WORKING PAPER SERIES

Série spéciale Liban

Numéro 01/2022

Currency Board Regimes for Lebanon: Impacts on asset convertibility

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Abstract

The cascading breakdown of the Lebanese financial system has accelerating spillover effects over income, prices and production. The economic outlook is catastrophic, and the impact of the currency crisis is directly linked to a meltdown in the productive sector, the dynamics of real income, prices and the disruption of supply chains. To insulate the monetary base from discretionary fiscal spending, Currency Board models are advocated to restore confidence in the convertibility of assets and local currency. These regimes prove effective in reversing capital outflows and shaping the needed institutional environment for macroeconomic recovery and stability. This paper aims to provide answers to the question of whether a Currency Board system can restore asset convertibility in response to the Lebanese currency crisis. The point is to draw implications on economic recovery and stability. The analysis is focused on statistical methods that are grounded on a model theoretical approach to estimate parameters. The structure of the model is designed by a statistical classification analysis of the drivers of asset convertibility. Findings show that the suspension of convertibility is directly explained by foreign exchange parallel markets and by the reversal in capital flows. The findings also imply feedback loops in system dynamics that breed panic to fuel the crises. Results also imply that currency board models prove are adequate policies to restore confidence and the convertibility of assets and local legal tender as reserve currency is guaranteed by law under fixed exchange rates which are sterilized by the mechanism of the balance of payments.

Key words: *Monetary Regimes, Currency Board, Convertibility, Speculative attacks, External Imbalances, Rules vs. Discretion.*

JEL Classification : *C44 – E52 – E58 – E63 – F37*

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Introduction

What culminated to the burst of the Lebanese model by late 2019 falls beyond the scope of this short paper, but the dramatic outcomes of the crises as they continue to unfold can hardly be overstated. The root of the economic meltdown goes beyond a systemic collapse. Indeed, it is argued that a great transformation in post-civil war State and social institutions – whether formal or not so – a critical historical juncture which fueled a vicious circle towards a failed State model (Acemoglu, Robinson, 2013). As recent studies show, a widening gap has been building up between foundational liberal ideas (Chiha, 1949) and the rise of clientelism, nepotism, and corruption that are characteristic of crony capitalism (Mardini, 2015). Nonetheless monetary and fiscal imbalances were at the tipping point of a systemic series of crises.

Postwar Lebanese monetary policy had opted since 1997 for a fixed currency peg regime which was maintained by a lender of last resort institutional setup in one of the highest indebted worldwide nations. Once the peg regime was no longer sustainable by late 2019, the cascading breakdown of the Lebanese financial system was accelerating spillover effects detected in income, prices and production. The breakdown of the financial system was shaped by the suspension of convertibility, capital controls, credit crunch, limits to withdrawals and barriers to payments and international transfers. Convertibility disruption led to an economic meltdown as supply chains and financial services could no longer function properly.

In short the monetary, financial and economic crises contributed to a total collapse in social, political and economic institutions (North, 1981; Tainter, 1990). To insulate the monetary base from discretionary fiscal spending, Currency Board models are advocated for their successful record in restoring confidence in the convertibility of assets and local currency. They also prove effective in reversing capital outflows and providing the needed institutional environment for macroeconomic recovery and stability. The fundamental outcome is to offset spillover effects on the economy, provided minimum fiscal discipline (Hanke & Schuler, 1994; Nenovsky & Hristov, 2002).

This paper offers an empirical study of the main drivers of the suspension of asset convertibility. Grounded on the findings it draws implications of free float regimes and sterilization instruments versus automatic balance of payments mechanisms in currency board model necessary to restore confidence and asset convertibility. Conclusions are of substantial relevance for current policy debates. They shed new light on the implications of exchange rate regimes for developing countries.

In addition, little academic research was published in the field of monetary stability in Lebanon since most of the literature focuses on the case of Latin America, Eastern Europe and South-East Asia. With few skeptical exceptions, most economists are used to take for granted the stability of the Lebanese currency thanks to the post-war pegged regime. Others focus on the impact over the structure of the service oriented economy because of banks' hoarding and

excess liquidity ratios (Ghalayini, 2011; Iskandar, 2017; Khoury, 2018). Indeed, by focusing on the main drivers behind the recent crisis, this paper aims not only to explain the forces that have driven the suspension of asset convertibility and therefore to explain exchange rate volatility and to answer normative applications that shape the monetary policy problem for economic recovery and stability.

