation might become worse if the monetary authorities respond to the depreciation by increasing the interest rate. In this case, interest payments might go up, increasing the number of Ponzi economic units in the economy.

Kregel (1998) and Arestis and Glickman (2002) used such a Minskyan perspective to explain the 1997–98 Southeast Asian financial crisis. De Paula and Alves (2000) and Gallardo et al. (2006) used similar Minskyan insights to analyse the 1998–99 Brazilian currency crisis and 1994 financial crisis in Mexico, respectively. A key argument of these studies is that, while such financial crises can be magnified by exogenous shocks, they should primarily be seen as the result of endogenous processes.

Kohler (2019) has recently developed a Minskyan model that shows how endogenous cycles can arise in emerging market economies (EMEs) through the interaction between flexible exchange rate dynamics and balance sheet effects. In this model currency appreciation results in an investment boom since this appreciation improves the financial position of domestic firms, inducing capital inflows. However, the investment boom triggers an increase in imports, deteriorating at some point the trade balance. This ultimately leads to currency depreciation and capital outflows, causing a decline in investment.[10]

However, endogenous cycles à la Minsky can arise in an open economy framework even in the case in which the exchange rate is not flexible. For instance, Foley (2003) has developed a model in which an endogenous change in the interest rate (because of central bank policy) is sufficient to trigger refinancing problems for firms that rely on external debt. Moreover, Dafermos (2018) has shown how endogenous cycles can emerge as a result of endogenous changes in the target debt ratio of the domestic private sector. These changes in the target debt ratio are driven by the expectations of both the foreign lenders and the domestic borrowers.

4. HOW CAN AN UNSTABLE ECONOMY BE STABILISED?

[10] Note though that capital outflows in EMEs can also be triggered by developments that are independent of the domestic economy conditions. For example, Bonizzi and Kaltenbrunner (2019) have used a Minskyan perspective to show that the demand of insurance companies and pension funds for emerging market assets is driven by changes in the liability structure of these institutions and the search for high yields, which are largely unrelated to the conditions in EMEs.

Both Minsky and Minskyan scholars have suggested several policies that can prevent financial fragility and contain financial instability. First, in Minskyan analyses the government needs to be large enough to be in a position to play a stabilising role by increasing spending and reducing taxes during periods of high economic activity, and doing the opposite during economic booms when the expectations of borrowers and lenders and borrowers are euphoric (see also Chapter 10). Many Minskyan models have shown that counter-cyclical fiscal policy can indeed play a stabilising role (e.g. Keen, 1995; Nasica and Raybaut, 2005; Nikolaidi, 2014; Dafermos, 2018; Kapeller et al., 2018; Reissl, 2020). However, while counter-cyclical fiscal policy can reduce economic fluctuations, it does not necessarily eliminate them.

Second, employment programmes are a key component of Minsky's policy recommendations (see Minsky, 1986 [2008]; Papadimitriou and Wray, 1998). In particular, Minsky was an advocate of employer of last resort (ELR) programmes that guarantee a public sector job to those who are unable to find a job in the private sector. Minsky was more in favour of such programmes instead of transfer payments. He was of the view that the provision of public employment at a wage rate that is lower than the one provided in the private sector would be less inflationary and stabilising than the provision of transfers. This is so primarily because the latter tend to increase aggregate demand without necessarily increasing supply; on the contrary, employment programmes generate directly additional output.[11]

Third, Minsky viewed the lender-of-last-resort interventions of central banks as a significant stabilising mechanism (see also Chapter 9). However, he emphasised at the same time that central banks should take action in preventing speculative and Ponzi finance. Otherwise, their interventions might validate financial innovations that destabilise the financial system (see Argitis, 2013, 2017; Kregel, 2014a). Minsky was always in favour of a 'macroprudential' approach to financial regulation, according to which the interactions between the macrofinancial system and individual financial institutions are analysed as a whole. Since the Global Financial Crisis, such an approach has become fashionable (see also Basel III and Chapter 13). However, as explained by Kregel (2014b), the Basel III regulatory framework has not explicitly incorporated Minsky's view on the crucial role of endogenous evolutionary change and the endogenous tendency of the financial system to instability.

[11] Note that ELR has been the subject of considerable debate. See, for example, Sawyer (2003, 2005) and Mitchell and Wray (2005).

