How Bailouts Improve Societal Welfare: An Agent-Based Simulation

Aristeidis Samitas[1a], Stathis Polyzos[b], Elias Kampouris[b]

[a] *College of Business, Zayed University*
Abu Dhabi - Khalifa City, UAE

[b] *Department of Business Administration, Business School, University of the Aegean*
8 Michalon Str, Chios, 82100, Greece

Abstract

We model the effects of banking crises on the happiness of employees, using an agent-based model. Existing literature suggests that happiness is influenced by both the negative psychological effects of recessions and the adverse economic effects of income loss and increased unemployment. We show that the different choices of regulatory response to a banking crisis carry different opportunity costs in terms of welfare and that societal preferences should be taken into account. In addition, we examine the transmission of banking crises to the well-being of individuals and show that the resulting adverse effects influence different employee classes in an asymmetric manner. Finally, our results demonstrate that it is generally preferable for authorities to bail out banks in distress, rather than sustain the welfare loss of a bank failure. Our findings extend existing literature on employee happiness and well-being, by quantifying the welfare cost of financial instability.

Keywords: happiness economics; banking crises; agent-based modelling; subjective well-being

JEL Classification: E6 I3 G28 H3

[1] Corresponding author. E-mail address: Aristeidis.Samitas@zu.ac.ae, Telephone: +971 2 599 3474

1. Introduction

The effects of banking crises on the financial system and real economy have long been the center of attention for researchers. Numerous studies quantify the results of such crises in monetary terms and propose different solutions to the problem. In this paper, we describe the results of banking crises on the subjective well-being of individuals that are affected by crises. We use an agent-based model to perform simulations in order to quantify the welfare loss of financial instability and to propose solutions, according to the relative preferences of the focal society. We show that using public money to bail out banks is, in some cases, less costly in terms of welfare as opposed to dealing with a bank failure. Additionally, we find that, despite the trade-off between bailouts and public goods spending, lower employee classes, who consume relatively more public goods, benefit equally from bank bailouts. Finally, we introduce a Tobin tax (a tax on withdrawals during a banking crisis) and examine its effects on the above issues.

In general, researchers (Chari and Jagannathan, 1988; Allen and Gale, 1998; Zhu, 2005) tend to consider household agents as utility-maximizing agents, who behave rationally under a constant utility function. However, we can argue that, during a severe banking crisis, the agents' utility function shifts significantly. In such a case of (real or perceived) financial fragility, the preferences of some economic agents change and they may no longer focus on consumption or on maximizing their wealth (by investing excess funds). These agents instead behave with the sole purpose of retaining their current level of wealth, which is at risk owing to the perceived banking crisis. Hence, the rational behavior hypothesis of maximizing utility through maximizing wealth and consumption and maintaining financial stability is no longer valid. This needs to be handled in any modelling effort.

In order to model the effects of banking crises on societal welfare, we extend the agent-based financial model of Polyzos and Samitas (2015) in order to include subjective well-being and unemployment. The model is designed to simulate the behavior of economic agents and is loosely based on the work of Tsomocos (2003). However, the Tsomocos model is extended to include agent-based characteristics, with agents behaving as active decision makers with learning capabilities. This is a new trend in financial research (e.g., Riccetti et al., 2015; Bookstaber et al., 2018), even though agent-based models have been heavily used in business research (e.g. Midgley et al., 2007; Schubring et al., 2016). The specific agent-based model has also been used to simulate the post-Brexit economic system (Samitas et al., 2018). Our banking crisis model is based on that of Wong et al. (2011).

This study contributes to three aspects of the relevant literature. First, to the best of our knowledge, there is no research using agent-based modeling to examine the links between subjective well-being and financial stability. Second, this study models the effects of a Tobin tax on the economy, from the perspectives of both financial stability and societal welfare. Third, this study proposes the best policy mix to handle banking crises according to society's preferences for financial stability and public goods.

The rest of this paper is organized as follows. Section 2 presents the relevant literature, while Section 3 discusses agent-based modeling and the methodology employed. Section 4 presents the empirical findings, and Section 5 concludes with policy implications.

2. Literature Review

Even though there are known difficulties in defining and measuring subjective well-being (Kahneman and Krueger, 2006), it has been shown that it is affected by financial distress (Giarda, 2013) and income (Kahneman and Krueger, 2006), regardless of the definition used. Diener et al. (1993) agree that income is an important factor in measuring subjective well-being and that this is true for all social classes. Marini (2005) attempts to link the setup of a financial system and social welfare. A thorough review of the economics of happiness, the research field that attempts to find links between economic policies and societal welfare, can be found in Powdthavee (2007). The author finds that, apart from demographic factors (e.g., age, marital status, and gender) researchers have linked employee happiness to GDP (Di Tella et al., 2003; Jaikumar et al., 2018), stress (Rego and e Cunha, 2008), unemployment (Stracca, 2014; Arampatzi et al., 2015), the quality of corporate leadership (Salas-Vallina et al., 2018), and inflation (Janiak and Monteiro, 2011).

In addition, Di Tella et al. (2003) find that happiness is negatively affected by banking crises both through the effects of the crises on the aforementioned factors and through the crises themselves. The authors note that during a perceived financial crisis, the reported levels of well-being are lower, even though the actual effects of the crisis may not yet be visible by other means. Ervasti and Venetoklis (2010) use data from 21 European countries and show that both unemployment and financial strain cause welfare loss. Ratcliffe and Taylor (2015) suggest that the stock market (and stock market volatility) is linked to the level of happiness of individuals, since it is often an indicator of economic prospects.

However, other researchers seem to add more ingredients to the mix of happiness economics. Jappelli et al. (2013) conclude that the level of debt may affect a household's perceived happiness. Hovi and Laamanen (2016) show that the link between well-being and the absolute level of output is spurious, since output has a generally upward trend, while well-being does not. The authors propose the use of output deviation from its long-term average trend as a variable with stronger explanatory power. Happiness is also linked to economic development (Stevenson and Wolfers, 2008) and, thus, GDP growth, and there seems to be no evidence of a "satiation point," a point of economic development after which a country would have no further improvement in subjective well-being.

Senik (2014) and Van Praag et al. (2003) imply that net wealth may also be a factor in happiness economics. Giarda (2013) corroborates these findings and proposes that a banking crisis causes financial distress in an asymmetric manner among households, implementing the distinction according to the Eurostat deprivation index. This asymmetric effect is also demonstrated by Arampatzi et al. (2015), with unemployment being the transmission channel in this case. Finally, consumption preferences appear to affect happiness, and are in fact closely linked to behavior toward risk. Zhu (2005) proposes a simulation model that clearly distinguishes household agents based on consumption preferences, characterizing them as "patient" or "impatient."

Happiness, however, may also be linked with government policies. Di Tella et al. (2003) suggest that even as unemployment rises, the state can mitigate the negative effects in well-being by implementing welfare-improving policies. The authors examine unemployment benefits as the go-to choice for correcting welfare losses and show that there is a positive link with reported levels of happiness. Pacek and Radcliff (2008) show that higher government spending on welfare in general is, *ceteris paribus*, linked to a higher level of perceived happiness by individuals. Often, this parameter is overlooked in the relevant literature discussing financial crises.

The relationship between the financial sector and subjective well-being has been examined in the relevant literature. García-Palacios et al. (2014) show that there is a welfare opportunity cost to bailing out banks using public money. The authors conclude that the preferences of households in terms of public services and the propensity of banks to invest are decisive factors in determining the optimal solution and propose a tax on early withdrawals as a relatively efficient alternative to bailouts. Policy responses to mitigate the moral hazard are also examined in Cheng et al. (2015).