The paper is organized as follows: Section 1 states the research question, narrows down the problem to the suspension of Bonds and bank account convertibility. It also draws the logic of the methods and tools used in the analysis. Section 2 estimates panics and bank run parameters by simulating a Diamond-Dybvig (1983) baseline model. Section 3 trains a decision tree model to estimate the main drivers behind the suspension of asset convertibility. Section 4 concludes on the implications of currency board regimes on the balance of payments, market confidence, and the convertibility of reserve-backed assets.

1. Research Question and Methodology

Currency Board regimes vary fundamentally from orthodox to second generation models, and along those lines the ability to conduct monetary policy is often disputed in this framework. These models are framed within the rules versus discretion debate. They fall within institutional regulations that have a large impact on fiscal policies, monetary governance and financial stability. Different generations of Currency Board models perform well yet they have mixed impacts on fiscal and monetary imbalances. To narrow down this piece of the puzzle, this paper aims to provide answers the question of whether a Currency Board system can restore asset convertibility. The point is to draw implications on assets convertibility, confidence and the reversal of capital and trade flows. This falls within the broad idea to study whether the mechanics of such regimes can restore economic stability to Lebanon.

To seek answers to the question on whether Currency Boards can restore asset convertibility, this paper is focused on statistical methods that are grounded on a model theoretical approach to calibrate qualitative parameters. This follows from the hypothetical nature of the question about Currency Boards in Lebanon. Considering key observations such as monetary and fiscal imbalances, capital flow, market confidence, asset discounts, and exchange rate dynamics, the central idea is to study scenarios of bank runs to estimate the magnitude of the panic factor. Given the logic of the model theoretical approach, a simulation of a baseline Diamond-Dybvig (1983) bank-run model is proposed for that purpose. This approach builds upon the diffusion of control systems theory in macroeconomics, economic dynamics, rational expectations, state-space models, the Kalman Filter and their applications as in the case of the German hyperinflation for example (Pau, 1979; Burmeister and Wall 1982; Sargent 1993).

Parameter calibration draws on data from Lebanese national accounts, monetary policy statistics, banks and central bank balance sheets. The structure of the model may be designed by a statistical analysis of the data. The contribution of each variable in explaining a movement

of the exchange rate may be estimated with a random forest classifier algorithm (Pedregosa et al., 2011). Finally, the impact of currency board regimes on the convertibility of assets is analyzed within the framework of the modern monetary approach to the balance of payments (Frenkel & Johnson, 1976; Frenkel,1978; Hanke & Schuler, 1994; Nenovsky et al. 2002).

2. Simulation Parameters and Data Analysis

Data set

We choose a sample of monthly economic and financial data published by the Central Bank and the Association of Banks in Lebanon[1]. Time series span from January 2017 to February 2020. The sample covers the following indicators: (1) Average Interest Rate [AIR] which is the weighted average in percentage on deposits in different account terms; (2) resident [RD] and non-resident deposits [NRD] in USD billions; (3) commercial banks portfolios in sovereign instruments i.e. Treasury Bills denominated in Lebanese Pounds [TB] and Euro Bonds [EB], both converted to USD billions; (4) Changes in Net Foreign Assets in USD Billions of commercial banks [NFAFIN] and the Central Bank [NFABDL]. Although some studies conclude on excess liquidity and credit rationing (Cho, 2016), banks' liquidity is computed with an average liquidity ratio of 0.25 based on the study conducted by Khoury (2018) and on official data published by the Association of Banks in Lebanon. Aggregate data of deposits and securities portfolios are published in Billions of Lebanese Pounds and converted to USD Billions at the official exchange rate[2].