Minskyan models have examined the effects of specific aspects of macroprudential regulation. For example, Ryoo (2013b) has shown that Minsky's (1986 [2008]) proposal about the containment of bank leverage through the control of banks' dividend policy can be conducive to stability. Kapeller et al. (2018) have developed a Minsky-Veblen model in which they analyse the impact of a financial regulatory reform that increases household credit provision to changes in bank leverage. They show that such a reform reduces household indebtedness. Although this makes lower the amplitude of the cycles, it increases their frequency.[12]

Fourth, Minsky was in favour of policies that are conducive to medium-sized firms and a decentralised banking system with many small and independent banks (see Minsky, 1986 [2008] and Papadimitriou and Wray, 1998). He argued that a decentralised banking system where small banks finance medium-sized firms encourages more stable and sustainable borrower-lender relationships than what is the case in systems in which big banks play a dominant role (see also Chapter 6). In this context, he developed proposals about community development banking (see Minsky et al., 1993). He also argued that industrial policies that favour smaller firms are conducive to high employment − a key target of Minsky's policy recommendations − since such firms tend to use less capital-intensive production techniques.

All these Minskyan policy recommendations should, however, be viewed with caution. Minsky was not of the view that a static implementation of his policy proposals would safeguard long-run stability in capitalism even if some of these policies are initially effective. As he explains:

"Even as I warn against the handwaving that passes for much of policy prescription I must warn the reader that I feel much more comfortable with my diagnosis of what ails our economy and analysis of the causes of our discontents than I do with the remedies I propose. We need to embark on a program of serious change even as we need to be aware that a once and for-all resolution of the flaws in capitalism cannot be achieved. Even if a program of reform is successful, the success will be transitory. Innovations, particularly in finance, assure that problems of instability will continue to

[12] See also the Minsky-inspired empirical analysis of Greenwood-Nimmo and Tarassow (2016) for the US which shows that a credit-constrained macroprudential policy shock that is combined with active monetary policy can reduce financial fragility.

crop up; the result will be equivalent but not identical bouts of instability to those that are so evident in history." (Minsky, 1986 [2008], p. 319)

5. MINSKY MEETS CLIMATE CHANGE

Central banks and financial supervisors have recently paid attention to the financial instability that might arise from climate change (see Scott et al., 2017; Campiglio et al., 2018; NGFS, 2019; BIS, 2020). In a famous speech about climate change, Mark Carney, the former Governor of the Bank of England, talked about the possibility of a 'climate Minsky moment'. He used this phrase to refer to the implications of the so-called climate transition risks (see also Campiglio et al., 2019). A climate Minsky moment can arise because of abrupt changes in climate policies (e.g. a sudden increase in carbon prices) or because of sudden changes in energy-related technologies and environmental preferences that can result in a change in the climate-related expectations of financial actors. This in turn can lead to a revaluation of financial assets related to carbon-intensive companies and a tightening of credit provision to these companies. Given that many of these companies typically have an important position in the production system (see e.g. Cahen-Fourot et al., 2019) and interact with financial networks (see e.g. Battiston et al., 2017), the tightening of the financial conditions for these companies can lead to financial instability (see also Semieniuk et al., 2021).

Dafermos and Nikolaidi (2019) have modelled a specific dimension of a climate Minsky moment using an ecological stock-flow consistent model. They have shown that an abrupt increase in carbon taxes can reduce the profitability of firms, making investment and economic activity lower. This in turn can deteriorate the financial position of firms leading to higher defaults. The effects on economic activity are reinforced by the impact that a higher default rate can have on the capital of banks. This induces the latter to reduce credit supply, worsening the financial implications of the transition.

However, climate-induced financial instability might also result from the physical effects of climate change. Climate-related events (like hurricanes, typhoons and droughts) and global warming can affect both the supply-side and the demand-side of the economies. For instance, they can lead to lower labour productivity, capital destruction, lower consumption and lower investment. Dafermos et al. (2018) and Lamperti et al. (2019) have modelled the long-run implications of climate change for default rates and asset prices.

Both the physical and the transitions risks are typically viewed as exogenous shocks to the financial system. How can this be reconciled with the Minskyan perspective that

emphasises endogenous forces in the emergence of financial instability? There are three ways to connect climate-induced financial instability with broader endogenous financial forces.

First, climate shocks can interact with endogenous financial dynamics, altering the severity of their impact. For instance, a disruption in carbon-intensive finance might cause more financial problems when a climate transition shock hits an economy that experiences a financial boom where leverage is already very high. In this case, the destabilising endogenous forces that are at play can reinforce the effects from the decline in carbon-intensive asset prices and the rise in the default rates.

Second, specific climate policies might induce a specific type of credit expansion that can gradually lead to more financial fragility. For instance, the European Commission has recently discussed the possibility of introducing a 'green supporting factor' in financial regulation, that is, a reduction in capital requirements related to 'green' loans (see HLEG, 2018). Although this might be beneficial for carbon emissions, it can also lead to an increase in bank leverage (see Dafermos and Nikolaidi, 2021) and can induce a green credit bubble that can increase the financial fragility of the economic system.