3. Methodology

3.1 Agent-Based Modelling

In agent-based economics (LeBaron, 2001; Tesfatsion, 2006), the economic system is modelled as a constant interaction between heterogeneous agents, with differing (and often clashing) rational objectives. In this type of model, multiple dynamic equilibria can be attained as the outcome of the aforementioned interactions. The lack of a single equilibrium is one of the key advantages of agent-based models as descriptions of real-world economic systems. In addition, the term "agent-based" describes an economy with a bottom–up approach, which begins at the individual agent level.

The agent-based system used in this study can perform multi-period simulations of the banking environment. The general model structure is based on Tsomocos (2003) and Goodhart et al. (2004), which has been extended to include four types of economic agents: banks, firms, households, and the regulator. Only one regulator can exist in the model, while the numbers of banks, firms, and households are theoretically unlimited. All types of agents share some common features and functions. This type of artificial economy setup is very popular in agent-based models, such as Iacoviello (2005) and Rashid et al. (2011). The model is comprised of two components, the training period and the simulation period, as is common in models of this genre.

These agents operate under a given supervisory framework that is set forth by a market regulator. There is a constant, but not unconditional, flow of funds between these agents, which can take place in various ways, ranging from the exchange of financial goods between banks and their customers to the payment of wages by firms to households. Firms operate and improve their productive capacity using financing from the banking system, which draws liquidity from the funds of depositors. The model allows agents to go bankrupt. Bankruptcy occurs when agents are unable to meet their financial obligations. The insolvency conditions are stricter for banks than they are for other agents and, naturally, the consequences also differ. The model supports various methods of handling banks in distress, including the bail-in solution, which was implemented to resolve the 2013 Cyprus financial crisis.

3.2 Formal Model Definition

The model performs a series of algorithmic steps on the artificial economy. In this section, we present the notation used in our model and describe the steps in detail. The notation is as follows.

N1. $t \in T = \{1, \dots, T\}$: The model runs on group time periods of order $|T|$

N2. $h \in H = \{1, \dots, H\}$: The artificial economy includes a set of households of order $|H|$

N3. $b \in B = \{1, \dots, B\}$: The artificial economy includes a set of banks of order $|B|$

N4. $f \in F = \{1, \dots, F\}$: The artificial economy includes a set of firms of order $|F|$

N5. $bc \in BC = H \cup F$*:* The set of potential bank retail customers in the economy (i.e., firms and households)

N6. $e \in E = BC \cup B = H \cup F \cup B$*:* Set of all economic agents in our system

N7. $fa \in FA = \{1, \dots, FA\}$: The active financial assets traded at any given time *t*

N8. $eb \in EB \subseteq E$: The set of bankrupt economic agents (the agent type can be a bank, firm, or household). This a subset of set E and is initially empty.

It must be noted that once an agent goes bankrupt, she will not participate in any financial transactions in the artificial economy. Thus, in the simulation steps described later in this section, sets E, H, F, and B actually contain only the active agents of the corresponding sets. These sets are defined as the difference of the sets at time *t*=0 from EB. Consequently, the active agent sets are as follows.

N9. $h \in H = H_0 - EB_H$

$f \in F = F_0 - EB_F$

$b \in B = B_0 - EB_B$

$e \in E = E - EB = (H_0 - EB_H) \cup (F_0 - EB_F) \cup (B_0 - EB_B)$

N10. $g \in G_t = \{1, \dots, G_t\}$: This set contains all the goods available for sale at time *t*. These goods are produced at time *t*-1.

N11. Total production (i.e., the total value of goods traded) at time *t* equals the total capacity of active firms at time *t*-1.

$$Production_t = \sum_{\forall f \in F} Capacity_{f,t-1} = \sum_{\forall g \in G} Value_{g,t}$$

N12. $un \in UN \subseteq H$: The set of unemployed households. This is a subset of H and its members change every period.

In addition, the following assumptions hold.

A1. $\forall\, e \in E : a \in A_e \subseteq FA$: All economic agents carry a proprietary list of assets, which is a subset of FA.

A2. $\forall\, e \in E : l \in L_e \subseteq FA$: All economic agents carry a proprietary list of liabilities, which is a subset of FA.

A3. $\forall fa \in FA: \exists!\, e \in E: fa \in A_e$ and $\forall fa \in FA: \exists!\, e \in E: fa \in L_e$
For all financial assets, exactly one agent carries the item in her assets and exactly one agent carries the item in her liabilities.

We should note here that the banks' asset vectors are further divided into three subgroups according to the asset's liable agent. These groups can then be used to calculate the sum of weighted assets, since a different asset weight is assigned according to the type of the liable agent (bank, firm, or household).

A4. $\forall g \in G_t: \exists!\, h \in H: g \in Exp_e\ and\ \forall g \in G_t: \exists!\, f \in F: g \in Production_f$
For all goods in the market at the end of time period *t*, only one household has purchased the item (and thereby derived utility from it) and only one firm has produced the item at time *t*-1.

The corollary of assumption A4 is that the goods market must always clear domestically at the end of each period, since foreign trade (and hence, currency crises) is not considered for now. It should also be noted that price changes are not modeled.

The regulator decides on a vector of market rules, which includes the capital adequacy ratios (the basic Tier 1 ratio, the capital conservation buffer[2], and the countercyclical capital buffer[3]) as well as the liquidity coverage ratio (LCR). The LCR, when applicable, is calculated separately for each bank in each time period and is set equal to the total outflow of funds from deposit accounts in the last time period. The resulting rule vector imposes the minimum requirements for each banking institution, thereby affecting the funds that the institution makes available to other agents in the system.

[2] The Capital Conservation Buffer is an additional capital buffer introduced under Basel III and is equal to 2.5% of the bank's weighted assets.

[3] The Countercyclical Capital Buffer was introduced under Basel III and its implementation is at the discretion of authorities. It allows national regulators to require additional capital buffers which are accumulated during periods of economic growth. The Countercyclical Capital Buffer can equal at most 2.5% of the bank's weighted assets. According to Basel III, the Countercyclical Capital Buffer must be increased if the economy experiences three consecutive expansionary periods and must be reduced if the economy experiences three consecutive contractionary periods. The Countercyclical Capital Buffer is currently being be phased-in

The rule vector is the following.

N13. $r_{b\in B,t\in T} = \{CapReqVector_t, LiqC_{b,t}\} = \{\{t1, CapB, CntCapB_t\}, LiqC_{b,t}\}$

The vector for each bank in each time period contains a Tier 1 capital requirement (t1), the capital conservation buffer, and the countercyclical capital buffer for the given time period as well as the amount resulting from implementing the LCR on the given bank in the given time period (LiqC). This amount, LiqC, is calculated for each bank at each time step (see Step 1.1 below).

The rules are applied in sets. We enforce the Basel III set of rules and thus, the vector is as follows:

$$r_{b\in B,t\in T} = \{\{0.08, 0.025, CntCapB_t \in \{0.000, 0.005, 0.010, 0.015, 0.020, 0.025\}\}, LiqC_{b,t}\}$$

The countercyclical capital buffer is initiated at 0.005 (i.e., 0.5% of a bank's weighted assets).

The regulator also implements the vector by which the assets of a bank are weighted. The weight vector depends on the type of rule set and is fixed throughout each simulation.

N14. $w = \{w_{b\in B}, w_{h\in H}, w_{f\in F}\}$: The weight vector w contains weights for each type of asset, which may be different from each other.