Pre-processing

The purpose is to explain bank runs as interpreted in an open economy Diamond-Dybvig model. In consequence the contribution of the interest rate to preferences and bank liquidity for instance, will be insignificant unless data is normalized. In the presence of trends, time series are normalized in relative values. Time series of the variables AIR; RD; NRD, TB and EB are detrended by applying the Hodrick & Prescott, (1997) filter with the conventional parameter $\lambda = 400$ for monthly data. Normalized values are computed relative to trend and standard deviation[3].

Scenarios

Model outcomes are studied by creating dummy variables of different setups. The first dummy variable features deposit convertibility scenarios. As reported by banking

[1] The data set may be consulted on the web pages of the Banque du Liban and the Association of Banks in Lebanon https://www.bdl.gov.lb/webroot/statistics/ ; https://www.abl.org.lb/english/about-abl/monthly-editorial; accessed May 5, 2020.
[2] Note that no foreign exchange was traded at the official rate since October 2019.
[3] The results of pre-processing the data is reported in Appendix 1

practices, convertibility evolved from full to limited since September 2019 then finally the suspension of convertibility in December 2019. Foreign exchange market is officially a fixed rate regime pegged to the US Dollar at USD = 1507.5 Lebanese Pounds. This is in tandem with a free economic order that warrants constitutional rights of free capital movement. During the month of September 2019 rationing trading in foreign currencies was observed as practiced by Banks and money exchange houses. After social turmoil in October 2019 banks ceased to trade at the official rate and a parallel market emerged. The variables are classified as follows:

Convertibility	**FX Market**	**Capital Flow**
Convertibility	Fixed Rate	Free Movement
Limited Convertibility	Rationing	Capital Controls
Suspension of Convertibility	Parallel Markets	

Finally, a dummy variable is generated to account for the panic factor. The variable is simulated in a Diamon-Dibvig (1983) open economy systemic bank failure. The parameters of the preference functions are chosen to replicate the characteristics and size of the Lebanese financial sector.

The baseline model

The baseline Diamond-Dybvig (1983) model studies equilibrium states of liquidity allocations for both depositors and the banking system. The problem is to maximize preferences for bundles of holding assets and the liquidation cost of those assets, subject to risk aversion constraints which depend on the probability of asset liquidation; and the rate of return r.

Let $i = 1 \dots t$ be maturity periods; c_i bundles of assets yielding rates of returns r_i ; optimal allocation is established when agents maximize their preference for liquidity subject to risk aversion constraint:

$$\max U = \theta U(c_1) + \theta U(c_{i-1})$$

Subject to

$$\theta c_1 = \frac{1-\theta}{r} c_1$$

The banking sector can manage different maturities by exploiting the law of large numbers subject to fractional reserves and prudential regulations. A state of equilibrium is attained if the banking system allocations coincide with the social allocation problem

$$U'(c_1) = RU'(c_{i-1})$$

However, if depositors suspect asset liquidation, banks will be forced to bankruptcy due to liquidity shortages. A systemic open economy bank run occurs when preference bundles for liquid assets are greater than the fraction of banks' liquid assets.

Simulation parameters

A yield parameter is set at 0.0558 which is the AIR on deposits observed before the banks started rationing liquidity[4]. A parameter of 125 billion USD investments in the banking sector corresponds to total deposits in USD. The depositors' base is rounded 3 million depositors. Liquidity ratio is set 0.25 and it corresponds to the official average ratio. Change in risk aversion, Bank cash and current account are set as a stochastic variable. Depositors withdraw to maximize their utility by trading off liquidity for assets while minimizing their risks. Using the code developed by Yenko and Peynetti (2015)[5], the results are simulated over 60 trials corresponding to the number of weeks following the meltdown events. The results are reported in figure 1.