Third, climate-induced financial instability can be analysed from a broader long-run perspective that takes into account the interactions between the macroeconomy, the financial system and the ecosystem (see Dafermos et al., 2017). From this viewpoint, climate change can be conceptualised as a secular endogenous outcome of carbon-intensive financial and economic activities. For many decades, the provision of finance to carbon-intensive companies contributed to the generation of carbon emissions. However, cumulative carbon emissions were not sufficiently high to cause significant feedback effects on the economy and the financial system. This is no longer the case: cumulative carbon emissions have now been very high and continue increasing. The transition and physical effects that cumulative emission cause should not be viewed independently of the provision of carbon-intensive finance over the last decades.

6. CONCLUSION

Minsky provided us with a rich framework for analysing the macroeconomic implications of debt relationships in modern capitalism. Minsky's FIH focuses on the role of interconnected balance sheets that interact dynamically with macroeconomic factors within a non-equilibrium setting. This dynamic interaction, combined with evolutionary change in social norms and institutions, gives rise to financial fragility and endogenous cycles. Since the

1980s, Minsky's FIH has been expanded in several directions that capture the increasing expansion of global finance and the multiple sources of financial fragility that this expansion has created. Although Minsky paid attention primarily to corporate debt, many Minskyan frameworks and models have been used to analyse the role of household and external debt, which have been at the core of financial crises seen over the last decades. A significant amount of research has also been conducted on Minsky's policy proposals, broadly verifying the stabilising role of his suggested policy reforms.

Minsky's rich framing of macroeconomic dynamics has not yet found its way to the approaches to macro modelling used by international organisations, governments and central banks. It is important that this happens in the coming years. Equally important is the need for more empirical work on the sources of financial fragility analysed by Minskyan theoretical frameworks. In addition, it is worth mentioning that the channels of transmission of financial fragility from high-income countries to emerging and developing economies, in the context of global shadow banking, are still under-explored. Moving forward, the investigation of these channels should be at the core of Minskyan theoretical and empirical research.
More crucially, in the era of climate change, Minskyan perspectives can illuminate the complex dimensions of climate-induced financial instability, both in terms of transition and physical risks. A Minskyan account of these risks can provide a more integrated understanding of their sources and financial implications. Such an understanding might be crucial for the design of a smooth transition to a low-carbon economy.

NOTES

REFERENCES

Abdulkadir, R.I., Abdullah, N.A.H. and Wong, W.C. (2016) Dividend payment behaviour and its determinants: The Nigerian evidence. *African Development Review* 28(1): 53–63.

Arestis, P. and Glickman, M. (2002) Financial crisis in Southeast Asia: Dispelling illusion the Minskyan way. *Cambridge Journal of Economics* 26(2): 237–60.

Argitis, G. (2013) Veblenian and Minskian financial markets. *European Journal of Economics and Economic Policies: Intervention* 10(1): 28–43.

Argitis, G. (2017) Evolutionary finance and central banking. *Cambridge Journal of Economics* 41(3): 961–76.

Argitis, G. (2019) *Evolutionary Financial Macroeconomics*. London: Routledge.

Argitis, G. and Nikolaidi, M. (2014) The financial fragility and the crisis of the Greek government sector. *International Review of Applied Economics* 28(3): 274–92.

Arza, V. and Español, P. (2008) Les Liaisons dangereuses: A Minskyan approach to the relation of credit and investment in Argentina during the 1990s. *Cambridge Journal of Economics* 32(5): 739–59.

Asada, T. (2001) Nonlinear dynamics of debt and capital: A post-Keynesian analysis. In Y. Aruka (ed.), *Evolutionary Controversies in Economics* (pp. 73–87). Tokyo: Springer-Verlag.

Barba, A. and Pivetti, M. (2009) Rising household debt: Its causes and macroeconomic implications – a long-period analysis. *Cambridge Journal of Economics* 33(1): 113–37.

Bastidas, D., Fabre, A. and Mc Isaac, F. (2019) Minskyan classical growth cycles: Stability analysis of a stock-flow consistent macrodynamic model. *Mathematics and Financial Economics* 13(3): 359–91.

Battiston, S., Mandel, A., Monasterolo, I., Schütze, F. and Visentin, G. (2017) A climate stress-test of the financial system. *Nature Climate Change* 7(4): 283–90.

Benigno, P., Eggertsson, G.B. and Romei, F. (2020) Dynamic debt deleveraging and optimal monetary policy. *American Economic Journal: Macroeconomics* 12(2): 310–50.