N15. Hence, the sum of weighted assets of the bank can be calculated using the following equation:

$$wa_{b\in B,t\in T} = \sum_{\forall b\in B} \begin{cases} a_{b,t} \times w_b \; if \; \exists \; b' \in B : a_{b,t} \in L_{b',t} \\ a_{b,t} \times w_h \; if \; \exists \; h \in H : a_{b,t} \in L_{h,t} \\ a_{b,t} \times w_f \; if \; \exists \; f \in F : a_{b,t} \in L_{f,t} \end{cases}$$

The sum of the bank's weighted assets is the sum of the products of each asset in the bank's asset set with the corresponding weight (for that asset) from the weight vector w.

The system is initialized using the algorithm described below.

0. System Initialization:

0.1. Banks receive a random amount of initial cash equal to the product of a random variable times the number of households in the system

$\forall \; b \; \in \; B : \; CB_{b,t=0} = \; U(1, 10) * |H|$

0.2. Firms start with an initial random productive capacity equal to the product of a random variable times the number of households over the number of firms in the system

$\forall f \in F : Capacity_{f,t=0} = U(1,10) * (|H|/|F|)$

0.3. Households receive a random amount of initial cash. Furthermore, firms are characterized by random precautionary demand for money[4], which signifies the amount of money that they choose to keep outside of deposit accounts. This is a fraction of their initial cash.

$\forall h \in H : CB_{h,t=0} = U(1,10)$

$\forall h \in H : PB_{h,t=0} = U(1,10)$

In addition, some households behave in a risk-loving manner, opting for higher interest rates for their deposits even if the bank offering them is in distress. Finally, we implement a feature of increased vulnerability to financial crises, based on García-Palacios et al. (2014) and Giarda (2013). Giarda (2013) suggests that this affects approximately 15% of the workforce. This feature is important, because we monitor the unemployment and happiness levels of the vulnerable group separately.

Before beginning the simulation process, we introduce some further notation.

N16. $\forall b \in B, t \in T: AvB_{b,t} = CB_{b,t} - \left[\sum_{\forall i \in CapReqVector_t}(CapReqVector_{i,t} \times wa_{b,t})\right] - LiqC_{b,t}$

For each bank, the available balance is calculated by subtracting regulatory funds for the bank's cash reserves. The sum in the statement above is the sum of the products of each imposed capital buffer rule (see N13 above) with the sum of the weighted assets of the bank, as calculated in N15. This amount is subtracted from the bank's cash balance, since it cannot be used to purchase assets.

N17. $\forall h \in H, t \in T: AvB_{h,t} = CB_{h,t} - PB_{h,t}$

For each household, the available balance is given by the difference of the cash balance and the precautionary demand.

[4] The precautionary demand is important in the model, since it corresponds to the households' trust in the banking system (when there is mistrust in the banking system, the precautionary balance increases – Karas et al, 2013)

The simulation steps follow the order given below.

1. Simulation Step at Time *t*

1.1. The LCR is calculated for each bank. The required amount is the difference of deposit funds from the last period to the current one. If the outflow of funds is negative, the LCR is zero.
Assuming that the deposits of a bank at any given time are given by
$d \in D_{b\in B,t\in T} \subseteq L_{b,t}$,
the amount required to satisfy the LCR rule is given by

$$LiqC_{b\in B,t\in T} = 100\% \times \begin{cases} 0\,, if\ outflow\ is\ negative \\ \sum_{d\in D_{b\in B,t\in T}} d_{b,t-1} - \sum_{d\in D_{b\in B,t\in T}} d_{b,t} \end{cases}.$$

1.2. Interest is added to all loans in the list of financial assets
$\forall\, \lambda \in \Lambda \subseteq FA: Amt_{\lambda,t} = Amt_{\lambda,t-1} + \left(Amt_{\lambda,t-1} \times ir_{\Lambda}\right)$,
where Λ is the subset of financial assets that represents a loan asset, *Amt* is the amount remaining in the loan, and *ir* is the interest rate for the particular security.

1.3. Add household income (wages or unemployment benefits) and subtract expenditure
$\forall\, h \in H:$

$$\begin{aligned} CB_{h,t} &= CB_{h,t-1} + Wage\left(\stackrel{\text{def}}{=} f(Production_{t-1}, |H|)\right) \\ &+ UnemploymentBenefit(if\ h \in UN) \\ &- Expenditure\left(\stackrel{\text{def}}{=} g(Wage)\right) \end{aligned}$$

Household wages are a function of last period's total production (by firms) and the number of households in the system. In addition, it is important to note that unemployment benefits are paid from government funds collected via taxation and the Tobin tax, if implemented (see step 1.12).

1.4. Banks make payments for high-risk securities as follows:
$\forall\, b \in B: \forall\, i \in I \subseteq A_{i,t}: Amt_{i,t} = Amt_{i,t-1} + \left(Amt_{i,t-1} \times ir_{I}\right)$ (interest is added to the amount).
In this step, the amount remaining in each security is added to the CB of the asset holder and subtracted from the CB of the liable bank. When paying out a security yield, the liable bank uses its CB value, not the AvB value (see N16).

1.5. Economic agents (banks, firms, and households) pay their loan obligations $\forall\, \lambda \in \Lambda \subseteq FA: Amt_{i,t} = Amt_{i,t-1} - Pmt_{\lambda} = Amt_{i,t-1} - InitialAmount \times \left(ir + \frac{ir}{(1+ir)^{n}-1}\right)$.

Payment *Pmt* is subtracted from the CB of the liable economic agent and added to the CB of the asset holder (bank). When repaying loans, the liable economic agents use their CB value, not the AvB value, since the precautionary demand (which leads to the AvB value) is not taken into account when repaying a loan. If CB does not fully cover the obligation, households have to dip into their savings (money in deposit accounts), until either all savings are withdrawn from banks or no more outstanding payments remain.

1.6. Households place their excess cash balance in a deposit account. Banks in more urgent need of cash issue high-yield securities. Only risk-loving households[5] may opt to invest the money in a security (if any banks offer the product) or a deposit, with equal probability for each case. Meanwhile, rational, risk-averse households stick to normal deposit products. Once the choice of product is made, a random bank is chosen, with banks that offer higher interest rates having more chances of being picked.

Hence, the expected reward function of each asset for the depositor is as follows:

(EQ1) $$E(R)_{a,h\in H,t} = Amt_{a,t-1} \times ir_{a} \times \left(1 - PD_{b\in B: a\in L_{b}}\right)$$

where PD is the probability of default of the bank that carries the asset in its liabilities. The probability of default is different for each institution, depends on the regulator's solution to bank distress, and is equal to

(EQ2) $$PD_{b,t} = f_{b}\left(r_{b,t}\right)$$

Combining (EQ1) and (EQ2), we obtain

(EQ3) $$E(R)_{a,h\in H,t} = Amt_{a,t-1} \times ir_{a} \times \left(1 - f_{b}\left(r_{b,t}\right)\right)$$

[5] We assume that there is a signalling behaviour here, meaning that households are aware that the reason why the bank issues the high-yield security is its immediate need for cash. Thus only specific categories of households will participate in this market. This assumption is consistent with Diamond (1997) and Allen and Gale (2004), who suggest limited market participation.

(EQ3) signifies the importance of regulation for the utility received by depositors in the banking sector, a setup similar to social planning in García-Palacios et al. (2014).

1.7. Bank customers seek financing. In this step, any firms or households that have liabilities with missed payments or that have a negative available balance seek funds from the marketplace. Banks are selected according to the lowest interest rate offered for loans and agents ask for the full financing required. Banks in turn offer the amount they can (i.e., their AvB figure at time *t*) and if the required amount is not covered, the next bank in the ordered list is chosen. Banks finance the firm or household if the banking system can cover their full financing needs. If, at the end, the customer's full financial needs are not met, then no loans are taken out.