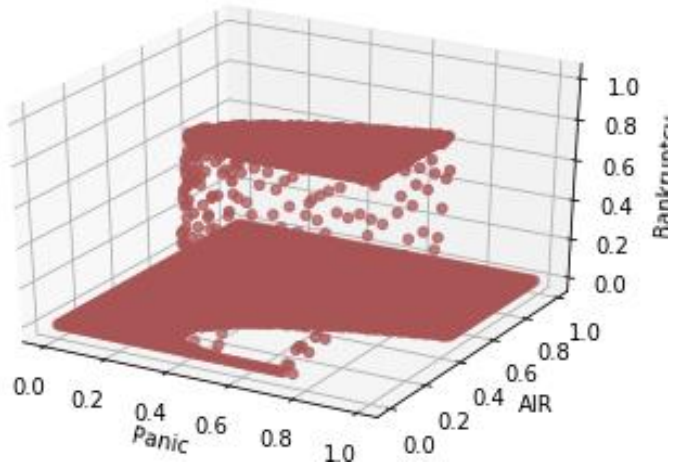

Figure 1 – Model simulation od the panic factor

3. Findings

To analyze the contribution of each variable in explaining the suspension of convertibility, we use the random forest classifier algorithm (Pedregosa et *al.*, 2011). A random forest is a collection of many decision trees averaged to reduce the amount of overfitting. Each tree is randomly tweaked differently from the others.

To estimate a decision tree, data is partitioned into 2 subsets below and above a certain threshold. An accurate model may be created by repeating the process of training each node in both subsets. The recursive partitioning is repeated until each subset only contains a single node.

We use our data set to estimate the coefficient of each data feature in explaining the rationing of withdrawals and the suspension of deposit convertibility. The test size is set

[4] *cf.* https://lebaneselira.org accessed May 5, 2020.
[5] *cf.* https://github.com/cyenko/dd_sim accessed May 5, 2020.

at 30 % *i.e.* the model learns over 30 % of the sample. Observed cases of deposit non-convertibility make up for around 16 % of the sample. Thus, the model learns on withdrawals rather than suspension.

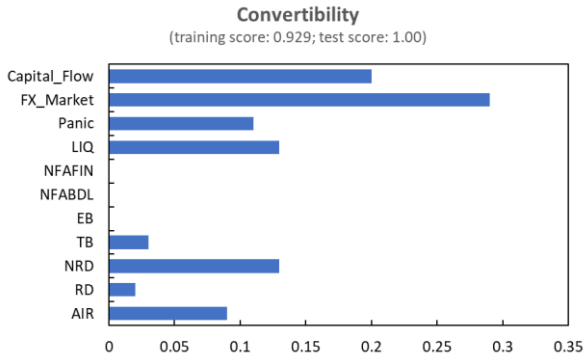

Figure 2 – factors weighing on deposit convertibility

The results of a random forest of depth 1 in figure 2, show that convertibility is directly driven by the following features of the data:

(1) the stability of the foreign exchange market. Results show that the fixed rate regime is the main factor weighing 30 % in explaining deposit convertibility. As soon as access to foreign currencies is restricted banks start rationing withdrawals. With the advent of parallel markets withdrawals are suspended.
(2) Capital controls are the second most weighing factor with 20 %, as restricted movement of capital limits bank access to liquidity.
(3) Confidence, changes in non-resident deposits, changes in bank liquidity, and changes in the AIR come next with the following respective weights: 11%; 13%; 13% and 9%.
(4) Resident Deposits and Treasury securities come last with weights at 2% and 3% respectively.
(5) Finally, Eurobonds and Net Foreign Assets have no direct impact on deposit convertibility at depth 1. However, at depth 2 and above they weight almost 1% and 2% respectively as shown in figure 3.

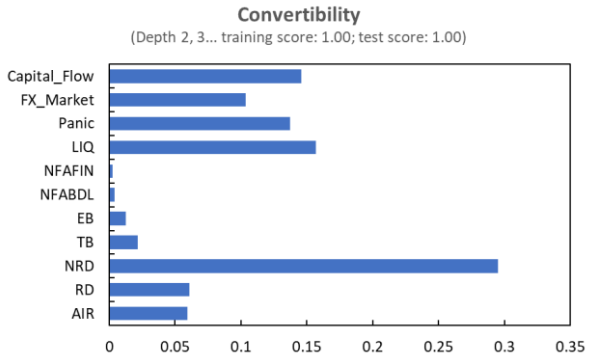

Figure 3 – Random forest of depth 2, 3, …

Beyond depth 2 the results remain the unchanged. Although these weights remain insignificant this means that these two variables affect convertibility indirectly, most likely through changes in liquidity and non-resident deposits. A spike occurs however with the latter variable. At depth 2, change in non-resident deposits weight 30% on deposit convertibility. This implies that at best 17% of the change in this variable explains convertibility through changes in bank liquidity and AIR.