Benito, A. and Young, G. (2003) Hard times or great expectations? Dividend omissions and dividend cuts by UK firms. *Oxford Bulletin of Economics and Statistics* 65(5): 531–55.

Bernanke, B. and Gertler, M. (1990) Financial fragility and economic performance. *The Quarterly Journal of Economics* 105(1): 87–114.

Bhattacharya, S., Goodhart, C.A.E., Tsomocos, D.P. and Vardoulakis, A.P. (2015) A reconsideration of Minsky's financial instability hypothesis. *Journal of Money, Credit and Banking* 47(5): 931–73.

BIS (2020) The green swan: Central banking and financial stability in the age of climate change. Bank for International Settlements.

Bonizzi, B. and Kaltenbrunner, A. (2019) Liability-driven investment and pension fund exposure to emerging markets: A Minskyan analysis. *Environment and Planning A: Economy and Space* 51(2): 420–39.

Botta, A., Caverzasi, E., Russo, A., Gallegati, M. and Stiglitz, J.E. (2021) Inequality and finance in a rent economy. *Journal of Economic Behavior & Organization* 183: 998–1029.

Cafferata, A., Dávila-Fernández, M.J. and Sordi, S. (2020) (Ir) rational explorers in the financial jungle: Modelling Minsky with heterogeneous agents. Working Paper No. 819, Department of Economics, University of Siena.

Cahen-Fourot, L., Campiglio, E., Dawkins, E., Godin, A. and Kemp-Benedict, E. (2019) Capital stranding cascades: The impact of decarbonisation on productive asset utilisation. Working Paper Series No. 18/2019, WU Institute for Ecological Economics.

Caiani, A., Godin, A., Caverzasi, E., Gallegati, M., Kinsella, S. and Stiglitz, J.E. (2016) Agent based-stock flow consistent macroeconomics: Towards a benchmark model. *Journal of Economic Dynamics & Control* 69: 375–408.

Caldentey, E.P., Favreau Negront, N. and Méndez Lobos, L. (2019) Corporate debt in Latin America and its macroeconomic implications. *Journal of Post Keynesian Economics* 42(3): 335–62.

Campiglio, E., Dafermos, Y., Monnin, P., Ryan-Collins, J., Schotten, G. and Tanaka, M. (2018) Climate change challenges for central banks and financial regulators. *Nature Climate Change* 8(6): 462–8.

Campiglio, E., Monnin, P. and von Jagow, A. (2019) Climate risks in financial assets. Council on Economic Policies. Discussion Note No. 2019/2, Council of Economic Policies (CEP).

Carney, M. (2015) Breaking the Tragedy of the Horizon – climate change and financial stability. Speech given at Lloyd's of London, 29, 220–30.

Charles, S. (2008a) Teaching Minsky's financial instability hypothesis: A manageable suggestion. *Journal of Post Keynesian Economics* 31(1): 125–38.

Charles, S. (2008b) Corporate debt, variable retention rate and the appearance of financial fragility. *Cambridge Journal of Economics* 32: 781–95.

Charles, S. (2016) Is Minsky's financial instability hypothesis valid? *Cambridge Journal of Economics* 40(2): 427–36.

Charpe, M., Flaschel, P., Proaño, C. and Semmler, W. (2009) Overconsumption, credit rationing and bailout monetary policy: A Minskyan perspective. *European Journal of Economics and Economic Policies: Intervention* 6(2): 247–70.

Chiarella, C. and Di Guilmi, C. (2011) The financial instability hypothesis: A stochastic microfoundation framework. *Journal of Economic Dynamics & Control* 35(8): 1151–71.

Cynamon, B.Z. and Fazzari, S.M. (2008) Household debt in the consumer age: Source of growth – risk of collapse. *Capitalism and Society* 3(2): 1–32.

Cynamon, B.Z. and Fazzari, S.M. (2016) Inequality, the Great Recession and slow recovery. *Cambridge Journal of Economics* 40(2): 373–99.

Dafermos, Y. (2018) Debt cycles, instability and fiscal rules: A Godley-Minsky synthesis. *Cambridge Journal of Economics* 42(5): 1277–313.

Dafermos, Y. and Nikolaidi, M. (2019) Fiscal policy and ecological sustainability: A post-Keynesian perspective. In P. Arestis and M. Sawyer (eds), *Frontiers of Heterodox Macroeconomics* (pp. 277–322). Basingstoke: Palgrave Macmillan.

Dafermos, Y. and Nikolaidi, M. (2021) How can green differentiated capital requirements affect climate risks? A dynamic macrofinancial analysis. *Journal of Financial Stability* 54, 100871.

Dafermos, Y., Nikolaidi, M. and Galanis, G. (2017) A stock-flow-fund ecological macroeconomic model. *Ecological Economics* 131: 191–207.