1.8. Banks seek financing. In this step, any banks that have liabilities with missed payments or that have a negative available balance seek funds from the marketplace. Financing banks are chosen in random order and the initial bank asks for the full financing it needs. Financing banks in turn offer the amount they can (i.e., their AvB figure at time *t*) and if the bank is not covered, the next random bank is chosen to seek the remaining financing from. Banks finance the initial bank if the banking system can cover their full financing needs.

1.9. Any agents (banks, households, or firms) that still have missed payments are candidates for default. The default criteria differ for banks and households and naturally, the consequences for the specific agent and the entire system are different. Banks with one missed payment are immediately candidates for default while for firms and households, the threshold is placed at three missed payments. The criteria for banks are stricter, since it is not acceptable for a financial institution to be unable to make payments for its liabilities.

1.10. The government produces public goods, using the remaining funds collected from taxation in the last period. In this way, there is a trade-off between bank bailouts, unemployment benefits, and public goods. If the government chooses to rescue a bank, it has less to spend on public goods. However, if the bank fails and unemployment rises as a result of the ensuing crisis, there is less money available for public goods.

1.11. Banks re-examine their interest rate policy. The average weighted cost of capital is used as the main deposit rate, which is increased further if the bank approaches the distress zone.

1.12. Firms propose investment projects. If a firm does not currently have an investment project underway, it proposes one to the banking system. Investment projects carry a random return (this can be considered similar to the internal rate of return, IRR), which will help the firm increase productive capacity. For a project to be accepted, the firm must find a willing financier to finance the venture at a cost lower than the project's return. Each firm carries a random probability that its projects will fail. If the firm is unable to find funding for investment projects, it gradually loses productive capacity. In this way, high interest rates tend to reduce long-term economic growth and eventually lead to bank distress.

Therefore, the productive capacity for each firm at any given time is expected to be equal to

(EQ4)
$$Capacity_{f\in F,t} = Capacity_{f,t-1} + \begin{cases} U\big(\mathrm{Min}(IRR), \mathrm{Max}(IRR)\big) \times (-1), & without\ active\ investment\ project \\ IRR_{pr,f} \times \big(1 - PF_f\big), & with\ active\ investment\ project \end{cases}$$

If the firm fails to find financing for its current project, its productive capacity is reduced by a random amount, with uniform distribution between the minimum and maximum IRRs of all active projects in the system. We should note that firms produce the artificial economy's goods according to their capacity and taxes are collected on production, since the market always clears.

1.13. The regulator re-examines the countercyclical capital buffer. The decision to increase the percentage for the countercyclical capital buffer is taken when three consecutive growth periods have been achieved. Similarly, it is

decreased after three consecutive recession periods. This is a limited approach to the implementation of the policy (Drehmman et al., 2010)[6].

1.14. Individual and societal subjective well-being is calculated. We base our utility function on Giarda (2013); the intertemporal change of variables and not their absolute levels affect happiness. The function is defined as follows:

(EQ5) $$SubjectiveWell - Being_{h \in H,t} = f'(\Delta GDP, \Delta Income_h,\ BankingCrisis_t,\ Employment_h, \Delta PublicGoods, \Delta NetWealth_h)$$

In order to avoid problems with the relative values of these heterogeneous components, each one of them contributes just 1 unit to subjective well-being. Thus, if there is positive growth, subjective well-being increases by one, while it decreases if there is contraction in the economy. All variables affect subjective well-being positively, except for banking crises, which affect it negatively.

All variables contribute equally, except for banking crises and spending on public goods. We calculate a coefficient of these two variables in order to shift societal preferences toward financial stability.

1.15. The system recalculates each household's employment status. During an economic downturn (i.e., a reduction of GDP), there is increased chance of a negative change in households' employment status (i.e., from employed to unemployed), while the opposite occurs during economic expansion. In addition, there is increased probability of a negative change for vulnerable households and a decreased probability of a positive change, similar to Giarda (2013).

1.16. Statistics are collected.

1.17. The system progresses to the next time period.

[6] Despite its limitations, this implementation is consistent with the basic motivation behind its introduction in Basel III whereby banks are forced to accumulate capital during expansionary periods in order to ensure liquidity under recessionary periods.

3.3 Robustness Checks

Table 1. Results of Robustness Checks

Variable	Average Value (Standard Deviation)
Subjective Well-Being	25,141.95 (11,902.05)
Public Goods Spending	41,241.99 (16,757.76)
Unemployment Rate	5.98 % (2.68 %)
GDP Growth	2.48% (3.12%)

Before calculating the empirical results, we run robustness checks for the model, and execute 10,000 simulations. The results are demonstrated in Table 1. As a comparison indicator, the average unemployment rate in the US for the period 1998–2017 was 5.91%, according to the US Department of Labor. For the same time period, the World Bank records a real average growth rate of 2.23%. These results are similar to those of our model. In addition, the standard deviation is lower than the respective average values of the variables, which means that the results of our simulations are fairly constant and do not fluctuate heavily with each repetition.

4. Empirical Results

Table 2. Number of Simulations for Each Policy–Preference Combination

	With Tobin Tax			Without Tobin Tax		
	Allow Default	**Bailout**	**Bail-in**	**Allow Default**	**Bailout**	**Bail-in**
Public Goods	1,000	1,000	1,000	1,000	1,000	1,000
Equal	1,000	1,000	1,000	1,000	1,000	1,000
Financial Stability	1,000	1,000	1,000	1,000	1,000	1,000

***Note**: This table demonstrates the number of simulations executed according to the different policy responses to bank distress, to different societal preferences, and to the implementation of the Tobin tax.*

We designed an artificial economy with 40 banks, 80 firms, and 3,000 households. We executed 18,000 simulations with varying combinations of the regulator's policy mix and the population preferences. Specifically, the policy mix included the

implementation of a Tobin tax and the three types of response to bank distress. The Tobin tax is a tax on withdrawals during a banking crisis. The funds collected here are used by authorities for unemployment benefits, public goods, and/or bank bailouts.

In addition, we implemented different types of preferences that, for reasons of simplicity, we assumed were uniform across the population. Households either could value public goods higher or could value financial stability. We also implemented a third option by which households value public goods and financial stability equally. Table 2 shows the number of simulations executed for each combination of policy and preference. The detailed results for each simulation set are shown in the Appendix.

Table 3. Policy Mix for Best and Worst Results

	Public Goods		**Equal**		**Financial Stability**	
	Min	**Max**	**Min**	**Max**	**Min**	**Max**
Subjective Well-Being	Default	Bailout	Default (TT)	Bailout (TT)	Bail-in	Bailout (TT)
Subjective Well-Being (Vulnerable)	Default	Bailout	Default (TT)	Bailout	Bail-in	Bailout (TT)
Subjective Well-Being (Non-Vulnerable)	Default	Bailout	Default (TT)	Bailout (TT)	Bail-in	Bailout (TT)
Unemployment Rate	Bailout	Default	Bailout (TT)	Default (TT)	Bailout (TT)	Bail-in
Unemployment Rate (Vulnerable)	Bailout	Default	Bailout (TT)	Default (TT)	Bailout (TT)	Bail-in
Unemployment Rate (Non-Vulnerable)	Bailout	Default	Bailout (TT)	Default (TT)	Bailout (TT)	Default (TT)
Public Goods Spending	Bail-in (TT)	Bailout	Bail-in (TT)	Default	Default	Bail-in (TT)
Rescue Costs	Bail-in	Bailout (TT)	Bail-in	Bailout (TT)	Bail-in	Bailout
Periods to Recovery (Banking Crisis)	Bailout	Default	Bailout (TT)	Bail-in	Bailout (TT)	Bail-in
Periods to Recovery (Welfare Crisis)	Bailout	Default	Bailout (TT)	Default	Bailout (TT)	Default
Average Wage	Bail-in (TT)	Bailout	Bail-in (TT)	Bailout	Default	Bailout (TT)
Tax Rate	Default	Bailout (TT)	Default (TT)	Bailout	Bail-in (TT)	Bailout (TT)