4. Conclusion: Currency Boards Policy Implications

By focusing on the main drivers behind the recent crisis, our findings show that the suspension of asset convertibility can be directly explained by foreign exchange parallel markets and by the reversal in capital flows: including remittances and non-resident deposits. The interesting part of our results is that yields, Treasury default and Euro Bonds have no statistical significance in explaining asset convertibility. Nonetheless feedback loops have major impacts on the dynamics of the system. Appendix 3 shows how the crises breed panic, reversals in capital flows and the emergence of parallel exchange markets. This is a salient feature of a currency regime crisis that is associated with cascading systemic effects on public debt, payment systems, convertibility, and economic meltdown.

To understand such systemic crises and to evaluate adequate policies, the merits of exchange rates regimes have been the main driver of the debate in the field of international economics since the nineteen-fifties. Within this theoretical framework, Currency Board regimes are designed to foster recovery and stabilization in developing economies that experience external imbalance. Such regimes are governed by a monetary authority that is mandated to back the issued monetary base with foreign currency reserves. As a rule the issuing authority is prohibited from holding domestic assets. The theory behind Currency Board and other rule-bound regimes builds on the fundamental predicates of the modern monetary approach to the balance of payments and the theory of speculative attacks.

In a nutshell, the theory of speculative attacks explains how in pegged regimes, panics breed a massive selling of local assets, bonds and national currency. Following a suspension of assets' convertibility (Diamond & Dybvig, 1983), a reversal in capital flows, monetary authorities are forced to float and devalue the currency (Krugman, 1979; Schuler, 1999). The modern monetary approach to the balance of payments is on the other hand fundamentally grounded on capital account imbalances as a monetary phenomenon. Because a deficit in the balance of payments necessarily implies a loss of international reserves, the counterpart of the deficit translates in the money supply by an increase in domestic credit creation or a 'dishoarding of residents' (Frenkel & Johnson, 1976).

Policy conclusions beg the questions raised about the function of central banks in issuing money and credit, in holding international reserves, and their established role as lender of last resort. On the subject of internal policy instruments the aim is to influence output and prices.

The debate over rules versus discretion for that purpose is no less problematic (Barro & Gordon, 1983; Taylor, 1993). Rule-bound monetary policy is achieved by enacting institutional rules that govern central banks' intervention. To stabilize exchange rates and external imbalances, the case for improved governance of monetary authorities is equally emphasized by proponents of Currency Board regimes (Hanke & Schuler, 1994; Nenovsky & Hristov, 2002).

Discretionary intervention and sterilization is usually ruled-out by enacted legislation against such practices. Foreign reserve adjustments are operated automatically through changes in the balance of payments. Although different second generation models allow for limited or constrained discretionary policies, the general framework was successful in Eastern Europe and South-East Asia (Hanke, 2002; Nenovsky et al., 2002) as convertibility is guaranteed by law at a fixed exchange rates. Under these stringent rule-bound regimes, Currency Boards gains credibility in restoring confidence, stability and initiating a reversal in capital outflows following periods of high inflation.

In theory, the rationale behind such regimes is to insulate currency convertibility from the influence of fiscal and discretionary monetary policy. Under a strict Currency Board system, monetary authorities are prohibited by law from holding domestic assets in their balance sheets – including Government Bonds and Loans to Financial Intermediaries. The impact of rule bound regimes, on fiscal imbalances and the productive sector, depends substantially established institutions and the structure of the economy. This remains an open question in the Lebanese context which is a rather complex case.

Since the currency peg regime became unsustainable, the cascading breakdown of the Lebanese financial system has been accelerating spillover effects in income, prices and production. The World Bank Economic Update describes the social impact as catastrophic. Half the population fell below the poverty line, unemployment has been soaring, and hyperinflation treads about a monthly 50% rate for over a year (Hanke, 2020). Nonetheless monetary disorder cannot be detached from to Lebanon's fiscal crisis fueled by extractive corruption, crony capitalism and institutional deadlocks.