Dafermos, Y., Nikolaidi, M. and Galanis, G. (2018) Climate change, financial stability and monetary policy. *Ecological Economics* 152: 219–34.

Dafermos, Y., Gabor, D. and Michell, J. (2020) Institutional supercycles: An evolutionary macro-finance approach. Working Paper No. 15, Rebuilding Macroeconomics Working Paper Series.

Davis, L.E., De Souza, J.P.A. and Hernandez, G. (2019) An empirical analysis of Minsky regimes in the US economy. *Cambridge Journal of Economics* 43(3): 541–83.

De Paula, L.F.R. and Alves, A.J. (2000) External financial fragility and the 1998–1999 Brazilian currency crisis. *Journal of Post Keynesian Economics* 22(4): 589–617.

Delli Gatti, D. and Gallegati, M. (1990) Financial instability, income distribution, and the stock market. *Journal of Post Keynesian Economics* 12(3): 356–74.

Delli Gatti, D., Gallegati, M. and Gardini, L. (1994) Complex dynamics in a simple macroeconomic model with financing constraints. In G. Dymski and R. Pollin (eds), *New Perspectives in Monetary Macroeconomics* (pp. 51–76). Ann Arbor, MI: University of Michigan Press.

Delli Gatti, D., Gallegati, M., Greenwald, B., Russo, A. and Stiglitz, J.E. (2010) The financial accelerator in an evolving credit network. *Journal of Economic Dynamics & Control* 34(9): 1627–50.

Di Guilmi, C. and Carvalho, L. (2017) The dynamics of leverage in a demand-driven model with heterogeneous firms. *Journal of Economic Behavior & Organization* 140: 70–90.

Dutt, A.K. (1995) Internal finance and monopoly power in capitalist economies: A reformulation of Steindl's growth model. *Metroeconomica* 46(1): 16–34.

Dutt, A.K. (2006) Maturity, stagnation and consumer debt: A Steindlian approach. *Metroeconomica* 57(3): 339–64.

Economist, The (2016) Minsky's Moment, 30 July. Available at: https://www.economist.com/schools-brief/2016/07/30/minskys-moment (last accessed: 31 August 2021)

Eggertsson, G. and Krugman, P. (2012) Debt deleveraging, and the liquidity trap: A Fisher-Minsky-Koo approach. *The Quarterly Journal of Economics* 127(3): 1469–513.

Fazzari, S., Ferri, P. and Greenberg, E. (2008) Cash flow, investment, and Keynes-Minsky cycles. *Journal of Economic Behavior & Organization* 65(3–4): 555–72.

Ferrari-Filho, F., Terra, F.H.B. and Conceição, O.A.C. (2010) The financial fragility hypothesis applied to the public sector: An analysis for Brazil's economy from 2000 to 2008. *Journal of Post Keynesian Economics* 33(1): 151–68.

Ferri, P. and Minsky, H.P. (1992) Market processes and thwarting systems. *Structural Change and Economic Dynamics* 3(1): 79–91.

Ferri, P. and Variato, A. (2010) Financial fragility, the Minskian triad, and economic dynamics. *International Journal of Political Economy* 39(2): 70–82.

Foley, D.K. (1987) Liquidity-profit rate cycles in a capitalist economy. *Journal of Economic Behavior & Organization* 8(3): 363–76.

Foley, D.K. (2003) Financial fragility in developing economies. In A.K. Dutt and J. Ros (eds), *Development Economics and Structuralist Macroeconomics: Essays in Honor of Lance Taylor* (pp. 157–68). Cheltenham, UK and Northampton, MA USA: Edward Elgar.

Franke, R. and Semmler, W. (1989) Debt financing of firms, stability, and cycles in a dynamical macroeconomic growth cycle. In W. Semmler (ed.), *Financial Dynamics and Business Cycles: New Perspectives* (pp. 38–64). New York and London: M.E. Sharpe.

Gabor, D. (2020) Critical macro-finance: A theoretical lens. *Finance and Society* 6(1): 45–55.

Galí, J., 2018. The state of New Keynesian economics: A partial assessment. *Journal of Economic Perspectives* 32(3): 87–112.

Gallardo, J.L., Moreno-Brid, J.C. and Anyul, M.P. (2006) Financial fragility and financial crisis in Mexico. *Metroeconomica* 57(3): 365–88.

Giraud, G. and Grasselli, M. (2021) Household debt: The missing link between inequality and secular stagnation. *Journal of Economic Behavior & Organization* 183: 901–27.