***Notes**: This table shows the policy mix that yields the best and worst outcomes of the monitored variables according to societal preferences. When TT is added to the bank distress solution, it signals that a Tobin tax was implemented. The underlined results are the best outcome for each variable.*

This form of setup allowed us to examine the effects of the policy mix on the monitored variables, according to the different preferences of the population. A summary of the best and worst result for each variable is shown in Table 3. If, for example, policymakers aim to minimize the unemployment rate, when faced with a banking crisis, they should bail out banks that are in distress, since this mix achieved the lowest

possible outcome in all cases of population preferences. Furthermore, if policymakers believe that households value financial stability at least as much as public goods, then a Tobin tax should be imposed as a preventive measure. It is interesting to note that the same policy strategy achieves the highest possible value in terms of subjective well-being (both in total terms as well as for the different employee classes), even though it does not maximize government spending on public goods and does not minimize the tax rate. However, it does seem to maximize the average wage.

This result suggests that subjective well-being is not directed by government spending, but instead by employment and financial stability, either directly or indirectly. Before examining these results in further detail, we present the effects of the Tobin tax on the average values of the monitored variables. Table 4 shows that the effect of the Tobin tax is minimal on both subjective well-being and the unemployment rate.

Table 4. Average Values of Monitored Variables by Tobin Tax Policy

	Without Tobin Tax	**With Tobin Tax**
Subjective Well-Being	25,251.90	25,032.01
Subjective Well-Being (Vulnerable)	3,494.03	3,470.91
Subjective Well-Being (Non-Vulnerable)	21,757.87	21,561.09
Unemployment Rate	5.90%	5.89%
Unemployment Rate (Vulnerable)	7.54%	7.52%
Unemployment Rate (Non-Vulnerable)	5.61%	5.60%
Public Goods Spending	39,527.73	42,956.25
Rescue Costs	247,264.38	310,536.22
Periods to Recovery (Banking Crisis)	2.17	2.02
Periods to Recovery (Welfare Crisis)	2.31	2.21
Wage	116.74	114.62
Tax Rate	8.40%	8.40%
Real Contagion	65.68%	67.29%
Welfare Contagion	23.58%	22.19%

The Tobin tax policy improves welfare spending but also increases rescue costs, since the implementation of the tax seems to lead more banks into distress. In other words, the tax does not appear to work as a deterrent to bank runs but, instead, seems to burden the banking sector even more. This is demonstrated in Figure 1, in which we observe that total government spending is higher when the Tobin tax is enforced but the extra amount is channeled to the banking system. Other variables are also similar between the two policies. In other words, our appraisal of the Tobin tax is negative, since the tax

does not help to limit the crisis and, even though it helps authorities collect more funds, these funds are channeled into bank bailouts rather than public goods.

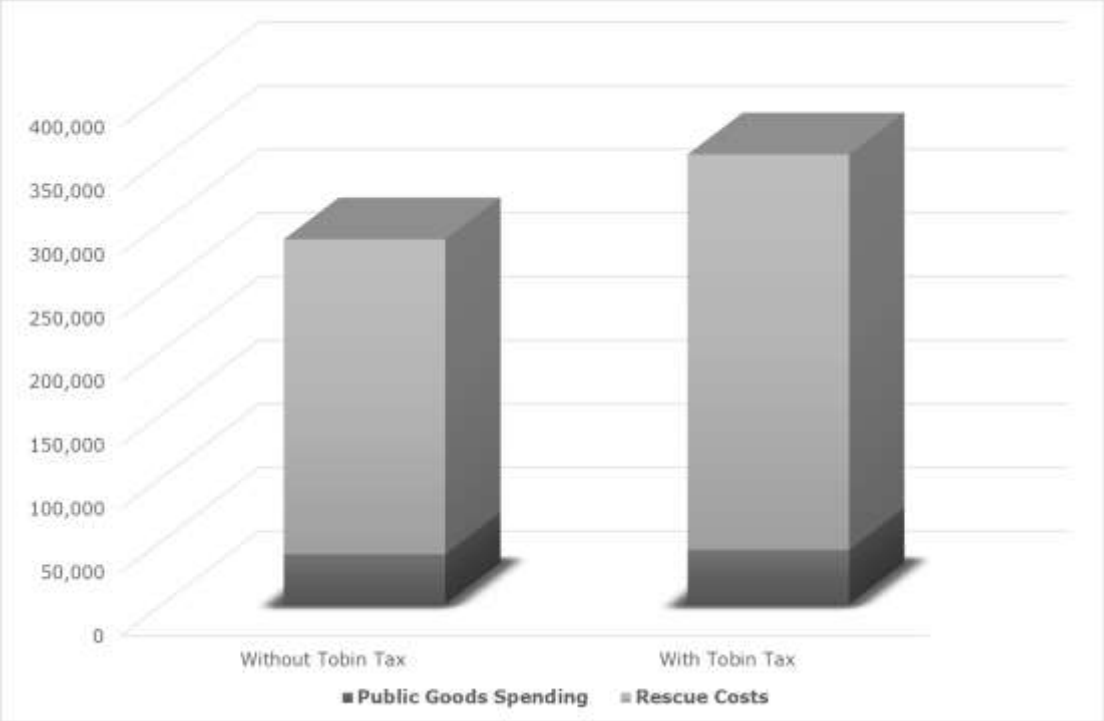

Figure 1. Public Funds Spending

We now examine the effects of the various solutions to bank distress given societal preferences regarding financial stability and public goods. In Table 5, we observe the variations in subjective well-being. As noted in Table 3, the best outcome for societal happiness is the bailout solution, which maximizes total subjective well-being across all preference scenarios. It is also interesting to note that with the bailout solution, the vulnerable class enjoys a bigger welfare gain than the non-vulnerable class does.

The second-best solution is the bail-in, but only if society does not favor financial stability over public goods. If society favors stability, then allowing banks to default yields better results in terms of total well-being. This finding suggests that the financial turmoil resulting from a bail-in costs society more in terms of welfare than bank bankruptcy does, when societal happiness is based on financial stability.

Table 5. Variations in Subjective Well-Being

		Public Goods	Equal	Financial Stability
Bail-in	**Total**	1.45	1.00	0.55
	Vulnerable	*1.49*	*1.00*	*0.52*
	Non-Vulnerable	*1.44*	*1.00*	*0.55*
Bailout	**Total**	1.58	1.25	0.65
	Vulnerable	*1.64*	*1.28*	*0.62*
	Non-Vulnerable	*1.57*	*1.24*	*0.65*
Default	**Total**	1.18	0.91	0.58
	Vulnerable	*1.21*	*0.92*	*0.55*
	Non-Vulnerable	*1.18*	*0.91*	*0.58*

Notes*: This table shows the variations in subjective well-being (total and by employee class) according to the different solutions to bank distress and the differences in societal preferences. We use the case of the bail-in and of indifference between public goods and financial stability as the benchmark (value 1) and calculate the proportionate changes of subjective well-being according to the different scenarios.*

This result has an important implication for the social outcomes of the different solutions to bank distress. Our model shows that using public money to bail out banks helps society in general but favors vulnerable employee classes to a bigger extent. It is also interesting to note that the welfare loss when moving preferences toward stability is greater for the vulnerable class. This means that when society in general favors financial stability over public goods, the lower social class experiences a loss in well-being, since their consumption is based more on public goods