The immediate response designed in the Government's plan of April 30, 2020 adopted an inconsistent approach to economic recovery. The framework was shaped by a floating exchange rate regime. Monetary and fiscal imbalances were tackled by reactive policy measures such as devaluation, government planning, import substitution, infant-industry protection, fiscal austerity, capital and trade controls, capital hair-cuts, write-offs, income redistribution, direct subsidies, economic and financial restructuring. Unless a synergy governs the relations between the political and the economic regimes to create a virtuous institutional cycle, one of the pitfalls of the Prebisch doctrine (Prebisch, 1959) is in the dangers seigniorage and bad governance (Marques-Pereira & Theret, 2001; Acemoglu & Robinson, 2013).

Finally currency Board models proved successful in restoring confidence in the convertibility of assets and local currency. They also proved effective in reversing capital outflows and providing

the needed institutional environment for macroeconomic recovery and stability. The fundamental outcome is to offset spillover effects on the economy, provided minimum fiscal discipline. Orthodox currency boards, have no jurisdiction however to act as a lender of last resort. Given high levels of public debt and the weight of the public sector in the Lebanese economy, the impact of such regimes on fiscal sustainability and on transmission mechanisms into the productive sector remains an open question. To address the problem a different set of analytical tools may be needed in forthcoming work.