Giri, F., Riccetti, L., Russo, A. and Gallegati, M. (2019) Monetary policy and large crises in a financial accelerator agent-based model. *Journal of Economic Behavior & Organization* 157: 42–58.

Goodwin, R.M. (1967) A growth cycle. In C.H. Feinstein (ed.), *Socialism, Capitalism and Economic Growth: Essays Presented to Maurice Dobb* (pp. 54–8). Cambridge: Cambridge University Press.

Grasselli, M.R. and Costa Lima, B. (2012) An analysis of the Keen model for credit expansion, asset price bubbles and financial fragility. *Mathematical Financial Economics* 6(3): 191–210.

Greenwood-Nimmo, M. and Tarassow, A. (2016) Monetary shocks, macroprudential shocks and financial stability. *Economic Modelling* 56: 11–24.

HLEG (2018) Financing a Sustainable European Economy, Final Report 2018 by the High Level Expert Group on Sustainable Finance Final Report, European Commission.

Isenberg, D. (1989) The financially fragile firm: Is there a case for it in the 1920s?. Working Paper No. 15, The Levy Economics Institute of Bard College.

Jakab, Z. and Kumhof, M. (2019) Banks are not intermediaries of loanable funds – facts, theory and evidence. Staff Working Paper No. 761, Bank of England.

Jarsulic, M. (1989) Endogenous credit and endogenous business cycles. *Journal of Post Keynesian Economics* 12(1): 35–48.

Jarsulic, M. (1990) Debt and macro stability. *Eastern Economic Journal* 16(2): 91–100.

Jump, R.C., Michell, J. and Stockhammer, E. (2017) A strategy switching approach to Minskyan business cycles. Manuscript.

Kaltenbrunner, A. (2015) A post Keynesian framework of exchange rate determination: A Minskyan approach. *Journal of Post Keynesian Economics* 38(3): 426–48.

Kapeller, J. and Schütz, B. (2014) Debt, boom, bust: A theory of Minsky-Veblen cycles. *Journal of Post Keynesian Economics* 36(4): 781–814.

Kapeller, J., Landesmann, M.A., Mohr, F.X. and Schütz, B. (2018) Government policies and financial crises: mitigation, postponement or prevention? *Cambridge Journal of Economics* 42(2): 309–30.

Keen, S. (1995) Finance and economic breakdown modelling Minsky's 'financial instability hypothesis'. *Journal of Post Keynesian Economics* 17(4): 607–35.

Kim, Y.K. (2013) Household debt, financialization, and macroeconomic performance in the United States, 1951-2009. *Journal of Post Keynesian Economics* 35(4): 675–94.

Kim, Y.K. (2016) Macroeconomic effects of household debt: An empirical analysis. *Review of Keynesian Economics* 4(2): 127–50.

Kohler, K. (2019) Exchange rate dynamics, balance sheet effects, and capital flows. A Minskyan model of emerging market boom-bust cycles. *Structural Change and Economic Dynamics* 51: 270–83.

Kregel, J. (1998) Yes, 'it' did happen again. Working Paper No. 234, The Levy Economics Institute.

Kregel, J. (2014a) Economists and depression: Did it happen again? On Minsky's financial macroeconomics. *History of Economic Ideas* 22(3): 137–45.

Kregel, J.A. (2014b) Minsky and dynamic macroprudential regulation. Public Policy Brief No. 131, The Levy Economics Institute.

Lamperti, F., Bosetti, V., Roventini, A. and Tavoni, M. (2019) The public costs of climate-induced financial instability. *Nature Climate Change* 9(11): 829–33.

Lavoie, M. (1995) Interest rates in post-Keynesian models of growth and distribution. *Metroeconomica* 46(2): 146–77.

Lavoie, M. (2014) *Post-Keynesian Economics: New Foundations*. Cheltenham, UK and Northampton, MA, USA: Edward Elgar.

Lavoie, M. and Seccareccia, M. (2001) Minsky's financial fragility hypothesis: A missing macroeconomic link? In P. Ferri and R. Bellofiore (eds), *Financial Fragility and Investment in the Capitalist Economy: The Economic Legacy of Hyman Minsky* Vol. 2 (pp. 76–96). Cheltenham, UK and Northampton, MA, USA: Edward Elgar.

Lima, G.T. and Meirelles, A.J.A. (2007) Macrodynamics of debt regimes, financial instability and growth. *Cambridge Journal of Economics* 31(4): 563–80.

Lojak, B. (2018) The emergence of co-existing debt cycle regimes in an economic growth model. *Metroeconomica* 69(3): 526–45.

McLeay, M., Radia, A. and Thomas, R. (2014) Money creation in the modern economy, *Bank of England Quarterly Bulletin* 54(1): 14–27.