Table 6. Variations in Unemployment Rate

		Welfare	Equal	Stability
Bail-in	**Total**	5.95%	5.93%	5.96%
	Vulnerable	*7.58%*	*7.56%*	*7.62%*
	Non-Vulnerable	*5.66%*	*5.64%*	*5.67%*
Bailout	**Total**	5.73%	5.63%	5.73%
	Vulnerable	*7.35%*	*7.20%*	*7.30%*
	Non-Vulnerable	*5.45%*	*5.35%*	*5.45%*
Default	**Total**	6.12%	6.00%	6.03%
	Vulnerable	*7.80%*	*7.65%*	*7.70%*
	Non-Vulnerable	*5.82%*	*5.70%*	*5.73%*

Note*: This table shows the variations in the rate of unemployment (total and by employee class) according to the different solutions to bank distress and the differences in societal preferences.*

With regard to unemployment (Table 6), the solution of bank default generally seems to yield better results. This suggests that the repercussions of a banking crisis in the event that a bank is allowed to default are more easily handled by the economy if no resources (either private or public funds) are channeled to the banking sector. This is a clear sign that the real economy is harmed more by the outlay of funds to save banks than by the actual bank default.

Table 7. Contagion Effects

		Public Goods	Equal	Financial Stability
Bail-in	**Real**	58.78%	52.18%	65.27%
	Welfare	25.90%	22.29%	17.98%
Bailout	**Real**	49.99%	45.51%	51.22%
	Welfare	27.74%	25.50%	15.83%
Default	**Real**	88.42%	87.09%	99.89%
	Welfare	24.43%	23.19%	23.16%

***Notes**: This table presents the contagion effects according to the various scenarios simulated. Real contagion is defined as the percentage of financial crises that were followed by output loss (real crisis). Welfare contagion is defined as the percentage of financial crises that were followed by a loss in societal well-being (welfare loss).*

Furthermore, as Table 7 shows, the real contagion effect (spillover of crisis from banking sector to real economy) is much higher if banks are left to face bankruptcy. In addition, real contagion is higher when households favor financial stability. On the other hand, welfare contagion is lower when financial stability is preferable. This is an intuitively unexpected result, as we would expect that in that case, it would be more likely that welfare loss followed a financial crisis. However, this finding is an indicator that, even when stability is preferable, any well-being loss incurred because of the crisis is offset by the other components of (EQ5).

Finally, in Figure 2 we observe the differences in subjective well-being for different employee class. It is evident that the bailout solution is best in terms of welfare, both for society as a whole and for separate employee classes. We believe this to be the most important finding of this study. Bank defaults or bail-ins result in heavy income losses to individual agents, which lead to a significant drop in total subjective well-being. This loss cannot be compensated by public goods spending, even in cases in which society values public goods more than financial stability.

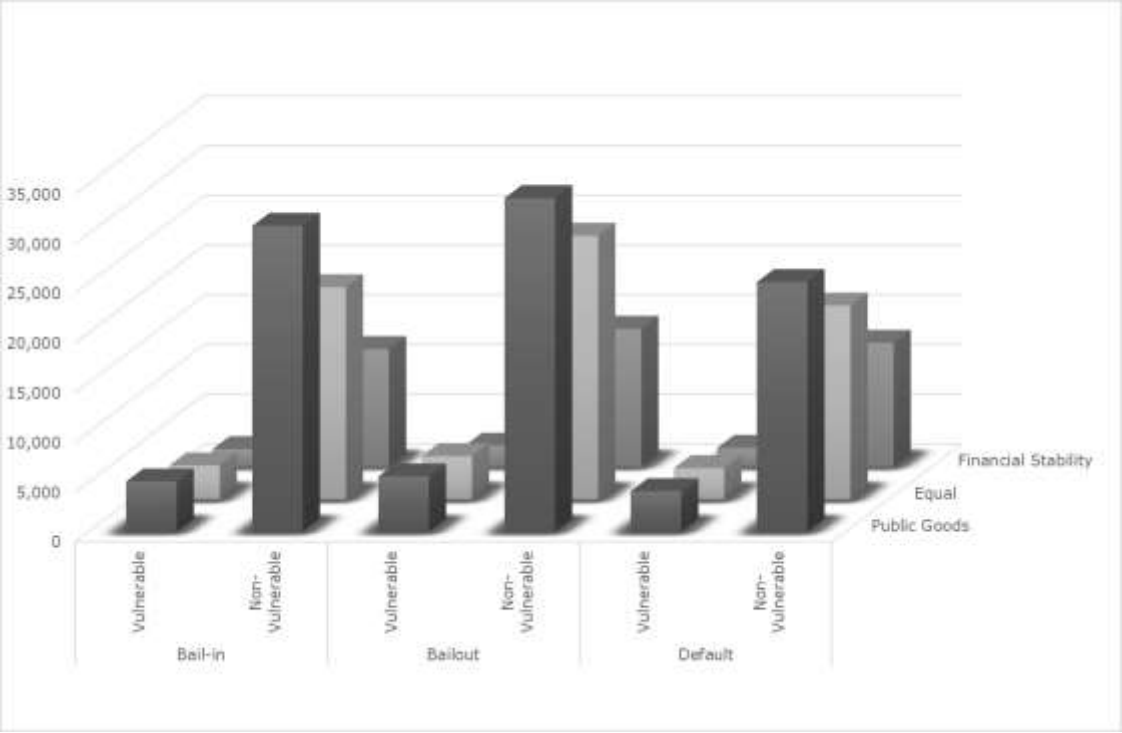

Figure 2. Subjective Well-Being by Employee Class

***Note**: This figure demonstrates the outcomes in subjective well-being by employee class for the different combinations of bank solvency and societal preferences.*

5. Conclusions

In this study, we examined the effects of banking crises on subjective well-being. Our methodology is based on agent-based simulations, which permit interactions between heterogeneous agents in a stylized market model. We also tested the effectiveness of a Tobin tax, which is modeled as a tax on withdrawals when the banking system is in crisis. Finally, we tested for the asymmetric effects of crises on different households by introducing an employee class that is more vulnerable to financial distress.

Based on our findings, we propose different policy mixes to accommodate societal preferences, while targeting specific variables. We showed that subjective well-being is maximized and unemployment is minimized when authorities bail out banks in distress and that a Tobin tax should be implemented in all cases except when society prefers public goods to financial stability. In addition, we showed that, if society prefers financial stability to public goods, then the vulnerable employee class experiences a loss in total well-being, regardless of the policy mix. This occurs because these employees' consumption is based more on public goods.

In addition, we showed that bank bailouts should be the preferred solution of policymakers when dealing with banks in distress. Our findings suggest that a bail-in or a bank default results in higher welfare costs than a bank bailout does. This is an argument in favor of implementing bailouts and against the adoption of the new fad for banks in distress, namely, the bail-in, which is contrary to the findings of García-Palacios et al. (2014). The welfare loss due to income damage incurred is greater than the cost of the bail-in, even when society values public goods over financial stability. We should note however, in line with García-Palacios et al. (2014), that the guarantee of a bank bailout increases the moral hazard in the banking sector. Finally, our assessment of the Tobin tax is not *a priori* positive, since it does not seem to help limit the consequences of the crises under all circumstances. We show that this type of policy should be implemented selectively, according to societal preferences.

A possible extension of our model is to implement non-uniform preferences across the population and to measure the results of the crises on each preference group. This would be a good way to examine if the effects of the policy mix are symmetric over the different preference groups, since we showed that they seem symmetric over employee classes. In addition, the amount of the Tobin tax was not examined exhaustively. Researchers could in future examine the optimal value of the Tobin tax and assess whether different values help prevent banking crises.