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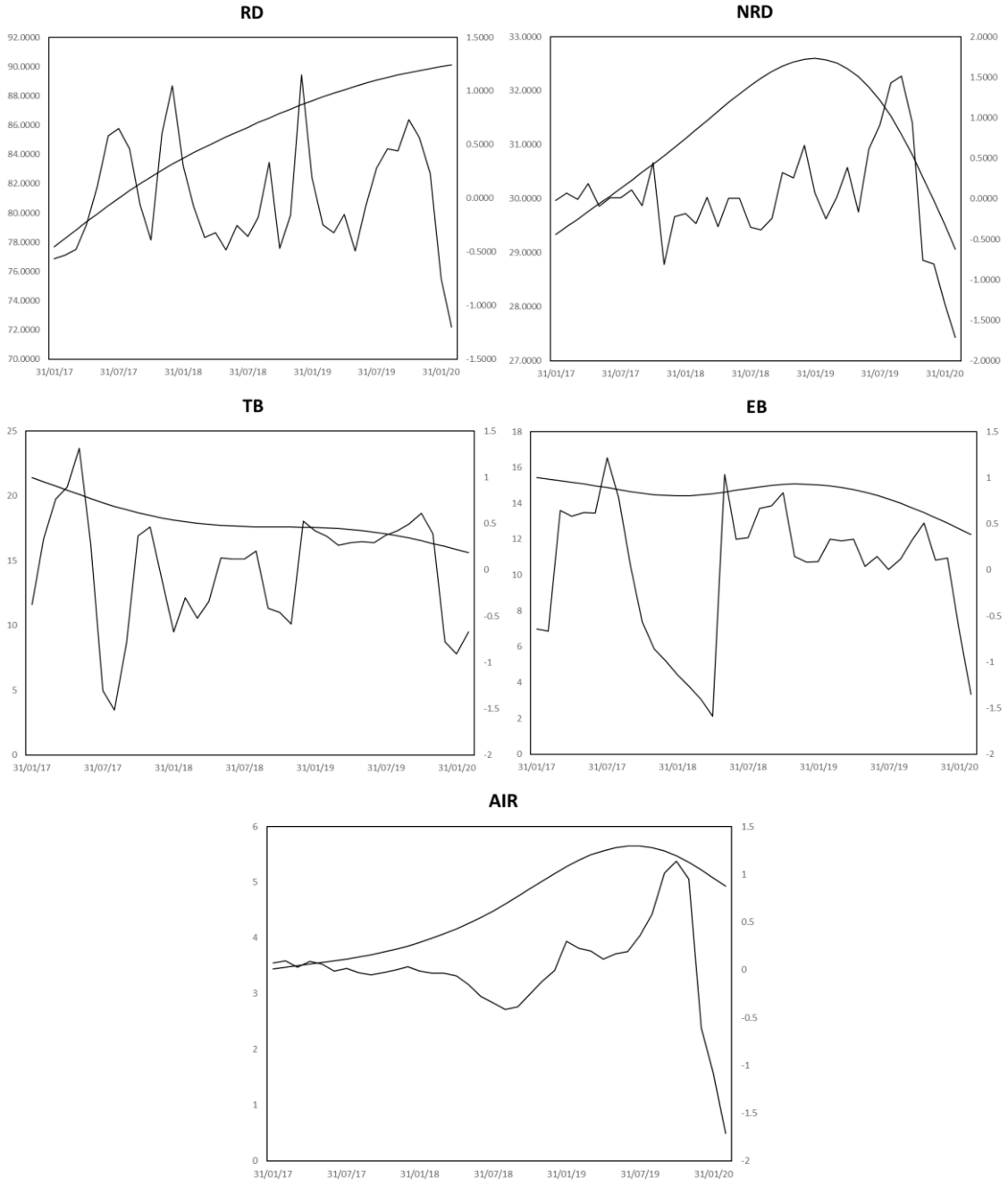
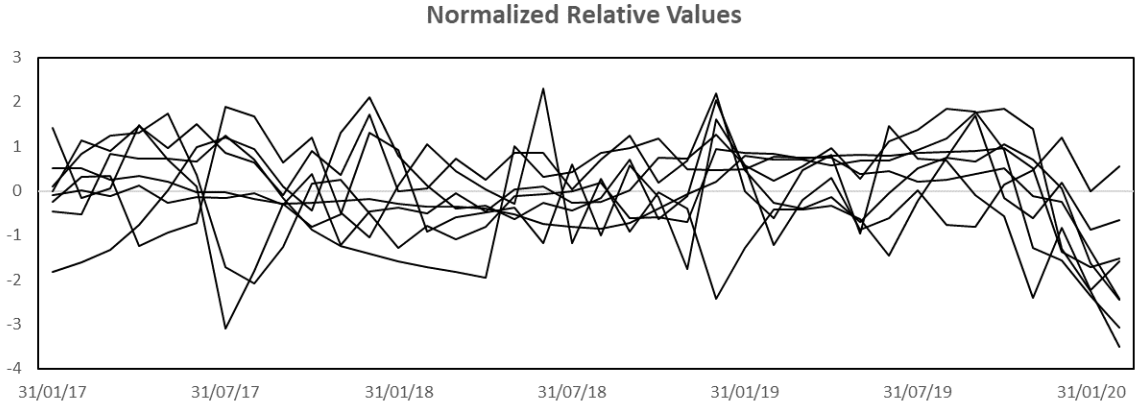
Appendix 1