Michell, J. (2014) A Steindlian account of the distribution of corporate profits and leverage: A stock-flow consistent macroeconomic model with agent-based microfoundations. Working Paper No. 1412, Post-Keynesian Economics Study Group (PKSG).

Minsky, H.P. (1975) *John Maynard Keynes*. New York: Columbia University Press.

Minsky, H.P. (1982) *Inflation, Recession and Economic Policy*. New York: M.E. Sharpe.

Minsky, H.P. (2008) *Stabilizing an Unstable Economy*. New York: McGraw-Hill. Originally published 1986.

Minsky, H.P. (1992) The financial instability hypothesis. Working Paper No. 74, The Levy Economics Institute.

Minsky, H.P., Papadimitriou, D.B., Phillips, R.J. and Wray, L.R. (1993) Community development banking: A proposal to establish a nationwide system of community development banks. Public Policy Brief No. 3/1993, The Levy Economics Institute.

Mitchell, W. and Wray, L.R. (2005) In defense of employer of last resort: A response to Malcolm Sawyer. *Journal of Economic Issues* 39(1): 235–44.

Mulligan, R. (2013) A sectoral analysis of the financial instability hypothesis. *The Quarterly Review of Economics and Finance* 53(4): 450–9.

Nasica, E. and Raybaut, A. (2005) Profits, confidence, and public deficits: Modeling Minsky's institutional dynamics. *Journal of Post Keynesian Economics* 28(1): 136–54.

Ndikumana, L. (1999) Debt service, financing constraints, and fixed investment: Evidence from panel data. *Journal of Post Keynesian Economics* 21(3): 455–78.

NGFS (2019) Macroeconomic and financial stability: Implications of climate change. Network for Greening the Financial System, June.

Nikolaidi, M. (2014) Margins of safety and instability in a macrodynamic model with Minskyan insights. *Structural Change and Economic Dynamics* 31: 1–16.

Nikolaidi, M. (2015) Securitisation, wage stagnation and financial fragility: A stock-flow consistent perspective, Greenwich Papers in Political Economy No. 27, GPERC.

Nikolaidi, M. (2017) Three decades of modelling Minsky: What we have learned and the way forward. *European Journal of Economics and Economic Policies: Intervention* 14(2): 222–37.

Nikolaidi, M. and Stockhammer, E. (2017) Minsky models: A structured survey. *Journal of Economic Surveys* 31(5): 1304–31

Nishi, H. (2012) A dynamic analysis of debt-led and debt-burdened growth regimes with Minskian financial structure. *Metroeconomica* 63(4): 634–60.

Nishi, H. (2019) An empirical contribution to Minsky's financial fragility: Evidence from non-financial sectors in Japan. *Cambridge Journal of Economics* 43(3): 585–622.

Palley, T.I. (1994) Debt, aggregate demand, and the business cycle: An analysis in the spirit of Kaldor and Minsky. *Journal of Post Keynesian Economics* 16(3): 371–90.

Palley, T.I. (1997) Endogenous money and the business cycle. *Journal of Economics* 65(2): 133–49.

Palley, T.I. (2010) The relative permanent income theory of consumption: A synthetic Keynes–Duesenberry–Friedman model. *Review of Political Economy* 22(1): 41–56.

Palley, T.I. (2011) A theory of Minsky super-cycles and financial crises. *Contributions to Political Economy* 30(1): 31–46.

Papadimitriou, D.B. and Wray, R. (1998) The economic contributions of Hyman Minsky: Varieties of capitalism and institutional reform, *Review of Political Economy* 10(2): 199–225.

Passarella, M. (2012) A simplified stock-flow consistent dynamic model of the systemic financial fragility in the 'New Capitalism'. *Journal of Economic Behavior & Organization* 83(3): 570–82.

Pedrosa, Í. (2019) Firms' leverage ratio and the Financial Instability Hypothesis: An empirical investigation for the US economy (1970–2014). *Cambridge Journal of Economics* 43(6): 1499–523.

Pedrosa, Í. and Lang, D. (2018) Heterogeneity, distribution and financial fragility of non-financial firms: An agent-based stock-flow consistent (AB-SFC) model. hal-01937186

Reissl, S. (2020) Minsky from the bottom up – formalising the two-price model of investment in a simple agent-based framework. *Journal of Economic Behavior & Organization* 177: 109–42.

Ryoo, S. (2010) Long waves and short cycles in a model of endogenous financial fragility. *Journal of Economic Behavior & Organization* 74(3): 163–86.

Ryoo, S. (2013a) Minsky cycles in Keynesian models of growth and distribution. *Review of Keynesian Economics* 1(1): 37–60.