References

Allen, F. and Gale, D., 1998. Optimal Financial Crises. The Journal of Finance, 53(4), pp.1245-1284.

Allen, F. and Gale, D., 2004. Financial intermediaries and markets. Econometrica, 72(4), pp.1023-1061.

Arampatzi, E., Burger, M.J. and Veenhoven, R., 2015. Financial distress and happiness of employees in times of economic crisis. Applied Economics Letters, 22(3), pp.173-179.

Bookstaber, R., Paddrik, M. and Tivnan, B., 2018. An agent-based model for financial vulnerability. Journal of Economic Interaction and Coordination, 13(2), pp.433-466.

Chari, V.V. and Jagannathan, R., 1988. Banking panics, information, and rational expectations equilibrium. The Journal of Finance, 43(3), pp.749-761.

Cheng, J., Dai, M. and Dufourt, F., 2015. Banking Crisis, Moral Hazard and Fiscal Policy Responses (No. 2016-06). Bureau d'Economie Théorique et Appliquée, UDS, Strasbourg.

Diamond, D.W., 1997. Liquidity, banks, and markets. Journal of Political Economy, 105(5), pp.928-956.

Diener, E., Sandvik, E., Seidlitz, L. and Diener, M., 1993. The relationship between income and subjective well-being: Relative or absolute?. Social Indicators Research, 28(3), pp.195-223.

Drehmann, M., Sorensen, S. and Stringa M., 2010. The integrated impact of credit and interest rate risk on banks: A dynamic framework and stress testing application, Journal of Banking & Finance, 34 (4), pp. 713-729.

Di Tella, R., MacCulloch, R.J. and Oswald, A.J., 2003. The macroeconomics of happiness. Review of Economics and Statistics, 85(4), pp.809-827.

Ervasti, H. and Venetoklis, T., 2010. Unemployment and subjective well-being: An empirical test of deprivation theory, incentive paradigm and financial strain approach. *Acta Sociologica*, *53*(2), pp.119-139.

García-Palacios, J.H., Hasman, A. and Samartín, M., 2014. Banking crises and government intervention. Journal of Financial Stability, 15, pp.32-42.

Giarda, E., 2013. Persistency of financial distress amongst Italian households: Evidence from dynamic models for binary panel data. Journal of Banking & Finance, 37(9), pp.3425-3434.

Goodhart, C. A., Sunirand, P., & Tsomocos, D. P., 2004. A model to analyse financial fragility: applications. Journal of Financial Stability, 1(1), pp. 1-30.

Hovi, M. and Laamanen, J.P., 2016. Mind the gap? Business cycles and subjective well-being. Applied Economics Letters, 23(17), pp.1206-1209.

Iacoviello, M., 2005. House prices, borrowing constraints, and monetary policy in the business cycle. American Economic Review, 95(3), pp.739-764.

Jaikumar, S., Singh, R. and Sarin, A., 2018. 'I show off, so I am well off': Subjective economic well-being and conspicuous consumption in an emerging economy. *Journal of Business Research*, *86*, pp.386-393.

Janiak, A. and Monteiro, P.S., 2011. Inflation and Welfare in Long-Run Equilibrium with Firm Dynamics. Journal of Money, Credit and Banking, 43(5), pp.795-834.

Jappelli, T., Pagano, M. and Di Maggio, M., 2013. Households' indebtedness and financial fragility. Journal of Financial Management, Markets and Institutions, 1(1), pp.23-46.

Kahneman, D. and Krueger, A.B., 2006. Developments in the measurement of subjective well-being. Journal of Economic Perspectives, 20(1), pp.3-24.

Karas, A., Pyle, W. and Schoors, K. 2013. Deposit insurance, banking crises, and market discipline: Evidence from a natural experiment on deposit flows and rates. Journal of Money, Credit and Banking, 45(1), 179-200.

LeBaron, B., 2001. A builder's guide to agent-based financial markets. Quantitative Finance, 1(2), pp.254-261.

Marini, F., 2005. Banks, financial markets, and social welfare. Journal of Banking & Finance, 29(10), pp.2557-2575.

Midgley, D., Marks, R. and Kunchamwar, D., 2007. Building and assurance of agent-based models: An example and challenge to the field. *Journal of Business Research*, *60*(8), pp.884-893.

Pacek, A. and Radcliff, B., 2008. Assessing the welfare state: The politics of happiness. Perspectives on Politics, 6(02), pp.267-277.

Polyzos S. & Samitas A. (2015). Banking Crises and Contagion: Why Worry About Taxation, Output and the Cost of Capital?, Investment Management and Financial Innovations, Vol. 12 Issue 2, pp. 65 – 79

Powdthavee, N., 2007. Economics of happiness: A review of literature and applications. Chulalongkorn Journal of Economics, 19(1), pp.51-73.

Rashid, S., Yoon, Y. and Kashem, S.B., 2011. Assessing the potential impact of Microfinance with agent-based modeling. Economic Modelling, 28(4), pp.1907-1913.

Ratcliffe, A. and Taylor, K., 2015. Who cares about stock market booms and busts? Evidence from data on mental health. Oxford Economic Papers, 67(3), pp.826-845.

Rego, A. and e Cunha, M.P., 2008. Authentizotic climates and employee happiness: Pathways to individual performance?. *Journal of Business Research*, *61*(7), pp.739-752.

Riccetti, L., Russo, A. and Gallegati, M., 2016. Financialisation and crisis in an agent based macroeconomic model. Economic Modelling, 52, pp.162-172.

Salas-Vallina, A., Simone, C. and Fernández-Guerrero, R., 2018. The human side of leadership: Inspirational leadership effects on follower characteristics and happiness at work (HAW). *Journal of Business Research*. In Press

Samitas, A., Polyzos, S. and Siriopoulos, C., 2018. Brexit and financial stability: An agent-based simulation. Economic Modelling, 69, pp.181-192.

Senik, C., 2014. Wealth and happiness. Oxford Review of Economic Policy, 30(1), pp.92-108.

Schubring, S., Lorscheid, I., Meyer, M. and Ringle, C.M., 2016. The PLS agent: Predictive modeling with PLS-SEM and agent-based simulation. *Journal of Business Research*, *69*(10), pp.4604-4612.

Stevenson, B. and Wolfers, J., 2008. Economic growth and subjective well-being: reassessing the Easterlin paradox (No. w14282). National Bureau of Economic Research.

Stracca, L., 2014. Financial imbalances and household welfare: Empirical evidence from the EU. Journal of Financial Stability, 11, pp.82-91.

Tesfatsion, L., 2006. Agent-based computational economics: A constructive approach to economic theory. Handbook of computational economics, 2, pp.831-880.

Tsomocos, D. P., 2003. Equilibrium analysis, banking and financial instability. Journal of Mathematical Economics, 39(5), 619-655.

Van Praag, B.M., Frijters, P. and Ferrer-i-Carbonell, A., 2003. The anatomy of subjective well-being. Journal of Economic Behavior & Organization, 51(1), pp.29-49.

Wong, J., Wong, T.C., Leung, P., 2011. Predicting Banking Distress in the EMEAP Economies, Journal of Financial Stability, Vol. 6 (3), pp. 169–179

Zhu, H., 2005. Bank runs, welfare and policy implications. Journal of Financial Stability, 1(3), pp.279-307.