HP Cycles and trends





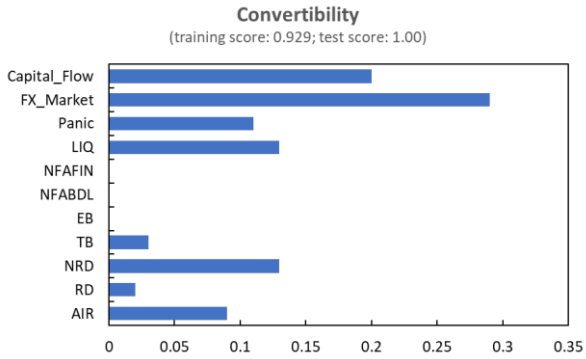
Appendix 2 Random Forest code

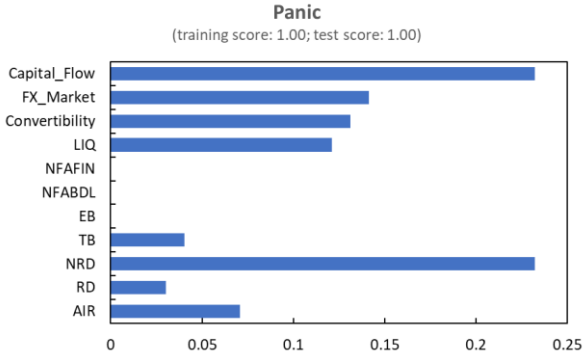
```
% Setup environment
import matplotlib.pyplot as plt
import math
import pandas as pd
import numpy as np
import sys
from sklearn.tree import DecisionTreeClassifier
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestClassifier
from sklearn import preprocessing

% Load data
sim_data = pd.read_csv('C:/…Path…/Data.csv')

% Pre-process the data and set target variables
le = preprocessing.LabelEncoder()
cols = [col for col in sim_data.columns if col not in ['Convertibility']]
data = sim_data[cols]
target = sim_data['Convertibility']
data.head(n=12)
from sklearn import preprocessing
le = preprocessing.LabelEncoder()
sim_data['Convertibility'] = le.fit_transform(sim_data['Convertibility'])
sim_data['Panic'] = le.fit_transform(sim_data['Panic'])
sim_data['FX_Market'] = le.fit_transform(sim_data['FX_Market'])
sim_data['Capital_Flow'] = le.fit_transform(sim_data['Capital_Flow'])
data = sim_data[cols]
target = sim_data['Convertibility']

% Explore data
sim_data.tail()
```

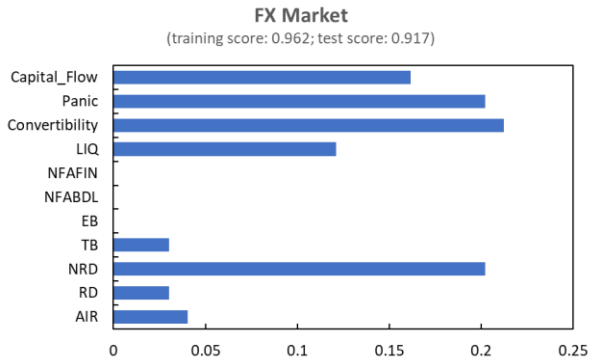
	AIR	RD	NRD	TB	EB	NFABDL	NFAFIN	LIQ	Convertibility	Panic	FX_Market	Capital_Flow
33	2.161869	1.356313	1.474073	1.096571	0.739825	-0.170386	0.138956	-0.574571	1	0	2	0
34	1.846529	1.052228	-1.193171	0.708125	0.153893	-0.621202	0.474664	-2.410273	1	1	1	0
35	-1.203131	0.434158	-1.258132	-1.444777	0.194917	0.177729	1.200187	-0.824673	3	1	1	0
36	-2.209883	-1.382580	-2.030202	-1.711383	-0.998120	-0.879920	-0.017216	-2.238242	3	1	1	0
37	-3.606855	-2.213827	-2.676740	-1.278519	-2.149891	-0.652171	0.559514	-1.586226	2	1	1	0

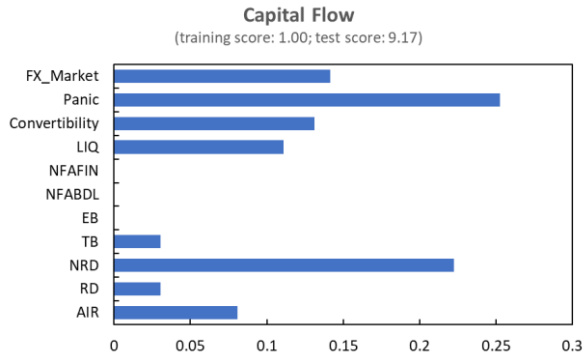
```
% Train the model
from sklearn.model_selection import train_test_split
target_test = train_test_split(data,target, test_size = 0.30, random_state
= 0)
X_train, X_test, y_train, y_test = train_test_split(data, target, test_size
= 0.30, random_state = 9)
tree = DecisionTreeClassifier(random_state=0)
tree.fit(X_train, y_train)

% Print results
print("Accuracy on training set: {:.3f}".format(tree.score(X_train,
y_train)))
print("Accuracy on test set: {:.3f}".format(tree.score(X_test, y_test)))
print("Feature importances:\n{}".format(tree.feature_importances_))
```

Appendix 3 Results and tuning









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