Ryoo, S. (2013b) Bank profitability, leverage and financial instability: A Minsky-Harrod model. *Cambridge Journal of Economics* 37(5): 1127–60.

Ryoo, S. (2016) Household debt and housing bubble: A Minskian approach to boom-bust cycles. *Journal of Evolutionary Economics* 26(5): 971–1006.

Ryoo, S. and Kim, Y.K. (2014) Income distribution, consumer debt and keeping up with the Joneses. *Metroeconomica* 65(4): 585–618.

Sasaki, H. and Fujita, S. (2012) The importance of the retention ratio in a Kaleckian model with debt accumulation. *Metroeconomica* 63(3): 417–28.

Sawyer, M. (2003) Employer of last resort: Could it deliver full employment and price stability? *Journal of Economic Issues* 37(4): 881–907.

Sawyer, M. (2005) Employer of last resort: A response to my critics. *Journal of Economic Issues* 39(1): 256–64.

Schroeder, S. (2009) Defining and detecting financial fragility: New Zealand's experience. *International Journal of Social Economics* 36(3): 287–307.

Scott, M., van Huizen, J. and Jung, C. (2017) The Bank of England's response to climate change, *Quarterly Bulletin* 2017 Q2.

Semieniuk, G., Campiglio, E., Mercure, J.F., Volz, U. and Edwards, N.R. (2021) Low-carbon transition risks for finance. *WIREs Climate Change* 12: 1–24.

Semmler, W. (1987) A macroeconomic limit cycle with financial perturbations. *Journal of Economic Behavior & Organisation* 8(3): 469–95.

Skott, P. (1994) On the modeling of systemic financial fragility. In A.K. Dutt (ed.), *New Directions in Analytical Political Economy* (pp. 49–76). Aldershot, UK and Brookfield, VT, USA: Edward Elgar.

Sordi, S. and Vercelli, A. (2014) Unemployment, income distribution and debt-financed investment in a growth cycle model. *Journal of Economic Dynamics & Control* 48: 325–48.

Stockhammer, E. and Michell, J. (2017) Pseudo-Goodwin cycles in a Minsky Model. *Cambridge Journal of Economics* 41(1): 105–25.

Stockhammer, E., Jump, R.C., Kohler, K. and Cavallero, J. (2019a) Short and medium term financial-real cycles: An empirical assessment. *Journal of International Money and Finance* 94: 81–96.

Stockhammer, E., Gouzoulis, G. and Jump, R.C. (2019b) Debt-driven business cycles in historical perspective: The cases of the USA (1889–2015) and UK (1882–2010). Working Paper No. 1907, Post-Keynesian Economics Society (PKES).

Taylor, L. and O'Connell, S.A. (1985) A Minsky crisis. *Quarterly Journal of Economics* 100(Supplement): 871–85.

Terra, F.H.B. and Ferrari-Filho, F. (2020) Public Sector Financial Fragility Index: An analysis of the Brazilian federal government from 2000 to 2016. *Journal of Post Keynesian Economics*: 1–25.

Toporowski, J. (2008) Minsky's 'induced investment and business cycles'. *Cambridge Journal of Economics* 32(5): 725–37.

Torres Filho, E.T., Martins, N.M. and Miaguti, C.Y. (2019) Minsky's financial fragility: An empirical analysis of electricity distribution firms in Brazil (2007–2015). *Journal of Post Keynesian Economics* 42(1): 144–68.

Tymoigne, E. (2014) Measuring macroprudential risk through financial fragility: A Minskian approach. *Journal of Post Keynesian Economics* 36(4): 719–44.

Wolfson, M.H. (1990) The causes of financial instability. *Journal of Post Keynesian Economics* 12(3): 333–55.

Wray, L.R. (2006) Extending Minsky's classifications of fragility to government and the open economy. Working Paper No. 450, The Levy Economics Institute of Bard College.

Wray, L.R. (2011) Minsky's money manager capitalism and the global financial crisis. *International Journal of Political Economy* 40(2): 5–20.

Wray, L.R. (2015) Minsky on banking: Early work on endogenous money and the prudent banker. Working Paper No. 827, The Levy Economics Institute of Bard College.

Wray, R. and Tymoigne, E. (2009) Macroeconomics meets Hyman P. Minsky: The financial theory of investment. In G. Fontana and M. Setterfield (eds), *Macroeconomic Theory and Macroeconomic Pedagogy* (pp. 234-251). Basingstoke: Palgrave Macmillan.

Yilmaz, S.D. and Stockhammer, E. (2019) Coupling cycle mechanisms: Minsky debt cycles and the multiplier-accelerator. Working Paper No. 1904, Post-Keynesian Economics Society (PKES).