Appendix. Simulation Results

Public Goods Preference			
	Without Tobin Tax		
	Bail-in	**Bailout**	**Default**
Subjective Well Being	34,879.24	41,213.39	28,398.99
Subjective Well Being (Vulnerable)	4,941.09	5,883.70	3,915.22
Subjective Well Being (Non-Vulnerable)	29,938.15	35,329.69	24,483.77
Public Goods Spending	36,964.00	55,318.58	45,447.15
Rescuing Costs	0.00	487,541.52	0.00
Periods to Recover (Banking Crisis)	2.24	1.89	2.44
Periods to Recover (Welfare Crisis)	2.26	1.58	2.70
Average Wage	69.71	235.46	86.58
Tax Rate	8.39%	8.44%	8.38%
Unemployment Rate	5.98%	5.68%	6.15%
Unemployment Rate (Vulnerable)	7.55%	7.21%	7.89%
Unemployment Rate (Non-Vulnerable)	5.70%	5.41%	5.84%
Real Contagion	57.37%	47.57%	82.23%
Welfare Contagion	26.67%	28.87%	23.45%
Subjective Well Being Standard Deviation	16,200.67	20,082.32	13,442.88
Welfare Spending Standard Deviation	21,939.27	30,425.40	26,934.30
Unemployment Rate Standard Deviation	2.88%	1.85%	3.30%

Public Goods Preference			
	With Tobin Tax		
	Bail-in	**Bailout**	**Default**
Subjective Well Being	36,819.75	37,105.28	30,053.08
Subjective Well Being (Vulnerable)	5,190.08	5,277.03	4,274.45
Subjective Well Being (Non-Vulnerable)	31,629.67	31,828.25	25,778.63
Public Goods Spending	34,682.15	35,240.59	38,633.61
Rescuing Costs	0.00	872,081.06	0.00
Periods to Recover (Banking Crisis)	2.02	1.94	2.07
Periods to Recover (Welfare Crisis)	2.15	1.78	2.35
Average Wage	66.40	170.56	72.44
Tax Rate	8.41%	8.47%	8.39%
Unemployment Rate	5.92%	5.78%	6.09%
Unemployment Rate (Vulnerable)	7.61%	7.48%	7.71%
Unemployment Rate (Non-Vulnerable)	5.62%	5.48%	5.80%
Real Contagion	60.18%	52.41%	94.61%
Welfare Contagion	25.13%	26.60%	25.40%
Subjective Well Being Standard Deviation	17,755.16	20,149.94	12,610.34
Welfare Spending Standard Deviation	11,082.18	7,709.86	18,136.94
Unemployment Rate Standard Deviation	2.72%	2.07%	3.12%

Equal Preferences			
	Without Tobin Tax		
	Bail-in	**Bailout**	**Default**
Periods Executed	38.38	39.40	37.38
Subjective Well Being	24,207.74	30,801.69	24,900.67
Subjective Well Being (Vulnerable)	3,306.18	4,344.75	3,491.76
Subjective Well Being (Non-Vulnerable)	20,901.55	26,456.94	21,408.91
Public Goods Spending	28,108.50	32,822.75	61,617.44
Rescuing Costs	0.00	883,922.53	0.00
Periods to Recover (Banking Crisis)	2.26	2.03	2.03
Periods to Recover (Welfare Crisis)	2.42	1.91	2.77
Average Wage	54.81	200.28	116.00
Tax Rate	8.40%	8.47%	8.33%
Unemployment Rate	5.89%	5.64%	5.95%
Unemployment Rate (Vulnerable)	7.49%	7.26%	7.52%
Unemployment Rate (Non-Vulnerable)	5.60%	5.36%	5.68%
Real Contagion	52.24%	47.03%	86.38%
Welfare Contagion	22.40%	28.63%	23.68%
Subjective Well Being Standard Deviation	9,760.73	17,254.68	12,751.10
Welfare Spending Standard Deviation	10,283.89	14,897.53	17,884.18
Unemployment Rate Standard Deviation	2.54%	1.93%	2.91%

Equal Preferences			
	With Tobin Tax		
	Bail-in	**Bailout**	**Default**
Periods Executed	38.33	39.24	37.43
Subjective Well Being	25,240.24	30,881.90	20,315.44
Subjective Well Being (Vulnerable)	3,482.77	4,326.10	2,772.44
Subjective Well Being (Non-Vulnerable)	21,757.47	26,555.79	17,542.99
Public Goods Spending	26,933.89	27,999.47	28,454.65
Rescuing Costs	0.00	1,465,459.67	0.00
Periods to Recover (Banking Crisis)	2.23	1.95	2.06
Periods to Recover (Welfare Crisis)	2.40	1.86	2.63
Average Wage	51.03	158.62	55.71
Tax Rate	8.41%	8.44%	8.33%
Unemployment Rate	5.97%	5.61%	6.04%
Unemployment Rate (Vulnerable)	7.63%	7.14%	7.77%
Unemployment Rate (Non-Vulnerable)	5.67%	5.34%	5.73%
Real Contagion	52.12%	43.99%	87.80%
Welfare Contagion	22.18%	22.37%	22.71%
Subjective Well Being Standard Deviation	10,415.40	12,928.66	9,023.78
Welfare Spending Standard Deviation	11,470.15	10,387.75	9,261.66
Unemployment Rate Standard Deviation	2.98%	1.94%	3.16%

Financial Stability Preference			
	Without Tobin Tax		
	Bail-in	**Bailout**	**Default**
Periods Executed	38.17	38.54	37.84
Subjective Well Being	12,558.20	14,817.90	15,489.28
Subjective Well Being (Vulnerable)	1,573.61	1,926.43	2,063.52
Subjective Well Being (Non-Vulnerable)	10,984.58	12,891.47	13,425.75
Public Goods Spending	41,972.04	28,835.27	24,663.83
Rescuing Costs	0.00	853,915.42	0.00
Periods to Recover (Banking Crisis)	2.48	2.09	2.10
Periods to Recover (Welfare Crisis)	2.41	2.28	2.50
Average Wage	79.65	158.41	49.03
Tax Rate	8.38%	8.44%	8.37%
Unemployment Rate	6.05%	5.74%	6.03%
Unemployment Rate (Vulnerable)	7.81%	7.34%	7.75%
Unemployment Rate (Non-Vulnerable)	5.74%	5.45%	5.72%
Real Contagion	62.87%	46.71%	108.69%
Welfare Contagion	19.08%	16.48%	23.01%
Subjective Well Being Standard Deviation	7,295.32	6,026.75	7,862.81
Welfare Spending Standard Deviation	15,157.10	8,645.34	8,847.14
Unemployment Rate Standard Deviation	3.36%	2.12%	3.20%

Financial Stability Preference			
	With Tobin Tax		
	Bail-in	**Bailout**	**Default**
Periods Executed	37.30	39.15	37.52
Subjective Well Being	14,592.75	17,108.69	13,170.94
Subjective Well Being (Vulnerable)	1,941.48	2,272.75	1,701.13
Subjective Well Being (Non-Vulnerable)	12,651.28	14,835.94	11,469.81
Public Goods Spending	97,178.15	45,730.95	51,752.77
Rescuing Costs	0.00	457,285.24	0.00
Periods to Recover (Banking Crisis)	2.03	1.63	2.28
Periods to Recover (Welfare Crisis)	2.27	2.11	2.30
Average Wage	176.02	183.24	97.55
Tax Rate	8.31%	8.46%	8.34%
Unemployment Rate	5.88%	5.72%	6.03%
Unemployment Rate (Vulnerable)	7.43%	7.27%	7.64%
Unemployment Rate (Non-Vulnerable)	5.60%	5.45%	5.74%
Real Contagion	67.68%	55.72%	91.10%
Welfare Contagion	16.89%	15.17%	23.30%
Subjective Well Being Standard Deviation	7,940.23	7,014.31	5,721.89
Welfare Spending Standard Deviation	53,842.96	11,442.51	13,291.44
Unemployment Rate Standard Deviation	2.81%	2.00%	3.29%